General report of the Commission appointed for improving the sanitary condition of barracks and hospitals / [(signed) John Sutherland, W.H. Burrell, Douglas Galton].

Contributors

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GENERAL REPORT

OF

THE COMMISSION

APPOINTED FOR

IMPROVING THE SANITARY CONDITION OF BARRACKS AND HOSPITALS.

Presented to both Houses of Parliament by Command of Her Majesty.

LONDON:
PRINTED BY GEORGE EDWARD EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
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INSTRUCTIONS.

(1.) You are to proceed immediately to examine and inquire into the sanitary condition of all barracks and military hospitals in the United Kingdom, as regards their position, neighbourhood, construction, drainage, water supply, lavatories, laundries, baths, kitchens, water-closets, latrine arrangements, urinals, means of ventilation, lighting, and warming, both by day and by night, the dimensions of the barrack rooms and sick wards, the arrangements of and the distance between the beds, the supply of bedding and utensils, the amount of cubic space per bed in barracks and hospitals, the state of repair of the buildings, the condition as to cleanliness of wards, barrack rooms, and other buildings, and of their vicinity; and into all other matters connected with the buildings which, in your opinion, may be prejudicial to the health of the soldier. You will also examine the amount and character of the accommodation provided for the sick of the families of married soldiers.

(2.) You will confer with the commanding officer, the principal medical officer, and barrack master of every barrack and hospital inspected, and with the inspector or deputy inspector of hospitals of the district within which the barrack or hospital is situated, who have been instructed to render you every assistance in their power.

(3.) You may call to your aid any persons connected with the establishment, as witnesses or for obtaining information. You may examine any records, or call in any assistance in the way of labour, to aid in conducting inquiries.

(4.) You will state your opinion as to all removable causes of sickness and mortality in all barracks and hospitals; and you will devise the necessary works and measures required for removing defects in the drainage, for the abolition of cesspools, for the formation of improved drainage, for improvements in water-closets, latrines, and urinals, for providing lavatories, baths, and laundries, for thoroughly and efficiently ventilating all barrack rooms, wards, and day rooms, for warming and lighting by day and by night, and for improving the kitchens in all barracks and hospitals.

(5.) You are further instructed to allot the existing accommodation in all barracks and hospitals, so far as it may be practicable so to do, in such manner that not less than 600 cubic feet be provided for every man in barracks and guard rooms, while at least three feet shall intervene between every two beds in the former; and that in hospitals a cubic space of at least 1,200 cubic feet be allowed for each bed, and at least four feet between the sides of the beds, and 12 feet from foot to foot when practicable.

(6.) You will direct the number of inmates which every barrack room, guard room, and sick ward should contain, in accordance with these measurements, to be painted on the door; and if any room or ward be found not suitable for accommodating healthy or sick men, and if the sanitary condition of such room or ward be not capable of being rendered satisfactory, you shall direct the inhabiting of such ward or room to be discontinued.

(7.) If the existing accommodation will not allow of this latter instruction being carried out, you are directed to improve the wards or rooms as far as possible, and to report to the Secretary of State the additional amount of accommodation required.

(8.) If the buildings admit of additional accommodation being provided for married soldiers, and for the sick of their families in hospital, you will direct such accommodation to be set apart as you may think necessary. If the buildings do not admit of such arrangements, you will report what additional accommodation should be rented for this purpose.

(9.) You will immediately direct the use of limewashing, and such measures of cleansing within the barrack or hospital premises as may appear requisite.

(10.) You are further authorized to direct the immediate execution of such works as may appear to you to be necessary for the ventilation, warming, lighting, draining, and sewering of, and the securing a sufficient supply of good water for, such hospitals and barracks; provided the cost of such works does not exceed a sum equal to 100*l.* for each hospital or barrack so inspected.

(11.) If the defects cannot be removed without the execution of works, the cost of which would exceed the resources thus placed at your disposal, you are directed to report to the Secretary of State in regard to such hospital or barrack, and to frame plans and estimates of all such works or measures which you consider necessary, but which cannot at once be executed within the financial limit prescribed to you.

(12.) The instructions for the immediate execution of works not exceeding 100*l.* in cost for each barrack or hospital shall be signed by the chairman, and shall be the authority to the district engineer to proceed with the works so authorized.

(13.) You shall further see that the works directed or recommended by you are completed to your satisfaction, and you shall report on the same forthwith to this Department.

(Signed) PANMURE.

October 1857.

GENERAL REPORT

ON THE

SANITARY CONDITION AND IMPROVEMENT OF BARRACKS AND HOSPITALS.

My Lord,

The Commission for improving barracks and hospitals on which we have had the honour of serving was appointed by the Secretary of State for War, immediately after the Report of the Royal Commission on the sanitary state of the army was presented. The Report had shown that the army was subject to an excess of mortality over and above that prevailing among males in civil life. The annual deaths among all arms of the service on home stations were shown to be 17·5 per 1,000 per annum, as against 9·2 per 1,000, which represents the annual deaths among males of the same ages taken over the town and country population of England and Wales. An analysis of the diseases which had led to this high rate of mortality demonstrated that the excess of deaths was due almost entirely to zymotic diseases, such as fevers, cholera, diarrhœa, and to chest and tubercular diseases, such as consumption, &c. Seven-ninths of the entire mortality among the infantry of the line, were found to have arisen from these two classes of diseases; and for each class the mortality among the infantry was shown to be more than double what it is among males of the same ages in civil life.

With these facts before it, the Royal Commission proceeded to make a general inquiry into those conditions of the soldier's life and service likely to have influenced his health so injuriously, and among other causes assigned for the excess of mortality were sanitary defects in barracks and hospitals, such as overcrowding, defective ventilation, bad drainage, insufficient means of cooking and of cleanliness. But as the nature of the inquiry in which the Royal Commission was engaged precluded anything like a minute personal examination of either class of establishments, it recommended the appointment of our Commission for the special purpose of examining into the sanitary condition of barracks and hospitals, and of devising means for removing any defects injurious to health, which further examination might bring to light.

Immediately on receipt of Lord Panmure's instructions, we proceeded to arrange the manner of inquiry best adapted for enabling us to ascertain the sanitary condition of all the barracks and hospitals, the improvement of which was committed to us.

We considered it to be advisable to divide the inquiry into two parts, one to be carried out by statistical returns, to be filled up by medical officers and barrack masters, the other to be carried out by personal examination and inquiry on the spot. Copies of the returns, Nos. 1, 2, 3, 4 and 5, are appended to this Report. Those intended to be filled up by barrack masters related to the position of barracks, the area of ground, the nature of the subsoil, the size of barrack rooms; their means of warming, lighting, and ventilation; the space and superficial area allowed per man; the state of drainage, water supply, cook-houses, ablution rooms, latrines, &c.

From medical officers we obtained similar information in regard to hospitals, the health of troops, &c.

While these returns were being prepared and sent in, we proceeded to make a personal examination of the barracks and hospitals of the United Kingdom, beginning with those of the metropolitan district, following out the examination in all the larger and more important barracks, and reporting the results of our inquiry in each district as soon as possible, in the form of interim reports, in order that the necessary works might be proceeded with at once.

The total number of barracks, to which our inquiry referred, amounts to 243, and of hospitals to 167, distributed throughout the United Kingdom in the following proportions:—

	Barracks.	Hospitals.
England - -	- 117	- 76
Scotland - -	- 20	- 15
Ireland - -	- 106	- 76

Of these we have personally examined and reported for improvement, up to the present time, 162 barracks and 114 hospitals. We have examined the camps at Shorncliffe and Colchester, and we have also made a partial inspection of the camp at Aldershot, but we have not yet reported on them in detail.

The remaining establishments yet to be inquired into are thus 81 barracks and 53 hospitals, nearly all of which are small, with accommodation for a few men only. Had we inspected these smaller barracks together with the larger and more important ones, it would have occupied much time, better devoted to improving those establishments in which large numbers of men are massed together, and where sanitary improvements are more urgently required. Although our work of primary inspection is thus still incomplete, it does not appear to be necessary to keep back our General Report until these barracks and hospitals have been gone over. We therefore proceed to lay before you the results of our inquiry up to the present time, together with those principles of barrack and hospital construction and improvement at which our experience has enabled us to arrive.

In doing so, however, it is necessary to state, at the commencement of our report, that the amount of funds placed at our disposal, by our instructions, namely 100*l.* per barrack, was found to be totally inadequate even for the execution of the more urgent sanitary works because, as we shall presently show, although large sums of money have from time to time been spent on these barracks and hospitals, a very small proportion of it appears to have been devoted to sanitary purposes. So far, indeed, as concerns the health of the troops, almost every barrack and hospital we have visited can be considered in no other light than as never having been completed, and the funds required for the necessary improvements have consequently very much exceeded in amount what could have been anticipated when we entered on our work. In every instance, therefore, we have been under the necessity of having estimates prepared for sanitary works. For the execution of these estimates various sums have been voted by Parliament, all of which have been appropriated, and are now in the course of being spent; but the amount specially voted for our Commission will by no means complete the works already recommended and estimated for, while some important works recommended by us have been or are being executed out of the annual barrack votes.

In dealing with the whole question we shall, for convenience, divide our report into two parts, one referring to barracks and the other to hospitals, and in each part we shall devote separate sections to the following subjects:—

1. The sanitary condition of each establishment.
2. The sanitary works and improvements we have recommended.
3. The steps which have been taken on our recommendation, the sums expended, the works yet to be executed, and the probable cost of them.

It will not be necessary to enter into the details of each barrack and hospital. These details have already been given in the interim reports which we have had the honour of laying before the Secretary of State. We have at present to give the general results of our examination and inquiry, so far as they have been carried out, together with the nature and extent of the improvements we have deemed it to be our duty to recommend.

We shall devote a separate part of this Report to a discussion of the principles which ought to be kept in view in planning and constructing future barracks and hospitals.

PART I.

SECTION I.

SANITARY CONDITION OF BARRACKS.

Under this section we proceed to consider,—

1. The position and neighbourhood of barracks.
2. The construction of barracks.
3. The cubic space per man in barracks.
4. The state of ventilation and warming of barracks.
5. The state of water supply, barrack drainage, latrines, urinals, and cleansing.
6. The condition of ablution and bath accommodation, wash-houses and cook-houses.
7. The question of accommodation for married non-commissioned officers and soldiers, workshops, libraries, schools, day-rooms, &c.

Taking the points of inquiry in the order, we shall commence with—

1.—The Position and Neighbourhood of Barracks.

By far the greater number of barracks we have inspected are situated in the suburbs of towns, in positions, hardly any of which can be said to be unhealthy, while very many of them cannot be described as otherwise than healthy. Generally they are somewhat elevated above the neighbouring levels, with sufficient fall for drainage; sometimes they occupy lofty eminences, fully exposed to the winds. There are, however, not a few examples of barracks situated in densely peopled neighbourhoods, and closely surrounded by dwellings of the civil population. This is especially the case with the barracks of the metropolis, Portsmouth, Devonport, Glasgow, Manchester, Dublin, Limerick, Birmingham, and a few other places. Closely built town districts, deficient in drainage and cleanliness, and incapable of free external ventilation, are well known to be unhealthy; and men massed together in such localities are, of course, subject to any injurious influence on health which may be due to them. The health of a barrack is dependent on free, moving, pure air, outside and inside its walls; and anything which interferes with this prime condition of health will act injuriously on the men.

There are a number of large town barracks in which these advantages are very imperfectly obtained. As an example at hand, we may cite St. George's barrack, behind the National Gallery, where there is a single block of buildings, intended to accommodate 476 men, enclosed within lofty walls in such a manner as to keep the air about it stagnant at all ordinary times. Portman barrack, near Portman Square, presents another similar example. It is a closed square of two-story buildings, with regulation space for 483 men, surrounded on all sides by higher walls. Clarence barrack at Portsmouth, and Brighton infantry barrack, afford other examples of the same defect in locality, which, indeed, is more or less common to all barracks in towns.

In some cases of town barracks, the immediate neighbourhood abounds in nuisances, or the streets are badly paved and filthy. Not unfrequently barrack rooms are built close to the privies of adjoining houses. or rather, perhaps, the houses and privies have come to the barracks, and nuisance is experienced in the barrack rooms, on account of the buildings having been originally placed too close to the boundary wall. Ship Street barrack, Dublin, overlooks a street of filthy houses, behind which pigs are kept, and nuisance is experienced when the sties are cleaned. Under proper municipal regulations, pigs would never be permitted in towns on any account, and if there be a legal remedy, neither pigs nor any other nuisance should be allowed to exist near buildings where numbers of men are crowded together. Parts of Hulme cavalry barracks, Manchester, are at times permeated by the smell of privies from the neighbouring houses, which come close up to the barrack room windows. Piershill barrack, near Edinburgh, presents an example of a barrack and hospital in an open situation, but in the immediate vicinity of meadows irrigated by the sewage of the town. Its only safety is its proximity to the sea, and its very free external ventilation.

The Guards' recruiting barrack at Croydon has not been so fortunate. This barrack, originally used as stables for the waggon train, is situated in a damp imperfectly drained hollow, and exposed to winds blowing over wet land, a manure manufactory, and pigsties. Scarlet fever and typhoid fever have repeatedly prevailed among the recruits, and we

have been obliged to recommend their removal from the barrack altogether in consequence, but want of accommodation elsewhere has prevented this recommendation from being carried out.

Tilbury Fort, surrounded, as it is, by a wet, undrained, marshy district of country, is particularly exposed to malaria, and whenever it is occupied, a large proportion of the men are sure to find their way into hospital from intermittent fever. Not only so, but men so affected carry the diseased predisposition with them to other stations, where they are admitted to hospital for ague, due entirely to their service at Tilbury.

It may not always be possible to assign the precise influence which these and similar defects in the position of barracks exercise on the health of the troops, on account of the many concurrent causes, on the operation of which health depends; but there is no reason to doubt that barracks located in close unhealthy town neighbourhoods are influenced by the same laws which govern health in such neighbourhoods. A soldier's health is the result of all the conditions to which he is exposed, and bad locality will not spare him any more than it will not spare other people. Indeed, we have a striking proof of this in the remarkable state of health enjoyed by troops encamped in the open country, as, for instance, at Aldershot and Shorncliffe, as compared with the health of the home army generally.

In the Report of the Royal Commission on the Sanitary State of the Army, it is shown that the average annual mortality of all arms, previous to 1853, was 17·5 per 1,000 per annum, while the mortality at Aldershot and Shorncliffe for three years, ending December 31st 1859, has been only 4·7 per 1,000 per annum.

The Guards are, perhaps, more continuously barracked in town districts than any other part of the army, and if we compare their mortality in the London barracks, and also the relative proportion of admissions from diseases of the zymotic class, with that at Aldershot and Shorncliffe, we find the result as follows:—

	Deaths per 1,000 per annum.	Admissions per 1,000 per annum.		
		Fevers.	Diarrhœa.	Total.
Guards 1847-54 - -	15·24	51·86	61·32	113·18
Aldershot } 3 years, ending	4·7	37·5	17·5	55·
Shorncliffe } Dec. 31 1859.				

Only part of this difference in health and efficiency is due to difference of locality, for there are other influences, such as subdivision of the men into huts, more active habits and more exercise, in operation to make camps healthier than town barracks; but still the facts are striking. To estimate their value, it is necessary to keep in mind that the number of men barracked in town districts in the United Kingdom amounts to upwards of 25,000.

It is not our intention to recommend the removal of town barracks to the open country. There are military reasons which must primarily determine the positions to be occupied by a military force; but we are desirous of expressing our conviction that wherever barracks can be placed in the open country, or in the open suburbs of towns, such positions should, if possible, be selected in preference to sites in town districts. This rule is especially applicable to hospitals, on account of the greater susceptibility of sick men to the effects of impure stagnant air.

The area of ground within barrack enclosures should be sufficient to enable the buildings to be spread over a wide surface; and the men's rooms should not be placed too near to that part of the enclosure wall to which the civil population is likely to come.

With regard to existing barracks in garrison towns, it appears to us to be an essential condition of the military occupation of such towns that they be kept in a proper sanitary state. The safety of the garrison may at any time, especially during war, depend on the question whether the town is cleansed and drained, or whether or not it is properly supplied with water. Portsmouth, the seat of one of the largest garrisons and dockyards in the kingdom, is in a very bad sanitary state; Sheerness, Devonport, Chatham, Dublin, Galway, and many smaller towns, are not much better. A similar remark applies to parts of even otherwise well drained towns near barracks, where a degraded filthy population not unfrequently congregate in houses of the very worst class. It is not easy to apply a remedy to this evil, but wherever there are local powers, which can be called into operation to abate such nuisances, legal steps should be taken to remedy the evil. The case of Sheerness is one requiring special notice. This town is the site of one

of the most important of our naval arsenals and dockyards, and is generally garrisoned by between 700 and 800 men, chiefly artillery. Its position, although on the sea shore, is most unhealthy, from the vicinity of marshes and undrained land. The town itself lies very low, and is in a wretched sanitary condition, without drainage or proper cleansing, all the filth being received into cesspits, from which it percolates into the soil. The water supply has in times past been obtained from two wells only. The troops in garrison are exposed to the influence of marsh miasma, and suffer to a large extent from miasmatic diseases, especially ague. At the time of our inspection half of all the sick in hospital were suffering from this disease. From information supplied to us by the Director-General of the Army Medical Department, it appears that the annual admissions into hospital at Sheerness from ague, on an average of the last three years, have amounted to no fewer than 125 per 1,000 strength, while the usual proportion of admissions from this disease in the cavalry regiments is 0·55, and in the infantry 2·74 per 1,000 strength.

Intermittent fever when once fairly implanted in the constitution, is one of those diseases most injurious to the efficiency of an army, especially on foreign service, on account of the frequency with which the disease recurs, even from trivial exciting causes. It is common among the men of the royal artillery stationed along the banks of the Thames, for no fewer than an average of 120 cases per annum have been received into Woolwich garrison hospital from these localities. Neglect of land drainage at home thus becomes a direct cause of inefficiency in the army abroad. Woolwich itself, nevertheless, affords a gratifying proof of how much may be done to improve the health of garrison towns by sanitary works. It has been placed under the operation of the Public health Act, and its local board has carried out many very important measures of local improvement, affording in this respect a marked contrast to the neglect of sanitary works in many other garrison towns.

2.—Construction of Barracks.

The barracks in the United Kingdom exhibit great diversity in plan, and still greater diversity in internal arrangement and proportions. Some of the plans, especially those of certain Irish barracks, are good, convenient, and well adapted for securing the healthiness of the buildings. Of the great majority, the plans are very indifferent, and there are not a few of which the plans or construction, or both, are essentially bad.

The question as to what are the attributes of a healthy barrack plan appears hardly to have been considered. Facility of supervision and of discipline seems to have been chiefly aimed at, and in not a few instances the only guide in framing the plan appears to have been the amount and shape of the ground at the disposal of the architect. This is much to be regretted. It is not necessary to build a bad barrack because the ground on which it is to be placed is limited. A small area admits of being covered with buildings on a good plan, to the extent of its capacity, as well as a large area.

The best barracks are not those of recent construction, but they are to be found among the Irish barracks, built in the end of last century or early in the present one. It is true that we have seen no barrack possessed of all the requirements which such buildings ought to have for health, comfort, and convenience, but so far as concerns their general plan and arrangement, the barracks to which we allude are certainly the best we have seen.

The errors in plan bearing on the healthiness of barracks which have come under our observation are of the following kinds:—

1. Errors in the general arrangement of the block plan of the buildings.
2. Errors in the internal arrangement of the barrack rooms.

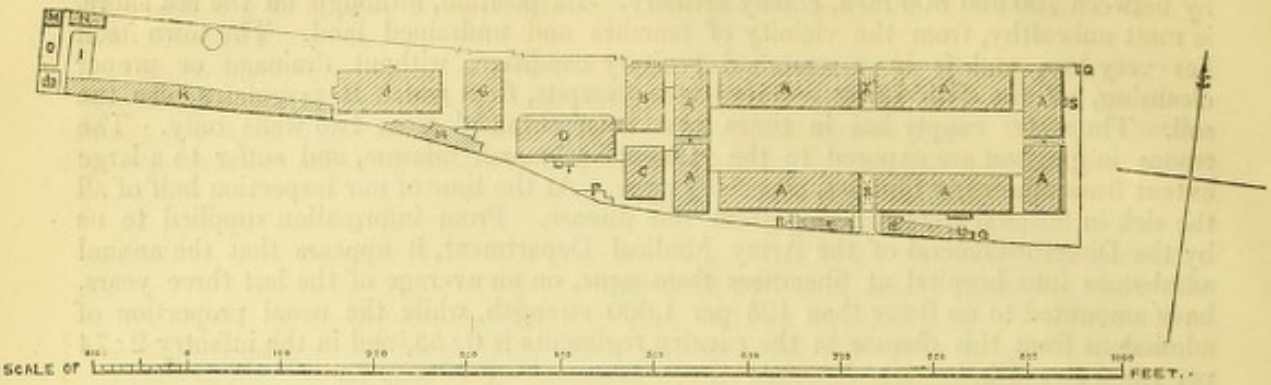
The errors in plan most frequently committed are the following:—

Want of simplicity in the general arrangement of the blocks; buildings so placed as to interfere with the ventilation of each other; buildings erected round closed courts, or with deep closed angles; barrack room buildings placed too close to the boundary walls: with latrines, urinals, dung heaps, ashpits, &c. placed in a narrow space between the barrack and wall; buildings in which the men are concentrated in one or two large blocks, instead of the barracks being spread over the ground.

These errors in plan include hospitals as well as barrack rooms, and their general effect as regards health is to obstruct that free movement of the external atmosphere over all the surfaces of the buildings which is essential to the preservation of purity of the air within the rooms. Free access of light is prevented and the air already stagnated by the arrangement of the buildings is liable to be rendered more impure by nuisances

We shall introduce a few illustrations of these various defects.

Fig. 1.—Hyde Park Cavalry Barracks.



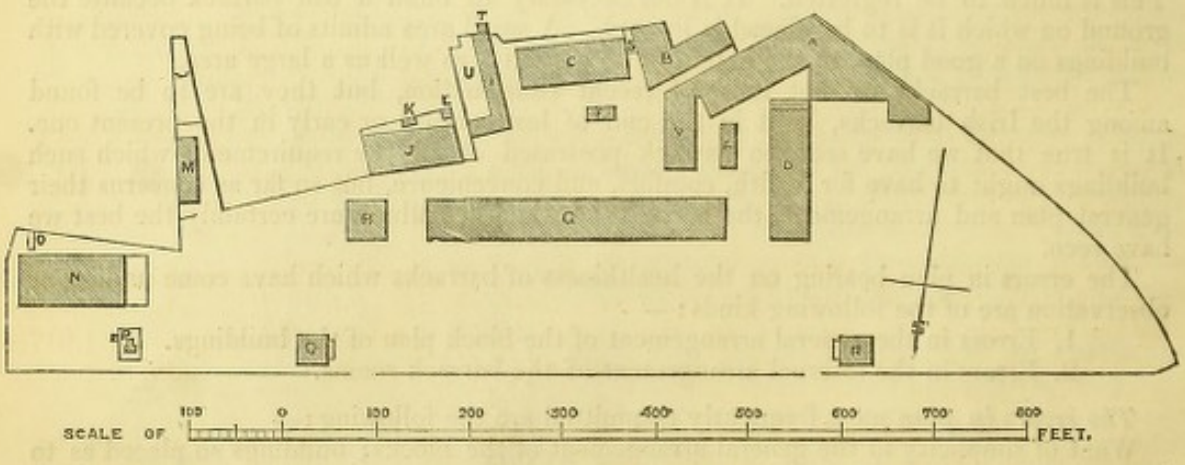
A Soldiers' barracks over troop stables.
B Granary over officers' stables.
C Hospital.
D Officers' quarters.
E Guard room.
F Cells and privies.
G Staff officers' quarters over sick boxes.
H Pharmacy, shoeing forge, armourer's shop, and privies.
I Straw yard.
J Riding school.
K Officers' stables.
L Magazine.
M Carpenter's shop.
N Coach house and engineers' store.
O Open shed.
P Hospital and officers' privies and dust bin.
Q Women's privy.
R Do. do.
S Dust bin.
T Servant's privy
U Bath room.
X X Archways.

Fig. 1 is a block plan of Hyde Park cavalry barracks at Knightsbridge, constructed to accommodate 536 non-commissioned officers and men, with a proportionate number of horses, on a long strip of ground, 3A. 2R. 35P. in extent. The buildings for men and horses are crowded into about 5 acres of the area, which, if the barracks were fully occupied, would equal a density of population of 114,560 to the square mile, exclusive of women and children, and exclusive of horses. The actual number in barracks when we inspected them was 385 men, besides women and children.

The situation towards the park is open, but it will be seen that there are 14 blocks of building on the ground, so disposed as effectually to cut off free air currents from the square.

There are no back premises, and the litter and manure are thrown out directly under the windows of the barrack rooms, and of the corridors giving access to them. The rooms are over the troop stables, and the whole place smells of ammonia. This is one of the worst cavalry barracks in the United Kingdom, and from radical defects in its structure, it does not admit of material improvement.

Fig. 2.—Wellington Barracks.

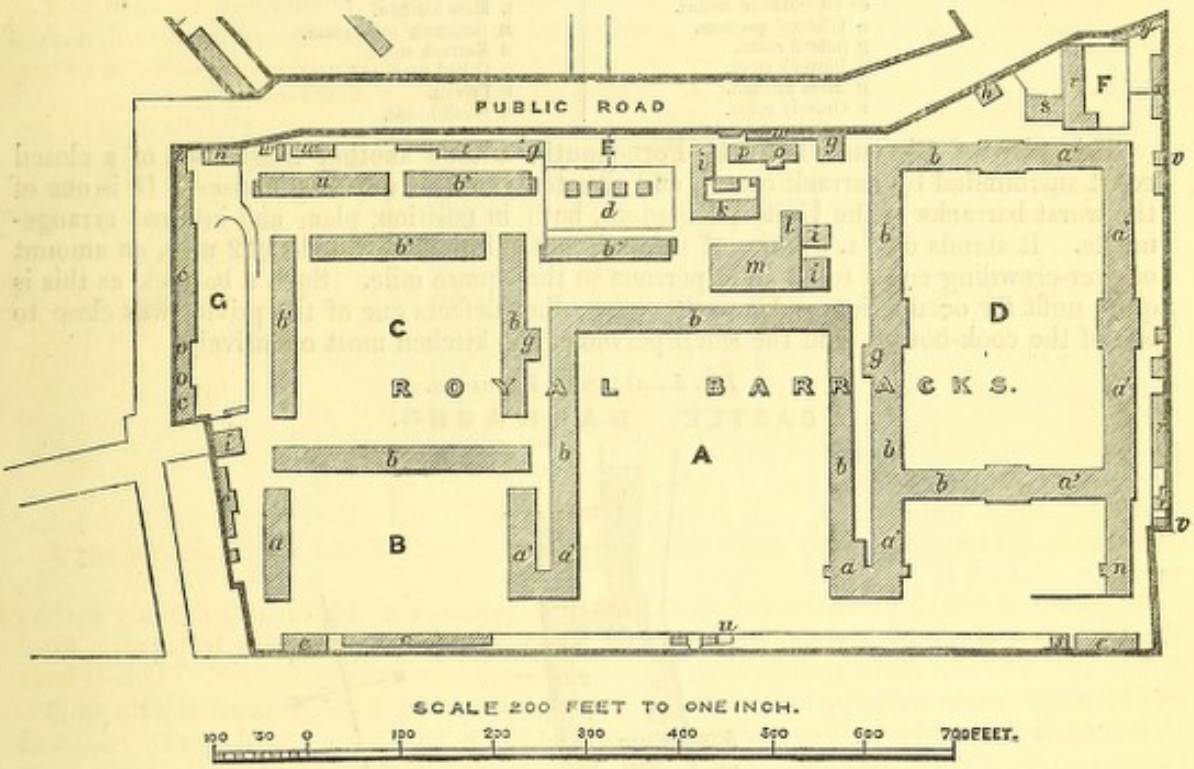


A Soldiers' barracks over ablution rooms and stores.
B Wash house and drying rooms.
C Soldiers' room and canteen.
D Soldiers' room over ablution rooms and stores.
E Soldiers' privies and urinals.
F Do. do. do.
G Soldiers' barracks and officers' quarters over ablution rooms.
H Officers' quarters.
I Prison.
J School.
K Privy.
L Do.
M Officers' stables.
N Chapel.
O Urinals.
P Magazine.
Q Guard house.
R Do. do.
S Engine house.
T Provost serjeant's privy.
U Prison yard.
V Cook house and serjeants' quarters.

Fig. 2 shows the arrangement of buildings in the Wellington barracks. In this instance the area within the barrack enclosure has an extent of 7A. 3R. 3P., about 3 acres of which are covered with large blocks of buildings, containing regulation space for 1,530 non-commissioned officers and men, giving a density of 326,000 inhabitants per square mile

for the built area, being nearly double that of East London, which is one of the most densely peopled town districts in England. It will be seen that in this instance also the blocks are so arranged as to prevent that free circulation of air which should always take place round densely occupied buildings. The parade ground is open to the park in front, but the advantages of this favourable exposure are to some extent neutralized by the arrangement of the blocks, which has been determined by the fact, that the ground was obtained, and the buildings erected bit by bit, and without sufficient attention to a proper sanitary disposition of parts.

Fig. 3.—Royal Barracks Dublin.



SCALE 200 FEET TO ONE INCH.

100 50 0 100 200 300 400 500 600 700FEET.

A Royal square.
B Cavalry square.
C Stable square.
D Palatine square.
E Ball courts.
F Coal yard.
G Drying ground.
a Major-General's quarters.
a' Officers' quarters.
b Soldiers' quarters.
b' Soldiers' quarters, over stables.
c Officers' stables.

d Magazines.
e Guard houses.
f Cells.
g Ablution houses.
h Wash houses.
i Cook houses.
k Canteen.
l Canteen store.
m Riding school.
n Barrack master's store and office.
o Barrack serjeant's quarters.

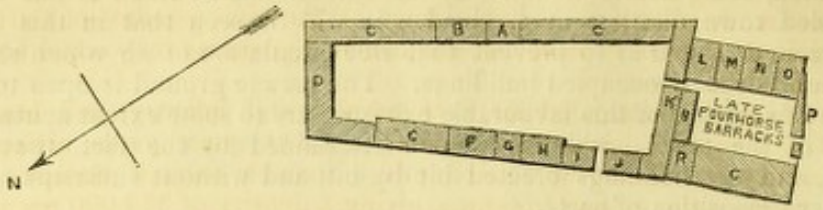
p Armourers' shops.
r Barrack stores.
s Shoemakers' shops.
t Farrier's sheds.
u Granary, over stables.
v Officers' privies.
w Soldiers' privies.
x Engineer office and clerk of work's quarters.
y Workshops.
z Straw store.

The Royal barracks, Dublin, afford an illustration of similar defects, together with an example of a court of lofty buildings entirely closed at the angles. The area occupied by the buildings is 13A. 3R. 10P., and the barrack rooms have regulation space for 1,917 men, being in the ratio of 88,000 to the square mile, or about 25 per cent. more than the density of Liverpool.

The buildings, although disposed with an apparent regularity, are crowded together, and are much inferior in sanitary arrangement to the Wellington barracks. There are narrow dark lanes between lofty three and four story buildings, without any outlet sufficient to prevent stagnation of air. The ground, moreover, rises rapidly behind the barracks, and there is no free circulation of air at the back.

The men's rooms on three sides of the cavalry square are over the stables. The barrack rooms in the Royal and Palatine squares have windows to the outer air only at the back; on the other side towards the square they are covered by a glazed corridor. There are rooms in the corners and lower flats of the squares, dark and incapable of ventilation, and which are hardly fit for human dwellings. Taken as a whole, the arrangements of this plan afford an excellent illustration of what ought to be avoided in barrack construction.

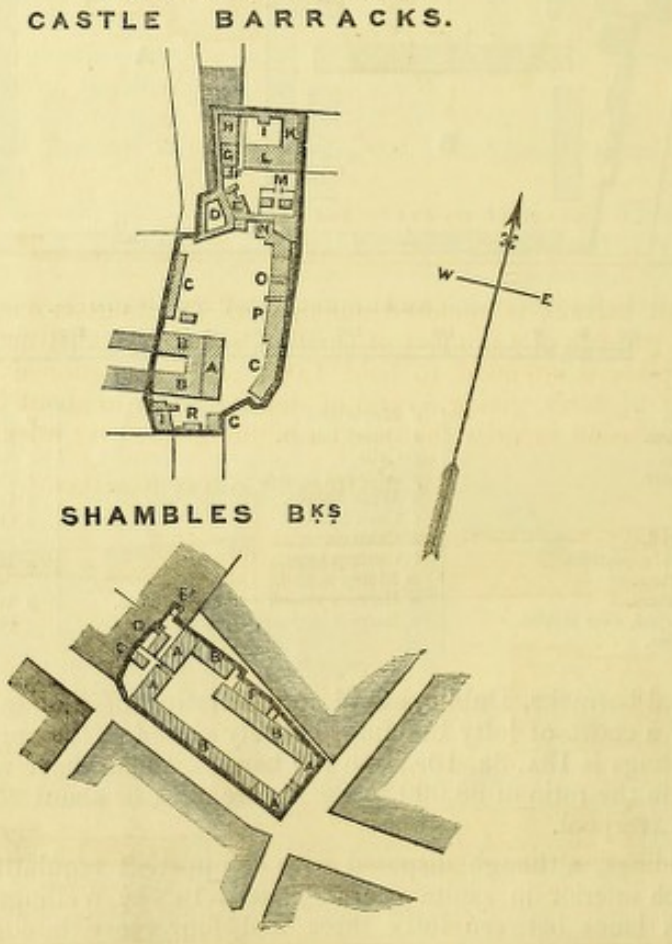
Fig. 4.—Clarence Barracks, Portsmouth.



A Infant school.
BB Cooking houses.
CCCC Soldiers' rooms.
D Officers' quarters.
F School room.
G Barrack store.
H Mess kitchen.
I Orderly room.
J Guard room.
K Staff serjeants' quarters.
L Mess kitchen.
M Serjeants' mess room.
N Barrack store.
O Guard room and store.
P Privies.
R Wash house.

This plan of Clarence barrack, Portsmouth, affords another illustration of a closed court surrounded by barrack rooms, and situated amongst dwelling houses. It is one of the worst barracks in the United Kingdom, both in position, plan, and internal arrangements. It stands on 1A. 3R. 6P. of ground, and is intended to hold 912 men, an amount of over-crowding equal to 330,000 persons to the square mile. Such a barrack as this is quite unfit for occupation. Amongst many other defects one of the privies was close to one of the cook-houses, and the smell pervaded the kitchen most offensively.

Fig. 5.—Galway Barracks.



Castle Barracks.

A Officers' quarters.
B Soldiers' do.
C Stables.
D Coal yard.
E Armourer's shop and shoeing shed.
F Dead house.
G Engineer store.
H Barrack store.
I Privies.
K Kitchen.
L Hospital.
M Magazine.
N Barrack office.
O Cell.
P Engineer office and guard room.
R Cook house.

Shambles Barracks.

A Officers' barrack.
B Soldiers' do.
C Officers and non-commissioned officers' privies.
D Men's privies.
E Tank.
F Stables.

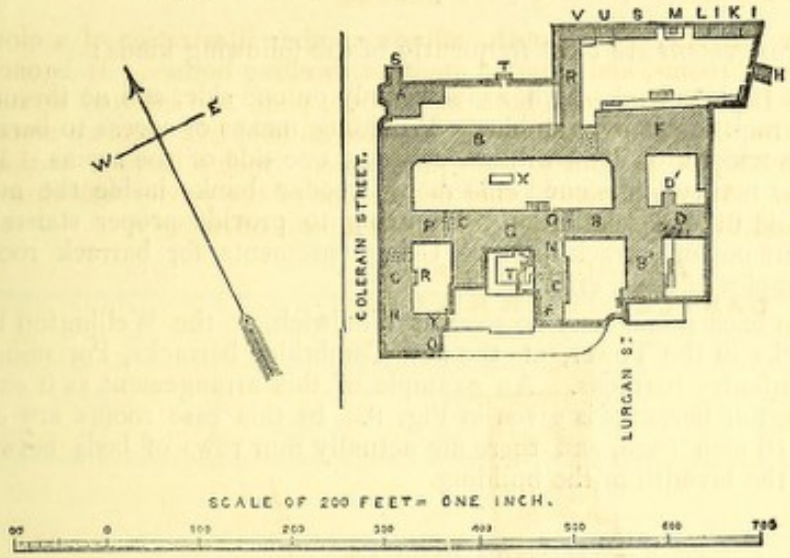
The Castle and Shamble barracks, Galway, show errors both in position and plan. These barracks are embedded among buildings of the civil population, and their plans are so defective that even if placed in less confined positions they could not enjoy the benefits of free ventilation.

The Castle barrack is intended for both cavalry and infantry, and has regulation space for 120 men besides horses, on an area of 4,500 square yards, giving a ratio of population of nearly 80,000 to the square mile. Shamble barrack occupies an area of 2,238 square yards, and contains 256 men, giving a density of 352,000 per square mile, exactly double the density of the most densely peopled town districts in England.

The plans show small narrow closed courts surrounded by high buildings, and destitute of sufficient light and ventilation.

The next plan is that of a building not originally intended for soldiers, namely, an old linen hall at Dublin, leased by the War Department as a temporary reserve barrack.

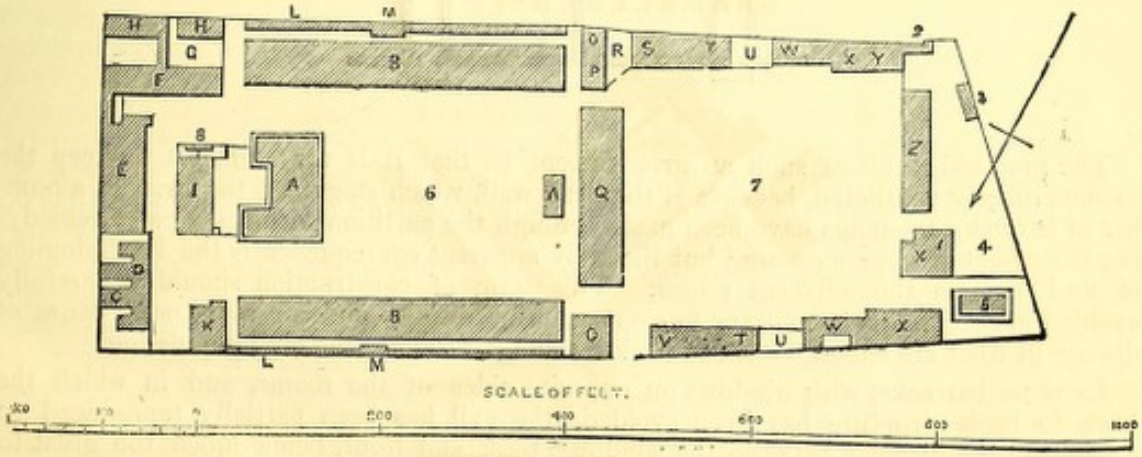
Fig. 6.—Linen-Hall Barracks, Dublin.



A Officers' quarters.
B Officers' and soldiers' quarters.
B' Officers' mess and soldiers' quarters.
C Barrack serjeant's quarters.
D Hospital.
D' Water closet.
E School room.
F Soldiers' quarters.
G Canteen and soldiers quarters, over.
H Engine house.
I Women's wash house.
K Armourer's shop.
L Serjeants' mess kitchen.
M Magazine.
N Guard room.
O Orderly room.
P Barrack stores and office.
R Cook house.
S Stables.
T Officers' privy.
U Women's privy.
V Soldiers' privy.
W Straw store.
X Tanks.
Y Ablution room.

Linen Hall barrack is enclosed among civil dwellings in one of the worst districts of Dublin. It consists of a number of small closed courts obstructing the external ventilation. The place is intended to hold 1,094 non-commissioned officers and men, on an area of about 2½ acres, giving a ratio of density equal to about 325,000 per square mile. It can only occasion surprise that such a building was ever selected for such a purpose.

Fig. 7.—Hulme Cavalry Barracks.



A Officers' quarters.
BB Stables, soldiers' rooms over.
C Canteen.
D Barrack office, barrack serjeants' quarters, &c.
E Riding school.
F Hospital.
G Do. yard.
H Do. outbuildings.
I Workshop, school, library, &c.
K Guard room, orderly room, and cells.
LL Litter sheds.
MM Serjeants' privies.
N Ablution room.
OO Cook houses.
P Harness room.
Q Temporary stables.
R Coal yard.
S Hay and straw stores.
TT Soldiers' privies.
UU Dung pits.
V Regimental store, &c.
WW Infirmary stables.
XXX Barrack stores, &c.
Y Wash house.
Z Married soldiers' quarters.
1 Ball Court.
2 Married soldiers and womens' privies.
3 Drying and ironing room.
4 Drying ground.
5 Magazine.
6 Foot parade.
7 Horse do.
8 Officers' privies.

This plan of Hulme cavalry barrack is introduced to illustrate the injurious consequences of building barracks too close to the boundary walls. The men's rooms are over the stables, and behind them is a narrow strip of ground, affording no adequate means either for cleanliness or for circulation of air between the barracks and the wall. Outside the boundary on one side is a lofty cotton mill, which shuts off the ventilation in that direction, and on the other side is a closely peopled district of houses, the privies and middensteads of which come close up to the enclosure walls. The smell from these privies and middensteads pervades the rooms at certain times, much to the annoyance of the men. This example shows the necessity of having a sufficient area to isolate barracks and to admit of free outer ventilation of the buildings.

These instances are sufficient to illustrate defects in the block plans of barracks, which ought to be carefully avoided. They are among the worst examples we have met with, but similar defects are common enough; they only differ in degree. As already stated, the effect of all of them is to stagnate and pollute the air both within and without the barrack rooms, to obstruct light, and to predispose the men to disease.

Errors in internal arrangement are most frequently of the following kinds:—

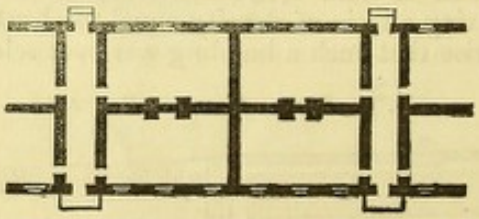
Placing barrack rooms back to back, with windows only on one side, and no thorough draft. Constructing barrack rooms over stables. Providing means of access to barrack rooms by long internal corridors, or by corridors covering one side of the rooms. Providing accommodation for non-commissioned officers by wooden bunks inside the men's rooms, so as to obstruct light and ventilation. Omitting to provide proper staircases, and taking space for stairs out of barrack rooms. Using basements for barrack rooms. We shall give a few examples of these errors.

Illustrations of back to back rooms may be seen at Woolwich, at the Wellington barracks, at the new barracks in the Tower, at the new Cambridge barracks, Portsmouth, and in numerous other infantry barracks. An example of this arrangement as it exists in A block of the Wellington barracks is given in Fig. 8. In this case rooms are constructed for 14, 15, and 16 men each, and there are actually four rows of beds between the opposite windows in the breadth of the building.

Fig. 8.—Wellington Barracks.

PART OF A. BLOCK.

Showing the mens' rooms back to back with windows on one side only.



The practical result of such an arrangement is, that it is very difficult to keep the rooms properly ventilated, because of the dead wall, which stagnates the air. In a number of barracks, openings have been made through the partition with the view of remedying the defect in some measure; but the only apparent consequence is the intermingling of foul air from the adjacent rooms. This form of construction should be carefully avoided in future. It is contrary to every sound principle, and is a well-known cause of disease in what are called "back to back dwellings," among the civil population.

In some barracks, with windows on opposite sides of the rooms, and in which the back to back structure has been avoided, the evil has been partially reproduced on account of the distance between the windows, back and front, being much too great to admit of the rooms being properly ventilated. This defect exists in the new infantry barracks at Aldershot, and in the new Raglan barracks at Devonport. The rooms in these barracks are long and narrow, and have the men's beds arranged along the dead walls, 12 beds on each side. The windows are at the ends of the rooms instead of being along its sides, and the rooms are deficient in light and in means of natural ventilation in consequence.

Cavalry barracks present some remarkable errors in construction and internal arrangement.

The common custom in these barracks is to build the men's rooms over the stables, and to place the blocks of building as close as possible to the boundary wall. In the narrow lane left between the barracks and the boundary wall are placed, not only the latrines and ashpits, but litter heaps, dungpits, ablution houses, cook-houses, &c., and if, as often happens, the pavement is in a bad state, this narrow lane resembles nothing so much as one of the filthiest and most neglected alleys in the filthiest part of our towns. There is nothing in the internal arrangement of cavalry barracks to redeem this error in plan. On account of the depth of the stables from front to back, it has been the custom to carry a long, dark, unventilated corridor or passage along the whole length of the block, giving entrance out of it to the rooms right and left. The rooms have, consequently, windows only on one side. The windows are almost always deficient in number, and so placed as to leave half of the room in darkness, while the room doors have been placed close to the fire instead of being at the opposite end of the room, an arrangement by which the fire-side is rendered as uncomfortable as possible, and the end of the room opposite the fire is left without the advantage of the door for ventilation.

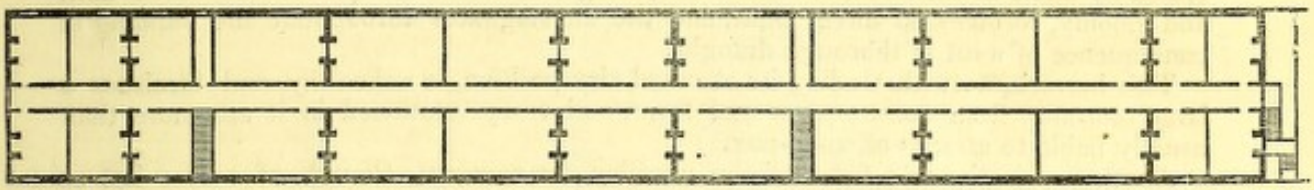
Examples of this error exist in Regent's Park barrack, Hounslow, Hulme, &c.

Figure 9 is a plan of Hounslow barrack, in which the relation of the dark inside corridor to the barrack rooms is shown.

Fig. 9.—Hounslow Barracks.

PLAN OF EAST WING,

Showing the access to the men's rooms, provided by means of a long, dark, unventilated inner corridor 320 feet in length, with the rooms opening right and left out of, and having windows on one side only.



Every cavalry barrack we have seen constructed on this plan is saturated throughout with ammonia and organic matter; and in cases where the barrack rooms have been shut up and unoccupied for some time, the putrescent odour experienced on entering them is indescribably offensive.

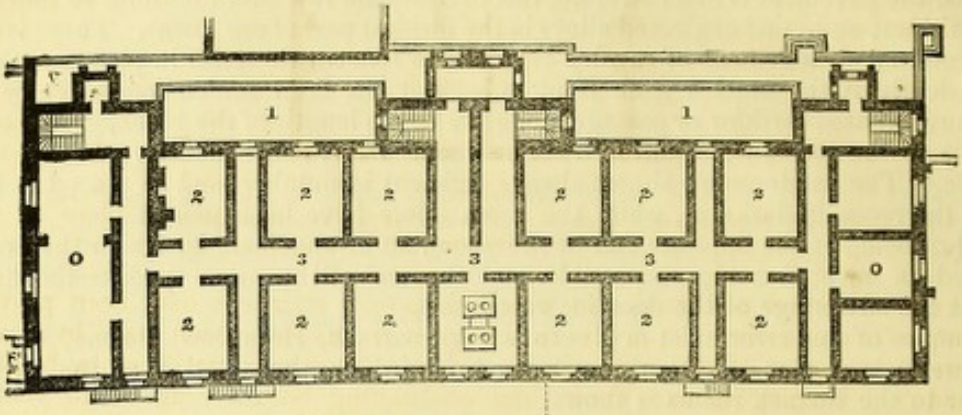
The usual reason assigned for these errors of construction is, that it is necessary or advantageous to have the men barracked close to the horses, partly on account of facility for discipline, and partly to avoid the supposed risk of exposure in going to and from the stables. For a similar reason, apparently, we have met with instances, as for example, at Knightsbridge barracks and Horfield barracks, in which the door into the stable actually opened from the stair leading to the men's rooms above. These reasons are quite untenable, because there are excellent cavalry barracks in which the horses are stabled away from the men's rooms, and in which none of the alleged inconveniences are experienced. Besides, stables under barrack rooms are by no means unattended by other disadvantages besides those to the health and cleanliness of the men. They are generally constructed to contain from 12 to 16 horses, in stalls placed back to back, with a central passage between the two rows of horses, terminated at each end by a door, through which the greater part of the light is obtained. This arrangement exposes the horses to continual draughts, without necessarily ventilating the stable, while the separation of the horses among so many stables actually increases the difficulty of supervision and maintenance of discipline. In addition to this, we hold it to be very difficult, if not impossible, to ventilate a stable containing many horses sufficiently with rooms over it. Moreover, a proper allowance of cubic space per horse, which is an element as necessary to the healthiness of stables as to that of barrack rooms, can only be obtained at great expense, except where there is an open roof over the stalls.

The objectionable system of internal corridors has also been adopted in some infantry barracks, which afford as bad examples of this construction as do most cavalry barracks.

In the "New Barracks," Edinburgh Castle, for instance, there are five or six flats of barrack rooms in one large block, with dark unventilated passages running the lengthway of the block in each flat, giving access to the rooms right and left. In such an arrangement the corridors and staircases extending from top to bottom of the building become merely receptacles for foul air, which is thus diffused through the whole establishment.

Figure 10 gives a plan of one flat of the new barracks in Edinburgh Castle, which exhibits one of the most objectionable instances of inner corridors in existence.

Fig. 10.—New Barrack, Edinburgh Castle.



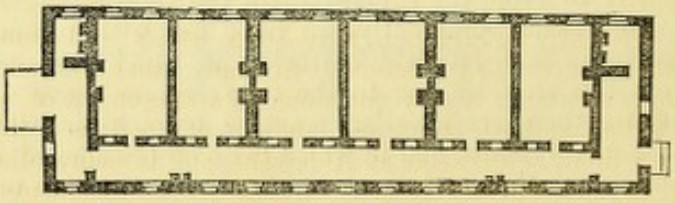
1, 1. Deep sunk areas from which part of the lower Barrack Rooms derive their light and ventilation.
2, 2. Soldiers' rooms having windows only on one side; opening out of—
3, 3. Dark, unventilated inside corridors.
o, o. Officers' quarters and mess establishment, &c.

The corridor abuts at the ends on the officers' quarters and mess establishment, and is closed by doors at each end, so that no thorough draft can take place in it. It is dark and gloomy, receives no direct light, and the air stagnates throughout the building in consequence of want of thorough draught.

This barrack, notwithstanding its elevated airy position, is unhealthy, and furnishes a large mortality from consumption and fever, and troops stationed in it are more than usually liable to attacks of small-pox.

Another objectionable form of the corridor arrangement, though of course not so objectionable as the former, consists in carrying the corridor along one face of the barrack. This arrangement may be seen in part of the Wellington barrack, in the Royal barrack, Dublin, and in the new Kensington barrack. It gives an apparent facility of access to the rooms at the expense of their light and ventilation, both of which are cut off along one side, or at one end if the rooms are deep from front to back. It is shown in Fig. 11.

Fig. 11.—Wellington Barracks.



Plan of B. block.

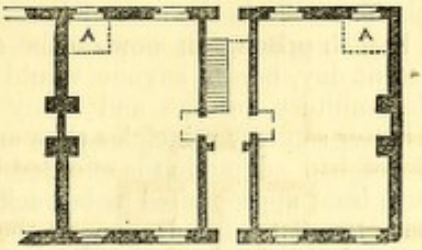
Showing a corridor covering one side of the range of rooms, which have consequently windows to the open air only at one end.

The time which barrack room floors take to dry after having been washed affords a useful indication of the freedom, or otherwise, of the ventilation provided in the construction and arrangement of the rooms. In barracks with corridors covering one side of some of the rooms, and where other rooms in the same block have windows to the open air on two opposite sides, it is observed that the floors of the latter class of rooms dry much more speedily than the floors of the former class.

In many barracks, even of recent construction, no sufficient accommodation has been provided for non-commissioned officers, and to supply this deficiency, a wooden bunk is generally placed in one corner of each barrack room. The result of this arrangement is, that if there be a window where the bunk is placed, the light of the window is taken from the barrack room; and if there be no window, as sometimes happens, the bunk is simply a large dark unventilated box, in which the serjeant sleeps.

Fig. 12 shows how these bunks are generally placed in the rooms. The instance we have selected is from Bury barracks, in which rooms, otherwise good, have their light and ventilation injuriously interfered with by this defective construction.

Fig. 12.—Rooms with Serjeants' Bunks in Bury Barracks.



GROUND PLAN.

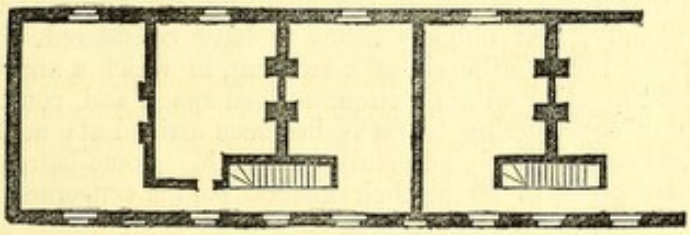
A, A. Serjeants' bunks, so placed as to obstruct the light and ventilation from one window in each room.

There are a number of barracks in which no proper staircases have been provided in the construction, and means of access to the upper rooms have been made by boxing off a staircase from a part of two adjoining barrack rooms on each flat, thereby blocking up one window belonging to each room, and obstructing both the light and ventilation. Examples of this arrangement occur at Maidstone, Paisley, Stockport, Western Heights barracks at Dover, Canterbury, Salford, Brighton, and other places.

An illustration of this defect, as it exists in Brighton infantry barrack, is shown in Fig. 13. This is a very bad barrack, but it is made worse than it would otherwise be, from the want of proper staircases for access.

Fig. 13.—Infantry Barracks, Brighton.

Showing the staircases taken off the barrack rooms, and both light and ventilation obstructed in consequence.



UPPER FLOOR.

Even where proper stairs exist, the best material is not always used in their construction.

Many barracks, especially in Ireland, have stone stairs and stone landings, which afford the best means of access to the rooms. In many other barracks the stairs are of stone and the landings of wood; a very questionable arrangement of materials in case of fire, but preferable to having both stairs and landings of wood, as is the case at Wellington barracks, the new infantry barracks at Aldershot, and in many others.

There are some barracks in which men's rooms are in basements partly below the level of the ground. Woolwich barracks, Waterford artillery barrack, and the new barracks recently completed at Gosport, afford illustrations of this bad form of construction. It should be totally discontinued in all buildings intended for human habitation. Basements can never be kept free from damp; they can never be sufficiently ventilated nor lighted; and any outer air they may receive passes over the wet or filthy surface of the ground before reaching the rooms. Cellar dwellings have been abolished in some towns by Act of Parliament, and it is time they should be struck off the construction of barracks.

Errors in plan and construction, similar to those enumerated above, exist to a greater or less degree in the majority of the barracks we have visited, but they are to be seen in their most aggravated form in buildings which have not been originally erected as barracks, but have been adapted to that object.

One of the most noteworthy of these buildings is the Linen Hall barrack, Dublin, already referred to. It contains 128 rooms, or rather cells, without sufficient light or ventilation; the whole internal arrangement being of the most complicated character. There are only five fire-places in the whole building, and there is no fire-place in the hospital. The absence of fire-places is supplied by stoves in the passages, which, at the time we inspected the building, were pouring out volumes of smoke so dense that both passages and rooms were filled with it.

Arbour Hill barrack, Dublin, was once a prison, and as such was not fit for prisoners.

It is now a barrack for 91 men. If it were proposed to restore it to its former use, no inspector of prisons would be justified in sanctioning it.

Another similar misappropiation exists in the case of Fort Elizabeth, at Cork, a building originally occupied as a French prison, but now on the construction as a barrack for 180 men, although at the present day, hardly anyone would consider it good enough for a prison. Indeed, as a rule, military prisons and many provost establishments are planned and constructed on better sanitary principles than are most barracks.

Another noteable example of bad adaptation is afforded by Stirling Castle, in which the old halls of the palace have been appropriated as barrack rooms by carrying galleries round the walls, so as to have two flats of beds, one on the floor and the other on the gallery; the result of the arrangement being that the heads of the men in bed in the galleries are above the tops of the windows, and, as there was no outlet for foul air from the top of the room, the only air which the occupants of the beds in the gallery had to breathe was the foul air from the soldiers who sleep on the lower tier of beds below. Barrack accommodation of the very worst description is obtained in this way, and the old halls of the palace are damaged.

Even recent adaptations of buildings to barrack purposes are open to serious objection. May Street recruiting barrack at Belfast, and Victoria Street barrack at Perth, afford illustrations of this remark. In the former case, a barrack for 50 men has been made out of a shop or factory, with windows on one side of it, which occupies one side of a narrow enclosed court, having the privy, cesspit, and ashpit at one end of it; the whole being on the model of a badly constructed blind alley or court in the worst districts of towns.

In the Perth example a manufactory has been converted into barracks, by simply putting bedsteads on the floors, while in all the other arrangements necessary for a barrack there is simply entire deficiency. Even the hospital is a place not fit to be occupied by people in health.

It appears to us that these defects in the plan and structure of barracks all proceed from one cause, namely, that nobody seems to have considered what conditions are required for preserving the healthiness of a building, in which a number of adults must necessarily be massed together within a circumscribed space, and, consequently, no intelligent uniform plan of constructing barracks has been arrived at; no fundamental principles are recognized as absolutely necessary for health. Some barracks are better than others, and a few are good, so far as their general plan is concerned, but these are the fortunate exceptions which prove the rule.

In the open country, and with a population distributed over a considerable area, free external movement of the air neutralizes or dissipates many causes of disease, which otherwise would have a potent influence on health; but this immunity has its limit. Whenever, even in the open country, the process of aggregation begins, and a number of human beings come to live and sleep in the same room, or under the same roof, the mere external movement of the atmosphere no longer affords the same immunity from disease. In built suburbs, or in the heart of densely peopled towns, where the external air itself is more or less impure, any stagnation, either within or without human dwellings, becomes hazardous to health. Hence the immense advantage gained in constructing all buildings to be occupied by numbers of people, and barracks as well as others, in open and airy districts. Indeed, the gain to health, by a proper selection of site, is so great, that nothing short of well-established military requirements should be permitted to overrule it. By a proper selection of site, the whole question of construction becomes simplified, for it insures the one paramount condition of health, a free, moving, outer atmosphere.

But it is quite possible to neutralize, to a greater or less extent, this advantage by errors in plan, and hence if barracks are built in town districts where the external air is not only more or less impure, but the external ventilation always more or less obstructed by surrounding buildings, any error in plan which still further obstructs the external ventilation becomes a positive risk to health.

The block plan of a barrack should therefore always be as simple as possible; the largest possible proportion of its surface should be exposed to the sun and to the action of prevailing winds; the buildings should be so arranged that no one part shall interfere with the light and ventilation of another; there should be no closed courts, no deep closed angles, no large projections; the latrines, urinals, ashpits, &c., should never be placed among the buildings, but away from them. The architect should from first to last consider, "How can I make the best use of my ground to secure pure flowing air and sun-"light over every part of my building?"

If such questions were asked, nearly all the existing errors in plan would be avoided. To secure these inestimable advantages as regards health, it is never necessary to sacri-

fice any other advantage, whether as regards convenience, comfort, discipline or even architectural effect. Healthy construction is quite compatible with all the rest.

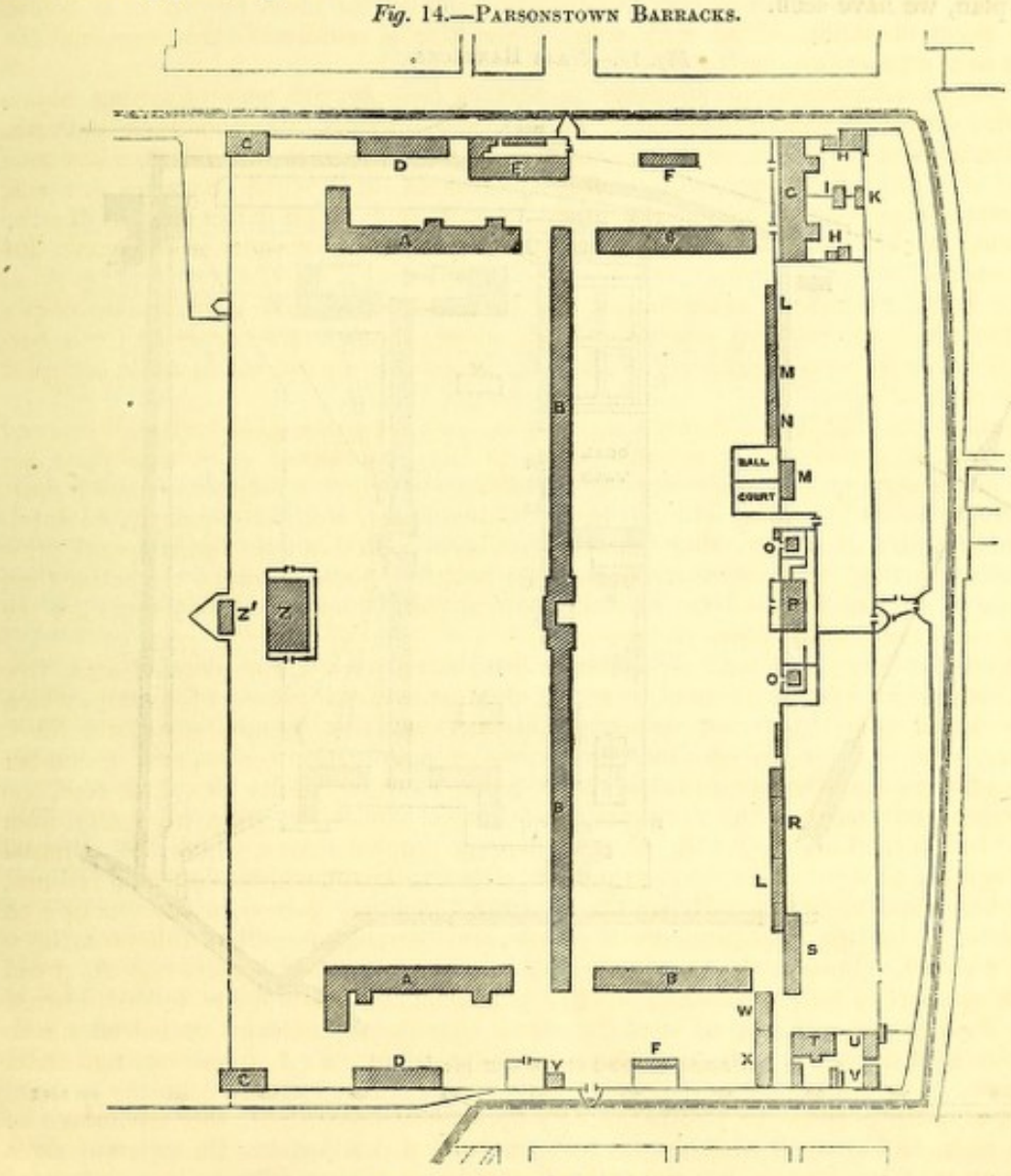
We have given on table C. a brief digest of facts bearing on this important subject, as regards existing barracks.

Having stated fairly the general results of an inquiry as to defects in plan and internal arrangement of barracks, we next proceed to give a few instances of improved plans and internal construction already in use.

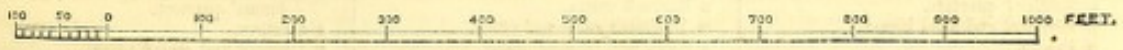
Improved Block Plans.—Some of the better class of Irish barracks exhibit the nearest approximation to a good block plan which has yet been attained in the United Kingdom.

The infantry barracks at Parsonstown afford a good example of this, as will be seen by the following plan, Fig. 14.

Fig. 14.—Parsonstown Barracks.



SCALE 200 FEET=ONE INCH.



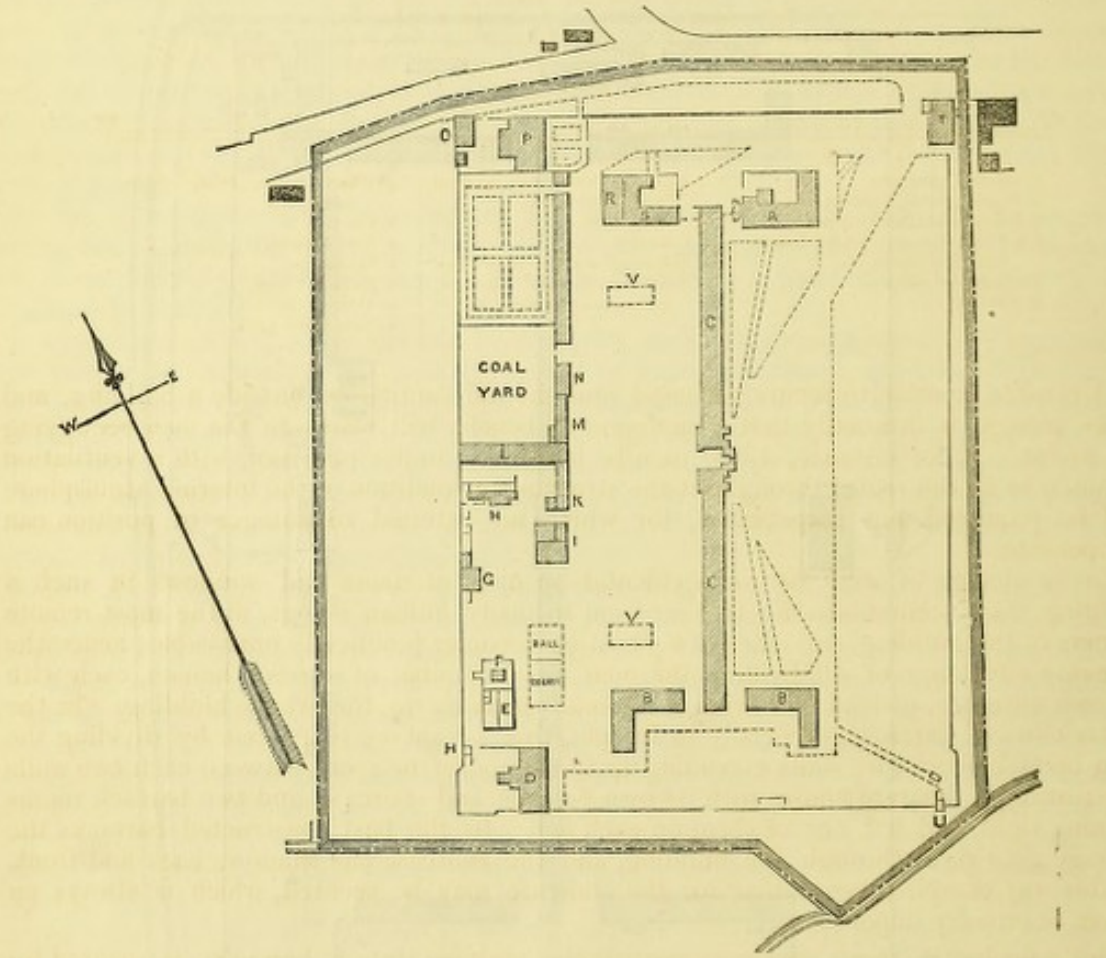
A Officers' quarters.
B Soldiers' quarters.
C Guard houses.
D Stables.
E Canteen.
F Privies.
G Hospital.
H Dead houses.
I Wash house.
K Privy.
L Ablution houses.
M Sheds.
N Wash house.
O Magazines 1 and 2.
P Prison.
R Engine house, store, and wash house.
S Barrack stores.
T Barrack masters' house.
U Coach house.
V Stable.
W Barrack store and office.
X Straw store.
Y Armourer's shop.
Z Chapel school.
Z' School masters' quarters.

In this plan barracks for 1,105 men are built in one long central range, with an arch way through the middle of its length, and in two detached blocks at the ends. All the barrack offices are at a sufficient distance, so as not to interfere with free external ven-

tilation. The rooms go through and through the ranges, and have windows on opposite sides. But even in this case there are serious errors in detail. Some of the outbuildings are not well placed, and nuisance is experienced from the privies, a defect which admits of remedy. It will be observed that there are no cook-houses; cooking is done in four barrack rooms on the ground floor, an error by which four good soldiers' rooms are abstracted from the construction of an over-crowded barrack, and all the heat and fumes of cooking are given off under the men's rooms above.

Naas barrack, Fig. 15, built for 360 non-commissioned officers and men, affords another good illustration of a similar block plan. Its proportions are somewhat better, and abundant ventilation and light are secured for the whole exterior of the buildings. The outbuildings are sufficiently removed from the men's rooms without being inconveniently placed, and on the whole this barrack may be considered one of the best, as to ground plan, we have seen.

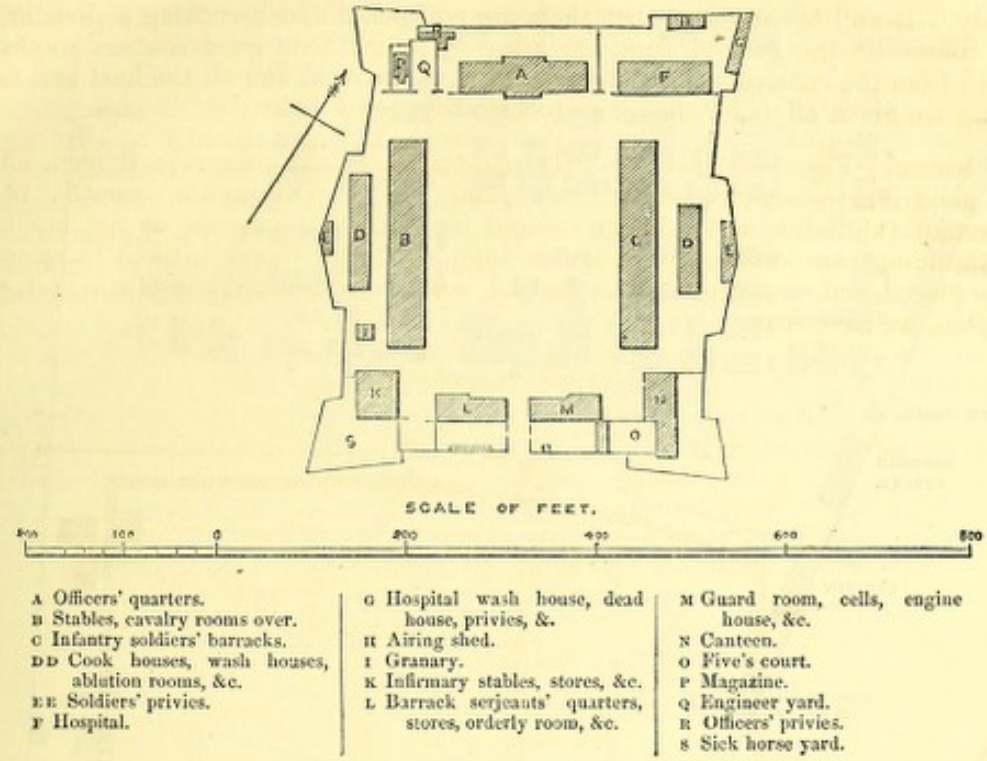
Fig. 15.—Naas Barracks.



A Officers' quarters and mess.
B Officers' quarters.
C Soldiers' quarters.
D Hospital and dead house.
E Prison.
F Magazine.
G Officers' stables.
H Privies.
I Wash house and cookhouses.
K Ablution house and store.
L Barrack stores.
M Engineer store and office.
N Store and Engine house.
O Commanding officers' stable and coach house.
P Officers' quarters.
R Barrack and quarter-master-serjeants' quarters.
S Canteen.
T Orderly and guard room.
U Officers' privy.
V Fire tanks, 1,200 gallons.

Several defensible barracks in Lancashire present illustrations of good block plans. We select Bury barracks (Fig. 16) as an example. The arrangement of parts is simple, and the external ventilation good. The position of the latrines behind the ablution rooms, washhouses, and cook-houses, by which they are screened from the barrack rooms, is also good. But, on the other hand, the cavalry stables are under men's rooms, and the latrines are placed over cesspits.

Fig. 16.—Bury Barracks.



A Officers' quarters.
B Stables, cavalry rooms over.
C Infantry soldiers' barracks.
DD Cook houses, wash houses, ablution rooms, &c.
EE Soldiers' privies.
F Hospital.
G Hospital wash house, dead house, privies, &.
H Airing shed.
I Granary.
K Infirmary stables, stores, &c.
L Barrack serjeants' quarters, stores, orderly room, &c.
M Guard room, cells, engine house, &c.
N Canteen.
O Five's court.
P Magazine.
Q Engineer yard.
R Officers' privies.
S Sick horse yard.

It is quite possible to secure sufficient sunlight and ventilation outside a building, and so to arrange it internally that a minimum of benefit will result to the men occupying the rooms. If, for instance, 1,000 men be barracked under one roof, with a ventilation common to all the rooms throughout the structure, a condition of the internal atmosphere will be produced and perpetuated, for which no external advantages of position can compensate.

Every change of wind, or the accidental opening of doors and windows in such a building, may accumulate the foul air from so many human beings, in the most remote corners of the building, and efficient ventilation becomes practically impossible; hence the immense advantage of subdividing the men into a number of separate houses, each with its own entrance, instead of having a common entrance to the whole building. In the better class of barracks, especially in Ireland, this advantage is secured by dividing the long barrack blocks by walls extending up to the roof: the space between each two walls constituting a separate house, with its own passage and staircase, and two barrack rooms opening right and left out of them on each flat. In the best constructed barracks the passage goes right through the building, and the staircase has windows back and front. In this way complete ventilation for the staircase may be secured, which is always an object of primary importance.

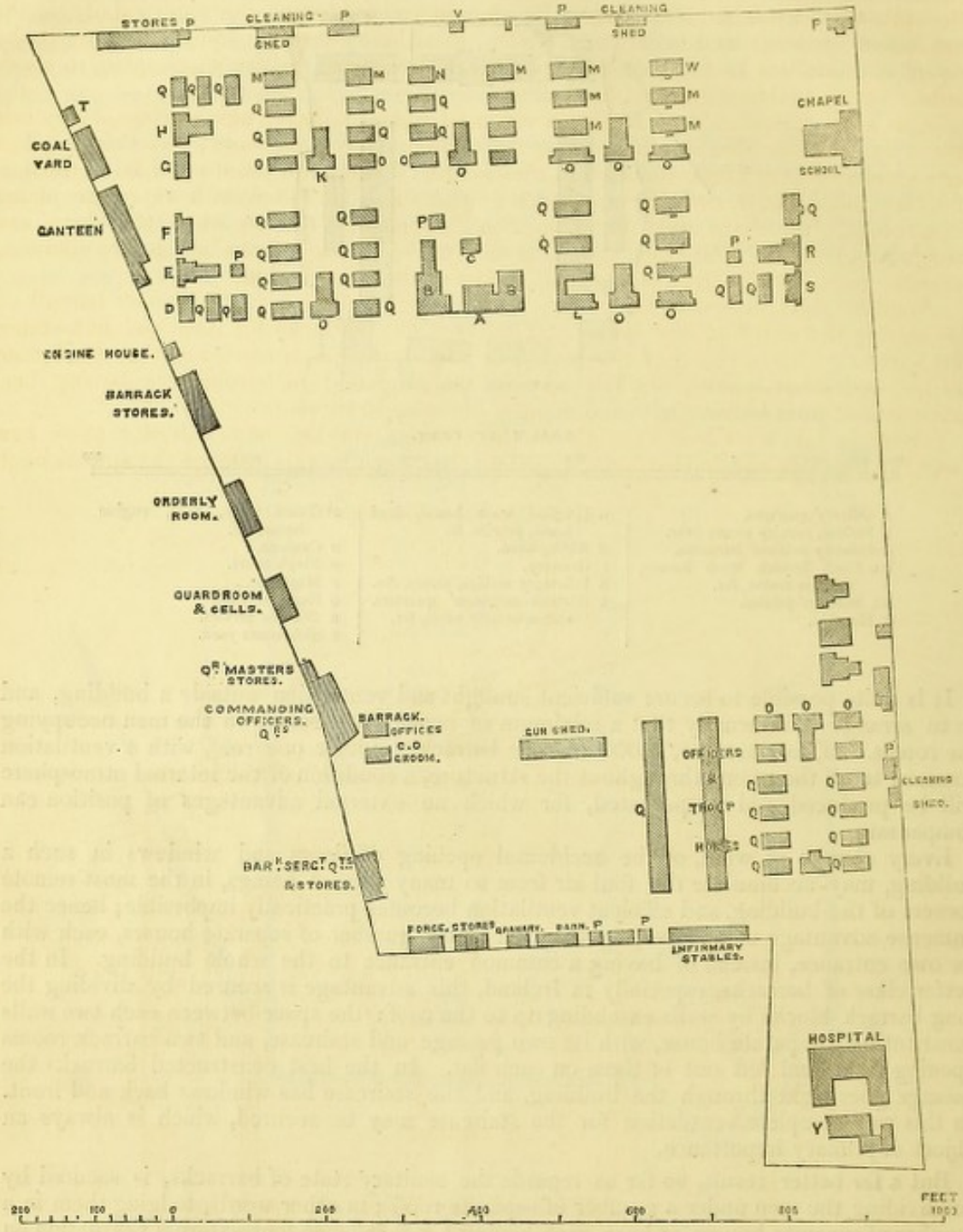
But a far better result, so far as regards the sanitary state of barracks, is secured by subdividing the men under a number of separate roofs; in other words, lodging them in a number of separate houses, or huts, each having a free independent external ventilation on all its sides.

This principle of subdivision is indeed a fundamental law, to be observed, as far as practicable, in all constructions intended for human habitation. Its adoption is one of the sources of the healthiness of what otherwise would be unhealthy cottages; it is one of the causes of the superior healthiness of hut barracks and hospitals. The neglect of this law is one of the chief causes of the unhealthiness of large barracks, workhouses, hospitals, and other densely inhabited buildings.

The full benefit of the principle of subdivision is best obtained by dividing barracks into small distinct and separate parts. It may be obtained, but much less perfectly, by arranging the houses end to end as already described; but in buildings where several hundreds of men are exposed to the same atmosphere under one roof, the advantages of subdivision to health are unattainable.

A good example of subdivision exists at Chichester barracks, which have been built for a considerable number of years. It is shown in Figure 17.

Fig. 17.—Chichester Barracks.



A Officers' mess room.
B Field officers' quarters.
C Mess, men's.
D Serjeant-majors' quarters.
E Artillery serjeant's quarters and orderly room.
F Ablution room.
G Staff serjeants' quarters and orderly room.
H Staff serjeants' quarters.
K Library and reading room.
L Lecture room.
M Married soldiers' quarters.
N Cooking kitchen.
O Officers quarters.
P Latrines.
Q Soldiers' quarters.
R Serjeants' quarters.
S Barrack master and schoolmaster's quarters.
T Stables.
V Armourer's shop.
W Wash house.
Y Hospital wash house, cook house, store, and dead house.

The site is in the open country. It is 22A. 2R. 15P. in area, and consists of a subsoil of shingle and clay, only partially self-draining. Within the area are 42 barrack huts, 33 of which are for infantry and 9 for cavalry. The huts are of wood, resting on brick foundations; they are lined inside with wood, and have plastered ceilings. Each infantry hut is intended to contain 14 men, and each cavalry hut 13 men. There are thus 42 separate barracks, with the air moving freely on all sides of them. The arrangement is a very good one, and has been followed on a large scale in the camps. It has great and

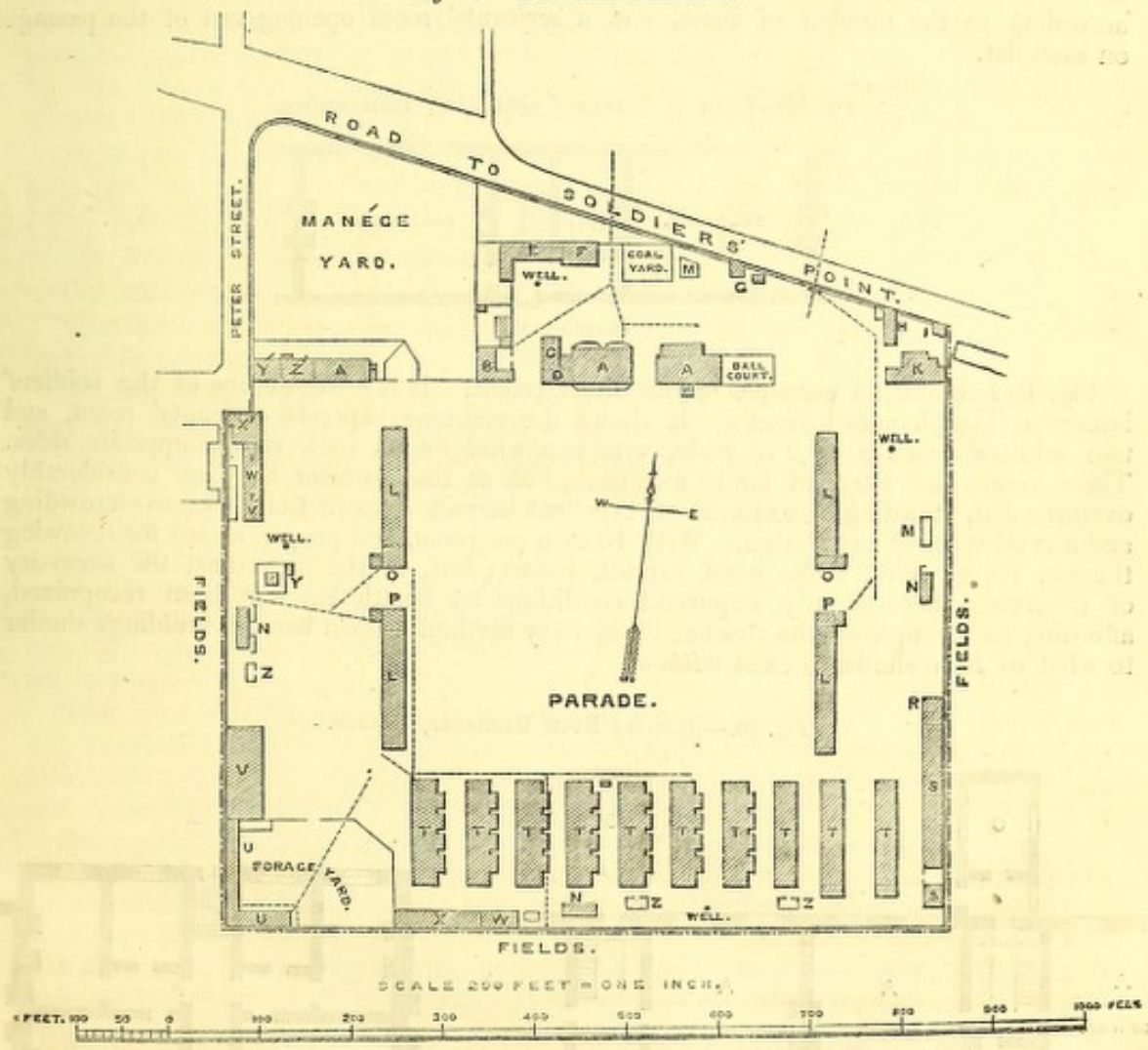
obvious advantages as to health; but in this case, as in others which have come under our observation, the advantages are limited to the two points of subdivision and free external ventilation. When we examine the state of the surface and subsoil drainage, the state of the internal ventilation, the amount and quality of the water supply, or the amount of space allowed to the men, we find that these essential conditions to health by no means conform to the excellent principles recognized in the block plan, to which indeed our commendation must be limited.

The huts at Chichester, although not well planned, have, nevertheless, a separate porch in which, in the daytime, urine tubs, brooms, &c., are kept; but this excellent arrangement has not been followed in the camps. There is no place provided in the huts for these implements, and in every hut the urine tubs, half filled with water, are placed in a corner, during the day, increasing the dampness of the air when the doors and windows are shut. The space in huts is so confined that a separate porch for containing vessels, mops, brooms, &c., is an essential part of the construction.

Another good principle recognized in the cavalry portion of Chichester barracks is separating the men from the horses. There are hut barracks for men and hut stables for horses. This is as it ought to be. The same principle is carried out at Maidstone, Cahir, and other places, without any of the supposed inconveniences having been experienced from lodging men and animals under separate roofs.

There is one excellent example of the arrangement, the best indeed that we have seen, in Dundalk cavalry barracks, Fig. 18. But even in this instance the stables might

Fig. 18.—Dundalk Barracks.



A Officers' quarters.
B Barrack master's house.
C Bedding store.
D Barrack master's office.
E Barrack stores.
F Straw store.
G Officers' privies.
H Hospital privy.
I Dead house.
K Hospital.
L Soldiers' quarters.
M Ash pits.
N Soldiers' privies.
O Cook house and cleaning sheds.
P Wash houses and cleaning sheds.
R Armourer's shop and pharmacy.
S Infantry stables.
T Troop stables.
U Hay, corn, and straw stores.
V Riding school.
W Soldiers' washing house.
X Forge and workshop.
Y Magazine.
Z Dung pits.
V' Engine house.
W' Canteen.
X' Cells.
Y' Barrack serjeants quarters and cells.
Z' Guard room and regimental stores.

have been placed somewhat nearer the barracks, without detriment to the sanitary condition of the rooms.

These barracks are constructed for 352 men, who are accommodated in four blocks of buildings, each block consisting of two floors of rooms, going through and through the blocks, with windows on opposite sides. The stables are in 10 one-story buildings, arranged at the lower end of the parade ground, and sufficiently removed from the men's rooms to prevent nuisance, but not too far for convenience. It will be obvious at a glance that this plan presents immense advantages for health and cleanliness. The stables where the men perform their duties, and the houses where they dwell, are, as they ought to be, two distinct establishments. The men have more opportunities and inducements for cleanliness, and there cannot be a doubt of their having greater comfort and healthiness. This barrack presented a remarkable contrast in the cleanliness both of its stables and quarters, as compared with barracks where the stables with their litter, filth, and foul air are placed under the barrack rooms.

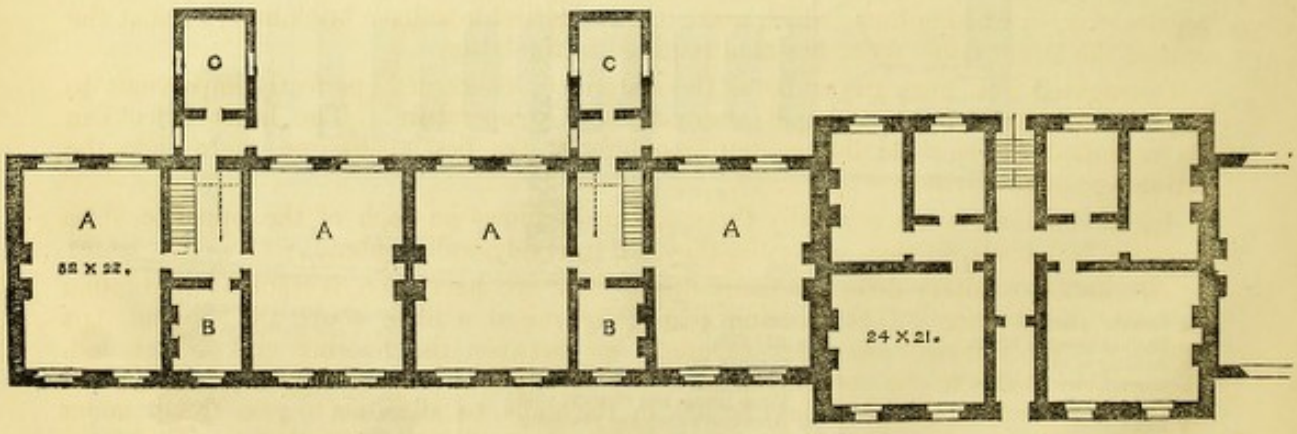
Examples of improved internal construction.—There are barracks which have good roomy stone stairs extending the whole height of the building, with windows back and front, and possessing the important advantage of being easily adapted for ventilation. In these barracks the men's rooms generally go through and through the buildings, and have one or more windows according to the size of the room on each of the opposite sides: but there are in some of them serjeants' bunks to interfere with the light and ventilation. Some of these barracks are two stories high and some are three stories. Each house contains two rooms on each floor; four or six rooms in all, according to the number of floors, and a serjeants' room opening out of the passage on each flat.

Fig. 19.—Plan of Soldiers' Quarters, Templemore.

GROUND PLAN.

Fig. 19 exhibits an example of this arrangement. It is a flat of one of the soldiers' houses in Templemore barracks. It shows the staircase, separate serjeants' room, and two soldiers' rooms 20 ft. 2 in. wide, with two windows on each of the opposite sides. These rooms are intended for 15 men each, but at that number they are considerably overcrowded, affording an example of excellent barrack construction, with overcrowding and a total want of ventilation. With 10 men per room, and proper means for renewing the air, these would make good barrack rooms; but, in the meantime, the necessity of observing these equally important conditions for health has not been recognized, affording an example of the absence of sanitary method *within* barrack buildings similar to what we have shown to exist *without*.

Fig. 20.—Beggars Bush Barracks, Dublin.



GROUND FLOOR.

A Men's rooms. B Serjeants' rooms, C Ablution rooms.

Fig. 20 representing part of the ground floor of Beggars Bush barrack, Dublin, shows another adaptation of the same principle, but not quite so good an one, as the distance between the opposite windows is 32 feet, which is too great for the height of the rooms.

There is a projection from the back of each staircase on the ground floor of this barrack, in which the ablution rooms have been placed. They are cut off from the staircase by a ventilated porch, and are conveniently situated for the rooms. They afford an excellent example of a good arrangement of ablution accommodation. It will be observed that in the central part of the building, viz., the portion on the right hand of the sketch, an external architectural effect has been produced at the cost of sacrificing the healthy structure of the men's rooms situated in it.

Hut-Barracks.—In the preceding pages we have given a sketch of the construction and defects in permanent barracks, and we now proceed to describe briefly the general construction and arrangement of barrack huts, which are now becoming so important a part of barrack accommodation. At present these huts are constructed as follows: wooden huts with single walls; wooden huts with double walls; corrugated iron huts, and brick huts.

The best form of wooden hut is where the boards overlap, so as to allow a ready passage for air. The walls should be, as it were, porous. Whatever prevents this condition being obtained, takes away from the special advantages of huts to health.

Wooden huts used as barrack rooms vary considerably in dimensions. Those at Colchester are 38 feet long, 20 feet wide, and, including the slope of the roof, they average 9 feet in height. Their cubic contents are 6,840 feet, and each hut has regulation space for 24 men, at 285 cubic feet per man. These huts are arranged side by side, in a somewhat similar manner to those in Chichester barracks (Fig. 17), with about a hut's space between them, and broader roads between the parallel rows.

At Shorncliffe the huts are 38 feet 10 inches, by 20 feet; they are 11 feet high to the ridge, and are well arranged along the sides of a large parade ground. Their cubic contents are 8,360 feet, and each hut contains 25 men, with 334 cubic feet per man.

The huts at Aldershot are of a similar construction.

The artillery huts at Woolwich allow 285 cubic feet per man.

None of these wooden hut barracks, although much more healthy than permanent barracks, are in so good a sanitary condition as they ought to be.

In some instances the space left between the outer and inner boarding of double-walled huts has been filled up with earth or some similar material. This proceeding at once deprives the interior of the advantages of percolation of air through the walls, and converts it into a kind of permanent barrack, in which several important sanitary advantages of hut construction are lost.

In some instances there are huts built of brick, as is the case at Hamilton. Brick walls although to a certain extent pervious to air, nevertheless, deprive their inmates of the advantages derived from wooden walls. In this instance, the huts have been erected against the boundary wall of the barrack enclosure, with windows only on one side and no thorough draft.

With brick huts the advantage of subdivision remains, but there is not the same facility for ventilation. There are certain disadvantages, however, from vermin, cost of repairs, &c., in wooden huts, which make it more desirable to have brick huts, even at the cost of the larger cubic space per man required in the latter.

Corrugated iron huts are, so far as the material is concerned, perfectly impervious to air, and they are subject to rapid alternations of temperature. The latter defect can be remedied by suitable lining; but iron huts at the best realize no more than the advantage of subdivision.

In all huts, there are generally three or four windows on each of the opposite sides over the bedsteads, so that, as a rule, they are tolerably well lighted.

An obvious sanitary defect in many of the huts we have seen, is want of ventilation beneath the flooring. The flooring is usually raised a little above the ground, but there are no sufficient openings to admit air between the flooring and the ground. To enable this to be provided, all huts should be raised above the level of the ground, and openings should be left in the walls, to allow air to pass freely under the floor. For want of this, the space underneath the floor exhales damp and malaria, which pass between the floor boards into the interior of the huts, to be there breathed

by the men, and predisposition to epidemic disease is very apt to show itself among the inmates in consequence. This is particularly the case in warm climates, where much disease has arisen among troops from neglect of so very simple a precaution, but even in this country similar instances have come to our knowledge.

All ground on which huts are to be erected ought to be carefully underdrained for a similar reason; but we have met with no instance of this having been attended to, and as a consequence the rainfall soaks the ground between the huts, and saturates the subsoil. Where huts have been already erected the ground between them should be tile drained to remove moisture.

Ventilation is generally provided for by louvres in the ridge; in many instances, insufficiently. At Colchester we found the ventilation of the huts very defective, and the low sanitary state of the troops on what ought otherwise to have been a healthy position, was attributed partly to this circumstance, although there were other concurring defects in operation in lowering their health.

The usual method of warming huts is by iron stoves of an unsatisfactory form. It is not a good way of warming. The stoves are constantly overheated, or even red hot; they burn the air; they are themselves burnt out rapidly, and may at any time lead to accidents from fire. There are huts, however, not only provided with proper open brick fire-places, but also, as at Woolwich, with the means of warming part of the air admitted. This is a much better plan of warming than that by stoves, which not only encumber the room but supply very dry, burnt air, while they contribute little or nothing to the ventilation.

All the huts we have seen are very much overcrowded, and they have generally no porches and no place for urine tubs, brushes, &c.

Notwithstanding several obvious sanitary defects in all the huts we have seen, the principle of sub-dividing the men into a number of separate houses renders this kind of barrack accommodation, as a rule, more healthy than the great majority of barrack rooms.

Casemated barrack rooms.—Casemates, as a general rule, form the worst kind of barracks for anything but temporary purposes, or for occupation during siege. At the present time, they form part of the current barrack accommodation in garrisons where there are defensible works. They are usually constructed in a series of arches behind the curtains or in the flanks. They vary considerably in character; some are lofty, tolerably well lighted, and have certain means of ventilation, generally by some opening opposite the door, which if sufficiently made use of subjects the inmates to the inconvenience of living in a gusty archway; others are low, narrow, dark, and without means of renewing the air. Some casemates are hollowed out of the rock, as, for example, those at Dover Castle. The best examples of habitable casemates are those at Dover Citadel, and Prince of Wales redoubt at Plymouth. The worst are the casemates at Fort George, Dover Castle, Chatham, and Carlisle Fort, Cork Harbour. Casemates vary considerably in length, breadth, and height. The loftiest are those in Dover Citadel, which have an average height of 13 feet. The longest casemates are those of Dover Castle, which vary in length from 100 feet to 227 feet. They are cut out of the chalk cliff, and are lighted at one end only. They are not fit for ordinary occupation; on emergency during a siege they might possibly save life; at other times they are rather calculated to destroy life by producing sickness.

Dover Citadel casemates have windows of some kind or other at both ends. They can be ventilated, and, if not overcrowded, they can be kept healthy. The casemates at Fort George have their earthen floors below the level of the ground. They are dark, damp, and unfit for occupation.

St. Mary's casemates, Chatham, are in two flats. They are long, narrow, dark, damp, overcrowded and unhealthy arches, or rather cellars; but they are, nevertheless, occupied both by troops and by invalids returning from foreign service. For the latter purpose they are wholly unfit.

From returns for 22 months preceding 31st October 1857, supplied to us by the medical officer on the station, it appears that out of an average monthly strength of 749, there were 6,393 admissions to hospital, and 142 deaths; the admissions per annum were 4½ times the strength, and the deaths were in the enormous ratio of 103 per 1,000 per annum! Of these deaths, 40 per cent. arose from consumption. These facts show the potent influence exerted by sanitary defects on the weakened constitution of invalids.

The following Table shows the occupation at the time of our inquiry of casemates we have inspected:

Casemates.	Present Regulation Number of Men.	Number of Casemated Rooms.
Chatham:		
St. Mary's	1,128	47
Spur Battery	42	12
Dover:		
Cliff Casemates	414	9
Spur Battery	245	15
Citadel Casemates	654	25
Drop Redoubt	25	3
Portsmouth:		
Fort Cumberland	641	33
Point Battery	80	4
Fort Moncton	99	
Blockhouse Fort	90	5
Plymouth Citadel	298	31
Prince of Wales Redoubt	72	4
No. 6 Redoubt	31	3
Fort George	unoccupied.	—
Carlisle Fort	do.	—
Kinsale, Charles Fort	60	4
Total	3,879	206

At the time the returns were made, there were 206 casemated barrack rooms returned to us as available for accommodation, and there were 3,879 men on their construction. In two sets only, namely, at the Citadel casemates at Dover, and at Blockhouse Fort, Gosport, was the space per man at all sufficient. In the other casemated barracks it was a little more than 300 cubic feet per man.

The manner of construction of this class of accommodation has apparently been determined more from considerations of protection than of health. The question is one which deserves most serious consideration, because if the fortifications proposed by the Defence Commission are to be constructed, the troops located in the several forts will inhabit casemates, and if proper care be taken in their construction these casemates may form a valuable accession to barrack accommodation. If not, they will injure the health of the men placed in them. It is possible to realize both objects, of health and protection as has to a considerable extent been done in the Citadel casemates at Dover.

3.—Cubic Space per Man in Barrack Rooms.

The Royal Commission on the Sanitary State of the Army recommended that in all barrack rooms an allowance of 600 cubic feet per man should be given, and our instructions require us to set apart this amount, and to see that the numbers of men per room in accordance with it are painted on the doors.

Very little experience was sufficient to show that at present it would be impossible to carry out literally this instruction. We had no idea, until we examined the barrack rooms personally, of the amount of overcrowding, beyond the requirement of 600 cubic feet per man, which existed. Formerly it was very much greater than it is at present. By a General Order, issued on 9th May 1845, a *maximum* space of from 450 to 500 cubic feet per man was directed to be provided in all new barracks on home stations. The order did not necessarily include existing barracks, and whatever effect it may have had on barracks erected since that date, there can be no doubt that the space per man throughout the barracks of the United Kingdom falls far short of 450 or 500 cubic feet.

In the course of our inquiry we have obtained the dimensions of every barrack room in the United Kingdom, as well as the number of inmates prescribed by regulation for every room, and we have thrown the general results of this portion of our inquiry into the annexed Table A., showing the number of men in the rooms of all barracks we have inspected, for every 50 feet of space, from under 250 to above 600 cubic feet.

The following Table gives the numerical results of Table A.:—

Number of Men having less than 250 Cubic Feet per Man.	Number of Men having from 250 to 300 Cubic Feet per Man.	Number of Men having from 300 to 350 Cubic Feet per Man.	Number of Men having from 350 to 400 Cubic Feet per Man.	Number of Men having from 400 to 450 Cubic Feet per Man.	Number of Men having from 450 to 500 Cubic Feet per Man.	Number of Men having from 500 to 550 Cubic Feet per Man.	Number of Men having from 550 to 600 Cubic Feet per Man.	Number of Men having above 600 Cubic Feet per Man.	Total Number of Men.
1,335	4,485	9,375	19,687	16,650	13,739	6,886	2,653	2,003	76,813

Some of the deductions from this Table are remarkable. We find, for example, that there are 1,335 men, equal to one and a half regiments, living and sleeping in rooms with less than 250 cubic feet per man; that there are 15,195 men with less than 350 cubic feet per man of sleeping space; that 34,882 men have less than 400 cubic feet each; that 65,271 men have less than 500 cubic feet per man; and that out of the whole force for which there is accommodation in these permanent barracks, namely, 76,813, there are only 4,656 men with sleeping room exceeding 550 cubic feet each. There are 2,003 men whose allowance of space exceeds 600 cubic feet; but this excess occurs either in a few rooms in cavalry barracks, where the stable area below the men's rooms is unusually large, or where the ceiling follows the line of the roof, or it occurs in infantry barrack rooms, where, from defective construction or position, it has not been considered advisable to allow a smaller space per man.

In order to estimate what is likely to be the effect of this great overcrowding on health, we must consider that these 76,813 men occupy, in rotation, barrack rooms presenting these diversities in cubic contents; while, at the same sime, we must bear in mind the very imperfect ventilation or total want of ventilation in these rooms, which we shall presently show; those affording the smallest amount of space per man being generally the worst ventilated; we must, moreover, take into account the presence of urine tubs, bedding and clothing more or less imbued with animal exhalations, adding their quota of impurities to the already foul atmosphere, in which about a third part of the soldiers' time is passed, and that too during sleep, when the system is more peculiarly liable to the influence of impure air. Any person at all conversant with the effect of such conditions on health and life can arrive at no other conclusion, than that the polluted atmosphere of overcrowded unventilated barrack rooms has been, in times past, a potent cause of disease and mortality in the British army.

As 600 cubic feet per man must now be considered as the space to be allotted in all permanent barracks in temperate climates, it need hardly be stated that at this rate there is a very considerable deficiency in barrack accommodation.

It amounts to above 32 per cent.

It would, therefore, be necessary to add about a third part to the permanent barrack buildings of the United Kingdom, to enable 600 cubic feet per man to be given.

The deficiency is very irregularly distributed in different districts. It is least at Woolwich and greatest at Chatham, where the barracks, as a whole, are the most overcrowded in the United Kingdom. At Woolwich 100 men are accommodated in a space sufficient for 79 only; at Chatham the space allotted to 100 men is sufficient for no more than 57! Fortunately Chatham is a recruiting barrack, and young soldiers do not remain above a few months in it; but nevertheless its inmates are less healthy than the civil male population at the same ages. Thus the mortality of males in civil life between the ages of 15 and 25 is 8·1 per 1,000 per annum, whilst among the recruits in Chatham barracks the mortality during six years, 1851–57, was 10·2 per 1,000 per annum.

During the same years 43 per cent. of the mortality among the recruits arose from consumption, as compared with 39·8 per cent., which is the mortality from consumption for males of the same ages in civil life.

Catarrhal, pulmonary, and zymotic diseases are the chief causes of sickness among recruits in Chatham garrison. 66 per cent. of the deaths in the above-named years arose from consumption, fever, cholera, dysentery, and diarrhœa.

In the following Table are given the per-centages of deficiency of barrack accommodation for the principal stations in Great Britain and Ireland, calculated on the assumption

that the number of troops on the construction of each barrack is the number required for service on the station.

Station.	Deficiency of Barrack Accommodation per cent.
London	25·7
Chatham	43·4
Portsmouth	30·
Winchester	36·6
Plymouth and Devonport	27·
Woolwich	21·6
Dover	37·
Canterbury	32·5
Manchester District	24·6
North British District	30·
Dublin	33·
Cork	26·6
Fermoy	32·4
Athlone	31·
Limerick	29·
Kilkenny and Birr	40·

The per-centage of deficiency in the smaller barracks is somewhat similar to those in this Table.

These instances are sufficient to show the extent to which additional barrack accommodation will have to be erected before 600 cubic feet per man can be provided.

In some portions of barracks overcrowding is very much greater than the average.

Thus at Chatham there are eight rooms containing 104 men, with only 247 cubic feet per man.

In 56 rooms, with 896 men in them, the space amounts to no more than 345 cubic feet per man.

In 54 rooms, containing 864 men, the regulation allowance is 281 cubic feet per man.

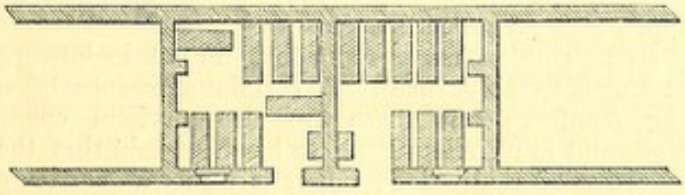
In 16 rooms, containing 256 men, the space is 285 cubic feet per man.

In 20 rooms, containing 320 men, the allowance is only 275 cubic feet per man.

We have met with individual rooms in other barracks, where the overcrowding was even greater than at Chatham, and from which rooms it was necessary to remove all the tables and forms before the beds could be folded down. In some such rooms there is hardly 12 inches between the beds in any direction; and when folded down for the night, the beds appear to cover the whole area of floor.

The following fig. 20A will enable a better idea to be formed of the surface overcrowding in many barrack rooms than any mere description. It is drawn to scale, and shows the area occupied by the bedsteads and their position in barrack rooms 10 feet high, and affording 350 cubic feet per man.

Fig. 20A.—Plan of Two Rooms in the Citadel, Fort George, Guernsey, showing the Position of Bedsteads when folded down.



It is impossible for such rooms to be healthy. Indeed what more efficient method could be adopted to produce disease, even if this were the object sought for, than crowding men into such places?

Considered in relation to health, almost every infantry barrack room we have seen is very much overcrowded, and yet the importance of this, as bearing on the efficiency of the army, appears to have been hitherto very imperfectly appreciated. It has even been the custom to place more men in the rooms than could be accommodated, at the limited cubic space laid down by the regulation. A few examples of this will suffice. The regulation number of men in the Wellington barracks was found to exceed the accommodation, at 600 cubic feet per man, by no less than 220 men; and yet there were 93 men in excess of the regulation number at the time the return was made up for us.

The regulation number of men in St. George's barracks is 476, which is 62 more than the accommodation, at 600 cubic feet per man. In this case the actual number in barracks was 517.

Walmer south barrack has regulation space for 397 men, where 305 ought to be. The actual number in barracks was 443.

The worst example of overcrowding, by departure from the regulation, was at St. Mary's casemates, Chatham, where 1,128 men are by regulation crowded into a space sufficient for 600, if the place were otherwise suitable for habitation, which it is not. In this instance, the actual number in the casemates was 1,410, an excess of 282 over the regulation number, and of 810 over the accommodation, at 600 cubic feet per man.

A common cause of departure from the regulation space is a sudden addition being made to the force on the station by the arrival of troops or invalids either from other home stations or from abroad. Accommodation must necessarily be found somewhere for the increase of strength, but such emergencies ought to be provided for without endangering the soldiers' health.

It is in vain to expect the troops to be healthy, so long as these departures from the law are permitted. The first thing at all stations ought to be to determine how many men there must be accommodation for, and after the accommodation is provided, the amount of space for a man should be as little liable to reduction as his rations. A man can live without food as many days as he can live minutes without air. A soldier's barrack room space is his air ration, but it is, notwithstanding, subject to reduction from circumstances over which the soldier himself has no control.

The introduction of schools and libraries into barracks, although productive of very great good in one direction, has operated injuriously in not a few cases, by abstracting space from the limited barrack room accommodation. Wherever special accommodation for schools and libraries has not been provided, the usual way has been to appropriate one or more men's rooms for these objects, and to that extent the men have had to be drafted into other occupied rooms. Of course, the only remedy for this is to provide proper rooms for both schools and libraries.

We have also found barrack rooms, in many instances, misappropriated for other purposes, as for instance, for stores, offices, married quarters, &c., in consequence of the want of suitable accommodation for such purposes elsewhere. If all misappropriated rooms were restored to the construction, they would add considerably to the men's accommodation; but to meet the whole amount of the present deficiency, the only remedy is to provide additional barracks.

Nevertheless, the very necessity for such misappropriation argues defect in the barrack construction, or deficiency which has not been foreseen or not provided for. Major White, barrack-master of the Wellington barracks says in regard to this, in his return, "The "present requirements of the head-quarters of a regiment not being sufficiently provided "for when barracks are built, misappropriation takes place, and confusion and discomfort "ensue." "The orderly rooms, reading rooms, tailors' and shoemakers' shops, quarters "for regimental staff serjeants, as marked by authority, are so often insufficient for "their purposes, as almost to force the misappropriation of the soldiers' sleeping rooms. "This is the case at present." "The barrack-master cannot alter the 'construction' "sent to him by the Inspector-General of Fortifications, or the 'occupation' sent to "him by the commanding officer. One deducted from the other is called the 'available "accommodation, when in reality it is nothing of the kind." The result of this confusion is, that the soldier's health and comfort are at the mercy of contingencies, which ought never to happen under a proper system.

We have hardly seen a single barrack room that did not look overcrowded, and where the space was not uncomfortably small. A certain allowance of space is absolutely necessary, even for comfort; but there are also physical conditions which must also be taken into account in its allotment. It has been said that the question of cubic space is simply a question of ventilation; but it is rather a question as to the possibility of ventilation. The more beds or other encumbrances you have in a room, with a limited cubic space, the more obstruction you have to ventilation; the fewer the beds, the more easy is it to ventilate the rooms. There are fewer nooks and corners, fewer surfaces opposed to the movement of the air, and less stagnation. Stagnant air, especially in sleeping rooms, is a poison. We have been in rooms, both in barracks and hospitals, as for instance, in certain rooms in Portman Street barracks, in Edinburgh Castle, and in Croydon Hospital, which we select merely as examples, in which the atmosphere was positively offensive, with the doors and windows open. An overcrowded room or ward cannot be sufficiently ventilated, to keep the air pure, even with open windows, unless there is a breeze outside.

Besides, ventilation is intimately connected with warming. It is easy to ventilate a barrack room having a large cubic space per man, and a properly constructed fire-grate, without lowering the temperature injuriously, but it is difficult to do so with a small space per man, because the amount of air which must be passed through the room for the use of each inmate is a fixed quantity, and has no necessary relation to the cubic space allotted to

the inmates. If we suppose that every man requires 1,200 cubic feet of air per hour, and if into a room with 6,000 cubic feet of contents we put 10 men, giving to each 600 cubic feet, the quantity of air to be passed through the room will be 12,000 cubic feet per hour, or twice the cubic contents of the room. If we increase the number of men to 20, at 300 cubic feet each, the amount of air to be passed through the room will be 24,000 cubic feet, or four times the contents of the room. A moment's consideration will show what is likely to be the effect of each amount of air on the temperature of the room, with the outer air at 32° F., the heating power of the room fire remaining the same. This objection might certainly be diminished in force, by using mechanical ventilation with warmed air; but were this done, the open fire-place, with its ventilating power and its many other advantages, would have to be given up, and all the cost of machinery and superintendence incurred. The loss would be greater than the gain; and in existing barracks great difficulty, and a large outlay would have to be incurred in applying any such general method of ventilation and warming.

But there are other considerations of a practical kind involved in the question. Even, if with great care, the atmosphere in a crowded room could, by some such means, be preserved in a state of comparative purity and warmth, it would by no means follow that proper care would always be exercised, and any neglect or omission might at any time render the air poisonous. The construction of barrack rooms, and the habits of their inmates, must also be considered in dealing practically with the subject. A soldier, no more than anyone else, likes to have twice the quantity of air blowing on him in a crowded room that he would have if the inmates of the room were reduced to one-half, and the remedy he usually adopts is that of closing all the ventilating openings within his reach.

The only safe principle in dealing with the subject is to leave a large margin for these contingencies; and the question really is, not whether 600 cubic feet per man be too much, but whether 600 cubic feet per man be enough for all the purposes of ventilation, warming, and comfort. This is denied by very competent authorities, both here and abroad. Certain good authorities fix the minimum of space required for health in sleeping rooms at from 1,400 to 1,600 cubic feet for each inmate; and that upon the principle that it is practically impossible to ventilate, with due economy of warmth, a smaller amount of space in a sleeping room, occupied by a number of persons, sufficiently to keep the air in the requisite state of purity for recruiting the body exhausted by the fatigues of the preceding day. Sleep is a reparative process, requiring certain conditions to its fulfilment, one of the most important of which is pure, dry air; and not until the size of the room, and the means of ventilation applicable to it, admit of these indispensable conditions being realized can the health of the inmates be considered safe.

Our experience has led us to the opinion, that the air in barrack rooms can be kept sufficiently pure with about 600 cubic feet per man, provided the local position of the barrack be open and airy, the structure of the buildings simple, and admitting of free external and internal movement of the atmosphere, and provided the barrack rooms, as well as all other internal parts of the buildings, are duly ventilated.

In large complicated structures, where a number of human beings are massed together, it is difficult to state what amount of space would make the rooms healthy, on account of the necessarily stagnant state of the air within the rooms, and the constant liability of poisonous miasm generated by the breath and bodies of inmates, to be carried in unforseen directions, and accumulated in every corner where there is any delay in the circulation of air. Nothing but *dilution* of these miasms in a large mass of atmospheric air can render them innocuous. The sooner they arrive outside the walls the better for the health of the inmates, and if there be any form of construction by which this desirable end may be attained most speedily, in such a case, but only in such a case, would it be safe to reduce the space even a fraction below 600 feet per man.

This result may be obtained under two conditions. 1st, subdivision of the men among a large number of detached buildings, with the air flowing freely all round them; and, 2nd, by making the walls and roof pervious to air. These conditions can be realized with properly constructed brick huts, or with ordinary wooden huts, the latter of which are found in practice to be among the most healthy of all barracks. In such huts a constant interchange of air goes on through the overlapping boards, and by the roof ventilators, there are fewer stray drafts or currents than take place in permanent barrack rooms, where the points of inlet and outlet for air are necessarily limited in number. Ventilation takes place rather by the law of diffusion operating over the whole surface of the hut than by ventilating currents, and the atmosphere with ordinary care can be kept comparatively pure during the hours of sleep. Even under these favourable conditions there is a limit below which the amount of space per man cannot be carried with safety.

Just as people have died of suffocation from impure air in dense crowds out of doors, with the unlimited atmosphere above them, so men sleeping for seven or eight hours at a time in wooden huts, have suffered from severe types of fever when the space allotted to them has been reduced below a certain amount.

The most intense forms of these fevers, ending in death, have occurred in huts giving 150 cubic feet per man, where no other evident cause existed except overcrowding. Fevers of milder type have been of frequent occurrence in wooden huts with a much more liberal allowance of space, even with 300 cubic feet per man.

If wooden barrack huts, with say 20 men in each, be placed at sufficient distances, with due regard to the direction of winds, and away from walls, trees, and other obstructions to ventilation; if the wooden walls be left pervious to air, the huts properly ventilated along the ridge, and the floors well raised above the ground with free ventilation beneath, under such conditions we consider that 400 cubic feet would be of as much value to health as 600 would be in a permanent barrack. But, on the other hand, if huts are built of brick or iron, or if the walls be otherwise made impervious to air, they at once come within the same category as permanent barracks, and should afford 600 cubic feet per man to each inmate.

We have given in Table A the regulation space in huts we have inspected, from which it will be seen that out of 6,998 men in these huts, 1,098 men had less than 300 cubic feet each, and that the whole number, except 110, had less than 400 cubic feet per man.

The following summary of a return recently prepared by the Army Medical Department to show the accommodation in barrack huts at the principal stations, gives the comparative amount of space per man at the end of January in the present year.

TABLE showing the NUMBER of OCCUPIED HUTS at ALDERSHOT, WOOLWICH, SHORNCLIFFE, BROMPTON, PEMBROKE, DUBLIN, NEWBRIDGE and CAHIR, with the AMOUNT of SPACE PER MAN in each.

Number of Huts.				
With 200 to 250 Cubic Feet per Man.	With 250 to 300 Cubic Feet per Man.	With 300 to 350 Cubic Feet per Man.	With 350 to 400 Cubic Feet per Man.	With 400 to 500 Cubic Feet per Man.
8	98	176	162	222

For similar reasons huts are liable to the same variation in the number of inmates as barrack rooms. If additional stores are wanted, or a reading room or other accommodation is considered advisable, a hut is taken for the purpose. If more men arrive at the station than the huts can contain with safety to health, the newcomers are nevertheless crowded into them. In any case the regulation as to space, whatever it may be, is stretched to meet all emergencies, notwithstanding representations made by medical officers to the contrary.

4.—STATE OF VENTILATION AND WARMING OF BARRACK ROOMS.

It is hardly necessary to urge the importance to health of having fresh air in living rooms; every one admits it, but very few persons consider what objects fresh air is intended to serve; and hence, although the necessity of free room ventilation is generally recognized, the practical application of this great sanitary principle is not so strictly followed out as it ought to be.

To show the importance of this matter to the efficiency of the army, and to arrive at a full understanding of the influence exercised by the foul air of barrack rooms and hospitals on the health and life of their inmates, it is requisite to state briefly what changes air undergoes in unventilated living rooms, the agencies by which these changes are brought about, and how it is that air so altered from its native purity causes disease in those who breathe it.

Atmospheric air when pure contains in every 100 parts, in round numbers, 79 parts of nitrogen and 21 parts of oxygen gas. About a fifth part of the cubic contents of every room consists of vital air, and the remaining four-fifths consist of nitrogen, which would be immediately fatal to life if breathed by itself.

Besides these gases, pure atmospheric air contains a proportion of carbonic acid varying from three to nine parts in every 10,000 parts of air, and a certain quantity of water held in solution, the amount of which depends on temperature. The proportion of water in a healthy atmosphere should not be less than about half the quantity which the air can dissolve, and it should not exceed four-fifths of that quantity.

If it falls below one-half, the air is too dry; if it exceeds four-fifths, the air is too moist, to be wholesome.

A healthy atmosphere then consists of,—

Oxygen gas - - - - - -	21 per cent.
Nitrogen - - - - - -	79 „ „

Carbonic acid, from 3 to 9 parts in 10,000.

Water, from one-half to four-fifths of the total amount required to saturate the air.

Whatever diminishes the amount of oxygen, or increases the amount of carbonic acid or of water; or whatever adds extraneous impurity to the air, renders it more or less injurious to health.

The whole end and object of ventilation is to maintain these constituents in their proper proportions in inhabited apartments, due regard being had to maintaining a proper degree of temperature at the same time.

In applying these principles to barrack rooms let us first inquire what agencies there are in these rooms which render the air impure?

The first and main cause of impurity is the presence of the men. A human being shut up in a close room injures the purity of the air in those very matters which act injuriously on his own health.

1. He withdraws oxygen by the process of respiration, and thus diminishes its proportionate quantity.
2. He replaces the oxygen by an equivalent of carbonic acid, and thus increases the amount of that gas.
3. By the natural process of exhalation from the lungs and skin he increases the proportion of water in the air.

Lastly. In the moisture so exhaled from the body there is a quantity of excreted animal matter disengaged from the system, which, were it retained in the system, would be fatal to health and life.

This excreted matter is the most injurious of these impurities if breathed again. It hence follows, that those processes by which life and health are preserved are directly injurious to the purity of the air, and that unless the air were renewed loss of health or of life would ensue.

When the carbonic acid in air amounts to a half per cent. it cannot be breathed for any length of time with impunity.

An adult man produces, according to the late Dr. Thomson's estimate (40,000 cubic inches in 24 hours) not much less than a cubic foot of carbonic acid per hour, and hence in a close barrack room, allowing as is not unfrequently the case no more than 300 cubic feet per man, this dangerous condition of the air would be produced in an hour and a half if there were no means of removing the gas by diffusion or dilution in a mass of fresh air. But, as already stated, carbonic acid in excess is not the most injurious to health of barrack room impurities.

The lungs and skin of an adult man exhale about three pints of fluid every 24 hours, all of which would in a confined space go to increase the humidity of the air. The animal matter held in solution by this exhaled fluid enters very readily into putrefaction after it is excreted from the body; and hence the moisture becomes a vehicle for a subtle aerial poison, which when breathed for a sufficient length of time poisons the blood through the lungs and so predisposes to disease.

This putrescent organic matter can be detected by the sense of smell in crowded rooms, and especially in any foul air flues connected with such rooms. It attaches itself to furniture, bedding, floors, walls, and ceilings, which in time it saturates, and from which it can be scraped off and examined. Rooms with these filthy saturated walls are always unwholesome, and are nurseries of epidemic disease. The plaster absorbs organic matter, and thus tends to purify the air of an unventilated room; but at length the plaster can take up no more; what is in it already becomes putrid, and the smell of such rooms is as characteristic as it is offensive, while it indicates that the contained air is unwholesome, and the room not fit for habitation.

Now it is a law of our organization, that organic matters excreted from the body cannot be reintroduced into the body without danger to health and life. The lungs are the medium through which aerial poisons of this nature reach the blood. The poison is exhaled from the body into the air, and with the air it is again reintroduced into the blood through the lungs.

Were the poison visible or sudden in its effects it would probably be avoided, but because it is invisible, and acts slowly on the constitution, its presence is forgotten, and disease and increased mortality are the result.

Where the amount of overcrowding is excessive in proportion to the means of ven-

tilation the results of this poisonous air are much more speedily manifested than they are under ordinary circumstances. Such was the case in the Black Hole of Calcutta, where out of 146 persons shut up in it one-third were dead within three hours, and all were dead except 23 in ten hours.

In unventilated barrack rooms, as well as in unventilated living rooms and workshops, where a number of people are crowded together, the effects are produced more slowly on account of the larger amount of space. The blood becomes gradually diseased; of which result, blanching and loss of general vigour are the first and most common effects, indicating a slow but steady deterioration of the constitution, scarlet fevers fever, small pox, are generated, but more commonly the respiratory function itself becomes diseased, as well as the functions of the skin, giving rise to great susceptibility to colds and catarrhs from slight exposure, and finally to pulmonary consumption. Moreover, during epidemic seasons, typhus, diarrhœa, or cholera are very liable to break out among the inmates of overcrowded unventilated rooms; the whole process being the result of unsuspected aerial poisoning.

For many years past these facts, although overlooked or undervalued in their importance by most people, have been familiar to all sanitary observers. The mitigation or prevention of diseases arising from atmospheric impurity, constitutes indeed a large part of every sanitary procedure.

As regards barrack rooms we may form a tolerable estimate of what must be the condition of the air during the night by selecting one example from Chatham barracks. On our inspection we found 54 rooms, occupied by 864 men, with only 281 cubic feet per man, with no special provision for ventilation. Each of these rooms contained 16 men. During the eight hours of night occupation there would be exhaled into each room of these 54 rooms, by its 16 occupants, about 120 cubic feet of carbonic acid gas, or more than a 40th part of the cubic contents of the room, besides 16 pints of water containing animal matter given off from the skin and lungs. No doubt part of the gas would escape by the chimney and by crevices, but the very offensive smell of the rooms, even when the men were out of them, and the windows were open, was of itself sufficient to prove the foul and unwholesome state of the air breathed by the men during the hours of sleep, when the body is more peculiarly susceptible of its influence.

There are other sources of atmospheric impurity in barrack rooms besides those arising from respiration and from the skin. Urine tubs, which are often made receptacles of every kind of filth, increasing the dampness and foulness of the air; exhalations from the damp foundations of barracks; damp from wash-houses, cook-houses, &c., improperly placed under barrack rooms; wet body linen and other clothing secreted in barrack rooms by soldiers' wives, from want of proper means of drying; effluvia from unventilated gas burners, every two union jets consuming as much air as is required for 8 men; vapours containing carbonic oxide, carbonic acid, &c. escaping from stoves and fire-places; all these agencies add their quota to the impurity of the air in crowded unventilated barrack rooms to those proceeding directly from the occupants themselves.

These facts and considerations prove that ventilation, the proper renewal of the inner atmosphere of barracks, is one of the prime necessities of health for men occupying these rooms; but, nevertheless, at the time of our inspections we found no means of renewing the air in any barrack room worthy of the name of ventilation, except in a few rooms in three of the Dublin barracks, which accommodate about 600 men.

Table C. contains the result of our examination into this most important subject, together with the approximate space per man allowed in each barrack, and the number of men exposed in each to the two conditions of defective ventilation and overcrowding.

We learn from this Table—

1st. That in 83 barracks of the United Kingdom, containing 3,130 rooms, and 42,521 men, with from 200 to 400, 500, and in a very few rooms only 600 cubic feet per man, no means of ventilation whatever had been provided.

2nd. In 78 barracks, containing 2,237 rooms, and 33,601 men, with 230 cubic feet per man and upwards, ventilating arrangements exhibiting all stages of imperfection and inefficiency had been introduced.

The following were the arrangements generally in use in these imperfectly ventilated barracks:—

In some rooms we found that openings had been made in the ceilings, communicating with hollow boxes or beams carried across the room to the open air, a method of ventilation imperfect, inefficient, and liable to produce constant down-drafts by the action of the fire when the doors and windows are shut.

In the upper rooms of some infantry barracks, and generally in cavalry barracks, openings had been made through the ceilings into the space beneath the roof. Besides

producing down-drafts, openings of this kind, communicating with one reservoir of foul, stagnant air common to a number of rooms, may, by the irregular action of the fires, supply the rooms with each other's foul air.

One modification of this arrangement which we found at Northampton deserves notice. In this barrack the rooms are over stables, and above the rooms is an attic partially occupied by men. The rooms below this attic were ventilated by an opening through the ceiling into a triangular space, formed by the slope of the roof, the side wall of the attic, and the ceiling of the lower rooms. From this space there was a ventilating opening into the attic close to the heads of the men's beds, who thus would breathe during sleep foul air from the rooms below, unless there were fires in these lower rooms, in which case the men in the lower rooms would be supplied with foul air from the attics, drawn down the ventilators by the action of the fires. Perhaps no more striking illustration could be given of hopeless confusion of ideas on the whole subject of ventilation.

As a general rule, the ceiling openings are furnished with sliding covers, which, as might have been expected, were as a general rule shut; so that these barracks, although we have classed them in the Table among those "inefficiently ventilated," were in reality not ventilated at all.

In one or two barracks, as for instance, in Anglesea barracks, Portsmouth, Dr. Arnott's ventilators have been placed in the chimney close to the ceiling. For non-commissioned officers' and other rooms with a small number of inmates these ventilators are of great utility, but for barrack rooms they are by no means sufficient, because in the first place they have been introduced without reference to Dr. Arnott's condition that the fire-place must be contracted below before a sufficient draft can be produced in the ventilator, while barrack fire-places are the largest and most wasteful of heat we have anywhere seen. The ventilator, for want of sufficient draft, generally acts imperfectly, and not unfrequently smoke issues through it into the room and it has to be permanently closed. Secondly, if the whole draft of a barrack room chimney could be rendered available for ventilation, it would not of itself be sufficient to maintain a requisite degree of purity in the air of a room with a dozen or more inmates. In all cases the fire-place is a most valuable aid to ventilation, but it must be properly used, and combined with other means, as we shall afterwards show.

In a very few barracks, as, for instance, in St. George's barracks, Trafalgar Square, in two or three barracks in Dublin, and in Sheffield new barracks, shafts have been carried up from the ceilings of each room in the chimney stalk.

This is an indispensable part of barrack room ventilation, but it is insufficient without means of admitting fresh air to supply the shaft, and means of warming part of the admitted air in winter.

In two or three barracks, such as Belfast infantry barrack, inlets for air with sliding covers had been made in the walls close to the ceiling of the rooms; but no outlets had been provided, and these inlets produced drafts towards the fire. They are part of a proper system of ventilating, but they are not the whole of it.

Another method, and a very objectionable one, of supplying air to barrack rooms, we found in existence in Wellington barracks, the Tower barracks, new barracks at Kensington, and in Portman Street and other barracks; this consists of placing inlets close to the floor of the rooms, so that the cold air admitted, instead of mingling with the air of the room, blows among the men's feet to the fire-place, thus lowering the temperature near the floor where it is always most important to have the air warm, and risking the health of the men. At Portman barracks these openings for supplying the lower rooms with air were nearly on a level with badly formed and filthy gutters and rough paving outside, so that foul air as well as damp cold air flowed into the rooms.

In no instance have we found any means of diffusing the air in use from these inlets; the air simply rushes in in a column, producing drafts.

We have met with a few instances in which wire gauze or perforated zinc has been introduced into windows. However useful this may be in an ordinary sitting room, it is a totally inefficient expedient for the night ventilation of a crowded barrack room.

In barrack rooms built back to back, with windows only on one side, it has been a practice to make openings through the walls between the rooms, with the object, no doubt, of trying to prevent that stagnation of air so injurious to health, directly produced by the construction of the rooms. Such openings only do mischief by permitting the foul air of the rooms adjoining to intermingle without removing the impurity. So far as concerns the construction, these openings simply convert two rooms with two rows of beds in each into one room with four rows of beds, which is worse for ventilation and health.

We are glad to be able to state that in parts of three barracks we found a proper combination of inlets for fresh air and outlets for foul air in use, although from the too small size of the outlets in comparison to the cubic contents of the rooms the ventilation was not all that it ought to have been. This arrangement of shafts and inlets we found had been introduced into six rooms in the new part of Island Bridge barrack, into some rooms in Ship Street barrack, and also into a few rooms of Beggar's Bush barrack, all in the city of Dublin.

These rooms, occupied by perhaps 600 men, were the only barrack rooms in the United Kingdom in which there was any recognition of the true principles of ventilation. But even in these cases the old barrack grate was in use, and no attempt had been made to obtain warmed air for ventilation to prevent the temperature of the rooms being unduly lowered.

To ventilate a barrack properly the stairs and passages must be ventilated, otherwise they become receptacles of stagnant air, especially on the upper floors.

Non-commissioned officers' rooms being also within the barracks require ventilation for a similar reason.

We have scarcely met with an instance in which staircases, passages, and non-commissioned officers' rooms have been ventilated at all. In long dark inner corridors or passages of cavalry barracks free ventilation is especially required to prevent them becoming receptacles of stagnant foul air, percolating upwards from the stables below. In one or two instances only have we found this inner passage sufficiently lighted or ventilated; in all others there has been no sufficient ventilation.

A most important part of the ventilation of cavalry barracks is the ventilation of stables under barrack rooms. With very few exceptions the ceiling of the stable is merely a plaster ceiling, with nothing intervening between it and the flooring of the men's rooms above. The plaster affords very little obstruction to the passage of ammoniacal gases and foul air upwards from the stable, and hence the offensive, sometimes sickening odour which pervades the rooms. Most stables have some means of ventilation, generally by openings above and below, in the side walls, but the state of the air in the rooms over them proves that the ventilation provided is far from being sufficient or correct in principle. Only by very free ventilation can the evil be abated, but no practicable amount of ventilation would remove the odour: for even if the stables were ventilated there would be constant liability of foul air from the stables reaching the men's rooms through the windows and other ventilating inlets. We have been in such barracks where the air was purest in those rooms in which the windows were shut. Only by separating the men from the horses can the evil be thoroughly remedied.

Our conclusion from this part of our inquiry is, that, with the three exceptions stated, for all practical purposes the barracks we have inspected were not ventilated. Considerable sums of money have nevertheless been apparently spent on the object, but it is quite evident that this matter has never been dealt with on any defined principle, or with any adequate recognition of its great importance to health.

Warming.—In no instance have we seen any attempt at combining barrack room ventilation with warming, which latter is an essential part of the winter ventilation of all barrack rooms in this climate. An ordinary barrack fire-place consists of a large open chimney space, in which there is placed as far back as possible a large iron grate about four feet long, like a kitchen grate without the boiler and oven. The construction of the chimney is such as to diminish the draft and to cause it to smoke; to prevent which the fire is often screened from the room by a tin blower. There is no attempt at economy in fuel, but, on the contrary, there is so much waste on account of the size and position of the grate and the large chimney opening, that it is often impossible to keep the rooms at a comfortable temperature with the usual allowance of coal. We have ourselves inspected occupied barrack rooms in winter, where there was no fire, and where there would be none for a couple of days, on account of the fuel rations not lasting their time, and having been consumed. The fuel ration is nevertheless more than enough for comfort and health, if barrack room grates were constructed with a view to economy.

A most serious difficulty in the way of room ventilation arises from this wasteful construction of the fire-grates. In order to preserve the air sufficiently pure, it is necessary to pass through the rooms many times the quantity of air at present admitted, and this cannot be done with the fire-grates hitherto in use, except by lowering the temperature of the rooms to an uncomfortable degree. We have therefore directed our attention to this important point, and have had several grates on trial for economizing heat and warming part of the admitted air. We shall describe in the sequel the improved form of fire-grate which is now being introduced into barracks and hospitals.

Another reason for introducing improved fire-grates is, that by diminishing the number

of men in proportion to the amount of space, the quantity of fuel available for barrack rooms at the present rate of allowance will be reduced in proportion as the men are drafted to other rooms. Additional cubic space must therefore infer additional fuel, unless the grates were constructed on more economical principles.

Hence, improvements in warming must go hand in hand with ventilation, and with spreading the men over a larger space.

5.—State of Water Supply, Drainage, Latrines, Urinals, and Cleansing.

Water Supply.—The water supply of barracks is derived from three sources, namely, wells, rain-fall, and the mains of water companies.

The larger number of barracks are supplied by wells of greater or less depth, generally from 20 to 50 or 60 feet. There are a few wells of a much greater depth, but "shallow wells," supplied by strata near the surface, are those in general use.

In most instances water is drawn directly from the pumps for daily consumption. In other cases there are tanks, generally of iron, into which the supply is raised for distribution. Rain water is collected from the roofs, and is generally conveyed to underground tanks, from which it has to be again raised by pumps for use. These underground tanks and wells are liable to pollution by infiltration from the subsoil of water charged with impurities of cesspits, dungheaps, ashpits, and of the undrained subsoil itself. There are not a few examples of wells being placed much too close to these nuisances. It appears to have been overlooked that in most cases wells of the ordinary depth, especially in porous soils, derive their water solely from the rain falling on the area which these wells drain. All nuisances within the area afford soluble organic matter and salts, which are carried down with the water to the lowest level, which is the well. A similar remark applies to underground tanks. In most instances the water drawn from barrack wells and tanks contains numerous filaments of organic matter visible to the naked eye; but the impurities are not generally cognizable by taste or smell. We have nevertheless met with instances where the water was most offensive to both. As illustrations of this we may cite the water from an underground tank, placed at a few feet from the privies of Brompton barracks, and a well at Fort George near a privy. In both these instances the water was strongly impregnated with sewage matter. At Fort George, indeed, on account of the defective nature of the drains, the sewage percolates into the gravelly subsoil, from which subsoil all water for the use of the troops and sick is pumped up from shallow wells.

Shallow wells and water tanks to be safe from these evils should be placed at a distance from all possible sources of impurity. They should never be placed in the vicinity of privies, dungheaps, &c.

The common practice of conveying the roof water to underground tanks involves not only the danger of pollution, but a very unnecessary amount of labour in pumping it up again. Rain water is generally used for washing and ablution, or for extinguishing fires, for all of which purposes it would be much more at hand if it were stored in tanks at a sufficient height above the ground.

Where water can be obtained from public mains it is always advisable to adopt this method of supply, at least for all ordinary purposes. It can be laid over the whole buildings at pressure, and the facility with which water can be obtained in this way contributes very greatly to general comfort and cleanliness. The immense advantages in these respects possessed by a constant water supply available at all times over an intermittent supply obtained from the same mains is now fully recognized, and the advantage of this method of obtaining water over that by shallow wells is of course infinitely greater. Besides, shallow wells are apt to fail in dry weather. We have met with many instances of this defect; one of which, and a result which flowed from it, we may mention. Manchester has an excellent water supply, the mains of which pass the barrack gate at Hulme cavalry barrack. This barrack at the time of our inspection derived its water from wells in front of the stables and not from the mains. The canteen, being an *occupied* dwelling, was supplied with town water. Shortly before our visit to the barrack, the wells became deficient, and the men had to procure water from the canteen, for supplying which the owner was fined 10*l.* by the authorities.

We have met with a few instances of water being obtained from rivers; but these are the exceptional cases. One of them, however, we cannot pass over without notice. We found the garrison in the Tower drawing its supply partly from an artesian well at the Mint and partly from the Thames, where it passes the Tower. It need hardly be stated that the Thames water, although filtered, was in an abominable state, and quite unfit for any domestic purpose. It was, nevertheless, laid on behind the hospital by

a tap side by side with the artesian well supply, so that the one water might easily have been drawn instead of the other. Moreover, the Thames supply was the only one laid on to the hospital kitchen. The great danger of such an arrangement to the health of the troops, during an epidemic season, especially when cholera prevails, is obvious. It is right to state that this arrangement was immediately altered on our calling attention to it.

Generally speaking the quantity of water available appeared to be sufficient for current uses, although in some instances it was not so. In the majority of barracks, however, the present supply will in all probability be found insufficient when the drainage is improved, cesspits abolished, and water latrines substituted for privies.

On the whole we are of opinion, that the water supply, of all country barracks at least, has not kept pace with the improvements which have been carried out in water sources for towns, and in the means of collecting, conveying, and distributing water for use. In town barracks the arrangements are somewhat better, but there are still too many instances in which water from mains might be obtained without advantage being taken of the facility. Even if it be necessary for military reasons to have an independent water supply within the barrack enclosure, no argument can be founded on such necessity for neglecting to make use of more abundant, purer, and more convenient sources of supply until at least an emergency arises. The fact that a barrack *may* be besieged, can never afford a sufficient reason for condemning the men, when there is no siege, to use shallow well water in quantities too small for purposes of health, while they might enjoy the immense advantages of an unlimited, pure, and constant supply always at hand.

Drainage.—All the barracks we have inspected are surface-drained more or less effectually. The parade grounds are formed and guttered, but in numerous instances this is not sufficient for drainage or for keeping the surface hard and dry. The result is that many parade grounds are soft and sloppy in wet weather, and there are several grounds connected with cavalry barracks, especially, which cannot be used except during dry seasons. The exercising ground at Leeds barrack, for instance, was in such a condition that the horses at certain seasons had to be exercised on the public roads.

The back yards of cavalry barracks are generally paved with irregular boulder stones, instead of square setts now universally introduced in all well-paved towns. Hence the surface is never well drained and cannot be kept clean. The gutters are often in a very defective condition in consequence, and pools of foul water often lie directly under the men's windows.

The floors of most cavalry stables are paved with the same material, and are very difficult if not impossible to keep thoroughly clean. A strip of boulder stone or pitch paving is often carried round the barrack blocks instead of flagging, and it always forms a bad surface for drainage.

It is time that this boulder paving should disappear from all barracks, as it has been gradually disappearing everywhere under the progress of public improvement.

No other paving except square setts should be permitted within barracks or stables, and all footways round the men's rooms should be flagged. We would strongly recommend that the change be made as speedily as circumstances will permit. Paving even in its roughest form was one of the first effectual means adopted for improving the public health, and as paving itself has been improved the public health in districts where this has been done has greatly benefitted by the change.

Very few if any parade and exercising grounds are underdrained, and until this improvement be thoroughly carried out the surface will never be good. Moreover a wet undrained area several acres in extent, enclosed among barrack buildings, always tends to keep the air moist and unwholesome. But besides, undrained surfaces, especially if they be at all porous, may become a positive source of disease, for in time they are sure to be saturated with organic matter and foul water. This is an especial risk in fixed camps. If an airy, porous, healthy site is selected for a camp the troops will continue healthy for a certain period of time. After this period has elapsed the camp is found not to be so healthy as it was at first, and finally it has to be shifted to fresh ground. But with a fixed camp such a change of position is neither intended nor provided for. The camp is intended to be occupied for an indefinite period of time; but this object cannot be realized without loss of health unless proper sanitary precautions be adopted. If the ground is not thoroughly under-drained, and the surface kept scrupulously clean, it loses its porous character from being constantly trampled on; it becomes saturated with filth and foul water, and generates malaria. Fevers appear among the troops, and ground which has been thus neglected, or, so to speak, used up for want of proper precautions in the way of subsoil drainage and cleansing, becomes in time uninhabitable. All

ground, therefore, in the immediate neighbourhood of barrack rooms or huts, should be thoroughly underdrained, the tiles being placed at such distances and depths as will ensure dryness and hardness of surface. Guttering should always be formed with the best available fall, and of well-laid material, so that it may rid itself of the water as quickly as possible. From want of attention to this precaution, we have seen instances where the surface guttering simply collected and retained foul water from wash-houses, kitchens, ablution rooms, &c., until it evaporated or sunk into the soil.

Barrack huts constructed on ground dealt with in this manner are apt at certain seasons to have fever among their inmates. Such cases have happened recently both at Colchester, Chichester, and Shorncliffe, and in each of these camps the inhabited ground is in much need of drainage.

We have met with not a few examples of very bad surface drainage arrangements. It is customary in barracks to dig deep ashpits and manure heaps, without making any provision for draining them. The rain and surface water accumulates in them, and being saturated with filth, becomes putrid and exhales unwholesome effluvia. We have met with instances of manure ashpits, in which foul water stood several feet in depth, close to barrack rooms, and not far from shallow wells. At the artillery barrack at Exeter, we saw water from one of these manure pits being baled out upon the surface, that it might find an escape by the surface drains. One of the most notable examples of deficient drainage we have met with was at Belfast, where a large unfinished sewer emptied itself into an open drain within the barrack enclosure, and in front of the hospital, the foul water escaping into a pond, or rather an immense cesspit, also within the enclosure. It appeared as if drainage works had been commenced, and never completed.

At the best, the existing drainage contemplates the removal of nothing but the rain-fall, and waste water from wash-houses, ablution houses, &c. There are but few instances of such a thing as privy drainage in the barracks of the United Kingdom. Cesspits, placed within or without the barrack walls, are all but universal. Sometimes, the cesspit and ashpit are the same. In cavalry barracks, the cesspit and dungheap are often together, and a process of mixing up the various kinds of manure is not unfrequently carried on by the contractor close to the men's rooms. The nuisance from these cesspits is at times intolerable, and we have met with instances in which the production of fever could be clearly traced to them. As an example of this, we may state that at the Porto Bello artillery barrack, Dublin, the men's rooms nearest these cesspits have had a considerable amount of diarrhœa, and also of low fever among their inmates. The fact was frequently complained of by the medical officers; but as there was no drainage, the evil could not be abated.

Privies and Latrines.—Although one of the main objects of recent sanitary legislation has been to abolish cesspits in all towns and inhabited districts, the principle involved has never yet been fully recognized as applicable to barracks, and we found the cesspit, with its abominations, its injury to health, and its costliness, still existing in the great majority of barracks in the United Kingdom. It is true, that in some instances, privies or latrines have been drained to an outlet and flushed; but these are in reality the exceptional cases. Yet the cheapest, quickest, and most innocuous method of removing human excreta is by water; and until this principle be applied in practice, no barrack can be said to be drained.

The form of privy almost universally adopted has a long seat formed by a bar or ladder placed over a deep trough opening into the cesspit behind. It has no divisions between the seats, no ventilation, and very little light.

It is situated usually in a long narrow building, with a shed roof, placed at a short distance from the men's rooms, and as near as possible to the boundary wall. Sometimes the cesspit extends under the whole area of the floor, and is covered merely by moveable boards under the men's feet, which are taken off after the lapse of months or years, when the place has to be emptied. At the Brighton infantry barrack, the process of cleansing occurs at an interval of years, and is an intolerable nuisance to the barrack, and to the neighbourhood, being alike offensive to the senses, to health, and to decency.

In many Irish barracks the privies are in a building reached by a flight of steps, an arrangement which is adopted to facilitate the emptying of the cesspits. The best constructed cesspits are lined with masonry inside and covered with stone slabs, and in two or three instances these cesspits are provided with ventilating shafts, but their only means of drainage is into the subsoil, the wells being frequently polluted by these foul infiltrations.

At Aldershot, Chatham hut barrack, and Colchester, the excreta are collected and

removed in trucks and tubs, a most offensive and costly process, but avoiding some of the evils incident to cesspits.

In a few barracks, as, for instance, those of the metropolis, a system of water latrines, some of them self-discharging, had been adopted. In this arrangement a water trough of brick or masonry, generally five or six feet deep, in which water is maintained at a constant level, extends under the seating. Once a day, or oftener, the whole contents are discharged into the sewers by opening a valve, and the trough is refilled from the water mains or from a cistern. The valve is usually opened by hand, but occasionally, as in Salter's patent apparatus, by a water balance, by which the arrangement is rendered self-discharging. The troughs are generally too deep; they require too much water, and as the water stands several feet below the seats the sides are permanently covered with filth.

There are various modifications of this principle in use, but they all consume an unnecessarily large quantity of water on account of the great depth of the trough. The most economical of water are a cast-iron water latrine made by Mr. Macfarlane of Glasgow, and an earthenware latrine made by Mr. Jennings of Blackfriars, of which we have had a specimen erected at Buckingham guard room. Macfarlane's latrine is used both for public use and in many manufactories. It has also been introduced with great advantage into a number of barracks and hospitals.

Urinals.—There is considerable variety in the structure of barrack urinals, as well as in their position. The most common form is a shallow trough of porous stone, with scarcely any inclination, having a round opening at one end of it communicating with a superficial drain. Generally there are no divisions, and no provision for decency. Sometimes a small urinal, capable of being used by one person at a time, is placed in a corner and similarly drained. In some barracks improved forms of urinal have been recently introduced; the best of these is on the model of the common railway urinal, with the back and divisions made of slate or of iron. A small proportion only are supplied with water for cleansing, and all of them which we have seen have been offensive from putrescence of the solid matter of the urine, which adheres to the sides, and especially to the angles of the urinal.

This is the great defect of almost all forms of urinal in use, and even those made of white porcelain and supplied with water are not altogether free from nuisance. The odour from these urinals is so powerful that when placed under the same roof as the latrines the nuisance from the latter is very greatly increased by the presence of the urinal, unless the ventilation be very free.

Barrack urinals are generally placed near the latrines, but in some barracks they are under the men's rooms, though open to the outer air, an arrangement which is always offensive to the rooms above.

We have found no barrack room urinals in use. The urine tub exists in all barrack rooms, and although every care has evidently been taken to keep these tubs clean and free from smell, the result is far from satisfactory.

Cleansing.—As a rule, we have found the surface cleansing of infantry barracks in a satisfactory state. The parade grounds, at least at the time of our inspection, have been thoroughly swept and all impurities removed.

The back premises have been also clean, and in this respect there has been nothing to complain of, except ashpits and privies, which have often been very foul.

The surface cleansing in cavalry barracks has not been by any means so well attended to as that of infantry barracks, particularly in the immediate vicinity of the stables, but more especially in the spaces intervening between the back of the stables and the boundary wall. But we are bound at the same time to state that cleanliness, as a rule, has, in these barracks, been rendered far more difficult than it should have been by defects in the barrack plans, and by the description of surface paving generally in use.

The parade and exercising grounds of cavalry barracks have generally been clean, but as soon as we have approached the blocks where the horses were stabled we have frequently found the surface badly paved with rough cobble stones both within and without the stables; the gutters imperfectly laid, foul water lying in holes on the surface, and the stable floor often plastered over with horse-dung and urine, and smelling most offensively. In the great majority of cavalry stables there are no litter sheds, and the horse litter is piled on the pavement against the walls, directly under the men's room windows, which are generally placed over stables, so that whenever the windows are opened the smell enters the rooms. On wet days the litter, from want of proper sheds, is left in the stables, where it cannot be properly aired, and where it adds to the ammoniacal fumes pervading the place.

Within a few yards of the back wall of the stable are the dungpits, dug out of the ground to the depth of several feet, adding thereby to the trouble of cleansing by necessitating the dung to be first thrown into a hole, and then to be lifted out for removal. They expose a large foul evaporating surface, without any drainage or paving, and often contain a foot or two in depth of foul water. These dungpits are often connected with privies, and, as already stated, the privy soil is sometimes mixed with horse-dung in the pits by the contractor before it is removed.

Taken as a whole, the arrangements of these defectively planned cavalry barracks, with men's rooms over the stables, and every part of them impregnated with stable odour, the narrow, ill-paved, and badly-drained back yards with huge middens in them, throw great difficulties in the way of cleanliness. We have seen cavalry stable yards which it was next to impossible to keep clean, from such defects as we have described, and where the outer air from which the men's rooms have to be ventilated is always more or less foul. There are, however, a few cavalry barracks in which the men's rooms are separate from the stables, and in which the general plan, paving, and surface drainage are all of a better character, and in such instances we found a marked contrast in the cleanliness of the whole establishment. Any one who has had an opportunity of comparing the stable square at the Royal barracks in Dublin with the cavalry barracks at Dundalk cannot fail to have observed the much greater facilities for cleanliness afforded by the latter barrack.

In all barracks the present contract system for removing refuse is objectionable, because it provides for collecting and retaining the refuse within the barrack boundary, and close to the men's rooms, until a sufficient quantity has been accumulated to meet the contractor's convenience.

This system is radically bad. No putrescent matter should ever be allowed to remain near human dwellings; it should be swept up and removed at once. There should be no dung-heaps in close narrow back yards anywhere.

Cleansing of Barrack Rooms.—Speaking generally, the inside cleansing of barracks is apparently well attended to. To the eye, the floors, ceilings, and walls have been apparently clean and white, even those of the outer passages and stairs. There have been exceptions, mainly in unoccupied barracks and in some bad cavalry barracks, but the rule has been as we have stated it.

To *be* clean, and *to appear* clean, are however very different things where health is concerned. It is quite possible to have white walls and ceilings and not to have cleanliness in them. This distinction, as we shall presently show, has been altogether overlooked in the Barrack Regulations, and as one consequence we have been struck on entering closed barrack rooms, especially if they happened to have been unoccupied for a short time, by the very offensive smell of the atmosphere. We have already shown that in an overcrowded unventilated barrack room, the air, especially at night, is saturated with organic matter about to enter into a state of putrescence—a kind of aerial filth, ready to generate disease in those who breathe it; that fresh plaster and brick absorb this foul air, and that the putrescent matter in it attaches itself to the wall; hence a clean plaster wall tends to keep the air of an overcrowded room pure; but to do this the wall must take up and retain the foul matter. There is, however, a limit to its capacity in this respect, and at length it not only ceases to absorb, but the saturated surface becomes itself a nuisance. Putrid organic matter can be scraped off from such walls, and also from the furniture. It can even be detected, by chemical or microscopic analysis, in the air itself.

Were there no way of destroying the organic matter in porous walls it would be difficult to protect the inmates of crowded rooms from epidemic disease. There is a remedy, however, which is found in practice to be most effectual even during epidemic seasons; and that is washing the walls and ceilings with a solution of quick-lime, a process which appears to destroy or chemically to alter the organic matter in the wall, so as to remove danger for the time. After a certain period, however, it is necessary to scrape the wall as well as to limewash it, and even to replaster it. Quick-limewash alone has this property of cleansing foul walls; ordinary whitewashing only covers the filth.

Keeping these principles in view, let us see how this cause of unhealthiness in barrack rooms is dealt with under the Barrack Regulations.

Regulation 186 directs that "Internal painting, whitewashing, or colouring, including "scraping, stopping, and washing, are to be performed every nine years." "Any inter-"mediate whitewashing that may be found necessary" is "to be performed by the bar-"rack master, on the requisition of the commanding officer," &c. Reference is made to

Appendix xvi. of the Barrack Regulations, for the manner in which this intermediate whitewashing is to be done. It is there described as follows:—

"In the performance of whitewashing, it is the practice to whitewash plastering, and "to limewash brick walls, size being used in all cases."

The barrack master is to satisfy himself of the necessity of this intermediate whitewashing, which may be done by the troops if the commanding officer will grant permission. The barrack master is to supply the lime and whitewash brushes, and the instruction proceeds to state that, "It is considered that urine tubs are of sufficient capacity to "mix the limewash in," as if there were not enough of foul matter in the walls already, without incurring the risk of an additional dose from the urine tub!

There cannot be a doubt that the whole proceeding is most defective, and by no means sufficient to keep the walls and ceilings of barrack rooms in a healthy condition.

Defects in cleanliness exist, as we have stated, both without and within barracks. In the former case they can only be dealt with efficiently by better paving and draining, improved construction, and by a better organized system for removing refuse matters. In regard to barrack rooms, a change in the regulation, such as we shall point out in the sequel, requires to be adopted and rigidly put in practice.

6.—State of Ablution and Bath Accommodation, Wash-houses and Cook-houses.

Ablution Rooms.—Ablution accommodation has only of late years been attached to barracks. Not many years ago, the men had to wash at pumps in the open air or under any convenient shed. At the present time, however, there are very few barracks not provided with ablution rooms of some kind or other. The lavatory buildings are generally detached from the barrack, and placed behind the ranges. They usually consist of one-story sheds, leant against the boundary wall, or placed at the end of the ranges. Sometimes they are in the basement or ground floor of the barrack, under the men's rooms. In many instances, buildings already existing have been adapted for ablution accommodation.

Many of these buildings are neither sufficiently lighted nor ventilated. The washing arrangements consist of one or more long narrow tables of slate or of wood, placed down the centre of the room or along the walls, or both. These tables are sloped away from the washer, and there is usually a gutter behind, which conveys away the water after being used. At the back of the table a water pipe is carried along, with taps at intervals. Water is generally supplied from a cistern. In some instances water is not laid on, but has to be carried from the pump. Each table is supplied with a number of metal basins which receive water from the taps, and after the water has been used the basin is simply turned over on the table and the waste water escapes by the gutter to a drain in the floor.

Many tables are supplied with a bead about an inch deep, running along the edge nearest the washer. This is a very necessary arrangement for preventing water dashing over on the men, when the basins are emptied. The floors are generally flagged, sloped, and drained by gulleys in the floor. Generally there are wooden gratings for the men to stand on, and in many instances there are pegs for hanging coats on. There were many lavatories, however, not supplied either with beads to the tables, gratings, or pegs.

These ablution rooms vary much in character. Some are very complete and good; the majority are deficient in some part of the accommodation; some ablution rooms require much improvement, and there are some barracks yet to be provided with them. Taken as a whole, there has been more improvement of late years in ablution accommodation than in any part of barrack construction, although much yet remains to be done to make ablution-rooms what they ought to be.

The most frequent defects we have observed are in the position of the rooms, and in the actual amount of ablution accommodation as compared with the strength in barracks.

When a man goes to wash in the morning he is only partly dressed, and in that state he leaves a close crowded barrack room, where perhaps he has been in a state of perspiration all night; he goes into the open air, traverses the barrack yard in all weathers, wet and dry, winter and summer. He has perhaps to wait his turn in the open air in wet cold weather, as we ourselves have seen, and after he has washed himself he has to return again to his room to dress. In many instances the distance to be so traversed is certainly not great, but in some large barracks the ablution rooms are so far from the barrack rooms that the exposure to be undergone is a great risk in winter for men even in health. In some instances we have seen the ablution room placed at as great a distance as possible almost from the barrack ranges.

If, as is sometimes the case, ablution rooms of the ordinary construction are placed in the ground floor or basement, so that there is a free communication between the ablution and barrack rooms by means of the atmosphere, the advantage is certainly realized of enabling men to wash without exposure to the air; but on the other hand, the constant dashing of water over large surfaces, the evaporation going on, and the infiltration of water into the barrack foundations, all tend to charge the air inside the building with moisture: and damp is a well-known predisposing cause of zymotic disease. Instances of these ablution rooms being placed within the barrack houses are by no means common, but when they are so placed they have been complained of on account of damp. In one case, on the cavalry side of the Royal barracks, Dublin, an ablution room under a barrack room, although with a separate entrance to the outer air, had occasioned fever among the inmates of the room above.

There are very few barracks in which the extent of ablution accommodation is sufficient. The number of basins is too small for the number of men. The proportion ought to be at least 10 per cent. of the force.

Baths.—In a country where baths are so little used among the working population, as a means either of cleanliness or of health, it is scarcely matter of surprise that so few barracks have hitherto had accommodation of this kind provided for their inmates. At the time we commenced our inspection, there were a few baths in the basement story of the Wellington barracks; but with this exception, there was hardly a barrack in the United Kingdom provided with means of bathing. The occasional use of an old horse-trough, or of an iron barrack coal-box as a bath, such as we have seen in two or three barracks, cannot be considered as an exception to the rule.

It is scarcely necessary, in the present state of public intelligence on this subject, to enforce the advantages to health and cleanliness, of cold bathing. It is a most potent agent in preventing disease by strengthening the excretory functions of the skin, and by enabling the constitution to resist exposure to sudden changes of temperature. It is also a powerful tonic, and tends to improve the stamina of the men. These advantages were fully recognized in former times, when frequent cold bathing constituted an important part of the hygiene of armies, although in modern times it has been very much neglected.

As a means of cleanliness, baths are especially required in artillery and cavalry barracks, both of which ought to be liberally supplied with them.

Where barracks are within an easy distance of the sea, the men have certainly a great advantage as regards bathing in one of its aspects, but not in others. Sea bathing can only be resorted to in certain seasons, and sea water does not cleanse the skin like fresh water. Sea bathing is more a tonic than a means of cleanliness, and cannot be considered as a substitute for fresh-water bathing. Where men sleep in one common room, and where the difficulties in the way of personal cleanliness are so considerable as they are under such arrangements, it is essentially necessary to provide in some suitable locality for the observance of those habits of personal cleanliness, which cannot be attended to in barrack rooms.

Bath rooms need not be placed so close to barrack rooms as ablution rooms should be, neither do they require a covered communication with the barrack. Men go to the bath room at any time of the day most convenient to them, with their clothes on and return dressed, and they are hence not exposed to the same risks as men who go partly dressed to an ablution room situated at a distance.

Wash-houses.—With a very few exceptions, all the barracks we have inspected have wash-houses, where soldiers' wives wash the men's body linen. These wash-houses, in the great majority of instances, consist of a long narrow lean-to building, erected against the boundary wall of the barrack enclosure. They are almost always provided with two, three, or four boilers, according to the size of the barrack, and with frames or forms on which to rest the washing tubs. In a few instances we found the conveniences of the ordinary barrack wash-house increased by fixed washing troughs placed along the wall. The floors of these wash-houses are generally flagged, guttered, and drained, though in many cases they are simply paved with rough stones. Foul water from the tubs is usually disposed of by being poured on the floor, from which it is carried away more or less perfectly by the gutter and drain, but the floor is always wet, and when the surface is not perfectly even, water lies on it, and the health of the washers is unnecessarily endangered by having to stand in it. In a number of instances a partial remedy is found for these defects in the flooring and drainage by wooden gratings, on which the women can stand while washing.

In the great majority of instances water is not laid on within the wash-house, but has to be carried a greater or less distance by hand.

Except in about half a dozen barracks no provision has hitherto been made for drying or getting up soldiers' linen for use. It is true there is generally some part of the barrack enclosure, with posts and lines, set apart as a drying ground, but there are no means of drying linen in moist weather, and as a necessary consequence wet linen is secreted by the women in barrack rooms until an opportunity occurs of drying it at the barrack room fire. This is against order, but it is nevertheless done from sheer necessity. Ironing is also done on the tables in the men's rooms, for there is no other place for it.

These deficiencies in accommodation have an important influence on the health of the men, who are exposed to the continual risk of having damp linen to put on. When linen has to be dried at the barrack room fires, it makes the rooms damp, and they are not so completely aired as they ought to be when the men are absent on duty.

The wash-house buildings themselves are often without sufficient light; they are imperfectly ventilated, and almost always too small for the number of washers. They are sometimes placed within the barrack buildings in the basement, or immediately adjoining the men's rooms, so that the steam and foul air from them can pass into the general atmosphere of the buildings. There are a few detached recently-built wash-houses, in which the structural arrangements are better, but they are all much behind similar establishments connected with workhouses, prisons, and other public establishments.

In several barracks, establishments for washing, drying, and getting-up soldiers' linen on a much more extensive scale have been introduced, chiefly in connection with married soldiers' quarters. There is one such at the Brompton barracks; there is another at Anglesey barracks, Portsmouth, and there are one or two at Dublin; there is also one at the Wellington barracks, capable of washing and drying the bedding required for 5,000 men.

These laundries contain fixed washing troughs, with water laid on, and proper drainage from each trough; drying rooms, boilers, ironing and folding tables, &c. The buildings are very far superior to those of any barrack wash-houses; but they have not been devised on a plan suited to the system at present in use for washing the linen of soldiers.

Cookhouses and Cooking.—Cookhouses are generally situated in the rear of barrack ranges, at a short distance from the men's rooms. In a few instances they are too far off, and as there are no pans in use capable of retaining heat, the dinners are spoiled before they reach the rooms. The cookhouses are often lean-to buildings erected against the boundary wall of the enclosure, or they are built detached from the wall and at a short distance from it. Sometimes they are placed in the ground floors of barracks, or occupy misappropriated barrack rooms, an obviously objectionable arrangement, because it abstracts men's accommodation from barracks already overcrowded, and at the same time exposes the rooms above to the heat, fumes, and damp inseparable from cooking. Sometimes the temperature of the rooms above is injuriously raised by the heat of the fires, as was the case with the non-commissioned officers' quarters at the Wellington barracks.

Cookhouses vary much in character. A few are really good, well built, sufficiently lighted, ventilated, and drained. Very many are small, narrow, and confined, without sufficient space or conveniences, and neither well lighted nor ventilated. Some cookhouses, especially those connected with the smaller class of barracks, are very defective, and scarcely suited for their purpose.

Means of Cooking.—1. *Common Boilers.*—With reference to cooking, in permanent barracks, it may be stated, as a general rule, that when we commenced our work there were no other available means of cooking except boiling. In some few barracks, as for instance, in Wellington and St. George's barracks, there were ordinary bakers' ovens. Captain Grant's kitchen, which has an oven attached to it, was in use in the camp at Aldershot, but these were almost the only exceptions to the rule that boiling was the sole culinary expedient in use in permanent barrack cookhouses. Not that the soldiers placed no value on variety in cooking, for we have met with a number of instances in which the dinners were baked at a public bakehouse at the cost of the men. At Chatham we found that, before bakers ovens were erected, the men had actually been in the habit of spending 200*l.* a year to obtain the advantage of baked meat occasionally.

The boilers are usually placed in a range along the side or at the ends of the cookhouse. In a few instances they are built round a central shaft passing through the roof. They are mostly set in brick-work, but in a few instances there are iron settings. Each boiler has a separate fire and flue, and there is frequently a steam-pipe from the top of the boilers into the flue, intended to carry off the steam produced in excess

by unskilful and too rapid boiling, by which a large part of the aroma of the meat is passed into the chimney and lost.

The boilers are of two sizes; the larger will hold 25 gallons, and the smaller size about half that amount. The larger boilers are put up in the majority of barracks; they are intended to cook for from 30 to 40 men, and the smaller for about half that number. They are used for all purposes, for making coffee, boiling tea, preparing hot water, and boiling the men's dinners. They are of cast iron, about three eighths of an inch thick, a thickness which interferes with the passage of heat to the contents of the boiler, and occasions waste of fuel. Each boiler is provided with a thin moveable sheet iron lid, covering two thirds of the top; the remaining portion being fixed, and from the centre of the fixed part the steam pipe before-mentioned is carried into the chimney flue. Besides boilers there are the usual cooking tables.

The fire-grates are under the centre of the boilers. They are large, have no proper registers, and are not planned to save fuel, hence the amount consumed is very great for the quantity of food cooked. No doubt the fuel is extravagantly used, because the men have never been taught to economize it, but most of the extravagance is due to the construction of the fire-places, and to the setting of the boilers.

Count Rumford's standard consumption of fuel for cooking is one-fifteenth part of the weight of the food. When tried by this standard, all the barrack cooking apparatus consume an extravagant amount of fuel.

To enable us to arrive at some definite judgment on this important subject, and also as to the facilities for varying the cooking, afforded by existing barrack kitchens, we were authorized by the Minister at War to obtain the assistance of two experienced cooks, Messrs. Warrener and Guerrier, to whom we remitted the whole subject for practical examination and inquiry. They were instructed to be present at the time the men were cooking their rations, and to report with great care the result of their observations as to the capabilities of each apparatus, the amount of fuel per head consumed, and the state of the cooking. As the Minister at War was desirous of ascertaining the capabilities of Captain Grant's apparatus, which combines the two processes of boiling and baking with the same fire, Messrs. Warrener and Guerrier were also instructed to report specially on this arrangement.

Their inquiry was carried on in barracks and at several of the hospital kitchens in the metropolitan district, at Chatham, Brompton, Dover, Shorncliffe, Hythe, Woolwich, Brighton, Canterbury, Aldershot, &c., and for the purpose of comparison they extended it to a number of the leading civil public institutions in London and its vicinity, such as workhouses, prisons, schools, hospitals, &c.

They have embodied the results of their inquiry in a series of reports on all the forms of apparatus they found in use at the time, from which the following general conclusions may be deduced, as to the ordinary barrack boilers:—

That, so far as regards cooking by boiling, the common regulation boiler has the advantage of being exceedingly simple, and not liable to inadvertent damage.

That these boilers have been hitherto set without any regard to economy of fuel, and consume from a pound to a pound and a half, or upwards, of coal per man per day.

That the pipes for allowing of the escape of steam into the flues are injurious to the results of the cooking.

That there is a want of practical knowledge on the part of the cooks, so that even with the present boilers, the cooking is by no means so good as it might be.

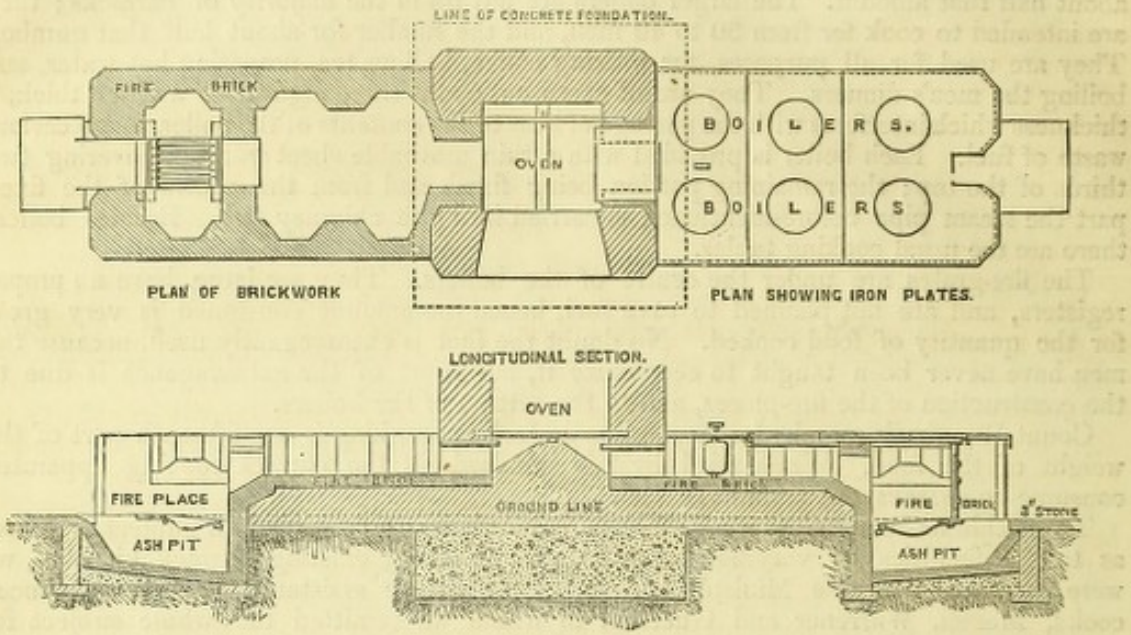
These results describe the practical condition of barrack cooking with the old regulation boiler. Besides its imperfection and extravagance in fuel, it, of course, does not admit of any variation in cooking; but it has the merit of simplicity, and it admits of improvement.

Three methods for varying and improving barrack cooking had been on trial for a short time, before we began our inquiry; namely, Captain Grant's stove, which was in use at Aldershot camp, and in one cookhouse at Woolwich; the ordinary brick baker's oven; and Dean and Dray's gas cooking apparatus. We shall describe these arrangements here because they were in use when we began our inspections, and we shall in the sequel compare their cost in fuel with the results obtained from other apparatus.

2. *Captain Grant's Cooking Stove.*—Captain Grant's stove consists of ranges of boilers, between which the flame and heat of two fires pass towards a flue in the middle, where there is a vertical iron oven, intended to utilize the residual heat, before it escapes by the draft up the chimney. The boilers are set in an iron plate, which forms the top of the apparatus, and which may be used as a hot plate. One of the objects sought to be obtained in the arrangement is economy of fuel, and another is variety of cooking.

The apparatus is shown in the following plan and section, Fig. 21.

Fig. 21.—Captain Grant's Cooking Apparatus for 500 Men.



Messrs. Warrener and Guerrier examined 28 of these stoves in use, and have reported the results to us. They state that the plan is not a new one; that it has been in use in taverns, where it has given way to modern improvements; that from the arrangement of the fire and boilers, the latter are exposed very unequally to the heat; that as a result, if the boilers were left in their places, the food, in some of them, would be cooked too much, and in others it would be nearly raw, and hence it is necessary to change the position of the boilers, so as to expose them alternately to the action of the fire; that the moveable nature of the boilers makes them liable to injury, that the advantage of durability is on the side of the common fixed barrack boiler, that the ovens although requiring a strong heat, are placed as far as possible from the fire, and that they cannot be depended on for roasting, on account of the variable amount of heat which reaches them.

As regards economy of fuel, they state that out of 28 of Captain Grant's stoves examined by them, the smallest consumption of fuel in one at Aldershott, cooking for 585 men, was found to be $12\frac{1}{6}$ oz. per man per diem. That in 8 it was under a pound per man, that in 20 the consumption was above a pound, and varied between 16 ozs. and a pound and a half. In one case, at Woolwich, the consumption for 137 men was 2lb. $5\frac{1}{2}$oz. per man.

The amounts consumed at these trials varied very little from those consumed by ordinary barrack boilers. So that, admitting that the arrangement has a certain compactness, it is open to the objection that the boilers have to be moved, that the ovens do not necessarily cook, and that the quantity of fuel consumed is nearly as great as with the ordinary barrack boilers.

The reporters consider that in some points Captain Grant's apparatus might be improved with advantage, but the large consumption of fuel would still remain to be dealt with.

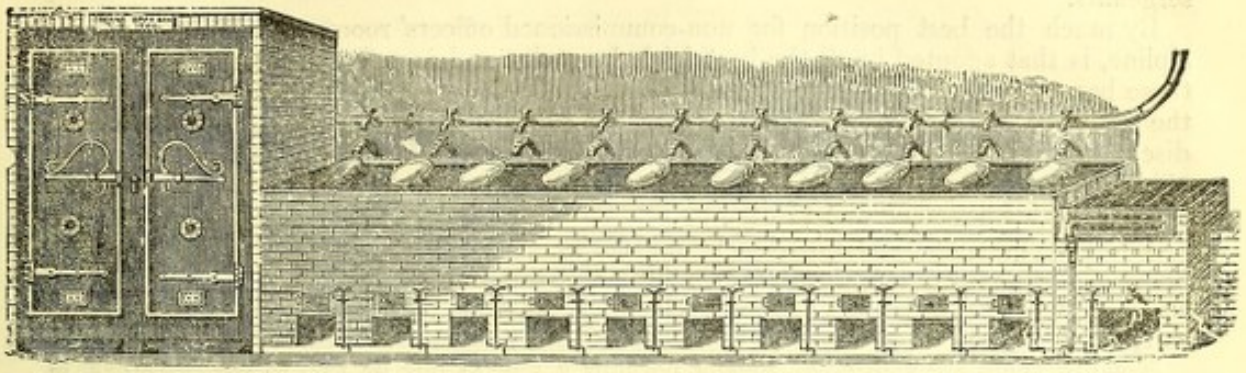
3. *Brick Ovens.*—These ovens are of the usual baker's construction, and are used for baking the men's dinners in tins. It is not necessary to describe them.

4. *Gas Cooking Apparatus.*—With regard to the use of gas for cooking in barracks, the reporters state that it possesses great facilities; that it supplies the best means of stewing which exists; that it is far from economical if used for boiling; that it is very good to roast with; but that with all its advantages it is questionable whether gas is suitable for barrack cooking.

There were two kitchens at St. George's and the Tower barracks in which gas was used for all purposes, including boiling. In these instances the consumption of gas was found to be equivalent in money value to 5 lbs. of coal per man per day.

The arrangement of this apparatus is shown in Fig 22.

Fig. 22.—Gas Cooking Boilers and Oven, St. George's and Tower.



It consists of the ordinary barrack boiler cooking range, to which has been added a gas oven at one end and a gas gridiron at the other. The meat to be roasted is surrounded by a number of gas jets. The boilers are heated with gas instead of coal.

Gas was used for roasting in two or three other barracks together with coal for boiling, and the consumption of gas and coal was found to be equivalent to from 2 to 3 lbs. per man per day.

The annexed Table D shows the results of the trials made by Messrs. Warrener and Guerrier, with all the forms of apparatus used in barracks and hospitals. It will be seen that in the consumption of fuel none of them approach, even, to Count Rumford's requirement as to economy.

The amount of fuel consumed varies remarkably in different forms of apparatus. Part of the variation is due to the amount and kind of cooking, but making every allowance for this circumstance, there can be no doubt that these results go to show how little has yet been done to perfect culinary apparatus, and that the whole subject is still open to practical inquiry. We shall afterwards show how much may be done in saving fuel in barrack cook-houses, even with the common boiler, and that there is a prospect of arriving at better results than any yet attained. It is perfectly safe to assume economy in the use of heat, to be an index of the greater or less perfection of an apparatus, if at the same time the apparatus cooks satisfactorily, and it is in this direction that we have looked for improvement in barrack kitchens. In the meantime we may sum up the defects in barrack cooking, which we found on beginning our inquiry, as follows:—

1. As a rule the want of any means of cooking, except boiling.
2. Apparatus erected so as to consume a most unnecessarily large amount of fuel.
3. Cooking by gas too costly for ordinary barrack purposes.
4. Defects in the position and construction of some cook-houses.
5. Attempts at improvement which, although most praiseworthy, do not fulfil the conditions of economy of fuel with efficiency.
6. Want of sufficient knowledge of cooking on the part of barrack cooks, and a necessity for instructing them in their art.

7. State of Accommodation for Married Non-commissioned Officers and Soldiers, Libraries, School-rooms, Workshops, and Day-rooms.

Non-commissioned Officers' Quarters.—In many barracks there are quarters for non-commissioned officers separate from the men. In most instances, however, separation is obtained in a very objectionable manner, namely, by boxing off a small apartment from the men's barrack rooms. This bunk, as it is called, is usually placed in a corner of the room, and if there happens to be a window in the corner it is cut off from the barrack room, which to that extent is deprived of light and ventilation (see Fig. 12).

If the non-commissioned officer happens to be married, his wife and children sleep in the bunk, and by adding inmates to the barrack room beyond the number on the schedule, additional overcrowding takes place. Besides this, when the men are out on duty their rooms have not the advantage of a thorough ventilation and purification by open windows, because washing or drying of clothes, or ironing, or cooking is carried on in their absence, with perhaps all the windows closed. Sometimes there is no window opening into the bunk so that it is quite dark, and has no means of ventilation except

what is common to the barrack room. In some recent barracks accommodation has been constructed for non-commissioned officers quite away from the men, as may be seen at the new barracks at Gosport. This arrangement is objectionable except for senior or staff sergeants.

By much the best position for non-commissioned officers' rooms, for purposes of discipline, is that adopted in all the best Irish barracks, and in a few in Great Britain. In these barracks there are one or more non-commissioned officers' rooms opening out of the staircase on each floor. This arrangement answers every purpose of health and discipline, and should be followed in all new barracks. It keeps the non-commissioned officer close to his men, while it separates him from them. It gives him a distinct entrance to his quarters, and ventilation separate from that of the barrack room.

These non-commissioned officers' rooms are generally good, but there are exceptions. Some of them on ground floors, under the stairs, are flagged instead of being boarded, and are too small, cold, and uncomfortable. Their usual cubic contents are from 1,400 to 1,800 or 2,000 cubic feet, and they have generally one window each.

None of them are ventilated, except perhaps a few in one or two recent barracks, in which shafts have been provided in the construction.

The fire-places generally are of an old and wasteful pattern.

In most barracks a non-commissioned officers' mess-room and separate kitchen have been provided. Sometimes the mess-room is a barrack room taken off the construction for the purpose. Sometimes accommodation has been obtained in a separate building by displacing some less necessary occupiers. In a few instances mess accommodation has been built on purpose for non-commissioned officers. The accommodation generally is sufficient and good. In a few instances it is bad. But there are examples of mess-rooms for non-commissioned officers, which have been made ornamental, and even provided with ante-rooms. This we consider a mistake ; non-commissioned officers should have a clean, airy, cheerful mess-room, with a kitchen, store-closet, and a small room for the mess cook, but anything beyond this involves an unnecessary expenditure of public money.

The mess kitchens generally are sufficient. In a few cases they might be improved, and we have met with instances in which the kitchen was merely part of the mess-room divided off by a barrier or partition.

Where gas has been introduced into barracks, these mess-rooms have generally been lighted with it, occasionally, however, at the cost of the occupants.

As a whole, there is still great deficiency of suitable quarters for non-commissioned officers. They ought to be provided for outside of the men's rooms, and the bunks should be removed. There can be no question that the mere presence of these bunks is prejudicial to the healthiness of the rooms.

Married Soldiers' Quarters.—The present regulation number of married soldiers is 6 per cent. of the strength. Every regiment of, say, 1,000 men, will have 60 women and probably 70 to 80 children with it, apart from women and children of marriages not sanctioned.

How to provide quarters for these 60 families is one of the greatest difficulties in the army at the present time. The soldier's pay will not admit of his hiring lodgings. With the aid of his wife's industry he may be able to rent a room, but it will, in all probability, be a miserable and unhealthy place, where both the man himself, his wife, and his children, are exposed to continual risk of illness.

Commanding officers appear to be always ready to mitigate this great evil to the full extent of their ability. We have met with instances, indeed, in which they have paid the rent out of their own funds. If there are any spare barrack rooms at their disposal, they manage, in most cases, to find accommodation of some kind for married people, but the space is either deducted from the amount necessary for the soldier's health, or the poor women and children have to be thrust into the worst and most unhealthy part of the barrack. A few examples of the operation of this want of accommodation will suffice.

In the Royal barracks, Dublin, we found 87 women and 109 children in barrack rooms, exclusive of the families of the men of the Guards on duty there at the time, who are generally in lodgings outside. At Birr barracks, which are very much overcrowded, there were seven rooms, with regulation space for 119 men, occupied by 21 men, 21 women, and 33 children. At Island Bridge barracks, Dublin, families of married soldiers are lodged in a long, dark, unhealthy ground-floor room, once part of the adjacent stables. At Edinburgh Castle married people are accommodated in the arched basements of one of the worst constructed barracks in the United Kingdom, and suffer from epidemic disease in consequence. Generally there are no divisions between the

families, except a coverlid, or some similar screen, hung over a cord. This arrangement may be seen in use at present at Knightsbridge barracks.

There are many barracks where even this merest apology for decency does not exist. We have seen married men's beds in the men's barrack rooms without any screen. At Chatham barracks, at the time of our inquiry, there was a married non-commissioned officer or soldier in every barrack room among the men; and not unfrequently girls from 14 to 16 years of age were thus accommodated.

It is true that there is far more regard to decency now than there was formerly in these arrangements, but still this great evil exists, although there is every prospect that an end will be put to it before very long, if Government continues the annual outlay of a specific sum for providing separate quarters for married non-commissioned officers and soldiers, of which quarters there are already, we are very glad to say, a number of excellent examples.

Having been planned by different architects, the construction of these buildings varies considerably. The best we have seen are those at Preston, intended to accommodate about 80 families. They consist of a row of two-story houses of stone, like the side of a street. Each house is completely cut off by a division wall from the adjoining houses on either side, and there is a good stone staircase and passage running through and through each house, dividing it into two halves, right and left. Each half contains four living rooms, two on the ground floor and two above. Each room accommodates a married soldier's family. There are eight families to each house, and by the arrangement of the passage and staircase there is a thorough draft of air across the house. The rooms receive fresh air from the passage by perforated zinc or wire gauze ventilators over the door, and there is an air shaft in the chimney stalk to carry off foul air. The rooms are of a good size and height, and much superior to those usually occupied by the same class of people in civil life.

Figure 23 shows the general arrangement of the rooms in these married quarters.

Fig. 23.—Married Soldiers' Quarters, Preston Barracks.

GROUND PLAN.

Behind the range there is an excellent gravelled yard for the use of the children; and the barrack laundry, where the women wash, is on the side of the yard opposite the houses. The latrines are against the boundary wall, and as they were not drained, but were over cesspits, they formed an exception to the general good arrangement of the whole structure.

The laundry room of this establishment is not so well fitted up as we have found it in other instances, but as a whole these quarters, when we examined them, were excellent and clean.

The married quarters at Anglesea barrack, Portsmouth, are on a somewhat similar principle.

The largest establishment of the kind we have seen is at Devonport; it is intended for about 100 families of non-commissioned officers and soldiers, and differs in construction from the Preston quarters. The buildings are on three sides of a square closed at the angles, the fourth side being completed by a detached block containing the laundry, cook-houses, &c.

There are no separate houses as at Preston, and access is obtained to the rooms by long central passages without sufficient light or ventilation, out of which the rooms open right and left. The buildings are two stories in height, and the upper flat is reached by a large staircase opening on the upper passage. The rooms look small and confined, and the plan is not so good an one for health as the Preston plan. We have no desire to disparage these buildings, but the Preston plan is preferable for married quarters.

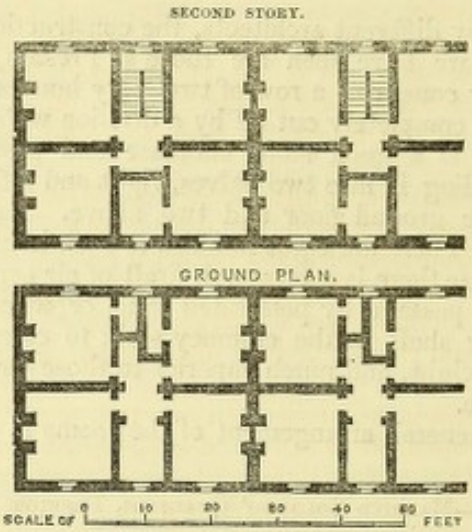
There is a set of excellent married quarters for 56 soldiers at Beggars Bush barrack, Dublin, constructed in two blocks, one of four, the other of three houses, each two stories

high, and much on the same plan as those at Preston, except that the ventilation of the upper part of the staircase in Beggars Bush quarters is interfered with on account of a small room being taken off it and added to the adjoining quarter. They are all ventilated by shafts and lighted with gas. Being within the barrack enclosure they are rather confined for space, but the cubic contents allowed for each family varies from 1,800 to 2,000 feet.

There is an excellent laundry attached to these quarters. It is supplied with fixed tubs, water, boilers, a drying room, and tables for getting up linen.

The arrangement of rooms is shown in Figure 24.

Fig. 24.—Married Soldiers' Quarters, Beggars Bush Barrack, Dublin



Quarters for 80 soldiers' families of a similar construction, but arranged in a half square, have also been erected at Richmond barracks, Dublin. They are at one corner of the barrack enclosure, and have a spacious yard enclosed between the buildings on two sides, and by the boundary wall on the other two sides.

There is a block of married quarters belonging to the Guards in Vauxhall Road, London, which is constructed on a principle differing in some respects from any of the others. It is intended for 56 families, and was built by subscription from the officers of the Guards, by Mr. Darbyshire, a London architect. It was hoped that the rent of the rooms would pay interest on the money invested, but the building has recently been purchased by Government. The building consists of four stories and a basement. Entrance to the different flights of rooms is obtained by a central passage going right through the middle of the block, and by a stone stair carried up within the back line of the building. A passage branches off from the stair right and left on each landing. The rooms open back and front from this inner passage, and at the dead ends of it are the water-closets lighted and ventilated from the outside. Ventilation is secured for all these inner passages by leaving the staircase open to the outer air from top to bottom.

The quarters are in two or three rooms, according to the rent, which varied from 3*s.* or 4*s.* a week.

Each room is ventilated from the outside; and there is a row of perforated bricks carried along the upper side of the partition wall, between the adjoining rooms in the same quarter to admit of circulation of air.

The quarters are provided with a cooking range, with oven and boiler; there is a sink, and water laid on, and a dust shoot at the end of each passage.

The building has a flat roof, which is used as a drying ground.

The back premises are narrow and confined for want of space. The laundry is in the basement, and has a drying apparatus, wringing machine, &c.

This building, although well planned, is not so simple in its structure as could be desired, but at the same time the area of land at the disposal of the architect was very restricted, and he has made excellent use of it.

Free communication with the outer light and air at all points, and simplicity of structure for the attainment of this object, are the great desiderata for health in all buildings where numbers of people are to be massed together, whether in barracks, hospitals, or family

dwellings. Of existing married soldiers' quarters, those at Preston realize these desiderata better than any others we have visited.

Besides recently erected family buildings, there is an old establishment at Woolwich differing entirely in its structure from any of the others. It consists of a long range of small brick huts or cottages situated on the west side of the common. They are each subdivided into several small rooms, and are occupied by married soldiers of the Royal Artillery. The accommodation, although very limited, is good of its kind, but not so complete in all points as that afforded by more recently constructed married quarters. A great advantage possessed by hut construction is subdivision of families among a number of separate buildings, instead of agglomerating them under one roof, and consequently better external ventilation.

Among temporary appropriations for married soldiers' families may be mentioned the accommodation in the citadel casemates at Dover and Plymouth. The former are large lofty structures, with wooden subdivisions, or bunks, arranged on two sides of a central passage. They are dark, as might be expected, but there are sufficient means of ventilation, and families are separated from each other. At Plymouth they are not separated, and in one of the casemates beds occupied by different families almost touched each other.

The worst apology for married soldiers' quarters we have ever seen are those in St. Mary's casemates at Chatham. It is to be hoped that the time is not far distant when they will be entirely vacated by women and children.

At Colchester, Shorncliffe, and Aldershot, married quarters are provided in ordinary wooden camp huts, by subdividing them into eight parts by partitions of wood. The quarters are very small and crowded, but under any circumstances they are better than barrack rooms.

We found several instances in which married quarters were being erected, or were in contemplation. Those at Sheffield have, we believe, been completed, and those at Dover are in progress. Money was voted some time ago for married quarters at Chatham, but from a difficulty about the site the money was expended in constructing some good married quarters, and an excellent laundry for Brompton barracks. These quarters are more like comfortable cottages than any of the others, but in point of healthy construction they are not equal to those at Preston.

It is understood that a site for married quarters has been selected at Chatham by his Royal Highness the Commander-in-Chief, but there is no money for the buildings at present.

Married quarters have been made at Canterbury out of the old hospital. They are very inferior in character, and the rooms in the ground floor are damp, dark and miserable, and quite unfit for human habitation.

On the whole, although so much remains to be done in providing barracks with a proper proportion of married quarters, a good beginning has been made, and we would strongly recommend that this necessary provision be extended as rapidly as possible.

Libraries and Reading-rooms.—Accommodation for these purposes has generally been obtained by misappropriating barrack rooms. The rooms are often too small, and not well lighted, but they are clean, and the books, &c., apparently well kept. They are generally lighted with gas, but very few of them are ventilated.

There is a general want of proper librarian's quarters.

Schools.—Almost every barrack has its school for children and adults. There is a considerable number of chapel schools now in use, and these afford excellent accommodation. They are built pretty much on the same model, namely, that of a large Gothic room, with an open roof, and early English windows. The style is simple, inexpensive, and suitable.

For warming there are generally stoves down the centre. The provisions for ventilation are generally deficient.

In a number of barracks school accommodation is provided by misappropriating men's rooms, or in some similar manner. These schools are far from being good and suitable, as a general rule, although there are, of course, exceptions. In all of them there is a want of ventilation, and the warming is often defective.

Workshops.—There is a general deficiency of workshops in the barracks of the United Kingdom. Almost the only shop constantly to be found is that of the armourer, and in cavalry barracks the forge and saddlers' shop. Even these most necessary work places

have not in all cases been originally intended for their object. They are often merely lean-to sheds, sometimes hardly six feet high, but the forges, although in some cases complained of as being too small, are, as a rule, better than the armourers' shops. There is often a deficiency of accommodation for tailors and shoemakers, and sometimes none at all. In many barracks it has been the custom to take men's rooms off the construction for these shops, thereby reducing the accommodation for the men, and helping to over crowd the barrack.

In most cases where there is special accommodation for tailors and shoemakers, it is of a very inferior or even of a bad description; sometimes in a dark damp basement, at other times in a small low-roofed confined attic, without sufficient protection from either sun-heat or cold coming through the roof. In all the shops we examined, the cubic space and superficial area for the workmen were very much too small.

We hardly remember a single instance in which any provision has been made for ventilation, and hence the atmosphere of these workshops has often been in the highest degree offensive, hot, and unwholesome.

Speaking generally we should say that the forges and armourers' shops were the best, next follow the saddlers and collar makers, and the worst of all are those of the shoemakers and tailors. Very many of the workshops have a make-shift look about them, and it may be safely said that, such as they are, they are far behind similar shops in civil life, and they are not such as the army should have at its disposal.

At the present time there are no workshops for affording the men occupation or recreation, such as were contemplated by the Royal Commission.

Day Rooms.—There are no day rooms in any of the barracks. The men live, eat, and sleep in the same room. As to the propriety of providing day rooms there can be no doubt, so far as health and comfort are concerned, but it is questionable how far day rooms in which the men could dine would accord with the prevailing ideas of the soldier. There can be no doubt, however, that cheerful, well lighted and warmed rooms, provided with comfortable seats, in which the men could smoke, play drafts and dominoes, procure tea and coffee, read newspapers and periodicals, and amuse themselves, would be acceptable to the men. We are glad to learn that it is in contemplation to erect some day rooms on trial. If, as is very likely, the practical objections which have been raised against these rooms, be found on trial to have no reality, the accommodation should be extended to all barracks as soon as possible.

We are not altogether without experience as to the usefulness of similar accommodation, for there are several soldiers' homes and club rooms supported wholly or partially by the men, already in operation, and, so far as we have been able to ascertain with satisfactory results.

8. State of Guard Rooms, Lock-up Rooms, and Provost Cells.

Overcrowding, foul air, and defective ventilation, which are the normal conditions of barrack rooms, are also the normal conditions of guard rooms. But we would go further than this, and state that there are certain influences arising out of guard room duties which make these conditions of even more importance as regards men in guard rooms than in barrack rooms.

A man on guard for 24 hours at a time, during all weathers, with short intervals only for repose, is in a certain state of susceptibility to foul air and damp, which the same man not on guard would not be exposed to in the same degree. If, when the man is off guard he has to sleep in the foul atmosphere of an ordinary barrack room, and if, when on guard duties, he is exposed to interrupted rest taken in an atmosphere perhaps fouler even than that which he has left in the barrack room, one can understand how guard room duties as a whole should be a cause of unhealthiness.

A barrack guard room is generally a one-story building, square or nearly square, and 10 or 12 feet in height. It has a fireplace, generally opposite the door, and one or more sloping wooden benches on which the men sleep with their clothes on during the interval between their guards, which is generally of about two hours' duration.

The rooms vary in size, but they have generally from 1,500 to 4,000 or 5,000 cubic feet of contents; and the number of men on duty in them may vary from time to time.

The following table, showing the cubic contents and accommodation of guard rooms at Chatham and Brompton, and the subsequent tables of accommodation in lock-up

rooms and cells in the same garrison, will give a good general idea of the state of this class of accommodation in barracks throughout the United Kingdom.

Guard Rooms.	Contents of Room in cubic Feet.	Regulation Number of Men.	Cubic Feet per Man.
Main Guard Room - - - - - -	5,250	30	175
Brompton Gate „ - - - - - -	4,512	16	282
Regimental „ - - - - - -	4,100	10	410
North Wing „ - - - - - -	4,752	18	264
South Wing „ - - - - - -	4,752	18	264
Barrier „ - - - - - -	4,800	22	218
St. Mary's „ - - - - - -	2,898	14	207
Barrier „ - - - - - -	1,710	12	142
Magazine „ - - - - - -	2,620	10	262

It is true that in practice the whole of these men would not be shut up in the guard rooms at the same time; one-third of them being usually on sentry. But it is also true that the regulation gives no security against dangerous overcrowding, as it recognizes so small a space per man as that shewn in the table, as being sufficient in a guard room. In cases where there is no lock-up, men under punishment are crowded together in the guard room with the men actually on guard.

We need hardly say that any of the amounts of space in the preceding table are wholly insufficient for health.

Perhaps the simplest way to calculate guard-room space would be to ascertain the maximum number of men likely to be in any guard room during night at the same time, and to allot for each man not less than 600 cubic feet.

As already stated, the present great overcrowding co-exists with absence of any means of ventilation, at least in the great majority of instances. None of the guard rooms at Chatham or Brompton were ventilated at the time of our inspection, notwithstanding the overcrowding.

In a few guard rooms there are Arnott's ventilators in the chimneys, or openings in the ceiling through to the space under the roof. But these methods are all but useless. It is no easy matter to renew the air in a crowded guard room. We have been in such guard rooms, where the atmosphere was offensive, although there was a large louvre through the roof.

We have met with no instance in which a drying-closet has been provided for drying wet clothing, when men come in from their turn of duty; but the recent introduction of guard-coats, which are transferred from the men going off guard to those going on, is a great improvement in the right direction. Formerly, men used to sleep with their wet coats on. Now this will necessarily happen in a less degree.

A want common to guard-rooms, with very few exceptions, is that of a water latrine, urinal, and means of ablution; and even where some provision for meeting these wants has been made, it is of the rudest description. For instance, we found at Brighton cavalry barrack an open privy over a cesspit at one end of the guard room, and beside it a urinal, apparently without any drainage. There was no place to wash, and the men washed themselves in an old bucket in the urinal.

In small barracks, or in instances where the latrines, urinals, and ablution houses, are sufficiently near the guard rooms, no provision of the kind would be required; but in very many instances, these absolutely necessary things are at the opposite corner, perhaps, of an extensive barrack enclosure.

Most guard rooms have verandahs, but there are numerous instances in which there is no shelter for the guard, either from sun or rain.

Lock-up Rooms.—Temporary lock-up rooms are generally attached to guard rooms. They consist usually of a small room, with a strong door opening out of the guard room, or they have a separate entrance outside. They have usually some provision for ventilation, but all the evils of overcrowding may at any time be produced in them. Usually there is some nominal limit to the numbers of men these places are to receive, and whenever the numbers at all approximate to those permitted by regulation, there is danger to health. In any case, if the number of prisoners exceeded the nominal limit,

it is probable that the extra prisoners would, nevertheless, be crowded into the lock-up Of all the parts of a barrack, the lock-up is most liable to extreme overcrowding Reverting again to the illustration afforded by Chatham, we give in the following table the regulation space per man for each lock-up in the garrison :—

Lock-up Rooms.	Contents in Cubic Feet.	Regulation Number of Inmates.	Cubic Feet allowed for each Inmate.
Old Provost Lock-up	4,200	20	210
Main Guard „	1,332	8	169
Brompton Gate „	1,332	8	169
Regimental „ No. 1	5,740	20	287
Do. „ „ 2	5,740	20	287
Brompton, North Wing	3,960	30	132
Do. South „	4,500	30	150
St. Mary's Guard „	2,620	10	262
Do. Regimental „	7,200	20	360

This table exhibits a degree of possible overcrowding almost incredible. It reminds us of the Black Hole of Calcutta. Hardly any ventilation would keep such places in a fit state for even temporary occupation. We were not at all surprised on being informed, that when these lock-up rooms happen to be crowded, the men break every pane of glass to obtain fresh air.

We have no doubt from what we have seen in other barracks, that the lock-up rooms at Chatham are by no means exceptional cases of overcrowding. They merely represent an ordinary result from want of correspondence between the requirements of a garrison and the provision made for them.

We have met with instances where there are no lock-up rooms at all, the prisoners being crowded with the soldiers on guard, into the already overcrowded guard rooms.

Provost Cells.—Generally speaking, the provost cells of a barrack form an exception, in several matters relating to health, to barrack rooms, guard rooms, and lock-up rooms.

When a soldier passes inside the prison walls he has in most cases sufficient cubic space to live in, his cell is more or less ventilated, warmed and clean. He has passed from over-crowding and foul air into isolation, larger cubic space and purer air.

Provost cells, nevertheless, differ considerably in some of these respects. The more recently constructed ones are the most roomy and the best. Many of the older cells are very defective.

The newer cells are generally constructed on the principles laid down by Sir Joshua Jebb, and are usually arranged in one or in two floors, and on one or on two sides of the corridor or passage giving access to the cells, according to the size of the barrack. The provost-sergeant's quarter is generally placed near the entrance door, but in large establishments it is usually in a separate building in the yard. Each establishment has such a yard for the purpose of punishment exercises. The cubic space per cell varies in different barracks, and according to the time during which the prisoner may be retained. Some of the older cells are unquestionably too small, but hardly any of them give so small a space per man as is given by regulation in barrack rooms. Many of them give two or three times the amount, exclusive of corridor space. The cells in Chatham garrison may be used to illustrate this point. The details of them are as follow :—

Cells at Chatham.	Cubic Contents for one Man.	Cells at Brompton.	Cubic Contents for one Man.
Old Provost	660	3 North Wing	705
Regimental	500	10 South „	312
New Provost Cells, 14 in number	1,482	—	—

The space in the ten south wing cells at Brompton (312 cubic feet per man), is dangerously small, but on the other hand, there were at the period of our inquiry, no less than 3,000 men in Chatham barracks, and St. Mary's casemates, with a smaller amount of space per man than that allowed in these 10 cells.

There were only 6 men in Chatham barracks at that time with more than 500 cubic feet each, and there were in Chatham and Brompton barracks, and St. Mary's casemates, 5,843 men with an average space of 323 cubic feet per man. These figures may be useful for comparison with the amount of room allowed to the soldier when in prison. Improvement in military prisons has indeed gone a long way ahead of improvement in barrack rooms in this respect. The most efficient means of ventilation adopted in the smaller establishments is by openings in the cell window and in the passage window. In the larger establishments ventilation is effected by extracting air from the bottom of the cell, and admitting fresh air at the top on Sir Joshua Jebb's principles. In some cases where ventilation of the cells had been provided on this plan, the extracting shaft essential to the operation of the system we found was never used, so that the cells were unventilated.

Warming is generally done by stoves. We have met with several instances in the smaller provost buildings where the ventilation was deficient.

In undrained barracks the cells are exposed to the evils arising from this defect, in common with the rest of the barracks. In these cases there are only open privies over cesspits for the use of the prisoners, and these cesspits are generally in the yard where the men exercise, and are sometimes only covered by loose boards. Of course there is no remedy for this until the barracks themselves are properly drained.

Before concluding this section of our Report, we are desirous of stating briefly our impressions as to the general bearings of the whole question of guard rooms, lock ups, and provosts establishments on the health of the soldier, with special reference to the question of minor punishments. While readily admitting that generally provosts establishments ought to be more healthy than barracks, no one, we think, can follow out such an inquiry as that in which we have been engaged without being struck with the generally defective sanitary conditions under which these minor punishments are inflicted. Taken as a whole, those parts of the barrack establishment set apart for the punishment of offenders are by no means so healthy as the majority of civil or military prisons. In an ordinary well-constructed prison the prisoner is in most instances simply deprived of his liberty. The inmates of those prisons are generally more healthy than the same classes elsewhere. Can as much be said in regard to soldiers undergoing minor punishments in barracks? We believe it cannot, but that, on the contrary, such punishments rather tend to lower the soldiers' health.

We have shown the extent of over-crowding and defective ventilation in guard rooms and lock-up places, and we think it very questionable whether, notwithstanding the dimensions of provost cells, the soldier confined in them has really an amount of space and of fresh air at all equivalent to that afforded to prisoners in civil prisons by the large corridors which form so essential a part of these establishments, and by the constant care bestowed on the arrangements for ventilating and warming the cells, which latter points appear to be habitually neglected in the provost cells.

In hardly a single instance have we found that freshness and movement in the air of provost cells which is necessary to health, and from the limited extent of the establishments themselves, it has appeared to us that the means of air and exercise provided for the men have not been sufficient. Many of the cells are gloomy or nearly dark, and the influence of these conditions cannot be otherwise than depressing on the health of the inmates. It appears to us that, as a whole, these establishments might be improved without diminishing their efficiency as places for reformatory discipline. Disease would be prevented by such improvements, without diminishing the moral effect of the punishment.

9. State of Canteens.

Nearly every barrack has a separate canteen building, but there are instances where there are no canteens. These, however, are very few in number.

The usual construction of a canteen is like a barrack house, sometimes one, sometimes two or more stories high. The accommodation consists generally of a bar more or less convenient in form and dimensions; store rooms often deficient in kind and extent; a non-commissioned officers' room, and a tap room for the men, generally fitted up with tables, forms, and sometimes boxes. The tap room is always provided with a fire-place, the non-commissioned officers' room sometimes has none. This deficiency has usually arisen from the circumstance that the non-commissioned officers' room has been the result of an after-thought, and has perhaps been boxed off from some other room. Besides this accommodation there are in almost all, but not in all cases, rooms for the canteen man.

With one or two exceptions we have found all the tap rooms and non-commissioned officers' rooms without any means of ventilation.

Canteens vary much in character and accommodation. Some are small, confined, and wretched, many of them having merely flagged floors. A better class resemble the ordinary public-houses or shops in the neighbourhood frequented by working people.

A few canteens are really good, built and furnished in a liberal way, and affording every required convenience. Among the best canteens we have seen attached to permanent barracks, we would instance those at Raglan barrack, Devonport, and the new barrack at Sheffield, both of which are complete and good. Perhaps the best we have met with, except that the buildings are of wood, are the canteens at Colchester camp and at Brompton, built, as we were informed, by a private individual under inspection. These are good establishments, with light airy cheerful rooms, and verandahs running along the front for shelter in wet weather.

They are, however, exceptional cases, in comparison with which the general run of canteens afford a not very gratifying contrast.

At present the canteen tap-room is the only place to which the soldier can retire for social intercourse from his close and overcrowded barrack room or hut. Like other men, he likes to be free of restraint at times, and to be able to talk and smoke with his comrades, and to enjoy himself. The library and reading room is a most excellent institution, but men in the soldiers' position do not always relish reading, and unless other means of amusement are provided for them, they will seek it in places where, in nine cases out of ten, they will suffer both in health and morals.

Up to the present time the only provision of this kind has been the canteen tap room, but it by no means follows that a better cannot be obtained.

Several instances have come to our knowledge of the usefulness of soldiers' clubs, where the men can meet without being tempted to drink. It has also been stated to us that since proper mess rooms have been provided for non-commissioned officers, they have frequented the canteen tap-rooms very seldom. In none of our inspections have we seen a non-commissioned officer in his tap-room at the canteen, while we have seen many soldiers in theirs, and in many cases the non-commissioned officers' rooms have been appropriated by the canteen man for his own use.

Rather than spend money in improving the canteens, we should greatly prefer that day-rooms should be provided for the men, where they might obtain tea, coffee, tobacco, &c., and a few innocent games.

But if this cannot be done the canteen tap-room should be made a far more comfortable place than it is at present.

Summary of Sanitary Defects in Barracks.

Having completed our general account of the defects we have found in barracks, likely to operate injuriously on the health of the soldier, we bring them together in the following general summary for the sake of greater clearness.

1. *Defects in Site.*—Barracks occupying sites exposed to marsh malaria, or enclosed more or less among the dwellings of the civil population, whereby their inmates are exposed to the influence of impure air arising from neglect of cleanliness, nuisances, defective drainage, and obstructed external ventilation incident to the vicinity.

2. *Defects in Plan.*—Generally a want of uniformity of plan and an imperfect and irregular recognition of the necessity of arranging the buildings so as to secure free external ventilation and sunlight to as large an extent as possible over the whole external surface of the barracks; consequent want of simplicity of plan. Barracks erected either close to the enclosure walls or so near the walls as to leave a space between the barrack and the wall too narrow for cleanliness and health. Barracks built round closed squares or courts, or in partial squares with deep closed angles.

3. *Defects in Construction.*—Agglomerating too large a number of men under one roof, and piling too many floors of building one over the other. Back to back barrack rooms with windows only on one side, an arrangement by which the ventilation of the rooms is impeded. The use of corridors for access, covering one face of the building, leading to a similar obstruction to the room ventilation. The use of internal corridors, dark and without sufficient ventilation, in cavalry barracks, with the rooms opening right and left out of these corridors, an arrangement by which the rooms have windows on one side only, while the ventilation of all the rooms communicates by means of the corridors. Constructing cavalry barrack rooms over stables, whereby the air in them is rendered foul and offensive. Deficiency of light in such cavalry barracks, and in a

number of infantry barracks, from defective position of windows or deficient window space. Doors placed close to the fire-place, by which the rooms are deprived of the influence of the doors in ventilating them, and the fire-sides are rendered uncomfortable to the men. Obstructing the light and ventilation of rooms by placing sergeants bunks in them, from deficiency of accommodation for non-commissioned officers. Obstructing the light and ventilation of barrack rooms by boxing off staircases from the rooms, proper staircases not having been provided in the construction. Ceilings too low in proportion to the superficial area of the floor. Basements constructed for and occupied as barrack rooms. Barrack rooms constructed with dark and unventilated corners. Buildings converted into barracks, although not originally intended for barracks, and not adapted for such purposes from their position or construction, or both.

4. *Deficient Cubic Space in Barrack rooms.*—No systematic recognition of the relation of cubic space to ventilation, warming, and health. Hence great diversity of practice in the amount per man allotted in different barracks; in nearly all barrack rooms the cubic space allowed being much too small for health, and in many rooms the overcrowding being excessive.

Misappropriation of barrack rooms leading to the cubic space being reduced below that fixed by regulation. Placing a larger number of men in barracks than the regulation number, so as to lead to additional overcrowding in rooms already overcrowded.

5. *Deficient Ventilation.*—A total want of any proper systematic method of ventilation. No means of ventilation whatever in the majority of barracks, except from the occasional opening of doors and windows and by the fire-places. Means for renewing the air in the other barracks, with the sole exception of those provided in a few rooms in three barracks, totally inadequate for purposes of health, being either erroneous in principle, or inefficient in operation. Want of ventilation in barrack stairs and passages. Want of ventilation in non-commissioned officers' rooms, libraries, reading rooms and school rooms. Ventilation of stables under men's rooms, not sufficient to preserve the air in the rooms above from stable effluvia. Want of ventilation of guard rooms. Deficient ventilation of lock-up rooms and prison cells. Want of ventilation in canteen tap-rooms and non-commissioned officers' rooms, and in many cook-houses, wash-houses, ablution rooms, &c. General want of ventilation in workshops.

6. *Defects in Warming.*—Barrack room grates constructed on a pattern not admitting of economy of fuel, generally so placed as to permit most of the heat to pass up the chimney and their heating power insufficient for the combined purposes of warming and ventilation.

7. *Defects in Water Supply.*—An almost universal adoption of shallow wells dug in the substrata of the barrack yards, often at no great distance from stables, privies, cesspits, ash-pits, and dung-heaps, whereby in porous soils the water is liable to contract impurity. The use of underground tanks for storeage, by which the water is also liable to impurity, besides the supply for barrack purposes being intermittent and dependent on periodical hand labour.

8. *Defects in Drainage.*—Surface drainage close to barrack rooms, especially in cavalry barracks, rendered difficult from want of a smooth surface arising from the use of boulder stone pavement. Guttering often bad from the same circumstance. Surface drains sometimes offensive from defects in them, and from open gully grates too close to the barracks. Surface drainage deficient in many parade and exercising grounds. Absence of latrine drainage in the great majority of barracks, and the use of open privies and cesspits, in consequence of this want. The present system tending to the saturation of the ground with filth, endangering the purity of the wells, and polluting the atmosphere within the barrack enclosure, and often in the immediate vicinity of barrack rooms. Defective construction of urinals. Defective drainage in many wash-houses.

9. *Defects of Cleansing.*—The use of dung-pits and ash-pits in barracks where, on account of want of space, they must of necessity pollute the air. Defective construction and want of drainage of both classes of receptacles, whereby they accumulate water and filth, sometimes to a depth of several feet. Surface cleansing of cavalry barracks near the stables, and the surface cleansing of the stables themselves, often deficient on account of the nature and condition of the paving. Lime-washing of the interior of barracks performed at intervals of time too great for maintaining the healthiness of the rooms.

10. *Defects in Cook-houses.*—With a very few exceptions, the absence of any means of cooking in barrack cook-houses except boiling. Want of economy in fuel in using the existing boilers. In a few barracks cook-houses placed under barrack rooms, thereby

occupying space required for accommodating men, and rendering the rooms above unhealthy from heat and smell. Want of proper cook-houses in one or two instances.

11. *Defects in Ablution-rooms.*—In many instances want of certain conveniences, such as gratings, to stand on while washing, pegs for clothes, forms, and beads for the margin of the ablution tables, to prevent the water dashing over on the men. Defective position of some ablution rooms, either too far from the men's rooms, or so placed as to diffuse damp through some rooms. General want of means of bathing.

12. *Defects in Wash-houses.*—Want of proper tubs for washing. No means of drying or getting-up linen, leading, as consequences, to risk to the men's health from damp linen. Very few proper laundries yet established.

13. *Defects in Quarters for Married Non-commissioned Officers and Soldiers.*—General deficiency of this class of accommodation except in a few recent instances. Barrack rooms often misappropriated for the purpose, so as to reduce the men's accommodation. Serjeants' bunks placed in barrack rooms, or married people sleeping in rooms with the men, on account of deficiency of proper married quarters.

14. *Defects in Libraries, Reading-rooms, and School-rooms.*—Misappropriation of barrack rooms for such purposes. Deficient ventilation and warming of rooms. Quarters for librarians and teachers deficient and often very defective.

15. *Defects in Workshops.*—General deficiency in this class of accommodation, and frequent misappropriation of men's rooms for the purpose. Workshops destitute of ventilation. Some of them in basements and attics quite unfit for human occupation.

16. *Defects in Guard-rooms, &c.*—Overcrowding and defective ventilation of guard-rooms, lock-up rooms, and many provost establishments. Frequent want of shelter for mustering guards in wet weather. Want of proper latrines, urinals, and ablution accommodation for many guard rooms.

17. *Defects in Canteens.*—Storeage and other accommodation often deficient. Some rooms without fireplaces. No ventilation in non-commissioned officers' rooms and tap-rooms.

18. *General Deficiencies.*—No day rooms for the men. Want of drill sheds except in a few barracks. Frequent deficiency of store rooms leading to misappropriation of men's rooms. Frequent deficiency of cleaning sheds. Occasional deficiency of non-commissioned officers mess rooms, and kitchens, leading to misappropriation to supply them.

SECTION II.

SANITARY IMPROVEMENTS RECOMMENDED FOR BARRACKS.

We next proceed to state what works and measures of a sanitary kind we have found it necessary to recommend for the purpose of remedying the defects described in the preceding section.

1.—Improvements with reference to Site and Construction.

Disadvantages arising to barracks from errors in their position and internal arrangements are of a permanent character and cannot be removed entirely. In several instances, however, they have admitted of palliation; but in cases where no temporary measures appeared capable of rendering buildings or parts of buildings suitable for occupation, we have advised their being abandoned as barracks.

There have, however, been very few instances in which we have adopted the latter alternative. Fort Elizabeth at Cork is one of these. Originally intended as a prison, for which purpose it never was good enough, it was put on the construction as a barrack, for which it is eminently unfit. There can be no doubt that it ought to be abandoned. Linen Hall barrack, Dublin, is another such instance. It never was intended for human habitation, and should be struck off the list of barracks at once.

Such buildings as the Castle and Shamble barracks at Galway, Portman barrack, and Knightsbridge cavalry barrack London, Coventry barrack, and Clarence barrack Portsmouth, should be given up as soon as practicable. They are better than those we have named, but are certainly not good enough for permanent occupation. We have recommended improvements for them; but this does not alter our conviction of their essential unfitness for healthy occupation by a number of men. Stirling Castle Palace affords an example of very bad barrack accommodation, with two ranges of beds, one over the other,

made out of rooms never intended for barrack purposes. The only course we could take in this case was to advise the evacuation of these rooms.

In two or three instances we have found basement rooms occupied by men. This is done to a greater extent at Woolwich than in any other barrack. There are, in this instance, 22 basement rooms containing 264 men, with from 293 to 298 cubic feet each in them, and not one of these rooms is fit to be occupied. They are nothing but what are called cellar kitchens, in which no persons of ordinary intelligence would put their servants to sleep. There are similar basement rooms in Waterford artillery barrack, and at the Artillery barrack, Limerick; but the worst example of them we have met with are the sunk rooms in the new barrack at Edinburgh Castle, some of which are so dark that the men can hardly see to dress in them, and the stairs and passages leading to these rooms have to be kept constantly lighted to prevent accidents.

In this class of examples, we have advised the adoption of such improvements in ventilation, diminution of overcrowding, &c., as appeared likely to diminish the evil; but there is, in reality, no effectual remedy except evacuating permanently all such parts of barracks as soon as possible.

The prohibition of cellars for human habitation has been already introduced as a principle into sanitary legislation, and it has been carried out in the compulsory disuse of a certain class of cellar dwellings in towns. The same principle requires to be adopted in the army, and henceforth no troops should be permanently barracked except above the level of the ground.

There is another class of cases, chiefly in cavalry and artillery barracks, where rooms over the stables have been made originally much too low for health. In some such cases, the side walls of the rooms are only a foot or two in height, and the men's sleeping accommodation has been obtained by appropriating the angular space under the roof. Such rooms are generally dark, close, liable to considerable variations in temperature, very cold in winter and hot in summer, besides having an appearance of great discomfort.

When we began our inspection, there were rooms of this kind at Woolwich, Island Bridge old barrack, the attics in Exeter, Brighton, and York cavalry barracks, and at the Royal (cavalry) barrack, Dublin, &c. The rooms at Woolwich were on the eve of being raised, and similar improvements had been contemplated in the other barracks. The result at Woolwich has been as great an improvement in the light, ventilation, and comfort of the rooms as the structure of the barrack admits of. We have recommended all similar rooms to be improved in the same way. More space, light, and air will be obtained by these alterations, but we would strongly advise that at least one good cavalry barrack be erected with separate stables. All the objections we have heard raised against this form of construction can be easily met by a few simple provisions in the plan, and we feel confident that the experience of one such barrack would lead to abandonment of the present system of placing men and horses under the same roof.

We have inspected two barracks, namely, those at Fort Augustus and Berwick-on-Tweed, which, although situated on healthy ground, are in such a state of disrepair as to render them unfit for occupation. In these instances we have recommended their being either struck off the list of barracks or being made tenantable.

In certain minor details of structure, such as deficient light, wrong position of the barrack room doors, &c., it has been necessary to advise the opening of fresh windows and an alteration of the position of the doorway. These improvements specially refer to barrack rooms over stables, in which it has been the custom, as already mentioned, to place the door and window close to the fire-place at one end of the room, leaving the other end in darkness and without the chance of ventilation.

When there have been back-to-back rooms, with openings into each other through the partition walls, we have been under the necessity of having the openings closed, because such openings do little else than admit the foul air of one room to pass into the other, and they are, moreover, objectionable on account of the noise of other rooms disturbing the men.

2.—Diminution of Overcrowding in Barrack Rooms.

Although our instructions require us to allot 600 cubic feet per man in all barrack rooms, and to have the numbers per room on this estimate painted on the doors, we very soon found that it would be impracticable to carry out this part of our instructions. Barracks, as we have already shown, have hitherto been occupied and their accommodation disposed of for other reasons than those relating to the health of the inmates, and hence the construction remaining the same, the numbers of men have varied from time

to time, so that at one period of the occupation every available corner has been crowded to excess, and at another period the barrack has been only partially occupied.

We have, however, generally found that barracks have been either full or empty. In a few examples only have there been vacant rooms. In some cases, chiefly from increase of regimental strength, barracks have been crowded beyond the numbers on the schedule. Misappropriation of rooms for purposes already mentioned have led to a similar result.

The facts all go to prove that although there are regulations as to cubic space, in conformity with which the numbers are now painted on the doors, yet in practice these regulations have been considered so flexible that any amount of liberty could be taken with them.

The evil then with which we have to deal is deeper than the present regulation, and unless that evil be grappled with it is of no use substituting another number on the barrack room door for the existing one, for in reality such a substitution would be the sole result of a literal obedience to the Secretary of State's instruction.

No doubt this unsatisfactory state of regulation as to cubic space has arisen from the circumstance that those persons entrusted with giving effect to the regulation have not appreciated the influence of overcrowding on the soldier's health. They have not been aware that if above a certain number of men are placed in a given cubic space the lives of some of these men, and the health of others, are certain to be sacrificed. They have not considered that to this overcrowding and its concomitant want of ventilation a large part of the excessive army mortality is due.

Before the soldier can be assured of having the amount of space required for health there must be a distinct recognition on the part of the War Office and Horse Guards that the amount given by regulation is on no account to be tampered with. No increase of regimental strength, no want of store rooms, libraries, or reading rooms, should for an instant be permitted to interfere with it. It would never be pleaded, as a reason for reducing the soldier's ration of bread and meat, that a larger number of men had joined the regiment than the commissariat could provide for. Why should the soldier's air ration, which is equally important to his health and efficiency, be differently dealt with? If there is not food enough, more can be had for money. If there is not space enough, money will supply space. It is a question of money, but also of time. Where additional barrack accommodation is permanently required it will have to be built. Where temporary provision only is wanted, it should be supplied by tents or temporary huts. In any case overcrowding should be utterly put an end to.

Partly with the view of exhibiting the amount of deficiency, and partly with the view of giving some effect to our instructions, we have in each interim report shown the number of men the barrack would contain, and the number for which, on the present construction of the barrack, additional space would be required. The results are shown in Table B., of which the following Table is a summary:—

Number of barracks.	Number of Barrack Rooms.	Present Regulation Number of Men.	Number of Men at 600 cubic Feet per Man.	Deficiency of Accommodation in Men.
162	5,339	75,801	53,806	21,995

The numbers given in this Table as the accommodation at 600 cubic feet per man are rather greater than they ought to be if the figure were rigidly adhered to. This has arisen from the fact that very few barrack rooms admit of division into spaces of 600 cubic feet without a remainder. Where the remainder has been such as to raise the question whether a man should be taken out of the room or left in it, we have decided the point with reference to the position and construction of the barrack. In open exposed situations, with a free external circulation of air, and when the barrack happened not to be complicated in structure, we have recommended that the man be left in the room, giving a little under 600 cubic feet per man. But in badly-constructed barracks, in close positions, we have as a rule recommended the man to be removed out of the room, so as to give in these instances somewhat more than 600 cubic feet.

Early in our inquiry another Commission, appointed at the same time, was occupied with revising the regulations of the Army Medical Department in conformity with the recommendations of the Army Sanitary Commission. The question of framing a regulation as to cubic space in barracks was considered by that Commission, and the new code recently issued applies a partial remedy to the evil of overcrowding, by giving to the Secretary of State a direct check on the appropriation of barrack rooms.

The regulation prescribes that in all barrack rooms 600 cubic feet per man shall be given, and that the number of men in conformity with this measurement shall be painted

on the door, and that no departure from the number is to be permitted without the sanction of the Secretary of State. It is prescribed in a note that 600 cubic feet per man is to be given in all new or extended barracks, and that in partially occupied barracks the men are to be spread, to give as nearly as may be the regulation amount.

Distributing the men through partially occupied barracks was also made the subject of a War Department circular about two years ago, but there were difficulties in its practical application on account of additional fuel not having been at the same time authorized.

The new regulation appears to us to meet the difficulty only for a temporary purpose, which is in reality all that it could do. But it does not provide that after a barrack is built for, say 1,000 men with 600 cubic feet per man, 1,500 men with 400 cubic feet may not be crowded into it.

The only way to meet the evil effectually is to settle how many men are required at a particular station, and to provide proper room for them. Having done so, on no account to permit more men to enter the barracks than the regulation number, and to provide at the camps all the additional temporary accommodation necessary to meet the emergencies of troops returning from abroad, or otherwise. Happily in this country it is not necessary to concentrate masses of troops within a small compass. Occasionally the necessity may arise, but until it arises the regulation as to cubic space should be rigidly adhered to. It can only be infringed at the expense of health and life, either or both of which are far more valuable commodities to the country than are additional barrack rooms.

3.—Improvements in the Ventilation and Warming of Barrack Rooms.

In a preceding section we have discussed the question of the external ventilation of barracks. We have shown how necessary it is in all barrack plans to provide for a free movement of the outer air, by studying simplicity of structure, avoiding all deep closed angles, and so disposing the different blocks of building that no stagnation of air can take place among them. *Stagnant air is foul air*, and if the outer air is stagnant it is impossible to ventilate the interior of barracks except with foul air.

Again, if there are open privies, ashpits, or dung-heaps near barrack walls, especially in courts more or less closed, or if the subsoil be undrained, the surface badly paved, and not properly cleansed or guttered, or if there are untrapped gulley grates communicating with badly constructed sewers loaded with filth, a state of the outer atmosphere is engendered which would make it a questionable substitute for the foul air inside.

A prior question, then, in regard to the ventilation of buildings, is the condition of the external atmosphere. If there be free moving, pure, dry air without, it is possible to ventilate a building effectually within. If these favourable conditions of the outer atmosphere do not exist, we may certainly obtain a circulation of air through a building, but we shall not be able to ventilate the building in the sense of supplying fresh air to its inmates. It is obvious, therefore, that proper construction, drainage, cleansing, and absence of nuisance, are in reality integral parts of ventilation, and hence the question of ventilating a barrack or hospital must be considered with reference to these other points and in connexion with them. Such considerations are especially necessary in discussing new plans for barracks or hospitals. In both classes of structures the great object is to have the rooms and wards in a healthy condition, and this object can only be secured by keeping clearly in view all those contingencies on which the purity of the air in the rooms depends.

It is much more easy to ventilate a building in theory than in practice, a circumstance which may account for the large number of plans and methods of ventilation which have been for many years past before the public. Under certain fixed conditions, most of these plans are more or less efficient, but, unfortunately, the conditions to which ventilation has to be applied are not fixed, but variable; except, perhaps, in the case of prison cells, in which the results of systematic ventilation, although not so satisfactory as regards health as might be wished, have, nevertheless, been on the whole the best hitherto attained by mechanical means.

At the beginning of our work, a number of plans for ventilating buildings were laid before us. Some of these were simple and required no mechanism, others consisted of complicated mechanical contrivances, combining warming of the air with ventilation. We examined a number of these methods in actual operation in the large Parisian hospitals, and also in London, and not until we had very carefully considered the peculiarities of the problem with which we had to deal, did we arrive at the conclusion, that none of them would satisfy the conditions of barrack ventilation.

The plans submitted to us were as follow:—

1. Methods of propelling air into barrack rooms by fan wheels and screws driven by steam, or by other mechanical means.

2. Methods for extracting air from barrack rooms by the draft of a heated flue, or by mechanical contrivances.

3. Methods of removing the air by shafts or openings, variously planned and arranged.

All or nearly all of the plans in the first and second classes provide for warming the air admitted, and dispense with the open fire-place.

Those under the third head professed to be applicable to rooms with fire-places.

It is necessary that we should state briefly, in the first place, the nature of these several plans, with our reasons for declining to adopt any of them for barrack rooms.

Ventilation by Propulsion. — There are two methods in use for propelling air for ventilation. The first is the ordinary fan blower; the second is an archimedian screw. There is yet a third method, the least costly of all, invented by Dr. Arnott, which consists of an air pump capable of being set in motion by a very small expenditure of force, worked by a small water engine with a head pressure, and which has been introduced into York Infirmary.

All of these methods are based on one common principle, namely, that the air is to be moved from a central position, from which it has to be conveyed in air trunks, subdivided into branches, and finally admitted into the rooms at such points as may be determined on.

All the methods provide for the egress of foul air from rooms so ventilated, by means of foul air shafts.

The two most favourable examples of the method of ventilation by propulsion which have been brought under our notice are those of Thomas and Laurent at the Hospital Lariboissière at Paris, and the plan of Dr. Van Heecke in the Hospitals Beaujon and Neckar at Paris. These plans may be briefly described as follows:—That of Thomas and Laurent consists of two 15-horse power high-pressure engines, with fan blowers attached, which may be used alternately in case of accident to one. The air from the blower is conducted along the arched basement of the hospital, in which the machinery is placed, by means of a large plate-iron pipe, from which branches are given off to the different buildings, and these branches are again subdivided to convey air to the wards. As the air flues have to pass under the floors, sufficient space is left between the floor and the ceiling of the room below for an air trunk 14 inches deep. The fresh air is admitted to the wards through pedestals in the middle of the floors, and the foul air escapes by openings close to the floor, one between every two beds, which openings communicate with flues in the walls, carried up to the roof of the building. It will be obvious, at a glance, that a plan such as this would be quite inapplicable to barracks of all sizes and construction, with accommodation from under 100 men to 1,000 and upwards. In most cases it would be practically impossible to put in the flues; and to erect steam engines for every barrack, of whatever size, would be a great and altogether unnecessary expense. Besides, the loss of force in driving air by means of a fan wheel through a series of narrow and frequently bent tubes would in itself involve a serious outlay, without any corresponding advantage.

Dr. Van Heecke's plan has the merit of greater economy. There is less loss of force in propelling air by the archimedian screw than by the fan blower, and by an ingenious provision the pitch of the screw used by Dr. Van Heecke is made to adapt itself to the velocity of the engine, an arrangement by which the air current is maintained at one uniform strength. In other respects the principle of conducting the air to the wards is the same as in the preceding method, except that Dr. Van Heecke professes to apply his system to existing buildings without derangement of structure. This is effected at the Hospital Beaujon by conveying the air propelled by a small steam engine in the basement directly up through the centre of the wards, by a tube passing through the floors of each superimposed storey.

Dr. Arnott's air pump consists of a light metallic gasometer, working in a water case, and so delicately balanced that a very small force indeed is sufficient to keep it in constant vibration. With large air flues this method would be more economical than any of the others. It has been proposed to us to obtain similar results for each separate barrack room, or for all the rooms on a floor, by small ventilating machines, the mechanism of which it was intended should be worked by a weight, like a kitchen jack. It appeared, however, that this plan had never been in operation, so that we had no opportunity of examining into its merits.

In regard to all these plans of machine ventilation, we have but one or two observations to make; their introduction into buildings such as barracks would be attended with great cost, while it is not always the case that barracks would bear, without injury, the introduction of the necessary flues. Moreover, from the construction of the buildings, it would be impossible to apply any of these plans on one uniform principle. Besides this objection, all of these plans rest on the assumption that air is to be introduced at or near the level of the floor, which, if the air be cold, is the worst of all forms of ventilation, on account of its chilling the room at the very place where it should be kept warm, namely, round the men's feet, or if, to obviate the objection, the air is warmed before being propelled into the room, then the additional cost of warming apparatus for each barrack would have to be incurred, and as a necessary consequence the open fire-place, which is just as essential a part of the barrack room as its door or windows, would have to be blocked up.

Indeed, in all these systems of artificial ventilation, the open grate, with its cheerful fire, must disappear, otherwise the system adopted ceases to be what it professes. In none of the applications of artificial ventilation which we have seen here or abroad, is there any open fire-place. The two are incompatible. It is true that air might be driven into a room with a blazing fire in the grate, but then the advantages of the artificial method are lost, and the room can be ventilated much better without it.

Ventilation by Extraction is in use at the great military hospital at Vincennes, on one side of the Hospital Lariboissière, in the Derby and other lunatic asylums, and in the new part of Guy's Hospital, London. It is also in use in most prisons in this country. The moving power in all these cases is heat, either from a fire or from hot-water vessels at the base of a shaft of greater or less elevation. The air flues required are very much on the same principle as those for ventilation by propulsion, the only difference being that the heat, which is the moving power, is placed at the mouth of the outlet shafts, in place of at the opening of the inlet shafts.

The essence of the system of propulsion is *repletion of the room with air*, which is left to escape as it best may by the outlet shafts. The essence of the system of extraction is *exhaustion of the air in the room*, the place of the exhausted air being supplied by other air rushing in through the inlets, or otherwise.

The conditions required for an efficient operation of the system of extraction are much the same as for the method of propulsion. There is a similar arrangement of inlet and outlet flues, the same difficulty in adapting the system to barracks of all sizes and constructions on one uniform plan, and the same incompatibility of the open fire-place with the extracting method; indeed the open fire-place is, if possible, less adapted for rooms ventilated by extraction than for rooms ventilated by propulsion. The chimney with its fire is in itself a powerful extracting shaft, but if the extracting shaft acted as it ought, with a predominating power, it would draw the smoke down all the chimneys. If, on the other hand, the chimney draught were the strongest, air would be drawn down the extraction shaft.

Besides these objections there are others equally strong, arising out of the management of any such apparatus; each barrack would require its propelling power to be provided in duplicate. Each barrack would require an educated engineer and fireman; and were the apparatus ever so perfect, any tampering with the valves or registers would interfere injuriously with, or put an entire stop to, the ventilation of the barrack.

In one hospital we examined, which was ventilated by one of the most perfect apparatus we have anywhere seen, and which professed to supply between 4,000 and 5,000 cubic feet of air per bed per hour, we found the atmosphere of the wards stagnant and foul to a degree we have hardly ever met with elsewhere. We at once pointed out this circumstance. An inquiry was immediately instituted, when it appeared that one of the valves of the supply pipe had been tampered with, for no other reason, that we could perceive, except to save fuel by diminishing the quantity of warm air supplied to the sick. The ventilation in this case was worse than a delusion.

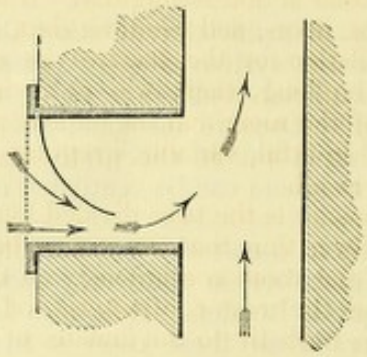
In prison cells which we have examined, where the system of extraction was stated to be in use, we have not found the air by any means so fresh as it ought to have been, and in some instances in which the ventilation was dependent on a fire or upon gas lights, both moving powers had fallen into disuse, so that the cells or rooms were virtually unventilated. But even if it were admitted, that renewing the air by mechanical contrivances could be efficiently done in apartments otherwise closed, which is an essential condition to success, it should not be forgotten that barrack rooms are not closed

apartments; that doors and windows are liable to be opened; and that above all there is the open fire-place, which it is essential to preserve.

For the reasons given above, and without meaning to throw any discredit on any of the systems of combined warming and ventilation, considered as systems, which have come under our notice, we have arrived at the conclusion that they are all inapplicable to the barracks of the United Kingdom.

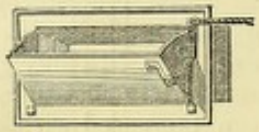
Ventilation by Shafts or Openings.—We shall next say a few words as to the third class of ventilating arrangements, namely, the various modifications of house and room ventilators, which have been brought under our notice. Five of these ventilators we have seen in operation, and they all have special advantages in certain cases.

Fig. 25.—Dr. Arnott's Chimney Valve.



(*a.*) *Dr. Arnott's Chimney Valve* (Fig. 25) has merits of a certain kind which have led to its extensive introduction into barracks, hospitals, private houses, &c. It consists of an oblong metal frame inserted into the room chimney near the ceiling. Its object is to take advantage of the upward draught of the chimney in drawing the upper strata of the air of the room through the frame into the flue, while to prevent down-draughts of smoke into the room, a light silk flap valve, supported behind a perforated metal plate, is placed in the opening of the box into the room. This valve, like every other, requires certain conditions for its action. If the throat of the chimney be very wide the quantity of air and smoke which pass up the shaft from below will be more than the chimney at its narrowest part, where the ventilator is placed, can accommodate, and smoke will consequently pass through the valve into the room. Wherever, therefore, Arnott's valve is to be used, the throat of the chimney must be contracted to such an extent as to leave a balance in the draught to be supplied by air passing through the valve. As, however, the amount of this balance, in other words, the number of cubic feet of air which can pass through the valve into the chimney per hour is very limited, this form of ventilator is not adapted for a barrack room, or for any room with several people in it. It is, however, a very economical and simple ventilator for non-commissioned officers' rooms, for which purpose we have almost uniformly recommended its adoption. As at present constructed it has one minor disadvantage admitting of remedy. The silk flap is apt to make a noise in falling, a defect which may be obviated by a valve of thin cork or some similar material. Dr. Arnott's valve, it will be seen, is simply an outlet for foul air.

Fig. 26.—Sherringham's Ventilator.



(*b.*) *Sherringham's Ventilator.*—This consists of an iron air brick or box inserted close to the ceiling of the room, and affording a direct communication with the external air. In order to prevent the air from coming in by stray currents there is placed at the mouth of the opening within the room a valve, hinged at its lower side and opening towards the ceiling; the result of which arrangement is, that the inflowing current required to supply the chimney draught is thrown up towards the ceiling, and diffused to a greater or less extent in the general mass of air within the room.

This ventilator may, under certain conditions, act as an outlet, but when the room is shut up it would, especially with a fire in the grate, act as an inlet for fresh air.

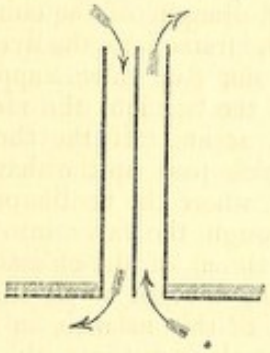
Considered as an inlet, its principle and position are both good, but acting by itself it is not a sufficient ventilator for rooms in which a number of men are together.

Ventilators similar in principle have been introduced into the upper panes of window frames, but upon the whole Sherringham's is the most convenient form, and we have used it in a number of instances.

These two ventilators, Arnott's and Sherringham's, are, the one an outlet, the other an inlet. There are other three, Watson's, Mackinnel's, and Muir's, professing to combine an outlet for foul air with an inlet for fresh air, in the same contrivance. There is no doubt that all three effect both objects, but in order to do so they require fixed conditions. Alter these fixed conditions, and any of them may become wholly outlet or wholly inlet. The condition essential to their operation is, that the room to which they are applied be closed, and in a closed room their action is singular. If a number of people be crowded into a room with the fire-place, doors, and windows shut, and if a tube of an apparently sufficient area to afford ventilation for the inmates be carried from the ceiling of the room above the roof of the building, there will be an irregular effort at effecting an interchange between the air of the room and the outside air. The outer air will descend and the inner air will ascend in fitful, variable, irregular currents, and the room will be badly ventilated, if ventilated at all.

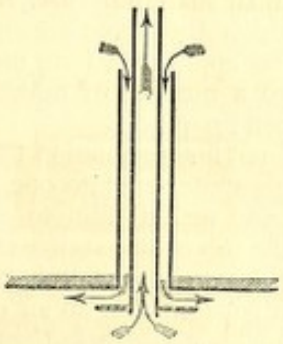
But singularly enough, no sooner is the tube divided longitudinally from top to bottom by means of any division, however thin, than its action becomes immediately changed—a current of air descends into the room continuously on one side of the partition, and a current of foul air ascends from the room continuously on the other side of the partition. One half of the tube supplies fresh air to the inmates of the room, and the other half removes foul air, so that if the size be properly adjusted the air in the room is kept sweet.

Fig. 27.—Watson's Ventilator.



(*c.*) *Watson's Ventilator* (Fig. 27) applies this principle in its elementary form. It consists of a square tube with a division down the centre, and it has no means of diffusing the descending current.

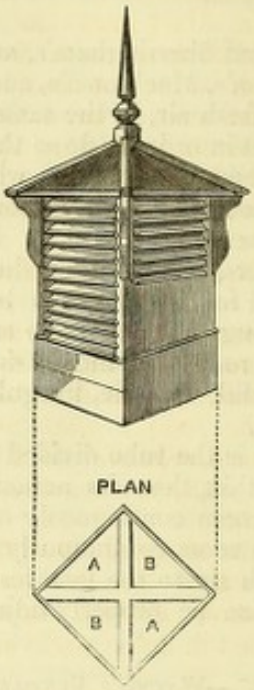
Fig. 28.—Mackinnell's Ventilator.



(*d.*) *Mackinnel's Ventilator* (Fig. 28) professes to be an improved application of the same principle. It consists of two tubes, one within the other, leaving a space between them. The inner tube is the longer, and projects above the outer tube at its upper end; the inner tube also projects a little below the opening of the outer tube in the ceiling to give support to a circular flange projecting parallel with the ceiling, and concealing the opening of the outer tube. The action of this contrivance is as follows:—The greater length of the inner tube determines the upward current to take place in it; it therefore

becomes the foul air shaft. The outer tube becomes the fresh air inlet, and the descending current striking against the flange, is thrown out in the plane of the ceiling, and so diffused.

Fig. 29.—Muir's Ventilator.



(*e.*) *Muir's Ventilator* (Fig. 29) consists of a square tube like Watson's, divided into four parts, A, A, B, B, by partitions, inserted diagonally. These partitions are carried above the top of the tube, and the box is completed outside and above the roof by louvres instead of solid sides. The object of this arrangement of divisions and louvres is to secure not only upward and downward currents at ordinary times, but to take advantage of any movement of the external air, light winds, &c., which by striking through the louvres on any angle, would cause a stream of air to be projected down into the room, and would assist the extraction of the air on the side away from the wind.

We have described the operation of these ventilators in a closed room, but as soon as a door or window is opened they become simply upcast shafts; they cease to supply air. Again, if there be a fireplace in the room with a strong fire in it, and the doors and windows shut, the fire will supply itself from the ventilators, and they will become inlets.

It is obvious that these plans possess certain advantages in cases where they are applicable. In single rooms standing apart, such as churches, chapels, schools, libraries, &c., warmed by stoves, and where the doors are kept shut for hours at a time, any of them will answer as ventilators.

In stables also, of a certain construction, in lock-up rooms and in guard rooms, they will be more or less applicable. In the latter case, less so on account of the open fireplace, and the frequency with which the doors are opened; but in the case of barrack rooms they would certainly not be applicable, both on account of the difficulty and cost of introducing the apparatus into a number of detached rooms on different floors, and on account of the existence of open fire-places.

Mr. Watson having applied to us for permission to ventilate some barrack rooms, we authorized the introduction of his apparatus into one of the houses at Wellington barracks containing twelve rooms, and we left him to apply his principle in his own way. He introduced his ventilator at the top of the staircase which passes up the middle of the house, and inserted louvres in the partition wall between the staircase and each of the twelve barrack rooms. It was anticipated that an air current would descend through one division of the tube into the staircase, would pass thence through one set of louvres into each barrack room, would return by the other set of louvres into the staircase, and pass up through the second division of his ventilator, and so escape.

On examining the operation of the apparatus, however, it was found that the current in both divisions of the ventilator passed down into the staircase through both sets of louvres into the rooms, and thence up the chimneys, so that there was no up-current in the ventilator at all. Without in any way disparaging Mr. Watson's contrivance in the cases to which it may be applicable, we certainly arrived at the conclusion that it was not adapted for those blocks of rooms with open fire-places to which he had applied it.

We authorized Mr. Mackinnel to introduce one of his ventilators into a detached guard room at Wellington barracks. It was inserted in the middle of the roof and ceiling, and appears to have answered its purpose.

We have recommended Mr. Muir's ventilators to be tried in some guard rooms. Our only reason for selecting it for the purpose is that its force is increased by the wind.

We have also recommended Mr. Mackinnel's to be adopted in a number of guard rooms. All three ventilators would be most useful for ventilating the holds of troop and hospital ships, but, as we have stated, we do not consider them adapted for barrack rooms.

In the preceding pages we have endeavoured to state fairly the advantages and disadvantages of the different forms of ventilating apparatus and arrangements which have been submitted to us for barrack rooms; and we next proceed to state the methods we have adopted as most likely to satisfy the conditions of the problem presented by all barracks.

The following is the problem requiring to be solved in ventilating a barrack:—*In a building consisting of a number of rooms, generally entered from common passages or staircases, sometimes directly from the outer air, and each having an open fire-place, which it is essential in every instance to retain, how to supply at all seasons and temperatures, and by day and night, each room by itself, and independently of every other room, with a sufficiency of air to keep the room healthy, and at the same time to prevent the temperature from falling below what is required for the comfort of the men. To do this with the least possible interference with the structure of the rooms, on a plan not easily deranged, and at a minimum of cost?*

The terms of this problem show at once the difficulties in the way of ventilating barracks. None of the methods we have seen in use afford anything like a solution of it, and we have had to consider the whole problem anew. We have endeavoured to solve it, and we believe we have succeeded in doing so to an extent sufficient for all practical purposes.

Amount of Fresh Air per Man required.—We began the work by endeavouring to ascertain approximately the amount of fresh air required to keep a sleeping room healthy. Various attempts have been made at different times to settle this amount scientifically, but nearly every experimenter has arrived at a different estimate of the quantity. These differences in opinion have arisen from not sufficiently considering the various offices already mentioned, which fresh air has to perform in the ventilation of human dwellings, and from not looking at the practical, rather than at the scientific side of the question.

One set of experimenters have based their calculations on the quantity of air required to dilute the carbonic acid produced by respiration down to the proportion in which that gas exists in the external atmosphere. Other experimenters have taken the amount of air required to dissolve the aqueous vapour escaping from the skin and lungs, and to diffuse it so as to raise the hygrometric state of the air to the same healthy standard as that of the outer atmosphere.

The estimates are hence very various, and differ to the extent of two, three, or four times, as to the amount of air required for health; a difference which proves how little is yet known scientifically on the subject.

The practical argument as to the amount of fresh air required to ventilate a room is in our opinion of far more weight than the mere scientific one. We find, for example, that nature has provided in the atmosphere unlimited extent and constant means of purification and of movement.

The building of dwellings interferes with these natural conditions, by enclosing air in confined spaces, saturating that air with impurities, and rendering it stagnant. It may be fairly argued, as indeed has been proved by experience, that those dwellings are the most healthy in which the natural conditions of the atmosphere are most perfectly preserved. Chemistry has told us distinctly enough that at least 200 cubic feet of air per hour is required by a human being, for the mere purposes of diluting the carbonic acid and water given off from the body to the same standard as they exist in the atmosphere itself. But chemistry takes no cognizance of those aerial poisons eliminated from the skin and lungs, and which in stagnant air are perfectly cognizable to the senses, even after the air has been diluted to the extent stated. Indeed, the object to be served by ventilation is primarily the dilution and removal of these poisonous exhalations, and if this be secured the carbonic acid and water will be removed at the same time.

Few persons are, perhaps, aware that an ordinary barrack fire-place removes a much larger amount of air than is required merely to dilute the carbonic acid and water to a healthy standard. The quantity varies, of course, with the section, height, and temperature of the chimney flue, and also with the force and direction of the wind. The extremes may be practically assumed at from 6,000 cubic feet per hour up to ten times that amount. A twelve-men room, affording 500 cubic feet per man, would on the lowest

estimate have 500 cubic feet of air per man per hour supplied to it by the chimney draft alone; that is to say, the fire-grate will ensure a ventilation above twice as great as will fulfil the requirements of chemistry; and yet it has been ascertained by sufficient experience that rooms so ventilated are both offensive and unwholesome.

This result is, no doubt, partly attributable to the point of the room from which the foul air is drawn; for although carbonic acid, like every other gas, diffuses itself equally through the cubic contents of a room, those poisonous organic compounds to which we have referred are detected by the senses most strongly near the ceiling of apartments, as for instance, in the galleries of unventilated churches, theatres, &c.; so that in all rooms ventilated only by the fire-place, there is a reservoir of foul air situated above the range of its ventilating power. The fire-place may be made an admirable adjunct to ventilation, but by itself it is certainly not sufficient for the purpose.

The sense of smell affording the chief indication of the healthiness or unhealthiness of a room atmosphere, and differing as the delicacy of this sense does in different individuals, it is not perhaps possible to arrive at an absolute standard of ventilation; but in order to obtain some practical estimate of the quantity of air required to preserve the air of a barrack room sufficiently pure, and of the size of shafts and inlets required to ensure this amount, we had air shafts having certain definite sections carried from the corners of the ceilings of twelve barrack rooms in the Wellington barracks, up through the roof, so arranged that the apertures might be contracted, and the quantity of air passing up each shaft measured by a delicate anemometer constructed by Naumann of Paris for the express object. The measurements were taken at different periods, during several months, between two and five o'clock in the morning. The requisite observations of temperature without and within the rooms, and of the hygrometric state of the air, were also taken, and the sensible state of the room atmosphere was observed at the same time. From these observations, as well as from others which we have been enabled to make, we are of opinion that an estimate on which we based our first improvements in ventilation, is sufficiently near the truth for practical purposes. It is as follows;—that in a barrack room containing a number of men, at 600 cubic feet per man, the whole air of the room should be renewed at least twice in the hour. In other words, that each man should have in round numbers 1,200 cubic feet of fresh air supplied to him per hour. Even this amount may not be sufficient to preserve a barrack room entirely free of odour at all times and seasons; but the difficulties of a thorough solution of a problem where the conditions are so variable, have led us to adopt this as our unit of ventilation, while in the ventilating plans we have had carried out, it is always possible to increase the amount without difficulty. After our plans had been for some time in operation, we were glad to learn, from a report on the warming and ventilation of dwellings, made to the General Board of Health, by Messrs. Fairbairn, Glaisher, and Wheatstone, that a similar unit, namely, from 15 to 20 cubic feet per man per minute, had been arrived at by these gentlemen. But while adopting this unit, we hold it at the same time to be an indispensable condition, that each man should have the amount of space, 600 cubic feet, recommended by the Royal Commission.

But to ventilate a barrack room, it is not only necessary to supply this amount of air, but to supply it at different seasons, during hot weather, during cold weather, and during what may be considered as the temperate days and nights of the year. During mild weather the problem is one of comparative facility. During warm weather, especially if the weather be at the same time moist, nothing short of open windows will keep a room comfortable in which a number of people sleep. This, indeed, is generally done by the soldiers for their own comfort. During cold weather, however, it is essentially necessary to provide for warming part of the admitted air.

Principle of Ventilating Barrack Rooms.—The next point is to determine what should be the principle of ventilation adopted. We have decided, after a careful consideration of the different methods which have been in use, to keep each barrack-room independent of every other in respect to the ventilation; and to depend for the movement of the air in barrack rooms upon the fireplace and upon the element of the difference of temperature between the air outside and the air within. According to the law of dilatation, discovered by Dalton and Gay-Lussac, atmospheric air, in the process of being heated from the freezing to the boiling point of water, increases in volume 0·375, or about $\frac{3}{8}$ of its original bulk, which gives a dilatation of a little more than 0·002 for every degree of Fahrenheit. If the air inside a room were 20° Fahrenheit warmer than the air outside, the air in the room would be expanded to a 25th part more in bulk, and would be to that extent specifically lighter than the outside air. The colder air outside has thus a tendency to press upwards the warmer expanded and lighter air within the barrack room, for which at present there is no outlet.

Ventilating Shafts.—We have taken advantage of this law by providing for each room a shaft of certain given dimensions, having a sectional area adjusted to its length

and to the number of inmates in the room. But as the number of occupants is, we trust, henceforth to be governed by the cubic space, we propose that the sectional area of the shafts should be dependent on the cubic contents of the room.

The velocity of the air in the shaft, and hence its ventilating power, will depend, 1st, on the difference of temperature between the inner and outer air; 2nd, on the length of the shaft; 3rd, on the amount of friction in the shaft; and, 4th, on the freedom, or otherwise, with which the air to supply the shaft enters the room.*

In rooms on the top floor of a barrack we recommend shafts with a sectional area of one inch to every 50 cubic feet of room space; for the floors next below the upper floor a sectional area of one inch to 55 cubic feet of room space; and where the barrack consists of three floors, we have required for the lower floors a sectional area of one inch to 60 cubic feet of room space.

The velocity in these shafts is dependent, of course, on the difference of temperature between the air in the room and the air without, on the amount of movement in the outer atmosphere, and other circumstances. When the temperature is nearly equal, as, for instance, when the windows are open, there is very little upward draught, except as the result of movements in the atmosphere without, but when the windows are open the room is being ventilated without the shaft. At other times the current is energetic.†

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* The following well-known formula gives the theoretical velocity which should obtain :—

$$V = 8{\cdot}024 \sqrt{H\, a\, (t-t')}$$

V = velocity in feet per second.
H = height of shaft.
t = temperature of room.
t' = temperature out of doors.
a = coefficient of dilatation of air for 1° Fahrenheit ·002.

But this theoretical velocity, as already stated, is influenced by friction, or by any impediments to the ingress of fresh air, or to the free course of the air in the shaft.

† The following Table gives a portion of the observations made with Naumann's Anemometer in the experimental shafts and in the chimneys of rooms in Wellington Barracks, which will sufficiently illustrate the question. A very large number of the earlier observations had to be rejected, in consequence of errors subsequently found in the instrument.

Date.	Hour.	Temperature of Air. Out-of-door. Dry bulb.	Out-of-door. Wet bulb.	In Room. Dry bulb.	In Room. Wet bulb.	Cubic space in Room. No. of Room.	Cubic space in Room. Cubic feet.	Cubic feet per Man of room space.	Velocity of air in shaft.	Velocity of air in chimney.	Volume of air removed per hour. By shaft.	By chimney.	By shaft and chimney.	Volume removed per Man per hour.	Condition of Atmosphere.
1858.	a. m.					No. of Room.	Cubic feet.		Feet per sec.	Feet per sec.	Cubic feet.	Cubic feet.	Cubic feet.	Cubic feet.	
7th April -	4·30	45°		55°		33	7,260	484	3·	5·	6,000	8,000	14,000	933	rather close.
		45°		54°		34	7,260	726	2·25	5·	4,500	8,000	12,500	1,250	quite fresh.
16th April -	4·30	50°	50°	66°	61°	33	7,260	454	4·1	5·6	8,100	9,000	17,100	1,070	fair.
Barom. 29·9		,,	,,	66°	60½°	34	7,260	518½	5·75	5·6	7,560	9,000	16,560	1,183	fair.
		,,	,,	65°		25	7,920	566	4·37	8·	8,640	12,600	21,240	1,517	sweet.
		,,	,,	69°		30	7,590	506	4·4	7·2	8,700	11,700	20,400	1,360	warm.
		,,	,,	66°		26	7,920	528	3·44	8·	6,840	12,600	19,440	1,300	fair.
		,,	,,	66°		29	7,590	506	4·7	7·2	9,360	11,700	21,060	1,400	fair.
		,,	,,	66°		33	7,260	454	5·	5·6	9,720	9,000	18,720	1,170	fair.
	5·45	50°		67°		34	7,260	518	4·37	5·6	8,640	9,000	17,640	1,260	sweet.
20th April -	4·30	45°	43½°	60°		25	7,920	528	3·95	3·36*	7,884	5,364	13,248	883	close.
Barom. 30·1		,,	,,	57°		26	7,920		4·53		9,036				sweet.
		,,	,,	60°		29	7,590	633	4·23	6·3	8,424	10,044	18,468	1,539	sweet.
		,,	,,			30	window open.								
		,,	,,	60°	55°	33	7,260	484	3·72	5·3	7,200	8,460	15,660	1,040	very fair.
		,,	,,	60°	55°	34	7,260	558	2·55	5·3	5,076	8,460	13,536	1,041	very fair.
21st April -	4·30	46°	44°	61°		25	7,920	566	4·4	10·08	8,700	16,092	24,792	1,549	very fair.
Barom. 30·		,,	,,			26	7,920	no men.							
		,,	,,	61°		29	7,590	506	3·	7·9	6,000	12,600	18,600	1,550	sweet.
		,,	,,	63°		30	7,590	506	5·24	7·9	10,512	12,600	23,112	1,608	sweet, rather warm.
		,,	,,	66°	55°	33	7,260	454	3·13	5·5	7,228	8,784	16,012	1,143	scarcely any smell.
		,,	,,	60°	54°	34	7,260	518	3·6	5·5	7,164	8,784	15,948	1,139	very fair.
24th April -	4·30	46°	45°	62°		25	7,920	520	shaft closed.	9·0	—	14,386	14,386	960	very close.
Barom. 30·1		,,	,,	63°		29	7,590	583							fair.
		,,	,,			30	window open.								warm.
		,,	,,	61°	57°	33	7,260	518	2·6	6·	5,200	9,600	14,800	1,036	sweet.
		,,	,,	63°	56°	34	7,260	558	3·5	5·	6,993	7,960	14,953	1,150	very fair.
	5.30	inlet shut		62°		33	7,260	518	1·8	5·	3,560	7,900	11,460	818	close.
27th April -	4·30	41°	41°	59°	53½°	34	7,260	484	3·8	5·	7,593	7,992	15,585	1,038	rather close.
Barom. 30·2		,,	,,	59°	54°	33	7,260	558	4·	5·	7,992	7,992	15,984	1,142	quite fresh.

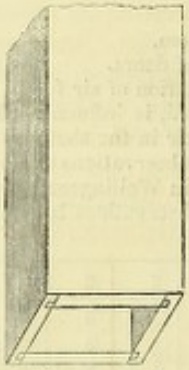
* Thermometer in chimney, 62°.

From a number of observations made with Naumann's anemometer, we have found that in rooms in the Wellington barracks, with a cubic capacity of 7,920 feet, a quantity of air equivalent to from 8,000 to 9,000 cubic feet per hour passes up the shafts. Each shaft would therefore remove from the room about 600 cubic feet per man per hour, if the rooms were occupied by 13 men each, which is the largest number they ought to contain. We have thus obtained outlets for foul air capable of removing 600 cubic feet of air per man per hour; we have already seen that the chimney removes about the same quantity; and thus the amount of 1,200 cubic feet is attained. The amount of air varies so much that it is necessary to provide regulating valves, not under the control of the men, for the inlets; but these valves should never admit of being completely closed.

The foul air shafts are carried from one angle of the ceiling to 3 or 4 feet above the roof, and protected by louvres to prevent the rain beating down. These louvres have required adjustment in a number of instances where, from local circumstances, wind and rain have had a tendency to beat in.

The shafts have been made of ¾-inch deal, very smooth inside, and rebated and grooved together at the angles, as shown in Fig. 30. But it would, of course, be better to have them of glazed pipe built in the wall, or to have smooth cement sides. They should be provided with valves, to allow of the aperture being reduced to two-thirds the area laid down above, at the direction of the medical officer, to enable the amount of ventilation to be adapted to the weather and season.

Fig. 30.



A ventilating shaft and a chimney flue are, however, not of themselves sufficient to ventilate a room.

If a room has two fire-places they will draw against each other, and the fire-place with the stronger draught will supply itself by drawing the smoke down the other chimney, unless it can obtain an air supply with a smaller expenditure of force. For a similar reason, if a closed barrack room has no other means of ventilation than a foul air shaft and a chimney flue, the fire-place will certainly supply itself by drawing air down the shaft, and troublesome down-draughts will be produced. It is essential, therefore, to provide inlets for air to supply both the fire and the ventilating shaft.

Inlets for Fresh Air.—The next important question, therefore, is, what should be the nature of these inlets, their position and dimensions.

In a number of barracks inlets have been placed close to the floor. These inlets have generally been closed by the soldiers, but where the men have not closed them we have, for reasons already stated, in all cases recommended them to be closed. After examining carefully the course of the air current produced by inlets near the ceiling, such for instance as the inlet afforded by drawing the upper window sash a little down, we found that air admitted in this position very soon ceased to exist as a distinct current; and that at a very short distance from the inlet it had mingled with the general mass of the air, and had disappeared.

This result is of course partially due to the mass of air in the room, with which the inflowing current mingles; it is partly due to the action of gravity, where the inflowing air is colder than the air in the room; and partly due to the action of the fire. The effect of this latter agency on the movement of the body of air in a room has been satisfactorily elucidated by Dr. Reid and others, and recently by J. F. Campbell, Esq., Assistant Secretary to the General Board of Health, by a series of experiments conducted in the Board Room of the office. The result arrived at by these various inquirers is, that the air in a closed room with a fire revolves in spheroids; it moves up the wall above the fire-place, across the ceiling to the wall opposite the fire-place, down that wall to the floor, and along the floor to the fire-grate. An open fire-place thus tends to preserve the atmosphere within the room in an average state of purity and temperature.

Position and Construction of Inlets.—For practical reasons, fully sustained by the results arrived at by experiment, we decided on placing all inlets for air close to the ceiling. The form we have adopted has been that of iron or perforated air bricks of different sectional areas, according to the number of men the room was intended to contain. We have allowed 1 square inch for every 60 cubic feet of contents of the room as the area for each room; but we consider 1 square inch to every 120 cubic feet of contents of the room sufficient if warm air is admitted round the fire-grate.

In barrack rooms of an ordinary size we have generally recommended two inlets, one on each of the opposite sides of the room, but not opposite each other, or in back-to-back rooms, both on the same side. In larger rooms we have increased the number of inlets.

In order to prevent draughts as far as practicable, as well as to limit the number of places in which the wall has to be cut away, we have covered these inlets by a wooden cornice several times their length, sloping upwards to the ceiling, at an angle of 45°. The upper side of the cornice is formed of perforated zinc, with holes of $\frac{1}{8}$ to $\frac{1}{6}$ of an inch in diameter. The front of the cornice opposite the inlet is of wood, to break still further the force of the current. The area of perforated zinc through which the air passes into the room is from six to eight times the area of the inlet from the outer air.

Fig. 31 shows an elevation of the ventilating cornice over the inlet. The front and triangular ends are of wood, and the upper surface is shown of perforated zinc, except the part opposite the inlet, which is of wood. Several separate small inlets would of course be better in a new building. These may be conveniently made in the thickness of the wall, the inlet at the outside terminating in an ordinary air brick, whilst on the inside it is splayed and fitted with iron or slate louvres $1\frac{1}{2}$ inches apart, sloped upwards towards the ceiling, and capable of being closed at pleasure, see Fig. 81, or Sherringham's ventilators would be applicable.

Fig. 31.

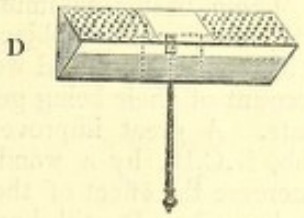
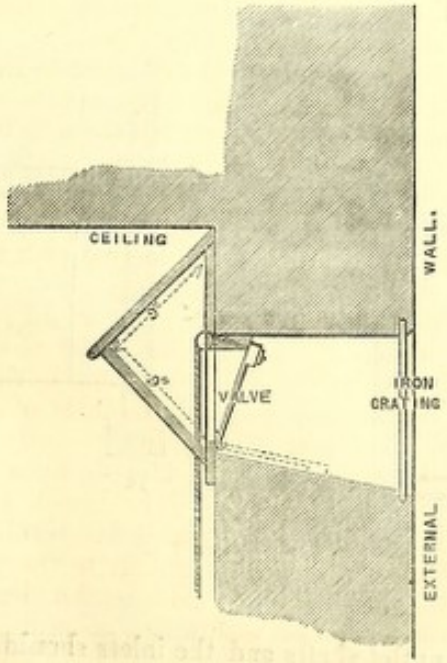


Fig. 32 shows the inlet in section, with the perforated zinc cover within the room, and the arrangement for closing it, with a valve and cord working on pivots fixed to its lower edge, and so adjusted that, by being weighted on its upper edge, it will fall down and leave the inlet open when not purposely raised and held up by a cord to close it. This valve should fit very loosely, so as to leave, when closed, at least from half an inch to one inch between it and the sides and bottom of the inlet hole. The valve may be made of zinc or galvanized iron.

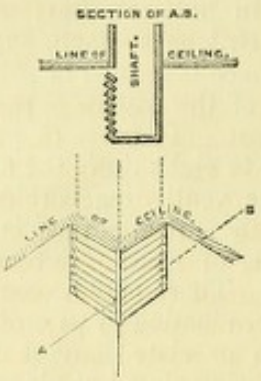
Fig. 32.



The cornice or louvres, covering the inlet openings, should be fixed with screws, so as to be easily removed for the purpose of occasionally cleansing the interior.

The supply of air from these inlets, and from those for warmed air, which inlets we shall describe presently, has generally been found sufficient for the fire-place and the foul air shaft, but there are times, especially in barrack rooms immediately under the roof, when, from the action of the wind outside, the air currents become disturbed and irregular, producing occasional down-draughts in the foul air shaft. To obviate this inconvenience, we have placed inverted louvres over the lower end of the shaft within the room, the operation of which is to throw such currents up towards the ceiling, and so prevent their falling on the men. The construction of these louvres will be better understood from Fig. 33. The line A. B. is in the plane of the ceiling.

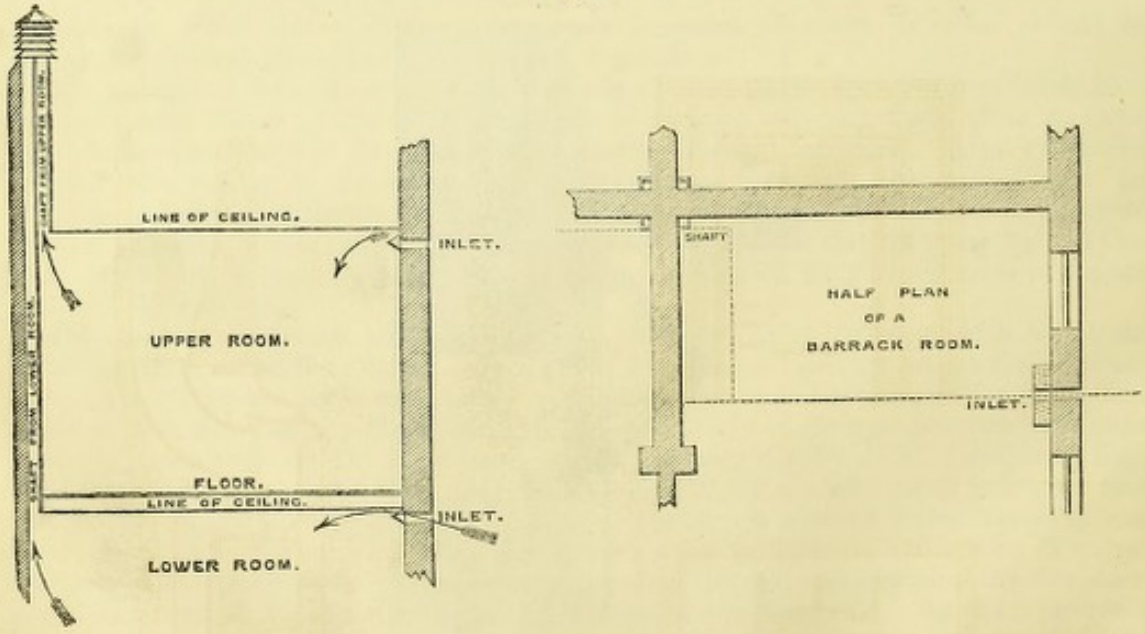
Fig. 33.



This precaution has been requisite in a few exceptional cases only. In some barracks we have not found it necessary to provide inlets on account of the existence of hollow beams carried across the ceilings. These beams communicate with the external air at both ends, and have openings into the room. Their object is to act as outlet shafts, but from the action of the fire they are in reality inlets, and we have had frequent complaints of down-draughts from them, on account of their being generally along the centre of the room over the men's tables and seats. A great improvement in the ventilating beam has been made by Sir Joshua Jebb, K.C.B., by a wooden partition placed across its centre, the object of which is to increase the effect of the beam when there is any wind blowing against either side of the barrack. It still, however, acts as an inlet, and in adapting it for this purpose, we have removed the openings from the lower surface to the sides of the beam, enlarged them, and placed louvres or perforated zinc over them to diffuse the inflowing current.

Relative Position of Shafts and Inlets.—The relative position and the arrangement of shafts and inlets we have introduced into barrack rooms is shown in Fig. 34, which exhibits them in plan and section.

Fig. 34.



It is important that the outlet shafts and the inlets should be placed as far from each other as possible, to enable a thorough diffusion of the inflowing fresh air to take place among the general mass of air in the room, so that the whole contents of the room may

be kept in an average state of purity and temperature; but from the way in which the currents of air move in a room, it is found best to place the foul air shafts to one side or the other of the fire-place, and not directly opposite to it.

The following would be the operation of these arrangements in renewing the air of a barrack room:—Suppose such a room, containing 10 men in a space of 6,000 cubic feet, to be supplied with a fire-place, an air shaft, and two inlets; during every hour about 12,000 cubic feet of atmospheric air would enter the room by the inlets; it would mingle with the contents of the room, preserving them in a certain average purity, as regards carbonic acid, watery vapour, and organic matter. About half of the air would escape up the chimney and the other half up the ventilating shaft, and the quality of the air in the room, as well as its temperature, would be as nearly as possible equal throughout.

The various parts of the apparatus will not always act with the same efficiency, but the variations will not be of such extent as to exert any serious influence on the general average result.

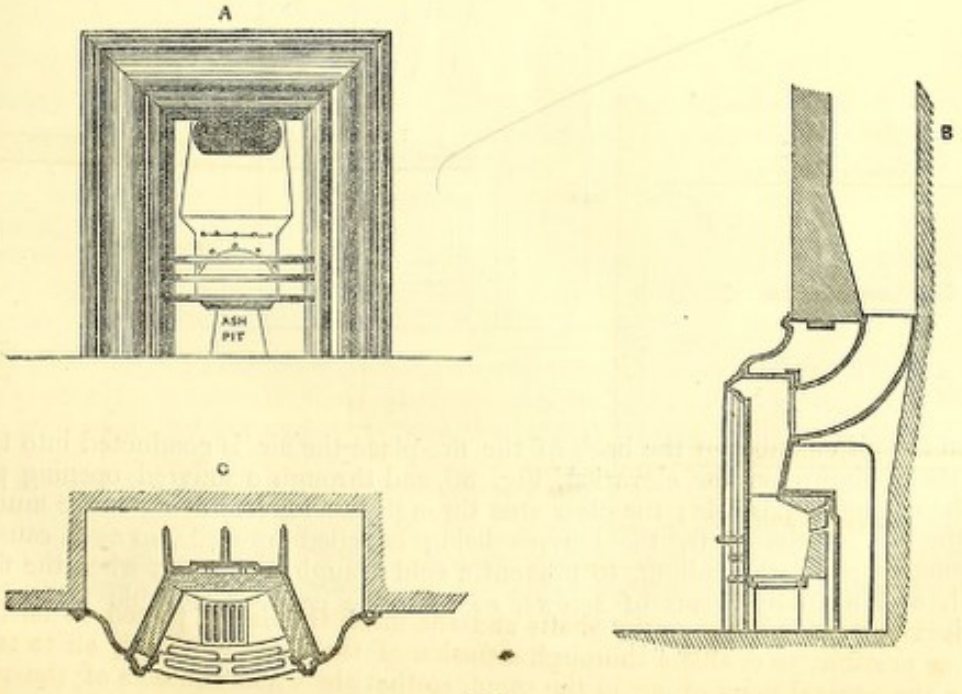
Warming the Air admitted.—It will be obvious that so large an amount of air passing through a barrack-room in winter must keep the room at a comparatively low temperature, unless some simple method can be adopted for warming a portion, at least, of the air admitted. We have had our attention specially directed to this matter, and we have examined all the best air-warming grates at present in use. None of them, however, appeared to us to be adapted at once for ordinary barrack room use, and for having their heating power made an integral part of the room ventilation. The present barrack room grate, as already mentioned, allows the greater part of its heat to escape up the chimney; and it is from this constant stream of wasted heat that we decided on warming fresh air for the room. After several trials, we adopted a grate which, so far as can be judged of by the experience of two winters, answers its purpose; but, in a subject involving so many difficulties it is probable that improvements will be made as the trial proceeds.

Remodelled Fire Grates.—The principles upon which these new fire-places have been constructed are as follows:—

The grate is intended to be placed as forward into the room as possible; the part in which the fire is contained is of fire brick, the bottom being partly solid to check the consumption of fuel. A supply of air is admitted from behind the grate, and thrown upon the top of the fire to assist in preventing smoke; the sides are splayed so as to throw the heat, by radiation, as much as possible into the room; the opening into the chimney has no *register;* a chamber is placed behind the grate, into which air is brought from the outer atmosphere, and warmed by the large heating surface of the back of the grate, increased by flanges, and after being heated to a temperature of from 56° to 70° Farenheit, the air passes into the room by a shaft cut out of the wall, which terminates in a louvred opening above the reach of the men. The chamber is made as large as possible.

The accompanying sketches (Fig. 35) will show the manner in which these principles have been carried into effect.

Fig. 35.



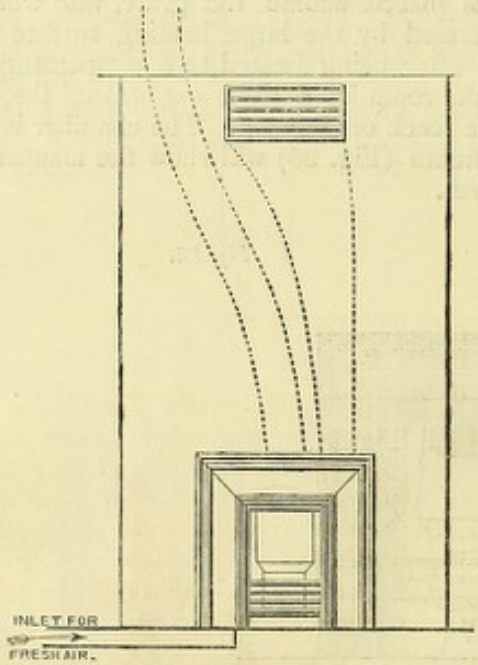
A, B, C, are a plan, elevation, and section of the stove. The fire lump lining of the grate is shown by the parts of the sketch, Figs. B and C, which are shaded; the back lump has grooves in it terminating in holes just at the bottom of the splay, which form air channels for admitting air at the back over the fire. The hearth is made of a plate of cast iron.

The grates have been made of three sizes, according to the cubic contents of the rooms. Thus, a grate with a fire opening of 1 foot 3 inches is intended for rooms having not more than 3,600 cubic feet of contents; a grate with 1 foot 5 inches opening is intended for rooms between 3,600 and 7,800 cubic feet; the largest sized grate, with 1 foot 9 inches opening, is intended for rooms between 7,800 and 12,000 cubic feet, above which capacity two grates would be required.

The plan further shows the dimensions of the ordinary opening for the fire-place of a soldier's room, with the method of setting the stove and forming the air chamber.

The mode of admitting the external air into this chamber must depend upon the locality of the fire-place. If the fire-place be built in an external wall, the opening for fresh air can be made in the back; but if in an internal wall, it will be necessary to construct a channel from the outside, either between the flooring of the room and the ceiling joists of the room below (if there be independent ceiling joists), or between the floor board and the plaster ceiling, in the spaces between the joists, or by a tube or hollow beam carried below the ceiling of the room below altogether. In any case, however, these horizontal ducts should contain one superficial inch of sectional area for every 100 cubic feet of room space; the grating covering the opening to the outer air should not be larger in total area than the flue, so that the clear area through the grating would only be about half that of the flue. If the shafts are of considerable length the sectional area should be rather more: but if there be a direct communication with the outer air the sectional area should be rather less than that recommended. Great care should be taken that the supply of air is drawn from a point where there are no nuisances, such as gulley grates, latrines, gutters, middensteads, &c.; and that it is taken as high above the surface of the ground as possible.

Fig. 36.



From the air chamber at the back of the fire-place the air is conducted into the room by a shaft, shown on the elevation, Fig. 36, and through a louvred opening placed as near the ceiling as possible; the clear area through the louvres being made much larger than the area of the shaft, the louvres being bevelled upwards, so as to cause the air to impinge against the ceiling, to prevent a cold draught being felt when the fire is not lighted, and fixed by means of screws, so as to be easily removable for purposes of cleaning.

The air shaft, if formed in brickwork, should be rendered inside with cement and lime-whited. The minimum area of the shaft should be one square inch to every 100 cubic feet of room space.

If there be inconvenience in breaking into the chimney breast, or if it be more economical, the air from the chamber in which it is warmed may be admitted to the room through a shaft of sheet iron (No. 26 or 28 Birmingham gauge will suffice), in a semicircular form fixed to the wall, the top being sloped back and covered with large-holed perforated zinc. This shaft would communicate with the chamber behind the fire by a hole in the top of the front projecting part of the stove, or through a hole in the chimney breast.

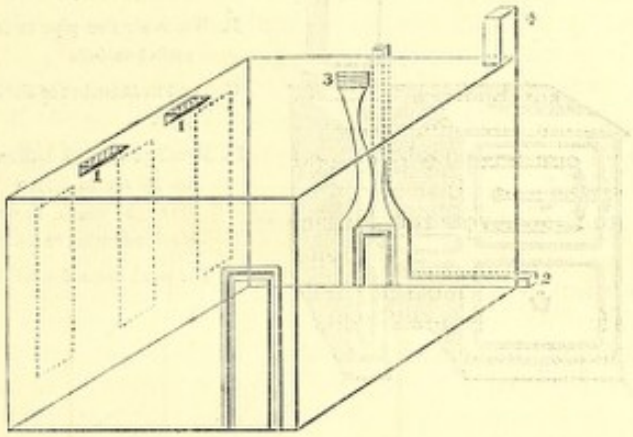
The stove is made in two separate parts, so that the front may be occasionally removed for the purpose of cleansing and limewhiting the air chamber, iron work, and shaft.

By the adoption of these grates, it is found that a sufficient amount of moderately warm air can be admitted into the rooms for the purposes of ventilation, while the form of grate and the system of warming the air ensure a considerable saving in the consumption of fuel.*

When the fire is lighted and the air warmed, a very large quantity of air enters the room; but when the fire is out, the horizontal length of the flues along which the air must, in many cases, be brought, tends to check the current, so that it is desirable to construct inlets as above mentioned direct from the fresh air whenever practicable.

Fig. 37 shows the entire arrangement for ventilating and warming a barrack room in the Wellington barracks. 1, 1, are the cold air inlets, protected by wooden cornices with perforated zinc covers. 2 is an inlet for air to be warmed in the space behind the fire-grate, which air, after being warmed, passes up the flue in the wall, and is admitted into the room through the louvres 3. The outlet foul air shaft is at 4. But in practice this outlet shaft should be placed at as great a distance as possible from the fire-place.

Fig. 37.



Necessity of responsible Supervision of Barrack Ventilation.—As already mentioned, we have thought it advisable to place moveable valves over the air inlets, and it is also desirable to have the means of partially closing the outlet shaft, in order to have a control over the ventilation in very cold weather; and as no ventilating arrangement, however perfect, can be considered as self-acting under every variety of condition, we think it absolutely necessary that some person should be in charge of the ventilating arrangements of every barrack, as well as of the other sanitary arrangements, and who shall be held responsible for their efficiency.

It is wisely ordered in the New Medical Regulations, that the medical officer in charge of the regiment in possession shall satisfy himself as to the state of the ventilation in every barrack room, by day and night, and shall report defects to his commanding officer.

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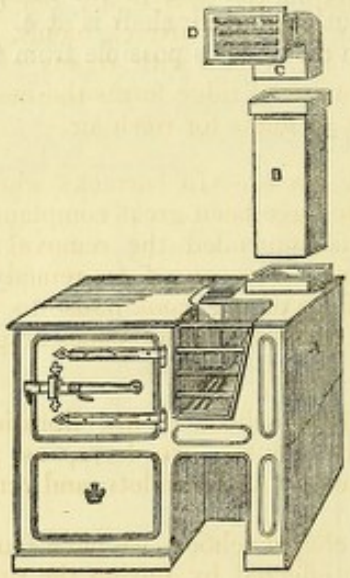
* While this Report has been passing through the press, the very severe and quite exceptional winter of 1860–61 has led to complaints of want of heating power in some of these grates. This experience has led to the adoption of certain simple improvements, which it is hoped will obviate similar complaints in future.

It appears to us to be a very necessary supplement to this regulation to hold the barrack master, who should be a competent person for such a charge, or some person specially appointed, responsible for the proper repair and use of these ventilating and warming arrangements. We have endeavoured to plan and arrange the whole in the simplest and least complicated manner, so that any person can understand the apparatus. But it must nevertheless be made some one's business to see that it is not tampered with, nor allowed to get into a state of disrepair or inefficiency. It is also possible that in very cold weather the temperature of the rooms with ventilation may fall below 50°, in such case we would suggest that, rather than stop up the ventilation, the soldiers be supplied with an extra blanket.

Ventilation and Warming of Non-commissioned Officers' Rooms and Married Quarters.—In all barracks where there are separate non-commissioned officers' rooms, we have deemed it to be sufficient to ventilate these rooms by an Arnott's silk flap valve in the chimney, and a Sherringham's ventilator. In the majority of non-commissioned officers' rooms the cubic space allowed is so much greater than that in any barrack room, that we have not considered a separate shaft to be necessary. But in all newly constructed rooms we propose to introduce a grate for warming the air, together with a shaft formed in the wall and a Sherringham's ventilator. The following, Fig. 37 A, is a sketch of a new fire grate and oven which has been recently introduced for non-commissioned officers' and married soldiers' quarters.

Fig. 37 A.—Stove for Married Soldiers' Quarters.



A. Fire lump, with warm air flue through back.

B. Warm air flue pipe to fit into socket on hob.

C. Bend to fit socket of the above pipe.

D. Mouth-piece, with buffer front, to fit on to above bend, through which the warm air is admitted to the room.

The oven has a double door.

Fresh air is passed into the room direct from the outer air, through the fresh air flue, into a flue in the fire lump at the back of the stove, by the nearest and most convenient route. The channel for the admission of this air from the outer air should be of best glazed earthenware pipe, at least six inches diameter, built into the wall. The outside mouth of this air channel should be at as great a height as can be conveniently arranged above the level of the ground, and removed from gully holes, receptacles for filth, &c.

Ventilation of Passages and Staircases.—The ventilation of a barrack would be imperfect unless all the stairs and passages were also ventilated. In barracks of simple construction, where the staircases have windows back and front, and the buildings do not exceed two floors in height, there is little danger of stagnation of air in the passages; but in more complicated buildings, three or four stories in height, or where there are long internal passages or corridors, such as exist in cavalry barracks, it is very necessary to make as ample provision as possible for renewing the air within them. It must be remembered that these stairs and passages keep up a continuous communication among all the barrack rooms of the building, and form a reservoir of impure stagnant air, from which the rooms would be partially supplied on every opening of the doors.

The method of ventilation which we have adopted to obviate this has been as follows;—For barrack staircases we have had a shaft protected by louvres carried from the top

ceiling of the staircase above the roof, and we have had panes of perforated glass put into the top row of each staircase or passage window.

For the long inner corridors and passages of cavalry and other barracks this plan is not sufficient. In cases where there has been only one floor of barrack rooms, we have carried two or more square shafts the entire breadth of the corridor from its ceiling through the roof. These shafts are plastered inside, and are roofed over by ventilating skylights. By placing the shafts at suitable distances from each other in the length of the corridor, both light and ventilation have been afforded where both were very much wanted. There are several cavalry barracks with two flats of rooms over the stables. The corridors of the upper flats have been ventilated and lighted on our recommendation in the manner described, but unfortunately it has not been possible to ventilate the lower passages directly. We have therefore been obliged to insert gratings in the floor of the upper corridor under the skylights, so as to obtain a circulation of air in the corridor below, as far as practicable. In all windows connected with these inner passages, we have recommended the introduction of perforated glass panes or glass louvres.

Ventilation of Stables under Barrack Rooms.—In every cavalry barrack having men's rooms over stables, we have endeavoured as far as possible to diminish the risk of effluvia passing into the men's rooms through the stable ceilings, by carrying up four shafts, one from each corner of the stable, to above the roof. These shafts have a total conjoint area of 12 square inches per horse. Their object is two-fold; to improve the ventilation of the stable itself, and to prevent the accumulation of foul air at the ceiling of the stable. Where it has been necessary to carry these shafts through the men's rooms, they have been lined inside with soldered zinc, in order to obviate any risk of leakage into the room. We have found ventilation by *four* shafts, one carried up from each corner, with inlets for fresh air, similar to those for barrack rooms, but without the covers, by far the most satisfactory method for stables with rooms of any kind over them. For stables without rooms over them, a raised ridge forms the best outlet, with a row of perforated bricks under the eaves to act as inlets for fresh air.

Ventilation of Cook-houses under Barrack Rooms.—In barracks where cook-houses have been placed under the men's rooms, there have been great complaints of heat and fumes from the cooking. While we have recommended the removal of cook-houses from all such positions, we have at the same time endeavoured to remedy the evil as far as practicable by carrying shafts from the ceiling of the cook-house to the roof of the building, and by supplying fresh air through perforated glass panes or glass louvres in the windows.

Ventilation of Schools, Libraries, &c.—Where school rooms, libraries, and reading rooms have been situated within the barrack houses, we have, as a general rule, recommended their being ventilated and warmed by shafts, inlets, and remodelled grates, similar to those for barrack rooms.

In detached one-story school buildings or in chapel schools, we have found the simplest and most economical kind of ventilation to be effected by raising the ridge tiles to form outlets; or, in some cases, by constructing small shafts or openings in the gables: the inlet for fresh air being brought under the floor to the stoves, round which warmed air can be supplied to the room. Either Nettleton's or Gurney's stoves will answer the purpose; the latter perhaps are preferable, provided a large volume of fresh air be introduced close to the stove, in such a manner as to be effectually warmed by it.

Ventilation of Guard Rooms, Lock-up Rooms, and Cells.—For ventilating guard rooms, we have generally adopted either a square shaft carried through the ceiling and roof, and protected by louvres above, or we have recommended the introduction of Muir's or Mackinnel's ventilator under special circumstances, where either of these appeared more applicable. We have as a rule recommended all guard room grates to be remodelled on the principle already described, and we have considered it sufficient to supply the whole of the fresh air warmed by means of the fire-grate.

In cases where ventilation has been required for lock-up rooms, we have generally advised a shaft through the roof of the building and inlets for air. In defectively ventilated prison cells, we have recommended the introduction of more air to the passages by perforated panes or otherwise, together with small shafts for the cells, with means of regulating the ventilation, at the discretion of the medical officer, where it appeared to us to be necessary to improve their ventilation.

Canteen Ventilation.—For ventilating canteen tap-rooms, we have generally adopted Dr. Arnott's silk flap valve in the chimney, and perforated glass panes in the windows, or a Sherringham's ventilator.

Summary of Principles adopted in Barrack Ventilation.—We shall conclude this subject by summing up the principles we have recommended as practically applicable to the ventilation of barracks.

(1.) Ventilating each room by itself, and quite independently of any other room.

(2.) Providing each room with a shaft passing from the ceiling of the room up through the roof.

(3.) Closing up all inlets near the floor, where such have existed, and placing the inlets for air close to the ceiling, so constructed as to ensure the diffusion of the inflowing current.

(4.) Remodelling the barrack room grates and providing a chamber behind, for heating fresh air drawn from without to be introduced warm above the level of the men's heads.

(5.) Ventilating all passages, staircases, and corridors by shafts and perforated panes independently of the rooms.

(6.) Providing as nearly as possible 1,200 cubic feet of fresh air per man per hour, in a room space of 600 cubic feet per man.

(7.) Ventilating guard rooms by shafts, and remodelled grates for warming the air admitted.

(8.) Ventilating libraries, school rooms, reading rooms, and cook-houses situated in the same houses as the barrack rooms on the same principle as barrack rooms.

(9.) Ventilating non-commissioned officers' rooms, canteen tap-rooms, &c. by Arnott's ventilators and perforated panes.

(10.) Ventilating all stables under barrack rooms by shafts from the ceilings, carried above the roof, and by inlets for air.

(11.) Providing for the ventilation of all gas burners in the way about to be mentioned.

(12.) We have recommended that ventilating and warming, together with the other sanitary arrangements of barracks, be placed in charge of some officer responsible for their efficiency.

4. Improvements in Lighting of Barrack Rooms.

In all country barracks the barrack rooms are lighted with the usual ration candle, and the barrack yards by oil lamps. In such cases the lighting is most unsatisfactory and uncomfortable. In this class of barracks of course gas cannot be obtained from public works, but for all country barracks of any size, it is worthy of consideration whether gas might not be made on the spot, as is the case with railway stations.

Even in the most remote parts of the country there are numerous small stations supplied with gas of their own making. We can see no reason why what has been done for the convenience of a small periodical passenger traffic should not be done for barracks where several hundred men are congregated together.

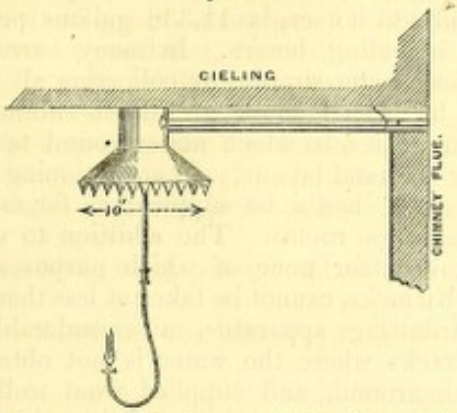
Barracks near towns, where gas can be readily obtained, are generally lighted by it. There is usually a burner with one or two branches for each barrack room, and the barrack yards are lighted with gas lamps. We have, however, met with a number of instances where, though gas is laid on within the barrack enclosure, it is only partially used for lighting; generally the barrack yard, the library, and school room have gas burners, while the men's rooms, and even the hospital wards, have nothing but candles. We have met with cases in which, though gas could be readily obtained, it was not laid on at all. Although improvements in lighting barracks have been much more slowly introduced than in civil establishments, there has nevertheless been a progress in the right direction. We have recommended in every case where gas could be obtained, that it should be laid on over all the buildings within the barrack enclosure.

In no barrack room lighted with gas have we found any provision for ventilating the gas burners. This absence of gas ventilation has no doubt in many cases added seriously to the impurity of the air in barrack rooms. Every burning candle introduced into an inhabited room is about equivalent to the addition of a fresh inmate. Two common gas jets require more fresh air than suffices for the respiration of three men. Two fan gas lights, similar to those in use in barrack rooms, are equivalent to the addition of eight men to the occupants of the room. Each cubic foot of good coal gas consumes about $2\frac{1}{4}$ cubic feet of oxygen, and produces $1\frac{1}{4}$ cubic feet of carbonic acid, together with a large amount of watery vapour and other deleterious products, which, when diffused through the atmosphere of a crowded room, produce oppression of the vital powers, and other sensations, similar to those arising from great overcrowding and insufficient ventilation. But the remedy for this evil is simple enough. An ordinary ventilating shaft, if not too far from the gas burner, effectually removes the products of combustion, while the heat of the gas increases the draught of the shaft. Hence, in ventilating the room, we have also ventilated the gas burners.

Where, however, the distance between the burner and the shaft has been too great, and where there has been danger of the foul air becoming diffused through the atmosphere of the room, we have had the burners ventilated separately by a ventilating funnel and

tube of the common form, Fig. 38, to convey the products into the chimney, an arrangement which not only removes the products of combustion from the gas burner, but improves the ventilation of the room.

Fig. 38.



The hot air from a gas light may also be used for increasing the draught in the foul air flue, by being conveyed directly to it by means of a metal tube. In some peculiar situations, or where the length of the shaft or the difference of temperature between the air in the room and the air outside is too small to occasion a current in the ventilating shaft, a gas burner placed at the lower end of the shaft becomes of great use in producing a current. All barrack outbuildings, such as cook-houses, wash-houses, ablution rooms, latrines, urinals, &c., should be lighted with gas. We have been glad to find that in some cases this has been already done.

5.—Improvements in the Water Supply of Barracks.

The sanitary objections we have taken against the principle of water supply at present adopted in the great majority of barracks, are :—

1. That the source of supply is frequently from shallow wells, dug in a porous subsoil more or less charged with organic matter, and in many instances close to cesspits and other nuisances.
2. That the amount of water is often deficient for the purposes of latrine drainage, and baths, although sufficient for other purposes.
3. That the manner of distribution is by hand labour.

With reference to the first of these objections, namely, the source of the supply, there is a remedy at hand wherever there are public water mains in the vicinity of the barracks, and accordingly, in all such cases we have recommended that water be obtained from the mains. This recommendation only amounts, in fact, to carrying out a principle already adopted in many town barracks. Wherever there are no mains, and spring water can be obtained within a moderate distance of the barrack, we have advised pipes to be laid to bring it in. In several such instances we have found that water had actually to be carted from the spring to the barracks at a considerable cost.

Where access could be had to good river water, we have recommended its introduction after being filtered.

When, from the local position of the barrack, none of these sources could be rendered available, we have advised the deepening of existing wells, or sinking fresh deep wells in a better part of the ground. We have however made this recommendation only where it appeared to be impossible to derive water from other sources. Most of the superficial area within barrack enclosures has become more or less used up by infiltration of impurities from hundreds of men and horses, who have occupied the ground for perhaps many years. Shallow wells derive their water solely from the rainfall on the area within which they are dug. So that at the best water derived from a barrack yard is only surface drainage, filtered. Deep wells, or wells dug in new ground are less liable to this kind of pollution. We nevertheless, consider it to be desirable to give this caution in regard to these wells.

In cases where the water supply has been polluted by infiltration of impurities from the subsoil, or from cesspits, &c., we have advised the immediate closing of the wells, on the principle that the risk to health from deficiency of water is much less than from impurity.

As most barracks are without any drainage, in the proper sense of the term, and as laying down drains, without sufficient water to keep them clean, is a mere delusion, we have found it necessary in many instances, on account of the drainage alone, to advise the extension of the water supply from one or other of the above-mentioned sources. The precise additional expenditure of water required for drainage, baths, &c., over the present available supply of barracks can hardly be ascertained, without determining the

yield of existing wells over a considerable period of time. If we are to be guided by the provision made by local authorities for the wants of the civil population, about 20 gallons per head of water per diem will be required for all barrack purposes, including baths, wash-houses, &c. The actual measured consumption at Knightsbridge barracks for 572 officers and men, and 383 horses, is 11,336 gallons per day for all purposes, or under 12 gallons a head including horses. In many barracks considerable addition could be made to the existing water supply, by collecting all the roof water into tanks. Wherever such tanks can be placed above ground it should be done to prevent the liability to infiltration by impurities, to which underground tanks are liable, and to save the trouble of raising water by hand labour. In apportioning the water supply it should be borne in mind that rain water should be supplied as far as possible to women's wash-houses, and for baths, and ablution rooms. The addition to existing supplies for baths, drainage, latrines, urinals, &c., for none of which purposes there is at present any provision in the majority of barracks, cannot be taken at less than 3 gallons per man per day.

With reference to distributing apparatus, a considerable improvement has been effected, even in many barracks where the water is not obtained from mains. Tanks, at a sufficient height above ground, and supplied from wells by force pumps worked by hand labour, are very generally in use for supplying ablution tables by gravitation. Cook-houses, washhouses, and urinals are not unfrequently supplied in the same way; the principle, therefore, is already in operation; it has been found to answer well in practice, and we have recommended the extension of the principle, to include the entire water supply of barracks. It is a point worthy of consideration, however, whether in barracks of a certain size it would not be better to raise the water by means of a small steam engine to one central tank at a sufficient height above ground, or by means of a form of windmill now coming into use for supplying motive power for such purposes, and to lay the water on over the barracks. The objections to the windmill are, of course, that the tank must be of sufficient size to contain two or three days supply, and that in stormy weather, the windmill, however constructed, must require careful superintendence.

The water supply of Dover barracks is raised by steam power, but this is done under circumstances where manual labour would probably be insufficient.

In a matter where so much improvement is required in order to raise the water supply of barracks to the same standard as the water supply of improved towns, a considerable time must elapse before the necessary works can be carried out.

The present water sources of barracks are the same as those which have been given up for many years in improved towns. The method of distribution is still in a comparatively rude state, and the quantity of water requires to be increased for sanitary purposes. These are the points which should be kept in view in dealing with this important matter.

6.—Improvements in Barrack Drainage, Latrines, and Urinals.

The chief difficulty we have found in dealing with the drainage and latrine arrangements of barracks has been the question of drainage outlet. Surface drainage and refuse water from ablution rooms, wash-houses, and cook-houses, is generally conveyed away in brick or pipe drains of very various dimensions and construction. Any that we have seen are vastly too large for the water they have to carry off. In one such example, we found the outlet sewer intended to convey away the rainfall together with the ablution, wash-house, and cook-house water, from a barrack of under 1,000 men, no less than 4 feet high by 2 feet 6 inches wide, the sectional area of the sewer being many times greater than necessary. In such cases where the fall is deficient, the sewers accumulate deposits, and give rise to nuisances in hot weather. This state of the superficial drainage should be remedied as repairs may be required, and in doing so more attention should be paid than has hitherto been the case to the relation which the section of every drain ought to bear to the fall, and the quantity of water it has to convey.

In barracks in towns and suburbs of towns, the surface drainage usually passes into the general system of sewerage.

In country barracks, the surface drainage is conveyed to the nearest river or water-course, and there discharged. In many instances, however, there is no such outlet, and the drainage is allowed to pass into stagnant ditches, which in hot weather give rise to serious nuisance not only within the barrack, but to the neighbouring houses.

There are instances again in which the site is so low, and the fall consequently so insufficient, that it is hardly possible to obtain an outlet. In one such case, we have been obliged to sanction an attempt to dispose of the surface drainage of a large barrack, that at Hounslow, in regard to which serious complaints had been made, by sinking soak wells in the gravelly subsoil, at as great a distance as possible from the barrack, but we have required in this case, that the whole surface drainage should be previously

passed through a sand filter. The district is at present totally undrained. If drainage works be ever carried out, the barracks will of course derive benefit from them.

Such being the difficulty of obtaining an outlet for the surface drainage of country barracks, it is scarcely necessary to state that it is impossible in not a few instances to obtain an outlet for the drainage of latrines. Their contents cannot be discharged into ditches, and in a number of instances, especially in Irish barracks, persons living in the neighbourhood, object very decidedly, and very properly, to throwing this kind of drainage into watercourses or rivers.

Up to the present time the use of cesspits within the barrack enclosure and immediately connected with the privies has been universal in country barracks, and yet we are bound to express our conviction that in no one instance has it appeared to us to be absolutely necessary to resort to these expedients.

Latrine drainage can be much more safely and satisfactorily disposed of in one of three ways :—

1. It may be discharged at an outlet where it can do no harm, provided such outlet be available.

2. It may be conducted in pipes to a filter and the liquid used for irrigating grass lands at a sufficient distance from the barrack boundary ; the solid part being periodically removed.

3. It may be conveyed to an impervious manure tank at a distance from inhabited buildings, from whence it can be run off into water-tight manure carts, and so removed daily or at other short intervals, or the sewage may be discharged direct from the latrine once or oftener a day into a water-tight cart and removed.

In one or other of these three ways the latrine drainage of every barrack should be disposed of.

In a few instances we have found cesspits in use, where it was possible at a moderate outlay to obtain access to an existing outlet. In such cases we have recommended proper sewers to be laid down for the purpose. In one such instance, at Chichester, in order to meet a local objection, it has been proposed to us to construct a filter bed at a distance from the barrack, through which to pass the drainage before entering the sewers.

As a general rule, we object decidedly to the loss of fertilizing matter involved in running sewage to waste, even when filtered. No one who has seen the irrigated meadows at Edinburgh or near Watford, or even the single irrigated field over which part of the sewage of Parsonstown barrack is allowed to flow, can otherwise than regret the incalculable loss continually incurred by the present method of disposing of town sewage. The waste is perhaps more to be attributed to popular ignorance and prejudice than to anything else, for it can never be supposed that it would be allowed to continue if the fact were realized, that the annual value of a strip of sand on the sea shore near Edinburgh has been raised from 2*s.* 6*d.* to 18*l.* per acre, merely by allowing sewage water to flow over it. The proprietor of the irrigated field at Parsonstown has strenuously opposed any attempt at interference with the irrigation, although it is close to the walls of the hospital, to which it has occasioned nuisance, on account of the large amount of produce which this very imperfect irrigation has raised. The nuisance in this case, as in others, is due not so much to the irrigation, as to a foul stagnant ditch about 70 yards long, conveying the sewage. The field is much too close to the barracks, but we were of opinion that the nuisance might be almost, if not altogether, abated by laying a pipe drain in the ditch, and filling the ditch up, and we therefore recommended this to be done.

The most economical way of removing excreta is certainly by means of water, and we have, therefore, as a general rule, advised that inquiry should be made whether any neighbouring farmer or proprietor would take the sewage for irrigation before resorting to any other method of removing it.

As the population of a barrack is not large, we have fixed the nearest point at which irrigation should take place, even in the most populous barracks, to 500 yards from the boundary. With ordinary care, no nuisance can arise from the process of irrigation. The earth and the vegetation rapidly absorb or deodorize the fertilizing matter, and where nuisance is experienced it will generally be found to arise from defects in the drains, but not from the land itself.

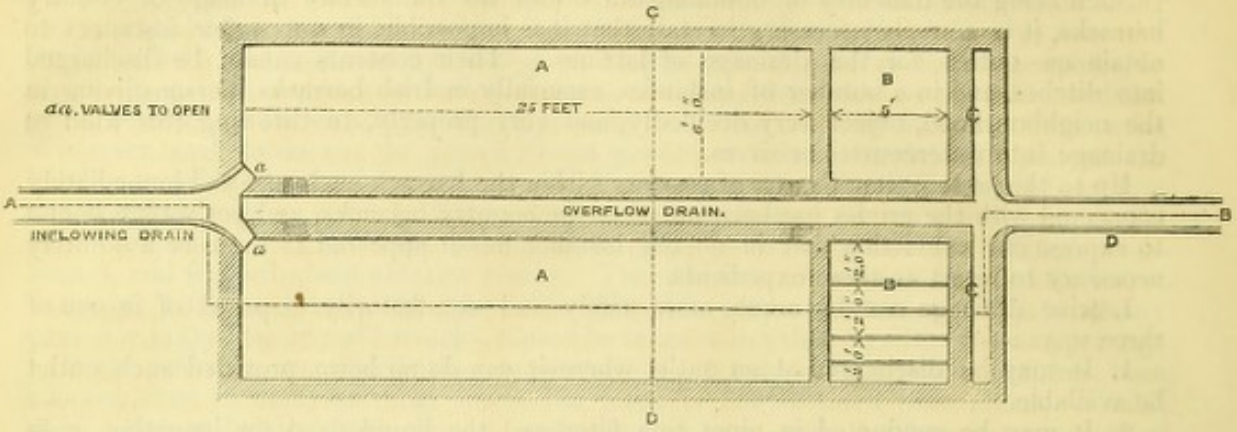
The discharge of barrack drainage is not constant, but periodical, and it is necessary, in disposing of the sewage by irrigation, to make provision for its being received into a sewage tank, situated on the higher level of the ground to be irrigated. The fluid part, which contains about five-sixths of the fertilizing matter, ought to be separated from the comparatively inert solid matter by filtration, before being applied to the land, and the solid refuse should be taken out by hand and used for manure.

The form of tank we have recommended for adoption, when filtering is required, is shown in Fig. 39.

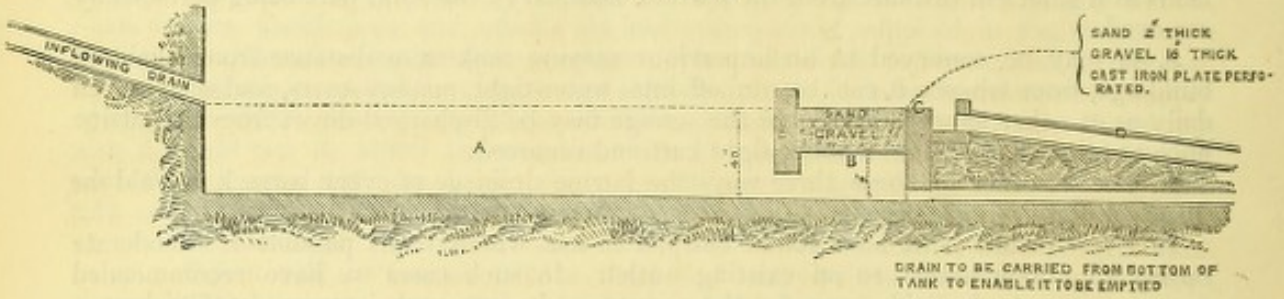
Fig. 39.—Filtering Tank for Sewage.

Capable of filtering about 6 gallons of sewage per minute.

Pl[a]n.



Section on A, B.



Two tanks are shown on the sketch, one to be in use whilst the other is being cleansed, but it is probable that in the generality of cases one tank would suffice, as the heavy sediment may be removed without difficulty while the tank is full; if necessary the filtering compartment might alone be made in duplicate.

The top of the tank should be covered either by a brick arch or otherwise, an opening being reserved for cleaning. The filtering material is clean gravel or shingle and sharp sand, both being as free from earth as possible. The sand and gravel may be washed when foul and used again. The washing in such a tank as that shown above would probably occupy two men from a quarter to half a day.

The sewage is received into the larger tank A, where it deposits the heavy matter, the lighter matter floats on the top and is kept away from the filter by the cross wall E; the liquid passes up through the filter in the compartment B, and flows off at C into the drain.

In the present state of public intelligence on this subject, we have considered it probable that the boon of being permitted to apply barrack sewage to irrigation would, in most cases, be refused by neighbouring farmers, and we have therefore had under consideration other methods of disposing of it. In certain cases it has been necessary to make use of impervious manure tanks, at a distance from inhabited buildings, from whence the sewage is removed in water-tight carts; but the best plan which has come under our notice, where an outlet is not available, is a plan used at Glasgow barracks, whereby the contents of the latrine are discharged into a water-tight cart once or twice a day, and removed. Th s process, which we have seen in operation, is quite satisfactory. It is attended with little or no nuisance, and no cost is incurred in the removal, as the manure is taken by a farmer. We shall afterwards revert to this plan when describing the latrine to which it is adapted.

The principles we have kept in view in improving barrack drainage, are,—

1. The abolition of cesspits forthwith.
2. The application of the sewage to agriculture in one of the methods mentioned.
3. Drainage into existing sewers where it can be done without injury to the public health, and at a less cost than would be incurred by using the sewage for irrigation.

If sewers and drains are proportioned to the fall and to the amount of fluid they have to convey, they ought to keep themselves free of deposit if the flow through them be constant. With an intermittent flow, such as takes place in barracks, it would be safe to provide for occasional flushing, at least of certain lines of drain. But this expedient would be unnecessary for the main lines receiving the latrine drainage, because these lines would be flushed out effectually once a day by the discharge of the latrines.

Latrines.—Before cesspits can be abolished, the present barrack privy must be reconstructed so as to admit of the soil being received and conveyed away in water. The most perfect manner of effecting this object would be by soil-pans, and the time

may yet arrive when they will be introduced into barracks. At present, however, there are practical objections to them, which are not easily overcome. The chief of these objections is the large quantity of water required for current use, and the difficulty and cost of conveying this diluted sewage away in carts in cases where no outlet can be obtained, or where land cannot be had for irrigation. Soil-pans can also be easily damaged, and we have been informed of instances, even in hospitals, where they have been wilfully broken by the troops. Unless soil-pans were carefully used, they would also be liable to obstruction, and would involve a large annual outlay for repairs.

Water latrines are preferable to soil-pans, because they are not open to the same objections. They can be made to consume a very small amount of water; they cannot be injured by any ordinary force; they are simple in construction, require very little repair, and are easily kept clean.

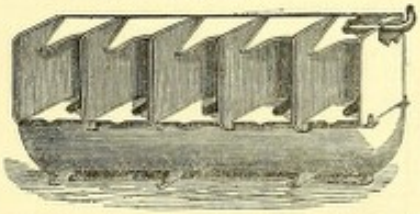
There are various forms of these latrines in use, but the principle of construction is the same in all. It consists in placing a water-trough under the seating, which is filled to a certain depth with water, and discharged into the sewer or drain once a day at least. The whole process is simple and efficient, is attended with very little nuisance, and is perfectly innocuous to health.

The different forms of latrine in use vary in construction and in adaptation to their object. The troughs which have generally been adopted in barracks are of great depth generally four or five feet below the level of the ground. They are constructed of brick cemented, requiring solid foundations, and are consequently very expensive. If kept filled with water, they would consume an unnecessarily large quantity, but in practice they are never filled, and the brick walls become encrusted with soil and produce nuisance. This mode of construction likewise sacrifices several feet of vertical height, which, if a shallower form of latrine were used, would become available as "fall" between the latrine and the outlet.

We do not recommend this form of built latrines, on account of these obvious objections.

A very much better arrangement of water latrines is one by Messrs. Macfarlane of Glasgow. They are made of various sizes, according to the number of seats required. Fig. 40 represents No. 4 size, without the fittings up. The trough, back and divisions are of cast iron. Above the seat there is an iron back plate sloping forwards, the lower edge of which is two feet above the seat. The space under this back plate is connected with a ventilating pipe, and the plate answers the double purpose of diminishing the smell from the latrine, and preventing any one from standing on the seat.

Fig. 40.



The bottom of the trough is slightly inclined towards the discharge hole over the drain, where there is a valve, which can be opened by a lever. The whole contents of the latrine are discharged suddenly into the drain; water is allowed to flow through it for cleansing; the valve is dropped into its place, and the trough is filled to a depth of 9 or 10 inches with water.

The essential parts of the apparatus are a trough, with a depth of not more than 18 inches from the seat, having an egg-shaped section and an incline towards the discharge hole at the rate of a quarter of an inch for every foot. The supply and overflow should be so arranged that, when the discharge valve is closed, water should always stand at a level of 9 inches below the seat.

Troughs which answer the same purpose have been made of stone, glazed stoneware, or they may be made of slate. Any smooth, non-absorbent, easily-cleansed surface would do, but in any case the construction should be as simple as possible, and all the joints should be water-tight.

One of the best of these earthenware latrines is made by Mr. Jennings, of Blackfriars, and has been on trial for some time, at Buckingham guard barrack. Although it has only one water receptacle which is discharged and filled daily, like other water latrines, it is constructed so as to resemble a number of detached water-closets or soil pans. It is free from smell, and has shown no liability to choke up or to get out of order. The sketches (Figs. 41 A, B, C, D), show the arrangement of the latrine.

The discharge in the present water latrines is effected by a ball valve of sufficient size, the ball is raised out of its socket by a lever, and the contents of the latrine discharged through a syphon trap into the drain, and the ball dropped into its place.

Fig. 41. *A.*

PATENT HYDROSTATIC BALL VALVE.

SECTIONAL ELEVATION OF A SINGLE SET OF JENNINGS' LATRINES.

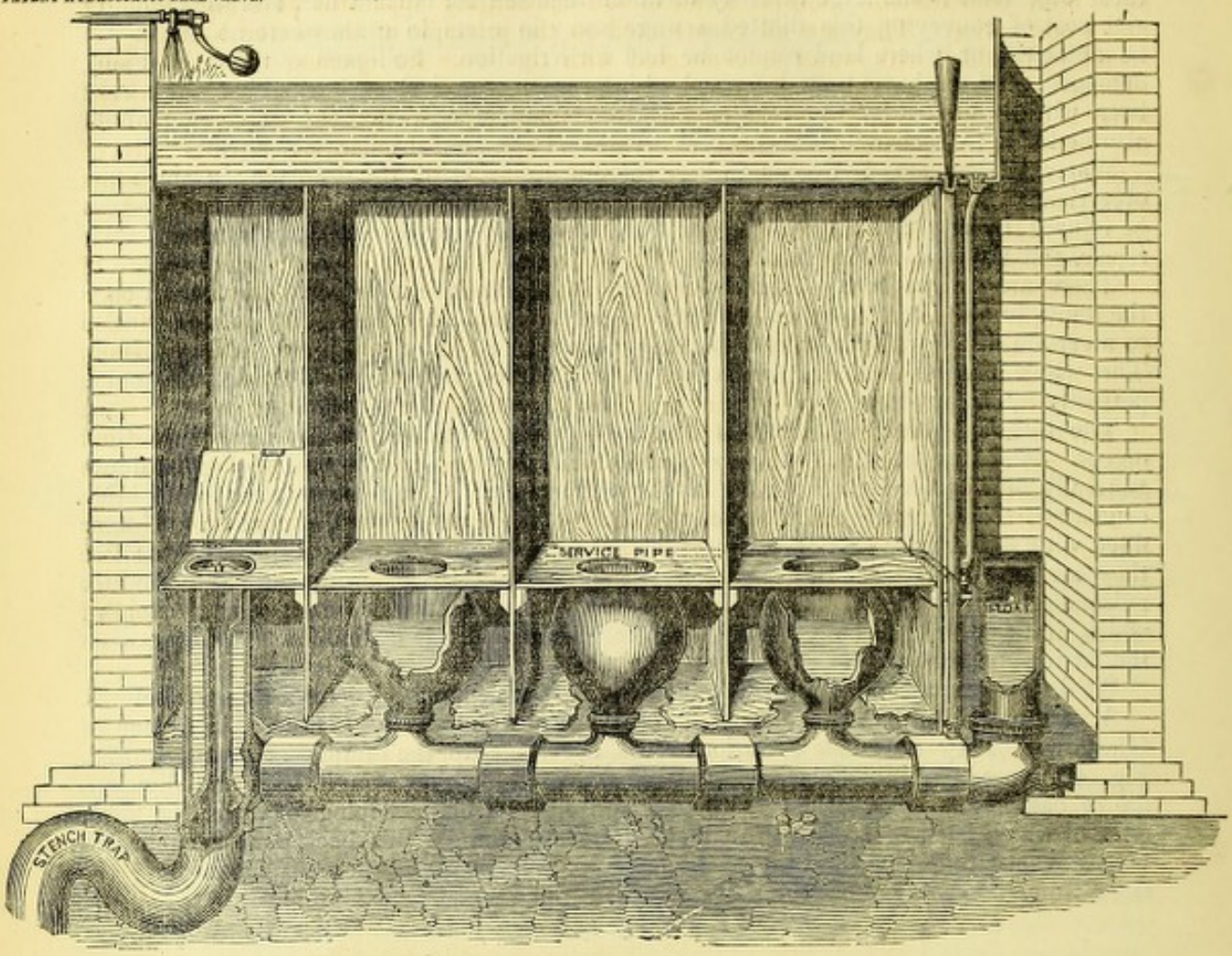


Fig. 41. B.—TRANSVERSE SECTION OF A DOUBLE LATRINE.

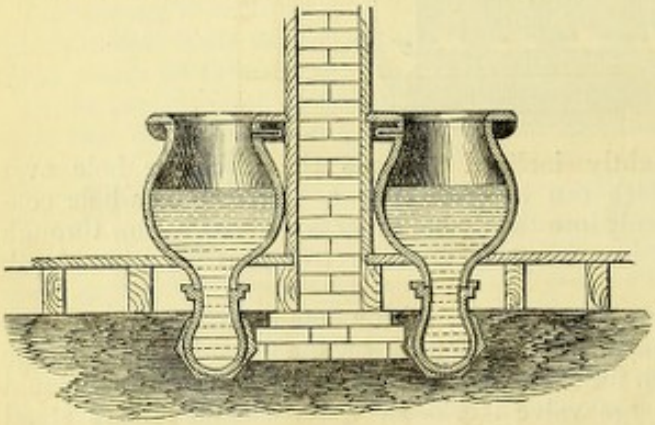


Fig. 41. C.—SIDE ELEVATION OF A SINGLE LATRINE.

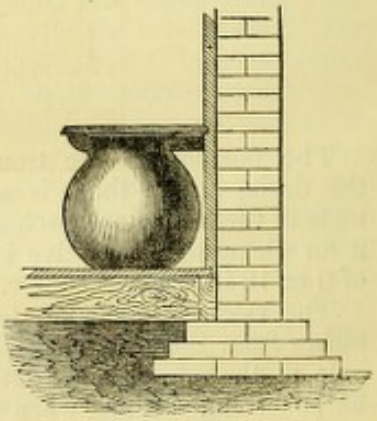
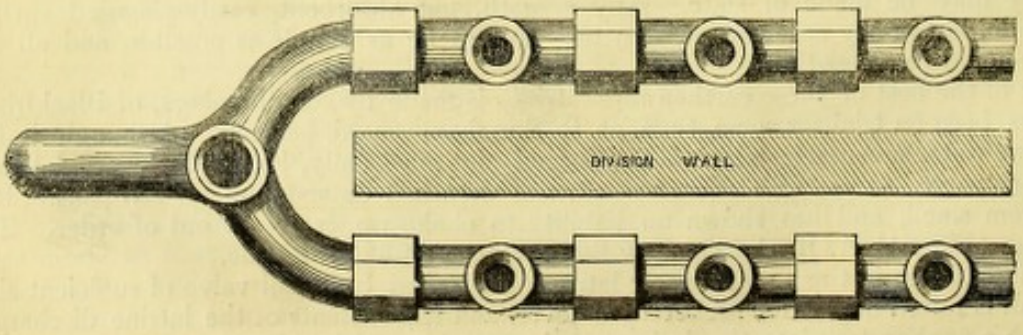


Fig. 41, D.—GROUND PLAN OF DOUBLE LATRINE.



Other and better forms of valve, serving the twofold purpose of valve and overflow, have been constructed. Several forms of self-discharging apparatus have been brought under our notice. They are all constructed on the principle of the water balance. A vessel to be filled with water is connected with the lever for opening the valve, and, when so filled, its weight discharges the latrine. In one form of latrine so constructed water is constantly supplied to the balance by a small pipe, so that the whole contents of the latrine are discharged at short intervals. These self-discharging latrines are, of course, only applicable in barracks where there is an outlet for the drainage. Complaints have been made to us that the discharging apparatus is apt to wear, or to get clogged, so that the water escapes from the latrine.

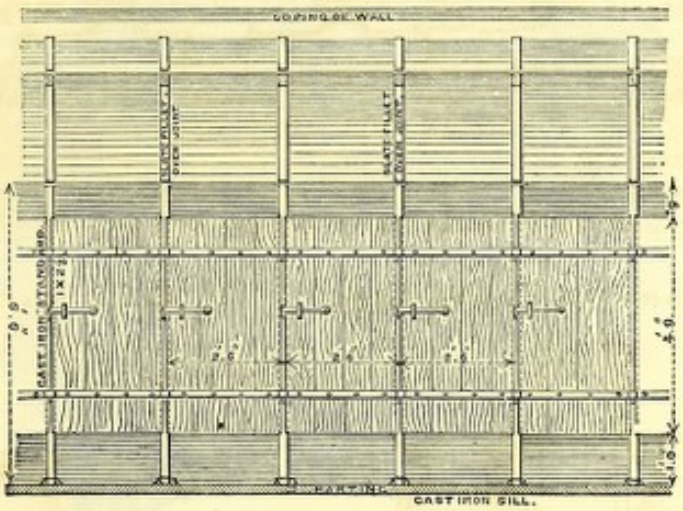
Self-discharging apparatus may be useful in some situations, but, as a rule, we are of opinion that it is better to make it somebody's duty to raise the valves, and see that they are in proper action, to see that the latrines are properly supplied with water, and also that they are kept clean. This last duty is, in our opinion, imperative, and in seeing to it, the discharge and water supply could be attended to at the same time.

We have in the previous section of this report alluded to the indecency and want of privacy in the ordinary barrack latrine. To remedy this evil we have recommended that proper divisions be placed between the seats, and that half doors be hung on the division partitions.

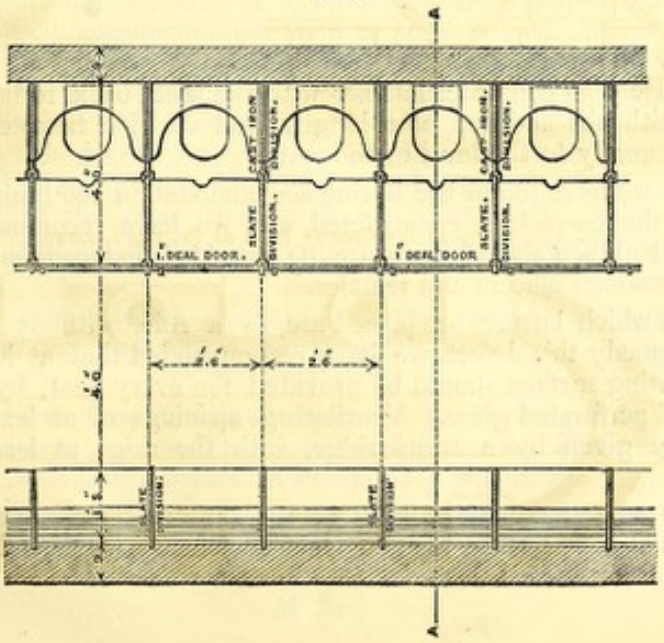
The latrine is divided into separate closets by divisions of slate, wood, cast iron, or corrugated iron, slate being the best, at least 6 feet high, 2 feet 6 inches wide, and 4 feet deep, provided with doors descending to within a foot or 15 inches of the ground. Fig. 42 shows an elevation and plan of these divisions and doors, as recently adopted, applied to one of Macfarlane's latrines.

Fig. 42.

ELEVATION.

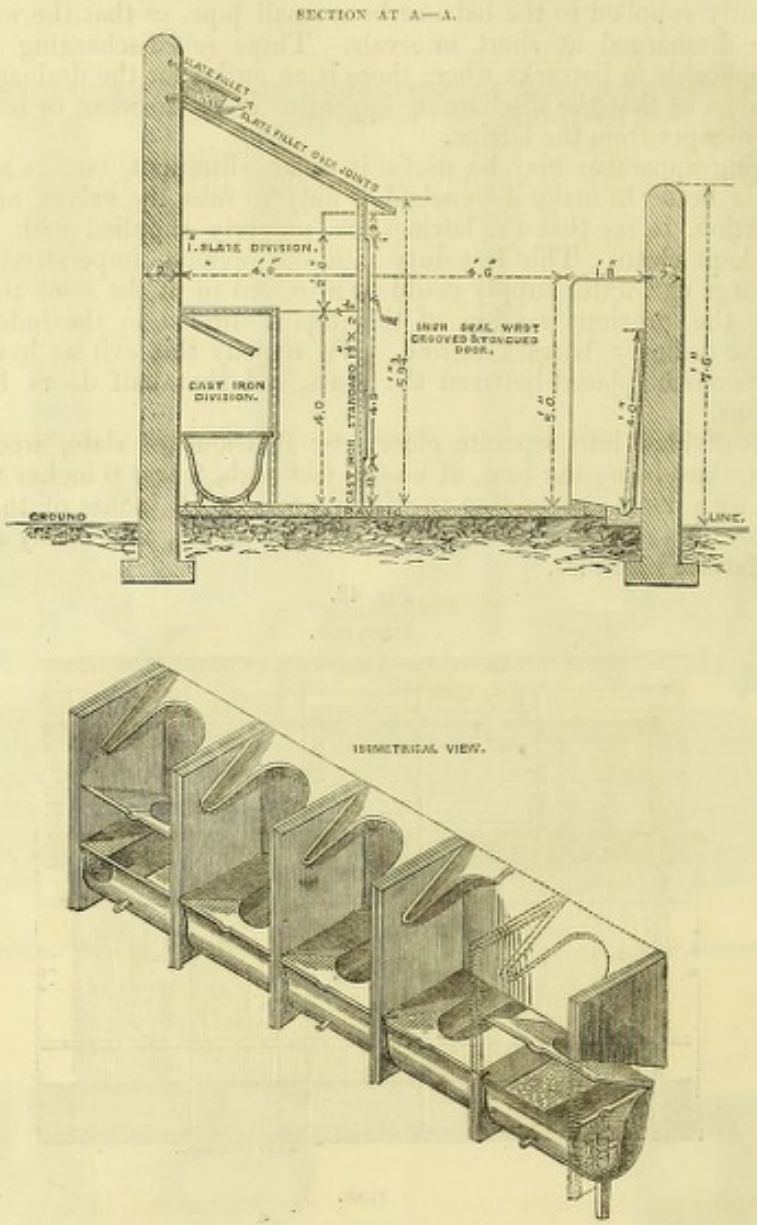


PLAN.



A section of the same arrangement is shown in Fig. 43. The figures also show a plan and section of the urinal (Fig. 45), and its position with relation to the latrine.

Fig. 43.



Where it is necessary to construct latrines with the seats back to back, the same plan may be adopted, with the addition of a longitudinal division between the two rows of seats, carried down nearly to the level of the water.

In most barracks we have found the latrine accommodation too limited for the number of men for whom the barrack is constructed, and we have recommended that not less than five seats per 100 men should in future be provided, independently of accommodation for non-commissioned officers and females.

The buildings in which latrines are placed are, as a rule, without sufficient light and ventilation. To remedy this defect, we have recommended that at least one and a half square feet of lighting surface should be provided for every seat, by glass slabs in the roof, or windows of perforated glass. Ventilating openings of at least 12 square inches per seat should be given by a raised ridge, with the ridge at least 10 feet from the ground.

Where, from the structure and position of the buildings, ridge ventilation is inapplicable, a vertical shaft 10 or 12 feet high should be placed in a central position, having a

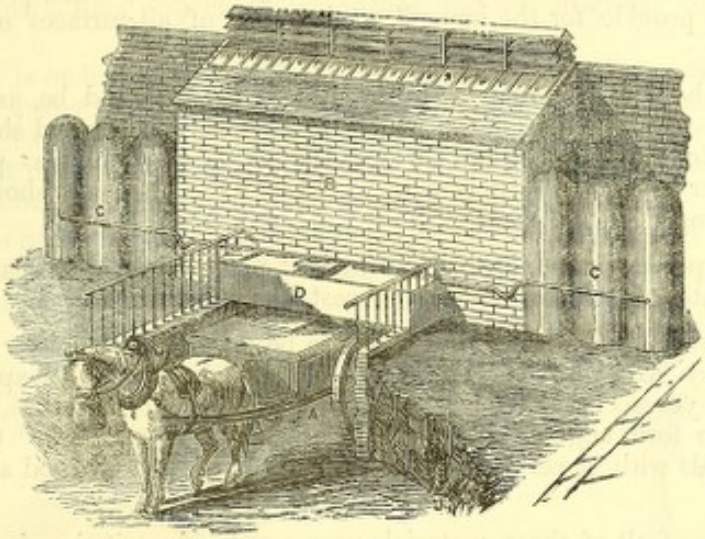
sectional area of at least 12 superficial inches per seat, and, if possible, with a gaslight in it.

In cases where no outlet for the latrine drainage is available, either by sewers or for irrigation, the only other resource, as already stated, is to remove it in a water-tight cart, and that this plan is a practicable one has been proved by the Glasgow experience already alluded to.

Glasgow infantry barracks have two latrines, one on each side of the entrance gate. There were originally cesspits under them, which were a source of great nuisance, and as a large sum was asked for permission to drain into the town sewers, the following plan was resorted to. The buildings were fitted up with Macfarlane's iron latrines, the discharge pipe of which was carried out directly behind the latrine. The earth was cut away to enable a water-tight cart to be backed down the slope under the pipe, and every day the sewage matter is discharged into the cart, and removed. The cart has a lid for admitting the discharge pipe, and also a valve for emptying it at the manure depôt. In order to save the urine for manure, the urinals can be drained into a urine tank, to be discharged into the cart, together with the contents of the latrine. It is advisable to keep the two separate, on account of the great increase of nuisance from admitting urine into the latrines.

The arrangement for removing the contents of both latrines and urinals is shown in Fig. 44.

Fig. 44.



This figure represents an elevation of a building containing latrine accommodation for 10 persons, and urinal accommodation for 3 persons at each entrance. The latrines and urinals may be either raised above the level of the ground, so that the cart can be backed under them, or the arrangement shown in Fig. 44 may be adopted. In this case, below the wall B there is a 2 feet 6 inches recess A, 8 feet wide, and about 4 feet 6 inches deep, the wall of the latrine being supported by a cast-iron lintel 1½ inches thick, with a central rib projecting upwards for strength. In like manner a cast-iron floor plate 1 foot 6 inches broad, of the same strength (but without a rib), covers over the recess inside of the building, and on this the latrine trough rests, the drop pipe of which passes through it.

An inclination of about 3 inches to the foot is the steepest inclination which should be adopted for the cart roadway, and it should be fenced in by a parapet wall and rail on each side.

The latrine and urinal accumulations require to be discharged at least once every 24 hours in the following manner:—The hinged door in the top of the cart is opened, and the cart backed until the opening comes under the drop pipe of the latrine tank, the valve of which is then opened, and the whole contents rush into the cart; the valve is then closed, and the same operation is gone through with the urine tank, and the contents of both are carted away to be used for manure.

By this means much valuable manure may be saved to the community, foul smells from the drains avoided, and the pollution of streams and rivers entirely prevented.

We have recommended, in all barracks where the soil-pit system is in use in connexion with latrines, that the cess-pits be thoroughly cleaned out, filled up, and abolished, and that one or other of the foregoing systems of removal be adopted; in most cases the same buildings will be available under the changes proposed.

In cases where latrines are flushed into drains, the ventilation of the drains must be very carefully attended to, to provide against the gases being forced through the traps when a large quantity of water is suddenly poured into the drain. Ventilation may be afforded by carrying flues or pipes from the drain to above the tops of the buildings, and by placing a box of powdered charcoal over the end of the pipe. Foul gases containing organic matter are rendered innocuous by simply passing them through charcoal, and this expedient should be resorted to in the ventilation of all sewers and drains. The charcoal should be kept dry, and its cubic quantity proportioned to the discharge of gas. In ordinary drains a few inches in thickness of the powder are amply sufficient to effect the object.

Urinals.—The ordinary barrack urinal is a nuisance, but it is not an easy matter to replace it by another entirely free of smell and at the same time not liable to injury.

The difficulty in preventing nuisance arises from the circumstance that the smallest quantity of urea deposited on any part of the urinal not only passes into a very offensive state of fermentation, but it acts as a ferment and determines the same change in every addition made to its amount. Any form of urinal, therefore, which proposes to remedy this defect must provide for the immediate cleansing of all surfaces on which urine is likely to fall.

There should be few or no angles in the urinal; there should be, as far as possible, continuous surfaces. The material of which the surface is composed should be polished and impervious to moisture. The surface should be as limited as possible, and the urine should either be diluted largely with water, or some provision should be made for immediate cleansing of the surface.

The common porous stone or brick urinal at present in use in barracks should be discarded, and slate, glazed earthenware, or cast iron substituted.

Slate forms a very good surface, but it has to be joined with angles. Glazed earthenware answers very well so far as surface is concerned, but in all applications of this material we have yet seen it has been conjoined with other materials, such as slate or cast iron, so as to form angular spaces where urea can be deposited. Cast iron can be formed into urinals with fewest angles, but the surface is not so good as in either of the others.

On the surfaces of all of these materials urea can be deposited and produce nuisance, though not to such an extent as on porous surfaces.

A common expedient for preventing deposit is to carry a perforated water-pipe along the top of the urinal so as to allow a thin sheet of water to flow down the surface. This, however, is only partially successful, for the water is not always flowing, and the holes become more or less obstructed by rust, so that in a short time the water is supplied to the surface irregularly, and deposit ensues. The nuisance from this class of urinals is, however, very much less than from urinals not supplied with water.

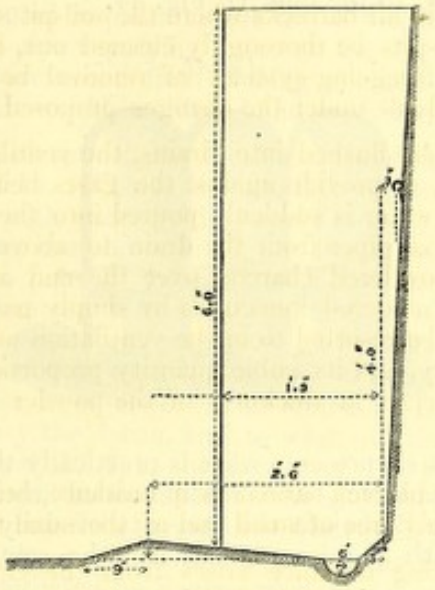
Properly constructed slate urinals can be kept clean without a continuous flow of water over the surface, provided a sufficient water supply be accessible for a thorough daily cleansing, and the cleansing be regularly attended to.

In another class of urinals there are basins of earthenware or of iron kept partially filled with water, but even this form is not free from smell. It is, moreover, somewhat complicated for ordinary barrack yard use, and requires a large quantity of water.

On the whole we have considered it better to adopt the simplest form of urinal, with a good non-absorbent surface, and to trust to daily hand cleansing to prevent nuisance, whether the urinal be supplied with water continuously or not.

A good form of slate urinal, and one capable of being easily kept clean, is shown in the sketch, Fig. 45.

Fig. 45.

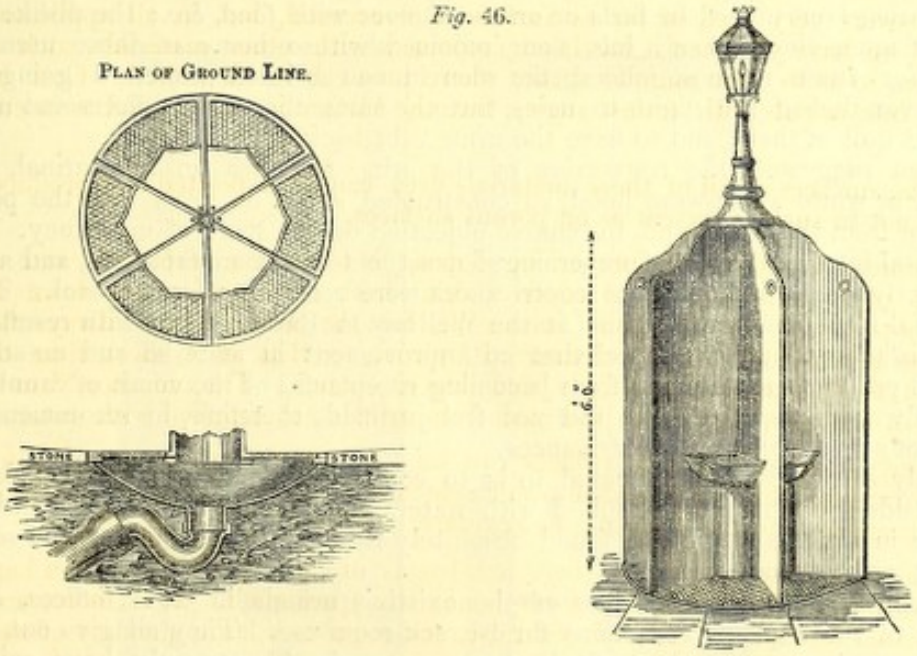


Urinals on this principle are arranged in line, and have slate divisions. The divisions are two feet apart, they project fifteen inches, and are from five feet six inches to six feet high.

The channel is inclined not less than one-third of an inch to a foot. Water should be supplied by a perforated pipe (a copper pipe is best) carried along the back horizontally, about four feet from the ground, with adequate pressure. When the supply is intermittent, it might be desirable to adopt instead, a plug and a hand hose, with which the urinal could be well washed out and scrubbed at stated times.

Another form of slate urinal with water basins and overflow, made by Mr. Jennings of Blackfriars, is shown in the following sketch (Fig. 46). It is intended to accommodate six persons, and has been found clean and efficient in practice.

Fig. 46.

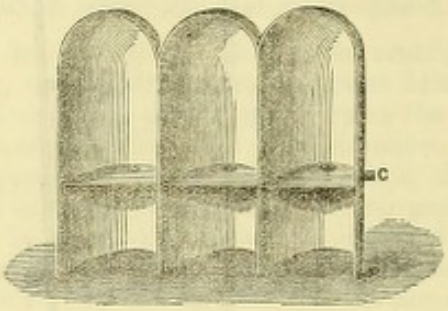


There are several kinds of cast-iron urinals, on a somewhat similar principle to the slate urinal Fig. 45, but they are more difficult to keep clean.

Mr. Macfarlane, of Glasgow, has constructed iron urinals cast in one piece, with a hollowed back and domed top. There are no angles in them and they consequently

admit of easy cleaning. Their form is shown in Fig. 47, except that the shelf is omitted. The shelf shown in Fig. 47 is intended to catch the urine, in order to its being conveyed by the pipe C to the tank D, Fig. 44.

Fig. 47.



One or other of these forms represents what is practically the best urinal yet contrived for ordinary barrack use, and we have recommended their adoption. No form of construction we have seen will obviate the necessity of daily cleansing, and that urinal which can be kept clean with the least labour and the smallest expenditure of water is the best for use.

Barrack-room Urinals.—One of the most difficult subjects with which we have had to deal is that of urine tubs in barrack rooms. They are an abomination in every respect, whether as regards health or decency, and were very properly condemned by the Royal Commission on the Sanitary State of the Army.

The first remedy which suggested itself was one mentioned in evidence before the Royal Commission, namely, the substitution of the common chamber utensil for the tub.

By an order from the Secretary of State for War, this was tried fairly on a tolerably extensive scale and for sufficient time, and it did not succeed. The practical difficulties were of the following kind:—The large number of utensils, the amount of cleaning required to prevent them becoming a greater nuisance even than the urine tubs, the number of cloths, &c., required for cleaning, the large amount of breakages charged against the men, and occasioned not so much by carelessness as by accident, in putting up and down their iron bedsteads; the want of any place to keep the utensils—leading to their being kept under the beds or on the shelves with food, &c.; the dislike the men had to bringing their friends into their rooms when so many of these utensils were about. For these reasons, indeed, the men in one barrack preferred going out of barracks even during the night to using them. Altogether, both officers and men were glad to get quit of them, and to have the urine tubs back.

We then suggested the conversion of the urine tub into an iron urinal, with an enamelled or white stone-ware hood, so constructed as to do away with the possibility of nuisance from the urine, and to remove objection on the score of indecency. We put this proposal into the hands of experienced designers and manufacturers, and a number of apparently simple and efficient contrivances were sent to us for approval. These we had on trial for a considerable time at the Wellington Barracks, but with results by no means satisfactory. It was found that no improvement in material and no amount of care could prevent such utensils from becoming receptacles of the vomit of drunken men, or even of worse nuisances. We did not feel justified, therefore, in recommending the adoption of any one of these contrivances.

The only other resource appeared to be to contrive a fixed urinal, to be placed in a recess outside the room, and supplied with water, which could be kept clean with ease, and which in practice would be found absolutely free from odour, and at the same time consistent with decency in use.

It appeared to us that not one of the existing urinals in clubs, offices, &c., was possessed of the requisite conditions for barrack-room use. They all give out offensive smells in time, and any that we have seen we should certainly have rejected as unsuitable for our object.

One cause of the difficulty is, that in existing barracks there is no space where such urinals can be conveniently placed, except within the rooms. There are very few barracks where space could be found for them on the landings, and besides, it would be inadvisable to require the men to go out into cold air if it could be avoided.

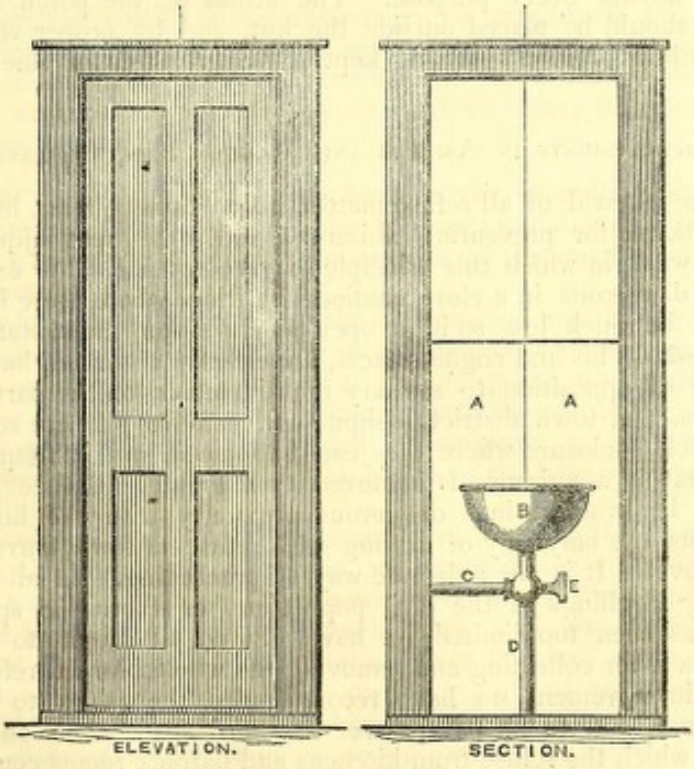
We determined, therefore, on placing a urinal in one corner of the room within the side wall with a door over it, to be opened only at night, and shut through the day. The principle we adopted in planning the urinal was that the urinal should always overflow near the lip from a pipe supplying water at the bottom of the vessel. By this means the urine would be prevented from coming in contact with any surface where it might become putrid, while it would be diluted and carried away without loss of time.

Figs. 48, 49, show a plan, elevation, and section of this urinal, as erected in a corner of a room in Wellington Barracks. The receptacle B is of enamelled iron or white glazed earthenware, and is supplied with water by the supply pipe C through holes in the bottom. The water rises to the water line shown in Figure 49, and overflows at K by the pipe, which discharges itself by a pipe D, a couple of inches over the mouth of an outlet pipe G, three inches in diameter, into the open end of a rain-water pipe H. This arrangement admits of the pipes being cleansed, and admits of a free circulation of air through the pipe. The discharge pipe has a nut at the top, which is removed for cleaning the pipe. The floor is of slate. The stop-cock E is constructed to regulate the supply of water, to empty the basin, and to wash out the tubes. The apparatus is boxed off in a triangular closet A, A, at the corner of the room. It has a door and a ventilator through the outer wall at I. It is, however, undesirable to place these urinals inside the barrack rooms, if it can be avoided. Whenever practicable, they should be placed in projections outside the rooms, with a door opening from the room, and the projecting building should be ventilated by having windows on opposite sides.

Every night when the men retire the door is opened and the water turned on and allowed to run during the night. As soon as the men have risen in the morning the basin and tubes are cleansed, the water turned off, and the door locked. The apparatus is thus entirely cut off from the room, and the space thoroughly ventilated. In new barracks such a urinal would project through the wall, or be otherwise effectually cut off from the room.

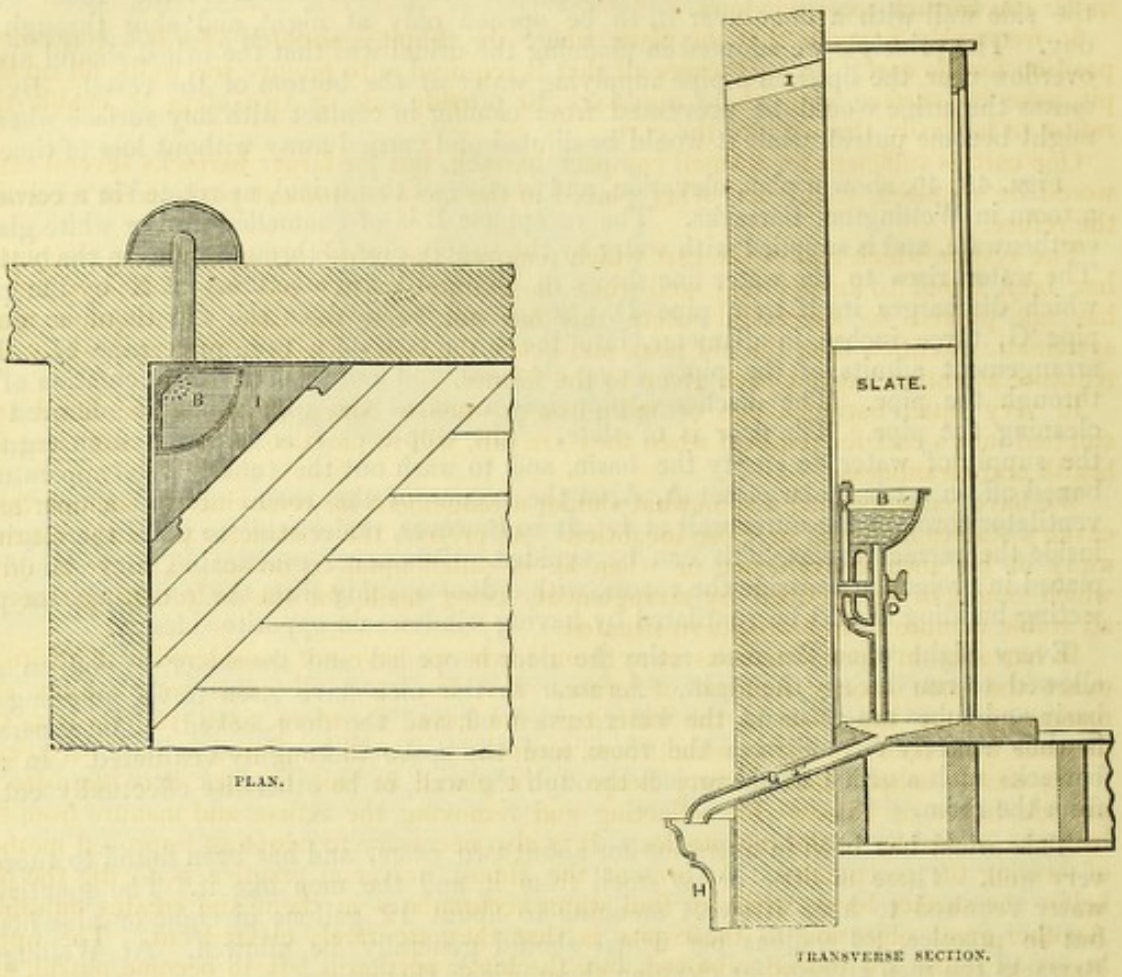
This urinal has been in operation for about two years, and has been found to succeed very well. There is little or no smell from it, and the men like it. The quantity of water required to keep it sweet amounts to about 12 gallons in eight or nine hours, but in practice, 20 gallons per urinal should generally be allowed. At Wellington Barracks the men arrange for cleaning these urinals themselves.

Fig. 48.



SCALE 2 FEET TO AN INCH.

Fig. 49.



PLAN. TRANSVERSE SECTION.

In hut barracks a urinal on this or any simpler plan may be provided, or a porch in which a proper utensil can be placed, so as to be removed and emptied from the outside, will be found to answer every purpose. The urinal or the porch for containing the moveable utensil should be placed outside the hut, and by proper ventilation and due attention to cleanliness, either may be kept sufficiently free of smell for all practical purposes.

7.—Improvements in Ashpits and Manure Pits, Cleansing, &c.

The immediate removal of all refuse matters to a distance from human dwellings is the only safe principle for preventing nuisances and consequent injury to health. But there are various ways in which this principle may be applied. For example, a nuisance which would be dangerous in a close confined position, where there is little movement of the air, would be much less so in an open airy position, the distance remaining the same in either case. This and cognate facts, imperfectly observed, have indeed afforded the chief ground of opposition to sanitary improvements on the part of interested or ignorant objectors. In town districts ashpits and manure pits are scarcely safe in any part of the barrack enclosure where they can be placed, and it frequently happens in such districts, that if a nuisance is removed to a greater distance from the barrack rooms, it has to be brought into dangerous proximity with the houses of the civil population. Hence the only way of dealing with refuse in town barracks is, to provide for its daily removal. It is the only safe way of proceeding. In all barracks in close situations, among dwellings of the civil population, or where the space set apart for barrack offices has been too limited, we have advised all ashpits to be abolished, and provision to be made for collecting and removing the whole barrack refuse daily.

To effect this improvement, we have recommended the ashpit to be filled up to the level of the ground, and to be paved over to afford space where an iron tumbler-cart could stand, into which the refuse from kitchens and barrack rooms could be thrown, and the cart removed daily.

Iron carts made by Messrs. Fry, of Bristol, are well adapted for this purpose. When there are several barracks in the same town, it is easy to organize a service whereby,

with one spare cart to leave empty while the full cart is being removed, the refuse can be taken away at once, instead of lying for days or weeks to rot in the sun and rain under the barrack room windows.

It frequently happens that the place where the ashpit is situated affords a convenient position for the cart. In such cases all that is required is to remove the walls, fill up the pit, pave its surface, and, where necessary, to provide one or two steps to enable the refuse to be easily thrown into the cart.

One cart is sufficient for a small compact barrack, but for larger barracks several carts would be required, each cart being placed in the most convenient position for receiving the refuse.

The system which makes the cart which removes the refuse act as ashpit or receptacle has been found to answer very well when the barrack master has been efficient, but it has not proved so successful where this has not been the case. It requires more systematic attention than the old plan, and hence the latter has been preferred where the requisite attention has not been given to the former.

In very small barracks one or more iron or wooden boxes, which can be lifted and emptied into a cart for removal when they are full, will in practice be found sufficient for health and cleanliness.

We have recommended a somewhat similar arrangement for removing the manure from cavalry stables in towns or close localities. At present the contractor takes the manure away at his own convenience or when he is called upon to do so. This is an error which ought to be rectified by arrangements being made for the daily carting away of all stable manure from barracks so situated.

In barracks in open situations away from towns we have not considered it requisite to exact the same speedy removal of refuse. But in almost all cases both ashpits and manure pits are too close to the buildings; we have, therefore, fixed 150 yards as the distance from men's rooms at which these receptacles should be placed in such barracks.

To enable ashpits and manure heaps to be placed at this distance, it is requisite to provide boxes or barrows for collecting and removing the refuse and manure from the barracks or stables to the receptacles. It is also necessary to adopt an improved method of forming the receptacles. At present the almost universal practice is to dig the pits below the surface level, whereby foul water accumulates in them and creates nuisance. Another great objection to these pits is that they are rarely cleared out. The upper layers of refuse are indeed removed, but the lower portion is left to become putrid, and give off noxious gases for an indefinite period. The proper mode of construction is to raise the bottom of the receptacle above the level of the ground, to flag it, or to pave it with square setts or other close-fitting pavement, and to drain it. On the mere point of saving of labour this alteration would be an advantage, for at present the refuse is *thrown down* into a hole, out of which it has to be again *lifted* before it can be removed.

In barracks where the position of ashpits or manure heaps has been such as to enable them to be used, we have advised their being filled up above the level, and paved and drained in the same manner.

Limewashing of Barrack Rooms.—We have in the preceding part of our Report, pointed out the very defective state of the present regulations in regard to the limewashing of barrack rooms, and the great importance of this matter to the health of the troops in occupation.

We are glad to know that according to the new medical regulations, the interior of all barracks must be limewashed at least once in six months. This regulation has rendered any interference on our part in the way of recommending unnecessary. But we beg strongly to express our concurrence in the propriety of the regulation, and to recommend that it be rigidly enforced. If it be carried out properly, we have no doubt that the air in barrack rooms will be purified, and the health of the inmates improved.

Sanding of Barrack Floors.—Although sand had for some time ceased to be used for cleaning floors in the barracks of the Line, we found it it is still used in the Guards' barracks. Four tons a week of it were so employed in the Wellington Barracks alone. Sand should never be used for cleansing barrack floors. It cleanses them only in semblance, and in doing so it loads the air with irritating dust injurious to health. It is a well-known fact, that all trades in which the men are exposed to inhaling silicious dust, such as masons, potters, &c., show a very high rate of mortality from pulmonary disease. As this class of diseases is very common among soldiers, we deemed it to be our duty to advise that the use of sand should be discontinued, and we believe the practice has been since given up. We have seen the dust from it filling barrack rooms and staircases,

and of course it is breathed by the men. Without attaching undue importance to this matter, we are of opinion, that on the score of cleanliness, no less than of health, the practice ought never to be resumed. Closely connected with this source of impurity in the air of barrack rooms, is—

Pipeclaying.—This is carried to a great extent in the Guards' barracks, in consequence of the men using a white undress jacket cleaned with pipeclay, and the result is, that not only does pipeclay-dust make its way into the general atmosphere of the barrack, but the men are compelled to breathe a dense white atmosphere all the time they are employed in cleaning their jackets. It is in reality a species of "dangerous trade" while it lasts. For reasons given in regard to sand, we have also advised this process to be restricted only to the accoutrements, for which it is absolutely necessary, and a coloured jacket not requiring pipeclaying to be introduced for use. This recommendation has not been adopted.

8.—Improvements in Ablution Rooms and Baths.

Notwithstanding the recent origin of ablution rooms, there has been considerable progress made in rendering them suitable for their object.

In a few instances, where they have been placed in objectionable situations, we have advised their removal and re-construction elsewhere. In cases where there have been no ablution rooms, we have advised their being immediately provided in the best practicable manner. It is not by any means difficult to realize the advantage of shelter to the men while leaving their rooms to wash without incurring the risk of disease from damp and cold. All that is necessary is to improve the ablution arrangements, and to cut off the ablution room from the barrack by a separate and distinct ventilation, so that while there is a covered communication between them, damp air from the ablution room may be prevented from entering the barrack room. The structure of existing barracks renders it impossible to provide an ablution room for every barrack room. In new barracks this can be done, and it should be done, if the soldier is to be encouraged to adopt strict habits of personal cleanliness.

The present means of ablution, namely the slate table, with water taps over it, and moveable basins, is tolerably efficient in practice, provided suitable ledges or beads are supplied to the tables to prevent the water dashing over the front of the table on the men while washing. Where beads have been wanting, we have recommended their immediate adoption.

There is, however, an obvious objection to the present ablution table, from the large extent of wet surface it exposes. In every ablution room we have seen, the floor has been saturated with wet, for the ablution water generally flows over the porous flagging to the drain; and from the nature of the arrangement, water has to be freely used for washing down the tables and floors every day. This defect has rendered it necessary to use wooden gratings laid on the flags for the men to stand on while washing.

In many instances, where these gratings have not been provided, we have recommended their introduction at once.

One advantage of the moveable basins is, that they can be used for washing feet, and the use of separate utensils is thus avoided; but to enable this to be done, forms for the men to sit on are absolutely necessary, and yet in very few ablution rooms have forms been provided.

Ablution rooms are often deficient in pegs for hanging the men's coats on while washing, and hence they frequently expose themselves to risk of colds by leaving them in their rooms.

In all cases where we have found these conveniences deficient, we have recommended gratings the length of the tables, forms along the walls, and one peg for each basin to be provided. As we have found the supply of basins generally too small for the strength, we have recommended as a regulation for all ablution rooms the adoption of 10 basins for every 100 men.

The present form of ablution room certainly admits of improvement, although if all these rooms were as good as certain marked examples, there would be little to complain of.

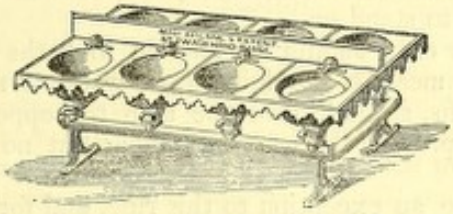
The only question is, whether, as the other parts of barracks are improved, ablution rooms could not be still further improved, so that the amount of wet, damp, and waste of water might be reduced to a minimum. This is of more importance than is apparent at first sight. The present form of ablution room has to be used by a large number of men; it is consequently soaked with water, and cannot be safely placed within the building

containing the men's rooms, as its extensive wet surface produces dampness in the air, and renders its presence near the men's rooms very undesirable, to say the least of it.

Inventors who have had their attention directed to the improvement of ablution apparatus have succeeded, to a considerable extent in this object, and their improvements are already in use in some barracks.

An ablution apparatus of this kind has been made of iron by Messrs. Macfarlane, of Glasgow, with a range of fixed basins, forming a bench, each basin occupying a space of 1 foot 6 inches broad by 2 feet long. A bib cock supplies each basin with water, and a moveable stopper discharges the waste water to the drain; the whole stands on brackets against the wall or in the middle of the floor, as may be found most convenient. The following is a sketch of the arrangement:—

Fig. 50.

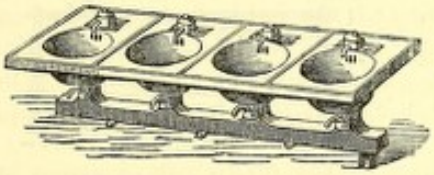


These ablution ranges have been introduced into the new Recruiting Barrack at Glasgow.

A similar arrangement of fixed basins is also in use in the New Marine Barracks at Woolwich. In that instance the water taps happened to be of brass, and they were broken off and stolen.

To meet the objection, that while moveable basins can be used by the men for washing their feet, fixed basins cannot, Messrs. Macfarlane, of Glasgow, have made an arrangement of foot basins, shown in the following sketch:—

Fig. 51.



This apparatus consists of a range of fixed basins, similar in construction to the wash-hand basins, each basin occupying a space of 1 foot 6 inches broad, by 2 feet long, and 1 foot 2 inches from the ground. A bib cock supplies each basin with water, and a moveable stopper discharges the waste water to the drains, the whole apparatus being fixed to the floor and wall. In using it, the men can wash their feet while standing, and the foul water can be discharged by the pressure of the foot. One range of these basins has been put up in Glasgow Recruiting Barrack.

Fixed basins of earthenware let into a slate slab, with water laid on to each, and discharging pipes and plugs in the bottom, are clean and good, but the chain attached to the plug should be of iron, as brass chains are apt to be removed.

Mr. Jennings has invented a very ingenious apparatus for economizing water, which we have had on trial in Regent's Park Barracks. The basins are emptied by being tilted upon one side, and when restored to their original position a fixed quantity of water flows into them by a self-acting arrangement, and waste is prevented.

Should fixed basins be found, on trial, to realize all the advantages of the present system, without its disadvantages, it would be worth while to introduce them in new barracks or in remodelled ablution rooms; in either case, they would enable the ablution rooms to be placed close to barrack rooms, and as each ablution room would only be used by the men in the barrack room to which it belonged, risk of damp from a large wet surface would be obviated.

Where fixed basins are not in use the ablution bench should be of slate, about 1 foot 9 inches broad, with a bead along the front not less than half an inch high; the gutter at the back of the bench should form a continuous channel about 3 inches broad, sloped at an inclination of half an inch per foot; and in fixing the bench, it should be sloped towards the channel at a rate of half an inch per foot.

In order to provide for the rapid removal of water from the floors, they should be inclined towards iron sunk gutters placed longitudinally and across the pavement.

Pegs should be provided in the proportion of one to each basin; wooden gratings should be furnished the whole length of the ablution benches for the men to stand on; a few forms or seats, fixed along the wall, should also be provided.

With regard to the existing ablution buildings, we have recommended, for removing defects in light and ventilation, that $1\frac{1}{2}$ superficial feet of window space or skylight should be provided for every 100 cubic feet of contents; that abundant ventilation by louvres, perforated panes, or otherwise, should be provided, and that the rooms should be frequently limewashed to give them a light cheerful appearance; this in itself is conducive to cleanliness.

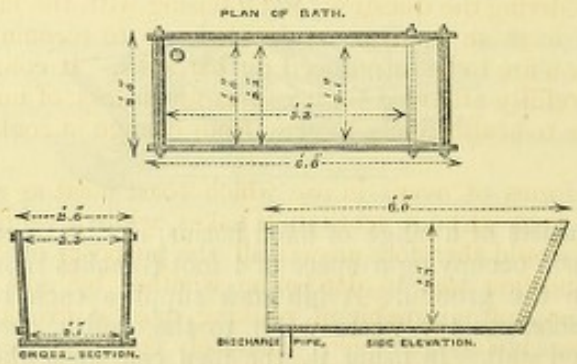
Bathing Accommodation.—We have advised that baths should be furnished to all barracks in the proportion of 1 bath per 100 men; each bath to be placed in a separate berth, about 6 feet 6 inches by 5 feet 6 inches, with side partitions 7 feet high, the front being protected by a wooden screen and door, to within 15 inches of the ground; also a seat, pegs, and a grating to stand on.

In barracks cold water only should be laid on to baths; where, however, the baths are very distant from any means of obtaining warm water, it may be convenient to provide a boiler near to the baths, so as to give the men the opportunity of washing in warm water if they choose to provide the necessary fuel; but no allowance of fuel should be made to such a boiler.

Recruiting barracks are an exception to this rule, and for reasons of cleanliness such barracks should be provided with a hot water bath.

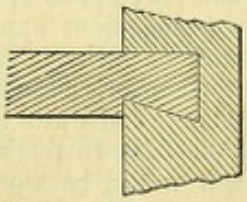
The baths should be of a material easily kept clean and very durable. In the Wellington Barracks some very good baths of fire clay, glazed inside, have been put up, but they are rather expensive (7*l.*) They are, however, perhaps the best adapted for hospital use, or where hot water baths are required, on account of their low conducting power for heat. The accompanying sketch, Fig. 52, shows a plain slate bath which has been put up at Dublin, the cost of which, complete, with $\frac{3}{8}$-inch round iron bolts, braces, plug, and washer, is about 4*l.*

Fig. 52.



The slates are grooved and tongued together, and jointed with slate cement. There is a better but more expensive mode of jointing, viz., by dovetailing the tongue thus,

Fig. 53.



and running the joints with hot lead.

Enamelled slate baths look better, but are more expensive. Enamelled iron baths are less expensive, but the enamel has been found in some cases to chip off or blister after a short time, in which case the rust becomes objectionable. An economical form of plain iron bath painted inside is made by Macfarlane of Glasgow, with a ball cock so arranged as to prevent waste of water; but the paint requires frequent renewal on account of the iron becoming rusted.

In laying the floors in bath rooms it is advisable to sink the baths about three inches below the general level, so as to form what plumbers technically call a safe, and further to slope the whole of the floor towards the safe to facilitate its drying.

A very good form of bath built of brick, lined inside with smooth gray cement, and sunk entirely below the level of the ground has been introduced recently into the camp at Colchester. It is cheaper than any of the others, and will apparently be durable.

It is very desirable that all barracks, containing 1,000 men and upwards, should, in addition to these baths, have a larger bath, eight feet long, six feet wide, and four feet deep; or instead of this, in barracks far from the sea, where the arrangements admit of it, a swimming bath would be preferable, so that swimming might become a recognized exercise for the troops.

We have already stated our reasons why sea baths cannot supersede fresh water baths for cleansing the skin.

Drinking Fountains. — Stirling Castle is the only barrack where we have found drinking fountains in use, and they are stated to be a great advantage. This we can well believe from our experience of the time usually consumed by us in procuring a specimen of barrack water for examination. Facilities for obtaining water for drinking are certainly not among those hitherto provided for in barracks, and yet there could be nothing more simple. We have recommended generally that drinking fountains should be placed in convenient situations out of doors. Those made of cast-iron by Messrs. Macfarlane, of Glasgow, or any other similar form, will be found suitable. We have no doubt that drinking fountains would help to keep men from the canteens, where alone, at present, they have facilities for quenching thirst.

9.—Improvements in Barrack Cook-houses.

In the preceding section of this Report we have described generally the defects in barrack cook-houses as we found them on commencing our inquiry.

There were, as we have stated, a few exceptions or partial exceptions, but the rule was as we have given it. There was little or nothing to guide us in improving the cooking arrangements, and we have therefore had to feel our way carefully before recommending any general improvements which might cost a large sum of money, and be found ill adapted in practice for their intended purpose.

After carefully considering the question, and advising with the late M. Soyer and other persons competent to form an opinion, we decided not to recommend the usual method of roasting meat before a fire to be introduced for barracks. It consumes a large quantity of fuel unless very carefully attended to, it causes much loss of nutriment, and we found that all the advantages to health likely to arise from change in cooking might be obtained by ovens.

There are various forms of ovens in use which roast meat as well as bake it, the difference being that an oven without ventilation bakes, while a ventilated oven roasts.

A boiler and oven would therefore answer all the purposes of variety of cooking, and the only remaining question was to determine whether by any arrangement of these essential elements an apparatus capable of cooking more conveniently and economically for a large barrack than boilers and ovens separately could not be found.

There was no apparatus existing which fulfilled these conditions, but as soon as it was known that such an apparatus was wanted, a number of proposals were made by different manufacturers all apparently more or less suited to the object.

We could not, of course, recommend the universal adoption of any or of all of these contrivances. Such a proceeding would only have amounted to a large and costly experiment that might have failed. Besides which, durability in an apparatus, a small expenditure for repairs, and facility in use, were all essential conditions in the question of economy which could be ascertained only after long experience.

The barrack cooking must, nevertheless, be improved; it could not remain for years as it was until these points were decided. We did know that the ordinary barrack boilers would boil, and that there were ovens that would roast, and, as all things wear out in time, we could at least make use of the means at our disposal, and leave the question of the best general form for a barrack kitchen to be settled by experience.

We have not, then, recommended any one of the apparatus on trial for universal adoption. Experience with them has shown defects not suspected before. Alterations and improvements have had to be made, and we have no doubt that the result will be that an efficient and economical barrack kitchen will in the end be obtained.

In the meantime we shall state what progress has been made in improving existing apparatus, and in providing a uniform system of cooking for all barracks.

Improvement of Common Barrack Boilers.—As already stated, the ordinary barrack kitchen we found in use consists of half-company boilers, set in brickwork, with a cast-iron grate, door frame, and ash-pit to each boiler.

The fire is usually placed directly in the middle, below the boiler, in the worst position for cooking, and as there are no sufficient means for regulating the combustion of the fuel, there is great waste of heat which passes up the chimney. From the position of the fire, there is continual risk of burning the contents of the boiler, a result which inevitably takes place, unless constant watchfulness is exercised by the cook.

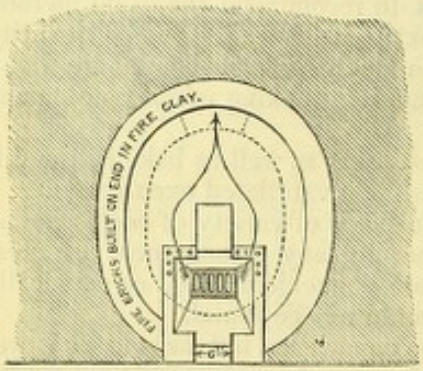
The brickwork setting is apt to get out of order, and to admit air at the joints; and this occurrence likewise interferes with the action of the fire, and the economy of fuel.

The only cooking operations which can be performed by these boilers, are boiling as in making soup; and stewing, which is a slower process, and requires less heat. But neither of these operations is performed in a satisfactory manner, partly on account of the structure of the furnace, and the want of an efficient means of regulating the heat, and partly on account of the ignorance of the men employed to cook.

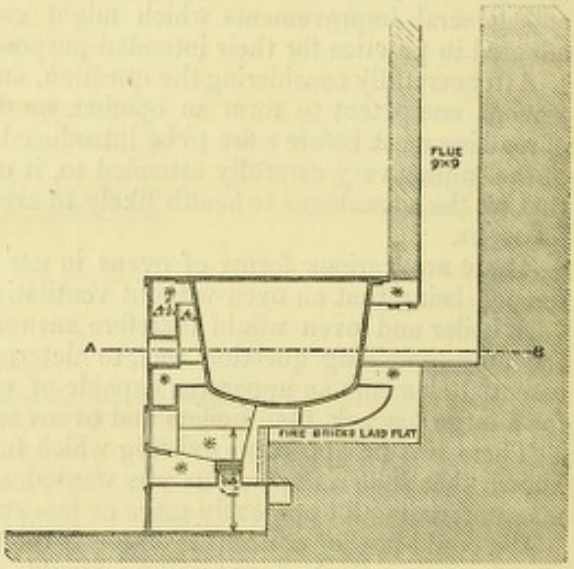
The common barrack cooking range has nevertheless the great advantage of having a separate fire for each boiler, an advantage which, if properly used, enables the heat to be regulated, provided the boiler setting be good. We began, therefore, by improving the furnaces of these boilers, so as to economize fuel and to apply the heat better for cooking.

Fig. 54 shows the details of the improved setting of an ordinary barrack boiler as finally adopted by us. The size of the fire is very much diminished, and the flue is carried by means of a fire-clay division round the boiler to the chimney. The ash-pit is closed by a door, and the furnace and ash-pit doors are provided with registers to regulate the supply of air to the fire. Air is also admitted to the immediate products of combustion as they rise from the fire, to prevent the formation of smoke. These boilers are very economical of fuel, and the heat can be regulated to any required degree. It is intended that the fire-brick settings of these boilers should be cast in fire-clay lumps, to diminish labour, to prevent mistakes by inexperienced workmen, and to insure greater durability than can be obtained by the use of fire-bricks.

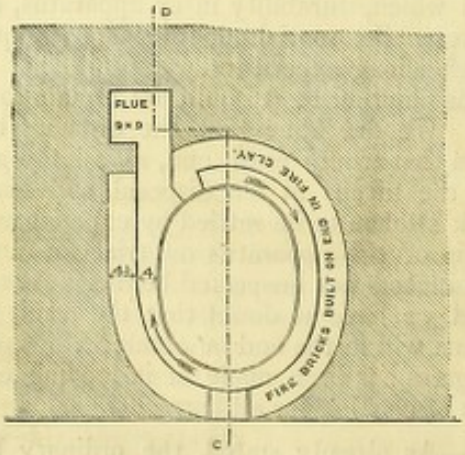
Fig. 54.—Details showing the Setting of a 25 Gallon Boiler.



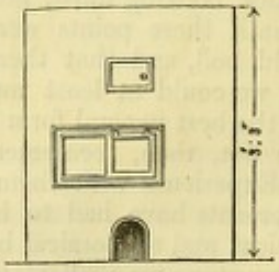
Plan of Furnace



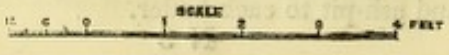
Section on the line C D.—* shows the fire-brick.



Plan of Flue on the line A B.



Elevation.



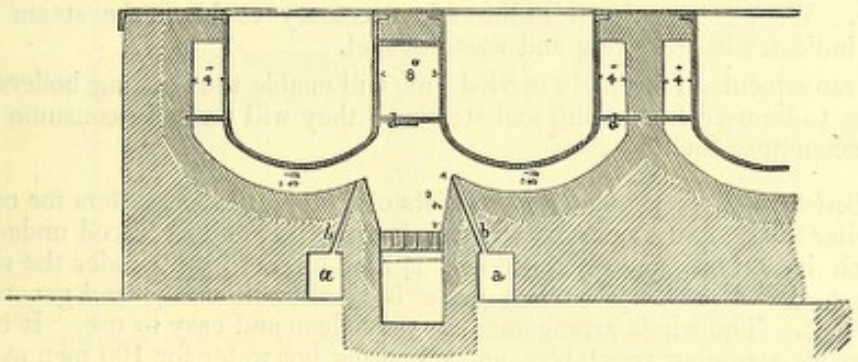
Double Boilers.—Keeping in view the fact that the men generally cook by companies, and in the course of the day employ two boilers per company, we found that on the score of economy one fire could be made to serve for two such adjacent boilers, and that with proper registers and care on the part of the cook, both boilers could be heated equally. The number of fires could thus be reduced to one half.

Existing boilers, if the setting be good, may be improved in this way, and a considerable saving of fuel may be effected by placing a fire clay box to hold the fire in the space between two boilers with a fire clay bridge on each side. The fire-bridge should have holes in it about three-eighths of an inch in diameter, and one inch apart, to admit fresh air from the outside for assisting in the prevention of smoke.

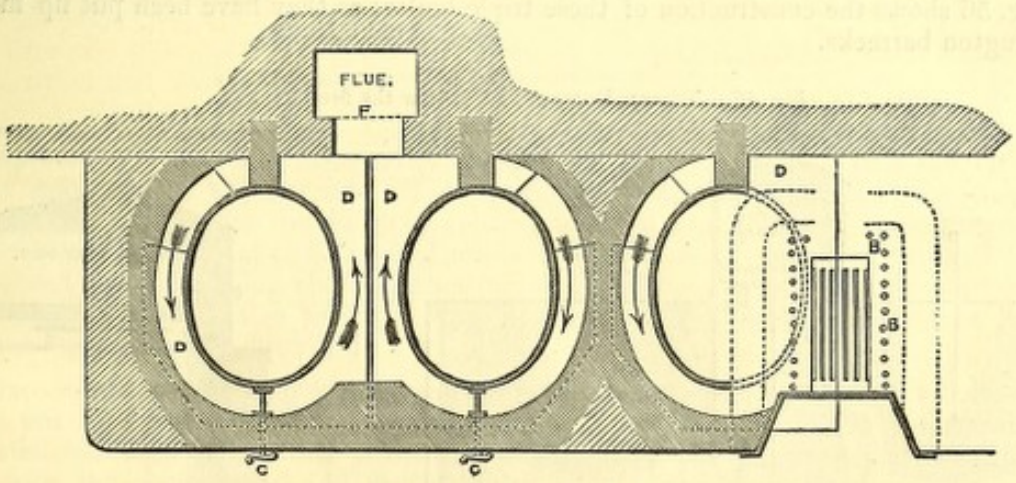
By this arrangement the boilers are heated on one side of the centre, and the fire is made to pass under the bottom and round the upper part by means of a horizontal plate of fire clay about three inches thick, set above the fire, so as to divide the space round the boiler into two parts. The setting round the boiler is of fire-clay lumps, which do not get out of order so frequently, as is the case with a mere fire-brick setting.

The economic results obtained show that by simply removing the fires from under the present regulation boilers, and placing one fire between every two boilers, the amount of fuel consumed is reduced at once to one-half, when compared with the best constructed single-fire boiler of the old construction, and that with Welsh lumps and an improved furnace the consumption of fuel in the ordinary regulation boiler set double is reduced to less than a fourth of the amount required for the single boiler. The cooking power remains the same, the heat admits of careful regulation, and three-fourths of the fuel are saved. Fig. 55 shows the common boilers set double, except that the divisions between the upper and lower parts of the flues should be of fire-clay, as shown in Fig. 56.

Fig. 55.



Longitudinal Section.



Horizontal section showing flues.

The fire is placed between two boilers, air being supplied through the channels A and B to assist in consuming the smoke.

A plate D divides the upper part of the space round the boiler from the lower, and the heated air passes under the boiler to the opening in the plate, and thence round the upper compartment to the flue F; the compartment round the boiler is lined with fire-clay lumps.

C is a damper to be used when only one boiler is required.

In new boilers, instead of the plate fire lump should be used, by which the heating surface is very much increased, and the consumption of coal proportionately diminished.

It is absolutely necessary in these improved furnaces that the furnace door should fit close and be provided with a register to regulate the admission of air.

The ashpit should be closed with a door well fitted to its frame, and provided with a register for regulating the quantity of air admitted to the fire through the grate; the flue leading into the chimney should be furnished with a damper. By means of this damper and register, the combustion of fuel can be regulated at pleasure.

New boilers should be made of wrought iron, not exceeding $\frac{1}{8}$th of an inch in thickness, or if steel $\frac{1}{16}$th of an inch thick could be obtained, it would probably be better, because the thinner the bottom of a boiler is, the more rapidly does the heat pass through it, and the less is it injured by the action of the fire, and therefore the longer will it last. Besides, wrought-iron boilers if burnt out can be repaired, but cast-iron boilers if cracked, as is frequently the case, are spoiled. The form of the boiler should also be improved by inclining the sides slightly from the bottom outwards, by which means the heated particles of fluid are enabled to move upwards from the sides of the boiler, to make way for other particles, more rapidly and with less friction than is the case with boilers of the ordinary shape.

Covers for these boilers should be non-conducting, and therefore made double, of thin sheets of tinned iron, with a vacuity of an inch or more between the sheets. They should be adapted to confine the heat in the boiler; there should be no steam pipe from the boiler, because the steam which passes through such pipes, carries off an enormous quantity of heat, as well as the finer and more rich and savoury particles of the food. The steam should pass off only when the cover is raised, and for removing it out of the kitchen a funnel over the boiler leading to a shaft will suffice, but there should be no steam pipe. Whenever such an addition is necessary to keep the steam out of the kitchen, it indicates bad cooking and waste of fuel.

These arrangements, if properly carried out, will enable the existing boilers in barrack cook-houses to be used for boiling and stewing; they will partially consume smoke, and materially economize fuel.

Triple Boilers.—This arrangement consists of two regulation boilers for cooking, and a centre boiler for steaming or preparing hot water. The fire is placed under the centre boiler, which it heats directly, and the heat is then made to pass under the side boilers, which are set in Welsh lumps. The grate is smoke-consuming and generates a large amount of heat. The whole arrangement is very clean and easy to use. It can perform boiling, stewing, steaming vegetables, and preparing hot water for 100 men at the cost of 5 oz. of coal per head per day.

Fig. 56 shows the construction of these triple boilers as they have been put up in the Wellington barracks.

Fig. 56.—Triple Boilers.—* * show the fire lump.

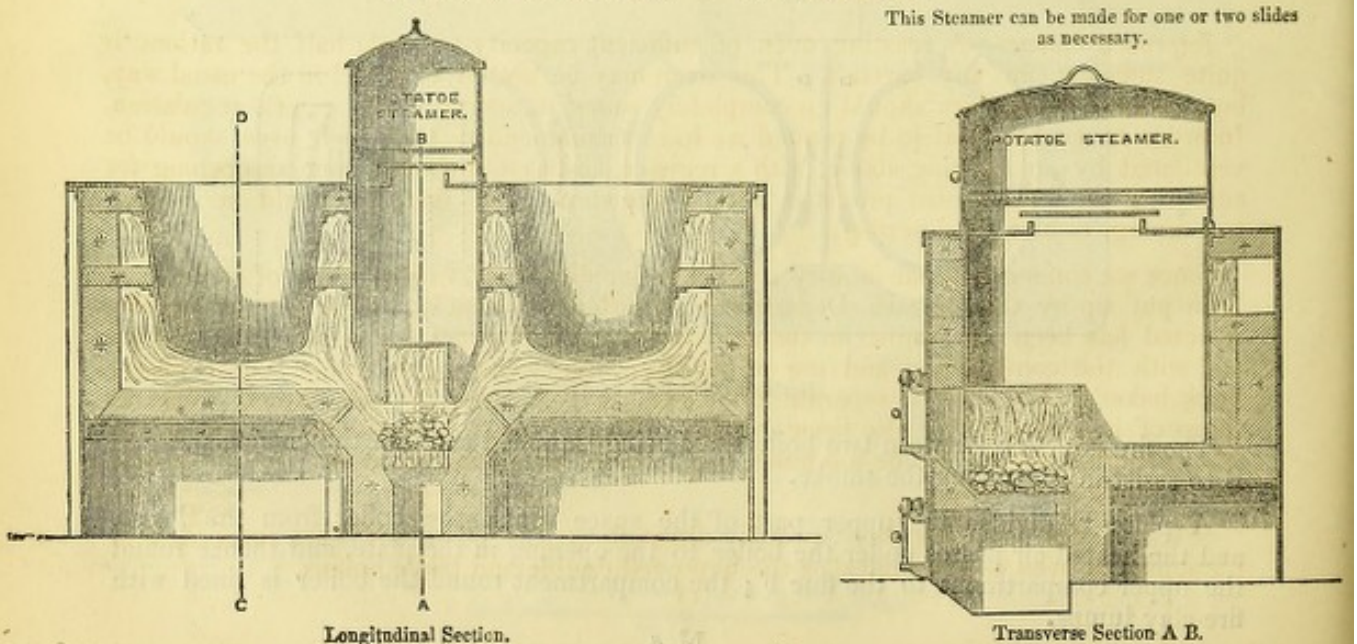
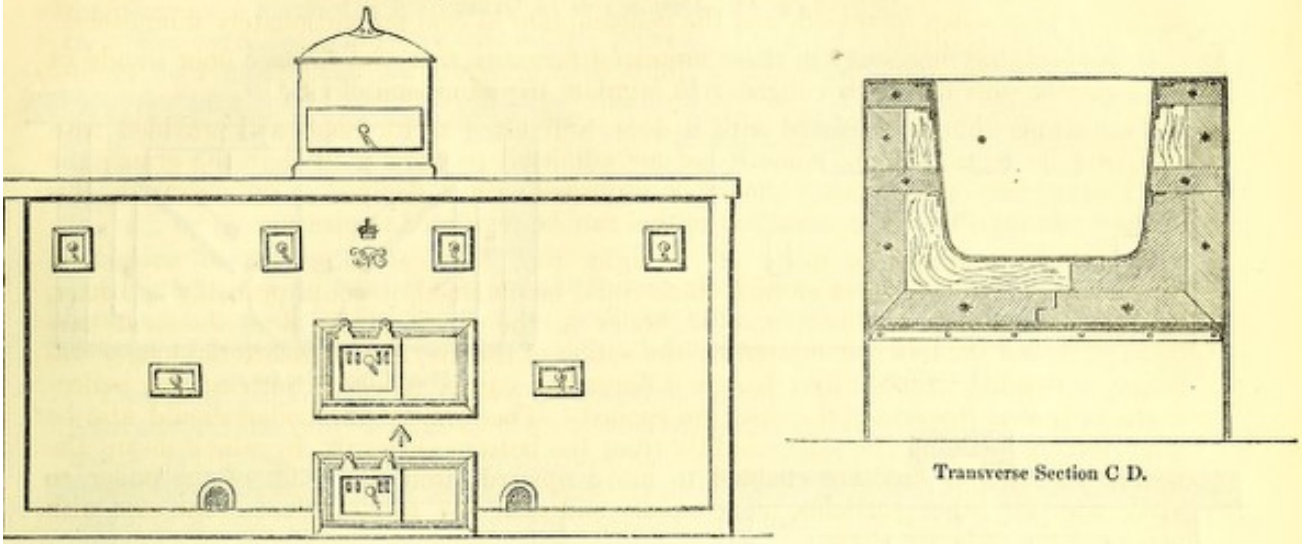
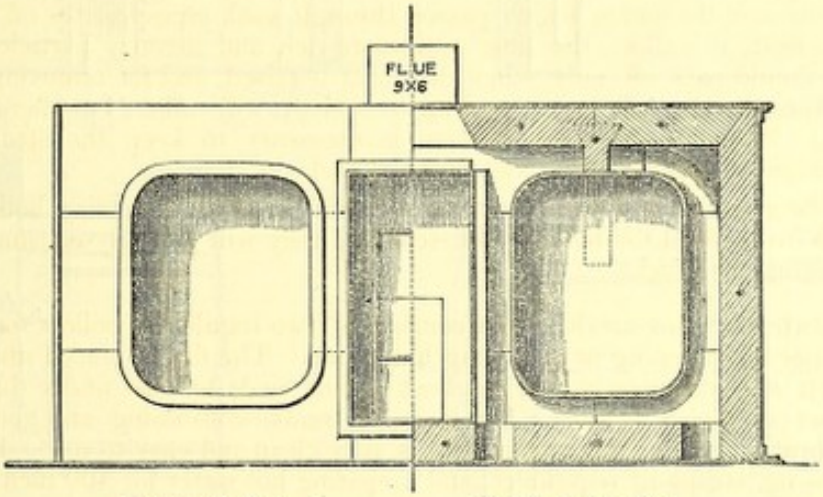


Fig. 56.—Triple Boilers—*continued.*



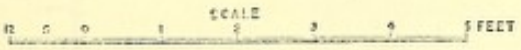
Elevation.

Transverse Section C D.



Half Plan of Top.

Half Vertical Section.



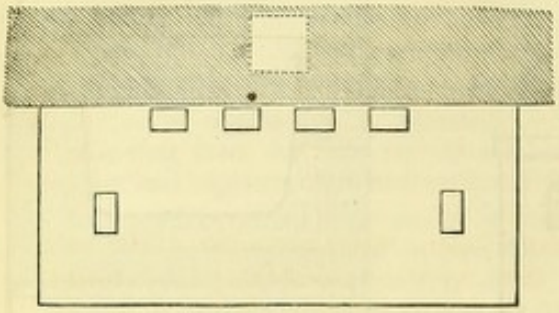
Improved Ovens.—A roasting oven of sufficient capacity to cook half the rations is quite sufficient for any barrack. This oven may be heated with fuel in the usual way, but the heat of the fire should go completely round it, and admit of careful regulation. In order to enable meat to be roasted we have recommended that each oven should be ventilated by an opening above, with a register, and that it should have an opening for admitting air below, also provided with a register. The furnace should be smoke-consuming, as already described.

Since we commenced our inquiry and made our first trials, various kinds of ovens have been put up by the Barrack Department in different barracks. The pattern usually selected has been one familiar in the district where the barrack happened to be placed, and with the construction and use of which people were acquainted. The ordinary brick baker's oven, with a separate fireplace, has been used to some extent. Various forms of iron ovens have also been erected. They all roast and bake meat more or less efficiently, but they consume too much coal. Some of them indeed will not cook with the ordinary fuel ration.

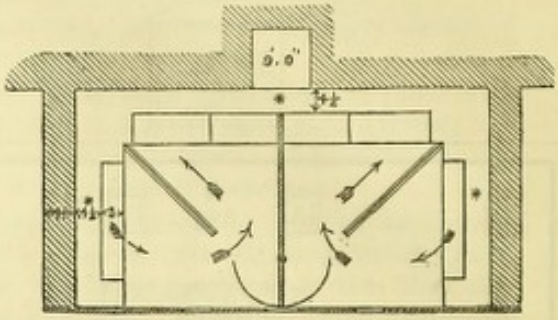
We have had our attention specially directed to this point, and have succeeded in obtaining an oven as economical as the improved double and triple boilers.

It is shown in Figure 57.

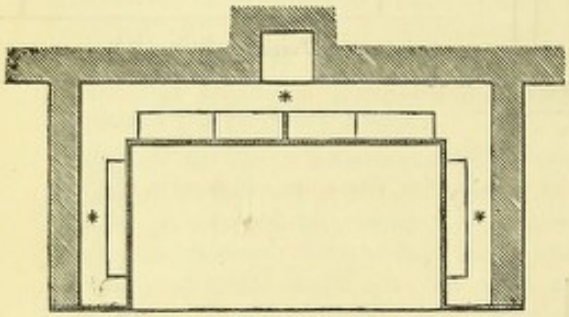
Fig. 57.—Design for an Oven.



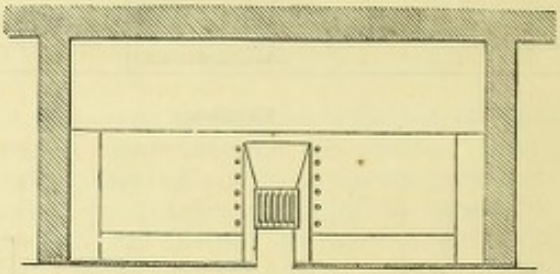
Plan of Top.



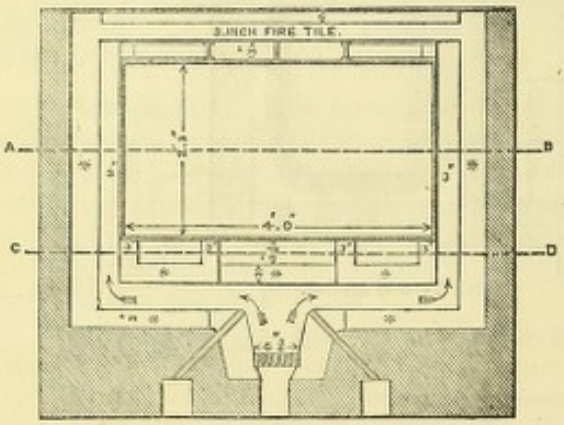
Plan of Top under fire tile.



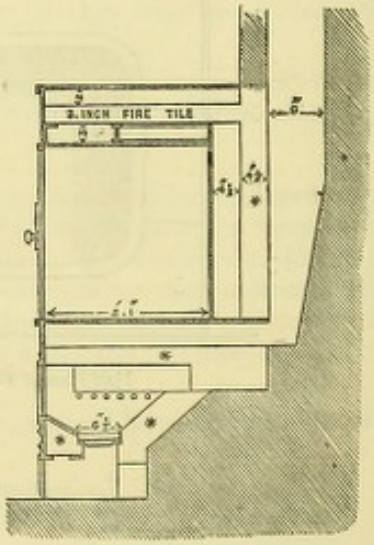
Horizontal Section on line A B.



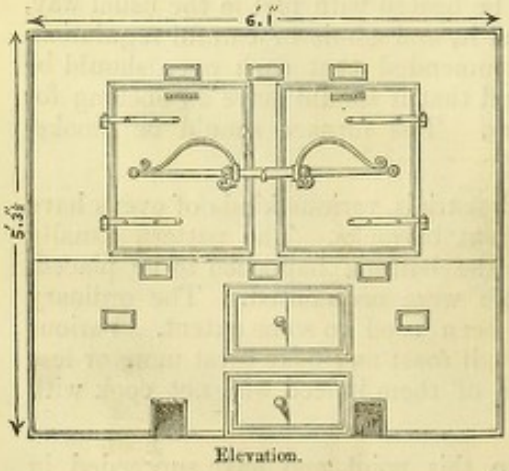
Plan of Furnace.



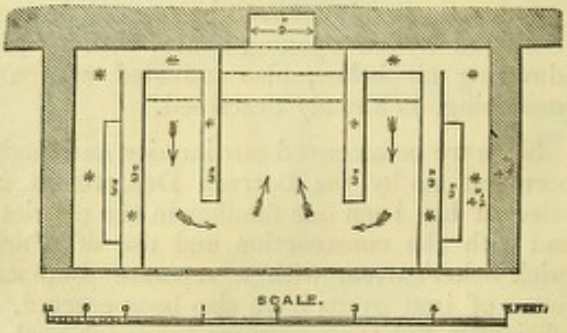
Longitudinal Section.



Transverse Section.



Elevation.



Horizontal Section on line C D.

* * * Fire tile.

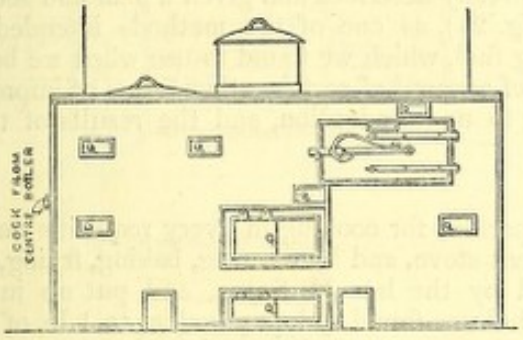
Scale, ½ inch to a Foot.

The fire in this apparatus is placed under the centre of the oven, and is contained in a grate between two lumps of fire-brick, through each of which holes admit fresh air to the flame as it leaves the fuel to assist in the prevention of smoke; the fire is separated from the oven by a fire-clay tile, which prevents the oven bottom being burnt. The direct heat passes first up one side, then over the top, and lastly under the bottom of the oven, in a space left between it and the fire-clay tile. The whole is set in fire-clay to prevent loss of heat. Flanges on the sides and top of the oven increase the heating surface. One of these ovens at the Wellington Barracks, if used to the extent of its capacity, is sufficient to bake eight tins of meat, for 500 men, with no more than 25 lbs. of coal, or four-fifths of an ounce per man, which is Count Rumford's standard of consumption for cooking food.

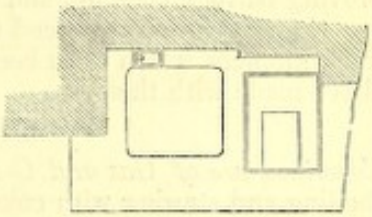
In practice, with smaller and variable numbers of men, these ovens roast the men's rations at a cost of 2 oz. to $2\frac{2}{3}$ oz. of coal per head, which we believe is the smallest amount of fuel with which food has hitherto been cooked in separate ovens.

Combined Boilers and Ovens.—For detachment barracks of from 50 to 100 men, we have advised the introduction of the cooking apparatus shown in Fig. 58. It consists of one of the triple boiler arrangements, in which the place of one of the side boilers is supplied by an oven. The same fire answers in this case both for boiling, steaming, and roasting or baking, with an expenditure of fuel not much more than would be required for performing one of these processes separately.

Fig. 58.—Cooking Apparatus for Small Barracks.—Plan, Elevation, and Section.

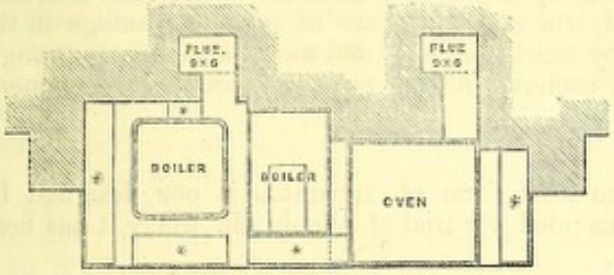


Elevation.



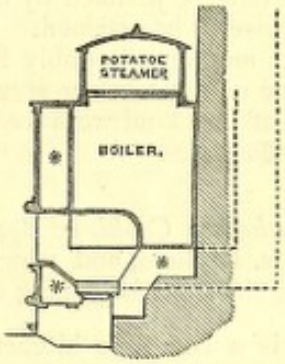
Plan of top.

The door of oven will be hung according to the light.

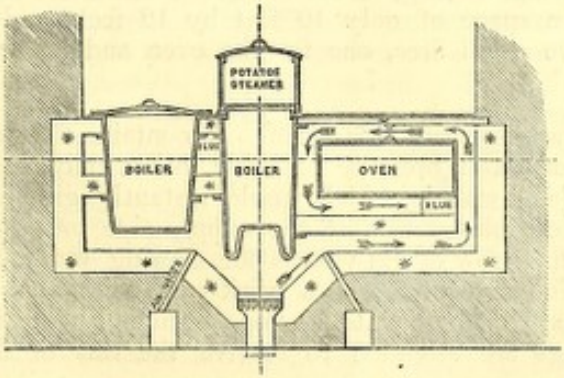


Horizontal Section on line C D.

Soot doors to be provided where necessary.

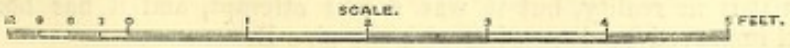


Section at A B.



Horizontal Section.

* * * Show the Fire Brick.



In baking or roasting meat in ovens the meat has hitherto been laid on the potatoes in a tin. This renders the meat sodden and makes it cook unequally. We have therefore recommended in all cases an iron tripod to support the meat at a short distance above the potatoes.

When space admits of it, it is very desirable to provide a long table or dresser, placed like a counter in a shop, to separate the cooks from the men who come for the dinners, in order to prevent the confusion which very frequently prevails in cook-houses whilst the dinners are being given out. In new cook-houses some such arrangement should always be provided.

These simple alterations of and additions to the common barrack boiler in existing cook-houses will enable the soldier to have every requisite variety in cooking. This being the case, we have not, as already stated, considered it necessary for the present to advise the general adoption of one uniform model of kitchen. Indeed, it would, in our opinion, be premature to do so.

Attention has, however, been directed to the subject, and we have no doubt that as the existing kitchens, with the alterations suggested by us, are used up, better cooking apparatus than any yet devised will be forthcoming for their reconstruction. We next proceed to state what has already been done towards arriving at a solution of this important question.

Improved Barrack Kitchens.—We have already described and given a plan and section of Captain Grant's cooking apparatus (Fig. 21), as one of the methods intended for improving barrack cooking, and economizing fuel, which we found in use when we began our work, and we next proceed to give a brief account of certain other forms of improved barrack kitchens which have been proposed to us for adoption, and the results of trials we have made with them.

Combined use of Gas and Coke.—An apparatus for cooking in every requisite variety by boiling and stewing with coke in his patent stove, and by roasting, baking, frying, &c. with a gas oven and circles, was proposed by the late M. Soyer, and put up in the Wellington Barracks. Its consumption of fuel was found to be equivalent to 1 lb. of coal per man per day, which we consider much too large an expenditure of fuel, and one which could only be justified by the apparatus fulfilling certain conditions as to convenience not otherwise to be attained. Such a cooking apparatus as that in the Wellington Barracks would answer admirably for a hospital, where gas jets are of great advantage in the routine of the kitchen service. It is by much the best and most economical arrangement of the kind we have seen, but we cannot, with our present experience, recommend it for barracks.

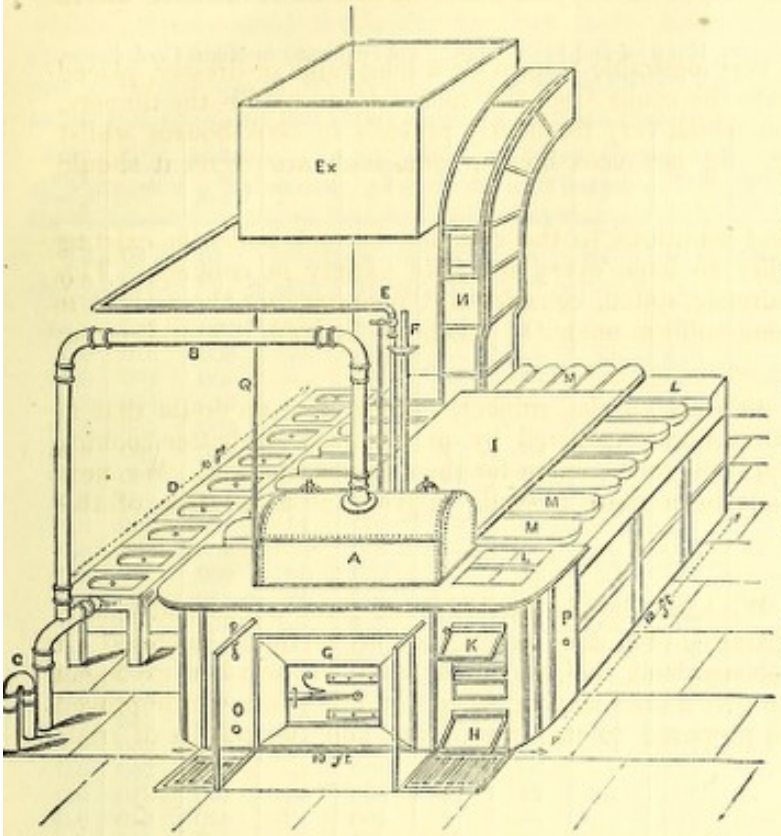
Benham's Cooking Apparatus.—The next form of apparatus is one designed by Messrs. Benham, and which we recommended for trial at Woolwich, where it has been in use since the beginning of May 1858.

It is a complete kitchen capable of performing every variety in cooking, such as boiling, stewing, steaming, baking, or roasting. Exclusive of the wooden bench for steamers, it occupies a space of only 10 feet by 12 feet, and was intended to cook for 500 men with two small fires, one for the oven and boiler, and one for the hot plate.

The boiler is self-acting and feeds itself. It contains 80 gallons of water, and is worked under a syphon water pressure of a few inches only, so that accident with it is impossible. It has also a whistle, which would instantly give notice of any deficiency in the water supply from obstruction of the supply pipe or otherwise. The steam is conducted by a pipe to a row of tin vessels for stewing vegetables, puddings, &c., for the men's dinners. Under the boiler is a brick oven ventilated for roasting meat, and baking pies, bread, &c. The hot plate contains a number of openings fitted with sliding covers; these openings are intended to receive the tins of the different messes for stews, &c.

The whole apparatus is shown in Fig. 59. It has an appearance of being more complicated than it is in reality, but it was a first attempt, and it has been since much simplified and improved by dispensing with the pipe B.

Fig. 59.—Messrs. Benham and Son's Cooking Apparatus in No. 6 Cook-house, Woolwich Garrison.



DESCRIPTION.

A. Steam Boiler.
B. Steam Pipe to supply steamers.
C. Syphon, which goes into drain and acts as a safety-valve.
D. The places for the steamers.
E. Self-acting feed-tap from :—
Ex. Cistern.
F. Blow-pipe, which gives notice by a whistle.
G. Oven Door.
H. Oven Furnace Door.
I. Top of Oven covered with fire-clay.
K. Hot-plate Door.
L. Hot plate.
M. Small covers to holes in hot plate, which, when in use, go under I.; when in use the steam pans go on these holes.
N. Flue.
O. Damper to Oven.
P. Ventilator to Oven.
Q. Pipe which feeds ashpit with water.

Size of Kitchen, 25 feet by 19 feet 6 inches.

We requested Messrs. Warrener and Guerrier, the two cooks placed at our disposal by the Minister at War, to examine into the efficiency, economy, and facility of use of Messrs. Benham's kitchen, and they have reported to us that after a few alterations of the flues the heat was rendered equal all over the apparatus; that the time required for steaming vegetables, &c. is about one hour; that it requires 2½ hours to bake the dinners; that though rather complicated, the apparatus is easily understood by the men, and that for men quite ignorant of cooking it is easier to cook with than the common boiler; that it is easy of repair, and is the coolest cooking apparatus they know of; that for artillery, marines, and cavalry it is remarkably well adapted on account of the size of the messes; that the baking of meat by it is perfect and the heat admirably regulated; that all the boilers are equally heated, so that cooking takes place equally in all of them; that it supplies hot water for tea without resorting to the soup boilers, which is the usual resource in barrack kitchens.

The cooks state that in using the apparatus "the stewpans and steamers are taken up "into the men's rooms in the morning; the dinners are placed in them and the number "marked on the side, and brought down to the master cook (there is one for six rooms), "who attends and sees that they are properly cooked. At half-past twelve the *room* "*cook* comes for them; they are delivered to him, and all is done with the greatest "order and regularity as if sending up the largest dinner in the best regulated tavern "or nobleman's establishment."

This experience proves satisfactorily that it is perfectly possible to combine in the army variety and excellence in cooking with facility, regularity, and great economy of fuel.

The following Table gives the results of one month's trial with Benham's apparatus while used by the men under superintendence of the cooks. It shows the daily number of rations, the classes of rations, and the manner and variety of cooking preferred by the men when left to their own selection, and exhibits a marked contrast with the constantly recurring boiled beef and soup of that system of barrack cookery, which happily

is now rapidly passing away. It will be seen that there were only twelve rations of soup cooked during the month.

STATEMENT of TRIALS made with Messrs. BENHAM and SONS' COOKING APPARATUS in No. 6 Cook-house, Woolwich Garrison.

Date.	No. of Rations.	Bakes.	Soup.	Stew.	Puddings.	Sea Pies.	Frys.	Potatoes lbs.	Green Rations.	Gallons of Water.	Coals, lbs.	Time Fire lighted.
												A.M
May 2	50	—	—	50	—	—	—	—	—	50	60	6.0
„ 3	50	50	—	—	—	—	—	—	—	50	140	6.0
„ 4	150	96	—	54	—	—	—	60	—	100	142	6.0
„ 5	490	241	—	220	—	17	12	125	—	200	260	6.30
„ 6	1026	451	—	675	—	—	—	630	—	600	370	6.0
„ 7	560	300	—	260	—	—	—	300	—	400	260	6.30
„ 8	569	288	—	281	—	—	—	300	—	350	260	6.45
„ 9	640	312	—	328	—	—	—	340	—	300	260	6.30
„ 10	680	300	—	308	12	36	24	300	36	300	260	6.30
„ 11	690	312	12	320	12	10	24	300	48	360	260	6.30
„ 12	701	312	—	389	—	—	—	320	12	400	260	6.0
„ 13	703	300	—	403	—	—	—	360	12	400	260	6.0
„ 14	712	312	—	300	—	—	—	300	—	300	260	6.0
„ 15	708	*420	—	240	12	36	—	260	60	300	260	6.0
„ 16	702	360	—	402	—	—	—	300	48	350	260	6.0
„ 17	689	288	—	301	—	—	—	324	—	350	260	6.0
„ 18	670	300	—	300	24	36	—	360	—	350	260	6.0
„ 19	662	312	—	324	—	—	26	340	—	350	260	6.0
„ 20	630	288	—	442	—	—	—	400	—	400	260	6.0
„ 21	602	324	—	242	12	12	12	360	24	400	255	6.0
„ 22	594	336	—	198	12	24	24	240	36	300	250	6.15
„ 23	560	300	—	224	—	36	—	300	—	400	240	6.0
„ 24	666	324	—	306	—	24	12	360	36	400	240	6.0
„ 25	648	360	—	240	—	36	12	300	12	450	240	6.0
„ †26	524	324	—	128	8	48	12	220	—	350	220	6.0
„ 27	620	348	—	272	—	—	—	280	—	500	200	6.0
„ 28	650	336	—	314	—	—	—	300	—	500	200	6.0
„ 29	692	360	—	260	24	48	—	310	—	300	180	6.15
„ 30	720	360	—	348	12	—	—	320	12	350	180	6.0
„ 31	703	348	—	331	—	24	—	300	24	350	180	6.0
June 1	706	360	—	330	—	16	—	290	36	509	160	6.0
„ ‡2	708	300	—	384	—	12	12	350	36	350	160	6.0

* May 15. 96 of these were fruit pies.
† May 26. On this day there were baked in the oven after the meat 4 bushels of bread.
‡ June 2. On this day there were baked in the oven after the meat 1 bushel of bread.

The plan of working the apparatus is as follows:—The fire is lighted at 6.0 a.m.; hot water for breakfast is ready in three-quarters of an hour. Oven lighted at 7.45; meat put in at 9.30; stews put on at 10; steam turned on at 11; meat turned in oven at 11; meat taken out of oven, stews, &c., vegetables served at 12.30. Hot water for washing up from 12.30 until 1.30. Hot water for teas from 2.30 to 3.30. Hot water is to be had in any quantity for washing up after that hour.

The average consumption of fuel during the preliminary trials for breakfast, dinner, and tea, and hot water for washing up, was 6 oz. per man per day. When the apparatus was completed and in operation, the consumption of coal fell to $3\frac{1}{2}$ oz. per head, per diem.

Messrs. Warrener and Guerrier state that even this amount is too large, and they suggest several improvements whereby the quantity of fuel might be still further reduced without impairing the efficiency of the apparatus.

The questions of durability, and current cost for repairs, have not yet been decided, on account of the shortness of the time Messrs. Benham's apparatus has been in use, but so satisfied were we with the results, that we advised a similar apparatus, simplified and improved, to be put up in Edinburgh Castle.

Benham's kitchen at Woolwich has hitherto required little repair, and it continues to give satisfaction; the men like it, and it cooks well.

Radley's Cooking Apparatus.—Another cooking apparatus, originally intended to roast meat for barrack use, was brought under our notice by Mr. Radley, of the Gresham Hotel, Dublin. The plan consisted of two iron ovens with a fire between them, which played round the ovens to heat them before passing into the chimney. It appeared a simple contrivance, not likely to be easily put out of order; and we advised one to be put up at Woolwich, with such additions as would enable it not only to roast meat, but to do all the other kinds of barrack cooking.

For this purpose, the hot plate over the ovens and fire was intended to be used for stewing, and a boiler was placed at the back of the fire to supply steam for a row of tin steamers placed on benches behind the apparatus.

The following elevation and plan, Figures 60, 61, show the general arrangement of the apparatus as it was first put up at Woolwich.

Fig. 60.—Radley's Cooking Apparatus.

Elevation.

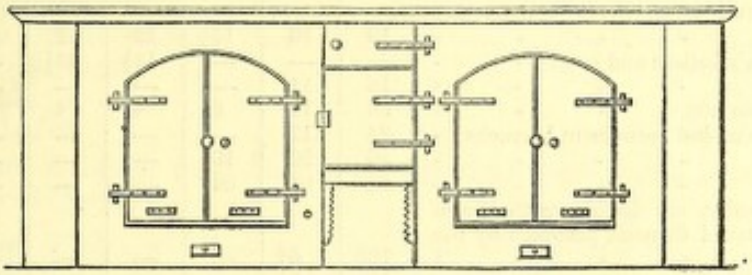
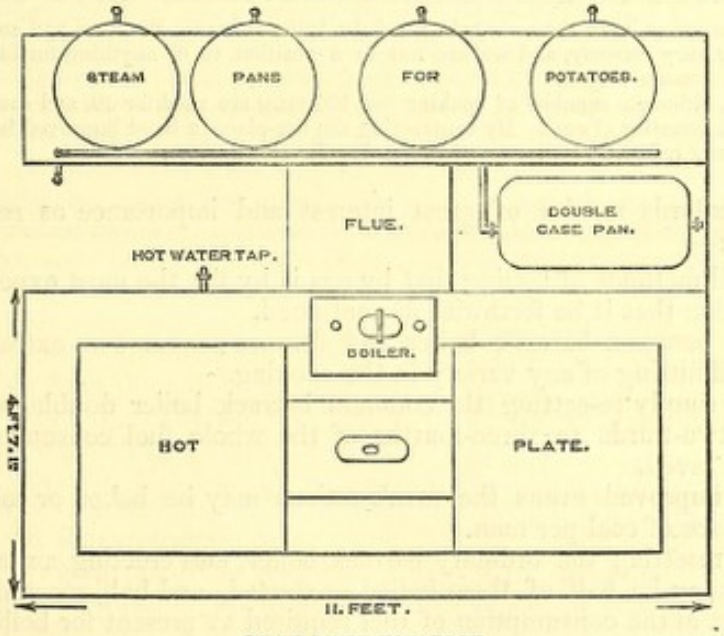


Fig. 61

Plan.



SCALE ½ INCH TO 1 FOOT.

After it was up several defects were discovered. It was found to cook imperfectly on account of the too great width of the flues and the small size of the boiler, besides which it consumed too much coal. To cook the dinners of 55 men required 120 lbs. of coal; for 120 men 160 lbs. were required, and the same quantity cooked for 200 men.

These defects have been removed and the apparatus has been reported to us as a good serviceable kitchen, well suited for rough barrack usage, and cooking satisfactorily. It roasts, bakes, broils, stews, steams, and boils, and supplies hot water for upwards of 500 men, at a cost of 6 oz. of coal per head per day, instead of 27 oz., its former consumption. Another apparatus of the same kind, as a further trial, was authorized for the General Hospital, Dublin.

The following Table gives the consumption of fuel *for all culinary purposes* in the various forms of barrack cooking apparatus at present in use :—

TABLE of the Average Daily Consumption of Coal per Man, for Breakfast, Dinner, Tea, and for Hot Water for Household Use, in various Forms of COOKING APPARATUS tried by Messrs. WARRENER and GUERRIER, under the Direction of the BARRACK AND HOSPITAL IMPROVEMENT COMMISSION.

COOKING APPARATUS.	Daily Amounts of Coal per Head consumed when cooking for							
	50 men.	100 men.	100 to 200 men.	200 to 300 men.	300 to 400 men.	400 to 500 men.	500 to 600 men.	600 to 1000 men.
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.
Old regulation boiler	32	18	—	—	—	—	—	—
Captain Grant's stove for boiling only	32	32	20	16	13	$12\frac{1}{6}$	—	—
Captain Grant's boilers and ovens	40	40	$37\frac{1}{2}$	18	16	14	12	10
Flavell's kitcheners, boilers and ovens	24	12	12	12	12	—	—	—
Soyer's boilers	$10\frac{3}{4}$	—	—	—	—	—	—	—
Radley's apparatus, iron ovens, steamers, and hot plate	12	12	12	8	8	6	—	—
Benham's apparatus, brick oven, boilers, and steamers	19	16	$15\frac{1}{7}$	12	12	$8\frac{1}{4}$	7	$3\frac{1}{2}$
Captain Lempriere's boilers and oven*	—	—	—	$14\frac{1}{2}$	$13\frac{1}{2}$	—	—	—
Sadlier's ovens	16	14	—	—	—	—	—	—
Brick ovens at Chatham	24	12	6	4	4	4	$3\frac{1}{2}$	2
„ Aldershot permanent barracks	24	12	—	—	—	—	—	—
Gas ovens	36	20	10	—	—	—	—	—
Gas boilers	64	64	64	—	—	—	—	—
Old regulation boiler, set double, with Welsh lumps and improved furnace, proposed by the Commission	$10\frac{1}{3}$	6†	—	—	—	—	—	—
Flange boiler set double, ditto ditto	16	$9\frac{1}{4}$	—	—	—	—	—	—
Triple boiler with single furnace, set in Welsh lumps, ditto ditto	8	5†	—	—	—	—	—	—
Improved iron ovens, proposed by the Commission	12	6	$2\frac{3}{4}$	—	—	—	—	—
„ „ set with fire-clay tiles	—	—	—	—	—	$\frac{3}{5}$	—	—

* This is an iron range, with the oven below and the boilers above. We have had an opportunity of trying this apparatus only very recently, and we are not in a position to do anything further than merely to state the amount of fuel consumed by it.

† These boilers, although capable of cooking for 100 men, are used for 50, and consequently consume an unnecessarily large quantity of coal. By contracting the fire-place in these improved boilers the consumption of fuel has been since reduced to 4 oz. per man per day for all purposes.

This Table affords results of great interest and importance as regards economy of fuel ; it shows :—

1. That of all methods of boiling that by gas is by far the most expensive, and justifies a recommendation that it be forthwith discontinued.

2. That the common barrack boiler and furnace consume an extravagant amount of fuel, without admitting of any variety in the cooking.

3. That by simply re-setting the common barrack boiler double, and improving the furnace, from two-thirds to three-fourths of the whole fuel consumed for boiling and stewing can be saved.

5. That by improved ovens the men's rations may be baked or roasted for 500 men at about an ounce of coal per man.

6. That by resetting the ordinary barrack boiler, and erecting an improved oven, the men's rations may be half of them boiled or stewed, and half roasted or baked, at less than a fifth part of the consumption of fuel required at present for boiling alone with the old regulation boiler, and by improving the regulation boiler a still further saving may be effected. Notwithstanding this great saving in fuel, we are of opinion that the limit to which economy may be carried has not yet been arrived at. The largest amount of saving in Benham's apparatus, as will be seen by the Table, is effected only where the number for which it is used exceeds the whole number of 500 men for which it was designed. This defect is common to all large cooking arrangements. When barracks fitted up with this apparatus happened to be partially occupied, the saving would be found to diminish in proportion to the smallness of the number of men.

Keeping this fact in view, and considering the variable occupation of barracks, it is obvious that any cooking apparatus constructed to economise fuel should be capable of being used with equal economy for any number of men the barrack is likely to accommodate. For all barracks with a fixed strength such a cooking apparatus as Benham's

and others would effect a very large economy of fuel, but for barracks of varying strength an economical apparatus is still a desideratum. One advantage, indeed, of the plan we have introduced for using and improving the ordinary barrack boiler, and adding a roasting oven, is that the saving would be nearly the same whatever were the strength in barracks, provided each boiler and oven were fully used: and the results appear to indicate that it is in this direction we shall arrive at obtaining a perfected barrack kitchen, combining efficiency of cooking with a small consumption of fuel.

But it should not be forgotten that the amount of fuel which any apparatus may consume when worked under careful inspection is not necessarily the amount which an unskilled cook, told off for the first time from the ranks, will be able to cook with. The allowance of fuel to be made for barrack cook-houses is hence a totally different question from the amount absolutely required for cooking.

Looking at the matter from this practical point of view, and after consulting the experience of the cooks, and considering the varying occupation of barracks, as well as the present state of barrack cooking, we are of opinion that the following allowances ought to be sufficient in practice:—

1. For the old barrack boiler, well set on the old plan and in good condition - - - - - - 1 lb. per man per day.
2. Captain Grant's stoves - - - - - - $\frac{3}{4}$ lb. „ „
3. Messrs. Benham's - - - - - - $\frac{1}{2}$ lb. „ „
4. Mr. Radley's - - - - - - $\frac{1}{2}$ lb. „ „
5. Triple boilers - - - - - - $\frac{1}{2}$ lb. „ „

The amounts of fuel for the old barrack boiler and triple boiler include what is required for the improved ovens.

Improvement of Barrack Cooking.—In as far as regards the very important question of efficient and wholesome cooking, no apparatus will of itself ensure this result. Messrs. Warrener and Guerrier refer constantly in their reports to the defective manner in which army cooking is now performed.

At present any soldier may be appointed as cook to a regiment, whether he has knowledge of the subject or not. The consequences are an unnecessary expenditure of fuel, burning out the bottoms of ovens, breaking fire-doors, and otherwise injuring the apparatus; *under* cooking or *over* cooking, and sundry irregularities, of which the following are mentioned, in their reports, as examples:—

"A troop is ordered on parade, the cook with them, shortly after dinner. They return at $\frac{1}{2}$ past 4 o'clock. The cook goes to the kitchen, and there is no hot water. On some days the kitchen is locked up at that hour, and the corporal in charge gone. The orderly officer on going his rounds finds the troop without tea; he goes to the cook-house and finding no fire, immediately orders the man in charge under arrest. This might be avoided, and a great saving effected to the service, by a system of regularity which most especially ought to be observed in the army."

In one barrack Messrs. Warrener and Guerrier found the ovens "always red hot, as "the fires are forced in consequence of the short time the men have to cook their "dinner, resulting from the nature of their drill."

In reference to another kitchen they state, that "the men are changed weekly, and "just as they are beginning to know the oven they leave it."

On a recent inspection of a barrack we found that although the men had dined at one o'clock, and had no further use for the oven, the oven fire was loaded with coal, and burning strongly at four o'clock.

The subject is again pointedly referred to in the following terms in a letter from Messrs. Warrener and Guerrier, accompanying their report to us of the 8th July 1859:—

"We beg to add that in the discharge of our duties we have had occasion to be frequently with the private soldier, and thus have heard opinions stated that officers and others could not obtain. They all express great gratitude for the exertions which are being made in ameliorating their condition, more especially in that connected with their food, in giving them the opportunity of having baked meat instead of meat always boiled; but they all agree that these advantages will not receive their full development if the present system of making the last recruit the cook, and changing him weekly, be continued. One uniform system should be adopted in all branches of the service, and a permanent cook to each kitchen appointed out of the regiment, removeable on bad conduct. This is done in some regiments with great advantage, and might be done in all."

The present manner of appointing cooks, as will be seen, leaves half the problem of improving army cooking unsolved. For the solution of the whole problem two things were required, namely, good economical apparatus, capable of affording the means of varying the cooking, and good cooks. The first, as we have shown, may now be obtained, but the cooks are just what they were, efficient or inefficient, by accident. It

is evident, therefore, that the next step to be taken is to provide for the practical instruction in cooking of a certain number of men in each regiment, who could teach others, and so keep up a sufficient amount of practical knowledge to meet any emergency of field or other service.

*We would strongly recommend that this be done forthwith.**

As already indicated, we have, in carrying out our instructions, recommended the addition of roasting ovens to be made to all barrack kitchens, and we have circulated information as to the best manner of constructing these ovens, and also of resetting the ordinary barrack boiler to save fuel.

As soon as we feel justified in recommending a uniform plan of kitchen for adoption in all barracks, we shall lay it before the Secretary of State for War. There is, however, no immediate necessity for this, because every practical result aimed at can be obtained by the reset barrack boilers and the improved ovens we have described above. But it would be well in any new barracks, or in replacing worn out barrack cooking apparatus, to adopt the best general plan which may present itself as embodying the conditions of easy, good, and economical cooking for any number of men the barrack is likely to contain.

Improvements in Cook-houses.—With regard to the cook-houses themselves, wherever they have been placed within barrack ranges, and under soldiers' rooms, we have advised their being removed to separate buildings. When placed under men's rooms, they overheat them, and diffuse damp over the buildings. As a temporary expedient, in such cases, we have advised shafts, giving an area of at least 18 square inches for each boiler or oven, to be carried up from the ceilings of these kitchens to above the roof of the barrack range, and inlets, near the ceiling, with diffusers or perforated glass panes or louvres to be placed in the windows, so as to allow a current of fresh air to pass through the kitchen.

When the cook-houses are in buildings separate from the barrack rooms, and where the light and ventilation have been deficient, we have advised that window space, in the proportion of one and a half superficial feet for every 100 cubic feet of contents, should be provided; one-third of it to be supplied by skylights, or glass slates in the roof.

The ventilation we have recommended for detached cook-houses is by louvres in the roof, giving an area of at least one square foot for each boiler or oven.

10.—Improvements in Barrack Wash-houses.

We have already stated that there are several examples of complete and excellent laundries attached to barracks where there are married soldiers' quarters. All of these are not equally good, but two or three of them,—as, for instance, the laundries at Brompton and at one or two of the Dublin barracks,—contain every convenience for preparing linen and for preserving the health of the washers. But these are laundries where washing must be done on a regular system, and for which the whole fuel consumed must be found by Government, an arrangement obviously at variance with the present one, which leaves the soldier to pay for his washing, and to select any woman he thinks fit for his washerwoman.

The wash-houses with which we have had to deal are of a character totally different from these laundries, with which indeed they have generally nothing in common, except their object. They are deficient in nearly every convenience except boilers, and they nearly all require more or less improvement to enable them to fulfil their intention even imperfectly. They will doubtless be eventually replaced by buildings and fittings better adapted for their purpose, but in the meantime we have endeavoured to improve them as far as practicable.

The improvements which we have advised in women's wash-houses refer—

1. To their position as regards barrack rooms.
2. To their means of lighting and ventilation.
3. Their internal fittings.
4. Suitable provision for drying linen in wet or damp weather.

1. In those cases in which wash-houses have been placed within barrack ranges and under barrack rooms, we have recommended their removal to separate buildings.

There are sufficient sources of foul air and dampness in barrack ranges, without adding to them by the presence either of wash-houses or cook-houses. Buildings intended for barrack rooms should be devoted to that purpose alone.

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* While this report has been passing through the press, the Minister at War has sanctioned the establishment at Aldershott of a school for the practical instruction of regimental and hospital cooks, a measure which we have no doubt will be productive of great benefits to the service. Men from all the regiments continually passing through the camp will be taught to cook, not only in ordinary barrack kitchens, but also in the field.

2. We have recommended the amount of light to be increased in all wash-houses to at least 1½ superficial feet of window space for every 100 cubic feet of contents, and that one-third of the light should be supplied by skylights or glass slates in the roof. The usual method of ventilation we have adopted is one already in use, namely, a large louvre through the roof, with a hanging cover over the boilers to carry away the steam.

3. With regard to fittings we have recommended the following as indispensably necessary.

The introduction of fixed washing troughs, having water laid on, and plugs for allowing the foul water to escape by a pipe into the drain. The less water allowed to run over the wash-house floor the better. At present the foul water is poured upon the flagging, and allowed to find its way by a grating, which grating, as we have frequently seen, gets stopped up, and the floor is flooded. We found a good plan for disposing of the foul water from fixed tubs in use at Preston. In this instance each tub has a short pipe through which the water flows into a semi-circular open gutter carried to a drain outside the buildings. Any stoppage taking place in the arrangement could easily be removed by the women themselves.

In front of each range of tubs should be placed a wooden grating for the washers to stand on. At no wash-house have we seen any means of ironing linen, and we have recommended that an ironing table, 2 feet 6 inches wide, and of sufficient length, be put up in a separate room wherever there is space for it. Some wash-houses have common barrack fire-places, but they never appear to be used.

It is no doubt by far the best plan to dry linen in the open air whenever it can be done, but in our climate artificial means of drying the soldiers' linen for at least eight months in the year are indispensably necessary for health. Such means have been introduced into most well regulated public institutions, such as prisons, schools, workhouses, &c.; but in these institutions the washing is all performed and paid for on an organized plan. In barracks, on the contrary, there is no such organization. The women are employed by the soldiers to wash for them and receive a specific sum. They find themselves in fuel as they find themselves in soap. They burn as little as they can, and hence it has depended very much on the state of the weather whether the soldiers' linen is damp or dry. The difficulty is as to what form of drying apparatus should be adopted, where to find room for it, and to induce the women to use it. In small barracks we have generally advised the adoption of the common cast-iron laundry stove, and where the amount of drying required is not great, it may be effected by one of these stoves placed in the room at a sufficient distance from the walls, with cords over it on which to hang the linen. This is done at Preston. The sloping sides of the stove can be used for heating irons. An allowance of fuel will be required, the cost of which, however, will be more than repaid in the saving of sickness among the men.

In many barracks separate accommodation for drying and ironing linen might be obtained at a trifling cost by fitting up a small outbuilding, or part of an outbuilding as a drying room with a laundry stove, cords, and an ironing table. In all cases, the admission of fresh air close round the stove, and free ventilation by louvres in the roof are indispensably necessary for efficient drying.

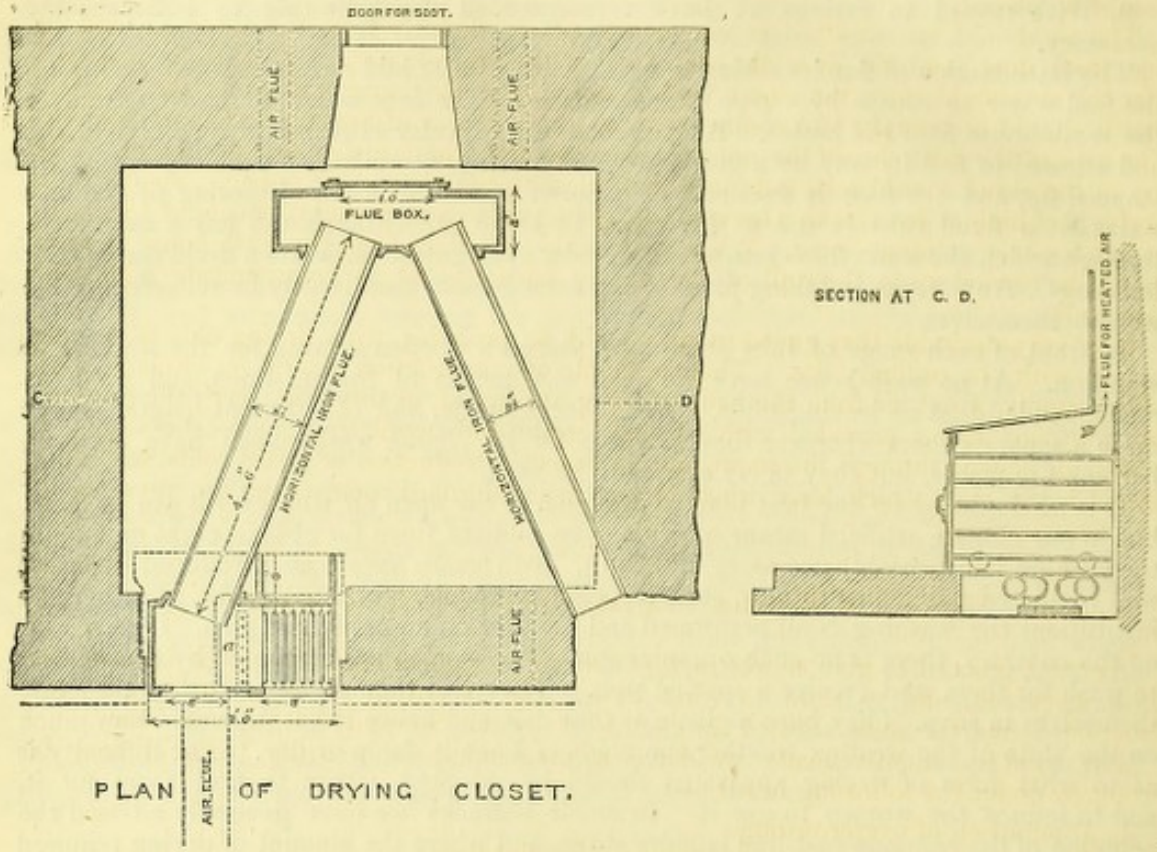
Drying Closets.—In the larger class of barracks it is doubtful whether one laundry stove will afford sufficient means of drying, and in all such cases we have recommended a proper drying apparatus to be provided; but a large room with one or more drying and ironing stoves, free admission of air round the stoves, and a free escape for moisture above, cords on which to hang the wet linen, and a suitable table for ironing, forms a very efficient drying and ironing room.

The form of drying closet we have adopted is the one in common use, which consists of a small dark closet, with sliding clothes-horses, and supplied with hot air from below. We have met with several examples where similar drying apparatus has acted very imperfectly or not at all, mainly on account of want of adaptation in its parts. The following is a form which will be found to answer in practice. The closet may be either built off from the wash-house if there be sufficient space, or it may be built out from it with the open side of the closet facing into the wash-house. The size of the closet will depend on the extent of the barrack. There should be space in all cases for two clothes-horses, and the accommodation should be at the rate of six horses per 1,000 men at least. The horses should be made of galvanized iron or of wood, the latter is preferable, and should be 5 feet 6 inches deep, and about the same height. Each horse should be suspended on two large grooved rollers 9 inches in diameter, one at each end, and running on a rail of ⊥ iron, with a guide running in a groove below to prevent any lateral movement. The

bars of each horse, when of galvanized iron, are fitted into a galvanized iron plate faced with wood, the handle being strongly screwed through.

Fig. 62 shows a plan and section of the apparatus.

Fig. 62.



There is an arched recess over the fire-place where irons can be heated.

The horizontal iron flue terminates in a vertical brick flue which, to ensure an efficient draught, should be nearly twice as high as the horizontal flue is long.

When the horses are pushed home their fronts should fit tight, so as to form the fourth side of the drying room facing the wash-house.

The essential conditions to be fulfilled in every drying closet, and the realization of which constitutes the chief practical difficulty, are,—

1. To provide a rapid current of highly heated dry air passing up through the floor of the closet.

2. To provide a sufficiently free outlet for this air above, after it has become moist by passing over the linen hung on the horses, without waste of hot air.

3. So to apportion the inlets, outlets, and extent of heating surface that the current may neither be too strong nor too weak. If the former, the air will not be sufficiently heated; if the latter, the air round the wet linen will be kept charged with moisture, and the drying will be delayed.

One fire should suffice for heating the smoothing irons and for supplying hot air to the closet, and the floor of the closet should be sufficiently raised to enable the flue from the fire to be carried under it to the chimney. The fire is enclosed in a stove, one side of which is exposed within the closet. The stove is entirely of iron, and the side within the closet should have three or four flanges about three inches broad cast in it to increase the heating surface. The top of the stove outside the closet should be flat or inclined, and should be capable of holding at least two irons for every horse, either in one or two rows.

The grate should be about one foot long, terminated by a fire-brick bridge perforated with holes, as already described, to admit fresh air to the flame, to assist in the prevention of smoke.

The flue is best made of iron, passing horizontally from the stove, under the floor of the closet, the whole length of the horses, and back to a chimney, which latter, as already stated, should be nearly twice the height of the horizontal flue. Arrangements for sweeping the flues should be made as conveniently as possible, and from the outside.

The floor of the closet should be of wire grating, or perforated iron or zinc, with holes large and numerous enough to allow of the easy passage of air through every part of it, and small enough to prevent any of the clothes from coming in contact with the flue or the stove. The top of the flue should be not less than three inches from the floor. It is desirable that immediately over the stove a double sheet of perforated zinc or wirework should be placed.

The air should be admitted at convenient places, directly from the outer air, and be free from dust, and not over the wet floor of the wash-house; it should be arranged that the air should enter the closet immediately under the stove and under the flue, and that it should be brought into contact with as large an area of heating surface as possible. The area of the inlet should be not less than one and a half square feet per horse. The top of the closet should terminate in a shaft close to the chimney if possible, about ten to twelve feet high at least, with a louvred top, giving an area of not less than about 18 square inches for every clothes-horse. Where practicable the flues from the wash-house coppers should be carried up in the wall of the drying closet, so as to communicate additional heat to it.

It is very desirable that guard rooms should be provided with drying closets in connexion with the ordinary fire. Their principle of construction should be similar. Half of the supply of hot air from the back of the grate would, in this case, serve the purpose. But in guard rooms provided with the new grate and ventilating shafts the supply of heated air passing through the room, and the recent introduction of guard coats, will much diminish the evils which have arisen in unventilated guard rooms from the presence of wet coats in them.

Summary of Barrack Sanitary Improvements recommended.

We next proceed to give an abstract of the works recommended in all the barracks we have inspected, and to show to what extent the execution of these works has been sanctioned, and the sums allotted for each work by the Secretary of State for War.

The sanitary improvements we have recommended for existing barracks may be arranged under the following heads:—

1. Diminution of overcrowding.
2. Improvements in ventilation, warming, and lighting.
3. Improvements in water supply, drainage, latrines, urinals, and cleansing.
4. Improvements in ablution and bath rooms.
5. Improvements in cook-houses.
6. Improvements in wash-houses.

In the preceding part of this section we have described the nature of the works we have advised for effecting each of these objects. The most cursory examination of them will show their great extent and importance, for indeed they involve almost everything necessary to render a barrack fit for healthy occupation. It will be obvious that a larger amount of outlay will be involved, and a longer time will be required in giving full effect to these improvements than was at first contemplated. But even this necessary delay has not been without its advantages, for it has enabled us to ascertain by repeated trials the sanitary works best adapted for barracks, a point in regard to which little or no experience existed at the time we commenced our inspections.

In carrying out our instructions, we completed the sanitary examinations of the more important barracks, district by district, and had estimates framed for the whole of the improvements required by the Commanding Royal Engineer of the district. There were not sufficient funds set apart to complete the improvements as quickly as the reports and estimates were sent in, and instead of appropriating the whole amount voted by Parliament to complete a few barracks, leaving the remainder totally unprovided for, we were requested by the Secretary of State to point out the class of improvements which were most necessary in each barrack, with a view to the grants of money being devoted in the first place to such improvements.

Ventilation and diminution of overcrowding were obviously the most urgent and important to health of all the improvements we had recommended. The first could be commenced with at once; but to reduce the inmates of barrack rooms to such an extent as to afford 600 cubic feet per man was simply impracticable until the barrack accommodation could be extended. To meet the emergency arising from deficient accommodation as far as possible, the Secretary of State issued a circular on the 1st October 1858, in which, after reciting the recommendation of the Royal Commission on the subject of

cubic space, namely, 600 cubic feet per man in barracks, 1,200 cubic feet per man in hospitals in temperate climates, and 1,500 cubic feet in hospitals in tropical climates, he directed that,—

"In future, therefore, whenever from but partial occupation of a barrack or hospital it be possible by spreading the men more generally throughout the barracks to allot to each man a greater cubical space than is now afforded, such extension is to be permitted to the extent necessary to afford the cubical space as above laid down."

This circular, no doubt, is an improvement on past practice, and if rigidly followed would enable in many cases a larger amount of space to be given than at present. It could be applied easily during summer and in temperate weather, but in winter it would hardly be applicable, because every inmate removed from a barrack room takes his coal ration with him, and hence without more fuel or improved methods of warming, such as we have recommended, more cubic space would necessarily imply colder rooms.

Another method of giving effect to the recommendation of the Royal Commission has been proposed, which, if carried out, would defeat the very object which the Commission had in view. It has been proposed to calculate the space per man not on the beds in the room, but on the chance occupation.

That is, suppose a room stands on the construction as a 10-men room, and that two men are, on an average, out of it on duty, the proposal is to give 600 cubic feet per man to the remaining 8 men, if the room will afford it. It hence would follow that $\frac{8\times600}{10}$ would give 480 cubic feet per man for 10 men as the regulation accommodation. Now, it so happens, that this 480 cubic feet for 10 men, raised to 600 for 8 men, by 2 men being on duty, is the identical method of apportioning space hitherto in use, which has been one cause of the sickness and mortality of the army, and which the Royal Commission wished to put an end to. We object to this proceeding in the most decided manner. The number of men painted on the door ought to indicate the number of beds in the room, at 600 cubic feet each, otherwise the overcrowding will continue as at present.

The only temporary remedy for overcrowding which can meet the requirements of the case is providing huts or tents, and the only permanent remedy is providing more barrack accommodation.

Next in importance to reduction of overcrowding and improved ventilation we ranked improved drainage, improved cooking, and washing arrangements, baths, &c. But large works of construction, such as barrack extension, involving great outlay, a cost dependent on local circumstances, which cannot hastily be ascertained, and much time in their execution, we have not included in our estimates, for obvious reasons.

The grants of money for sanitary improvements were apportioned by the Secretary of State on these principles, and the works were proceeded with in the order and manner recommended by us.

We have tabulated a summary of particulars in Table E., which shows the present financial position of the sanitary works in each barrack examined by us, under the following heads:—

1st. Sanitary works recommended for each barrack.
2nd. Estimates prepared for the entire works in each branch.
3rd. The items and amounts sanctioned by the Secretary of State.
4th. The items and amounts postponed.

In order to bring the whole subject under one view, we have given an abstract of the results of Table E., in the three following Tables, showing separately:—

1. The additional amount of barrack accommodation required to give 600 cubic feet per man in the 162 barracks we have inspected.
2. The state of the ventilation in the same barracks, with the extent of improvement required.
3. The state of the barrack water supply, drainage, latrines and urinals, paving and cleansing, means of cleanliness, means of cooking, &c.

1.—Additional Barrack Accommodation required to give 600 Cubic Feet per Man.

Number of Barrack Rooms included in Table B.	Total present Regulation Number of Men.	Total available Accommodation at 600 cubic feet per man.	Number of Men for whom additional Barrack Accommodation is required.
5,339	75,801	53,806	21,995

2.—State of Ventilation, and the Amount of it required.

Nature of Sanitary Improvements.	Number of Rooms in which each Improvement is required.	Nature of Sanitary Improvements.	Number of Rooms in which each Improvement is required.
1. Ventilation of barrack rooms by shafts and inlets - -	5,339 rooms.	6. Ventilation of barrack passages and staircases - -	All „
2. Ventilation of non-commissioned officers' rooms by Arnott's valves, &c. - -	All „	7. Ventilation of stables under barrack rooms, by shafts -	All „
3. Ventilation of school-rooms, library, reading-rooms, and workshops - - - -	Nearly all „	8. Remodelled grates for warming part of the air admitted	All barrack rooms and guard rooms, libraries, reading-rooms and some school-rooms.
4. Ventilation of guard rooms by shafts and inlets, &c. - -	Nearly all „		
5. Ventilation of canteens -	All „		

3.—State of the Water Supply, Drainage, Latrines, Cook-houses, Ablution Rooms, Lighting, &c., with the Number of Barracks in which Improvements are necessary.

Nature of Sanitary Improvements.	Number of Barracks in which each Improvement is required.	Nature of Sanitary Improvements.	Number of Barracks in which each Improvement is required.
1. Abolition of cesspits and privies, drainage of barrack, and construction of water latrines and urinals -	135	Other improvements in wash-houses - - - -	22
Other improvements in latrines	20	6. Roasting ovens required in cook-houses - - -	108
2. Improved water supply, where such improved supply is easily obtainable - - - -	40	7. Improvements in cleansing, including manure heaps, ash-pits, &c. - - - -	53
3. Improvements in ablution rooms - - - -	124	8. Improvements in surface drainage - - - - -	23
4. Bathing accommodation -	123	9. Substituting boarded floors for flagging or asphalte -	6
5. Means of drying linen in women's wash-houses, fixed tubs, &c. - - - -	110	10. Introducing gas with ventilated gas burners, where gas is easily obtainable - -	51
		11. Opening additional windows -	18

These Tables show the extent to which sanitary precautions have been hitherto overlooked in all barracks, and the large outlay required to remedy the defects. The foul air of over-crowded sleeping rooms and guard rooms has been treated as if it were a thing of no importance to health. Bad drainage, cesspits, manure pits, and ashpits, occasioning nuisance in many barrack rooms, and polluting the subsoil of the barrack enclosure with filth even to the extent of endangering or damaging the purity of wells, exist to a greater or less extent in nearly all barracks at the present time. With very few exceptions there were no means of cooking except the old regulation boiler at the time we began our work. There were hardly any baths. There were no means in wet or damp weather of drying the soldiers' linen washed in the defective barrack wash-houses, except the barrack room fire, although good laundries had been provided in connexion with married quarters in the very few barracks where these quarters have been recently erected. Into very few barracks had gas been introduced in comparison with the number of barracks into which, although at hand, it had not been introduced.

The result of our whole examination and inquiry has been to substantiate the general statements contained in the Report of the Royal Commission on the Sanitary State of the Army, as to the very defective sanitary condition of barracks, and the influence of such defects in deteriorating the soldier's health and increasing his mortality.

Unfortunately, the amount of money required to remedy the defects is very large, far more so than could have been foreseen, because such an entire ignoring of the necessity of sanitary works could never have been anticipated; but, on the other hand, it ought not to be forgotten that these structural deficiencies ought not to have existed at all in any barrack, or, indeed, in any building intended for human habitation. It will undoubtedly cost more to remedy the evils now than it would have cost to have prevented them in the first instance; but we feel perfect confidence in stating that whatever the cost of carrying out sanitary improvements in barracks and hospitals may be,—for both classes of buildings must be considered together,—it will be money well laid out, for it will not only lead to improved health and comfort of the soldier, but to general improved efficiency in the army.

PART II.

SECTION I.

THE SANITARY CONDITION OF HOSPITALS.

As already stated, the number of hospitals we have examined with reference to their sanitary condition, amounts to 114. Of these 55 belong to barracks in England, 16 are attached to barracks in Scotland, and the remaining 43 belong to Irish barracks.

In describing their condition we shall follow the same general arrangement of subjects adopted in the preceding part of this Report.

The points in regard to which we made special examination and inquiry were the following:—

1. Position, neighbourhood, and construction of hospitals.
2. Amount of cubic space allowed per bed.
3. State of the ventilation and warming.
4. State of the drainage, water-supply, water-closets, privies, and cleansing.
5. Ablution and bath accommodation.
6. Hospital kitchens.
7. Hospital washhouses.
8. Accommodation for medical officers, hospital serjeants, orderlies, stores, &c.
9. Accommodation for sick wives and children of married non-commissioned officers and soldiers.

We proceed to give the result of our inquiry under each of these heads.

1. Position and Neighbourhood of Hospitals.

As a matter of necessity the position of a hospital is mainly determined by that of the barrack to which it belongs. Both are situated contiguous to each other, and both are, with few exceptions, within the same enclosure. Whatever, therefore, has been stated in the preceding part of this Report, and in the last column of table C, regarding the position and neighbourhood of barracks applies to hospitals, except to such cases as the General Hospital, Queenstown, or the Military General Hospital, Dublin, where the hospital buildings are detached and separated by a considerable distance from the barracks whence they receive their sick. Such instances, however, are comparatively few in number, and they are not barrack hospitals in the proper sense of the term.

There is one general remark which it is necessary to make on the subject of hospital sites as compared with barrack sites, and it is this:—A site in every way suited for a hospital would answer for a barrack so far as regards health; but it does not follow that a site suitable for a barrack would be fit for a hospital. Sick men are much more susceptible to the influence of impure air and of unfavourable locality than healthy men; and their recovery might be retarded or prevented altogether by conditions which would be comparatively harmless to men in health. This point requires to be kept in mind in considering the remarks we have made on barrack sites, otherwise it might be inferred that we have a more favourable opinion of hospital sites belonging to these barracks than we really have.

There are, however, not a few hospital sites possessing considerable natural advantages for health. The two Irish general hospitals already mentioned are among the number. As a rule, to which there are exceptions, country barrack hospitals occupy tolerably healthy positions. Some are on considerable elevations, freely exposed to wind. Some overhang the sea; others are placed in a healthy open country or suburb.

As exceptional examples of unfavourable sites in open situations we may mention Tilbury Fort hospital, which is surrounded by marsh land; Stoke Devon General Hospital, built close to a foul muddy creek, without any apparent necessity having existed for doing so; Shorncliff hospital which has been erected against the steep slope of a hill, with the lines of wards placed across the natural fall of the drainage, and exposing the whole building to the effects of damp, as well as to rapid destruction by fire, should it unfortunately occur in any of the lower buildings. The hospital belonging to Piershill barracks, Edinburgh, is close to a large expanse of land irrigated by town sewage, but exposed at the same time to the full influence of the sea breeze. The hospital of the Guards recruiting barrack at Croydon is in a low damp situation, and was till recently exposed to nuisance from a sewage manure manufactory, pig-sties, &c.,

and cases of simple fever received into it were found to pass into typhus, or to linger for months after to all appearance, they ought to have recovered.

Hospitals belonging to barracks in towns are, as a rule, unfavourably situated as regards health. A large town is not a suitable place for a building intended to contain a number of sick persons. The air is not sufficiently pure, and the external movement of the atmosphere not sufficiently free to ensure good ventilation. On the other hand, regimental hospitals are generally occupied by a much smaller number of sick than civil hospitals in the same town, and this smallness of number to some extent counterbalances the defect of position.

The hospitals of a few town barracks are in positions irremediably bad. Galway Castle hospital, Limerick Castle, and Ordnance hospitals, and Linen Hall hospital, Dublin, occupy about the worst examples of town hospital sites we have met with.

The first (L, Fig. 5) is closely surrounded by high walls among the dwellings of the civil population. The second has a lofty barrack within a few feet of its front, and the third overlooks an extensive cattle market, and is exposed to the noise and nuisance arising from such a neighbourhood. Linen Hall hospital (D, Fig. 6,) is part of temporary accommodation existing in a bad building situated in one of the filthiest localities of the Irish capital.

The difficulties of finding a suitable site for the General hospital, Portsmouth, led to its being erected across the gorge of a bastion, the ramparts of which interfere materially with the outer movement of the air.

The subsoils on which hospitals are built are, of course, those on which the barracks stand. In many cases the ground is gravelly and porous. In many it is of clay, and in a few the foundations are laid on rock.

A more important matter as regards regimental hospital sites is the position which they occupy within barrack enclosures.

A reference to the woodcuts we have given above will show that the barrack ground is generally a parallelogram or polygon, with the buildings arranged in such a manner as to enclose the parade ground among them. In consequence of the comparative smallness of the areas of most of the enclosures the officers' quarters, men's rooms, offices, stables, &c., are placed as close to the boundary walls as possible, the object being to obtain the largest possible parade ground. As it would be objectionable on many accounts that the hospital should form part of the side of the parade ground, it is generally built close to the boundary wall, or is thrust into a corner in an angle of the wall, so that free external ventilation and light, as well as space for outdoor exercise, so necessary in all hospitals, cannot be realised.

As illustrations of these defects in site we may mention the hospital at Sunderland, which consists of a small one story building filling up an angle of the barrack enclosure and having the enclosure walls rising as high as its roof. The infantry hospital at Newcastle is a one story building close to the boundary wall which also over-tops it and obstructs the light and ventilation along one side. Hulme Cavalry hospital, as will be seen by reference to Fig. 7, fills up one corner of the enclosure wall, immediately outside which there is a densely packed neighbourhood of dwellings of the working classes with open privies among the houses. Hyde Park Cavalry hospital, Fig. 1, although close to the Park is so hemmed in by buildings and high walls as to have its external ventilation interfered with on all sides; a defect in position incidental to the confined nature of the site itself. We have already referred to Galway Castle hospital which, as will be seen from Fig. 5, is placed in a narrow well without any draft and surrounded on all sides by walls higher than itself. In this case there is actually a foot-path running past the windows of the third floor, the only one which has thorough light and ventilation.

There are instances of unfortunate selections having been made of hospital sites within barrack enclosures when better sites might have easily been obtained. The hospitals at Leeds and Weedon afford illustrations of this. In the former case the building is situated at the foot of a slope falling rapidly from the barracks, and as a consequence the drainage from the barracks flows towards it. At Weedon the hospital is situated near the barrack, with the ground falling rapidly towards it. In this instance the barrack privies are considerably above the level of the hospital, and within a few yards of the back of the building.

In many cases, however, the site on which the hospital has been placed is perhaps the best available within the enclosure. It is usually that shown in Figures 14, 15, and 16. The positions in the three examples we have selected are as good as any within the ground, except that the space available behind the hospitals, whether for convalescents exercising or for isolating the hospital from the enclosure walls, or from

the neighbourhood outside, is much too small. This last defect is a very general and prominent one in military hospitals, and is scarcely compensated for by the best possible construction of the hospital itself. The hospital at Templemore stands in an angle formed by a high boundary wall, and immediately outside the wall is a dense lofty screen of trees which cannot be removed, because they are on private property. These trees interfere injuriously with the ventilation of the hospital, and we were informed by the medical officer in charge that the damp stagnant condition of the air produced by them delayed the recovery of the sick. The defect in these and many similar instances is not in the selection of the positions so much as in not recognizing the necessity of isolating a hospital from all walls, buildings, &c. to a sufficient distance for every purpose of light and ventilation. In securing these important objects space for exercise is also obtained. In barracks where the only alternatives for the slightest ailments are duty, or the hospital, the want of sufficient exercising ground becomes in many cases a matter of serious importance, and often leads to more severe disease than that for which the patient was admitted.

It is not unusual to find a site, otherwise good, deteriorated from want of appreciation of what is necessary to the healthiness of a hospital.

We found for instance at Belfast an open sewer partly arched over and the works left unfinished within a few yards of the hospital front, while a little further off was a pond of stagnant sewage in the barrack-master's garden. At Parsonstown barrack, Fig. 14, the site of the hospital, though a tolerably good one, is subject to nuisance from three easily removable causes, all of which have been *brought* to the hospital.

Immediately behind the building we found an open ditch filled with sewage used for irrigating a meadow about 70 yards off. Under the hospital windows in front is the drying ground of the barracks, where the wet linen is hung out on cords to dry, and, as will be seen from the plan, half of the barrack privies are in a building in front of the hospital. When the wind blows on one side of the hospital, nuisance from the open ditch pervades the wards, and when from the opposite quarter, nuisance from the privies is much complained of. A tolerably good position is thus converted into a bad one by nuisances which ought never to have been permitted to exist.

The hospital at Kilkenny is in a tolerably good part of the barrack enclosure, but so far as concerns the sick, the site has been rendered a very bad one, in the following manner: The magazine is placed close to the hospital, and the sick are liable to constant disturbance by the pacing of sentries, and their half hourly calls, especially during night, when quietness for sick men is most necessary. Immediately behind the magazine, and much too close to the hospital, are the barrack privies, and on the opposite side of the hospital is the wash-house where the barrack washing is done, neither of which buildings ought to have been placed there at all. More recently a ball court has been provided for the barrack, a most laudable and necessary adjunct to all barracks, but in this case the court has been placed against the end wall of the hospital, so that the noise proceeding from the game is heard in all the wards on that side.

Another illustration may be taken from Portobello barrack hospitals at Dublin. There are two hospitals under on eroof with regulation space for 72 beds. Immediately in front of them and under the ward windows are the infirmary stables for sick artillery and cavalry horses belonging to a strength of 928 non-commissioned officers and men. Close to the stables was a large open dung pit, and in front of them an extensive forage yard covered with litter and decomposing matter.

Although it was the depth of winter when we examined these hospitals, the smell from the infirmary stables and dung pit, and from the large foul surface of the forage yard pervaded all the wards. A tolerably open and good site was thus converted into a very bad one by local nuisances, which ought never to have been permitted to exist near a hospital.

The hospital at Aberdeen, although exposed to the sea breeze on one side, has on the other side, close to the wards, a neighbourhood of low filthy houses, in front of which, and directly under the hospital wall, there were heaps of manure and filth, apparently collected by the people and accumulated there for sale. This nuisance, which no doubt could be dealt with summarily, affected the purity of the whole neighbouring atmosphere.

These and similar avoidable causes of unhealthiness would never have happened had there been sufficiently intelligent consideration given to points regarding site and vicinity, attention to which is absolutely necessary for the efficiency of all hospitals. Defects such as we have pointed out have in many cases arisen since the hospital was built, and indicate the necessity of taking precautions beforehand, which is our reason for referring to them so prominently. If it is a bad thing to have barrack rooms pervaded by the effluvia of privies and stagnant ditches and by the presence of wash-houses and stable

litter, and if it is a bad thing to have the sleep of healthy men disturbed by unnecessary noises, it is far more injurious to the sick to subject them unnecessarily to the same nuisances.

2.—Defects in Plan and Construction of Hospitals.

Of all parts of a barrack the hospital is planned with the smallest apparent amount of attention or consideration for the objects which the building is intended to fulfil. This, no doubt, has been partly due to the circumstance, that although the importance of observing certain principles in the construction of hospitals has been from time to time enforced by a few enlightened members of the medical profession, there has been no general recognition of the fact that the observance or non-observance of these principles exerts almost as great an influence as is exerted by the medical treatment on the final result of cases admitted into hospital, whether as regards their duration or termination.

Pure air is essential to the preservation of health among healthy people. Pure air is the very life-blood, so to speak, of the sick. Without it the most consummate skill in medical or surgical treatment may be of little or no avail. With it a patient will often recover when deprived of many of the appliances and comforts with which we are apt to associate the possibility of recovery.

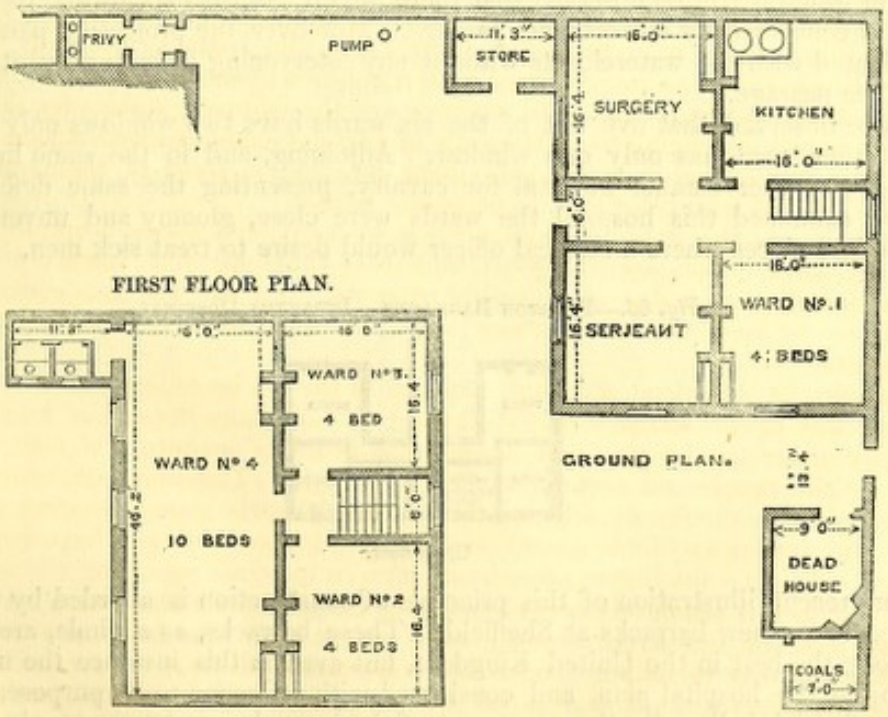
These principles are happily more generally recognized in the present day than they have been at any preceding period, and it is to be hoped that past errors in plan will not be re-produced in future buildings.

Unfortunately, however, we have to deal with a large number of existing hospitals, in regard to hardly one of which can it be stated that abundance of pure air as an element absolutely essential to the recovery of the sick has been provided for in the construction.

The barrack hospitals in the United Kingdom present almost every variety of plan except the right one. It is true that in a very few of the more recent hospitals there has been more attention paid to the essential conditions we have enforced above than in the older buildings. On the other hand, all the older hospitals are not equally defective in plan. Some are better than others, but in not one instance that we have seen can it be said that we have here a really good hospital supplied with all the requisites for facilitating the recovery of the sick and possessing adequate facilities for administration and nursing. Such a hospital has yet to be constructed for the British army.

The usual form of a barrack hospital is that of a barrack house. It consists of a two or three story building with a passage and staircase occupying the middle of it, and the rooms entering from them right and left. On the ground-floor are the surgery, serjeants' room, kitchen, stores, and sometimes a sick ward or two, and on the upper floors are the remainder of the wards. The usual internal arrangement is shown in the following plan of York cavalry hospital (Fig. 63). To the eye of the common observer such

Fig. 63.—York Cavalry Hospital.



a hospital bears a very close resemblance to the ordinary better class of houses in a country village. Its external architecture is the same. It has the same through and

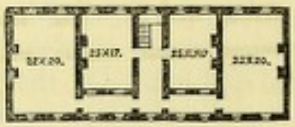
through passage with the staircase in the middle and small rooms opening right and left out of it, and it is just as little adapted for the successful treatment of a number of sick men, as an ordinary village house would be.

In depôt barracks, or in barracks large enough for more corps than one, it is usual to join on to the end of the hospital house another house of similar or smaller dimensions with everything in duplicate, passage, staircase, surgery, kitchen, stores, serjeants' room, &c. When the barrack requirements have overgrown the hospital accommodation, the want has been usually supplied by adding additional wards at the end without any separate entrance, so that these additional wards have to be reached by passing through other wards. In one such instance, at the hospital at Kilkenny, there are three wards *en suite*, the innermost ward being that devoted to sick prisoners over whom a soldier on guard is placed, and the sick in the other two wards have to be disturbed at every change of guard by the men passing and repassing by day and night! With such an arrangement the sick would be more comfortable and less exposed to the risk of being suddenly startled and awakened out of sleep almost anywhere than in hospital.

It is evident that this single house plan admits of only one ward in the length of the building being placed on each side of the staircase; but sometimes there are two wards in the depth, in which case the wards are back to back, with windows only on one side, an arrangement inadmissible in hospitals on account of the obstruction which it offers to thorough ventilation.

There is another class of hospitals in which a larger amount of accommodation than could be given in the plan we have discussed, is obtained by placing a number of wards or offices in the length way of the building. But to enable this to be done it is necessary to connect the entrance passage and staircase with all the wards by means of a corridor. As an illustration of this class of hospitals, we have selected a recent one at Ashton (Fig. 64), in which, as will be seen, there are four wards in the length of the building, connected by means of a corridor covering one end of two of the wards. By this arrangement the ventilation of all the wards on each floor is connected, so that without great care in managing the doors, windows, fires, and other means of renewing the air, the sick in any one ward may be compelled to breathe the foul air of the others.

Fig. 64.—Ashton Hospital.

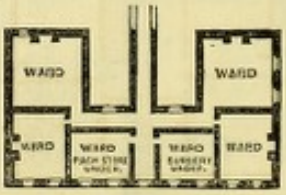


Upper floor.

A less favourable example of the arrangement is afforded by Preston barrack hospital, Fig. 65, in which it will be observed that there are no less than six wards, the ventilation of which is connected by a short inner passage. Moreover, the projecting passage behind, communicated with the waterclosets without any intervening door to prevent the effluvia entering the passage.

It will be observed that five out of the six wards have two windows only on one side and the other ward has only one window. Adjoining, and in the same line with this hospital, is another smaller hospital for cavalry, presenting the same defects in plan. When we examined this hospital the wards were close, gloomy and unventilated, and about the last places where a medical officer would desire to treat sick men.

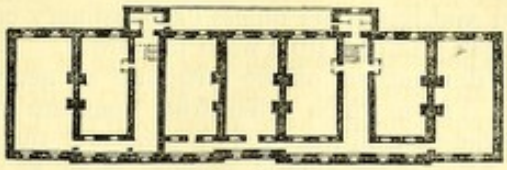
Fig. 65.—Preston Barracks. Infantry Hospital.



Upper floor.

A more recent illustration of this principle of construction is afforded by the hospital belonging to the new barracks at Sheffield. These barracks, as a whole, are very good, and among the best in the United Kingdom, but even in this instance the usual fatality has followed the hospital plan, and considered with reference to its purpose, the accommodation for sick is literally the worst part of the barrack, except as regards site, for it is only proper to mention that the building has been placed on the highest level.

Fig. 66.—Sheffield Hospital.

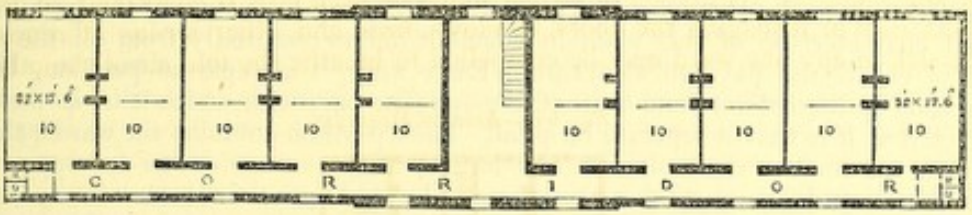


Upper floor.

The plan of one of the floors is given in Fig. 66, from which it will be seen that there are two hospitals, each with its separate passage and staircase. There are seven wards in the length of the building, five of which are covered along their ends by a glazed corridor, so that they communicate directly with the open air only at one end. The two end wards of the block go through and through; but from the plan which has been adopted, the distance between the opposite windows of these end wards is about 38 feet, or 8 feet more than it should be even if the wards were of a suitable height. The distance from the corridor windows through the wards to the opposite ward windows is the same. The corridor in this case forms a *cul de sac* for stagnant air, communicating with all the wards of each hospital by the staircases. On the ground floor of this hospital there is a large room for orderlies, ventilated into one of the passages, without any direct communication with the outside, either for light or air.

Chatham Garrison Hospital, a plan of the first floor of which is given in Fig. 67, appears to have been the original model on which the plans of all the more recent defective hospitals have been framed.

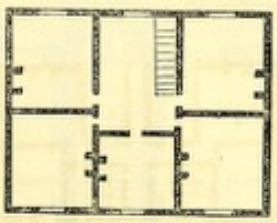
Fig. 67.—Chatham Garrison Hospital.



First floor.—The figures show the number of men in each ward.

This building consists of a basement with three complete floors of wards above, and a fourth floor containing five back-to-back wards at the top of the staircase. The front is 310 feet in length, and is covered for three stories by a corridor giving entrance to ten wards on each of the three flats. Each ward has only one window to the outer air, and a door into the corridor, in which there is a window opposite each ward door. The distance from this window through the ward to the ward window is 40 feet, or 10 feet more than it ought to be, even if the hospital were constructed on the best plan. Including the top story there are thirty-five wards, or rather cells, communicating with each other through the corridors and staircases, which are, in fact, a common receptacle for the foul air of the entire building. In these cells there was at the time of our inquiry regulation space for 290 sick.

Fig. 68.—Chatham Garrison Hospital.



Third Floor.

The plan of the third floor (Fig. 68) shows five wards at the top of the staircase, back to back, with a window only on one side. These wards are intended for six men each, and afford a very good illustration of rooms where sick men ought *not* to be placed. Indeed, nothing but the high exposed situation of the hospital keeps it free from hospital diseases. Whatever may be the apparent facilities of access gained by adopting this

form of closed corridor construction, it ought never to be used in any building where a number of men, especially sick men confined to bed, are congregated under one roof. It interferes with ventilation and light, and unless extraordinary care be taken, it is certain to become a means of passing foul air from ward to ward.

These five plans afford illustrations of the structure of nearly every military hospital in the United Kingdom. Those which differ from them are merely exceptional, but as they are exceptional in the right direction, it is necessary that we should notice them. We do so, however, not because we should propose them as models for adoption, but simply because they contain certain good elements and principles from which, when properly handled, a hospital in all respects sufficient, as regards healthiness, administrative facilities, and economy can be constructed.

Fig. 69.—Royal Military Infirmary, Dublin.

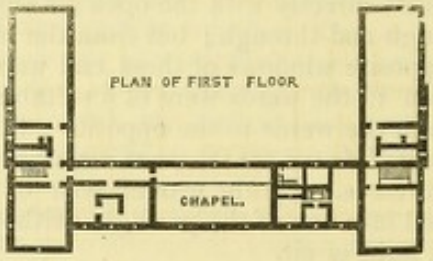
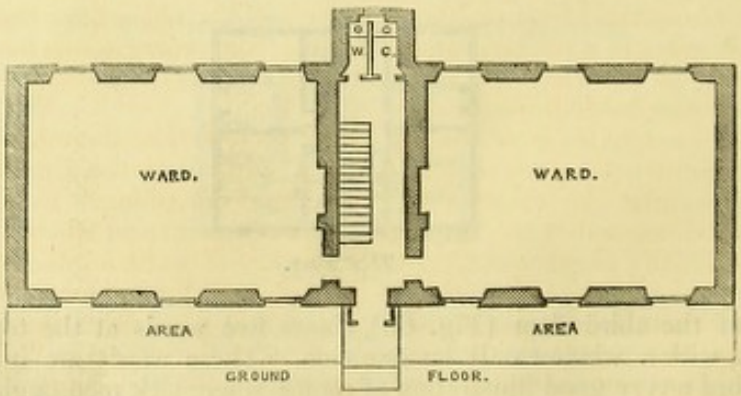


Fig. 69 represents a plan of the first floor of the Royal Military Infirmary, or General Hospital, at Dublin. It consists of a centre and two projecting wings. Each wing contains three flats of wards, and in the centre are the chapel, officers' quarters, orderlies' rooms, &c. There are two wards on each floor of each wing, and these wards are separated from each other by a stair extending from top to bottom of the building. The special characteristic of this plan, in which it differs essentially from all the others, is what is called the pavilion structure. Each wing is a separate pavilion, having its ventilation quite distinct from that of the opposite one, with which it is, in fact, as little connected as if it were a separate hospital. Each pavilion contains six wards, three large and three of smaller dimensions. The larger wards have windows on opposite sides; the smaller wards have windows on three sides. All the wards are freely exposed to sunlight and air. The great advantages as to healthiness possessed by this hospital plan over such a plan as that of Chatham garrison hospital are obvious at a glance. Fort Pitt General hospital is constructed on the same general plan; but these are the only two military hospitals in the United Kingdom in which the pavilion structure has been followed, although the elements of it exist, more or less, in the better class of house hospitals, at least in so far as their wards possess windows on two opposite sides instead of at opposite ends. As we shall presently show, there is a great and essential difference in hospitals resulting from this difference of position in the windows.

The nearest approach to a good *ward* plan on the house-hospital principle is at Aberdeen (Fig. 70.) In this instance the wards open right and left out of a central passage and staircase, and the wards are of tolerably good proportions and well lighted. In other respects the hospital presents the usual defects and deficiencies of similar buildings.

Fig. 70.—Plan of Aberdeen Barrack Hospital.

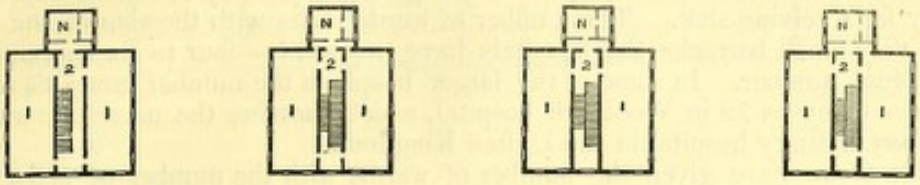


In one or two military hospitals a rather singular misapplication of the pavilion principle has been made.

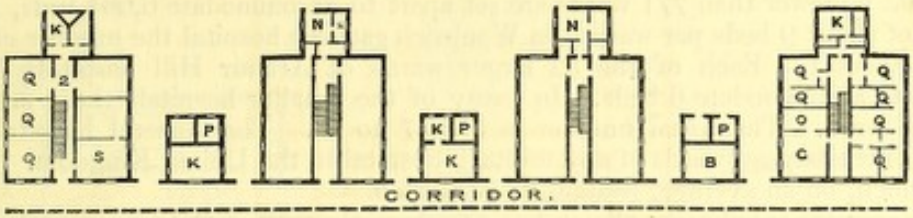
The General hospital at Stoke Devon affords the best illustration of this misapplication, as will be seen by the plan, Fig. 71.

Fig. 71.—General Military Hospital, Stoke Devon.

1st Floor.



Ground Floor.



Reference.

1 1 1, wards.
2 2 2, inner stairs, dividing each pavilion longitudinally from top to bottom.
s, surgery.
o, operation room.
c, consulting room.
q q, officers quarters.
k k, kitchens.
n n, nurses rooms, water-closets, sinks.
p p, privies.
b, bath room.

This hospital professes to be built in separate pavilions, connected by a one-story open arcade, or corridor running along its ground floor, with a terrace above, on which there is access to the open air from the first floors of all the pavilions. But just as the Dublin hospital represents the pavilion structure without proper means of communication, so Stoke Devon hospital represents the pavilion structure only in its means of communication between the pavilions. The error in this case is in the plan of the pavilion, and it is of a very singular kind. Each pavilion is double the breadth it ought to be, and to compensate for this it is split longitudinally from floor to roof by a staircase, on each side of which the wards are placed. The first result which necessarily follows from this arrangement of parts, is that the whole ward wall next the staircase is blank and has no windows. There is, therefore, no thorough cross ventilation and light, and the sunshine is very unequally distributed between the wards on the north and south sides of each pavilion, so that it is not possible to obtain the benefit of sunlight at all hours of the day, an object which ought to be aimed at in all hospital plans. It is true, that in this case the wards have windows at the ends, as well as along one side. This provision, and the otherwise good size and height of the wards must be taken into account in estimating the actual healthiness of the plan; but we cannot help feeling how much better a hospital this would have been if the wards in each pavilion had simply been extended out lengthways, instead of being doubled on each other as they have been!

The pavilion hospital at Walmer is on a similar plan, and exhibits similar defects in the application of the pavilion principle. In one or two other hospitals, as for instance, in the New Barrack hospital, Limerick, the end wards of the block have been provided with windows on three sides in a similar manner, but the intervening wards have windows only on one side, and as all the wards are connected by corridors and staircases, the objection as to the corridor plan holds throughout.

We have said enough to show that up to the present time there has been no general unit of hospital construction, adopted in military hospitals in the United Kingdom, and hence the plans exhibit the varieties we have been describing. Every architect has followed his own ideas, and there has been no one to point out whether any given plan was likely to be healthy or otherwise. The conditions of health are the same everywhere, although these plans take no cognizance of the fact. If, for instance, Chatham hospital, with its cellular structure be healthy, then the architect who built Stoke Devon hospital was unnecessarily extravagant in his designs, and so of the others. We shall endeavour in the sequel to point out the proper unit of military hospital construction, but, in the mean time, these plans, taken as a whole and not in parts, appear to us to teach what should certainly not be followed.

Wards and Ward Construction.—Having discussed the general plan of military hospitals, we proceed to describe the number, size, and general character of the wards.

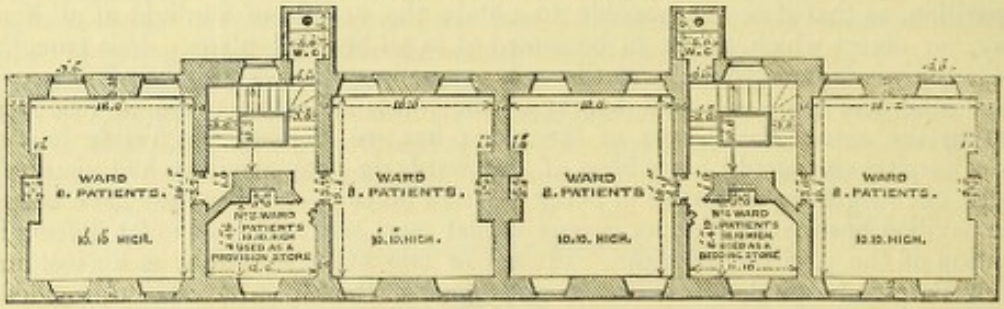
The number of wards in these hospitals varies, of course, with the strength for which the barracks were originally intended. The regulation number of beds is 10 per cent. of the force, but as this regulation takes little cognizance of the amount of cubic space necessary for sick, the number of beds in any given hospital by no means represents its capability for receiving sick. The number of wards varies with the size of the hospital. In a few very small barracks the hospitals have two wards—four to six and eight wards are the usual number. In some of the larger hospitals the number increases to 10, 20, 40, up to as many as 72 in Woolwich hospital, which contains the maximum number of wards in any military hospital in the United Kingdom.

On table G we have given the number of wards, with the number of beds, in each hospital we have inspected. The first thing which must strike any one looking at that table, is the very large number of wards in proportion to the number of beds. The table shows that no fewer than 771 wards are set apart to accommodate 6,664 beds, giving an average of about 9 beds per ward. In Woolwich garrison hospital the number of beds per ward is about 6. Each of the 32 larger wards of Arbour Hill hospital, Dublin, is intended to accommodate 6 beds. In many of the smaller hospitals there are about 4 beds per ward. The usual number is from 7 to 10. The General hospital at Stoke Devon has the largest wards of any military hospital in the United Kingdom. It has 20 wards, which, on an average, contain 21 beds each.

Such excessive subdivision of sick has arisen partly from certain exaggerated notions respecting the necessity of classifying diseases, which have obtained in the service, and partly from the presumed necessities of the regimental system. In any hospital, however small, one ward for medical and one for surgical cases would probably be required, but where it has been necessary to increase the accommodation to meet the size of the barrack, this has been done, not by enlarging the wards, but by adding to their number.

We have already stated that where more regiments than one have been accommodated at a station, it has been the custom to add on separate wards and offices, indeed, to provide another hospital, and as each hospital was supposed to require the same classes of ward accommodation, the most needless multiplication of parts has taken place. We shall give an illustration or two of these duplicate plans. Athlone hospital (Fig. 72) consists of two separate establishments under one roof, each having its separate staircase, wards, and offices, all in duplicate. The building is very much overcrowded, and notwithstanding the unnecessary multiplication of parts, it will be observed that on the floor shown in the plan two wards have been abstracted from the sick accommodation, one for a bedding store, the other for a provision store. The waste of space and consequent injury to the sick in such a plan are obvious enough.

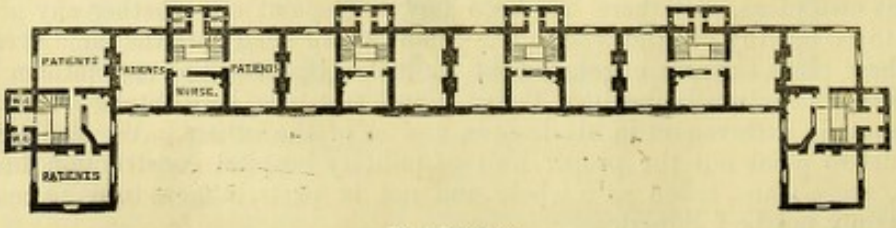
Fig. 72.—Athlone Hospital.



Plan of first floor.—Showing the usual structure and arrangement of a double regimental hospital.

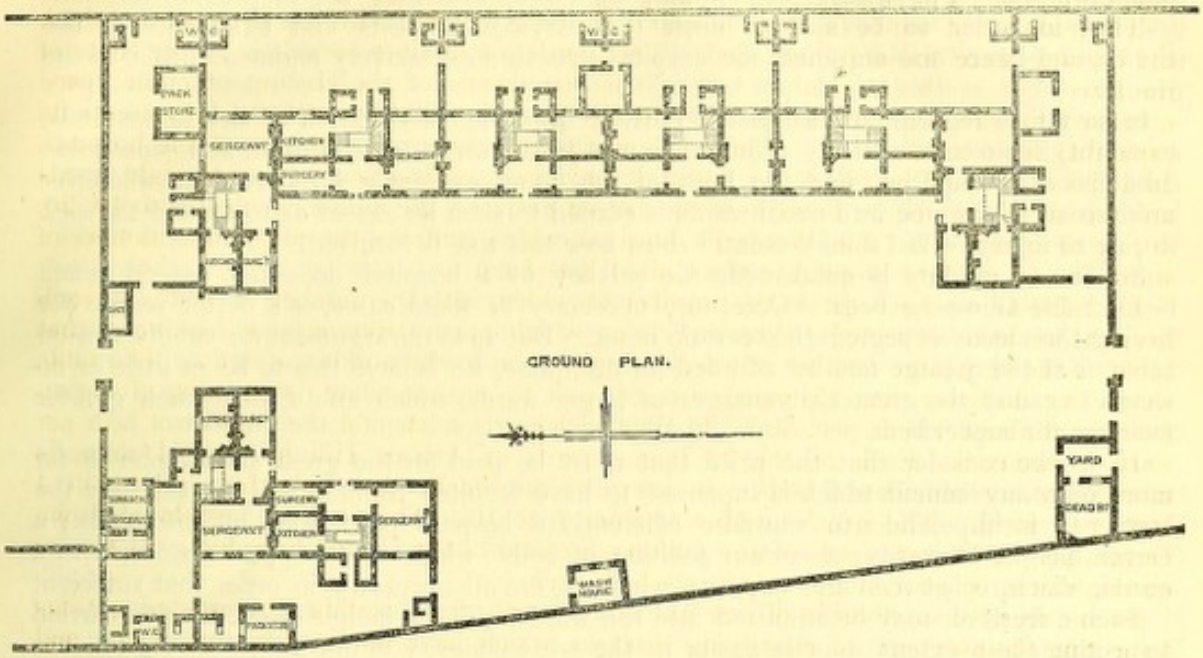
The most extreme instance of this unnecessary and costly form of construction exists in Arbour Hill hospitals, Dublin, as shown in Fig. 73–4.

Fig. 73.—Dublin Regimental Hospitals, Arbour Hill.



First floor Plan.

Fig. 74.



This building contains regulation accommodation for 208 sick in 40 wards. These wards are divided into no fewer than eight separate and distinct hospitals, all exactly alike. They have each four six-bed wards, and one two-bed ward. Each hospital has its separate entrance hall and staircase, and its separate back yard. The staircases are wide and gloomy, and occupy a large part of the superficial area of the hospital. Out of the staircase and passage on the ground floor, there open, in each hospital, a kitchen, a surgery, and a serjeant's room. On each of the two upper floors are two wards and one small room between them. Out of the two upper half landings is a projection containing dark waterclosets, under which, on the ground-floor, are the provision stores. There are thus provided for the medical treatment of 208 sick, 8 surgeries, 8 kitchens, 8 provision stores, 8 pack stores, 8 serjeants' rooms, with a corresponding number of waterclosets and privies. There is nothing in common, not even a consulting room or operating theatre. Each hospital is as independent of its neighbour as if it were miles away. The space and attendance in one hospital may be taxed to the very utmost, while next door, and under the same roof the wards may be nearly empty and the medical officers and attendants with little or nothing to do. When troops are brigaded for a common object, why should their hospitals work independently? Under such circumstances community of action should include hospitals as well as troops. Independent bodies of troops can alone justify the cost of independent hospitals.

The principle of subdivision has, in Arbour Hill hospital, led to waste of space and great overcrowding, for in reality there is only healthy accommodation for 104 beds, although there would have been ample room for all if there had been no such subdivision. The ventilation of the whole building is most injuriously interfered with and unnecessary cost is incurred in the administration.

The best thing to do with such a building would be to convert it into married quarters, for which it is well suited; but, as places for treating sick, Arbour Hill hospitals have nothing in structure to distinguish them from ordinary dwellings for the labouring classes.

The chief alleged advantage gained by this excessive subdivision of sick, is, as already stated, classification of cases, which is considered essential in the regimental hospital system. It is supposed also that small wards are quieter than large ones, that there is more privacy in them, that discipline is more easily preserved, and that if there happen to be a few severe cases they can be separated from the bulk of the hospital sick. We have no desire to undervalue any of these advantages. Some of them, however, we believe to be very questionable. It is of great importance to recognize and provide for our regimental hospital system, mainly from the peculiar nature of our service, but there is a limit to its advantages, because, without great cost, it does not meet the requirements of sick, and it necessarily comes to an end during war. It is then that another system, that of general hospitals, must come into operation, and it is in the highest degree important that medical officers who may be called upon at any time to organize general

hospitals should have the means and opportunities of being trained to this service in time of peace. The wisest plan would, therefore, evidently be, to provide for both systems, in order to be able to meet the varying interests and exigencies of the service, and hence the argument for hospital structure exclusively regimental falls to the ground.

In so far as regards the argument derived from the classification of sick in hospitals, no doubt, as we have already admitted, a certain amount of classification and consequent subdivision is required, but the limit of this must evidently be arrived at whenever subdivision of the sick into small wards is carried to such an extent as to expose the sick to risk or injury. We shall presently show how this risk is incurred.

So far as privacy is concerned, the privacy of a hospital does not extend much beyond the adjoining beds. Quietude, necessary in some cases, is a better reason for having the means of segregating certain cases. But as to the argument for subdivision on account of the greater facility afforded for discipline, we believe this to be of little or no weight against the greater advantages of larger wards, which afford also much greater facilities for supervision.

Hence we consider that the price that must be paid for too great subdivision is far more than any benefit which is supposed to have resulted from it, and the sick pay the cost. It is impossible to ventilate efficiently a hospital partitioned off into cells; a certain height of wards; a certain position of beds: windows on opposite sides, with a certain distance between the opposite windows, are all necessary in order that sufficient light and fresh air may be admitted into the wards. The principle of subdivision carried to a much less extent than it exists in the great majority of our military hospitals has prevented these essential conditions of healthy ward construction from being realized. As regards the movement of the air, within any given space occupied by sick, it has been proved by experiments, made in the wards of the Lariboissiere hospital at Paris, that the aerial movement is from two to three times greater in the middle of a ward than it is at its angles, from which experience it follows that, other conditions being the same, the more you subdivide a space occupied by sick, the more angles are produced, and the greater is the obstruction offered to ventilation.

But upon the efficiency of the ventilation, as we have already stated, depends to a great extent the course and termination of the cases in hospital, and hence subdivision under one roof, as a principle has a directly injurious influence on the sick.

We shall afterwards discuss what ought to be the proper size of a ward; what we have to do at present is simply to arrive at an estimate of the advantages and disadvantages of a certain principle of hospital construction. Bad ventilation is not the only disadvantage attending a too great subdivision of sick. Careful and efficient nursing is, as every one knows, most essential to recovery in sickness; but in hospitals with wards under a certain size this essential condition of hospital treatment cannot be obtained without incurring great additional cost for nursing. We have elsewhere shown that the cost of nursing in wards of nine sick as compared with the cost in wards for 24 sick, would be above a third more in the smaller wards, and the proportionate cost of wards below nine sick would of course be much greater. Admitting then, that a certain amount of classification is required we cannot but express our opinion that the excessive subdivision of our military hospitals into small wards has been influential in lowering their sanitary condition. In one hospital we inspected, where the principle of classification was as rigidly carried out as circumstances admitted, we found a little room called a "contagion ward," into which were crowded six patients with small pox, in a space where no more than one should have been;—a *reductio ad absurdum* of the whole argument for a rigid classification of cases.

Height of Wards.—In very few military hospitals is the height of the wards at all what it ought to be.

There must of necessity be a certain proportion between the height and the other dimensions, and hence the small superficial area of the floor has led to the adoption of low ceilings. In all the larger wards, such, for instance, as Stoke Devon, and Walmer, the ceilings are of a much better height. Usually the wards are between 10 and 11 feet high, some wards are between 12 and 13, and others are between 13 and 14 feet in height. These last are, however, exceptional cases. The loftiest hospital wards we have met with are those at Stoke Devon, some of which are 14 feet 6 inches high. A large good hospital ward should not be less than from 15 to 16 feet high. Smaller wards should be at least 15 feet in height. This is essential to good natural ventilation.

Ward Windows.—Except in a very few instances sufficient attention has not been given to the relation which the window space ought to bear to a ward. Generally the

windows bear about the same proportion to the wall space that they do in an ordinary small house. Many hospital wards have only one window. By referring to Figure 67, it will be seen that in Chatham garrison hospital there are wards for 10 sick, with only one window. In this hospital there are 20 ten-bed wards, with only one window to each, and there are 12 six-bed wards with only one window to each. There are thus only 32 ward windows for 272 sick, or one window to nearly nine sick. There should be at least one window to every two beds. In several of the best existing hospitals there is a window to every bed, but one window can be made to answer for two beds. There ought hence to be 136 windows to the wards of the main building instead of 34. There is a small hospital behind the main building containing six ten-bed wards, with two windows to each instead of five; the total number of windows ought, therefore, to be 166 instead of 44. In a properly proportioned ward window the extent of glass surface would be at least a third more than in Chatham hospital windows, and it hence follows that the amount of window space in this large hospital is only one-fifth part of what it ought to be.

This cardinal defect in ward structure exists more or less in nearly every military hospital of the United Kingdom.

In a few of the best house hospitals there is a nearer approximation to the proper amount of window space, and this is also the case at Fort Pitt, Stoke Devon, Walmer, and one or two other places, but as a rule, military hospitals are deficient in window light.

A very important consideration as regards the healthiness and comfort of a hospital is the position of windows with regard to the beds. Upon this, indeed, depends very much the possibility of ventilating the wards. If, as in the illustration we have drawn from Chatham hospital, there be a window only at one end of the ward, it is clear that the air at the opposite end will become stagnant. The ward becomes, in fact, a *cul de sac*, without an outlet when the door is shut, and the sick at the end of it have to lie in an atmosphere of foul air. The most distant beds in the wards at Chatham are no less than 30 feet from the window. Woolwich hospital presents a similar error in construction throughout. When we first inspected it we found a large number of sick congregated in a room with perhaps the smallest amount of window space, in proportion to the cubic contents, anywhere to be seen. These and similar errors in ward construction could never have been committed if the principle had been recognized that ventilating a ward means removing the foul air away from each patient as speedily as possible, without permitting it to be breathed by any other patient.

So carefully is this point attended to in the best constructed military and other hospitals abroad that when artificial ventilation is introduced it is made a condition in the contracts that the impure air is to be removed direct from the head of the bed of every patient, without passing over the beds or diffusing itself into the general ward atmosphere.

By way of showing how completely this principle has been ignored in our military hospitals we have only to cite the case of Portsmouth general hospital, which is one of recent construction.

It contains 25 wards, and has regulation accommodation for 316 beds, at about one half the cubic space required by the new medical regulations.

Of these 25 wards 22 are only 11 feet high, and three wards are each nine feet 11 inches high. Fourteen of the wards are 48 feet long and 22 feet wide. Ten of these 14 wards have only four windows each, and the other four have six windows each. Half the windows are placed at each end of the ward, so that the distance between the opposite windows is no less than 48 feet. Each ward, when we inspected it, had 17 sick arranged in two rows along the dead walls between the opposite windows, so that the effect of opening the windows for ventilation is to make the effluvia from the sick rake all the beds along the walls before escaping by the windows; natural ventilation, in the proper sense of the term, being impossible except a gale were blowing through the ward.

The same error in structure exists in Sheffield hospital, Ashton hospital, and in all other similarly planned hospitals. Whenever, in fact, a ward for 12 or more sick has been constructed, the windows, as a rule, with few exceptions, have been placed at the ends instead of along the sides.

In the pavilion plan of Fort Pitt and Dublin general hospital the windows have been placed along the sides as they ought to be.

In ordinary house hospitals, having only a few beds in each ward, the necessities of the case, rather than any recognition of sound principles, have required that the windows should be placed on opposite sides, and, whatever defects these hospitals exhibit, many of them embody this important principle, although from other defects they may not always derive all the advantages which ought to flow from it.

The true principle in regard to the extent and position of ward window space is that which has already been adopted in all the best civil and military hospitals, namely, that the window space should be not less than a third of the wall space; that the windows should be placed opposite each other along the opposite sides of the wards, and not at the ends, and that the beds should be placed in the blank spaces between the windows. By this arrangement the wards are thoroughly lighted, ventilation by the windows is greatly facilitated, emanations from the bodies of patients do not necessarily pass over other beds before escaping, the sick have the comfort of reading in bed with ease, and if the window sills be not too high, they may have the additional advantage of being able to see out while lying in bed. These latter advantages may appear trivial, they are, nevertheless, highly prized by convalescents.

Ward walls.—The walls and ceilings of wards are generally plastered, but there are some hospitals, and Portsmouth hospital is one of them, where the walls are of bare brick whitewashed. Generally the walls and ceilings appear white and clean, but they have the disadvantage of being porous, and consequently liable to absorb organic matter from the ward atmosphere. Brick is a bad material. It is porous, and the hollows in it are liable to attract vermin. Better than either brick or plaster is a non-absorbent surface capable of being washed and dried, and so kept always clean.

Several cements have been recently introduced for this purpose. In certain French hospitals they are coloured like marble. In this country those we have seen are of a dirty grey colour, instead of being pure white, which is to be preferred as the cleanest and most cheerful colour of all. None of these substitutes for brick and plaster have been introduced into our regimental or general hospitals, except at Netley, and there the cement is not polished.

Flooring.—Ward floors in all our military hospitals are made of pine, and kept clean by scrubbing. In a few instances the floors have been oiled. Those we have seen have generally been clean and well kept; but a considerable amount of labour is required to do this. Pine floors are not very suitable for sick wards. The wood is too open and porous. Abroad oak is used as a substitute, and makes a much closer and better floor. It is varnished or waxed, and polished by rubbing. This latter process is laborious, and apt to annoy the sick. We have had our attention directed to obtaining a suitable varnish, which will answer the twofold purpose of filling up the grain of the wood, to prevent impure fluids or water soaking into it, and of forming a surface capable of being easily cleaned.

Intimately connected with this subject is that of the material used for flooring corridors, passages, and stairs.

In all our military hospitals wood is the material used for some part or other of the approaches to the wards. Besides the objection arising out of the extent of surface exposed in the approaches liable to absorb fluids, the risk of fire is greatly increased.

Fires occurring in the stair ends of the corridors at either Chatham or Woolwich would cut off the chance of escape from all the wards, as the wooden corridors would carry the fire almost instantaneously over the entire building.

It need hardly be enforced that the means of access to the wards in all hospitals should be incombustible. The risk to life from wood is too great to be incurred. In the newer French hospitals the stairs and passages are of stone, in some instances covered with wood, to prevent the feet of convalescents being chilled in going out and in.

3.—Cubic Space per Bed allowed in Hospital Wards.

In order to understand the influence exercised on the sick by the amount of cubic space allowed for each bed in any hospital, it is necessary to state briefly the advances which have been made in arriving at correct views on this very important subject. We have already stated generally, the reasons for alloting a certain amount of space in barrack-rooms. All of these reasons are equally applicable in discussing the question as regards hospital wards, with this very essential difference however, that, whereas in barrack-rooms healthy men have to sleep in a comparatively confined space for 8 hours out of the 24, the remaining 16 hours being spent on duty, or more or less in the open air, the inmates of hospitals are sick men in all stages of disease, confined to bed, or, at all events, very much confined to the same ward during the whole period of their stay in hospital. However crowded a barrack may be, it is occupied by healthy men for only a third part of the 24 hours; but, however crowded a hospital ward may be, it is occupied more or less by sick men according to the severity of their diseases during every hour both by day and night.

A healthy soldier, even if he be half poisoned by the foul air of an overcrowded barrack-room at night, has the opportunity of throwing off its effects during the day;

but the sick soldier in hospital has no such opportunity. On the contrary, the effect in his case is cumulative. If hospital wards are not in a good sanitary condition, the most favourable result which can be expected for the sick is tardy convalescence; but the history of military hospitals, especially during war, has shown that the foul air of overcrowded hospital wards exerts, perhaps, the most powerful of all influences on the efficiency and mortality of an army in the field.

Hospitals are subject to two kinds of crowding. First, congregating too many sick under one roof. Second, congregating too many sick in a ward. The military hospitals within the United Kingdom cannot be said to be exposed to the first of these kinds of overcrowding, for the hospitals being, with few exceptions, regimental, they contain a comparatively small number of beds.

The smaller class of detachment hospitals rarely have regulation space for more than a dozen beds.

Out of 114 hospitals we have examined, 13 only contain above 100 beds, and these are chiefly garrison or general hospitals, and 76 hospitals have fewer than 50 beds each.

The present hospital system then, has the great sanitary advantage of subdivision of the sick among a number of separate buildings. Two or three of the larger hospitals, such as Fort Pitt and Stoke Devon, have their sick subdivided among separate pavilions and at present the only two occupied hospitals of any size, in which a considerable number of sick are congregated under one roof, are Woolwich hospital, which has 470 beds, and Chatham garrison hospital, with 332 beds. If Netley hospital should ever have its original destination changed from being a resort for invalids, three-fourths of whom would be able to walk about, to that of a general hospital for sick, most of whom would be confined to bed, it would have 1,000 sick beds under two roofs, 500 under each roof; and in that case it would present the largest aggregation of sick under a single roof of any hospital built in modern times.

The reason why large hospitals are dangerous to their inmates is, simply that it is extremely difficult, if not practically impossible, to preserve that degree of purity in the air round the sick, which is essential to speedy recovery. In a large complicated building the air is sluggish in its movements at all times, and in still weather it becomes stagnant. It is at the best of times charged, more or less injuriously, with miasm from the sick. What is called "a hospital atmosphere," or "an infected atmosphere," is very apt to be generated, and in still weather the air of a large hospital may become absolutely pestilential. It is at such times that malignant fevers, erysipelas, pyæmia, hospital gangrene, and the usual tribe of hospital diseases are very apt to appear. Any slight neglect of cleanliness, any foul air from nuisances outside, from sewers or from other similar sources of atmospheric impurity, become of serious importance to the state of the atmosphere in the building. Great attention to ventilation, and abundance of cubic space for each bed, are amongst the most obvious means of diminishing the evils of a large agglomeration of sick under one roof; but the best way to prevent these evils altogether is to subdivide the sick.

As already stated, however, it is not to this kind of overcrowding that the sick in military hospitals at home are exposed. Overcrowding takes place in sick wards themselves. The soldier has been hitherto overcrowded in his barrack-room, and when he is transferred to hospital, overcrowding goes with him. It occasionally happens, indeed, that he goes from his less overcrowded barrack-room to his more overcrowded sick ward.

At Croydon barracks, for example, 460 men have less than 500 cubic feet per man in barracks; but in hospital there are 24 out of 32 beds with less than 400 cubic feet per bed.

In many cases the ward cubic space per bed hardly exceeds the barrack-room space per man; but in the majority of cases the ward space is in a certain measure in excess of the barrack-room space. Thus in round numbers we find, that out of 76,813 men in barracks, about six-sevenths have an amount of space varying from less than 250 to less than 500 cubic feet per man, and that about six-sevenths of the beds in the hospitals have from less than 400 to less than 800 cubic feet per bed.

If, for the sake of comparison, we strike an average of the space per man allowed in all the barracks and hospitals we have examined, it would stands a follows:—

In the barracks we have examined, there is regulation space for 76,813 men, with 450 cubic feet per man; and in the hospitals there is regulation space for 7167 beds, at 722 cubic feet per bed.

These averages, however, show nothing more than the fact that, taken over the whole barracks and hospitals examined, the average proportion of space allowed in the former to that allowed in the latter is, in round numbers, as 45 to 72, or as five to eight. But, when we come to analyze the facts in detail, we find the most extraordinary diversity of

practice in the allotment of hospital space; so great, indeed, is the diversity that there is no appearance of any guiding principle having been laid down in the matter. We have transferred the results of an inquiry on this very important subject to table F, which shows the number of beds for every 100 cubic feet of space, from under 400 to above 1,200 cubic feet in all the hospitals.

The following are the totals of this table:—

Under 400 cubic feet.	400 and under 500 cubic feet.	500 and under 600 cubic feet.	600 and under 700 cubic feet.	700 and under 800 cubic feet.	800 and under 900 cubic feet.	900 and under 1,000 cubic feet.	1,000 and under 1,100 cubic feet.	1,100 and under 1,200 cubic feet.	Over 1,200 cubic feet.
No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No of Beds.	No. of Beds.
362	959	820	1,927	1,707.	705	423	240	18	6

A glance at the table is sufficient to show, that whatever may have been the principle on which space has been hitherto allotted to the sick in military hospitals, sanitary considerations have had little to do with it. Out of the entire number of 7167 beds, only 264 have anything like a sufficient extent of space, and very few of these beds are in the ordinary wards. They are, with a few exceptions, placed in what are called the small wards, which usually contain one or at most two sick each. All the rest are more or less overcrowded; indeed, the overcrowding for half the whole number of beds is excessive.

To judge of the extent to which this overcrowding exists, it is necessary to state briefly the present practice, as regards the apportioning of space in the better class of civil hospitals. The facts are given in the report of the Royal Commission, from which we have abstracted some of them, in the following table:—

Name of Hospital.	Cubic Feet per Bed.	Name of Hospital.	Cubic Feet per Bed.
Brighton	1,100	St. Bartholomew's	1,377
Bristol	1,000	York	1,425
Nottingham	1,000	St. Mary's	1,500
Glasgow	1,000	Newcastle-on-Tyne	1,560
Westminster	1,100	St. Thomas	1,600
University College	1,100	London	1,700
Middlesex	1,107	Guy's	1,300 to 2,000
Leeds	1,106		
Edinburgh	1,130		
Winchester	1,100	King's College	1,809 to 2,068
Manchester	1,200 to 1,500		
St. George's	1,260	Royal Free Hospital	1,618 to 2,426
Warwick	1,292		

If we compare this table with table F, we shall be better able to judge of the extent to which overcrowding is carried in our military hospitals.

Civil hospital governors and committees are not usually extravagant in spending their income, and it may with safety be concluded that before the amount of space shown in this table was apportioned to each bed, there was ample reason derived from the hospital experience itself for doing so. If some of the wards in these hospitals had their space per bed apportioned as it is in some military hospitals, there would be five or even six soldier's beds placed in the space occupied by one civilian bed.

Pyæmia, hospital gangrene, hospital epidemics, and slow lingering recoveries, or non-recoveries of sick, have been the teachers from whose lessons hospital improvements date their commencement. For a long series of years, the best observers of the phenomena of disease in the medical profession have inculcated the necessity of better hospital construction, increased space, and improved ventilation as the great means required for facilitating recovery, and the greatly diminished mortality in hospitals consequent on the adoption of these improvements has fully substantiated their value. Above a century ago Sir John Pringle gave the following rough direction for allotting military hospital space:—"The best rule is to admit so few patients into each ward "that a person unacquainted with the danger of bad air, might imagine there was room "to take in double or triple the number."

Applying this rule to military hospitals we have inspected, we should say, that with a very few exceptions, all the wards bear evidence of great overcrowding, and that, to give what the eye would recognize as a moderate allowance of room for a sick man, it would be necessary to remove from one-half to two-thirds of the beds. We have found the army medical officers generally alive to the importance of the subject, and many of them have expressed strongly their views of the necessity of extending the sick accommodation in barracks.

Frequent complaints have been made to us of cases of disease lingering which ought to have had speedy recoveries. In one instance of a recently-built hospital, where the space per bed is too small, the medical officer informed us that when he made use of the window ventilation to such an extent as to keep the air comparatively pure, his sick suffered from bronchitis, and when he diminished the ventilation to prevent this, ulcers became gangreous.

We have been in crowded hospitals filled with a polluted hospital atmosphere, even although the windows were open. Indeed, it is impossible to ventilate overcrowded wards in a satisfactory manner, and here, as in the case of barrack-rooms, it is absolutely necessary to have a large cubic space both for ventilation and warming. The atmosphere of a sick ward, besides being deteriorated by the ordinary process of respiration, is filled with miasms generated by the sick. These, if not sufficiently diluted and rapidly carried away, give rise to what are called hospital "contagions" and "infections," which, as all experience has proved, are far more prejudicial to the sick than is the breath of healthy men to the healthy. Sick men in hospital are much more exposed to danger from such causes than are healthy men in barracks, because not only are sick more susceptible to the influence of such miasms, but the emanations themselves have often a special poisonous quality, and generate disease even among healthy attendants.

It is these well known facts which give so much importance to the question of cubic space in sick wards, and which must ever render a sufficient allotment of it a matter of primary necessity in hospitals if they are to exist at all.

The amount of cubic space requisite in any given hospital must be necessarily influenced by considerations of climate, exposure, construction, &c. Space by itself is nothing except as a means of keeping the air in wards pure and sufficiently warmed. In hot climates the element of high temperature, by giving greater activity to disease, enhances the noxious qualities of all miasms, and hence the greatest facilities are required for immediately diluting and diffusing them. An amount of space such as would be sufficient in cold climates would be too small in hot climates. Again if a hospital is placed in an high airy position where there is much external movement of the atmosphere, it will be much easier to renew the atmosphere within the building than if it were placed in a very moist, close position. Hospitals of simple construction and especially wooden hospital huts with walls so constructed as to be easily permeable to air, require less space for the sick than large complicated stone buildings. The observation of Sir John Pringle, who says, "I have always found those wards most healthy when, by broken windows and other wants of repair, the air could not be excluded," shows the practical benefits resulting from pervious hospital walls.

Another element which ought not to be overlooked in this question of space is the nature of the cases which usually enter military hospitals. According to regulation every man not in the ranks must be in hospital, and hence many slight ailments lead to a soldier being confined to hospital which among civilians would hardly take a man from his daily work. Military hospitals, in fact, contain all classes of patients, slightly indisposed, ailing, sick, and convalescents in varying proportions, and not all requiring the same conditions for their recovery.

Considering these elements in the question and also the actual state of the atmosphere in wards presenting the highest amounts of cubic space per bed shown in the table we are of opinion that the proposal of the Royal Commission on the sanitary state of the army, which has been recently made matter of regulation, that 1,200 cubic feet per bed should be given in all hospitals in temperate climates and 1,500 cubic feet in warm climates, is a sufficiently high unit of space at all ordinary times; provided always that the buildings are properly ventilated and warmed. During severe epidemics it might be necessary to increase this unit, but the occasions in which it would be necessary to do so are very few in number. It would appear hardly necessary to give a caution that the additional accommodation required for increase of sick during epidemics should never be given by placing more sick in the wards. Nevertheless, the occurrence of an epidemic has often led to increase of overcrowding and consequently to great increase of mortality. During epidemic seasons both sick and healthy ought to be dispersed as much as

possible, and certainly they ought never to be agglomerated more closely together on any plea of want of additional accommodation.

Distance between Beds.—Another very important matter connected with the question of cubic space in hospitals is the superficial area per bed and the distance between adjoining beds.

It does not follow that a ward should be well aired merely because it gives a large amount of space for the sick. All the space may be above the beds where it is comparatively of little use, and little or none between the beds where a volume of air is most required to dilute the emanations from the sick. It is true that wards to be ventilated by natural means require to be of a certain height, but it is equally true that the patients who are to be benefited by this ventilation must be at a certain distance from each other. The general lowness of the ceilings in military hospitals ensures a certain distance between the beds even with a comparatively small cubic space per bed but when this distance is compared with the amount given in hospitals with a large cubic space it is found to be very small indeed.

In the military hospitals we have examined the distance from side to side of the adjacent beds varies from about 20 to about 30 inches. It very rarely exceeds the latter of these amounts. But in the better class of civil hospitals, such as those already mentioned, the distance varies from 3 feet to 4, 5, 6, 8, and even 10 feet. The distance from foot to foot of opposite beds depends of course on the breadth of the ward, but even in this dimension the crowding of beds on superficial area is much greater in military than in civil hospitals. There are wards in military hospitals in which the space from the foot of one bed to the foot of the opposite bed is as low as 3 feet 6 inches. Usually the distance is 5, 6, 8, or 9 feet. In large low roofed rooms not originally intended for sick wards the distance is somewhat greater, but any advantage from this increase of distance is more than counterbalanced by the bad construction of the ward itself. In the better class of civil hospitals the distance from foot to foot of opposite beds varies from 9 feet to 11, 12, 14, 15, or even 16 feet. In the element therefore of surface overcrowding military hospitals bear an unfavourable comparison with civil hospitals.

Space per Bed in Hospital Huts.—Detached wooden huts are in use in a few barracks for extending the hospital accommodation. They are of the usual camp construction, lined inside and having a partial wooden ceiling. They differ in size, but generally they accommodate about 15 beds with about 450 to 480 cubic feet per bed. Ten or twelve beds are as many as such huts ought to contain.

The amount of space per bed in those temporary, detached wooden huts need not be so large as in permanent hospital wards, on account of the facilities for ventilation afforded by such huts.

The walls are more or less pervious, ventilation can always be freely obtained at the ridge, and if the huts be placed at a sufficient distance from each other to allow the air to play freely around them, they possess the great advantage of sub-division of sick, in short each hut becomes a small separate hospital. Hospital huts, as for example at Colchester, have not always been placed at a sufficient distance to ensure good external ventilation, and at Shorncliffe they have been joined end to end, an arrangement which brings huts in which it is adopted more or less within the category of permanent buildings, by diminishing their capability for free ventilation.

Even with such advantages, however, a certain extent of space is requisite for health, and the customary allotment is not sufficient to prevent closeness and an appearance of uncomfortable overcrowding of the sick. A hospital of wooden huts with ten beds each, if properly arranged and constructed, would possess all the sanitary advantages resulting from an allowance of 1,200 cubic feet in permanent hospitals, if one half that amount per bed were given in each hut.

If the huts are not in an airy position, and detached, this space would be insufficient, and it would have to be raised to 1,200 cubic feet in all iron or brick huts, but in every case with free ridge ventilation.

4.—State of Ventilation and Warming of Hospitals.

In most of the hospitals we have examined there has been some recognition of the importance of ventilation, as some provision has been made for it. But we found a number of hospitals where no means of ventilation existed, except the casual opening of doors and windows. In only one hospital, that at Beggars Bush barrack, Dublin, was there any intelligent application of scientific principles to renewing the air in the wards.

We have not found a single hospital in which any of the offices, kitchens, surgery, stores, serjeants' rooms, or even the staircases have been ventilated. Attempts at ven-

tilation have been limited to the wards, and the rest of the building has been left full of stagnant air.

The almost universal method of ventilation in use is that of carrying hollow beams above and across the ceilings of the wards, opening to the outer air at the ends, where they are carried through the external walls, and opening into the wards by auger holes or by large circular apertures in the ceilings.

The object which these beams are intended to serve is to afford an outlet for the foul air of the ward. No doubt under certain conditions they will allow of a limited, irregular, and utterly insufficient interchange between the outer and inner air to take place, but at all ordinary times, especially when there are fires in the wards, these hollow beams merely act as badly placed inlets for cold air, to supply the draught of the chimney. The consequence is that they pour cold air directly down on the heads of the men, sometimes so powerfully as to blow the flame of a candle about when placed on a table under the ventilator. In such cases the ventilators are usually closed up, by having paper pasted over them. In some instances we found the inlets placed close to the floor, by which means cold air is thrown in upon the feet of the patients, and passes straight to the fire-place, without affecting in any beneficial degree the ventilation of the ward.

As a general result of these defective ventilating arrangements, we have found the air in the sick wards close and stagnant, especially if the number of beds occupied approached to the regulation number. In instances where the beds were fully occupied, and the two elements of overcrowding and defective ventilation were conjoined, we have found the ward atmosphere positively foul. We have sometimes observed this state of the ward air even where a more direct communication existed with the outer atmosphere, by means of glass louvres in the upper window sashes, and, as already stated, we have found instances in which the atmosphere round the sick was offensive with all the windows open.

There is no doubt that the best ventilation for a sick ward is obtained by a proper use of windows, but to enable this to be done the wards must have a certain height. They must be at least four or five feet higher than the usual run of military hospital wards.

Every system of ventilation, therefore, for wards of the present height, which contemplates the escape of the ward air into the outer atmosphere at or near the plane of the ceiling, must necessarily act imperfectly, or not at all, simply because the wards are not suited by their height for this species of ventilation. In one instance only, at Fort Pitt General Hospital, has the height and the other proportions of the wards appeared to us adapted for window ventilation, and we recommended this system to be trusted to at Fort Pitt, provided the number of sick were reduced to give 1,200 cubic feet per bed, this space being in our opinion the smallest amount at which any efficient ventilation in permanent hospitals can be carried out.

In one or two hospitals we have found Arnott's valves in use. For wards containing one or two sick they might possibly answer, if the chimney draught were contracted below. For wards of a larger class they are quite insufficient. In one or two recent hospitals, as, for instance, in the new hospital at Sheffield, outlet shafts have been provided in the division walls. These shafts are carried up in the brickwork along with the chimney flues. They are too small in section, and as no inlets for fresh air are provided, the wards would derive their supply chiefly from the stagnant air in the passages and staircases of the building. In Beggars Bush hospital, above referred to, outlet shafts are also provided in the walls, and there are properly placed inlets close to the ceilings. We found this arrangement to be efficient in action, for the ward air was comparatively pure, and would be sufficiently so, if each bed had 1,200 cubic feet of space.

Warming.—Warming, as an essential part of ventilation, has not been considered with reference to hospitals any more than to barracks. The ordinary regulation grate, with its large wasteful fire-place, is in general use, and numerous complaints have been made to us of the difficulty of keeping the wards warm with it. In a few recent exceptions the Anglo-American stove has been introduced. It has greater heating power than the ordinary fire-grate, but it is questionable whether, in the absence of proper means of ventilation, this stove can be considered as an improvement, on account of its having lowered the chimney breast and diminished the ventilating power of the old fire-grate. As none of the existing fire-places are intended to form part of the ward ventilation, they provide no means for warming air, an object of essential importance as regards hospital wards, on account of the large volume of air which must be passed through them to keep them healthy.

We may mention a marked instance illustrating the necessity of considering combined

arrangements for ventilating and warming hospitals which came under our observation at Newry. The hospital there has a very spacious inner hall and staircase extending the whole height of the building, affording an excellent means of keeping the air pure if properly made use of. But for want of a stove to warm the hall the wards could not be kept of a sufficient temperature, and the remedy adopted was to box off every ward and the passage leading to it from the stairs by tight wooden partitions, costing, no doubt, many times the value of a stove, and the result was that this hospital was one of the worst ventilated places we found anywhere during our inspections.

5.—Hospital Drainage, Water Supply, Water-closets, &c.

The state of the drainage of every hospital may be described as being essentially the same as the state of the barrack drainage to which the hospital is attached. Barracks situated in towns are generally drained into the public sewers, and the hospital drainage is disposed of by the same outlet.

In country barracks where there is no drainage, or where the drainage is defective, the hospital drainage is in the same condition. As the drainage both of barracks and hospitals necessarily form portions of one system, this result is perhaps inevitable. Good drainage is nevertheless of more importance to the purity of the air in hospitals than it is in barracks, because not only is the site occupied by a hospital, as a rule, more contracted and less airy than the site occupied by the adjoining barracks, but there is besides an essential difference as regards the influence of bad drainage of hospitals arising out of the more susceptible condition of the inmates of these establishments.

Surface Drainage, as a rule, is not in a good condition. In a considerable number of hospitals the ground close under the ward windows is either unpaved, or paved with round boulders, leaving interstices between them. In many instances the guttering is very imperfect, and allows water to lie on the surface. We have met with instances where the refuse water of the kitchen or other offices is allowed to stagnate in surface gutters directly under the ward windows. Such cases are, however, exceptional; for in all barracks where provision has been made for conveying away the rainfall and the drainage from ablution rooms, wash-houses, &c., by drains under the surface of the ground, the refuse hospital water is generally passed into the same system of drains.

Sewerage.—In so far as regards sewerage for conveying away the filth of privies, water-closets, &c., there is none except in a few town hospitals, where access can be had to existing sewers. Hence the most objectionable system of cesspits is almost universal. With these few exceptions, where a sewerage outlet is at hand, every hospital has one or more of these cesspits within its limited enclosure, often close to the hospital walls. They are generally constructed on the same principle as the barrack cesspit, and are emptied periodically in the same way. In hospitals provided with water-closets the cesspits are often full to overflowing with putrid water, infiltering the whole subsoil in their vicinity, and endangering the purity of the hospital well, which is generally close at hand. We found the well for supplying the hospital at Fort George so polluted with cesspool drainage that it had to be closed entirely. In this instance the neighbouring shingly subsoil appeared to be more or less charged with foul matter. The cesspool system of drainage, indeed, is based on the assumption that the fluid shall, to a large extent, be disposed of in this manner. The purity of the surface is to be preserved by polluting the subsoil; the very worst of all expedients for health. If the cesspit is made watertight, as is the practice in Paris, where it is in universal use, the expense of constructing and cleansing is very great, far greater than that of a proper system of drainage for not only must the receptacle be made very large and watertight to receive and retain accumulations, but the whole has to be raised and conveyed away by horse labour at a large annual cost.

If cesspits are not absolutely watertight, the subsoil must necessarily be polluted. A large cesspit, into which has been conducted the whole drainage, including that of the water-closets used by 241 sick at Fort Pitt hospital, is placed close under the ward windows; and so successfully has this cesspit drained itself into the chalky subsoil on which the hospital stands, that it has never required cleansing within the memory of any one connected with the fort! Close to this cesspit was a range of most offensive open privies over another cesspit emptied periodically.

In most instances these hospital cesspits are in a most noxious condition, and occasion nuisance in their vicinity. Often the surface drainage and rainfall are received into the privy cesspit close under the hospital walls. The subsoil of Exeter artillery hospital appeared to be soaked with this drainage at the time we were there. The entire method

of drainage by cesspits is so objectionable that it ought never to be permitted to exist near inhabited dwellings, far less within the precincts of hospitals. It is also more expensive than would be any properly devised method for the immediate removal of barrack and hospital sewage.

Water-closets and Privies.—Many hospitals have been recently provided with water-closets, but there are still not a few having no such provision for the sick.

Hospital water-closets, where provided, have generally been placed in a projecting building behind the central staircase. They are of the usual construction, and very often the soil pans are not of a good pattern, and the whole apparatus is defective. They are often imperfectly supplied with water from a cistern, and the outlet pipe discharges into a cesspit in the back-yard, except in the cases alluded to above, where access has been obtained to an existing town sewer. Sometimes the drain is carried under the hospital, which is always a very hazardous expedient, because any leakage or stoppage may be the means of poisoning the air within the hospital to such an extent as to produce fevers or other zymotic diseases among the sick. We have met with more than one instance in which much inconvenience has arisen from these stoppages, and in one such case, the men, finding the closets would not act, broke the pans in endeavouring to force the soil down them, and results of a very serious character arose from the leakage of cesspool matter under the flooring.

In very few instances have these water-closets been sufficiently cut off from the hospital by suitable cross ventilation, and complaints have been made to us, in some cases, of nuisance from them experienced within the building, partly from this cause, and partly from want of ventilation of the sewers, whereby foul air is thrown back through the trap of the pan into the closet itself. Sometimes we have found them out of repair or inefficient in action. The closets themselves are not unfrequently without sufficient ventilation, and foul air from them enters the passages. There are a few instances in which there is no direct communication between the external air and the interior of the closet.

Whether there be water-closets or not, there are always privies situated in outbuildings in the hospital yard. Where there are no water-closets these privies are resorted to by the sick in all weathers. They have no covered communication with the hospital, and have to be reached by walking over the wet ground, or over rough boulder pavement, sometimes for 50 or 60 yards from the hospital door. At Canterbury Hospital which has regulation space for 152 sick there was no other provision except noxious open privies in the hospital yard, the emanations from which infected the air to some distance. Hospital privies are generally constructed on the same principle as barrack privies, except that the seating is better. They are placed in small shed buildings, over open cesspits, which are generally emptied from without; but sometimes the cesspit and ashpit are the same receptacle. In the Artillery hospital at Limerick we found the cesspit under the floor of the privy, and covered only with the floor boards, which have to be removed when the cesspit is emptied.

The buildings in which these privies are placed are generally dark, and without any means of ventilation. We have found instances of open privies under the same roof with itch wards. One most notable example of this arrangement was at Hulme Cavalry Hospital, where an open privy, the ash-pit, and itch ward were all under the same roof in an outbuilding behind the hospital, and had all direct communication with each other.

In one or two instances Macfarlane's *water latrines* have been successfully substituted for the present barrack privy, but in the great majority of instances the arrangements are of the most rude and unwholesome description.

Water Supply.—The same general remark we have made as to hospital drainage is applicable to hospital water supply. It partakes of the character of the barrack supply whatever that may be. Whether the barrack receives water from the town mains, from a canal or river, or from wells, the hospital does the same. Generally there is a cistern into which water is raised by pumps for distribution to the kitchen, water-closets, &c. This cistern is not always covered, and the water is liable to pollution in consequence. It is generally raised on some outbuilding, but in one instance, at Cork hospital, we found the water cistern for affording drink to the patients placed within the kitchen and directly over the cooking range, so that the water was always tepid, and more or less unwholesome. This error in placing the cistern had been represented frequently, but without success, for it was still there at the time of our inspection.

The same objection we have urged against deriving the water supply of barracks from superficial wells dug within a confined area, tenanted for a length of time by men and animals, and receiving the drainage of cesspits, &c., apply with greater force to wells for

hospitals. Water derived from such a source is at best of inferior quality. It is hard, it contains a large quantity of both organic and inorganic matter, and is not suitable either for drinking water or for surgical dressings. At all events, water derived from such sources ought only to be used when no better supply is obtainable.

Cleansing.—Nearly every hospital has its ashpit, into which the dust, ashes, and kitchen refuse are thrown, placed within its enclosure and in proximity to the sick wards. These ashpits are dug out of the ground and have a wall built round them in the same manner as the barrack ashpits. They are undrained, without covering, and they receive the rain or surface water, which facilitates decomposition in the remains of vegetable or animal matter they contain. Sometimes, as already stated, these ashpits are also the cesspits of the hospital privies, and when so used are most noxious.

There can be no doubt of the propriety of avoiding all such accumulations of decaying matter in the vicinity of sick wards. We have seen no instance in which the existence of these ashpits is a matter of necessity, or in which the hospital cleansing could not be much better carried out without them. An iron box or barrow to receive the dust of a day, and to be removed at night, or early in the morning, would answer every purpose and avoid the uncleanliness of the present system.

With a few exceptional cases we have found the interior of the hospitals very clean, the floors well scrubbed, and the walls and ceilings white.

Frequent quick-lime washing of the whole of the interior walls and ceilings of hospitals is of essential importance to their healthiness, and according to the new medical regulations this must be done at least twice a year or oftener if considered necessary, and the walls are to be scraped at intervals. This regulation, if strictly complied with, will do much to preserve the purity of the air in sick wards.

6.—State of Ablution and Bath Accommodation.

At the time we commenced our inquiry a very small number only of hospitals were provided with ablution accommodation, and the facilities for bathing were totally inadequate for hospital use. The sick confined to bed are usually washed in the wards, but the greater proportion had to go out of the hospital into the yard for the purpose, or if ablution accommodation existed at all, it was placed at a distance from the wards in a damp, dark locality. The provision of this kind, where any had been made, was simply a barrack ablution table with moveable basins, to be emptied on the table or floor, and exposing a large wet evaporating surface. The only ablution accommodation we met with at all adapted for its object was in the hospital of the Scots Fusilier Guards, where a proper table, with fixed sunk basins and water laid on had been provided. This table appeared to be properly used by the men, and exhibits the kind of arrangement which ought to be introduced in all military hospitals.

Hospital bathing accommodation consisted of tin slipper baths, placed in the damp ablution room, or in the hospital wash-house. These baths and the water to supply them had to be carried into the wards, or else the sick had to go to the place where they were and there undergo an amount of risk in bathing which would far more than counterbalance any prospective benefit from the operation.

In one or two cases fixed baths had been put up, on such a plan as to render them quite unfit for being used by sick men. One of these fixed baths was in the Artillery Hospital at Exeter. It consisted of a large dirty-looking cistern in a damp room, close to undrained and offensive privies and cesspits. It had no water laid on, and required a fatigue party to fill it on account of its unnecessary size.

The fixed bath at Weedon Hospital was sunk in the ground, and was a far more likely place for a sick man to get accidentally drowned in than to derive any benefit from its use.

The shower bath arrangements are in most instances as extraordinary as the other bathing arrangements. The bath usually consists of a kind of sentry-box, outside the hospital, generally in the dead house or hospital yard, and it is to such a place that the convalescent is expected to go to bathe. When any man is able to stand such a regimen with impunity, it would be a tolerable proof of his being in sufficient health to return to his duties.

Considering the great importance of the judicious use of baths in many diseases, and lookng at the provision of them which has been hitherto made in our military hospitals, we can arrive at no other conclusion than that such provision is so totally inadequate for its object, as to amount to a prohibition of this important means of treatment, and that the sooner the whole of the ablution and bathing arrangements of hospitals are subject to revision and placed on a better footing the better will it be for the sick.

7.—State of Hospital Kitchens.

Except in a few instances, and these chiefly general hospitals, kitchens for preparing hospital diets, &c., are situated on the ground floor or in the basement of the hospital, and, in most cases, under the sick wards. This arrangement we consider to be more or less objectionable, on the general principle that buildings intended for sick should, as far as possible, be restricted to that purpose. Everything that can in any way interfere with the purity of the air within the wards should be kept at a distance. Besides the heat and fumes of cooking, there is generally a sink in the kitchen, from which, to say the least of it, there is risk of impurity to the air within the building. We have not, however, considered it to be necessary to advise the removal of hospital kitchens from under wards, as we have done in the case of barracks, because the whole amount of hospital cooking is so small in comparison with the ordinary cooking in a barrack cook-house. Still in future constructions it would be well to place the kitchen in an out-building.

To remove as far as practicable any chance of risk from existing kitchens, we have recommended their being ventilated by a shaft carried up from the ceiling through the roof. This precaution, together with glass louvres, or perforated panes of glass in the windows, will afford means of exit for the heat and vapours, and prevent them from passing into the ward air.

With regard to the cooking apparatus, it may be stated generally that we have found it much better adapted for its object than the ordinary cooking arrangements of barrack kitchens are for barrack cooking.

All hospital kitchens contain one or more regulation boilers, in addition to which there is a fire-grate, affording the means of roasting, stewing, &c. In most instances there is an oven in addition, and some kitchens are supplied with excellent ranges, capable of cooking in any required manner. In this, as in many other matters connected with barracks, there has not been much uniformity of practice, although the requirements for good hospital cooking are the same everywhere.

In some of the larger hospitals, as, for example, at Chatham garrison and Fort Pitt, we found the means of varying the cooking of diets insufficient. In numerous other instances we found the cooking ranges nearly worn out, and requiring renewal or improvement, and in some cases additions to the apparatus have had to be made. But as already stated, there has been more attention bestowed on this department of barrack cooking than on cooking the soldiers' rations.

With very few exceptions, the kitchens have been clean and well kept, although some kitchens bear evidence of much better management than others. We would instance one at Fort Pitt as about the most favourable example of good hospital kitchen management we have anywhere met with. We can see no reason why every hospital kitchen throughout the service should not be as good. In some instances the kitchen utensils appeared old and not in sufficiently good condition, but provision is made for obviating this in future by the new medical regulations.

We have met with no example of the use of a lift for raising the diets from the kitchen to the level of the wards, except in the recently finished hospital of the Coldstream Guards. Lifts would save much labour, and enable the diets to be delivered to the sick in a shorter time, and warmer, than is the case at present. In small regimental hospitals lifts would be unnecessary, but in such hospitals as Stoke Devon, Chatham garrison, and Dublin Military Infirmary, they would be an advantage provided they were properly introduced into the structure, which is certainly not the case at the hospital of the Coldstream Guards. In this instance the lift appears to have been an after-thought, not provided for in the original plan, and it has been given effect to by placing the lift in a large wooden shaft carried up within the wards, and opening into all of them, by which arrangement the foul air of the lower wards may at any time be poured in to the wards above. The lift in this case is placed exactly where it ought not to be. The proper arrangement is that the shaft should not communicate *directly* with the kitchen below, and that it should not communicate *directly* with the wards above. By observing these very simple conditions a lift may always be introduced when it is required, without injury to the hospital or risk to the sick.

8.—State of Hospital Wash-houses.

Hospital wash-houses are the least satisfactory portion of hospital establishments. Anything appears to be thought good enough for the purpose. Sometimes there is no wash-house at all, and what may be called minor hospital washing, such as that of dressings, towels, bandages, and such like, is done in the kitchen. Sometimes the wash-house

serves also the purpose of bath house, or ablution room, for which it is eminently unfit. Sometimes the wash-house opens directly out of some part of the hospital, whereby the fumes of washing and steam from the boilers can enter the building. Most frequently, however, the wash-house is a lean-to building in the small confined back yard. It usually contains a boiler, but no other evidence of the purpose it is intended to answer. It has no fixed tubs, no water laid on, and no means of drying what is washed in it, and the drying has to be done either in the open air, or in wet weather, in the kitchen.

The buildings are generally deficient in light and ventilation, and the floors are damp and not properly drained.

9.—State of Accommodation for Medical Officers, Hospital Serjeants, Orderlies, Stores, &c.

Surgeries.—Generally speaking the surgery accommodation is sufficient for the size of the hospital. It is under the same roof as the sick wards, and in most cases on the ground floor. There are instances, however, in which it is very deficient from want of space. This happens in the smaller class of hospitals, where from the small number of sick admitted it appears not to have been considered necessary to make any special provision for dispensing.

The hospital at Bandon has space for eight beds, and there is no surgery except the kitchen where the drugs are kept. Dumbarton Castle hospital, a building which was not originally intended for its present object, has a surgery seven feet long by three feet wide. Many other surgeries have been complained of on account of want of space.

The fittings up are not always sufficient. Very few surgeries have water laid on, or properly constructed sinks for disposing of waste water. Some are deficient in shelves, drawers, or other conveniences. Candles are often used for lighting at night where gas could be obtained.

In hospitals where recruits are examined complaint has frequently been made to us of the want of room for the purpose. In one hospital we found the surgery space so small that a recruit could not be inspected in it, and the whole of the inspections were conducted in one of the wards among the sick. But inspection of recruits ought not to be performed in hospitals unless they have special provision for the purpose. In a hospital, of all places, perfect quietness and absence of all noise or bustle are indispensable for the comfort and well-being of its inmates.

Hardly any hospitals have a receiving room for sick or for prescribing for women and children. Patients applying for aid are hence left outside or in the passages, or they crowd the surgeries. Complaints have been made to us of injury from the forced exposure of ailing men to blasts of cold air while waiting their turn for examination in cold gusty passages, in which they were obliged to stand for want of a room to receive them.

Hospital Serjeants' Quarters.—As a general rule the quarters provided for hospital serjeants are far from being sufficient, especially when the important nature of the serjeant's duties is considered.

He has generally a single small room in which he lives and sleeps, deficient in very ordinary comforts, and by no means adapted to the rank or importance of the serjeant's office. Sometimes there is no serjeant's quarter at all, and one of the wards, or the kitchen is set apart for the purpose. Want of space appears to be the cause of the deficiency, for in the larger hospitals the serjeants' accommodation is on a more liberal scale. Sometimes he has two rooms, but this is a rare exception.

Orderlies' Rooms.—In nothing are regimental hospitals more deficient than in the accommodation provided for attendants on the sick, for, as a general rule, there is none. There is neither bedroom nor sitting room. The orderly passes his day in going about the hospital in discharging his various duties, and at night he goes to bed among the sick.

The number of orderlies who ought, according to the 10 per cent. regulation, to be apportioned to the sick in those hospitals we have examined is equal to an entire regiment above 700 strong, and yet none of these men have any place to sleep in except the sick wards. They appear never to have been considered either in the structure or internal arrangements of the building, and yet upon the character of the men who take service as orderlies, and upon their efficiency in discharging their duties, depends, to a very considerable extent, the result of cases committed to their care. Another evil of the present system is that every ward with an orderly in it must necessarily be exposed

to additional overcrowding to that extent. In other words, there is absolutely no available space in such wards for orderlies, and, being compelled to sleep there, the sick are injured from additional overcrowding by the very men who are appointed to nurse them. On the mere ground of humanity, a man who is exposed, in the discharge of his duty all day, to the atmosphere of a sick ward, should have fresh air to sleep in at night.

In so far as regards discipline, there can, we believe, be no difference of opinion that it is better for the discipline of the orderlies, no less than for the discipline of the sick, that the orderlies should only be in wards while on duty. Their accommodation should nevertheless be so placed that they can at all times exercise a vigilant oversight whether as regards dangerous cases or ward discipline.

The new medical regulations contemplate the introduction of nurses into general hospitals; but to enable this regulation to be carried into effect, the necessary structural alterations will have to be made in existing general hospital buildings, in none of which is there accommodation either for superintendent or nurses at the present time.

It is evident that in carrying out structural improvements and additions in existing hospitals, no less than in all future hospital plans, sleeping accommodation separate from that of the sick must be provided for orderlies, and in new general hospitals for the superintendent and nurses.

Hospital Storeage.—Regimental hospitals generally are deficient in storeage. Those stores which are absolutely necessary for proper hospital administration are,

1. Clean linen bedding, and utensil stores.
2. Provision stores.
3. Pack stores.
4. Foul linen and bedding stores.

It is evident that all these stores should be separate, but there is hardly a single hospital we know of in which they are so. Generally two or more of them are in the same room. Sometimes the provisions are kept in the surgery. Almost invariably there is no place for the temporary reception of foul linen, except the dead-house or wash-house. The pack store has often no racks, and the men's effects are piled on the floor. Packs and bedding are often placed in the same store. Very frequently the stores are damp, and hardly fit for their purpose. Sometimes the hospital serjeant's quarter, or the nurse's room, where such a room has been provided in the original construction, or one of the sick wards in an already crowded hospital, has to be misappropriated for stores of some kind or other. The fittings-up are often very deficient even where a suitable room exists. For instance, at the artillery hospital, Ballincollig, where there are 50 beds, we found a tolerably good store without either boxes or drawers to hold articles of hospital consumption, and rice and other similar articles were kept in the new wooden frames of close stools. One would think such a purpose about the last to which such implements ought to be devoted. This store room has been properly fitted up since that time.

Generally the storeage provided for hospitals may be described in two words: it is both deficient and defective.

Dead houses.—Every hospital has a dead house of some kind or other. Usually, it consists of a small lean-too building, erected against the boundary wall of the hospital enclosure; and as the space is generally small, and otherwise crowded with outhouses, the "dead house," with its distinctive designation painted on the door, occupies a prominent position in the exercising ground allotted to convalescents, provided there be any ground. Sometimes the dead house is under the same roof as the hospital. This is the case at Edinburgh Castle, and also at Charles Fort, Kinsale Harbour. In the latter instance, the dead house is a cellar, under one of the sick wards, and the place being infested with rats, it is necessary to place a guard over any corpse deposited in it.

Being only used occasionally for its destined object the dead house serves for many purposes. Sometimes it is used as a store for various objects, such as foul linen, fuel, &c. At Edinburgh Castle it is used as a kind of scullery for cleaning knives, on account of deficient space in the kitchen which adjoins it. Sometimes the hospital shower bath is kept in it, and in one instance in Ireland it is used as an itch ward, when not otherwise occupied. It is often dark and almost always defectively ventilated. Very frequently it is unfurnished, and has no suitable tables, no water supply, nor other appliances for performing post-mortem examinations. In a very few instances, indeed, is the dead house in all respects suited to its purpose, and, like other hospital adjuncts, it requires to be improved, and provided with requisites on some general plan.

10. State of Accommodation for Sick Wives and Children of Non-Commissioned Officers and Soldiers.

In compliance with the 8th paragraph of our instructions from the Secretary of State for War, we have directed our attention to the important question of providing hospital accommodation for the sick of soldiers' families.

According to existing regulation the proportion of married soldiers in a regiment is six per cent., and in carrying out the regulation, every soldier must obtain the consent of his commanding officer before he can marry. But in all regiments there are a certain number of men who marry without leave, and their wives and families are hence deprived of any benefit which recognized marriages would possess.

A certain amount of accommodation for married soldiers has been specially provided at several stations, but no such provision exists in the great majority of barracks. Soldier's wives and children have, therefore, to be lodged wherever sufficiently cheap lodgings can be obtained, quite irrespective of the healthiness of the house or neighbourhood, and when a family so circumstanced is overtaken by sickness, or in cases of childbirth, the regimental medical officer has to attend the cases, sometimes at a considerable distance from his proper sphere of duties, and often at great inconvenience. He has to treat disease in localities where he has little chance of coping with it successfully. He is authorized, by regulation to supply medicines from the regimental chest, but in regard to diets, medical comforts, stimulants, &c., he has no power to order any, except the sick woman or child be in hospital. At present there is no hospital accommodation for these cases, and as the soldier's resources are too limited to meet such expenses, his family is exposed to privation at the very time when it can least be endured.

Frequent representations have been made to us as to the urgency of this matter. We shall only quote from one of these, made by his Grace the Duke of Richmond, with regard to Edinburgh Castle, which states the whole case in a few words.

"In a married room which contained three men, their wives and four children, one child three weeks old was attacked by small-pox. I was obliged to hire lodgings for the men, their wives and children in the town, at my own expense. The mother of the child caught the small-pox; and, since, one of the children.

"If married men and their families are to be permitted to be in barracks, surely there ought to be accommodation for them when attacked by an infectious disease.

"The medical officer cannot order medical comforts to the women and children. A soldier cannot support a wife unless she washes for the company. She is taken ill, or obliged to nurse her sick children, and her means of support are gone, and when sick she can only have such nourishment as is necessary for her recovery by the charity of the officers."

When proper married quarters have been provided, which is not the case at Edinburgh Castle, some of the evils complained of will be remedied. Each family will have at least one private room, and in case of sickness the medical officer would be at hand. But still, although medicine would be supplied to patients, diets, comforts, &c. would not be supplied unless the patient were in hospital. Moreover, married quarters, where they do exist, are small and crowded, and it would be better in every way to remove sick people out of them.

In order to form an estimate of the extent of the existing necessity for hospital accommodation for soldiers' families, we called for returns from a few of the larger stations, and the following table contains an abstract of them :—

Stations.	Families of Non-Commissioned Officers and Soldiers.		Approximate Numbers constantly sick and requiring Medical attendance.		Annual Number of Confinements.
	Wives.	Children.	Wives.	Children.	
London Guards	544	495	12	20	78
Woolwich	894	1,330	21	38	No records.
Chatham	456	662	18	33	98
Dover	241	318	4	8	54
Portsmouth	390	487	14	22	141
Gosport	200	301	13	17	66
Plymouth	433	577	12	12	100
Aldershott	1,053	1,397	33	20	202
Dublin	697	875	33	54	184
Fermoy	187	311	5	7	57
Total	5,095	6,753	165	231	980

This table shows that at these 10 stations there are 396 women and children constantly on the sick list, and requiring medical attendance, medicines, diets, and comforts; besides confinements, which, including Woolwich, would probably amount to 1,100 in number per annum.

The only provision as to hospital accommodation for such cases at present existing, at any of these stations, is at Aldershott, where, as we are informed by the acting principal medical officer, "if the cases are of an infectious or of a dangerous character, "the patients are usually ordered to hospital by their respective surgeons, otherwise "they are treated in their own regimental lines. The provision made for confinements "is, that all women who have no separate or private apartments are ordered to hospital." In a few corps stationed at Aldershott all lying-in women are sent to hospital.

The practice in regard to diets was at first not in conformity with the new medical regulations, which direct that all sick wives and children of soldiers are to receive diets while in hospital. At Aldershott the practice was that although all women might be received and treated in hospital, serjeants' wives and women married without leave were not put on the diet roll, but had to provide diets for themselves as they best could. The practical working of this was stated to have been, that "in very many instances "it is found that neither serjeants' nor privates' wives are able, from want of means, to "procure the nourishment necessary." The principal medical officer adds, that "in a "medical point of view, it is essential that they should be dieted in hospital."

By a misapplication of the regulations as to dieting, one of the main ends of providing hospital accommodation for sick women and children was thus rendered nugatory. But as soon as the circumstance was brought under the notice of the Secretary of State for War, the regulation as to diet was enforced, and with most beneficial results.

In as far as regards the other stations, there is no hospital accommodation for this class of cases, or for confinements at any of them. The want was felt so much at Dover that a subscription was raised and a small house was rented, and placed under the charge of a lady superintendent for the reception of sick women and children and for confinements. The result was most satisfactory, but for want of funds the house was closed at the end of a year. The experience was, however, sufficient to show how much good would be done by a permanent hospital at the station.

Sick women and children belonging to the Guards are treated in their own quarters, as far as practicable; but as many families live at long distances from the hospitals it is believed they receive attendance and medicines at public dispensaries. The medical officer of the Coldstream Guards states, that that regiment subscribes to several London hospitals, and the commanding officer has the privilege of recommending a limited number of persons for admission, which he has at various times exercised. He further states, that where the circumstances of the patients do not admit of their purchasing necessary diets, such diets are authorized to be supplied and paid for from the regimental fund; and that for confinements, the woman has the use of a box of linen, and a small sum is allowed her to cover extra expense.

The principal medical officer at Woolwich reports, that in consequence of the want of hospital accommodation for sick women and children, "they have to be attended at their "homes in all parts of Woolwich and Plumstead, and in most objectionable localities." That "they are often driven to the necessity of applying for admission to the London "hospitals." "No provision is made for confinements, and they are dependent on the "charity of the corps to which they belong." Medical officers are obliged to attend all serious cases during confinement, but at Woolwich slight cases are left to midwives, and are stated often to become serious in consequence.

The principal medical officer at Fermoy states, that sick women and children are seen by the medical officer at the dispensary, if they are able to present themselves; but that when not able, they have to be attended in a crowded barrack-room, without the least privacy, "husband, wife, children, sick or well, sleeping together in one miserable bed," or in some wretched, ill-ventilated, overcrowded lodging-room, far away from barracks, hospital, or medical aid. No provision exists for confinements, and the services of medical officers are not often called for on these occasions, from motives of delicacy, on account of the want of the requisite privacy.

Want of accommodation for sick women and children at Chatham has been a subject of frequent representation of late, on the part of commanding and medical officers. Up to October 1847 sick cases were received into the casemates at Fort Pitt. The accommodation afforded was bad enough, but still it was better than none. Infectious cases were dieted at the public expense, but other cases were dieted at the cost of the compassionate fund, provided by voluntary contributions of officers and others within the garrison. At the date mentioned above, this hospital accommodation, such as it was, ceased to be appropriated to the object, and since then the only provision for sickness

consists in medical officers prescribing for those women and children able to attend at the hospitals, and supplying them with medicines. When such patients are unable to attend, the medical officers visit them at their lodgings, wherever they may be. Medical comforts are supplied from the hospital, but they have to be paid for out of the compassionate fund. Nursing, when needed, is also paid for by the fund. No provision whatever exists for confinements, except what the fund supplies. Midwives are employed, and their fee is often paid wholly, or in part, out of the fund, which also furnishes linen, comforts, &c. From want of married quarters and hospital accommodation, the sick are often lodged in the most wretched localities, occupying dirty ill-ventilated rooms, for which a rent of three shillings a week has often to be paid.

We have been informed by the barrack-master, that during last summer cases of sickness had to be put under canvas, and that latterly, in the absence of other accommodation, a small house has been hired for such cases at New Brompton by the compassionate fund.

He further states, that after the wards at Fort Pitt were withdrawn from the use of sick women and children, women were confined in the same barrack rooms with "single men." For the last 18 months married people have been put into rooms by themselves; but in one dark room, he states, that during his last inspection he found three women who had just been confined, and all the windows closed. A death after confinement lately occurred in one of these rooms, apparently expedited by the noise by which the poor woman was disturbed during a critical period.

All parties of whom we have made inquiries, commanding officers, medical officers, chaplains, and others, concur in stating that a hospital for sick women and children is urgently required at Chatham.

These facts will give a general idea of the present state of the question. At none of the stations is there a possibility of providing the necessary accommodation for sick of soldiers' families out of existing buildings, unless by withdrawing them from purposes for which they are quite as much wanted.

Summary of Sanitary Defects in Hospitals.

We shall conclude this section with a brief summary of the defects in hospitals we have described above.

1. *Defects in Local Position.*—A few hospitals occupying sites either naturally unfavourable to health, or which have become unhealthy from causes which might have been prevented. Area of ground devoted to the hospital too small to afford sufficient space for offices, and for an exercising ground for convalescents.

2. *Defects in Plan and Construction.*—Want of any uniform plan for hospitals. Absence of any adequate recognition of the influence of one form of construction more than another on the ventilation, lighting, and sanitary state of the buildings. Back to back wards, with no sufficient means of thorough ventilation. The introduction of long passages or corridors into which a number of wards open, whereby the foul air of all the wards becomes diffused through the building, and direct light and ventilation are cut off from one entire side of each ward. Deficiency of window space. Windows only on one side the wards. Windows placed at opposite ends of the wards, with the beds arranged in consequence along the dead walls instead of between the windows. Distance between opposite windows too great to admit of the ward being properly lighted or ventilated. Deficiency in height of wards. Unnecessary multiplication of parts in some hospitals, by which the original cost of the building has been enhanced, the space cut up into an unnecessary number of wards and offices, the cost of administration increased, and the sanitary state of the building injured.

3. *Overcrowding.*—Great overcrowding in nearly all hospital wards. Great diversity in the amount of cubic space allowed for the sick, and the absence of any recognized principle as to the amount of space per bed necessary for the healthiness of the building.

4. *Defective Ventilation.*—No proper arrangements for ventilation in any hospital with the exception of one hospital in Dublin. The atmosphere in sick wards close and stagnant, in consequence of this deficiency, combined with overcrowding. No attempt at ventilation either of stairs, passages, serjeant's rooms, stores, &c. Defective means of warming, and no combination of warming with any ventilating arrangements.

5. *Defects in Drainage, Water supply, Water-closets, &c.*—Surface drainage defective in many cases. Gutters sometimes imperfectly laid, and retaining foul water in them. In the great majority of instances no drainage for the waterclosets. Only cesspits, often

close to the hospital walls, and full to overflowing with foul water, or their fluid contents infiltrating the subsoil, and endangering the purity of the hospital wells. Waterclosets not unfrequently of defective construction, and liable to go out of order; often without sufficient ventilation, or sufficiently cut off from the hospital itself. Privies in the hospital yard often as bad as the barrack privies: placed over cesspits, or emptying into open ashpits. Water supply often deficient in amount, and in the majority of cases obtained from shallow wells, and distributed by hand labour. Ashpits in general use for receiving and accumulating hospital refuse; generally situated in close back yards, and in immediate proximity to the sick wards.

6. *Defects in Ablution and Bath Accommodation.*—Little or no ablution accommodation suitable for sick or convalescents. Few or no fixed baths properly supplied with hot and cold water. No proper bath rooms. The whole arrangements, such as they are, totally inadequate for their objects.

7. *Hospital Kitchens.*—The chief defects in hospital kitchens are in their position within hospital buildings, and under sick wards. Want of ventilation. Want of uniformity in their means of cooking hospital diets; and cooking ranges in a state of disrepair or worn out.

8. *Defects in Hospital Wash-houses.*—No sufficient means for washing and drying the minor articles, such as towels, dressings, &c., used by the sick.

9. *Defects in Accommodation for Officers, Orderlies, &c.*—Hospital storeage both defective and deficient. Many surgeries deficient in space. Deficiency of hospital serjeant's quarters. No orderlies' rooms, and orderlies' sleeping among the sick. Misappropriation of wards in overcrowded hospitals, arising from want of such accommodation.

10. *Deficiency of Accommodation for the sick Wives and Children of Non-commissioned Officers and Soldiers.*—Universal, except at Aldershot, and much suffering and privation resulting from this want.

SECTION II.

SANITARY IMPROVEMENTS RECOMMENDED FOR HOSPITALS.

The improvements we have found it necessary to recommend for hospitals are of the same general nature as those we have recommended for barracks, and may be divided into two classes.

1. Those which admit of application to existing buildings.
2. Those which require additional buildings to give effect to them.

To the former class belong improvements in ventilation, warming, lighting, drainage, and water supply, &c.; and under the latter are included additional ward space, accommodation for orderlies, stores, &c.

As we shall presently show, the amount of the latter accommodation necessary to enable our instructions to be carried out is very much greater than could have been anticipated. We have therefore been able to do little more than indicate the nature and extent of the buildings required. Under any circumstances considerable time must elapse before these buildings can be constructed, and we have therefore directed our attention mainly to the removal of sanitary defects in hospitals as they are. The following are the points in which hospital improvements are necessary: 1.—In their position, internal structure, and arrangements; 2.—In diminution of over-crowding; 3.—In ventilation, drainage, and water supply, including waterclosets, improved latrines, surface cleansing, &c.; 4.—In ablution and bath accommodation; 5.—In better means of cooking diets; 6.—Improvements in hospital wash-houses; 7.—In accommodation for orderlies and stores; 8.—In accommodation for the sick of married soldiers' families.

We next proceed to state the nature of these various improvements, and the extent to which we have advised them to be carried out.

1.—As regards Position and Construction of Hospitals.

Where the site of a hospital is not conducive to the healthiness of the building, one of two courses must be taken in regard to it. Either the hospital must be abandoned, or the causes which render the site unhealthy must be removed. We have met with several instances in which nothing short of abandoning the hospital could be recommended. Such places as Linen Hall Hospital, Dublin; Galway Castle Hospital;

Limerick Artillery Hospital; the casemated hospital at Fort Pitt; and one or two others, ought not to be occupied by sick, on account of their position, even were they otherwise suitable. There are a number of other hospitals, such, for instance, as those at Aberdeen, Birr, Hounslow, Portobello Barracks, Dublin, in which the sites are injuriously affected by removable causes, such as dungheaps, defective surface drainage and cleansing, open ditches, &c. A bad hospital at Mallow has its site made worse than it would otherwise be by a wall obstructing the ventilation. In these and similar instances we have recommended the offending cause to be removed, whatever it might be, nuisances to be abated, surface drainage to be improved, obstructions to external ventilation to be taken away.

Defects in site *per se*, although very important, are not so frequent, or of so much consequence, in the military hospitals we have examined as errors in construction and internal arrangement. Different hospitals present these errors in very different degrees; but, generally speaking, they admit of being only partially remedied. In a few cases we have found the interior cut up by unnecessary partitions and passages, interfering with light and ventilation. We have directed these obstructions to be removed. In 19 hospitals we found that by opening additional windows, both the light and ventilation of the building might be materially improved. These alterations we have recommended to be carried out; but there are cases in which, from the structure of the building, additional light cannot be obtained, however necessary it may be.

We are sorry to say that there are not a few hospitals which, on account of errors of position or construction, or of both, it would be very advisable to evacuate altogether.

Out of 114 hospitals we have examined there are no fewer than 25 which might be rebuilt on better principles and on better sites with great advantage to the service.

Remembering, however, that these buildings must be occupied by sick until better accommodation can be provided, we have endeavoured to improve them in other respects as far as possible, with the exception of four or five, which are so very bad that we could not take upon ourselves the responsibility of recommending their being used in future.

2.—Diminution of Overcrowding.

Out of all the hospitals we have examined there are only two—the Cavalry Hospital, Knightsbridge, and Hulme Cavalry Hospital—the space per bed in which approaches sufficiently close to the amount we are required by our instructions to allot for each bed, to render a reduction in the number of beds unnecessary. In all the other hospitals the deficiency in bed spaces is very large, and, as a consequence, the hospitals are greatly over-crowded.

We have transferred to Table G. the statistics of wards and bed spaces for all the permanent hospitals we have examined, excepting a few rooms used merely for the temporary accommodation of slight cases until they can be removed to the hospital of the district, and of buildings which in our opinion are quite unfit to receive sick. The table therefore represents the present available accommodation at each of the stations, in comparison with what it would be if each bed had 1,200 cubic feet allotted to it.

The following table gives the general results:—

Number of Hospitals.	Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet per Bed.	Deficiency in Bed Spaces.
101	788	6,732	3,856	2,876

This table shows a total deficiency of above 42½ per cent. in hospital space. We have already shown that every portion of the barrack space is fully occupied, so that no relief for overcrowded hospitals can be obtained there, and it is hence evident that the additional bed spaces required must be found either by extending existing hospitals or by providing hut accommodation. In some instances indeed this latter course has been already taken. In these cases the increase of strength in barracks has led to so large an accession of sick, that the hospital accommodation could in no way be made sufficient. At the present time there are a number of barracks where the increase of strength has led directly to hospital overcrowding, and there are two or three cases in which provision for sick has actually had to be made in the barracks themselves notwithstanding their overcrowded state. At Tralee part of the sick have to be treated in officers' quarters. During the prevalence of fever at Croydon, it was on a recent occasion necessary to appropriate a barrack room for sick in order to relieve the greatly

overcrowded condition of the hospital wards, and at the Royal Engineer barracks at Brompton, which have regulation space for 1,725 men, where 1,124 only ought to be, it has been necessary to misappropriate two barrack houses, having regulation space for 384 men, in order to find accommodation for 150 sick, for whom there is no hospital room on the station.

These facts are sufficient to show why it has been impossible for us to fulfil our instructions as to the allotment of space in hospital.

All we have been able to do, is to point out the extent of the deficiency in our interim reports made to the Secretary of State for War, with a view to an increase of accommodation being provided with the least possible delay.

Hospitals, like barracks, are subject to considerable irregularity in the occupation. Sometimes sick wards are crowded to excess, at other times the space is more than sufficient for health. Some relief from the existing overcrowding may be obtained from time to time by taking advantage of this fact, but it is not always done, for we have ourselves found the sick crowded into one or two small wards, where sufficient space might have been obtained by spreading them over the hospital. With the view of taking advantage of such partial occupation the Secretary of State, in his circular of 1st October 1858, already referred to, directs that the sick in partially occupied hospitals should be distributed so as to give as near an approximation as possible to the amount of space per bed required. At the present time this is the only manner in which additional cubic space can be given to the sick in permanent hospitals. It is good, so far as it goes, but being only of a temporary character it can be considered in no other light than as a very partial expedient for remedying deficiencies which ought not to exist at all.

It would be better as a temporary remedy, to provide a sufficient number of detached hospital huts into which the sick, from overcrowded permanent hospitals, might be draughted. These huts insure subdivision of sick, and facility of ventilation on account of their previous structure, while the sick might be as safely accommodated in 600 cubic feet in wooden huts as they would be in 1,200, the minimum which ought to be allowed in hospitals with impervious walls. It has, however, been proved by experience that wooden huts are expensive to keep up, and as the large deficiency in permanent hospital space may not be soon provided, it might be advisable to consider how far the deficiency might not be better supplied in the meantime by brick huts. These would last longer, and require fewer repairs than wooden huts, but from the impervious nature of brick walls, it would be necessary to allow 1,200 cubic feet per bed in each hut.

We would recommend, therefore, that temporary accommodation should be provided, and that increased permanent hospital accommodation should be constructed with as little delay as possible. On the other hand existing hospital buildings could be perfectly well used for other purposes, and we are not aware of a single case where there is a defective hospital in which additional buildings are not required for barrack accommodation of some sort, such as married quarters, serjeants' rooms, soldiers' rooms, and the like, and whenever it is determined on to provide this class of accommodation at any barrack, we would recommend that it be considered whether it would not be better on the whole to begin by building a hospital.

Better sites on which to place sick could in many cases be obtained. The hospitals might be gradually reconstructed on better plans and principles and in better positions, and part at least of the other accommodation sought for could very well be secured in the present hospital buildings.

We are glad to know that this course is to be adopted with respect to one of our largest military hospitals, that of Woolwich. Increased barrack accommodation is very much wanted in that large garrison. A new hospital is to be built, and the present hospital wards will be converted into barrack rooms, for which purpose they are better adapted than for the reception of sick. A bad hospital will be got rid of, and a tolerable barrack will be obtained by the change.

3.—Improvements in Ventilation, Warming, and Lighting.

Ventilation of Stairs, Passages, &c.—In ventilating a hospital it is not sufficient simply to ventilate the wards; all parts of the building require to be examined, with the view of ascertaining the places where air is likely to become stagnant, and means must be adopted to prevent stagnation. Wherever there is stagnant air in a hospital, there is foul air, and the end aimed at in all ventilating arrangements is to keep up a steady circulation of fresh air throughout the entire building, otherwise the wards may be at any moment supplied with air from the kitchen, from close empty rooms,

shut-up corridors, under-ground cellars, if there be such, or even from waterclosets, imperfectly ventilated, or sinks badly placed.

With the exception of a few one-story hospitals, all we have examined contain good staircases, some of them, indeed, large and roomy, although not always well lighted. These staircases generally end at the ceiling of the top flat, and, as at present arranged, they serve as conduits of foul air from the wards and offices below to the wards above. This great defect, however, admits of very simple remedy. All that we have considered it necessary to do has been to carry a louvred shaft of from 9 to 12 inches square, according to the size of the hospital, through the ceiling and roof. This, with a few panes of perforated glass in the staircase and passage windows, is quite sufficient to keep up such a circulation of air in the staircase, as practically to cut off the ventilation of the wards of different flats and on opposite sides of the staircase from each other.

Where there are long passages and corridors, not capable of being ventilated through the staircase, we have advised the introduction of separate shafts and panes of perforated glass, by which the stagnation of air, incident to this form of hospital construction, will be in future materially diminished. We have found it necessary to ventilate the corridors and passages in 57 hospitals in this manner. The ventilation of hospital staircases in most instances involves the cutting off of the watercloset ventilation from the wards, as the waterclosets are generally placed behind the staircases, and outside the buildings. In a number of instances, however, we have not found this precaution sufficient, and we have advised the opening of additional windows in passages leading to the closets, putting up swing doors in the passages, or ventilating the closets themselves by shafts and perforated panes.

Where kitchens are placed within the buildings or under sick wards, we have had them separately ventilated by a shaft 12 inches square, carried from the ceiling up through the roof, and by perforated panes in the windows. This improvement has been necessary in 40 hospitals.

Ventilation of Wards.—Before deciding on the best means of ventilating the wards themselves, we examined the methods in use in a number of hospitals, both in this country and abroad. In the previous part of this report, we have stated generally the nature of the plans for artificial ventilation we found in use. We have shown that they would be inapplicable to barracks; and hospitals being establishments of so much less extent than barracks (the hospital being, in fact, only a fractional part of the barrack establishment), it would be impossible to introduce the extent of mechanism which is required by any of the plans, without an amount of first outlay and current cost which could only be warranted by showing that these plans have a great and decided advantage over all others. The cheapest of the artificial methods of ventilation, combining with it warming arrangements, which has come under our notice, is the one in use at the military hospital of Vincennes, near Paris, and which is practically very similar to the plan introduced by the late Mr. Sylvester into Derby Lunatic Asylum and other buildings. In this instance the air in the wards is renewed at the rate of about 2,000 cubic feet per bed per hour, by means of extracting shafts heated by furnaces, drawing the air from the wards by air-ducts placed between every two beds. The inflowing air, which is derived from the sunk basements of the building, is heated by hot-water vessels.

The estimated first cost of this apparatus was somewhat less than 11*l.* per bed for a hospital with 637 beds, and the current contract cost of warming and ventilating is 2*l.* 6*s.* per bed per annum. The expenses would greatly exceed this estimate were such an apparatus to be applied to 21 hospitals of 30 beds each, instead of to one hospital with 630 beds, like the Vincennes hospital; for every hospital would require a separate apparatus and separate attendance, besides which, for reasons we have assigned, it would be difficult, if not impossible, always to ensure the efficient action of the apparatus.

Under the circumstances we did not consider ourselves justified in adopting any one of the methods of artificial ventilation proposed to us; and we, therefore, had to consider of the best method for ventilating wards, without reference to these plans. We arrived at the conclusion that the same method applicable to barrack rooms might be very well adopted in hospital wards. This method is sufficiently simple; it is economical in practice, and with ordinary care on the part of medical officers and attendants, together with a judicious use of the windows, when the weather is favourable, it will keep the ward air as fresh as the air outside. Our method, besides, admits of the great advantage being obtained of ventilating each ward by itself, and independent of every other, which we look upon as a fundamental principle in the ventilation of all hospital wards as well as of barrack rooms.

The plan we have adopted consists in carrying a shaft, of sufficient sectional area,

from one corner of the ceiling of each ward up through the wards above, and so through the roof (as shown in Fig. 34). The shaft is protected in the open air by louvres so arranged as to prevent the rain from beating down. We have also provided one or more inlets for fresh air of the construction represented in Figs. 31, 32, and 34, placed close to the ceiling, and on opposite sides of the ward.

Warming.—To warm the admitted air in winter we have adopted the arrangement of fire-grate represented in Figs. 35, 36. The whole of the ventilating and warming apparatus of a ward is represented in Fig. 37. It is simple and inexpensive, and will very soon save its first cost in the economy of fuel.

The arrangement is especially adapted for cold and for moderate weather. It is not at all intended to obviate the proper use of windows. Nothing makes the atmosphere of a sick ward so fresh and wholesome as frequent airing by means of windows, whenever they can be opened. Indeed, in a properly constructed hospital, with wards of sufficient height and well proportioned, no means of ventilation are so effective as a judicious use of windows; but nearly every hospital we have had to ventilate has wards so low in the ceilings that the ward windows could only be used during mild weather. We have provided the means of keeping the air fresh when the windows cannot be opened, but we have not superseded the use of windows, which ought to be resorted to when the state of the weather requires it, or admits of the windows being opened.

Our method of ventilation has been adopted on the supposition, that 1,200 cubic feet is to be given to each bed with as little delay as possible, for, with the present amount of over-crowding, neither the plan we have adopted, nor indeed any other plan will preserve the air around the sick in the requisite state of purity. As already stated, we have been in hospitals in still weather, in which the windows were open, but where, nevertheless, the ward atmosphere was in a very offensive state, from the great over-crowding of sick. Ventilation, therefore, to be effective, must be accompanied by increasing the cubic space to 1,200 feet per bed, and, until that is done, it cannot be said that, even with improved methods of ventilation, the sick are altogether safe from hospital diseases, or from having their convalescence procrastinated. The best test of the state of the ventilation in any ward is by going into it directly from the open air. Any deficiency in the ventilation is at once detected by a sense of closeness or smell, and wherever either exists there is danger. The medical officer is very properly held responsible for the state of the ventilation by the new medical regulations, for without intelligent superintendence no mere apparatus for renewing the air will act in a satisfactory manner. We have recommended the introduction of this method of ventilating and warming into the wards of 105 hospitals.

In small wards, with one or two beds, we have generally advised an Arnott's ventilator to be introduced into the chimney, and glass louvres to be placed in the windows, or a Sherringham's ventilator in the wall.

Lighting.—The usual method of lighting hospitals by regulation dip candles is quite insufficient for the purpose. Gas is by far the best and most convenient light for sick wards, on account of the ease with which the light can be suited to any condition or emergency. We found 35 hospitals in which gas could be obtained from existing mains in the vicinity, and in all these we have recommended ventilating gas-burners, on the plan shown in Fig. 38, to be introduced into the wards.

4.—Improvements in Drainage, Water-closets, and Water Supply.

The state of hospital drainage being dependent on that of the barrack drainage, the drainage improvements we have recommended for barracks have generally included those required for hospitals. In some hospitals we have had to recommend improved paving and guttering, and in all, excepting where the hospital drainage had a communication with any general system of sewerage in the town, we have been obliged to recommend the necessary works to be executed, for enabling cesspits and privies to be abolished, and waterclosets provided, without which no hospital can be said to be fit for sick.

In 56 of the hospitals we examined we found no waterclosets, all the sick who were able to leave their beds being obliged to resort to open privies in the hospital yard, and we have had, in consequence, to recommend the construction of suitable out-buildings connected with the stairs or passages, but having a separate ventilation, in which to place waterclosets. In the great majority of instances, one or two waterclosets have been enough.

Generally about a third part of the sick are confined to bed and incapable of leaving the wards, another third part are convalescents and able to go beyond the hospital walls; it is only, therefore, for the remaining third, that watercloset accommodation has to be provided.

Usually the hospital privy and cesspits are in the back yard. In 59 hospitals we have had to recommend the removal of the privies altogether, and proper water latrines, on Macfarlane's principle, to be constructed instead.

In 45 hospitals we have had to recommend the abolition of cesspits.

Special drainage works are required in 49 hospitals without which neither the cesspits can be removed nor the privies altered into water latrines, so that improved drainage is absolutely necessary to enable cesspits and privies to be abolished and waterclosets and water latrines to be substituted for them. The form of latrine we have adopted for outdoor use is that represented in Fig. 40. We found it already in use in two or three hospitals, where it had answered very well. None but soil pans of the best construction and abundantly supplied with water are fit for use, especially in hospitals. And even the most perfect apparatus should be constantly watched to prevent the occurrence of defects which may at any moment exercise a most injurious influence on the sick.

We have discountenanced entirely the use of ash-pits for hospitals. Any space in which they can be placed is too confined and much too close to the wards. In 36 hospitals ash-pits will have to be removed and iron boxes substituted for the daily removal of the hospital and kitchen refuse.

Essentially connected with the question of hospital drainage and cleansing is the question of water supply which we have generally found in the same unsatisfactory state as it is in the adjoining barracks. In 28 hospitals the amount of water, its quality, its manner of distribution, or all of these together, require improvement. In some instances water from town mains requires to be introduced; in others, where pipe water is not available, wells require to be deepened, or the storeage increased, or the hospital supplied with water on some general principle applicable also to the barrack. We have indicated in our interim reports the nature of the improvement required in each specific case, and its relation to the drainage, baths, ablution rooms, &c. The principle in supplying hospitals with water is, that besides being abundant, and pure in quality, it should be laid on hot and cold over the whole building for washing the sick, for supplying baths, and for affording the means at hand for obtaining hot water on any emergency. In an ordinary regimental hospital supplied with hot and cold water on this principle, the services of attendants would be greatly curtailed.

5.—Baths and Lavatories.

The amount of bath and lavatory accommodation we have been under the necessity of recommending is very considerable, and forms a large item in the outlay for hospital improvements. Whether as a means of cleanliness or of treatment, fixed baths with hot and cold water close to the wards are absolutely essential in every hospital, and we have been obliged to recommend their introduction in no fewer than 77 out of the 101 permanent hospitals to which our Report especially refers. In the smaller class of regimental hospitals one bath conveniently situated is enough. We have sometimes found it possible to obtain space for it within the building, but generally we have had to recommend its being placed in a projection together with the watercloset and ablution table. The form and material of bath differs in different instances according to local circumstances. We have generally adopted the same form and material as for the barrack baths, with this difference, that hot and cold water have been supplied in place of cold water alone. In a few of the large hospitals it has been necessary to place one or more baths on each flat. The bath rooms are supplied with the usual gratings, seats, and pegs.

In 70 hospitals we have found no means of washing sick or convalescents except in sick wards. In some of these instances the necessity has been so strongly felt of having some such place that convalescents are not unfrequently obliged to use the wash-house, kitchen, back-yard, or other equally objectionable place for performing their ablutions.

To supply this great defect we have recommended generally the introduction of ablution tables with sunk basins, the tables being of slate and the basin of white earthenware. Over each basin are two water taps, one for hot and one for cold water, and in the bottom of the basin is a plug by which it may be emptied.

We have likewise recommended a form of cast-iron basin, represented in Fig. 50, which when supplied with hot and cold water answers very well. In most instances space can be obtained for the ablution table in the same projection where the bath is placed. In other instances space can be obtained in some equally convenient part of the hospital, but we have objected altogether to placing either ablution table or bath in sunk basements, where we found them generally placed in the few cases in which they were in use, because the men would probably receive more injury from cold and damp in using them than they would derive benefit either from washing or bathing.

6.—Improvements in Hospital Kitchens.

Besides the improved ventilation of hospital kitchens already mentioned, it has been necessary in a number of instances to provide improved means of cooking hospital diets. In two of the larger hospitals, at Fort Pitt and Chatham garrison, we advised the introduction of gas cooking ranges in addition to the usual boilers. For roasting, stewing, and preparing small articles of diet these gas ranges afford great facilities for hospitals and have been found to answer well in practice. In regimental hospitals, we have not considered it necessary to introduce cooking by gas, instead of which we have generally advised the introduction of some simple cooking range, supplied with a roasting oven and hot-water boiler.

There are several contrivances in common use which answer every purpose in a satisfactory manner, and from having been known for years their capabilities are established by experience. We have had one or other of these cooking ranges introduced into 37 hospitals.

The requisite cooking utensils being provided according to the purveyor's list in the new medical regulations, it has not been necessary for us to enter upon this part of the subject

7.—Improvements in Hospital Wash-houses.

All the hospital wash-houses we have inspected require improvement on one general plan, for their deficiencies are the same in kind throughout. They are generally deficient in light and ventilation. They have no proper washing tubs, they have no water supply, and they have no means of drying or ironing linen. Each hospital wash-house should have at least two fixed tubs with water laid on, gratings to stand on, an ordinary laundry stove capable of drying linen and heating irons, and an ironing table. We have in the meantime recommended such of these improvements as were most urgent in the wash-houses of 23 hospitals.

8.—Extended Accommodation for Medical Officers, Attendants, &c.

We have already stated the nature of the existing deficiency in this important matter. It has been out of our power to make any provision for supplying it, except in projected enlargements of existing hospitals, or in plans for new hospitals. In several of these cases we have required orderlies' rooms to be attached to the sick wards in such a position that the orderly can overlook the adjoining wards without sleeping in them. In plans for new buildings we have required suitable accommodation to be provided for inspections, stores, &c. A considerable time must necessarily elapse before improvements of this nature can be effected, involving as they do a considerable extension of hospital buildings. It appears, indeed, never to have been contemplated, until quite recently, that attendants on sick should not sleep in the sick wards. This principle is a very obvious one, but not having been recognized in military hospital construction, it is impossible to give effect to it except in cases where new wards have to be built. The remedy is, therefore, prospective. We shall subsequently show the manner in which this kind of accommodation should be provided in new hospitals. But with regard to existing regimental hospitals, the difficulty or impossibility of providing these necessary additions constitutes an additional reason for turning the buildings to other purposes, and for erecting proper hospitals.

9.—Accommodation for the Sick of Soldiers' Families.

In this instance, also, we have been able to do nothing more than to report the almost absolute want of accommodation. In the preceding section we have shown the state of the question as regards the larger stations, and we would strongly recommend that at these stations the deficiency should be remedied by providing two or three rooms into which the sick of soldiers' families could be received, and put on hospital diets. The accommodation would require to be near the barrack hospital, for the convenience of medical officers, as well as for administration and discipline. The readiest way of providing it would be by means of a hut divided into wards. More permanent accommodation might easily be constructed in connexion with new married quarters. It is possible that in some instances suitable rooms could be rented; but, unless they happen to be near the hospital, they will not fulfil all the conditions required for this class of accommodation.

Summary of Hospital Improvements recommended.

Although it has not been in our power to diminish overcrowding, we have stated in each interim report the extent of overcrowding, and the additional accommodation required to give 1,200 cubic feet per bed.

We have likewise indicated the deficiency of accommodation as regards orderlies rooms, stores, space for the sick of soldiers' families, &c., and in some instances we have had estimates framed for supplying the deficiency of accommodation; but these have been of little use except to show how large a sum of money will be required for the purpose. We have not, therefore, included these items in our estimates for hospital improvements sent to the Secretary of State; but with respect to all other matters, such as ventilation, warming, drainage, waterclosets, baths, &c., being essential to the very existence of hospitals, these have been always included in our estimates for works. In order to give a general idea of the sanitary state of each hospital at the time of our inspection, we have given on Table H. a digest of the defects, the improvements required, their estimated cost, the items and amounts sanctioned by the Secretary of State, and the items and amounts postponed. It will be seen that the items and amounts sanctioned for hospitals are much more numerous than those sanctioned for barracks, and in a very short time it is to be hoped that the sanitary defects of military hospitals will be amongst things of the past, always excepting the very important matter of overcrowding, which we would most earnestly recommend to be dealt with immediately.

The following summaries of Table H. exhibit the sanitary state of the hospitals at one view:—

1.—Additional Hospital Accommodation required to give 1,200 Cubic Feet per Bed.

Number of Wards.	Present Regulation Number of Feet Beds.	Number of Beds at 1,200 Cubic per Bed.	Deficiency in Bed Spaces.
788	6,732	3,856	2,876

2.—Improvements in Ventilation and Warming.

Nature of Sanitary Improvements.	Number of Wards, &c. in which each Improvement is required.	Nature of Sanitary Improvements.	Number of Hospitals, &c. in which each Improvement is required.
Ventilation of Wards	785	Ventilation of Kitchens	40
Ditto Staircases	57	Ditto Serjeants' Rooms	all

3.—Improvements in Water Supply, Drainage, Waterclosets, Baths, Ablution Accommodation, &c.

Nature of Sanitary Improvements.	Number of Hospitals where each Improvement is required.	Nature of Sanitary Improvements.	Number of Hospitals where each Improvement is required.
Water Supply	28	Abolition of Cess-pits	45
Baths	77	Ditto Ash-pits	36
Lavatories	70	Improved Cooking Apparatus	37
Improved Drainage	49	Improved Wash-houses	23
Waterclosets	56	Increased Window Space	19
Improved Latrines	49	Gas	35
Urinals	16	Exercising Grounds	9

SECTION III.

PROGRESS OF SANITARY IMPROVEMENTS IN BARRACKS AND HOSPITALS.

Paragraph 13 of our instructions from the War Department runs as follows:—

"You will further see that the works directed or recommended by you are completed to your satisfaction, and you shall report on the same forthwith to this Department."

This instruction involves a careful personal examination into the execution and efficiency of the various sanitary works we have recommended; but it has not been in our power hitherto to comply literally with it. In a practical matter where so much of the procedure required is new, and where so many important sanitary problems have to be practically solved in the most efficient and economical manner, it would not be surprising if some changes and alterations required to be made in order to adapt the

means to the end as perfectly as possible. Such an examination of works as that implied in our instructions and which is moreover necessary to the fulfilment of their intention, we hope soon to undertake. It happens, however, that a considerable number of references have been made to us on practical points of difficulty and importance, so that in reality the work of our Commission has not been by any means confined to the examination of barracks or to the framing of reports and estimates. We have had, besides these duties, to examine plans for nearly every kind of sanitary work and to give advice on many points of primary importance respecting them. Although the instruction we have cited above has certainly not been literally complied with we have been in possession of a considerable amount of information as to how the works were progressing. Besides, as will be seen from Table E., many works are still unsanctioned and estimates for several stations have not yet been received.

Under the circumstances of the case, then, we have considered it better to complete the inspections, reports, and estimates for all the more important stations before examining and reporting on the works executed.

Impressed, nevertheless, with the importance of ascertaining the progress already made we issued a circular on the subject to the Commanding Royal Engineers of the districts in which works had been authorized, and we have received returns from the following 15 districts :—

London	Exeter	North British
Woolwich	Western	Dublin
Chatham	Yorkshire	Cork
Dover	Midland	Curragh
Portsmouth	Manchester	Limerick.

These returns do not include in every case the whole works recommended, nor the whole works estimated for or authorized.

They only contain the works executed or in progress of execution.

In almost every instance they give the state of ventilating works for barrack rooms, hospitals, guard rooms, &c. In many instances the drainage works, improved latrines, urinals, &c. are included. In no instance are the whole sanitary measures, including the diminishing of overcrowding in barrack rooms and hospital wards, reported to be complete.

We have given on Table I. an abstract of these returns, which refer to 108 barracks and 59 hospitals.

It will be seen that in no one instance have any steps been yet taken for affording a sufficient amount of space per man either in barrack rooms or sick wards, so that up to the date of the returns which represent the progress of sanitary improvemen on June 30, 1860, this most important matter remained as it was.

That measure, which is of equal importance with diminution of overcrowding, namely, ventilation, has however been very extensively carried out.

The barrack rooms of 74 barracks and the sick wards of 53 hospitals have been ventilated, and 28 barracks and 10 hospitals have been supplied with our new ventilating fire-grates, for warming part of the fresh air admitted during winter.

The following abstract exhibits the number of rooms, workshops, wards, &c., which have been ventilated in each district included in Table I.

—	Barrack Rooms.	Non-Commissioned Officers' Rooms.	Guard Rooms, Orderly and Lock-up Rooms.	School-rooms, Libraries, and Workshops.	Hospital Wards.
London district - - - -	392	48	9	12	23
Woolwich do. - - - -	222	—	10	9	97
Chatham do. - - - -	333	58	7	3	43
Dover - - - - -	269	34	12	7	47
Portsmouth - - - -	383	10	6	5	50
Exeter district - - - -	93	34	4	1	20
York do. - - - -	74	23	6	11	12
Midland do. - - - -	71	11	4	2	9
Manchester do. - - - -	247	—	5	13	45
Dublin do. - - - -	285	39	5	3	39
Cork do. - - - -	178	—	5	—	40
Curragh do. - - - -	202	—	5	—	33
Limerick do. - - - -	247	89	10	1	42
Total - - -	2,996	346	86	67	500

This abstract shows that nearly 3,000 barrack-rooms and 500 hospital wards have been already ventilated on our plan, by shafts carried from the ceilings to above the roof, and by inlets close to the ceilings. In round numbers, three-fifths of all the barrack-rooms, and two-thirds of the hospital wards at the stations we have reported on have been already ventilated, besides non-commissioned officers' rooms, guard rooms, &c. But improved ventilating fire-grates, which are essential to the ventilation of both barracks and hospitals during winter, up to the date of the returns, have been introduced only into 28 barracks and 10 hospitals.

The following is an abstract of the sanitary improvements included in Table I.:—

Sanitary Improvements.	Number of Barracks in which each Improvement has been carried out.	Number of Hospitals in which each Improvement has been carried out.
Ventilation by Shafts and Inlets	74	53
Improved Fire-grates for ventilating and warming	28	10
Drainage, including abolition of Cess-pits	15	8
Improvements in Latrines and Watercloscts	45	15
Improved Urinals	19	1
Improved Water Supply	17	4
Increased Window Space and Improvements in Window Sashes	8	6
Baths	54	23
Improvements in Ablution Rooms	43	14
Improved means for Washing and Drying Linen	26	4
Improvements in Cooking Apparatus	75	10
Other Improvements in Kitchens	45	7
Improvements in Manure Heaps and Ash-pits	26	—
Ventilation of Stables under Barrack Rooms	13	—
Gas introduced	9	8
Exercising Grounds for Convalescents	—	3

It will be seen that eight barracks and six hospitals have been provided with more window space, or have had existing windows improved. About a third of the barracks and about a fifth of the hospitals we have reported on have been supplied with fixed baths, and water laid on. In the hospital baths both hot and cold water are supplied. Privies and cess-pits have been abolished, and water latrines substituted, or otherwise improved, in 45 barracks, and watercloscts have been put up in 15 hospitals. Means of roasting or baking meat have been provided for 75 barracks, and improved cooking ranges put up in 10 hospitals. In 43 barracks the ablution rooms have been improved in various ways, by gratings, pegs, light, ventilation, beads to the tables, &c., and 14 hospitals, hitherto unprovided with any special means of ablution, have had suitable lavatories constructed. Manure heaps and ashpits have been removed altogether from places where they occasioned nuisance, or they have been improved, so as to prevent nuisance in 26 barracks. In thirteen cavalry barracks stables placed under barrack-rooms have been ventilated by shafts from the corners, carried through the roof, to diminish the risk of foul air passing up to the barrack rooms.

Improved water supply has been introduced in 17 barracks and 4 hospitals. In one instance, at Chatham, a water tower has been erected, from which a constant supply of water is delivered throughout the whole garrison. Nine barracks and eight hospitals have been lighted throughout with gas, and three hospitals have had exercising grounds provided for convalescents; twenty-six barrack wash-houses have been improved to a greater or less extent, by having fixed tubs, ventilation, drying stoves, &c. provided.

Other improvements, such as drill sheds, improved stores, &c., not shown in the abstract, have also been carried out on one or two stations.

The practical result of these improvements is to purify the air in and around barrack rooms and hospital wards, to afford more variety in cooking food, additional means of cleanliness and bathing, diminished liability to disease and protracted convalescence, and greater facilities for medical treatment of the sick. It is true that the improvements as yet carried out constitute only a fractional part of those required to make the barracks and hospitals of the United Kingdom all that they ought to be as great public establishments; but a beginning has been made in applying practically to these establishments those sanitary works and measures which experience has shown to be very much required to preserve health and life in barracks and hospitals, no less than in all buildings where numbers of men are necessarily congregated together on a small area and within a confined space. It would be difficult as yet to determine the effect of these improved sanitary conditions in diminishing sickness and mortality; but we have not a doubt, that when all barracks and hospitals afford a proper extent of space for their inmates, and when the various sanitary improvements described in this Report, and which are intended to carry out recommendations of the Royal Commission, are in full operation, their influence will be to effect a marked improvement in the health and efficiency of the army.

PART III.

SANITARY PRINCIPLES OF BARRACK, CAMP, AND HOSPITAL ARRANGEMENT AND CONSTRUCTION.

In a preceding part of the report we have pointed out the more common defects in the construction of barracks and hospitals which have come under notice in our inquiry into the state of the barracks in the United Kingdom, and we now proceed to describe briefly the general sanitary principles which ought in future to be observed in the construction of these buildings. Much of what we have to state has been given in another form in the preceding pages, but we have considered that it might be useful to bring the whole of the sanitary principles we have discussed into a practical shape for future application.

In doing so we shall not enter into details of construction. These must necessarily be determined by the position, size, and form of the ground at the disposal of the architect. Neither is it our intention to discuss what should be the constituent parts of a barrack; all we propose to do is to endeavour to lay down certain general principles, which if followed out will enable healthy barracks and hospitals to be built.

SECTION I.

BARRACKS.

1. Principles of Barrack Construction.

Selection of Sites for Barracks.—The position of a barrack must be determined primarily by military reasons. But wherever there is a choice of position, it need hardly be stated that a healthy country site should be chosen in preference to a town site, that there should be a healthy local climate and exposure, that the vicinity of marshes, stagnant water, muddy banks, and sites generally where malaria exists, and produces its usual results among the civil population should be avoided, that there should be a good available water supply, sufficient elevation to ensure good drainage to an accessible outfall, that a porous subsoil should be selected in preference to a retentive one, wherever it can be had, and that the area of ground should be large enough, not only for the healthy disposal of the buildings, and for exercise and recreation, but for preventing encroachments of the civil population.

In practice it may not always be possible to obtain every one of these advantages, but they ought certainly to be sought for, and none of them dispensed with, unless for good and sufficient reasons.

An unhealthy barrack site leads to a constantly recurring loss of efficiency among the troops from preventible disease, and this fact ought to weigh forcibly as against selection of ground for purely military purposes. What we contend for is, that all the circumstances and conditions should be weighed together before arriving at a conclusion.

Surface and Subsoil Drainage.—Having selected the site, the whole area within the barrack enclosure should be thoroughly underdrained to the depth of four feet at least, by tile drains placed at distances differing according to the nature of the subsoil, and the fall of the ground. The lines of drainage should be closer to each other or more distant according as the subsoil is more or less retentive of moisture. In some positions with a very porous subsoil in which water never remains, tile drainage may be unnecessary, but such instances are rare exceptions. The drainage should be in all cases sufficient to keep the parade ground firm and dry. If the ground is on a slope, the water from the higher ground should be carefully cut off by catch-water drains, and turned away from the site.

Surface drainage requires special attention, and hence all paving for barracks and stables should be formed of square setts closely joined. The surface gutters should be well laid, and formed to convey away water as rapidly as possible. The guttering should not be close to the

barrack room walls, with a fall bringing the water to the walls. The fall should be away from the wall, and the gutter should be at least 5 or 6 feet from the buildings. It would be very advisable to flag the ground along each side of the buildings, for the double purpose of obtaining a dry pavement as a footway, and to turn rain water away from the walls.

Block Plan.—In barracks, as well as in all buildings where a large number of human beings are to be lodged together, it is most advisable, as a general principle, to place nothing likely to affect injuriously the purity of the air in the same building with the inhabitants.

Stables, kitchens, latrines, and baths should therefore be built away from them.

The buildings should be arranged in the simplest manner possible. Squares with closed angles should be as far as possible avoided. The great object to be aimed at is to have free external ventilation all round the buildings; in temperate and cold climates to have as much sunlight as possible, and to avoid a purely northern exposure for barrack rooms. These conditions are essential to health.

One of the simplest and best arrangements for barracks is in a single line, lying north and south if possible, to allow the sun to shine on both sides of the range every day. The line may be divided into separate blocks for facility of passing across it at different points.

We have given examples of this arrangement at present in use in figs. 14 and 15. The advantages of it as regards healthy ventilation, and sufficient sunlight are obvious. Dividing the buildings into two parts so as to have opposite blocks with the parade ground between them is also a good arrangement for barracks of a certain size, which are to be built on ground of a certain shape and area. Such an arrangement may be made quite healthy. Several parallel blocks at a sufficient distance from each other to enable the whole outer wall surface to be freely exposed to the sun during the day, might be used on some forms of ground.

Arrangement in square might also be adopted for large barracks, provided the angles of the square were left open. Separate blocks arranged in square with the angles open would allow of the requisite circulation of air. Free access of sunlight to a square is best obtained by placing two opposite angles of the square north and south.

Arrangement of Buildings.—No part of a barrack whether for sick or healthy men should be placed too close to the boundary walls. There should be always intervening space sufficient to ensure thorough ventilation round the buildings between them and the wall, and to prevent the ventilation being injuriously affected by buildings belonging to the civil population coming up to the walls. Latrines, cook-houses, stores, and other similar buildings, can be placed between the barrack and the wall, but the arrangement should be such as not to interfere with its external ventilation.

Barracks, as well as all populous buildings, are best constructed of only two stories of inhabited rooms. Three stories are not objectionable for healthy people, though objectionable for sick. Four stories should only be resorted to when from the dimensions or form of the ground it is absolutely necessary to adopt this number of floors.

Dry stores, staff and regimental rooms for administration, day rooms, libraries, and reading rooms may be placed without detriment on the ground floor, with men's rooms over, when it is necessary to do so.

Basements should never be used for barrack rooms, nor indeed for human dwellings. They are always more or less liable to damp, stagnation of air and deficiency of sunlight, and are well known nurseries of disease in civil life.

Each range of barrack rooms should consist of separate houses; each house having no direct communication with the adjoining houses. To ensure this, the party walls between the houses should be carried above the roof.

Each house should be divided up the middle by a wide roomy staircase, extending from the ground to the top flat, with a free ventilation through the roof. The staircase and passages should extend across the house from front to back with windows on opposite sides for thorough light and ventilation. Besides affording means of access, the stair and passages should be so constructed as to afford ventilation upwards between the two halves of the house, sufficient to prevent the atmosphere in the barrack rooms on opposite sides of the stair and passage from intermingling.

There should be only two barrack rooms on each floor of the house, one opening out of the right, the other out of the left-hand side of the passages and landings.

Unit of Barrack Room Construction.—There should be a unit of size for barrack rooms, and there should be certain appended parts to each room, so that a barrack of any size may be constructed by simply increasing the number of such units.

We would propose from 20 to 30 beds as the unit of number. The beds being arranged with their heads to the walls on opposite sides of the room.

The unit of space in temperate climates must be 600 cubic feet per bed in conformity with the new regulations. Each barrack room should, therefore, have a cubic capacity of from 12,000 to 18,000 feet.

Nineteen or twenty feet would be a good width for a barrack room. It would allow ample space for tables and forms when the beds are made down, and would allow about 11 or 12 feet between the opposite beds during the day when the bedsteads are turned up. The beds should be arranged with their heads to the walls between the windows. In no case should there be more than two rows of beds between the opposite windows. This rule holds good in all climates, but more especially in hot climates.

Barrack bedsteads are about three feet wide. When arranged side by side, there should be at least 2 feet between them, so that the average breadth of each bed space would be 5 feet. Barrack-rooms should not be less than 11 feet high.

A room 20 feet wide and 12 feet high, with 5 feet bed spaces along the walls, would give the regulation amount of 600 cubic feet per bed. If the height of the room is less than 12 feet, it would be better to make up the unit of cubic space by increasing the bed space along the walls, than by making the room wider.

All men's rooms in permanent barracks should have ceilings. The space in the slope of the roof should not be taken into barrack-rooms any more than into the rooms of ordinary dwelling-houses.

These data, which are required for health, will enable properly proportioned rooms to be planned.

There should be about half as many windows as there are beds in the room; they should be on opposite sides of the room; they should be carried up to within a few inches of the ceiling, and be hung so that both upper and lower sashes can be opened or shut.

The fire-place should be placed in the side wall in the centre of the length of one side of the room, and should be constructed to warm part of the air admitted for ventilation. If the room were constructed for 30 beds two fire-places would probably be required; in which case they should be placed on opposite sides of the room, but not opposite each other.

The elements of healthy barrack room construction are then:—

1. Accommodation for from 20 to 30 beds per room, at 600 cubic feet per bed.
2. Height of room from 11 feet to 12 feet.
3. Breadth of room 19 to 20 feet.
4. Windows equal to about half the number of beds, arranged on opposite sides of the room.
5. No more than two rows of beds in any barrack room. Beds to be placed with their heads to the walls, and 5 feet in breadth at least allowed for each bed.

No barrack room should in future contain either a serjeant's bunk or a urine tub.

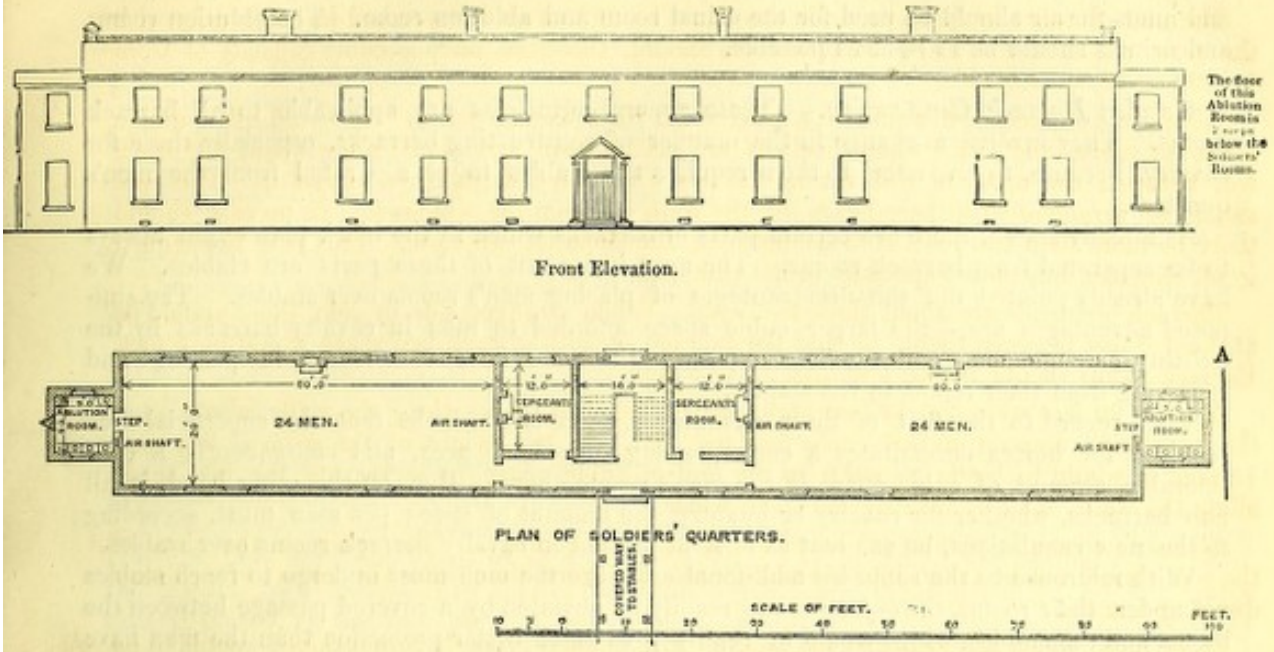
Each barrack room should have a serjeant's room opening from the landing or passage, and connected with the barrack room; and either at the entrance, or at the further end opposite the entrance there should be a well lighted and well ventilated room, with fixed ablution basins, with plugs and with water taps over them. See fig. 50. One basin for 10 men, or for every fraction of 10 men, is enough. In the same room there should be placed a night urinal constructed on the principle represented in figs. 48, 49.

The barrack room unit which we propose for adoption contains:—

1. The barrack room.
2. The serjeant's room.
3. An ablution room, with fixed basins.
4. A night urinal.

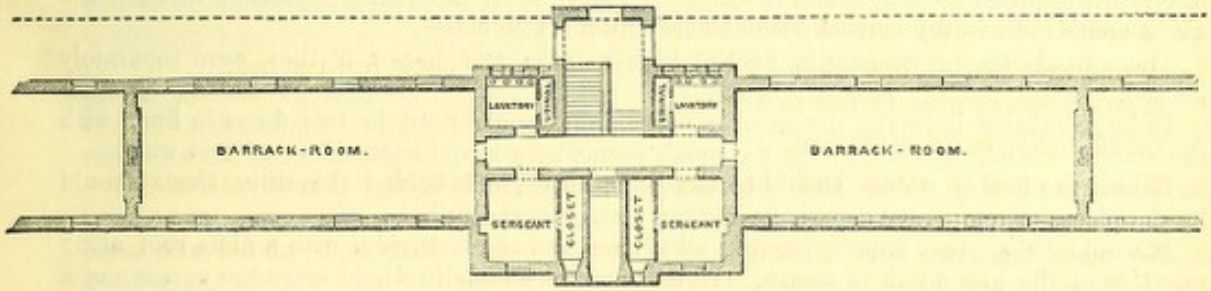
Arrangement of Units.—The plan of a proposed addition to the cavalry barracks at York, fig. 75, shows one form of arranging these units to suit a particular case. The addition is intended for 100 non-commissioned officers and men, and will be two stories high, with a central staircase; a serjeants' room right and left on each flat, and beyond each serjeants' room a barrack room for 24 men. Each room has two ventilating shafts, inlets for fresh air between the windows, and a ventilating fire grate. At the end of each room, opposite the door, is placed an ablution room with fixed basins, and a night urinal.

Fig. 75.—New Cavalry Barrack, York.



Another method of arranging the same parts is shown in fig. 76, which represents one floor of a barrack house in the New Chelsea Barracks. In this case a large barrack is being erected in separate houses in a single line, and the most convenient situation for the lavatory and night urinal in such a construction is at the staircase end of the barrack room, with the serjeants' room opposite.

Fig. 76.—New Chelsea Barrack.



Two barrack room units complete, with the passage between them, constitute in this plan one floor of a barrack house. Each house, according as it consisted of two or three floors, would contain four or six units, so that by multiplying these parts and houses a barrack of any size may be constructed. Chelsea Barrack will consist simply of a number of units such as those shown in the figure.

Ventilation and Warming of Rooms.—Every barrack room should be provided with independent means of ventilation. The best manner of effecting this is to carry up shafts in the thickness of the wall above the roof. The opening of these shafts in the angle between the wall and ceiling should be twice the area of the shaft, and the aggregate area of the shafts should be that already described, namely, one square inch for every 50 cubic feet of room space in top floors, one square inch to 55 cubic feet of room space in first floors, and one square inch to 60 cubic feet of room space in ground-floor rooms. The lower end of the shaft should be louvred so as to throw any chance downdraught of air up towards the ceiling, instead of pouring directly down into the room. The inlets should be of the description shown in figs. 26, 31, 32, or 81, and should be opposite and at a sufficient distance from the shafts.

The fire grates should be constructed for supplying the rooms with fresh warm air on the plan already described, figs. 35, 36. Fresh air admitted for ventilation, whether by inlets or for supplying ventilating fire grates, should never be taken close to the surface of the ground. Air near the ground is apt to be more or less impure from organic matter, nuisances, damp, or sewer emanations. The air for ventilation should be taken above the surface of the ground; the higher the better, but it should never be taken near any source of impurity.

Each non-commissioned officers' room should be ventilated by a shaft, and provided with a ventilating grate fitted with a small oven, of the construction shown in fig. 37 A. Shafts and inlets for air should be used for the urinal room and ablution room. The ablution rooms and urinals should be as light as possible.

Cavalry Barrack Construction.—These general principles are applicable to all barrack rooms. They involve a change in the manner of constructing barracks, especially those for cavalry, because, to give effect to them requires the stables to be separated from the men's quarters.

As already stated, there are certain parts of barracks which in the block plan ought always to be separated from barrack rooms. The most important of these parts are stables. We have already pointed out the disadvantages of placing men's rooms over stables. The supposed advantages are,—the larger cubic space afforded to men in cavalry barracks by the existing arrangement, and the less exposure the men have to undergo in passing and repassing from their rooms to the stables.

With regard to the first of these advantages, there is no doubt that the superficial area required for horses necessitates a corresponding superficial area, and consequently a considerable amount of cubic space in the men's rooms above. But, on the other hand, in all new barracks, whether for cavalry or infantry, the amount of space per man must, according to the new regulations, be as great as it is at present in cavalry barrack rooms over stables.

With reference to the supposed additional exposure the men must undergo to reach stables *not* under their rooms, the objection can readily be obviated by a covered passage between the rooms and the stables, which would in reality give much better protection than the men have at present.

There is, then, no reason why the present arrangement of cavalry barracks should be perpetuated in new barracks, more especially as the experiment of separating the men from the horses has succeeded in two or three large cavalry barracks in Ireland.

The advantages to be derived from the change proposed would be very great as regards men, but it would be even greater as regards horses. After much experience and attentive consideration of the subject, we do not hesitate to say that it is impossible to ventilate satisfactorily a stable accommodating a large number of horses, if anything beside the roof is interposed between the stable and the outer air, and that it is equally impossible to keep the air in men's rooms over stables pure and free from stable odour.

There would be a great gain in health, both to men and horses, if they were separately housed.

In large cavalry barracks the men's rooms might be arranged in two floors in line, with the stables behind, separated from the men's rooms by a paved court 30 or 40 feet wide.

Behind the line of stables should be the litter sheds, and behind the litter sheds should be the places of temporary deposit for manure, latrines, and urinals.

It would be a great improvement in all barracks to run a corridor with a glass roof along one side of the ground floor rooms. If made wide enough it would serve the purpose of a drill shed, and would enable the men to leave their rooms in wet weather. This corridor could easily be connected with the stables in cavalry barracks by a covered passage supported on pillars and carried across the court between the barrack rooms and the stables, and so the required protection in passing between the rooms and stables could be obtained; but in most cases this would scarcely be necessary, as the whole distance to be traversed by the men from the corridor to the stables would not exceed 30 or 40 feet.

Cook-houses.—Barrack cook-houses should not be under the same roof as the barrack rooms, but at such a convenient distance from the rooms as to enable the dinners to be brought hot to the men.

It is advisable that the distance to be traversed between the cook-houses and the men's rooms should not exceed 100 yards, and wherever a covered communication can be provided it would be a great advantage and comfort to have one. When, from the size of the barrack, one cook-house would be too distant from part of the buildings, two or more cook-houses should be provided.

Each cook-house should contain boilers and an oven capable of cooking, the former two-thirds, the latter one-half the rations.

Any of the improved cooking arrangements already described would answer. Any better ones that may be contrived should be adopted.

Simplicity, economy of fuel, efficiency, and suitable variety of cooking are the points requiring attention in barrack cooking apparatus.

Each cook-house should be thoroughly lighted, and ventilated through the roof. It should have sufficient area for every convenience. There should be tables, and a bar for receiving

and giving out dinners. There should be a sink with water laid on, in addition to any special water supply provided for the boilers. The floor should be flagged and drained.

Baths and Ablution Rooms.—Every barrack should have a bath house with baths in proportion of 1 to every 100 men. It may be erected in any convenient part of the enclosure. Each bath should be in a separate room, formed of wooden partitions or high bulkheads, with a door and lock. Water should be laid on. The rooms should be flagged or asphalted, and drained. They should have a form, wooden grating, a couple of pegs, plenty of light, and they should be ventilated through the roof.

A trustworthy man should be in charge to preserve order and to see that no damage is done to the works.

The present form of ablution room will be no longer necessary when barracks are provided with ablution accommodation for each men's room.

In artillery and cavalry barracks it would nevertheless be advisable to attach a small ablution room of the present construction to the stables. It would be conducive to comfort and cleanliness.

Water Supply.—From whatever source it may be derived, the water supply should be good and abundant, and filtered when necessary.

It should be laid on at pressure all over the buildings. To enable this to be done, there must be tank accommodation at a sufficient height, but it should not be under the same roof as the men's rooms. To supply the ablution room and night urinals a covered water cistern placed at the roof of the building, either over them or in some equally convenient position, would have to be resorted to, unless the entire barrack were supplied with water from one common tank.

The supply should be derived from existing water mains where practicable. Otherwise the supply would have to be collected and brought by pipes from a proper elevation where such supply could be obtained.

The roof water of barracks is very suitable for cleansing and washing purposes on account of its softness. It should be collected in iron tanks, at such an elevation above the ground as to admit of the water being drawn direct from the tanks for use.

If the only source of water available is a river or well, steam-power should be used to supply the tanks in all barracks large enough to make the use of steam economical. Otherwise hand labour would have to be made use of.

Sewerage.—We have already stated the principles to be kept in view in providing for subsoil and surface drainage. Drainage of latrines, wash-houses, &c., must depend on the nature of the outlet available.

The outlet pipes of sinks, urinals, ablution rooms and baths should never be directly connected with the sewers. It is never necessary to do so. All the outlet pipes of this description, whether for barracks or hospitals, should terminate in the open air, over a trapped gully-grate, or over the open end of a trapped rain water pipe, in either case several inches above the grating, or in a trapped pipe carried up to the roof, and left open there for ventilation.

No drain should pass under any inhabited part of either barracks or hospitals. All drains should be kept free of the buildings.

It should always be an object to make a profitable use of barrack manure, and hence the best outlet for sewage matter is that which enables it to be immediately applied to agricultural purposes.

It is committing waste, as well as injury, to throw latrine and other similar drainage into rivers.

In country situations it is probable that in most cases arrangements could be made to apply barrack drainage to grass land by irrigation. Where this can be done the field selected should be several hundred yards to leeward of the barrack, with reference to the prevailing winds. A sewage tank should be made in the higher part of the ground into which the sewage should be received in order to deposit solid matter. The liquid overflow, after passing through a filter, would then be conducted over the land.

If this cannot be done, some arrangement, such as that shown in fig. 44, should be adopted for carting away the latrine and urinal drainage as manure, either immediately from the latrine or from a sewage tank at a sufficient distance outside the barrack enclosure, into which the latrine and urinal drainage is discharged through pipes.

Where an outlet can be obtained into an existing public sewer, it may be made use of.

An outlet directly into the sea would be the most economical in cases where such an outlet is at hand, unless the sewage could be profitably disposed of.

Whenever, from peculiar local circumstances, the manure cannot be in any way profitably

employed, and an outlet can be obtained into a river, a sewage filter, such as that shown in fig. 39, should be constructed to reduce the nuisance to the greatest possible extent.

No cesspits, sunk ashpits, or sunk manure pits, should ever be resorted to within barrack enclosures.

If a sewage tank must be resorted to in rare cases, it should be placed away from the barrack altogether, and the sewage should be conducted thither in pipes.

Care should be taken to ventilate all barrack sewers at some point outside the barrack boundary. The ventilating openings should be protected by wire boxes filled with charcoal to deodorize the air escaping from the sewer.

Glazed earthenware pipes, except under very special circumstances, will be found sufficient for all purposes of barrack sewerage and drainage. Their sizes should be carefully adjusted to the fall, and to the amount of fluid they have to convey. As the discharge of barrack sewage is not constant, but intermittent and irregular in quantity, it will be found advantageous to provide means of inspecting, and of flushing the main lines of sewerage.

Latrines.—The form of latrine adopted should be on Macfarlane's or Jennings' principle, figs. 40, 41, not built deep into the ground, but shallow, with the bed of the latrine not below the level of the ground. It is important to save both water and fall for the drainage, both of which are unnecessarily expended by sinking the latrine below the level of the ground.

The seats should be not less than five per cent. of the barrack force. They should be divided from each other by partitions and half doors. The latrine buildings should be light and well ventilated. They should be placed near the boundary wall at as great a distance as may be convenient from the men's rooms.

Urinals.—Urinals in the same proportion should be provided near the latrines, but detached from them. They should be constructed on one of the plans shown on figs. 45, 46, 47, and provided with the means of thorough washing and cleansing with water.

Cleansing, Manure Pits, &c.—The great principle to be observed in removing the solid refuse of barracks is, that every decomposable substance should be taken away at once. This principle applies to all barracks, but especially to those in warm climates.

The principle, may, however, be applied in various ways to suit local convenience. In open situations exposed to cool winds there is less danger of injury to health from decomposing matters than there would be in hot, moist, close positions. In country barracks, generally, there is less risk of injury than in barracks built in the close parts of towns. These considerations show that the same stringency is not necessarily required everywhere. Position by itself affords a certain degree of protection from nuisance. The amount of decomposing matter usually produced is also another point to be considered. A small daily product is not, of course, so injurious as a large product. Even the manner of accumulating decomposing substances influences their effect on health. There is less risk from a dung-heap to the leeward than to the windward of a barrack. If a deep pit is dug in the ground, into which the refuse is thrown in the intervals between times of removal, rain and surface water will mix with the refuse and hasten its decomposition, and, generally, the lowest part of the filth will not be removed, but will be left to fester and produce malaria.

While, then, the principle on which barrack-cleansing should take place ought to be daily removal of all refuse, this rule may be relaxed where daily removal would be either impracticable or very costly, provided certain other conditions be observed.

First. With regard to the cases in which daily removal is imperative. These are, in warm climates, and during hot and unhealthy seasons, in all climates. Under such circumstances the whole refuse should be removed at least once a day.

Second. In town barracks there should be daily removal. Ash-pits and dung-heaps ought never to be permitted in such barracks. They are quite unnecessary. A light iron cart or carts should be placed to receive the refuse, to be removed every day, and an empty cart left.

Thirdly. In forts and other places where the space is very circumscribed, and where, if ash-pits are used, they must be placed close to men's rooms. In all such cases daily removal is necessary.

For these cases neither ash-pit nor dung-pit ought to be provided in the barrack construction. Places where the carts can stand, properly paved and conveniently placed for kitchens and stables, are all that are required.

In open country districts, if daily removal cannot be provided for, ash-pits and dung-pits, to hold two or three days' accumulation, may be provided, but only under the following conditions:—

1. That they be sufficiently removed from the barrack rooms to prevent any smell from them reaching the rooms.

2. That the places of deposit be above the level of the ground;—never dug out of the ground. The floor of the ash-pit or dung-pit should be at least a foot above the surface level.
3. That the floor be paved with square setts, or flagged, and drained.
4. That ash-pits be covered.

We are aware of very few cases in which the refuse cannot all be removed daily, and it should be the duty of the barrack-master to see that this is done. Should cases arise in new barracks where daily removal cannot be effected, the places of temporary deposit should be constructed on the principles laid down above.

Wash-houses.—Barrack wash-houses should be placed at a sufficient distance from the rooms to avoid nuisance from smoke or vapour. The buildings should be light, roomy, and well ventilated through the roof. The essential parts of a wash-house are fixed washing-troughs, with water laid on to each. The troughs to be drained by a short pipe into an open gutter communicating by a trapped gulley outside the wash-house, with a drain. The floor should be flagged with a good fall, channelled and drained. Coppers for hot water, with supply taps over them, a drying closet, with horses of the form already described, and an ironing-table. With these conveniences the usual barrack washing can be perfectly well accomplished. At large stations, where there are married quarters, it may sometimes be considered necessary to provide laundry arrangements on a more extensive scale, but every such case will have to be made the subject of special consideration. For all wash-house purposes, rain-water is best. It should be collected from the roofs and conveyed to a tank at a sufficient elevation to allow the water to be drawn from the tanks for use. Underground tanks within the enclosure of ordinary barracks should be discontinued.

Day-rooms.—New barracks should be provided with day-rooms. One or two large rooms, according to the size of the barrack, would be necessary. These rooms are not intended for either dining or reading rooms. They are more as places where the soldier can go to rest or amuse himself, converse with his comrades, &c. There has been already a sufficient number of these rooms in use to point out what they should be. Some have failed, others have succeeded. The failures have been where ordinary barrack rooms, not properly lighted or fitted up, have been tried. The successful cases have been those in which the rooms were of sufficient size, well lighted with windows by day and with gas or lamps by night, and furnished with tables, forms, chairs, games, billiards, newspapers, &c. Those at Gibraltar and Parkhurst are nearly self-supporting, as far as concerns the current expenses, and the men themselves preserve the strictest discipline in them. While every reasonable personal liberty is allowed, all profaneness or improper conduct is summarily put down. Two large day-rooms are provided in the plans of the new Chelsea barrack, and more experience for future guidance will be obtained from them. Day-rooms have also been recently provided for Wellington Barracks.

Workshops, Gymnasia, &c.—All barracks should be supplied with workshops, not only for ordinary purposes, but also for giving employment to the men. Those most necessary are shops for tailors, shoemakers, carpenters, armourers, blacksmiths, wheelers, farriers, saddlers, and collar makers. Painters' shops might sometimes be added. Shops for wheelers, farriers, saddlers, and collar makers, are required for artillery or cavalry barracks. The others would be useful in all barracks.

Workshops should be specially constructed, with sufficient cubic space, and suitable means of lighting, and especially of ventilation. For the latter purpose the outlets and inlets must be much more ample than in barrack rooms. Louvres through the roof are the best means of ventilation for workshops on one floor, or on upper floors. For workshops on intermediate floors shafts, inlets, and remodelled grates, with ventilating sections, at least half as large again as those used for barrack rooms, should be provided in the construction.

Gymnasia should be attached to large barracks. They should be partly covered, partly open. According to the new medical regulations, gymnastic exercises will in future constitute a part of the soldier's training. These exercises are of great importance to health, and are, besides, of great use in developing the frame, and in providing occupation and amusement for the men. A gymnasium on a large scale has been recently erected at Aldershott, which will no doubt furnish excellent experience for future guidance in the construction and nature of the apparatus best adapted for use.

Cleaning Rooms.—Cleaning rooms, well lighted and ventilated, are required in all barracks; they should be away from the men's rooms.

Drill Sheds.—Drill sheds are also an essential part of most barracks, and wherever they have been introduced they have been found of great service. In many instances broad glazed

verandahs carried along the face of the barrack would afford a covered area both for communication and for drills in wet weather.

Guard-rooms and Lock-up Rooms.—Guard-rooms should be sufficiently large to afford 600 cubic feet per man for the men in them not on sentry. They should have louvres through the ceiling and roof for ventilation, and remodelled fire-grates to warm part of the air admitted.

A drying closet, heated by the guard-room fire-grate, should be provided for drying the men's clothes on coming off guard in wet weather.

Every guard-room should have a lock-up room attached to it, capable of being overlooked from the guard-room. This room should be large enough to receive with safety any usual number of prisoners.

As a general rule these lock-up places ought to be about double the size they have hitherto been constructed. They require free means of ventilation through the roof by louvres; means of warming them by heated air from a fire grate should likewise be provided.

Every large guard-room, and every guard-room of whatever size, not conveniently situated as regards the barrack latrines and urinals, should have a latrine and urinal attached to it. A small ablution room should also be provided. The latrine, urinal, and lavatory accommodation should be in the same proportion to the strength of the guard as is supplied for barracks, namely, 10 per cent.

Prison Cells.—New prison cells should not have less than 1,000 feet of contents. Besides the present means of ventilation, it would be very advisable to have shafts from cells and passages so arranged that the medical officer might be able to increase the amount of air passing through the cells whenever he considered it necessary to do so for the health of the inmates.

Stores.—Deficiency of stores is a frequent occurrence in barracks and leads to serious inconvenience and misappropriation of men's rooms. The amount and kind of storage required, and the nature of the fittings-up should in each case be carefully considered by themselves. The superficial area and cubic contents of each description of store-room should be calculated and sufficient provision made for any contingency.

The amount and kind of storage required depends on the occupation of the barrack for the time being. Sometimes more space is required than at others. Sometimes more rooms are required than at others. To meet the varying occupation of barracks it would be better to provide liberally with the chance of store-rooms being occasionally misappropriated than to provide scantily with the chance of men's rooms being misappropriated, which latter alternative has been the one hitherto adopted. Stores can be crowded without much injury; men can never be overcrowded without injury.

Married Quarters.—All new barracks should be provided with married quarters for non-commissioned officers and soldiers. One room of good size, containing at least 150 to 170 superficial feet should be provided for each family.

The buildings should be extremely simple in construction. Long internal passages or corridors should be avoided. There should be no more than four soldiers' families on each floor, unless the rooms all open from a gallery and have windows on each side, and the fewer floors the better; but this will, of course, depend on the land available. Each house should have a passage and staircase extending from front to back. Each room should have a ventilating shaft and inlet, and a small ventilating grate with an oven. A play-ground for children is required. An ablution room with baths for women and children, and an ablution room for the men, should be provided. There should be one set of latrines for females, and a wash-house, unless there be a laundry provided for the whole barrack.

To ensure the best ventilation, by providing the rooms with windows on opposite sides, the rooms might be made to enter from outside corridors on which the house doors should open. The corridors could be reached by stairs at the ends, or in the middle.

Simplicity of construction, plenty of light, and abundant means of ventilation, both without and within the buildings, are the points to be attended to.

Married quarters being part of the barrack, should be included in the general scheme of barrack drainage and water supply, already mentioned, and the same principles should be applied in both cases.

2.—General Sanitary Principles applicable to the Arrangement and Construction of Fixed Camps.

Having discussed the principles on which permanent barracks ought to be constructed, it may be useful to state briefly the leading sanitary principles applicable to the arrangement of the more temporary class of accommodation provided in fixed camps.

The two most obvious and important principles to be kept in view in forming a camp are—

1st. To select the best ground obtainable, and at the greatest distance from all sources of malaria.

2. To adopt suitable sanitary precautions in constructing and arranging the accommodation.

Selection of Site.—The worst ground for a camp is clay soil, or a clay subsoil coming near the surface. Such sites should always if possible be avoided. They are retentive of water, and keep the atmosphere over them damp, or in a malarial condition. A few trial holes dug at different points of the ground will show whether the subsoil is dry or otherwise. Ground immediately at the foot of a slope is apt to be damp and unhealthy, on account of receiving water from the higher levels. Ground of this nature occupying the angle between hill ranges and the lower flat country, or situated in deep narrow valleys, often predisposes its occupants, even in temperate climates, to epidemic diseases. In tropical climates these angles and gorges are often covered with dense unhealthy vegetation. High positions exposed to winds blowing over low marshy ground, miles away, are in certain climates unsafe, on account of fevers. Indeed it sometimes happens that the immediate vicinity of a marsh, or other local cause of disease, is safer than an elevated and distant position to leeward. For a similar reason, elevated sites situated on the margin or at the head of steep ravines, up which malaria may be carried by air currents flowing upwards from the low country, are apt to become unhealthy at particular seasons. Such ravines, moreover, from want of care, are often made receptacles for decaying matter and filth, and become dangerous nuisances. There is reason to believe that in tropical climates these ravines convey malaria, and occasion aggravated remittent, or even yellow fevers, at an elevation which would be otherwise exempt from the action of tropical malaria. In tropical climates, camping grounds at the mouth of narrow, wooded valleys, down which wind blows, often predispose to fever, and should be avoided.

Ground covered with rank vegetation, especially in tropical climates, is unhealthy, partly on account of the amount of decaying matter in the soil, partly because the presence of such vegetation is in itself a mark of the presence of subsoil water, or of a humid atmosphere. In warm climates, muddy sea beaches or river banks, or muddy ground generally, if it be subject to periodical flooding, and marsh land, especially if it be partly covered with mixed salt and fresh water, are peculiarly hazardous to health.

A porous subsoil, not encumbered with vegetation, with a good fall for drainage, not receiving and retaining the water from any higher ground, and the prevailing winds blowing over no marshy or unwholesome ground, will, as a general rule, afford the greatest amount of protection from disease which the climate admits of.

Drainage of Site.—When ground on a slope is to be occupied, it should be catchwater drained above the site to carry off the water from the higher levels, and to prevent the water from passing into the ground on which the camp is to be placed.

The entire area should be trenched to an outfall, in order to drain the subsoil. Any amount of labour bestowed on draining will be amply repaid in the expense saved by preventing disease.

The site of every tent or hut should be trenched. The ground between the lines of tents should be trenched, not only to keep it healthy, but to prevent its becoming almost impassable in wet weather; and all the trenches should be laid out on a general plan, with a fall to the outlet.

Broken ground, with hollows or pits over its surface, should be avoided for camping purposes, on account of malaria, or if such ground must be occupied, the hollows should be filled up and levelled.

Water Supply.—All proposed water sources should be carefully examined. The microscope affords the readiest means of doing this, on account of the facility with which the presence of organisms and solid organic and inorganic matter can be detected by it. Generally speaking, water that is free of colour, taste, and smell is wholesome, but marsh water, whatever its physical characters may be, should be avoided. It is never wholesome. A few simple chemical tests will readily ascertain the nature of salts held in solution.

Of all water for camp use, that from springs away from, and, if possible, at a higher level than the camping ground, is the best. River water and lake water, if otherwise pure, rank next in wholesomeness, and after these deep well water. Shallow wells within a camp, especially if the ground is to be occupied for a length of time, are not safe as water sources.

Great improvements might be introduced into the manner of distributing water for camps. Indeed, a little ingenuity spent on this matter would remove half the difficulty, and render unnecessary a large part of the labour at present incurred in camp water supply.

In any given case, if the problem as to which is the easiest mode of distributing the water of a camp were considered, there cannot be a doubt that temporary expedients would readily

suggest themselves, which would greatly diminish the amount of fatigue duty at present necessary for the purpose. It would also obviate the constant risk of impurity to wells, arising out of the usual method of drawing water. The margin of the well is often a mere quagmire, from which mud falls into the well, and renders the water all but unfit for use.

This may be to a considerable extent prevented by paving the ground round the mouth of the well, and enclosing the mouth within a low wall. But the risk of pollution might be avoided altogether by improving the method of drawing and distributing water.

Filtration through sand, with or without charcoal, may generally be practised in cases where the condition of the water supply requires it. But before this expedient is resorted to, every endeavour should be made to obtain and distribute water free of impurities. The supply of water to camp animals is often very defective, and much unnecessary suffering and loss is the consequence. A little ingenuity expended on very simple materials will generally prevent this.

Arrangement of Tents and Huts.—As regards the arrangement of tents and huts, it may be laid down as a general rule that the more space allowed between them for ventilation, the more healthy will the force be, but the area over which it is possible to spread a force must necessarily depend on the size of the ground, and on the nature of the service. Some general principle should nevertheless be adopted in dealing with the question. It has been shown in the report of the Royal Commission on the Sanitary State of the Army that the Quarter-master-General's instructions for camping, issued at the commencement of the Crimean war, authorized densities of population on the camp surface equal to 347,000, 348,000, and 664,000 inhabitants per square mile. The lowest of these densities is double that of the most densely populated district in England. It includes, not only the ground actually covered by tents, but all the open spaces in the camp. The ground actually covered by tents in these plans of encampment gave a density of population equal to 1,044,820 per square mile.

The influence on health of surface overcrowding in towns is now well known, and there cannot be a doubt that surface overcrowding in camps is a common cause of camp diseases. A camp is a temporary town without paving or proper drainage. It is only by paving and drainage that the deleterious influence of surface overcrowding in towns can be reduced to a minimum. But paving and drainage cannot be carried out to a sufficient extent in camps to enable the surface to be crowded, and therefore as large an extent of space should be given as the nature of the ground or of the service will admit.

At the time of the Health of Towns Inquiry, it was found that the approximate density of population on the built area of five of the principal towns in England was as follows:—

Towns.	Inhabitants per Square Mile.
Leeds	87,256
Metropolis	50,000
Birmingham	40,000
Manchester (township)	100,000
Liverpool (parish)	138,224

It was, moreover, found that the proportional annual deaths from fever in these towns increased with the density.

In the Report of the Royal Commission on the Sanitary State of the Army the following examples are given of the most densely peopled districts in the metropolis.

District.	Inhabitants per Square Mile.
St. James', Westminster	144,008
Holborn	148,705
St. Luke	151,104
Strand	161,556
East London	175,816

All these examples drawn from towns occur in places where paving and draining have been more or less carried out, and where, nevertheless, the influence of surface overcrowding on health is obvious on a comparison being made with less crowded districts. If we compare any of these densities with the authorized densities for camps, which have neither drainage nor paving, given above, we shall be enabled to form some estimate of what is likely to be the influence on health of surface overcrowding in camps.

Assuming a square mile = 3,097,600 square yards, and 15 men to a tent as our units of comparison, the following table will give the surface area per tent for different densities of population per square mile.

Number of Square Yards per Tent.	Number of Tents per Square Mile.	Number of Troops per Square Mile.
50	61,952	929,280
100	30,976	464,640
150	20,650	309,760
200	15,488	232,320
300	10,325	154,880
400	7,744	116,160
500	6,195	92,928
600	5,162	77,440
700	4,425	66,377
800	3,872	58,080
900	3,441	51,626
1,000	3,097	46,464
1,100	2,816	42,240

It appears from this table that to allow about 350 square yards per tent would give a density per square mile equal to that of Liverpool; about 450 square yards per tent would give a density equal to that of Manchester. About 900 square yards per tent would give a density equal to that of the built part of the metropolis, and to reduce the surface density of a camp to that of Birmingham would require above 1,200 square yards per tent to be allowed.

The Quartermaster-General's regulations referred to would, if rigidly carried out, allow no more than from about 70 to 134 square yards per tent, but in estimating the probable effect of this area on health we must revert to the fact already mentioned that the town districts used in the comparison are paved and drained, while camps are not.

As already stated, the number of troops to be placed on a given area must be determined by local circumstances, but the tables we have given will be useful in enabling a correct judgment to be formed as regards one very important element in the sanitary state of camps, namely, density of population.

The manner of arranging tents is of importance to health, as well as to cleanliness. Battalion camps are not unfrequently arranged in such a way that the tents touch each other, except where a narrow passage is left between the rows for access. A camp so arranged can neither be clean nor healthy. In cleaning out one row of tents the dust is merely driven into the adjoining row. Thorough ventilation is impossible, and as regards the unhealthiness of such an arrangement, every army medical officer is in the habit of recommending the spreading of tents over a larger surface as one of the most efficacious means of arresting epidemic disease in camps, a sufficient proof of the relation between camp epidemics and surface overcrowding.

Battalion tents should never be arranged in double line; short single lines are best. The tents in line should be separated from each other by a space at the very least equal to a diameter and a half of a tent, and the farther the lines can be conveniently placed from each other the better.

Preparation of Tent Sites.—It is a hazardous expedient to dig out the ground of a tent site with the view of obtaining shelter. The cavity merely acts as a receptacle for water, or for damp air, while occasionally very fatal consequences result from the practice.

Sometimes a fire-place is made in the hollow, or a chaffer for charcoal is used for warming, and it has happened that the hollow has become filled with carbonic acid gas from the combustion of the charcoal, and the occupants have died from asphyxia. All shelter for troops, wholly or partially dug out of the ground, whether the cavity be covered above by a tent or by any similar contrivance can never be used without risk of fever. The men's heads should not only never be below the level of the ground while asleep, but their beds should, wherever possible, be raised above the ground. A certain amount of shelter can always be obtained while digging a trench round the tent site for drainage, by making a bank with the earth round the outside of the trench.

Tent Ventilation.—There is nothing in which more improvement is required in the regulation tent than in ventilation, for which there is at present no provision. The obvious remedy for this want is to provide ventilating openings of sufficient size round the top of the tent pole. This could be done in the present regulation tent by a trivial alteration, which would prevent the atmosphere from becoming so foul and unwholesome as it is at present. Tent ventilation although it has received so little attention is really one of prime importance as regards the health of troops in camp. The men have quite enough of exposure to other causes of disease, without subjecting them to the risks of foul air at night. Besides it is impossible to give the

men anything like the amount of space in tents which they have in barrack rooms. The space per man in the common bell tent does not exceed 51 cubic feet in camp, and it is only 34 cubic feet on march. In barracks it is now 600 cubic feet per man, or 88 cubic feet more than the total cubic contents of a bell tent. In camp a bell tent is expected to hold 12 men (excluding three men on guard), and 15 men on march. If the air in an occupied tent were renewed to the same extent as it is in the barrack rooms we have ventilated, the whole cubic contents of the tent would have to be renewed from 24 to 30 times per hour. It is a common observation that tents occupying the same ground for a length of time become unhealthy. It appears as if the subsoil becomes saturated with effluvia from the men's bodies and produces malaria. Shifting the tents to fresh ground within the same lines so as to expose the vacated spots to sun and air, is the obvious and usual remedy for this. These facts are sufficient to show the necessity of abundant ventilation in tents to keep the men in health.

Camp Police.—It need hardly be stated that it is of primary importance in all camps to institute an active camp police for preventing nuisances. As already stated camps have not, and cannot have the advantages of paving and draining enjoyed by towns. A paved surface is readily cleansed, and a drained subsoil cannot become injuriously saturated with water and organic matter. If an undrained and unpaved surface is kept in a filthy state, the subsoil will in a short time be saturated with decomposing matter, and will become a fresh source of malaria, and the whole site will shortly be unfit for occupation. Filth or decaying matter should never be allowed to lie on the surface of a camp or for a considerable distance round it. Camp nuisances can often be detected by the sense of smell a quarter or half a mile away, in the same manner as the smell of a filthy town can be detected for miles to leeward. Whenever in camps the air smells of foul matter, especially when the atmosphere is still, as it often is at night, there is danger to health, and particularly so during epidemic seasons.

Camp Latrines.—One of the most frequent causes of an unhealthy condition of the air of a camp is either neglecting to provide latrines, so that the ground outside the camp becomes covered with filth, or constructing the latrines too shallow and exposing too large a surface to rain, sun and air.

A camp unprovided with latrines is always in a state of danger from epidemic disease, and all the parts of a camp exposed to emanations from improperly constructed latrines are in the same condition. Latrines should be so managed that no smell from them should ever reach the men's tents; to ensure this, very simple precautions only are required.

1. The latrines should be placed to leeward with prevailing winds, and at as great a distance from the tents as is compatible with convenience.

2. They should be dug narrow and deep, and their contents covered over every evening with at least a foot of fresh earth. A certain bulk of earth, and thickness of covering are required to absorb the putrescent gas, otherwise it will disperse itself and pollute the air to a considerable distance round.

3. When the latrine is filled to within 2 feet 6 inches or 3 feet of the surface, earth should be thrown into it and heaped over it like a grave to mark its site.

4. Great care should be taken not to place latrines near existing wells, nor to dig wells near where latrines have been placed. The necessity of these precautions to prevent wells becoming polluted is obvious.

Screens made out of any available material are of course required for latrines.

In more permanent camps, moveable box latrines should be used, and their contents removed daily, as is the case at Aldershott, Colchester, and Shorncliffe; or water latrines should be provided on the plan already mentioned, if a proper drainage outlet can be obtained.

Picketting Grounds.—The presence of horses, bullocks, and other animals is another obvious cause of impurity in camps. They should be placed to leeward of the men's tents whenever practicable, and the most scrupulous cleanliness should be observed in all picketting grounds.

The safest way of disposing of the refuse straw and dung is to cart it away from the camp altogether. For a numerous body of horses a spot should be selected from three-quarters of a mile to a mile at least, to leeward, and even further than this in warm, moist climates. Continuous daily burning of the manure and refuse straw is also a good way of disposing of it, but unless very carefully done with a favourable dry wind to carry away the fumes, burning gives rise to much nuisance, and keeps the air to a considerable distance in an offensive state.

Slaughtering Places.—Slaughtering places should be selected with reference also to prevailing winds, at such a distance from the camp that the offal can be buried on the spot with safety, or the offal should be removed and buried at a safe distance.

Burying to a sufficient depth in dry earth is the safest way of disposing of the debris of camp slaughtering places, unless it be otherwise disposed of. The same remark applies to carcases of dead animals.

In certain fixed cantonments burning the whole camp refuse in properly constructed furnaces is a ready way of preventing nuisance or injury to health.

In cases where it is necessary to form camp burial grounds, they should be placed to leeward, a few hundred yards away from the tents. There should be 3 feet of earth besides the mound over each coffin, and a fresh grave should be dug for each corpse.

These principles of camp police, though applicable to all camps, apply more especially to fixed camps. Wherever a camp can be moved to fresh ground it is of course better to do so, and to leave the nuisances behind, but it is not always easy to find enough of fresh ground, and with fixed camps change of site is impracticable. These sanitary precautions ought therefore always to be kept in view, whatever the nature of the camp.

3.—Construction and Arrangement of Camp Barrack Huts.

In fixed camps, huts have great advantages over tents in a sanitary point of view. They afford much better protection and allow of a larger amount of space being given to the men, but they require to be carefully constructed, otherwise they may become more unhealthy than any other barrack accommodation.

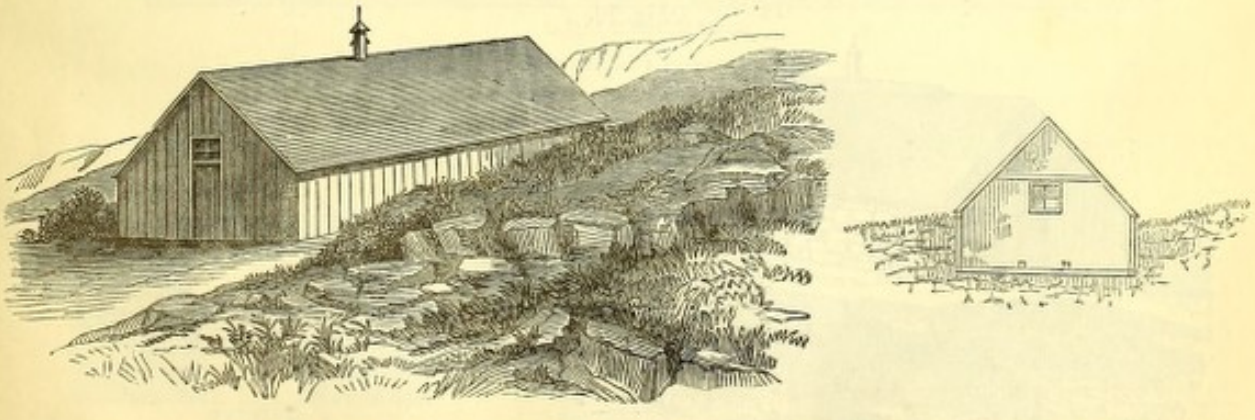
Hut Drainage.—The first essential condition to health is to ensure that the ground to be covered by the hut is dry. A dry subsoil is, in fact, absolutely necessary to health. It should be ascertained that there is neither water in the immediate subsoil nor that water from any higher level can saturate the ground. If this precaution is not observed, the effects of malaria in some form or other will very soon show themselves among the inmates. It may be fever or diarrhœa or even cholera, from one or other of which even low temperature is no protection if the ground over which the men sleep be damp.

Having selected dry porous ground for a hut camp, the next thing is to drain the ground. Tile draining is the best means of doing this, or if tile draining be impracticable, trenching should be resorted to, to such a depth as will free the subsoil of water. We have seen water in torrents discharged from such trenches, most of which would, but for the trenching, have been retained in ground over which a large force was hutted.

Isolation of Hut Sites.—The next point is to keep the hut entirely free of all surrounding higher ground; otherwise the evils resulting from a damp subsoil will be reproduced in another way. An illustration or two of sanitary defects which have occurred in practice in erecting camp huts, and the means of avoiding them, may be useful.

Fig. 76 represents an elevation of a hut, partly bedded in the ground, in which the occupants suffered severely from fever and diarrhœa. In this case water from a higher level flowed through the subsoil on which the huts were erected, and the ground under the boarding was damp and covered with fungus.

Fig. 76.

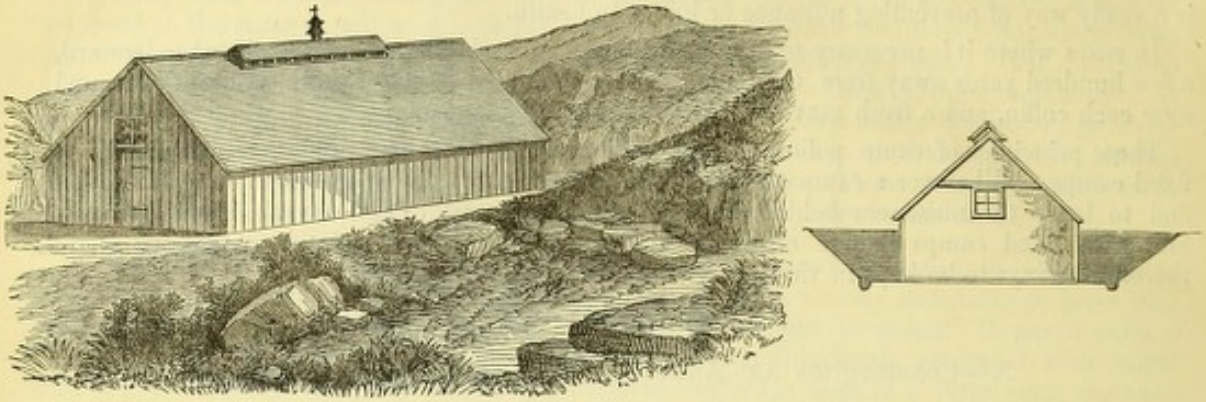


Hut with the Site excavated, and earth against the sides.

Cross Section—Upper end.

Fig. 77 shows how such a site, on the assumption that its occupation was necessary, ought to have been prepared for the hut by cutting away the earth all round, and draining the area on which the hut was to be placed.

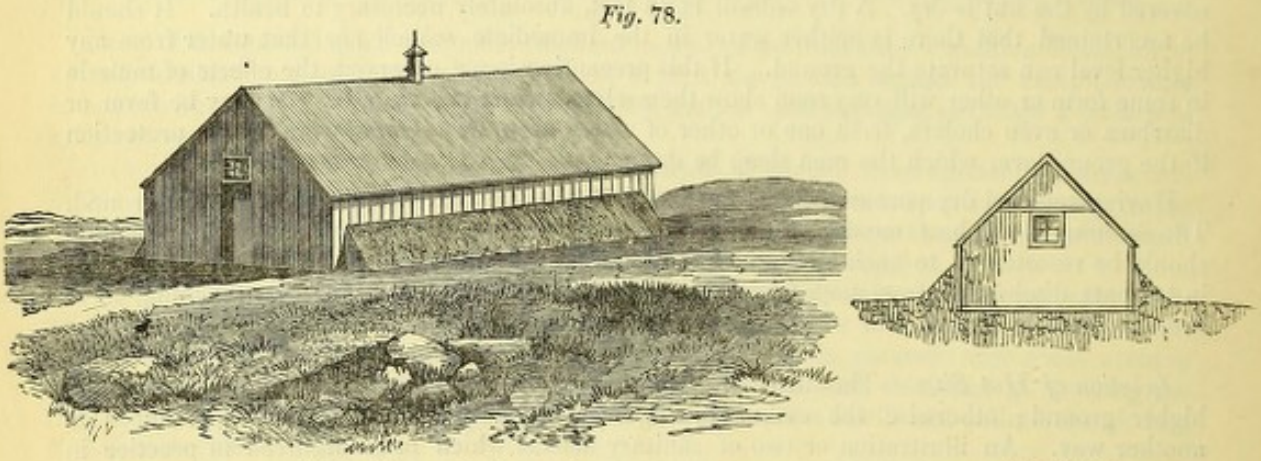
Fig. 77.



Hut site cleared and drained. Cross Section.

Self-draining sites have sometimes been made unhealthy by reproducing the conditions in Fig. 76 in another way. This is shown in Fig. 78. In this example the sides of the hut are banked up with earth, partly to obtain firmness of position, partly to prevent loss of heat in cold weather. Fever among the men was the consequence.

Fig. 78.

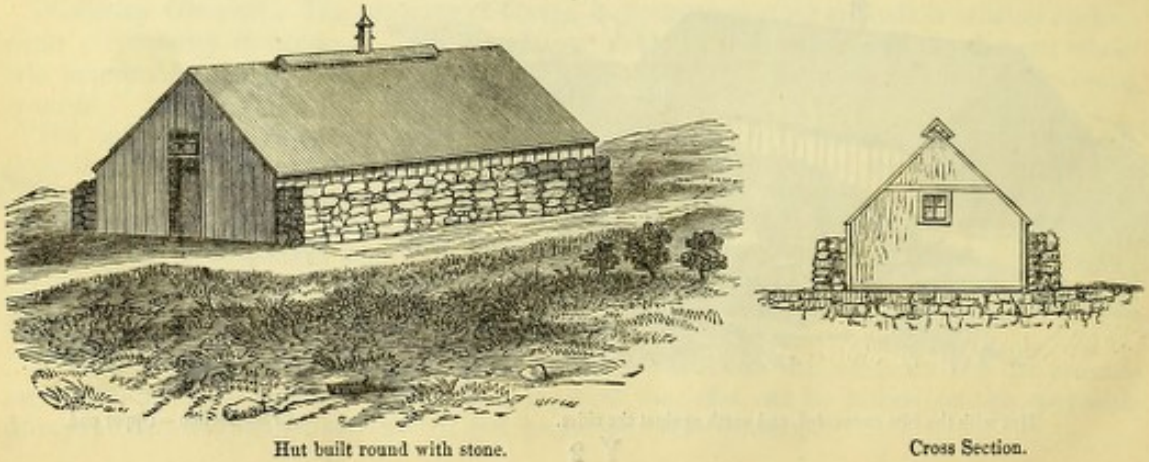


Hut banked up on level ground. Cross Section.

A less exceptionable method of obtaining steadiness and warmth is shown in Fig. 79, in which the hut sides are protected by an uncemented wall of rubble stone. But even this is not safe unless the eaves project sufficiently to turn the rain from the top of the wall. Otherwise the water may be conducted directly into the hut.

Figs. 76 and 78, it will be observed, have no windows, except small ones at each end, and no ventilation. Figs. 77 and 79 show the same huts ventilated by raising part of the ridge boards about 4 inches.

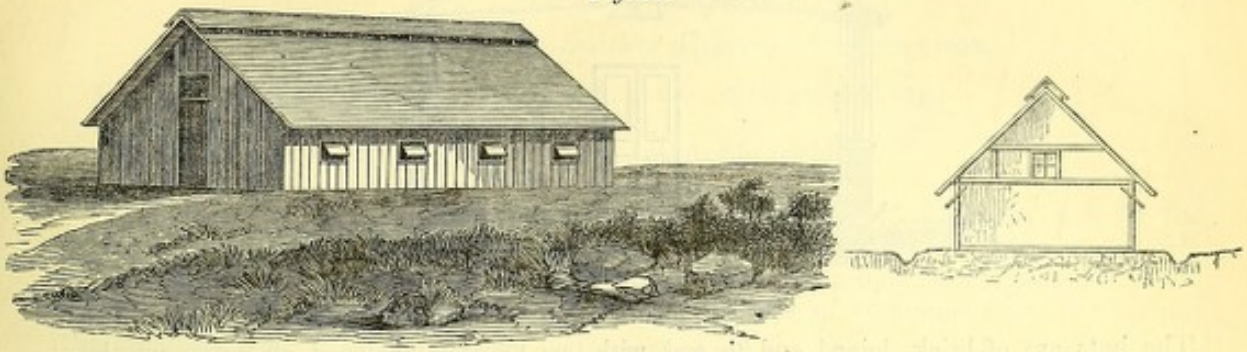
Fig. 79.



Hut built round with stone. Cross Section.

Fig. 80 shows a healthy construction of scantling huts, together with the ground cleared, levelled, and drained, ridge ventilation, projecting eaves to carry the roof-water from the foundations, and the requisite number of windows.

Fig. 80.



Hut with Site cleared and drained, ridge ventilated, windows, and projecting eaves. Cross Section.

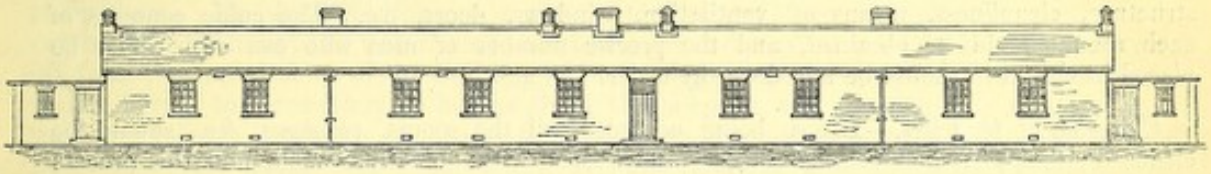
It would be a further improvement to raise the floors above the level of the ground, to afford free ventilation beneath, in the manner shown in Fig. 95.

Brick Huts.—Wooden huts ought not to be erected when the encampment is intended to remain for more than two or three years. After this period wooden huts become expensive on account of repairs; they become infested with vermin and saturated with organic matter, and brick huts are preferable.

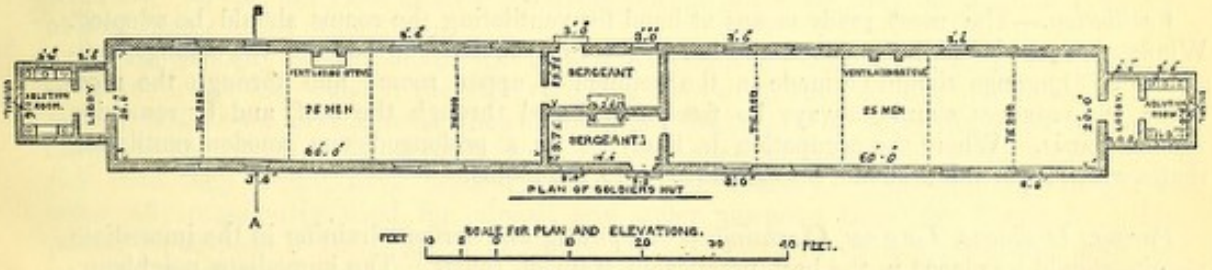
The huts, whether of brick or of wood, ought to be raised sufficiently above the ground to allow of a free current of air passing underneath the flooring. In hot climates the floors should be raised at least three feet above the ground. The huts may be arranged side by side in lines, with a space between them equal to at least three times their height. In hot climates they should be arranged in echelon or otherwise, so as to receive the full benefit of winds, and the walls and roofs should be double, or the walls should be protected from the sun by verandahs.

A good and at the same time a simple and economical form of construction of brick camp huts is that proposed for the extension of Colchester camp, represented in Fig. 81.

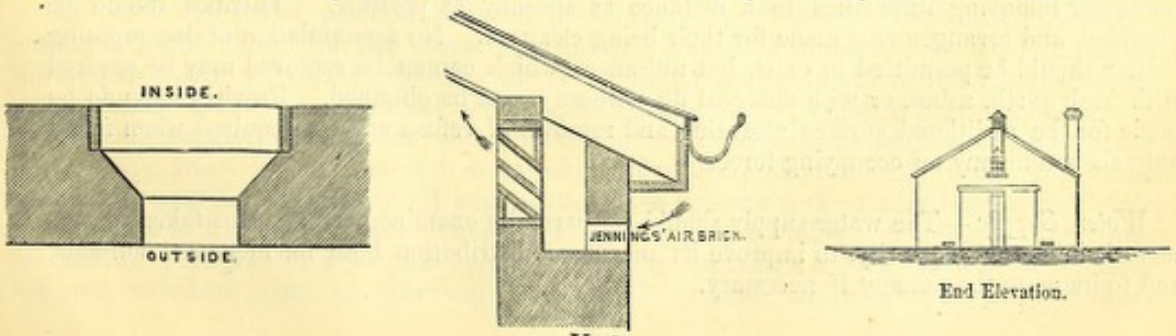
Fig. 81.—Colchester Camp Proposed Huts.



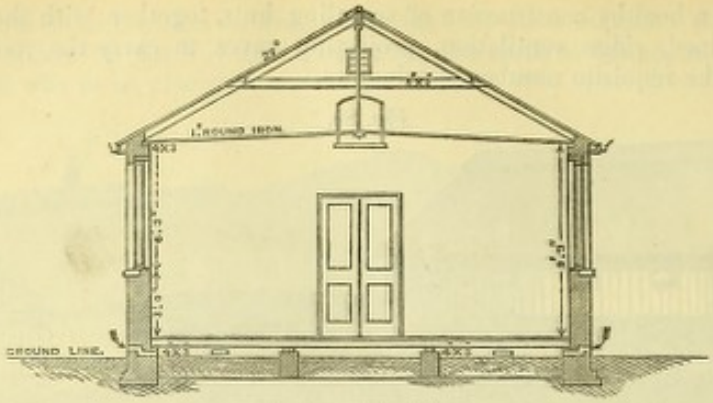
Front Elevation of Soldiers' Huts.



Detail, showing method of admitting fresh air under the eaves. The louvres are capable of being closed more or less in cold weather.



End Elevation.



Section on line A B.

The huts are of brick, joined end to end, with two non-commissioned officers' rooms between them. Each hut, or rather half hut, is 60 feet long, 20 feet wide, and 9 feet 6 inches high to the top of the wall, and accommodates 25 men. Including the space under the roof, each man will have very nearly 600 cubic feet of space. The floors are raised above the ground, with ventilation below them.

Ventilation of the huts is effected by outlet shafts passing through the roof and terminating in louvres, and by inlets under the eaves so arranged as to throw the inflowing current of air upwards. Ventilating grates are used for warming part of the air admitted in winter.

At the end of each hut is a small outbuilding containing fixed wash-hand basins, foot pans, and a night urinal. The baths, latrines, and day urinals are placed away from the huts.

These huts, it will be seen, are barrack units similar to those already described, applied to camp purposes.

4.—Temporary Barracks and Quarters.

The examples given in a preceding part of this report illustrate sufficiently the necessity of keeping certain principles clearly in view in selecting buildings for temporary barracks. Low, filthy, ill-drained, and unwholesome parts of towns should be avoided, as also all crowded, complicated buildings, with small courts, or surrounded with high walls or other encumbrances to a free external ventilation. The whole neighbourhood should be carefully inspected. Every building destined for occupation should be examined as to its drainage, structure, cleanliness, means of ventilation, windows, doors, &c. The cubic contents of each room should be obtained, and the precise number of men who can with safety be placed in the room should be laid down by order.

Cleansing of Quarters.—Before being occupied, all the rooms, passages, &c., should be cleansed; the walls and ceilings scraped and washed with quicklime wash, and this process should be repeated as often as the sanitary officer considers it to be necessary.

Ventilation.—The most ready means at hand for ventilating the rooms should be adopted. Window panes should be removed and louvre boards, slanting upwards to the ceilings, substituted. Openings should be made in the ceilings of upper rooms and through the roofs Stairs and passages should always be freely ventilated through the roof, and by removing window panes. Where the occupation is likely to be a prolonged one, wooden ventilating shafts with proper inlets should be introduced into the rooms.

Paving, Drainage, Latrines, Cleansing.—The paving and surface draining in the immediate vicinity should be placed in the best practicable state of repair. The immediate neighbourhood should be kept thoroughly clean and nuisances prevented. Arrangements should be made for removing impurities to a distance as speedily as possible. Latrines should be provided, and arrangements made for their being cleansed. No accumulation of decomposing matter should be permitted to exist, but nuisances which cannot be removed may be covered with fresh earth, ashes, or with charcoal dust where it can be obtained. Provision should be made for the additional surface cleansing and removal of refuse matters required when many animals accompany an occupying force.

Water Supply.—The water supply should be carefully examined, and means taken to preserve it in a state of purity, to improve its means of distribution both for men and animals, and to increase the amount if necessary.

SECTION II.

HOSPITALS.

1.—Principles of Permanent Hospital Construction.

In the construction of hospitals the great points to be secured are,—

1. Purity of the external atmosphere.
2. Abundance of pure air and sunlight within the building.
3. Facility of administration and of discipline.

The realization of these principles involves the selection of a healthy site for the building; simplicity of plan and construction; a sufficient number of windows properly placed; a certain number and arrangement of wards; proper ward proportions; a suitable number of offices, stores, &c.; and easy means of communication throughout the building.

It should never be forgotten that the object sought in the construction of a hospital is *the recovery of the largest number of sick men to health in the shortest possible time*, and that to this end everything else is only subsidiary. The intention aimed at is not, as would appear to be the case from actual structures, to cover a given piece of ground with buildings necessarily defective, because a better piece of ground is not obtainable, nor is it to produce a certain architectural effect, be that effect good or bad.

If the ground does not admit of a healthy building being erected, it should not be built on. If the barrack happens to be in an unhealthy or doubtful locality, it does not follow that the hospital should be there too.

If in the event of war, which only happens at long intervals, it may be necessary to place sick and wounded men in casemates or under ground, or in other doubtful places, it by no means follows that because such places are provided for a temporary emergency which may never occur it should be *always* necessary to use them for sick.

In short, by keeping steadily in view what the function of a hospital really is, many of those unhealthy conditions which it has been considered necessary to comply with in building hospitals disappear at once.

Selection of Site.—The ground selected for a hospital should be porous and dry, and should not receive the drainage of any higher ground. Clay soils and retentive soils generally should be as far as practicable avoided. It is an error to build a hospital on a steep slope. No doubt by forming a plateau for the structure, and adopting a system of catch-water draining, the water from the higher ground may be more or less perfectly cut off from the foundations of the building; but the higher ground, especially if it be steep, and if it rise to a considerable height above the hospital, will stagnate the air just as a wall or rampart stagnates it. In certain positions it is advantageous to secure shelter from unhealthy winds, but that shelter, be it a range of hills, or walls, or houses, or trees, should always be at a sufficient distance to prevent stagnation of air and damp, otherwise the shelter from an evil recurring only at intervals may be purchased by loss of healthiness at all other times.

As the majority of barracks in the United Kingdom are situated either at the outskirts of towns or in the country, the evils resulting from town sites are not of frequent occurrence; but, as we have already shown, there are instances of such sites, and wherever hospitals have been built on them, they are less adapted for the successful treatment of sick than they would have been if placed in the country. The buildings might be more advantageously used for almost any other purpose than for hospitals. The reason is obvious. Town air is not pure enough for sick in hospitals, and it is not possible to prevent the air being rendered more impure than it is by encroachments of the population and nuisances incident thereto.

In most cases the position selected for a barrack, if ordinary precaution has been exercised, will answer for the barrack hospital. The exceptions are in small confined forts and other unhealthy positions where military reasons must override all other considerations. But even in these instances, as already stated, there is a prior question to be solved, namely, whether the sick cannot be removed to a distance until at least the emergency arises which renders it necessary to find accommodation for them within the unhealthy position itself. In all such instances it appears to be a very obvious principle not to expose the sick to any risk except what is unavoidable. Whenever, therefore, a healthy position for a hospital cannot be obtained within a fort or garrison on account of circumscribed space or otherwise, we would propose to place the hospital in a

healthy position outside the lines, reserving such hospital accommodation as may be necessary within the lines solely for times of war.

Isolation of Hospital.—In arranging the buildings within an ordinary barrack enclosure, care should be taken to isolate the hospital to a sufficient distance from the boundary wall to ensure a free circulation of air round it. In doing this, space for an exercising ground would at the same time be obtained. The necessary distance will depend somewhat on the position. If the situation of the barrack be high and exposed, the circulation of air will be much freer than if it be in a low confined position, and a less amount of isolation will be required in the former than in the latter case. In all ordinary instances the interval between the hospital and the boundary wall should never be less than three or four times the height of the hospital, exclusive of the ground covered by out-buildings. In close positions this distance would be insufficient.

There should be no buildings near the hospital, except those immediately connected with its objects. To ensure this, it ought to be placed at the extremity of the parade ground most remote from barracks and stables, and it should be cut off from the parade ground by a low wall and railing sufficient for isolation and discipline, but not such as to interfere with the free circulation of air. Part of the exercising ground for convalescents might be in front or at the ends of the hospital.

Care should be taken not to place the hospital in an angle of the enclosure, unless the enclosure at that point be completed by railings, and not by a wall.

The site selected should be that where encroachments of dwellings or nuisances outside the enclosure would be least likely to arise. If there is no security in any part of the ground from such encroachments, the only remedy is to place the hospital at a greater distance from the wall. Shed buildings for stores of certain kinds might be placed between the hospital and the boundary, so as to increase the distance, but the distance between these sheds and the hospital should not be less than three or four times the height of the hospital.

These remarks apply specially to regimental hospitals in barracks. Where hospitals are to be built separate from barracks, there is of course much greater facility in the choice of site, but in this case also sufficient area should be provided to admit of the necessary isolation of buildings from dwellings of the civil population, and to prevent encroachments. From one and a half to two acres for every 100 beds ought to be provided, except in cases where from the nature of the position, encroachments are impossible. In such cases, sufficient ground only for isolating the buildings and for convalescents exercising would be necessary.

Tests of Healthiness of Site.—An inquiry into the rate of sickness and mortality in the district will afford valuable indications as to the suitableness of the site for sick. But care should be taken not to be guided by the mortality alone; for it by no means follows that a district with a low rate of mortality is suitable for sick. The nature of the diseases and the facility or otherwise with which convalescences and recoveries take place, must also be taken into account. Time is a most important element in the question, especially as regards sick soldiers, who ought to be returned to the ranks as speedily as possible.

Climate.—The local climate should be healthy. There should be nothing to prevent a perfectly free circulation of air over the district. There should be no nuisances, damp ravines, muddy creeks, or ditches, undrained or marshy ground close to the site, or in such a position that the prevailing winds would blow over them to the hospital. The natural drainage outlets should be sufficient and available. From want of attention to this matter the whole fluid refuse of large military hospitals has been allowed to percolate the subsoil within the hospital enclosures for many years. Why build a hospital on ground which does not admit of being drained? If a barrack or fort must be placed on such ground, there is no necessity for the hospital being placed there.

Plan and Construction of Hospital.—Having selected and prepared the ground, the next point is to determine on what principles the building is to be constructed. This is an all-important point, respecting which, as we have already shown, there have hitherto been no fixed principles recognized. Hence there are very few military hospitals planned in such a manner as to be sufficiently supplied with space, light, and air, and there is hardly a single building in regard to which it can be stated that it combines the requirements of healthy construction with sufficient facilities for administration and discipline.

On what basis should the plan rest? From what point of view should it be considered? We state, unhesitatingly, from the ward construction. The first thing is to obtain good

healthy wards, and having obtained them everything else must be made to follow. The means of access, discipline, and administration, must bend to the ward, but the ward must never be made to yield to them. In the great majority of cases the main question in hospital construction appears to have been how to get most conveniently in and out of the wards and building, or how to provide the best offices and quarters,—very proper questions in their place. But the real question is, how the sick are to get well in the shortest possible time, and this is mainly determined by the ward construction.

Ward Unit.—The ward is hence the foundation of a hospital plan, and the ward construction and proportions must be based on the number of cubic feet to be allowed per bed.

The new medical regulations have fixed this datum at 1,200 cubic feet in temperate climates and 1,500 in hot climates; it is evident, then, that the ward dimensions and proportions must vary with the climate.

It is a matter of considerable importance how the space should be disposed of; whether the wards should be high, or long, or broad.

The usual idea of appropriating space is to have high ceilings, which at a fixed amount of cubic feet infers short wards, or narrow wards, or wards both short and narrow.

Hence, if the wards be made higher than necessary the sick will be crowded too close together. A large cubic space badly used may hence involve overcrowding of sick on the ward floor. Overcrowding in cubic space would be removed, and surface overcrowding substituted for it.

When the regulation amount of 1,200 cubic feet per bed is carried out in existing military hospitals, there will be very little danger of surface overcrowding, because the ceilings of the wards are, as a rule, too low. But in constructing new hospitals, certain units must be adopted, and those must be selected which are most likely to unite the conditions of sufficient surface area and convenience, with as near an approximation as possible to the regulation space per bed.

We would propose to make the breadth of the ward the foundation of ward construction, because a certain breadth of ward is essential for the ordinary working of the hospital. There must be space along the centre for tables, or other conveniences, and also for improved fire-grates, which, under certain circumstances, may be introduced with advantage in the centre of long wards. While at the same time the breadth of the ward should not exceed a certain number of feet, otherwise ventilation by opposite windows, which should always be resorted to when the weather and season admit of it, cannot be efficiently maintained.

Keeping these principles in view, if we take the opposite beds at 6 feet 6 inches each in length (13 feet), we may allow 11 feet from foot to foot of the opposite beds, and the ward will be 24 feet broad. One of the dimensions of the 1,200 cubic feet allowed to each bed will thus be $\frac{24}{2} = 12$ feet. If we allow 7 feet 3 inches for each bed in the length way of the ward, we shall have 12 × 7 feet 3 inches = 87 square feet as the superficial area for each bed, and 14 feet for the height of the ward.

The unit of cubic space per bed will thus be 12 × 7 feet 3 inches × 14 = 1,218 cubic feet. It would nevertheless be advantageous to add a foot or two in width to the ward, in order to give more space for tables, &c.

Each bed is three feet wide, so that these dimensions would give a distance of 4 feet 3 inches from side to side of adjoining beds, if the beds were equally distributed along the wall.

The length of any ward can easily be obtained by assuming 24 feet as the width, and 14 feet as the height, and then by multiplying half the number of beds required by 7 feet 3 inches, we obtain the length of the ward in feet. Thus, suppose a ward is required for 20 beds, then $\frac{20}{2}$ × 7 feet 3 inches = 72 feet 6 inches, the length required.

Position of the Beds.—The beds should always be arranged foot to foot on opposite sides of the wards, with their heads to the walls. The number of beds to be placed in a ward should be divisible by 4, in order to prevent loss of corner space.

The greatest economy of space would be effected by adopting wards for 4, 8, 12, 16, 20, 24, 28, or 32 beds, beyond which last number we would not recommend any increase.

One bed should be placed in each of the four corners. The other beds, half on one side, half on the other side, should be ranged two and two between the windows.

Windows.—The number of windows should be equal to half the number of beds.

A ward with 20 beds ought to have 10 windows, 5 on each side.

The distance between the end wall of the ward and the first window from each corner should be 4 feet 6 inches. The wall space between every two windows should be 9 feet wide, and the splay of the window into the room should be 5 feet 6 inches wide.

One bed should stand in each corner about 18 inches from the end wall, and each 9 feet of wall space between the windows should have two beds placed in it, 3 feet from each other, with their heads to the wall.

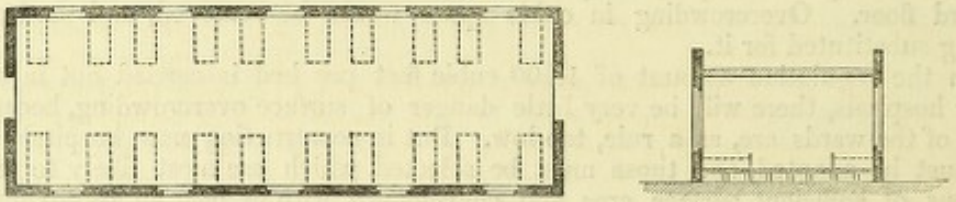
The windows should extend from within 2 feet 6 inches, or 3 feet, from the floor to within 1 foot of the ceiling.

In a ward 14 feet high the window would be from 10 feet to 10 feet 6 inches high.

The following plan and section, Fig. 82, show the proportionate spaces and the arrangement of beds and windows in a 20 bed ward at 1,218 cubic feet per bed. It does not profess to give detailed measurements, but is simply intended to exhibit a ward unit, combining healthiness of arrangement with convenience.

With an improved fire-place in the centre of the ward the plan could be adopted as it is, but if the fire-place were built into the wall a slight re-arrangement of the beds on the sides would be required, to enable a sufficient distance to be left between the fire-place and the two adjacent beds. It would be easy to introduce shades or cheeks on each side the grate to prevent the radiant heat falling too strongly on the adjacent beds. If the fire-place were built in the wall a window should be placed over the fire, to avoid the large blank wall space which would otherwise be left by the chimney breast.

Fig. 82.



The unit of space, namely, 1,200 cubic feet per bed, if rigidly adhered to, would necessarily put a limit to the size of wards, because the length would become too great for the height and breadth, and the ward would assume the appearance of a long passage or corridor. Even with 20 beds per ward, 14 feet is a minimum of height. If the number of beds were increased to 24, 28, or 32, additional height and greater width would have to be given, and consequently more space per bed.

The amount of space for tropical hospitals, namely, 1,500 cubic feet per bed, allows of better ward proportions being adopted. The breadth might be 25 feet, the height 15 feet, and the space per bed along the walls 8 feet. Every bed would have 100 superficial feet, and 1,500 cubic feet, in wards of these proportions.

It will be observed that the ward we have shown in Fig. 82 has direct communication with the outer air on two opposite sides, by a double line of windows, and in this it exhibits a fundamental principle in ward construction, without the embodiment of which, hospitals, so far as concerns recovery of the sick, will never fulfil their object perfectly.

Whenever a hospital is built this cardinal principle must never be lost sight of.

The only cases in which it can be dispensed with are in small wards with one or two beds for special cases requiring segregation, but even in such wards there should always be windows on two sides; if not on opposite sides, at least on adjacent sides. In all wards for 4 beds and upwards there should be opposite windows.

The ward shown in Fig. 82 is intended simply to illustrate the principle on which a ward unit should be framed. It is not intended that there should be no wards either smaller or larger. This question must be decided on other grounds, such as the size of the hospital and the kind of administration to be adopted. In small hospitals a shorter ward unit may have to be adopted. But in all hospitals, economy and efficiency of administration demands that each ward should be constructed so as to contain the largest number of beds consistent with sound sanitary principles. This is a most important element in hospital economy; it has been hitherto little attended to in England. The French appear to have fixed the number at which the two requisites meet at from 32 to 40 beds. In wards of 9 sick, arranged like those at Netley, the cost of *efficient* nursing would be nearly twice the cost of efficient nursing in wards for 32 beds on the Lariboisière plan. In wards of 32 beds, one attendant to eight sick is amply sufficient. In the naval wards of 14 beds, one nurse can attend to only seven sick. The British Army Hospital plan of one orderly to 10 sick has frequently to be departed from in consequence of the smallness of their wards.

Ward Offices.—Every ward requires for itself, or it must have easy access to, the following offices:—

1 A nurse's room so placed that a window in the wall will enable the ward master or nurse to overlook all the beds in the ward from the room.

2. A ward scullery, containing a small grate with an oven, a small table and racks for tea things, a well-constructed sink of white glazed earthenware, the drain pipe of which should be trapped and ventilated if connected directly with the sewer, or, it should terminate in the open air at a short distance above a trapped sewer grating or rain-water pipe. Over the sink should be two water taps, one for hot water, and one for cold water. The scullery is intended for washing up eating and drinking vessels, except such as are washed in the kitchen; for warming drinks, "extras," preparing fomentations, heating hot-bricks, filling water-bottles, making poultices, &c. (but not for cleaning utensils for wounds and sores, which should never be done at the same sink as that used for eating vessels,) and for keeping certain articles of ward equipment by themselves. It should also have the means of heating draw sheets, which are useful in cases of shivering, &c. This scullery should be conveniently placed for the ward, but should not open directly out of it. The orderlies should have a small table for their meals, and each orderly should be provided with a lock-up safe and small locker for holding food, &c. In every ward there should be two moveable dressers with lock-up drawers, the one for linen, the other for stimulants for the day in one place; another compartment for medicines, another for lint, oilskin, stock medicines, &c. &c. These dressers should be in the ward, visible to all the patients, never in the scullery, nurse's or ward-master's room. And the nurse or ward-master should keep the sole keys.

3. Water-closets, one for every 10 beds and under, and one for any number of beds exceeding 10, or any multiple of 10, should be provided. This number refers solely to military hospitals, as about a third of their inmates can go outside the building, which is always advisable when it can be done. In the larger class of regimental and consolidated hospitals, and in all general hospitals, these closets should be placed at the end of the wards furthest from the centre of the building, and in such a position that the external air can play freely round them. They should be cut off from the ward by a separately ventilated lobby. The closets should contain one seat each, with a half-door over the entrance. The simplest form of soil pan should be used, and abundance of water supplied. There should be a white stoneware urinal supplied with water. In an adjoining compartment should be placed a white stoneware sink, shaped and trapped like an ordinary soil pan, but of larger dimensions, with a large water tap over it for washing out bed pans, blood porringers, and similar utensils. In this compartment should be kept the bed-pans, urinals, &c. The room containing these closets should be thoroughly lighted and ventilated, and at night the means of lighting, whether by gas or oil, should be secured by a glass pane, and not accessible from the closet.

4. A bath room containing a fixed bath, with hot and cold water laid on, also an ablution table with sunk basins, and hot and cold water laid on. There should be a hot and cold water tap for supplying a slipper bath on india-rubber wheels. One such bath will be enough for one floor of a hospital, and may be kept in any convenient closet. In the floor of the compartment where the bath is kept there should be a small trapped sink, into which the water from the bath can be let off. There should also be a small earthenware sink at which to wash expectoration cups, basins used for dressings, &c.

The bath and ablution room should be so placed as to be easily supplied with hot water. It may be placed at the end of the ward, where the water-closets are, or between the scullery and the ward, as may be most convenient. In large hospitals constructed in separate pavilions, the former position will be, on the whole, best. In detachment and other small hospitals, the bath and ablution table may be placed between the scullery and ward. The number of bath and ablution rooms required will depend on the size of the hospital and on its construction. In small hospitals, with small wards, the sick of the different wards may very well resort to the same bath and ablution room.

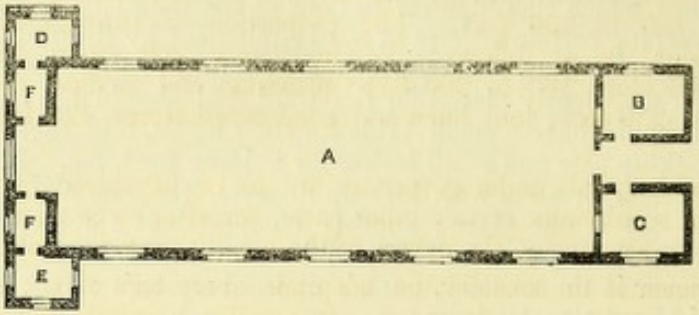
In hospitals of two flats one bath and ablution room per flat would be enough. But in general hospitals with large wards in separate pavilions, one bath per ward and an ablution room would be requisite.

Earthenware baths, glazed inside, would answer best for hospitals. They are more easily cleaned, and keep the temperature more equal than those of metal. Fixed ablution basins sunk in the table with discharge pipes and plugs, and hot and cold water pipes over them are best for hospitals. One basin for 10 sick is enough.

Arrangement of Wards and Ward Offices.—Fig. 83 shows a ward, with nurse's room, scullery, bath and ablution room, and water-closets added at the ends. The water-closets and bath room are in two corner turrets, with separately ventilated lobbies between them and the wards, so placed as to leave a large end window opening directly

from the outer air into the ward. The benefit of this arrangement is that the ward is entirely free of obstruction from end to end, and has the advantage of the end window, which should be of the tripartite construction, for ventilation, especially during night, and this window commands any points of view in the neighbourhood. This manner of arranging the baths and water-closets is well adapted for large wards and for large hospitals in separate pavilions.

Fig. 83.



A Ward for 20 beds.
B Attendants' room, with a window overlooking the ward.
C Scullery.
D Watercloset and ward sink.
E Bath-room and ablution table.
F F Ventilated lobbies.

A different arrangement of parts is shown in the plan of Lariboisière hospital—Fig. 86. In this case the water-closets are at the end of the long ward, and there is a lobby lighted by a large window, out of which they open, but the end window does not open directly into the ward. The principle to be observed is to have the water-closets freely ventilated, and at the same time to have a ventilated lobby between the water-closet and the ward. The lobby should be entered from the ward and the water-closet from the lobby through swing doors, closing of themselves without noise. The ablution and bath room doors should be similarly arranged. By placing them at the angles, as shown in Fig. 83, the risk of wind blowing the effluvia into the ward is very much less than if the closets projected directly from the end of the ward.

In small hospitals built on one flat, the water-closets and urinal should be placed at the end of the ward, and the ablution and bath room between the scullery and ward, as already mentioned.

These, then, are all the parts required for a hospital ward and its offices. They are shown in position in Fig. 83, which represents the ground plan of a ward in a pavilion hospital. They are those parts of a hospital which ought never to be interfered with or sacrificed for any supposed advantage whatever. They are the fixed data of hospitals on which the entire superstructure has to be reared.

Administrative Offices.—We next proceed to state what those administrative parts are which require to be added to the ward to complete the hospital, and where they may be most conveniently placed. In other words to consider which is the best arrangement of parts for the block plan of a hospital.

The essential parts of a large hospital are as follow :—

1. Ward units, containing as already mentioned,
   - *a.* The ward.
   - *b.* The ward orderly's room.
   - *c.* The ward scullery.
   - *d.* Water-closets.
   - *e.* Bath and ablution room.
2. The administrative offices, comprehending :
   - *a.* The surgery.
   - *b.* The waiting room.
   - *c.* Serjeant's or assistant ward-master's quarter.
   - *d.* Orderlies' quarters.
   - *e.* Kitchen, cook's quarter, scullery, and provision stores.
   - *f.* Stores, including pack store, bedding store, clean linen and utensil stores, fuel store, and small foul linen and condemned store.

g. Purveyor's or assistant-steward's room.
h. Wash-house.
i. Dead-house.
k. Out-door latrines.

The superficial dimensions of the various rooms in the administrative part of the hospital will, to a certain extent, depend on the size and arrangement of the buildings. Usually from 90 to 100 superficial feet will be sufficient for ward sculleries, and for ward orderlies' rooms. The waiting room, surgery, and hospital serjeant's rooms may have a superficial area of from 180 to 230 feet. The proportion of storeage surface required for 100 patients would be as follows:—Bedding store, 200 square feet; clothing store, 100 feet; utensil store, 160 to 200 feet; provision and medical comforts, 100 square feet; fuel stores, 250 feet; foul linen and condemned stores, 120 feet; pack store, 200 square feet.

Where general hospitals under governors are to be organized under Section VIII. of the new medical regulations, certain other parts, hereafter to be mentioned, require to be added to these, on account of the nature of the organization prescribed.

In large regimental or consolidated hospitals every one of the administrative parts mentioned above ought to be provided. In smaller hospitals, the number of administrative parts may be diminished by making one apartment serve for more than one purpose. In detachment hospitals where the service is very limited, more consolidation may with safety be carried out. The greater the number of apartments, the greater will be the difficulty of keeping the hospital clean, and the more labour will be thrown on the orderlies. An unnecessary multiplication of wards and offices in small hospitals involves the employment of a larger staff of attendants and more current outlay than is absolutely necessary for the sick. To avoid this, the parts should be consolidated as much as is consistent with efficient administration.

In the smaller class of detachment hospitals, the pack store may be in the same room with the clean linen and bedding; but it should always be divided off from it and under a separate lock and key. Care should be taken that all the stores are dry. Those for packs linen and bedding should have fire-places.

Relative Position of Parts in the Block Plan.—A fundamental principle in arranging the block plan of a hospital, except in small detachment hospitals, is to divide it into at least two separate parts under two roofs. Under one roof there should be nothing more than the sick and what is absolutely necessary for their treatment, nursing, and discipline. Everything else should be in another building. In small hospitals these accessories, although under the same roof, may be detached from the sick wards in such a way as to be virtually under another roof. The object is to preserve the air in the part allotted to sick as pure as possible, and to obviate the risk of disturbance from noise, &c. Any way in which this can be done will answer, but in large hospitals it is better to keep the sick and what is absolutely necessary for their welfare by themselves, and away from the stores, &c.

In applying this principle of subdivision, the hospital proper should contain the following parts:—

1. Wards.
2. Ward-masters' rooms.
3. Rooms for ward orderlies.
4. Sculleries.
5. Water-closets.
6. Baths and ablution rooms.

In pavilion general hospitals of the larger class there should be nothing more than these under the same roof with the sick. In regimental hospitals the surgery, waiting room, orderly's room, and day room for convalescents, may be placed in the centre of the building.

In the detached building or buildings should be placed,—

1. The kitchen.
2. Stores.
3. Wash-house.
4. Dead-house.
5. Other rooms and quarters.

Everything, in fact, which the sick have to use themselves, and every thing required on an emergency, must be where the sick are. But everything not immediately required by the sick should be placed at a distance, but within convenient reach.

The block plan of all hospitals, except those of the smallest dimensions, ought therefore, to consist of at least two parts,—one for sick, another for offices.

The smaller the number of sick the less risk is there in placing offices under the same roof; the larger the number of sick the greater the reason for detaching the offices. Hence in proportion as the number of beds and the size of the hospital increase, the number of parts, including pavilions for sick, will also necessarily increase.

Number of Sick under one Roof.—In applying these principles, let us first inquire what should be the maximum number of sick under one roof. It is not safe in any hospital to have much above 100 sick, with the requisite attendants, under one roof. In warm climates the number under one roof should not exceed 60 or 70. This rule is the result of experience. It is found to be very difficult, if it be not impossible, to keep the air sufficiently pure in buildings where large numbers of sick are congregated together. The experiment has been tried again and again. The mortality is always higher in large than in small hospitals, other things being equal. Small detached huts, with from 10 to 20 beds, have been found the most healthy in practice.

Large buildings with hundreds of sick under the same roof require extraordinary care to keep them free of hospital diseases, and the risk to life from agglomerating so many sick, and especially wounded men together, is too great to be incurred. It answers no good purpose which cannot be better answered by subdividing the sick, while the results have proved that subdivision is absolutely necessary for safety.

Agglomeration of sick as a principle of hospital construction must henceforth be abandoned.

2.—Block Plans of different Classes of Hospitals.

Having pointed out what ought to be the ward unit and administrative part of a hospital, we next proceed to consider the block plan of different classes of hospitals.

The block plan of a hospital, although it must always fulfil the same conditions, must vary not only with the size of the hospital, but also with the form of organization adopted.

Three varieties of military hospitals are recognized in the service, namely:—

1. Regimental hospitals, single or consolidated.
2. General hospitals.
3. Camp or temporary hospitals.

The organization in general hospitals differs materially from that of the others; and although the parts immediately required for sick are the same in kind in all classes of hospitals, the administrative portions of a general hospital require greater extension, and are more difficult of arrangement than those of a regimental hospital.

Temporary hospitals again may be either regimental or general in their organization. They may consist of marquees, of huts, or of any available buildings in the neighbourhood. In the latter case the buildings require to be adapted for their purpose on certain defined general principles, in order to make them fit for occupation.

Climate also must, to a considerable extent, determine the arrangements of the block plan, and construction of hospitals. The plan which would suit a temperate or cold climate would not suit a hot climate, and vice versâ.

Block Plan of Regimental Hospitals.—If we take the strength of a cavalry regiment at 580, and that of an infantry regiment at 1,000 non-commissioned officers and men, the proportion of sick for whom ward space would be required, would be 10 per cent. or from 58 to 100 beds.

It rarely happens, however, that an entire regiment, neither more nor less, occupies one barrack. If the arrangements of the service were such that barracks were occupied in this manner, the whole question of plan and construction as regards both barracks and hospitals would be very much simplified, and every new hospital in the service could be erected on one common plan. Should it be deemed at any time advisable to abandon small barracks, and to concentrate the troops on home service in regimental

establishments, infantry barracks, in round number, for 1,000 men, and hospitals for 100 sick, would constitute the future units of construction. But as regiments are at present divided into separate parts scattered among barracks of all sizes, no such general uniform block plan can be adopted.

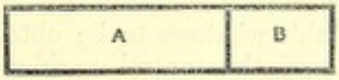
In the smallest class of detachment hospitals, with 8 or 10 beds, one unit of construction applicable to these, as well as to all other cases, cannot be laid down, and it is only when the number of beds exceeds a certain amount that a part or unit can be arrived at, which, by being multiplied, will enable a hospital of any size to be formed out of it.

Regimental hospitals may be constructed on one flat or on two flats, but they should never be in more flats than two, for a similar reason that not more than 100 to 120 sick should be under one roof. It is very difficult to keep upper floors free of miasm from the floors below, and upper flats of large hospitals three or more stories high are not healthy.

The smallest class of hospitals should be constructed of one floor. These hospitals, in common with others of a larger size, require a certain number of parts, which if arranged in such a manner as to make what might be considered a compact building of two or three stories high, such, for example, as the York hospital, Figure 63, would make the building nothing else but a common dwelling house, cut up into a number of small rooms; complicated in structure, difficult to ventilate, costly to administer, and after all unfit for the reception of sick.

A hospital for a detachment of under 100 men, *i.e.*, for less than 10 sick, may very well consist of one ward only, because among such a number, a severe case, actually requiring segregation in a small ward by itself, will be of rare occurrence. In such hospitals the ward unit might be so arranged as to occupy one end of the line of building, with the offices at the opposite end, but cut off from the ward by a lobby, ventilated and lighted through the roof, as shown in the block plan, Fig. 84.

Fig. 84.

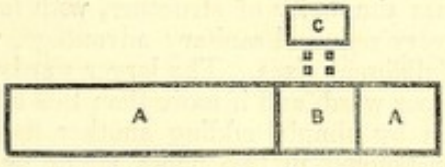


A Ward.
B Administration.

It is a simple one-story pavilion, standing by itself at a sufficient distance from walls and buildings to ensure a free circulation of air around it. A passage running across from front to back, ventilated and lighted from above, separates the ward unit from the administrative offices.

In detachment hospitals intended for from 10 to 20 sick it would be necessary to provide a second ward, but in doing so the same block plan should be retained, the small ward being simply added on at the opposite end of the administrative offices, as shown in the following plan, figure 85. But in this plan the kitchen should be detached and placed behind the block.

Fig. 85.

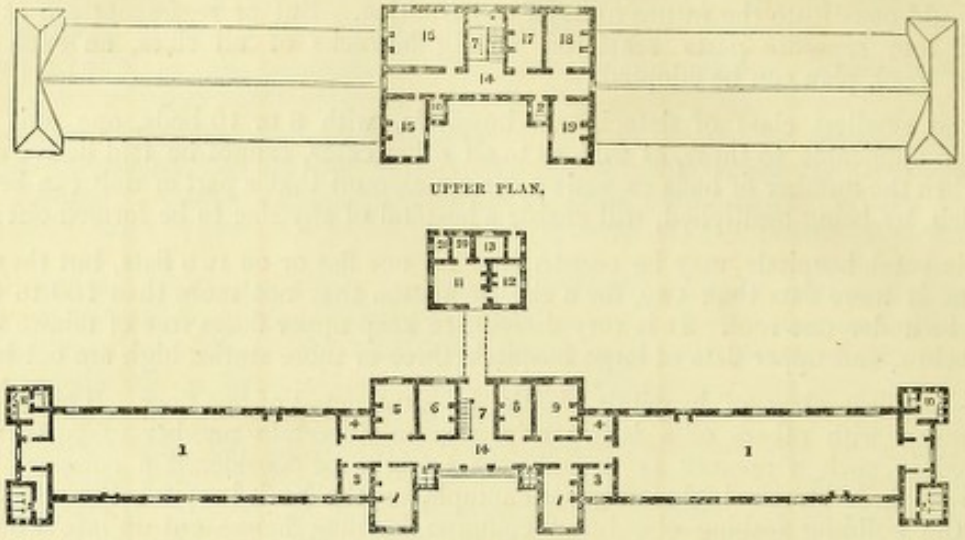


A A Large and small wards.
B Administration.
C Detached kitchen.

The wards may either be of the same size or may bear any convenient proportions to each other, and their length may vary to suit the number of beds for which accommodation is wanted.

Where hospital accommodation is required for 30 to 60 sick, three or four wards would be required, one large ward on each side of the administrative offices, and an additional smaller ward, or two, carried out at right angles to the main line of the building, and so placed that the assistant ward-master or orderly could overlook both it and one of the larger wards by windows opening from his room into each ward as shown in Fig. 86.

Fig 86.—Plan of a Regimental Hospital for 60 Beds.



UPPER PLAN.

GROUND PLAN.

1. Wards.
2. Water closets.
3. Orderly.
4. Scullery.
5. Day room.
6. Assistant ward-master.
7. Staircase.
8. Waiting room.
9. Surgery.
10. Ablution and bath room.
11. Kitchen.
12. Cook's room.
13. Scullery.
14. Corridors.
15. Assistant steward's room.
16. Orderlies.
17. Pack store.
18. Bedding and utensil store.
19. Clean linen.
20. Medical comforts, &c.
21. Larder.

Fig. 86 exhibits such an arrangement adapted to a cavalry hospital for 60 beds. It consists of two ward units for 28 beds each, and two small wards projected at right angles to the line of the front to enable windows to be obtained on two opposite sides. The administrative offices are behind the central corridor, and in order to ensure thorough light and ventilation in the centre of the building, the front of the administration is retired between the small wards, and there are three glazed arches in the centre, one of which is the door giving entrance to the hospital. There is a spacious staircase leading to the offices above, and a wide passage giving access by a covered way to the kitchen and provision stores, which are placed in a one-story detached block behind.

The administration consists of a waiting-room, surgery, assistant ward-master's quarter (two rooms), a ward orderly's room, a day-room for convalescents, and two ward sculleries. These are all on the ground floor. To facilitate inspection of the wards, each orderly's room has two small inspection windows, one opening into the larger ward, the other into the adjoining smaller ward. The water-closets, ablution, and bath-rooms and sinks, are placed at the end of the wards, and are freely ventilated.

In the upper floor of the administration are placed the pack store, bedding, and utensil store, and clean linen store. There are also quarters for the assistant steward and for the required number of orderlies.

This plan, which combines simplicity of structure, with facility of administration and discipline, together with every required sanitary advantage, would form a suitable model for regimental hospitals of different sizes. The larger wards might be reduced in length, or extended up to 32 beds per ward, and if more than this accommodation were required, it could easily be obtained by simply adding another floor of wards and rooms. A hospital on this model constructed in two floors might be made to accommodate 136 patients in four wards of 32 beds, and 4 wards of 2 beds each. Probably the largest amount of accommodation any regiment will ever be likely to require would be given in 4 wards of 28 beds and 4 wards of 2 beds, 120 beds in all. Any way the plan can be easily adapted to the number of beds required, and may be used safely up to 136 beds.

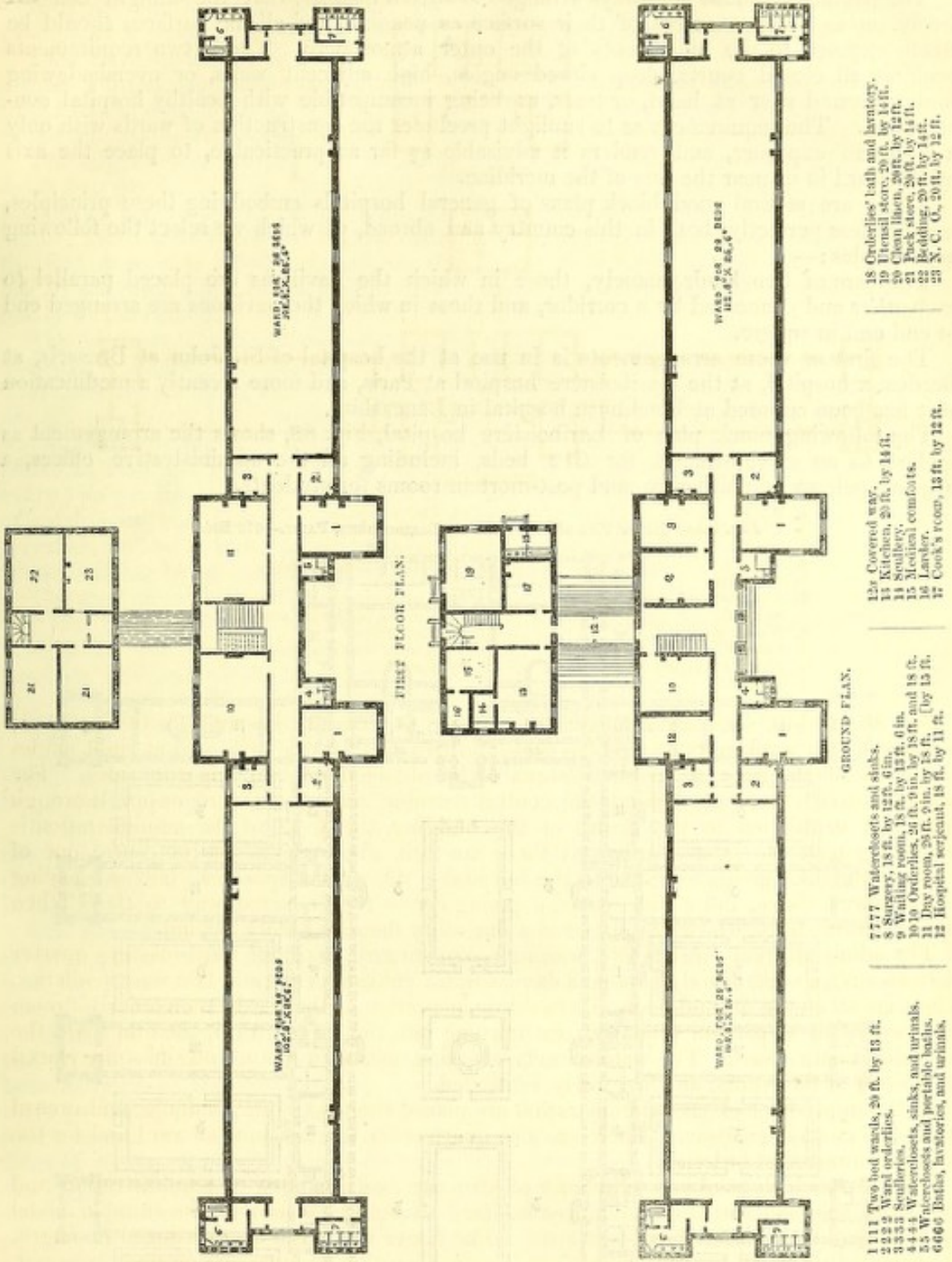
In a two-story hospital constructed on this plan, all the stores and the assistant steward's quarter should, for the sake of convenience and facility of administration, be removed to the kitchen block, which would be raised a story for the purpose, and the orderlies would have sleeping accommodation in the centre of the building, part on each floor.

The wash-house with the foul linen and condemned stores, fuel store, dead-house, out-door latrines, &c., would be separate from the hospital altogether.

The following plan, Fig. 87, shows the arrangement of a two-floor regimental hospital.

Fig. 87.

PLAN OF A REGIMENTAL HOSPITAL FOR 120 PATIENTS.



When accommodation is required for more beds than the regimental hospital plan will accommodate, a different arrangement of parts would be necessary.

The ward unit represented in Fig. 83 would become the foundation of the pavilion structure, and the best arrangement of the pavilions in relation to each other and to the administrative offices would become the question to be solved, both for large consolidated, and for general hospitals.

We next proceed to state the principles on which a proper arrangement of parts should be based, and to illustrate the application of those principles by existing examples.

General Hospital Plans.—When more sick have to be provided for than two end to end pavilions can accommodate, and where the hospital is to be administered as a general hospital under a governor, in conformity with the eighth section of the new medical regulations, it will probably become in each separate case a question as to the best manner of arranging the pavilions, a question which must be determined by the size, form, levels, and exposure of the ground.

The pavilions should be always arranged in such a manner, that the sunlight can fall freely on as large an extent of their surface as possible, and all the surfaces should be freely exposed to the movements of the outer atmosphere. These two requirements prohibit all closed courts, deep closed angles, high adjacent walls, or overshadowing higher ground near at hand, or trees, as being incompatible with healthy hospital construction. The requirement as to sunlight precludes the construction of wards with only a northern exposure, and renders it advisable as far as practicable, to place the axis of the ward in or near the line of the meridian.

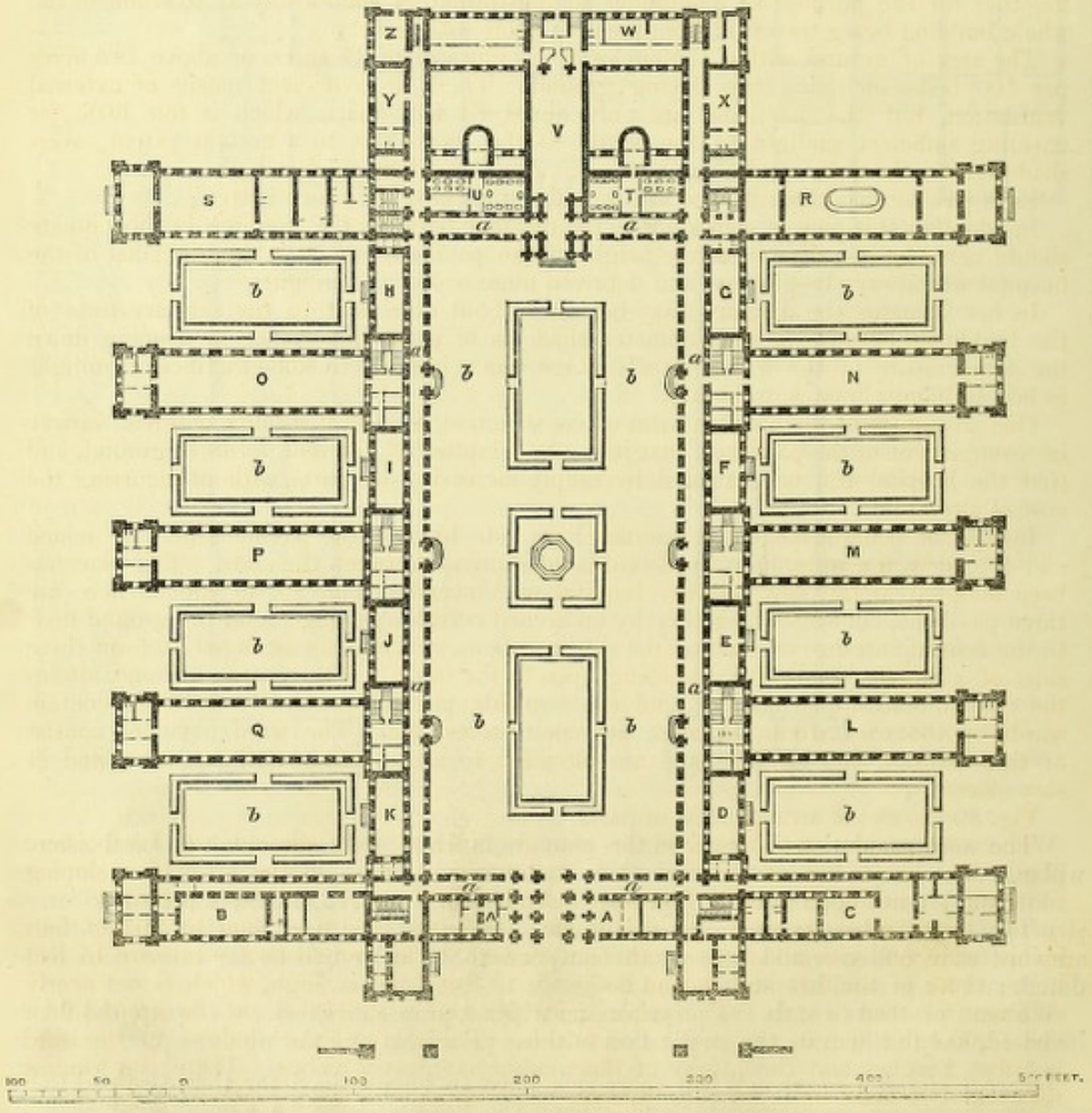
There are several good block plans of general hospitals embodying these principles, more or less perfectly, both in this country and abroad, of which we select the following as examples:—

They are of two kinds, namely, those in which the pavilions are placed parallel to each other and connected by a corridor, and those in which the pavilions are arranged end to end and in square.

The first of these arrangements is in use at the hospital of St. John at Brussels, at Bordeaux hospital, at the Lariboisière hospital at Paris, and more recently a modification of it has been adopted at Blackburn hospital in Lancashire.

The following block plan of Lariboisière hospital, Fig. 88, shows the arrangement as applied to an establishment for 612 beds, including all the administrative offices, a large chapel, an amphitheatre, and post-mortem rooms for students.

Fig. 88.— Ground Plan of L'Hôpital de Lariboisière, Paris.—612 Beds.



A Porter's lodge.
B On the ground floor, kitchen; on the 1st floor, lodgings of the officers; on the 2nd floor, dormitories for male attendants.
C On the ground floor, pharmacy; on the 1st floor, lodgings of the officers; on the 2nd floor, rooms of the resident pupils.
D E F G H I J K Dining rooms, &c., one story high.
L M N O P Q Pavilions for sick, three stories high.
R Ground floor, washhouse; on the 1st floor, linen store; 2nd floor, dormitories for female attendants.
S Sisters' rooms.
T U Baths.
V Chapel.
W Dead house.
X Y Operation theatre.
Z Manège and stores.
a a a a Corridor, one story high, with open terrace above, running round the buildings, and connecting them.
b b b Gardens.

It is not our intention to recommend this plan as a model; we merely adduce it as an example of a good block plan, embodying the principle of separate pavilions.

Each pavilion has three flats of wards. Each flat has a large ward for 32 beds, and a small ward at one end for one or two beds; but this method of attaching a small ward to the end of each large ward is unfavourable both to discipline and to the proper care of the inmates in the smaller ward.

The larger wards are 111 feet 6 inches long, and 30 feet wide, affording 104 superficial feet per bed. The ground-floor wards are 17 feet 6 inches high; those on the first floors are 16 feet 8 inches high, and the second floor wards are 16 feet 4 inches high. The cubic space per bed in each of the ground-floor wards is 1,860 feet. On the first floor it is 1,740 feet, and on the upper floors 1,700 feet per bed. Each ward has 16 windows, eight on each side. Each window is 4 feet 8 inches wide, and extends nearly to the ceiling.

The four corner pavilions contain quarters, administrative offices, medical officers rooms, dispensary, sisters' accommodation, the kitchen, washing establishment, linen stores, &c. The other six pavilions, those in the centre of each side, contain the sick wards. They are all connected by an arched, glazed corridor, one story high, with an open terrace above, passing completely round and connecting the entire buildings. There is a garden about an acre and a fifth in extent, enclosed within the square, besides gardens between every two pavilions. Each pavilion contains 102 beds. This plan illustrates the principle of subdivision and isolation of sick. It consists, in reality, of six hospitals, connected together for the purpose of a common administration, in such a way as to admit of the whole building being traversed from point to point with facility.

The area of ground within the enclosure is upwards of 13 acres, or above two acres per 100 beds, including the drying ground. There are sufficient means of external ventilation, but the pavilions are only about 64 feet apart, which is too little for ensuring sufficient sunlight to the wards, as the wards are, to a certain extent, overshadowed by the walls of adjacent pavilions, which are about 55 feet high.

Each pavilion has three flats of wards. Two flats only are much better.

In adopting this plan of construction the distance between the pavilions in this climate should never be less than twice the height of the pavilion, otherwise the lower flat of the hospital will always be gloomy, and deprived more or less of sunlight.

In hot climates the distance may be less without detriment to the sanitary state of the buildings, because in such climates shade is of great importance in keeping down the temperature of the wards, an advantage which it is worth some sacrifice of sunlight in hot, brilliant climates, to obtain.

One advantage of the pavilion form of construction is that it admits of great variety in arrangement of the pavilions, that it can be adapted to different forms of ground, and that the hospital can be extended by simply increasing its parts, without incurring the cost of alterations.

Instead of being arranged in parallel lines side by side, the pavilions may be joined end to end with a wide, light, well-ventilated staircase between the ends. This plan has been adopted in the new military hospital at Vincennes, Fig. 89, in which there are three pavilions, connected together by an arched corridor passing round the ground floor to the central entrance of each of the side pavilions. They are arranged to form three sides of a square, the fourth side being open to the south. The centre pavilion contains the chapel, offices, quarters, &c., and the two side pavilions, each 340 feet long, contain wards, apothecaries stores, kitchen, provision stores, &c. The ward pavilions consist of three stories, and an attic, and are intended to accommodate 616 sick men, and 21 sick officers.

Fig. 89 shows the arrangement of parts.

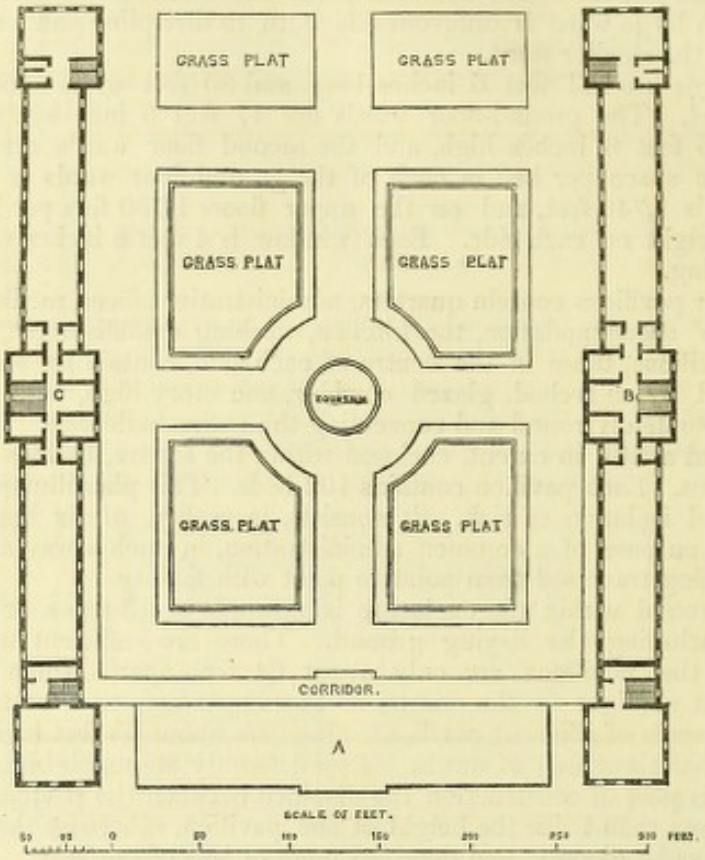
The ward proportions adopted in this plan are different from those of the Lariboisière plan. The wards are of different sizes and forms. Those in the attic have sloping roofs and are not good wards. They are intended for a reserve in case of pressure.

The larger wards contain 40 beds each. They are 135½ feet long by 26 feet four inches wide, and give about 90 square feet per bed. The ground floor wards are 15 feet high; those of the first and second floors are 13 feet 7 inches high, which is not nearly sufficient for their length. The cubic space per bed is 1,334 feet on the ground floor and 1,200 cubic feet in the upper floor wards. The splay of the windows in the ward is 5 feet 2 inches and the height of the window is 9 feet 2 inches. There is a window for every two beds.

The area of exercising ground enclosed between the pavilions is about 2¼ acres, and the total area within the hospital enclosure is about 11¾ acres or somewhat less than two acres per 100 beds.

Fig. 89.

Ground Plan of Military Hospital, Vincennes.—637 Beds.



A Offices, guard-room, chapel, and apartments for general establishment.
B Kitchen, linen rooms, and accommodation for 18 sisters and 308 soldiers.
C Pharmacy, baths, and accommodation for 21 officers and 308 soldiers.

Both of these French block plans are good, but the hospitals themselves have the disadvantage of having too many floors. Lariboisière has three floors, and the Vincennes hospital has three floors and an attic. For administration purposes both hospitals have certain advantages and certain disadvantages.

In the Lariboisière plan all the parts are continuously connected together under cover, but as there are only 32 sick on each floor, and as each floor has a flight of stairs for that number of sick, there is much time and trouble spent by the nurses and administrators ascending and descending stairs, &c.

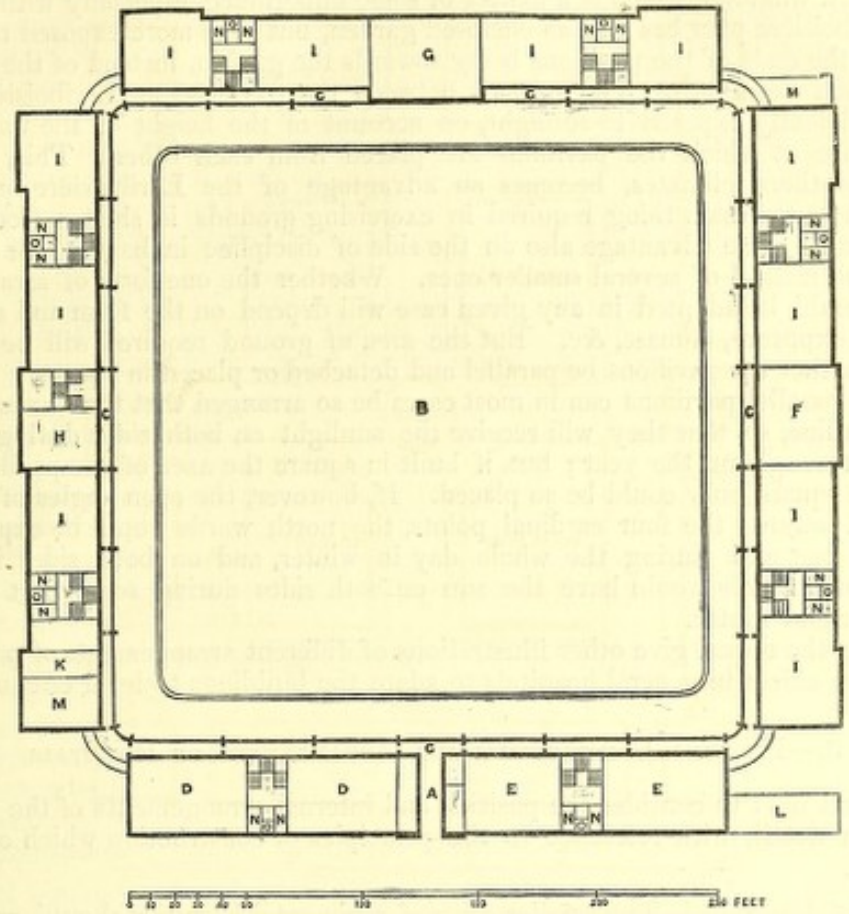
In the Vincennes plan there is not the same continuity of communication, so that in bad weather an officer must traverse the entire length of each pavilion to pass between the opposite extremities of the hospital, but on the other hand the facilities for ward administration and for nursing are greater in the Vincennes plan on account of the facility of passing from ward to ward, across the stairs and lobbies. There is one stair for every two wards instead of one stair for every ward, as is the case in the Lariboisière plan.

An arrangement of pavilions somewhat similar to that at Vincennes exists in the Royal Naval Hospital at Yarmouth (Fig. 90.) now used as a military invalid hospital.

This building consists of four pavilions, each 260 feet long, arranged in square with the angles open; the whole building being connected by an open arched corridor about eight feet wide surrounding the inner court. This court is laid out as a garden, and has an area of about $1\frac{3}{4}$ acres. Three pavilions are used for sick men, and the fourth is intended for sick officers and for stores. Each of the three men's pavilions is divided in the middle of its length by a large square block of building not occupied by sick. On one side this space is used as a chapel. On another side it is used as an operating room, and on the third side it contains the surgery, &c. There are thus six divisions for sick men. Each of these divisions is again divided up the middle by a large staircase out of which are entered the wards right and left. Between every two wards there are two nurses' rooms and a water-closet.

Fig. 90.

Ground Plan of Naval Hospital, Yarmouth.—310 Beds, exclusive of Sick Officers' Accommodation.



A Entrance archway.
B Garden.
C Open arched corridor, one story high, surrounding the garden.
D Rooms for sick officers.
E Steward's stores.
F Chapel.
G First floor, operating theatre ; ground floor, billiard room.
H Committee room, surgery, &c.
I I I, &c. Wards, 14 beds each.
K Padded room.
L Bath rooms, washhouse, &c.
M M Sculleries.
N N Nurses' rooms.
O O Watercloscts.

Each ward is 40 feet long, 23 feet wide, and 14 feet 6 inches high, and is intended to accommodate 14 beds in conformity with the practice in naval hospitals. The dimensions give rather less than 66 square feet, and about 953 cubic feet per bed. The windows are differently disposed in different parts of the building, but are on opposite sides of the wards with the beds between them.

The pavilions are, as they ought to be, only two stories high. The front pavilion, the one devoted to sick officers, is subdivided into rooms of different classes according to the custom in naval hospitals. Were the whole building given over for occupation by sick men and the store accommodation and officers' rooms removed, the ward space, exclusive of the centre blocks, would hold at the present cubic space per bed 448 beds. But at 1,200 cubic feet per bed each ward would hold 11 beds, and the whole hospital at this rate would have space for 352 beds. The present men's wards have space for 242 beds at 1,200 cubic feet per bed.

Were the interior better arranged, space might be still further economized without injury to the sanitary state of the building, and with great advantage to the administration, but taken as a whole Yarmouth Naval Hospital is perhaps the best hospital either civil or military in the United Kingdom as regards its block plan. Quarters for the commandant and medical officers are placed in two houses in the fore court of the hospital.

The total area of ground within the enclosure including the forecourt is 9½ acres, or nearly three acres per 100 beds (on the estimate of 352 beds given above). The site is a plateau of sea sand close to the shore, and the establishment is well adapted for its present object as is proved by the readiness with which invalids from foreign service convalesce there.

In exposed situations, the manner of arranging the pavilions shown in the plans of the hospitals at Vincennes and Yarmouth affords to the sick an enclosed and protected exercising ground, while it enables advantage to be taken of any views of the surrounding country from the ward windows, which is a matter of some importance, especially with invalids.

The Lariboisière plan has also an enclosed garden, but it is more exposed to drafts, on account of the ends of the pavilions being towards the garden, instead of the sides, as at Vincennes and Yarmouth. The grounds between the pavilions at Lariboisière hospital are not sufficiently exposed to sunlight, on account of the height of the walls and the small distance at which the pavilions are placed from each other. This, which is a defect in northern climates, becomes an advantage of the Lariboisière plan in hot climates, where the main thing required in exercising grounds is shelter from the sun's rays. There is some advantage also on the side of discipline in having one large exercising ground instead of several smaller ones. Whether the one form of arrangement or the other should be adopted in any given case will depend on the form and slope of the ground, the exposure, climate, &c. But the area of ground required will be very much the same whether the pavilions be parallel and detached or placed in square.

Detached parallel pavilions can in most cases be so arranged that their axes will fall in the meridian line, so that they will receive the sunlight on both sides during some part of the day throughout the year; but if built in square the axes of the pavilions on two sides of the square only could be so placed. If, however, the open angles of the square were placed towards the four cardinal points, the north wards would be exposed to the sunlight on one side during the whole day in winter, and on both sides in summer, while the south wards would have the sun on both sides during some part of the day both summer and winter.

We shall in the sequel give other illustrations of different arrangements of positions and administrative offices in general hospitals to adapt the buildings to local circumstances.

3.—Internal Construction and Arrangement of Hospitals.

We proceed next to consider the position and internal arrangements of the buildings a little more in detail, with reference to the principles of construction which ought to be kept in view.

Regimental Hospitals.—The smaller class of regimental hospitals should, as a rule, be only one story high. In regimental hospitals constructed on one floor, the assistant ward-master's quarter, which should consist of two rooms wherever possible, should be placed in the centre, in such a position that he can command the whole interior of the building. He should be able by simply going into the passage to see the whole length of the wards through the half-glass doors. He should be able readily to see the front and back door, and the interior of the kitchen behind, as well as the exercising ground. All this can be provided for in the plan.

Regimental hospitals for 80 or 100 sick may be constructed on two floors. In such hospitals, the hospital serjeant's quarters should be close to the centre, on the ground floor, where he can command all the entrances, wards, exercising grounds, &c., besides being able to pass rapidly from part to part of the building. We have already pointed out the best arrangement of stores and quarters for each form of hospital.

General Hospitals.—In constructing general hospitals regard must be had to the organization prescribed in Section VIII. of the new medical regulations of 7th October, 1859. As already stated, the minimum cubic space per bed is to be 1,200 feet in temperate climates, and 1,500 feet in warm climates. These dimensions, as we have shown, determine the size and proportions both of wards and pavilions; but it would be very advisable to allow a larger amount of space per bed, when by doing so, wards of better proportions and more suitable for their object can in any given case be provided.

There should be two or three small wards for offensive and noisy cases; the latter should be placed at a sufficient distance from the other wards to prevent the sick being disturbed by noise. Separate accommodation for sick prisoners, having the means of guarding, without disturbing the other sick, should likewise be provided. An operation ward easily accessible from an operating theatre is required in general hospitals.

In cases where it may be considered necessary to do so, quarters for sick officers should be provided. These should consist of separate rooms, detached from the men's sick accommodation. According to the regulations sick officers have a right to such accommodation, on payment of certain rates.

The new regulations also require that wards should be set apart for convalescents, where practicable. In the pavilion plan of construction the separation between sick

and convalescents is simple enough. All that is required is to select a ward or pavilion as a convalescent division of the hospital, but more than this is needed to give effect to the regulation. Convalescents require more liberty of moving about; they require change of room or of ward through the day. It is better that they should not sleep, eat, and live in the same room. A proper convalescent day room is therefore an essential part of every general hospital. It should be a good sized, light, cheerful, airy, warm room, with a good view from the windows, facility of access to and from the exercising ground, and facility of superintendence.

Each ward should have its hot and cold bath as already described, but every large hospital requires a general bathing establishment, of hot, cold, vapour, douche, and medicated baths. These are chiefly useful for convalescents and for patients not confined to bed. They should be detached from the pavilions, but accessible from them under cover.

The new organization of general hospitals will necessitate certain changes in the amount and position of the administrative parts of the building. Every such general hospital must have accommodation for the following officers:—

Governor or commandant.
Principal medical officer.
Orderly medical officer.
Apothecary or dispenser.
Purveyor or steward.
Paymaster or treasurer.
Captain of orderlies.
Superintendent of nurses.

Under these officers there will be placed—

Assistant apothecaries.
Female nurses.
Ward-masters.
Ward orderlies.
Cooks.
Washers, &c.

A general hospital, complete in all its parts, should be provided with a chapel and with chaplain's quarters, either within the precincts or at a convenient distance.

The whole staff, in fact, should be accommodated within the enclosure. Where the area of ground is too small to accommodate the whole staff, or where quarters already exist within a moderate distance, certain officers may be accommodated out of the building, but certain others should always be on the spot.

The governor should always have an office and clerk's room for administration within the hospital, and his quarters should be within the hospital precincts.

The principal medical officer should have his office within the buildings, but his quarters may be away from it. There should be office accommodation for the registrar either in or adjoining the principal medical officer's office.

There ought to be quarters for one or more orderly medical officers, according to the size of the hospital.

The dispenser should also have a quarter near the pharmacy, to be in readiness for night calls.

The purveyor and paymaster should both have offices and clerks' rooms, but not necessarily quarters.

The captain of orderlies and superintendent of nurses should always be quartered within the administrative part of the hospital; as also the nurses, ward-masters, and orderlies.

In case of sickness among the orderlies, they would be placed in the ordinary wards, but in case of sickness among the nurses, it would be necessary to provide a small light, airy room, with an attendant's room adjoining, containing a bed and a few necessaries for the woman in charge of the nurse during sickness.

The extent of quarters provided for officers would have to be, in one sense, proportioned to the size of the hospital. None of the superior officers should have fewer than two rooms and servants' accommodation.

A room for medical officers should be provided for meetings, consultations, &c. Likewise a waiting room for patients, a receiving room, and a surgeon's room.

No ward-master, assistant ward-master, or orderly should ever sleep in a sick ward. He should have a bed in the room adjoining the ward, shown in Fig. 83, or, in the case of orderlies, in a separate sleeping room, affording 600 cubic feet per man, placed in the administration. This sleeping accommodation should be so placed with regard to the

captain of orderlies' quarter or the ward-master's quarter, that proper order and discipline may be kept up with ease.

The captain of orderlies' quarter should be so placed that he can with facility pass to any part of the hospital where he may be required on emergency.

The quarters of the superintendent of nurses, and nurses should be cut off entirely from the remainder of the administration. They should include linen nurse's, and servant's room, sick nurses' infirmary, small room adjoining for woman attending on sick nurses, store-room, small scullery, bath, sink, and two water-closets. The whole of this part of the establishment should have one outer door communicating with the hospital proper. But as wherever possible the nurse should sleep in the nurses' room overlooking the ward, the room should be planned with this object in view.

The clean linen and clean clothing should be kept in rooms supplied with suitable racks and tables within the same outer door. One large room will be sufficient as a clean linen store, but a smaller room for repairing should be provided.

The new medical regulations have fixed the limits within which orderlies' and nurses' accommodation will require to be provided in general hospitals. One orderly is to be provided for every 10 sick, and for every fractional part of 10 sick.

With regard to nurses, the regulation concerning the number to be appointed is as follows:—A nurse is to be appointed for every ward or set of wards excepting for venereal or convalescent wards, and no nurse is to have charge of fewer than 25 sick. But in a properly constructed hospital a nurse could very well take charge of 60 sick on one floor. A nurse would occupy a nurse's room in every pair of wards wherever possible, and the remaining nurses, including the superintendent's linen-nurse, would be accommodated in the administration.

The kitchen may adjoin the administration, provided it be suitably cut off from the quarters and thoroughly ventilated. It should be sufficient for all the cooking both of sick and of the administration. In cases where the officers of the hospital have separate quarters provided, apart from the administration, but within the hospital precincts, each officer should be provided with a kitchen.

The stores already mentioned should be placed partly under the same roof as the administration, and partly in detached buildings.

Sufficient has been said to show that the block plan of the administrative buildings of a general hospital should be a subject of study by itself, just as the sick accommodation should be. But the sick accommodation must never be made to yield precedence to it in the block plan. On the contrary, the administrative part must always yield precedence to the sick part, provided any yielding be required.

Proposed General Hospital for Malta.—As an illustration of the relative arrangement of parts we have been discussing, we may adduce the plan proposed for a new military general hospital for Malta, where the present hospital accommodation is quite unsuited to the importance of the garrison. The ground proposed for the new hospital is St. Michael's Bastion, on the south-western side of Valetta, at an elevation of 160 feet above the level of the sea.

The available area is limited by the works, and is an irregular polygon projecting from an angle of the town, and almost entirely isolated from buildings. The extreme length of the ground is 510 feet, its greatest breadth 255 feet, and its superficies about 2¼ acres. The hospital accommodation required is for 300 sick.

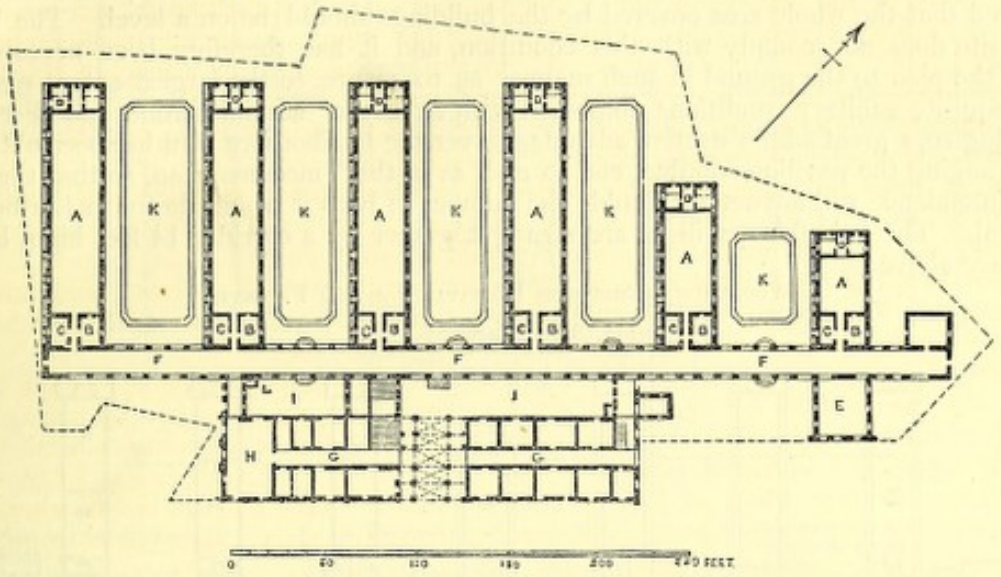
The shape, size, and lay of the ground in this case determines the construction. Its longest axis is from N.E. to S.W., and by running an open arched corridor in this line, and projecting the pavilions at right angles from it, so that the axes of the pavilions lie in a line from N.W. to S.E., a considerable amount of shade for the wards is obtained during a hot period of the day. This is a point of great importance in the climate of Malta. The distance between the pavilions is 50 feet, but the pavilion walls, being only about 35 feet high, there will be light enough in the wards in so brilliant a climate, while the pavilions will shade one another, and also the intervening exercising ground during the whole afternoon.

The only exception to this is the S.W. pavilion, on the S.W. wall of which the sun will shine the whole afternoon. To diminish the effect of the sun radiation, the S.W. walls of all the pavilions are intended to be constructed double, with a free ventilation from below upwards between the walls. In this way the inner walls will be kept cool, and the advantages of verandahs obtained without obstructing the ventilation of the wards. The pavilion roofs are also double and well ventilated between. Jalousies and shades will be used for all the windows.

Fig. 91 shows the proposed plan.

Fig. 91.

Ground Plan of proposed Military General Hospital at Malta for 300 beds.



The dotted line shows the outline of the bastion.

A A Pavilions, each two stories high, and containing two wards each.
B B Ward nurses' rooms.
C C Ward sculleries.
D D Water-closets, baths, ablution rooms, and ward sinks.
E Operating theatre and two small wards.
F F Open arched corridor connecting all parts of the hospital.
G G Administration, chapel, governor's, principal medical officers', and chaplain's quarters; nurses' and superintendent's quarters; captain of orderlies' and orderlies' rooms; surgery, waiting room, apothecary, stores, &c.; day room for convalescents.
H Convalescent day room, &c. &c.
I I Courts.
K Exercising grounds.
L Lifts for diets.

The pavilions, as will be seen, are of different dimensions, on account of the shape of the ground; but this is an advantage, because it enables wards of different sizes to be obtained, and the pavilions are echelloned towards the cool sea breeze.

Each pavilion is two flats high, and contains two wards. The largest wards have space for 32 beds each, or 64 sick under one roof.

The administration is placed in the middle of the length of the corridor, from which it is separated by a court 20 feet wide. It consists of a ground floor, mezzonine, and upper floor. All parts of the building can be reached with the greatest facility from its different floors by stairs and passages. The wards in the four larger pavilions are 110 feet long, 28 feet broad, and 16 feet high. Each bed has about 96 superficial feet, and 1,540 cubic feet of space.

The allowance of superficial and cubic feet per bed is the same in the smaller wards.

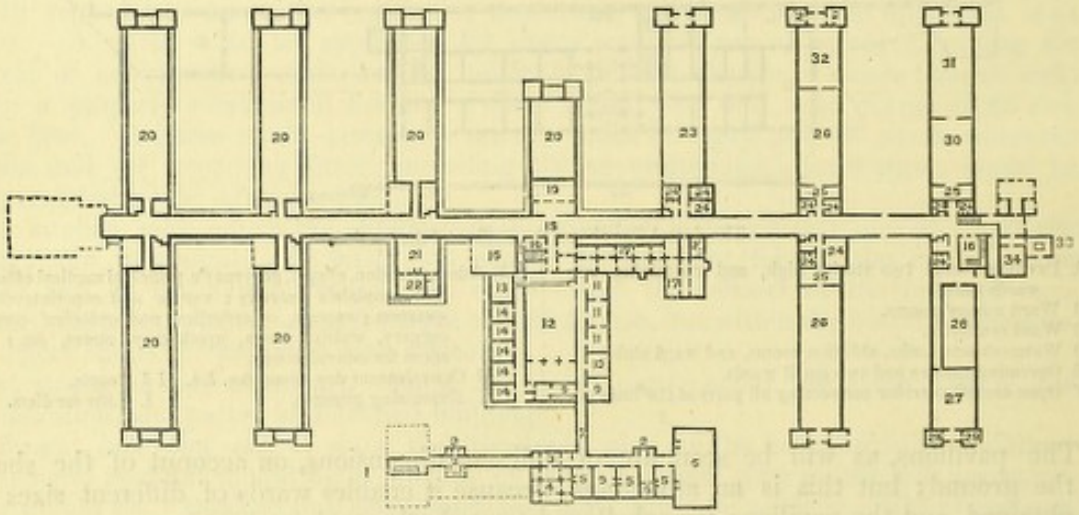
But there is, nevertheless, one feature of the Malta plan which it is essential to follow in all general hospitals, where nurses are to be trained for war service, and that is in the size of the wards. The highest authority on this subject, whose name is indissolubly connected with all that concerns hospital organization and nursing, has put it on record that in order to employ nurses in military hospitals so as to combine the greatest care of the sick with the greatest economy of attendance, we must have certain conditions as to structure, one of which is that every nurse ought to have immediately under her eye the ward administration for not fewer than from 50 to 60 sick men, in the smallest possible number of wards. Wards of this class may contain from 24 to 32 sick, and one nurse should have two of them contiguous to each other, and not on different flats. The nurse's time must be fully occupied in her ward duties, not uselessly in running up and down stairs, or out of one door into another of a number of small rooms, which cannot possibly be thoroughly superintended. In general hospitals large wards are indispensable, be the block plan what it may, whether the ward supervision be by hospital serjeants, ward-masters, or nurses. Large wards, independently of their superior sanitary advantages, can be much more economically and efficiently overlooked than small wards.

If the pavilions are arranged in square like the Vincennes and Yarmouth hospitals, there should be no more than two stories in each pavilion, with a large wide roomy staircase extending through and through the building, and ventilated through the roof, as in the Vincennes plan. The nurses' rooms and sculleries would be next the staircase, and the bath, water-closet, &c. at the far end of the ward, as in Fig. 83.

Proposed Woolwich Hospital—A somewhat different arrangement of pavilions has been adopted in the proposed new hospital for Woolwich garrison. In this case the form and inclination of the only convenient available ground has led to an arrangement of parts different from any of the examples we have cited. The number of beds required is 650, not much more than in the Lariboisière plan; but the adoption of that plan would have required that the whole area covered by the buildings should be on a level. The Woolwich site does not comply with this condition, and it has therefore been necessary to adapt the plan to the ground in such manner as to secure, to the largest extent possible, the requisite sanitary conditions combined with facility of administration and discipline. In doing so, a great administrative advantage over the Lariboisière plan has been obtained, by arranging the pavilions double, end to end, as in the Vincennes plan, so that the same superintendence will answer for double the number of beds it would do for in Lariboisière hospital. These double pavilions are strung together by a corridor 14 feet high, having a terrace above.

Woolwich.—Proposed Hospital for 650 Patients.

Fig. 92.—Basement Plan.

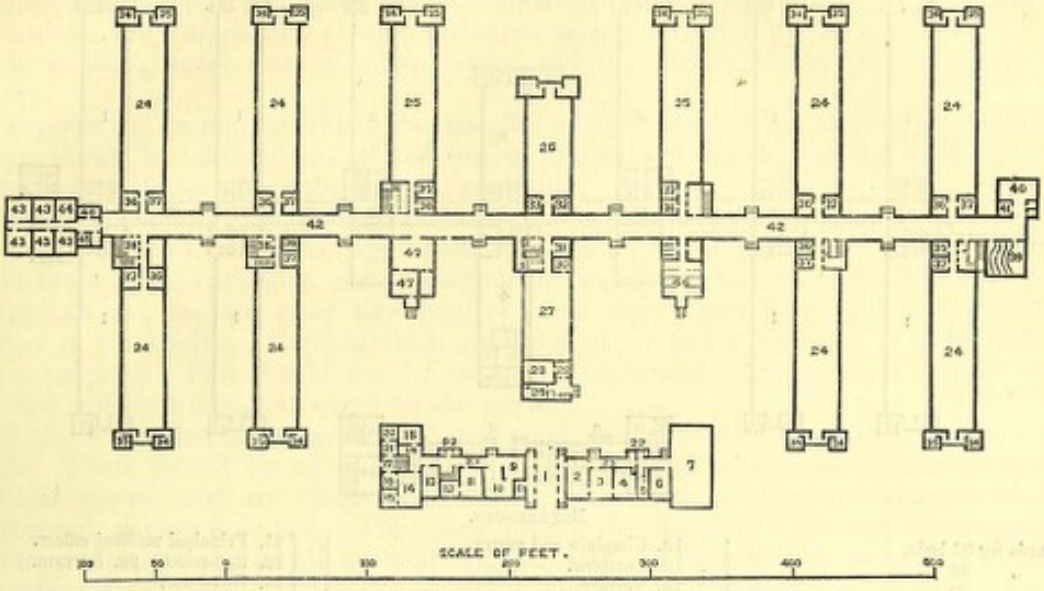


References.

1. Orderlies' stairs.
2. Lavatories, stairs, and waterclosets.
3. Corridor.
4. Coal stores.
5. Officers' kitchens.
6. Orderlies' dining room.
7. Passage.
8. Staircase.
9. Vegetable stores.
10. Wine cellar.
11. Beer cellar.
12. Kitchen.
13. Scullery.
14. Provision stores.
15. Boiler-house.
16. Staircase.
17. Coal stores.
18. Corridor.
19. Bell-room.
20. Areas under wards.
21. Dispensary.
22. Drug store.
23. Pack store.
24. Non-commissioned officers' quarters.
25. Lobbies.
26. Stores.
27. Board room.
28. Clerk's room.
29. Waiting room.
30. Museum.
31. Officers' library.
32. Itch ward.
33. Dead-house.
34. Post-mortem room.

Fig. 92 shows the ground plan of the hospital. The whole structure is raised on basements, partly to insulate the wards from the ground, partly to conform to the levels. Advantage is taken of the difference of level to obtain store rooms and offices of various kinds in the basements, but not under the ground level. The kitchen and provision stores, cellars, &c., are in partial basements in the centre of the establishment, as shown in the basement plan. These offices, as well as the dispensary, are all connected with a basement corridor running the whole length of the hospital. This corridor is to be devoted entirely to the carrying service of the hospital. Everything required for the wards, bedding, clothing, diets, medicines, fuel, will be transported on rails to lifts at each pavilion, by means of which everything necessary for the sick will arrive at the ward doors without passing by the stairs or corridors used by the sick or their attendants. In like manner, all refuse from the ward, such as remains of diets, dirty dishes, and utensils, will be sent down the lifts, and carried direct to the kitchen scullery. Dust, cinders, and sweepings will be passed down separate shoots into closed boxes in the basement corridor, whence they will be removed to the end of the pavilion, and discharged once or twice a day into a dust cart. Each pavilion has also a shoot for foul linen, opening into a small closet in the basement, from which the linen will be removed in the course of each day, and carted off to the laundry. In the basement of the right-hand pavilion, but above the level of the ground, there is a board room, museum, and medical officers' library, with separate entrances. Part of a pavilion on the same level is devoted to itch cases, with separate baths, &c., should such accommodation be necessary. The dead house and post-mortem rooms are detached, at the right-hand end of the corridor.

Fig. 93.—Ground Plan.



REFERENCES.

1. Carriage and foot entrance.
2. Waiting room.
3. Examination room.
4. Surgeon.
5. Linen nurse.
6. Mending room.
7. Clean linen store.
8. Porter.
9. Governor.
10. Clerk.
11. Principal medical officer.
12. Clerk.
13. Registrar.
14. Orderly medical officer.
15. Bedroom.
16. Kitchen.
17. Orderlies' stairs.
18. Paymaster.
19. Clerk.
20. Non-commissioned officer.
21. " "
22. Lavatories, waterclosets, &c.
23. Corridor.
24. Ward for 32 beds.
25. " 28 "
26. Day room.
27. Library.
28. Purveyor and clerk.
29. Steward.
30. Librarian.
31. Non-commissioned officers' quarter.
32. " " "
33. " " "
34. Lavatory and bath.
35. Waterclosets, &c.
36. Scullery.
37. Nurse.
38. Staircases.
39. Operating theatre.
40. Operating ward.
41. Nurse scullery.
42. Corridor.
43. Lunatic wards.
44. Ward master.
45. Padded room.
Lifts in corridor by scullieries.
46. Baths.
47. Pharmacy, &c.

The ground floor plan, Fig. 93, is devoted to sick wards, except the apartment over the kitchen, which is intended for a library, and the room opposite to it, which is a day room, having access at the end by a porch to the exercising grounds. There are on this floor seven 32 bed wards, and three 28 bed wards. One of these 28 bed wards at the left-hand end of the corridor is a prison ward, and has a sentry's room, with access from the outside, to prevent disturbance in changing guard. There are a set of lunatic wards at the same end of the corridor. At the opposite or right-hand end is the operating theatre, with an operation ward attached to it. On either side of the library are the pharmacy and general baths. Each ward is a unit similar to Fig. 83.

The ground plan of the administration offices, the basement of which is shown in the basement plan, contains office rooms for the governor, principal medical officer, registrar, orderly medical officer, paymaster, &c.; the waiting room and surgeon's room, also the clean linen store and mending room.

The first floor plan, Fig. 94, shows eight 32 bed wards, two 28 bed wards, one 20 bed ward, and two small wards at the right-hand end of the corridor for offensive cases. The chapel is also on this floor, over the library and kitchen. The communication between the wards on this floor is by an open terrace over the corridor, as in the Lariboisière plan, so as not to interrupt the free movement of the air between the pavilions.

The corresponding floor of the administrative buildings contains quarters for the governor and other officers, and also quarters for the nurses and their superintendent. This last part of the establishment has a separate entrance.

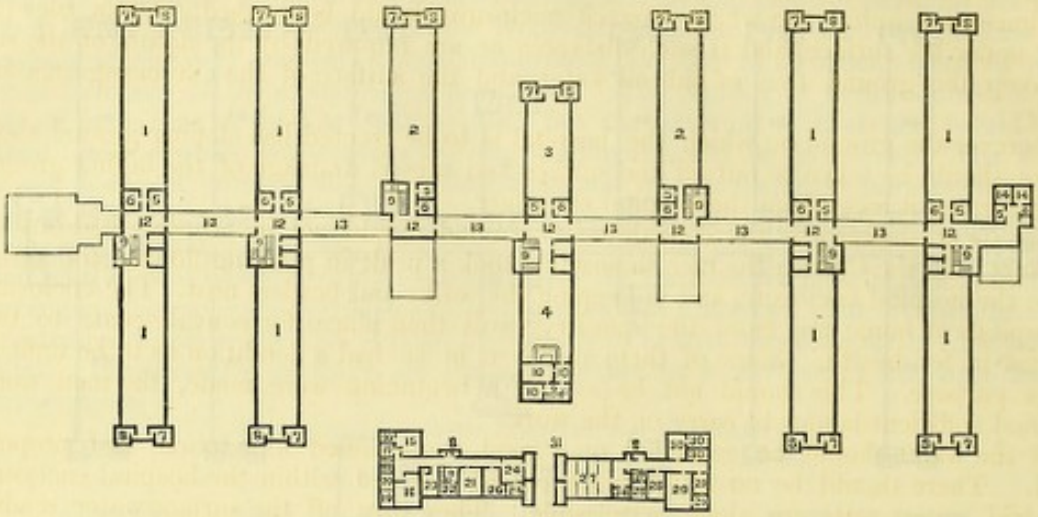
There is another floor in the administration intended for orderlies' sleeping rooms.

There are only two floors of wards. Each ward is to be 14 feet high, and the pavilions will be 64 feet apart.

The axes of the pavilions lie north and south, a little inclined to the east, and the wards will receive sunlight on both sides during the day.

In all general hospitals it will be necessary to provide a few small wards for cases requiring segregation. Such cases are chiefly those of persons affected with offensive sores and ulcerations, or noisy cases arising during fevers, head diseases, or fits of intemperance or of insanity. The noisy cases should be at a distance from any sick

Fig. 94.—First Floor Plan.



References.

1. Wards for 32 beds.
2. „ 28 „
3. „ 20 „
4. Chapel.
5. Nurse.
6. Scullery.
7. Lavatory and bath.
8. Waterclosets, &c.
9. Stairs.
10. Chaplain and vestry.
12. Corridor.
13. Terrace.
14. Offensive wards.

Lifts in corridors by scullories.

15. Captain of orderlies.
16. Bed-room. 17. Servant.
18. Dispenser.
19. Bedroom. 20. Servant.
21. Principal medical officer.
22. Bed-room. 23. Servant.
24. Governor.
25. Bed-room. 26. Servant.
27. Nurses' dormitories.
28. Nurses' rooms.
29. Sick nurses.
30. Superintendent of nurses.
31. Bath.

they could disturb, and each one such case should be in a small ward to himself. When they are the result of fever they should not be placed close to the offensive wards. The other cases merely require separation. The ward for offensive cases should always have a separate scullery, bath, water-closet, and lavatory, so that their utensils may be kept and cleansed separately from those of other patients.

Dangerous operations and accidents also sometimes require segregation.

All cases requiring segregation, require separate nursing, and a suitable nurses' quarter would have to be appropriated to them. It is undesirable to attach a small ward to every large ward, as in the Lariboisière plan, for the reason already stated.

These small wards for one or two cases each should never have less than 2,000 cubic feet of contents. This space is required on account of the nature of the cases, and the difficulty of ventilating a smaller room sufficiently.

In the Malta hospital plan the small wards are provided at the north-eastern end of the line. Two of them are in the separate building at the end of the corridor. Two, for noisy cases, are under the operating theatre, and there are two in one of the flats of the shorter pavilion next the small end block. A somewhat similar arrangement of these wards has been adopted in the Woolwich plan.

In all hospitals, as already stated, except those of the smallest size, a prisoners' ward should be provided, distinct and separate from the other wards, and in such a position that the other hospital sick cannot be disturbed at the change of guard. In large garrisons it is better to attach the accommodation for sick prisoners to the military prison if there be one.

There are certain requisites of a general hospital which should have no place on its block plan, for they should be always at a sufficient distance not to injure the purity of the atmosphere outside the hospital. These buildings are the bakehouse, laundry, and gas house, if there be one. These should always be away from the hospital, and not in the direction from which the prevailing winds blow.

There should be no ashpit. All the hospital refuse should be removed daily.

We are desirous that it should be distinctly understood that the plans of general hospitals we have given are only intended as illustrations of the embodiment of fundamental principles. It is highly important that every architect should be left to unfettered choice in his arrangements, provided these principles be clearly kept in view.

4.—General Principles of Construction for all Hospitals.

There are certain other principles in regard to all hospitals which should also be considered.

Preparation of Site.—The first thing to be done, after selecting a proper site, is to prepare the ground by thorough drainage wherever it is required. This drainage should

include the whole area within the hospital enclosure. If the building be intended for a regimental hospital, the whole barrack enclosure should be drained. Drain tiles laid 4 feet under the surface, and at such distances as are required by the nature of the soil, will keep the ground free of subsoil water, and the surface of the exercising area firm and dry.

Wherever the ground on which the hospital is to be erected has sloping ground above it, care should be taken to cut off the surface and subsoil drainage of the higher ground, and to convey it away from the hospital enclosure.

There is no reason why the convalescents' ground should not be properly laid out and well kept. In the Crimea the men themselves took a pride in planting flowers and shrubs within the hospital enclosure, and in keeping the walks and borders neat. The enclosures of hospitals at home are more like poultry yards than places for convalescents to take exercise in for health. Some of them are even in so bad a condition as to be unfit for such a purpose. This should not be so. If a beginning were made, the men would soon find sufficient labour to carry on the work.

All the walks should be gravelled on a good, well-drained foundation, and properly rolled. There should be no rough pitch paving allowed within the hospital enclosure. Well laid square setts are alone permissible. They turn off the surface water readily, which rough paving does not. The space round the hospital walls and footpaths used for communications should all be well flagged, and the flags should be sloped to throw the surface water coming from the buildings away from the walls into carefully formed smooth guttering, to be conveyed to trapped gulleys communicating with the general system of hospital drainage.

Enclosure.—The hospital should never be enclosed in high walls, except the ground be large and the walls sufficiently removed from the buildings to prevent stagnation of air. Otherwise, dwarf walls and high railings are better.

Basements.—There should be no sunk basement under the wards, except to isolate them from the soil, and such basement should be arched, well ventilated, and drained, and should not communicate with the wards. This precaution is necessary to cut off damp and malaria. There may be basements in the administration provided they be dry and well ventilated.

Number of Stories.—No hospital should be above two stories high, for reasons already stated.

Approaches to Wards.—In all hospitals where the wards are placed end to end there should be a wide roomy passage, going right through the building with a door front and back, and a good wide staircase also occupying the whole breadth of the building. All passages and stairs should of course bear in their dimensions a proper proportion to the size of the building. Staircases should generally be of well form, and should have ventilating lanterns or skylights above, so that a free circulation of air may at all times pass upwards between the two divisions of the pavilion or hospital.

All the approaches to the wards should be fire-proof and covered with wood. Where the access is by corridors these should also be incombustible, the floors being covered with wood or tiles.

Simplicity of Construction.—Simplicity in the internal construction and arrangement of all hospitals is essentially necessary. There should be plenty of light everywhere, and the atmosphere should move easily throughout the building.

Useless ornament is quite out of place in a hospital. It costs money. It is liable to damage. It harbours dust, and requires extra time in cleaning. But time is everything for the sick. The less of it spent in dusting ledges and reaching cornices where dust settles, in polishing or handling with precaution things which must be handled at all periods every day, the more time will there be for the real care of the sick, and for the real cleanliness of the helpless among them, as well as of the ward itself. Everything in a military hospital should be strong and simple. There should be no luxury of contrivances. Orderlies, patients, and nurses will have to do with remote hospitals, and occasionally with war hospitals, where these things are unobtainable. Simplicity, and real unexaggerated comfort are what are required. A sick soldier's idea of hospital comfort is not that of a civilian, and it is important that this distinction should be observed. The soldier passes from the ranks to the hospital, from which he again passes to the ranks should he survive and be fit for duty. Certain things are nevertheless necessary for both health and economy, but they are not luxuries.

Ceilings and Walls.—All wards in permanent hospitals should have ceilings. The roof space should not be taken in and counted as ward space.

The ward walls and ceilings of all hospitals should consist of white cement, highly polished. Grey coloured cements give the hospital a dirty appearance and are not suitable for the object in view. They should not be used. A highly polished surface is absolutely necessary in all cemented walls. The object is to have surfaces which will absorb sick miasms as little as possible, and which admit of being thoroughly cleansed with soap and water. A brick or plaster wall, limewashed frequently, is better than an unpolished cement wall, unless it be also frequently limewashed.

Floors.—The ward floors should be of some hard durable non-absorbent wood. Oak floors are the most durable. Teak would also answer. Pine wood is too soft and never makes anything but an imperfect floor. Hard wood floors are the cheapest in the end. They should be well seasoned, and carefully laid, with the joints impervious to moisture. They require polishing with wax or lacquer.

Pine floors generally require dry rubbing to keep them clean. It is a laborious and unsatisfactory process. Washing is inadmissible unless under the orders of the medical officer. Pine floors may be waxed or lacquered, but an easy and economical method of keeping a good surface on hospital floors is still a desideratum.

The "*frottage*" of the French hospital is too laborious. The "*laque lustre*" of the Berlin hospitals is much easier to keep clean, but it is not durable enough. A simpler method than these, though not so good as either, it to rub the floor with bees-wax dissolved in turpentine, allowing it to sink into the wood; then to wipe off the superfluous wax and to rub the floor with a cloth, afterwards with a brush, and then to polish by brisk rubbing with a duster. This process requires to be repeated twice or thrice a week to keep the floor in good condition, but it is not laborious.

The space between the flooring of the ward above and the ceiling of the ward below should be filled with some substance, to prevent noise passing from ward to ward; but no decomposable matter should be used for the purpose. Incombustible floors if properly made will prevent the transmission of noise.

Doors.—Doors opening into or out of wards should be of hard polished wood. The upper half of the doors should be of glass, except in lunatic, noisy, and other small wards. Half-glass doors afford great facilities for oversight and discipline. Lunatic and noisy wards should have a properly-secured opening, through which they can be inspected without opening the doors.

Windows.—Ward windows should be of plate glass not less than one-eighth of an inch thick. It is necessary in the construction to provide a large extent of window surface, which with thin glass windows would occasion much loss of heat and too rapid alterations of temperature. But it is possible to secure both objects, namely, light and warmth, by the expedient mentioned.

Ventilation.—A well constructed ward can always be ventilated by a proper use of the windows; but where wards are limited in *height*, which is an important element in ward ventilation, ventilating shafts and inlets should be provided in the walls.

The number of shafts and inlets should depend on the number of beds. One shaft and one inlet for every four or five beds would be sufficient.

Perhaps the best arrangement of these shafts would be to carry one up in the wall from the ceiling over the middle of each alternate wall space, and to place the inlet for fresh air close to the ceiling in each alternate wall space, in such manner that there should be a shaft and inlet opposite each other between each opposite pair of beds. There should be neither shafts nor inlets in the wall immediately over the fire-places.

The aggregate area of the shafts should be equal to at least 18 square inches per bed for the upper floor wards and 16 square inches per bed for the lower floor wards. The aggregate area of the inlets to be equal to at least 12 square inches per bed.

The principle on which these shafts and inlets ought to be constructed has been already described in the first part of this report. Sherringham's ventilating inlets are well suited for this purpose.

Warming.—The wards may be warmed by a ventilating fire-grate on the same principle as that already described, placed either at the side or in the middle of the ward: in the latter case with the flues carried under the floor. One or two ventilating fire-grates will be required, according to the size of the ward. If placed in the side, the grate should be in the space under a ward window, and the flue carried up in the next wall space. These grates would require certain modifications to prevent the radiant heat falling too strongly on the adjacent beds, but this could easily be done.

Water.—Water should be laid on hot and cold all over every hospital; to the ablution rooms, bath rooms, sculleries, and kitchens. Water tanks should never be placed under the same roof as the hospital. All water tanks should be sufficiently large and placed at a sufficient elevation to distribute water abundantly and by pressure over the whole building. The tanks should always be covered.

Drainage.—It is a cardinal principle in hospital drainage that no drain should pass under any of the buildings used for sick, or for officers or attendants. All lines of drainage should be carried clear of the external walls, and, if possible, entirely clear of the space between the pavilions. No sink pipes nor outlet pipes for waste water should be *directly* connected with any drain or sewer without free ventilation of the pipe itself. No trapping without ventilation affords an adequate protection against sewer gases passing up such pipes. They should either open directly in the open air, five or six inches over a trapped gulley grate, or over the open end of a trapped branch of a rain-water pipe connected with the line of drainage, or they should be connected with a pipe trapped below and carried up to the roof and left open. All drains should be ventilated at some distance from the hospital walls. By placing a perforated box filled with charcoal over the ventilating opening of the drain or pipe, any chance of the escape of noxious effluvia will be avoided.

Water-closets.—The water-closet soil pans should be of the best construction, the water traps having easy curves, and each soil pipe should be ventilated by a small tube carried from it into the open air, in a position where any gas escaping from it cannot enter the building.

The supply of water should be abundant, and the flushing pipe of sufficient diameter to wash out the contents of the pan with force. Supplying water to soil pans by driblets from small pipes is worse than useless.

The closets may be made self-acting by means of the door or seat, but this should never be considered as a reason for dispensing with constant supervision of all the water-closet arrangements by the ward-master or assistant ward-master. Hard wood seats well polished are both the cleanest and most economical for use.

It would be a cleanly and wholesome expedient to cover the walls of water-closets with white glazed tiles, bedded in cement, or to line them with white glazed bricks.

Urinals.—A glazed earthenware urinal, constructed on the principles already recommended for barrack room urinals, should be placed in a compartment with the closets.

Sinks.—In the same compartment, as already mentioned, should be placed a white earthenware sink, with a water tap over it for emptying bed pans. Its construction should be similar to that of a water-closet soil pan. The pipe from it should be connected with the sewer, and ventilated like the water-closet soil pipe.

Corridors.—Connecting corridors should consist of piers and arches. They should be light and well ventilated, as they are to be used by convalescents for exercising in wet or cold weather. They should be provided with means of warming in winter.

Kitchens.—In small hospitals a cooking range, such as Flavell's or the one by Captain Marsh, R.E., containing ovens and boiler, will afford sufficient facilities for preparing diets.

In the largest class of general hospitals a proper cooking range, sufficient for boiling, stewing, roasting, baking, and preparing hot water, with a few gas circles for cooking small quantities, would have to be planned to meet the specialties of each case. These cooking operations are required by the new regulations as to hospital diets.

The kitchen should always be very light and well ventilated. It should be separate from, but easily accessible under cover, from the hospital. In large general hospitals it might be advantageously connected by an arched basement with all pavilions, as is proposed to be done at Woolwich.

Lifts and Shoots.—In all large two-story hospitals there should be lifts to convey the diets and other things to the different flats, and shoots for removing dust and foul linen. Much time and attendance would be spared by such an arrangement. The lift should pass directly up to the roof and be ventilated above, and it should not open directly into any sick ward. The dust shoot and foul linen shoot should open above on the corridor or passage, and be carried up to a louvred opening above the roof for ventilation, and each should terminate below in the basement in a small light and well-ventilated closet, with a door through which the contents could be easily removed.

Proper lifts and shoots, together with hot and cold water laid all over a hospital, will be the means of saving one orderly's duty for each ward of 30 or 32 beds.

Wash-house.—The hospital wash-house should be provided with fixed tubs. Two would in any case be required, even for the smallest hospitals. There should be means of obtaining hot and cold water to these tubs, from taps, and there should be drainage plugs to allow the water to escape into a drain outside the building. All large hospitals should have a laundry with steam apparatus, &c., at a proper distance from the hospital.

If the laundry is at some distance from the hospital, a small wash-house for bandages, &c. should be connected with the hospital itself.

The cubic contents and superficial area per washer allowed in hospital laundries should be greater than in barrack laundries, because hospital washing is apt to be more prejudicial to health. There should be plenty of light, and the ventilation should be as perfect as possible.

Dead House.—The hospital dead house should have a convenient table, water tap, sink, and proper drainage. It should be well lighted and ventilated, and sufficiently removed from the hospital to permit the air to circulate freely between the buildings. It should be conveniently placed, both for receiving the dead from the wards, and for their removal for interment. The dead house should not be overlooked by the windows of any place occupied or traversed by sick. It should be drained, supplied with water and a sink, and also with a proper table and other appliances for post-mortem examinations.

5.—Temporary Hospitals.

1. *Tents, Marquees, and Huts.*

Temporary hospital accommodation consists of tents and marquees, to which are sometimes added wooden huts of various sizes and construction.

The regulation tent when erected is a cone 14 feet in diameter and 10 feet high, and has about 512 cubic feet of contents. It has no adequate means of ventilation, and the atmosphere in it becomes very offensive after a brief occupation by three or four sick.

The common marquee when erected forms a species of hut, with double walls of linen. The sloping roof is also double. It is 33 feet long, 12 feet broad, 5 feet high to the top of the side walls, and the height from the ground to the ridge is about 12 feet.

The cubic contents are about 3,366 feet.

Marquees possess very obvious advantages over tents as temporary hospitals. They have more than five times the cubic contents, they have double walls, which afford protection both from heat and cold, and the sides can be raised all round to any extent or in any direction to suit sun and wind.

The chief removable defect in hospital tents and marquees is in the ventilation. The cubic contents are so limited that nothing short of continual renewal of the air will keep this kind of hospital accommodation healthy. The best plan for supplying fresh air is by a sufficient number of openings round the top of the poles.

The French hospital tents are ventilated in this way. The apex of the tent is an open metal ring, eight or 10 inches in diameter, by which the tent is suspended by straps to the cover, fastened to the top of the tent-pole. The tent-pole passes through the middle of the ring, and the ventilation takes place round the pole, while the cover prevents rain falling in. The distance between the edge of the ring and the cover admits of being varied according to the weather.

This or any similar contrivance would be sufficient to secure proper ventilation.

Much may be done in preserving purity of the air in this class of hospitals by a proper selection of ground. A porous dry surface, removed as far as practicable from local sources of malaria, should, of course, always be selected on which to pitch hospital marquees. A trench a foot or 18 inches deep carried round the marquee, with a proper outlet, will be sufficient to isolate the area on which the marquee stands, and to keep it dry. The earth should be formed into a wall *outside* the trench. Hospital marquees should frequently shift ground, especially if fever be prevalent.

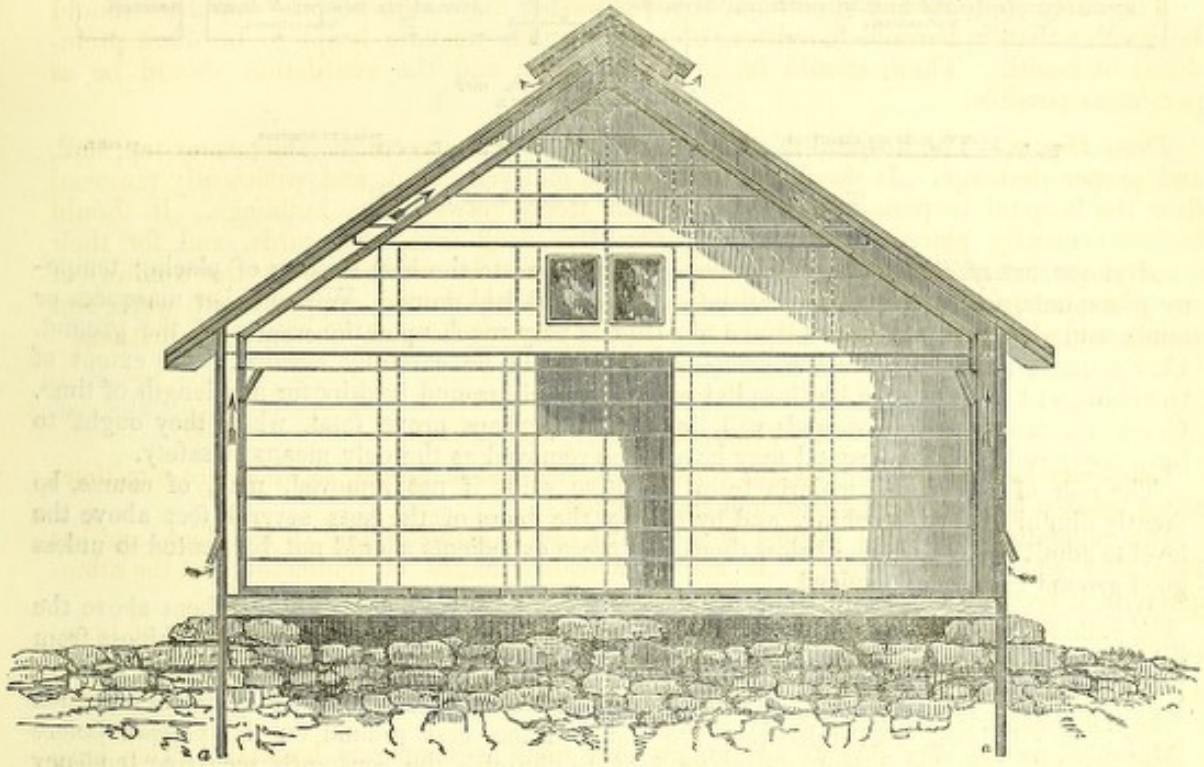
Hospital Huts.—Hospital huts not being moveable structures like marquees, require more care in selecting and preparing the ground, and in other respects the principles already laid down in regard to the construction of permanent hospitals are more or less applicable to them.

In warm climates, huts should have verandahs towards the sun, sufficient to shade the side walls, which in that case might be made single instead of double, but the roofs should always be double, with ventilators above and below between the outer and inner boarding.

The hut should be provided with a porch at each end. One of those porches could be used for the night chair, with means of removing it from without, and it would be a great convenience to attach a small scullery to the other porch, and if possible a sleeping place for the assistant ward-master.

Fig. 95 is a cross section of a hut intended for hospital use, constructed out of ordinary scantling, showing the floor raised above the ground: double walls and roof, and the means of ventilation. Such huts have been used during very hot weather. Their temperature has not been higher than that of the air outside in the shade, and during a rigorous winter they were sufficiently warm. The air within them was always pure, even during hot weather.

Fig. 95.

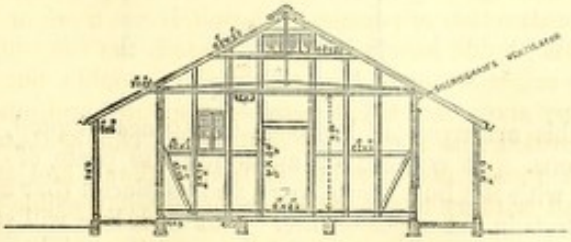


Cross Section showing ventilation under the floor, and up the side and roof. *a* Holding-down bolts.

The same principles of construction more perfectly adapted to the object are shown in Fig. 96, which exhibits the plan, elevation, and section of wooden sanitarium huts intended to have been erected for invalids from the Chinese force, at Wynberg, Cape of Good Hope. The floors are raised above the ground. The roofs are double. There is ridge outlet for ventilation the whole length of each hut. Sherringham's inlets are used along the eaves. Each hut is a separate ward for 20 beds, and is provided with water-closets and ablution room, and an assistant ward-master's, or orderly's room. Every couple of huts has a scullery and bath, and the whole are connected together by an open verandah surrounding the two huts. Each pair of huts is a separate hospital with its offices complete, and the pavilions were to be arranged in the best manner of which the ground admitted. Although the huts are of wood, each bed would have 937 cubic feet of space, an amount which is necessary for the climate, and the whole establishment was intended for accommodating 400 invalids.

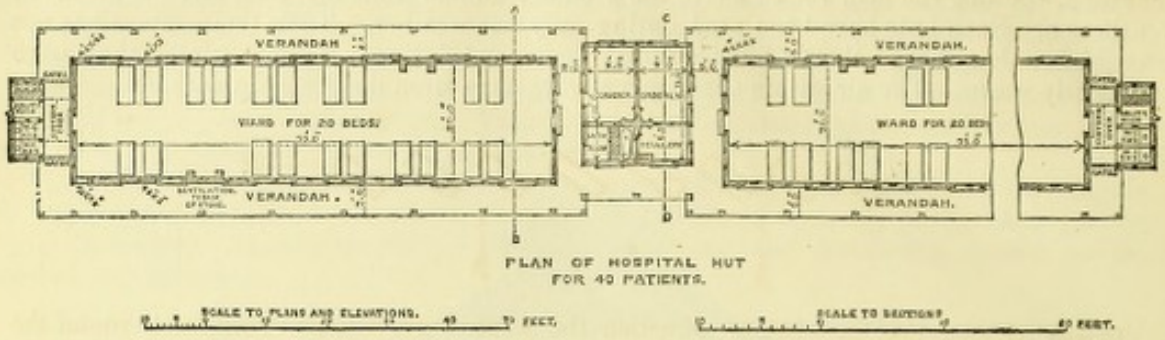
Fig. 96.—Proposed Hut Sanitarium at Wynberg, Cape of Good Hope.

Elevation of Hospital Hut for 40 Patients.



Section through Ward and Verandah on line A B.

Fig. 96—continued.



The Bath at × to be sunk half its depth below the floor.

Arrangement of Temporary Hospitals.—With regard to the best manner of placing temporary hospitals, no more than general principles can be laid down. Where either marquees or huts are used, the arrangement adopted will depend very much upon the nature of the ground. Clay ground, retentive or other damp ground, should be carefully avoided. No extent of trenching will keep a large hut hospital placed on such ground healthy for any length of time. Cases of sickness and of wounds will linger, and perhaps prove fatal, when they ought to have recovered, and the hospital may have to be removed as the only means of safety.

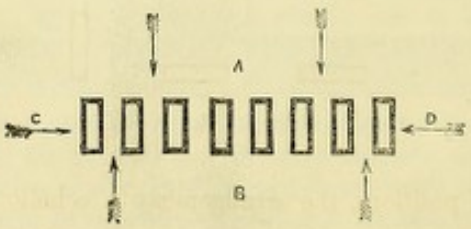
The risk of damp and malaria from retentive soils, if not removed, may, of course, be greatly diminished by trenching, and by raising the floors of the huts several feet above the level to admit free ventilation below them, but these expedients should not be trusted to unless good ground cannot be obtained.

When marquees or bell tents are used, it is, of course, impossible to raise them above the ground. Boarded floors, where they can be obtained, diminish the risk of unhealthiness from the soil, but frequent removal to fresh ground would in any case be an advantage. A large hospital formed of ventilated bell tents with three sick in each, belonging to the French army in the Crimea, although occupying some of the best ground on the plateau before Sebastopol, had to be shifted once a fortnight, to diminish the constantly recurring tendency to fever among the sick.

In arranging the different parts of a temporary hospital, the main principle to be kept in view is to have sufficient surface for the hospital, to keep the marquees or huts well apart, and so to place them as to have the full benefit of prevailing winds, together with sufficient facilities for administration and discipline.

A common manner of arranging such a hospital is represented in Fig. 97, in which the huts or marquees are erected side by side, with about a hut's breadth between them. Such an arrangement brings the various parts within narrow compass, and it might be adopted on elevated positions, especially on ridges where there is plenty of movement in the air. On low ground, and indeed on all but exposed situations, it should be avoided, on account of the difficulty of ventilation. The winds blowing from the directions A and B are the only winds which would sufficiently ventilate such a hospital. Any movement of the air from the points C and D, would be arrested by the end huts, and the effluvia from the huts would be carried from one to the other along the line. Air moving from all intermediate points would be more or less interrupted, and free external ventilation would be interfered with.

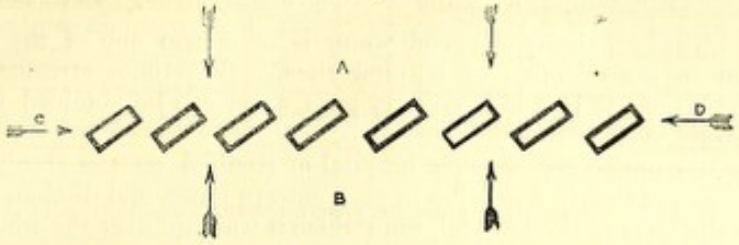
Fig. 97.



A modification of this arrangement has been sometimes adopted, which to a certain extent, obviates these objections. It consists of arranging the parts of the hospital in two lines instead of in one line, with the huts more apart, and so placed that a hut in one line is opposite a space between two huts in the opposite line. But each line will still be subject to the same condition that the wind can only blow beneficially upon it at right angles to its direction.

If the hospital be arranged in echellon, as in Fig. 98, the advantage obtained in external ventilation becomes immediately apparent.

Fig. 98.

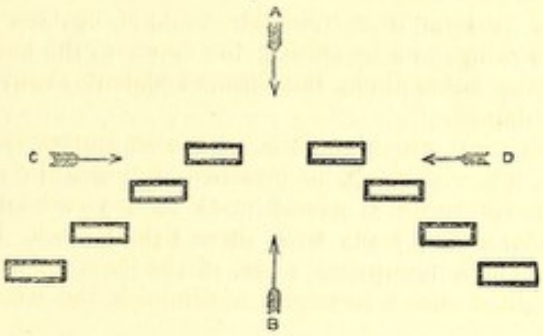


It will be seen that in whatever direction the wind blows, it must sweep freely round the marquees or huts. The line of the hospital is of course longer, but the advantage to the sick by the arrangement more than compensates the greater distance to be traversed in administering the hospital.

This plan illustrates one of the best arrangements for temporary hospitals. When it is desirable to obtain the full benefit of prevailing winds the sides A or B should face them.

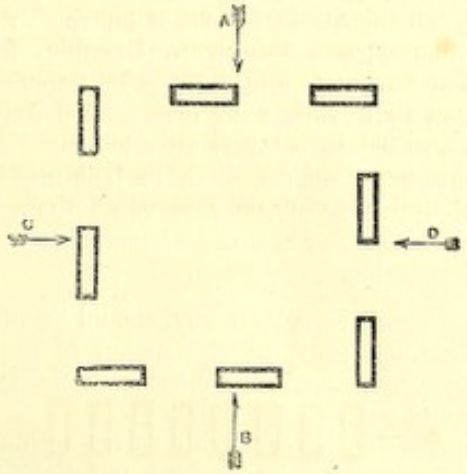
If the ground will not admit of such a length of line, the huts or marquees may be arranged in double echellon, the lines being kept at a sufficient distance from each other, or the line may be bent as in Fig. 99.

Fig. 99.



It is possible to arrange the marquees or huts in square, so as to enclose a space within, and yet to retain the advantages of full external ventilation. This is shown in Fig. 100. This form of hospital would be well adapted for huts in certain positions. By running a light wooden railing between the huts the inner square would be available as an exercising ground for convalescents.

Fig. 100.



Except in very exposed positions, the arrangement in echellon, Fig. 98, would be the best for free external ventilation.

Warming.—Probably wherever wooden hospital huts are erected it will be possible to build fire-places, which ought always to be done when practicable. Open fire-places are very much better than stoves. It requires great care, especially with the latter, to prevent the hut becoming over-heated when the fire is burning, and the temperature from falling too much when the fire is low.

Kitchens.—A little ingenuity exercised in planning temporary hospital kitchens, to economize fuel, to cook the diets properly, and at the same time to admit of any materials at hand being used in the construction of the cooking places, would save both suffering and life. For hut hospitals in permanent camps one of the cooking ranges already described might be put up.

Water Supply.—The proximity of good water is of course one of the elements to be taken into account in the selection of hospital sites. Sometimes streams or springs are available. Not unfrequently in a hilly country pure water can be obtained from wet ground at the outcrop of strata, &c.

The supply for the temporary wooden hospital of Renkioi on the Dardanelles was conducted from a distance of nearly five miles in earthenware pipes, and discharged into a cistern of masonry above the level of the hospital, from which it was laid over the whole establishment in iron pipes.

Where water free of suspended matter cannot be obtained, the supply should be passed through a filtering bed of sand, gravel, and charcoal before being distributed. In any case the possibility of obtaining pure water ought to be as much an element in selecting a position for a temporary hospital as the possibility of obtaining any other class of supplies.

Latrines.—Latrines, properly constructed, can be used for hospitals in fixed camps; but where the hospital is only for temporary use, the latrines can only be of a very primitive description, and no other arrangements are applicable to the state of the case. They consist simply of pits four or five feet deep, seated over, and protected by any convenient thing that may be at hand. One or two simple precautions are requisite to prevent injury to health from them.

The pit should expose as small a surface and should be as deep as possible. It should be dug in dry ground, away from the source supplying water to the hospital or camp. It should be on the side of the hospital opposite that from which the prevailing winds blow, at the greatest distance which the medical officer considers safe, and every night at sun-down a stratum of earth about a foot deep should be thrown over its contents. Charcoal dust, if obtainable, would be much better, as an inch or two of it would form sufficient covering, and the latrine could be longer used. If any obstacle, such as a wall or a mound of earth of sufficient height, intervene between the hospital and the latrine, without adding an obstacle to facility of access, which is indispensable, so much the better.

2. *Buildings occupied as Temporary Hospitals.*

Selection of Buildings.—According to the new Medical Regulations, buildings to be taken possession of for hospitals must be examined and approved by a sanitary officer. This procedure will render the execution of certain sanitary works necessary. It is impossible, of course, to predict what these works may be; all we can do is to state generally the principles on which the improvements should be carried out.

The first thing to do is to avoid damp buildings anywhere, but especially in close, unventilated, or filthy situations. All we have said on the subject of sites for barracks and hospitals, not only holds good with reference to buildings for temporary occupation, but considering the great difficulties which must always be experienced in providing accommodation suitable for sick men in buildings not originally constructed for hospitals, everything accessory should be only the more scrupulously attended to.

Better place the sick anywhere, almost, than in buildings imperfectly drained or without drainage, or without sufficient means of external ventilation. Suitable buildings, in a dry position, away from any nuisances, or sources of malaria which do not admit of immediate removal, are therefore indispensable.

Drainage.—The drainage arrangements, if any, should be carefully examined and rectified, the drains cleansed, repaired, and provided with means of flushing out their contents. All communication between the drains and the interior of the buildings should be cut off to obviate the risk of sewer gases entering the buildings.

As a temporary expedient, water barrels, with valves opening over the heads of drains, may be adopted with great advantage for flushing out the drains when it is necessary to do so.

Cubic Contents.—Next, the cubic capacity of the apartments should be ascertained, and the accommodation allotted at the rate of 1,200 cubic feet per patient in temperate climates, and 1,500 in warm climates. Should it be found that available buildings will not accommodate the number of sick at these amounts of space, the surplus should be provided for, not by overcrowding, but by finding some temporary shelter for sick elsewhere. As a rule, sick would be safer in the open air, with any kind of cover overhead to protect them from

the weather, than if they were overcrowded into any buildings, however apparently suitable for hospitals.

The rule as to cubic space will not hold in churches and similar apartments with very high ceilings, because in such buildings it would be possible to have all the space above the beds. Thus, to give no more than 1,200 cubic feet per bed in a room 60 feet high, the beds would have to touch each other all over the floor, without even space for a pathway between them. Every sick man should have at least 80 square feet for his bed in temperate climates, and 100 square feet in warm climates, altogether apart from the amount of cubic space.

Ventilation.—The rooms or wards should next be ventilated. The plans of ventilation to be adopted will depend on the nature of the building. In large single apartments, having lofty windows extending nearly to the roof, the air may be sufficiently renewed by removing the upper portions of the windows and inserting temporary louvres into the openings, with their boards so placed as to throw the air towards the roof, and not down upon the sick. The means of ventilation must be more abundant the larger and loftier the hall. In large lofty buildings the air is always more or less stagnant, and stagnant air is foul air.

It is always desirable to have a stove, or some other similar contrivance for warming and drying the air in such buildings, which would at the same time materially facilitate the ventilation.

Where the windows of large apartments are not sufficiently numerous or suitable for affording sufficient ventilation, square ventilating tubes should be carried through the roof, at such points as may appear necessary to obtain a free circulation of air. The upper parts of the windows if fitted with wooden louvres will act as inlets for fresh air. In this case also the loftier the building, the larger should be the ventilating openings.

Large barns and similar buildings will generally be most easily ventilated along the ridge.

In buildings with several flats of rooms over each other, each room should be ventilated separately by shafts carried from the ceiling through the roof, and by inlets through the upper window-sashes or through the walls close to the ceiling.

All stair-cases should be ventilated by shafts carried through the roof, and by removing some of the window panes. All shafts and inlets should be provided with wooden valves to enable the medical officer to regulate the amount of ventilation.

The only test as to the sufficiency of ventilation that can be depended on is the state of the air, as regards freshness, or the contrary, by day and night when the buildings are occupied. This rule holds good both for quarters and hospitals. If the air is sensibly close and impure the ventilation is insufficient, and should be improved until the air is pure by day and night.

Additional windows should also be made where they are required. The more light the better.

Cleansing.—While these improvements are being carried out the buildings must undergo a thorough purification both within and without. The vicinity should be cleansed, all nuisances removed, and defects in the drainage and paving remedied. Any removable obstacle to free external ventilation should be taken away. The interior walls should be carefully scraped and washed with quicklime, the flooring cleansed and repaired. If there be no wooden flooring it should be provided wherever possible, and rooms should be thrown together by clearing away useless partitions. In all permanent buildings it will be necessary, after the first purification, frequently to renew the limewashing.

Drainage and Latrines.—If there are suitable drains, water latrines should be provided. They can be made of wood lined with pitch. They should be placed outside the buildings, having no direct communication with them. If there is no drainage, it should be provided, if practicable, with such materials and labour as can be had on the spot. All drains should be kept clear of the hospital buildings. They should have a good fall, and the inside should be as regular and smooth as possible. Pipe drains are the best where they can be obtained. Wooden box drains, carefully made, and lined inside with pitch, form a good temporary substitute, if means of daily flushing be at the same time provided for them. If drainage be impracticable, provision should be made for removing the latrine refuse once a day in boxes; charcoal powder for deodorizing will prevent nuisance from this process.

Water.—Water should be supplied on the principles already mentioned. It is always advisable to provide water filters where the quality of the supply cannot be depended on.

Besides the sanitary works required to adapt existing buildings for military hospitals, provision must be made for all the accessory accommodation, such as stores, sculleries, nurses'

quarters, kitchen, pharmacies, ward presses, &c. These should be of the same kind as the accommodation provided for specially constructed hospitals, and the same general principles should be kept in view in making the provision, but the extent of it must necessarily vary with the nature of the buildings, their number, distance, and relative position. A careful allotment of stores, offices, &c., must be made among the different buildings constituting the hospital, so that every requisite for the sick, whether as regards clothing, bedding, diets, medicine, medical comforts, and attendance, may be had with the utmost readiness. This can only be done by a careful examination into each individual case, and by the selection of such buildings, or parts of buildings, or by the erection of such temporary accommodation as may be found requisite.

It need hardly be stated that the preparation and adaptation of all existing buildings for hospitals, including all sanitary works, should be completed before any sick or wounded men are received into them, and that care should be taken not to impair the sanitary condition of the buildings while providing the accessory accommodation required.

April 1861. (Signed) JOHN SUTHERLAND.
W. H. BURRELL.
DOUGLAS GALTON.

The Right Honourable Lord Herbert,
Secretary of State for War.

APPENDIX.

COMMISSION FOR IMPROVING BARRACKS AND HOSPITALS.

Barrack Return, No. 1.

Name of Barrack . Number of Men .

Barrack Rooms.	Number of Men allowed in each room by the regulations.	Actual Number of Men in each Room.	Dimensions of Rooms.			Cubic feet per Room.	Cubic feet per Man.	Distance between Beds.	Distance from foot of one Bed to foot of opposite Bed.	Windows.			Doors.			Fire Places.			Remarks.
			Length.	Breadth.	Height.					Number.	Height.	Width.	Number.	Height.	Width.	Number.	Height of breast above floor.	Width.	
Total accommodation.																			
Guard Rooms.																			
Cells.																			

Barrack Return, No. 2.

Name of Barrack .

Are the rooms all appropriated according to the Schedule, if not, state what misappropriations there are, and their cause?		Describe the kitchen and means of cooking -	
Have you any vacant rooms?		Describe the cleaning rooms	
Describe means of ventilation		Describe the covered sheds for drill - -	
„ „ warming -		Describe the accommodation for pursuing trades	
„ „ lighting -		Describe the water supply -	
If any day room for men -		Describe the sewerage, state whether the sewers pass under buildings, and whether the drains are trapped - -	
„ school room - -			
„ library - -			
Number, position, and dimensions of store-rooms -		Describe the latrines, whether flushed, and the destination of the soil -	
Describe the lavatories -		State the amount of accommodation for sleeping-rooms, and mess for non-commissioned officers -	
„ „ baths - -			
„ „ laundry -			
What accommodation is there for married men, non-commissioned officers and soldiers whose wives are allowed in barracks? -		State any defects or deficiencies in the arrangement or construction of the buildings - -	
What number of women are accommodated in men's rooms, with the men?		Have you any suggestions as to improvements? -	

No. 3.

Name of Barrack .

1. Area of ground within the enclosure of the barrack		4. Site of barrack, whether relatively low or elevated	
2. Whether the enclosure is near to other buildings or isolated - - -		5. Nature of soil on which the barrack stands -	
3. Proximity of the barrack to a river, canal, or other water, and the distance therefrom - -		6. Whether the barrack is built of brick, stone, or wood - - -	
		7. Whether the buildings are of recent erection, or old, (give the date if possible)	

No. 4.—Hospital Return.

Name of Hospital . Number of Beds . Number of Wards .

Ward.	Dimensions.			Cubic contents.	Number of Beds.	Distance between Beds.	Distance from foot to foot of opposite Beds.	Cubic space per Bed.	Windows.			Doors.			Fire Places.			Remarks.
	Length.	Breadth.	Height.						Number.	Height.	Width.	Number.	Height.	Width.	Number.	Height of breast.	Width.	

Accommodation for serjeants		Describe water-closet or privy - - -	
Rooms for orderlies and hospital attendants - -		Describe provision stores -	
Describe means of ventilation		,, pack stores -	
,, ,, warming -		,, bedding and other stores - - -	
,, ,, lighting -		Describe dispensary -	
,, lavatories - -		State any defects or deficiences - - -	
,, means of bathing -		Amount of hospital accommodation for soldier's families - -	
,, laundry - -		State any suggestions as to improvements - -	
,, kitchen and means of cooking - -			
Describe means of water supply - - -			
Describe means of sewerage -			

No. 5.—Medical Return.

Name of Barrack . No. of Regiment .
Average monthly strength, from to .*
Total admissions for the same period . Total deaths .

* To include the period in charge of present Medical Officer.

Table for the same Period.

Diseases.	Admissions.	Deaths.
Fevers - - - -		
Cholera - - - -		
Dysentery - - - -		
Diarrhœa - - - -		
Ophthalmia - - -		
Furunculus - - -		
Phthisis - - - -		

General Observations on present Sanitary condition of Barracks and Hospitals, and its influence on prevailing disease.

TABLE A.

NUMBER of MEN in BARRACKS for every 50 Cubic Feet of Space from under 250 to above 600

NAME OF BARRACK.	Under 250 Cubic Feet.	250 to 300 Cubic Feet.	300 to 350 Cubic Feet.	350 to 400 Cubic Feet.	400 to 450 Cubic Feet.	450 to 500 Cubic Feet.	500 to 550 Cubic Feet.	550 to 600 Cubic Feet.	Over 600 Cubic Feet.
	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.
Wellington	..	..	..	..	308	746	245	55	..
Buckingham Palace Guard	..	..	..	..	..	44	..	..	..
St. George's	..	..	..	..	..	..	476	..	..
Hyde Park, Cavalry	..	..	..	..	34	438	33	..	..
„ „ Magazine	..	..	..	79	..	..	..	..	..
Kensington, New	..	..	..	..	..	..	182	60	..
Regent's Park	..	..	..	..	..	..	..	..	363
Portman Street	..	..	..	420	..	..	..	..	63
St. John's Wood	..	..	220	..	..	..	..	..	..
Tower	..	..	..	..	216	250	266	..	..
Croydon	..	..	..	196	..	264	..	..	..
Hounslow	..	..	..	..	..	232	..	..	..
Hampton Court	..	..	..	..	..	..	73	48	..
Windsor, Cavalry	..	..	..	..	120	171	..	..	..
„ Infantry	..	..	..	870	52	..	..	..	..
Chatham	106	1,542	936	108	..	..	..	8	..
Spur Battery	..	..	4	10	16	6	..	..	..
Brompton	..	..	414	705	192	182	156	46	30
St. Mary's Casemates	..	..	624	..	464	..	..	..	..
Upnor Castle	4	22	32	..	8	..	..	..	..
Woolwich, Barracks	..	..	591	1,150	516	68	1,300	..	.
„ Riding House Establishment	..	8	..	..	..	..	..	34	..
„ Royal Horse Infirmary	..	..	..	..	..	24	..	..	..
Portsmouth :—									
Fort Cumberland	600	21	..	..	..	..	..	..	..
Anglesey Barrack	..	..	..	..	..	954	..	..	..
Clarence	..	..	..	130	173	237	145	192	34
Cambridge	..	..	..	185	216	77	514	22	..
Colewort	..	..	238	..	..	..	..	..	..
Royal Engineers	..	..	..	..	33	..	..	66	..
Royal Artillery	..	..	..	24	51	52	30	28	..
Point Battery	..	..	..	..	..	80	..	..	..
Hilsea	..	..	..	..	..	150	..	..	..
Fort Monckton, Gosport	..	172	99	18	..	..	..	..	..
Blockhouse Fort	..	..	..	..	..	..	..	..	92
Haslar	..	..	..	..	..	190	104	52	..
Winchester	..	..	562	936	..	168	..	..	..
Dover Castle, Keep Yard	26	45	138	..	..	32	..	..	..
„ Citadel Casemates	..	..	..	..	..	88	184	311	71
„ Drop Redoubt	..	..	..	..	75	..	..	..	9
„ Spur Battery	18	204	23	..	..	..	..	..	..
„ Cliff Casemates	..	..	..	92	282	40	..	..	..
„ Western Heights	..	..	..	..	..	1,071	..	..	..
Walmer, North, Infantry	..	..	..	..	137	280	..	..	18
„ South, „	..	..	..	..	397	..	..	..	..
„ Cavalry	..	..	..	..	..	64	8	..	..
Shorncliffe, Permanent Barracks	..	..	..	..	..	104	..	..	..
Hythe	..	..	..	124	120	16	4	..	4
Canterbury, Cavalry	..	..	..	..	..	..	270	..	..
„ Artillery	..	45	..	120	..	60	..	..	..
„ Permanent, Infantry	..	..	..	820	..	..	..	..	..
„ North Gate	..	..	..	140	160	120	..	..	..
Maidstone	..	..	..	..	360	..	..	..	..
Hulme	..	..	..	..	..	400	..	..	..
Salford	..	..	..	..	750	..	135	..	..
Burnley	..	12	120	108	..	..	..	..	..
Bury	..	..	..	..	..	248	..	..	64

TABLE A.—Showing the Number of Men in Barracks, &c.—*continued.*

NAME OF BARRACK.	Under 250 Cubic Feet.	250 to 300 Cubic Feet.	300 to 350 Cubic Feet.	350 to 400 Cubic Feet.	400 to 450 Cubic Feet.	450 to 500 Cubic Feet.	500 to 550 Cubic Feet.	550 to 600 Cubic Feet.	Over 600 Cubic Feet.
	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men
Stockport	..	..	..	..	160	..	..	..	..
Ashton	..	..	..	..	..	254	..	..	48
Preston	..	..	..	..	880	..	42	192	..
Brighton, Cavalry	..	..	..	..	254	72	76	..	..
„ Infantry	..	..	..	288	..	..	..	..	..
Exeter, Cavalry	..	..	..	16	..	10	158	..	..
„ Artillery	..	..	..	96	204	36	..	..	..
Bristol, Infantry	..	..	..	..	160	160	..	..	..
„ Cavalry	..	..	..	..	..	6	102	..	..
Devonport :—									
Raglan	..	..	..	..	..	774	184	..	..
Mount Wise	..	..	..	..	86	..	27	144	..
Granby, Cavalry	..	..	..	..	..	..	..	..	144
„ Infantry	..	..	..	46	98	..	..	..	..
Bull Point	..	..	..	..	..	96	..	..	..
Plymouth :—									
Citadel	..	157	326	481	58	37	3	21	..
Prince of Wales' Redoubt	..	..	..	..	..	72	..	..	..
Maker Barrack, and No. 4 Redoubt	..	28	14	54	18	48	22	10	48
Picklecombe	..	..	..	..	64	20	..	..	12
St. Nicholas Island	..	57	64	9	..	..	..	..	..
Birmingham	..	..	..	..	..	..	180	..	..
Coventry	..	..	..	36	49	67	40	..	..
Weedon	..	..	..	42	182	40	120	72	..
Northampton	..	..	92	..	108	..	..	..	8
Liverpool North Fort	..	..	..	..	..	200	..	..	..
„ Recruit Barrack	..	..	..	6	31	67	21	3	20
Chester Castle	..	..	..	..	10	..	101	173	..
Gravesend, New Tavern Fort	..	..	..	..	34	5	..	..	..
Tilbury Fort	..	..	126	35	40	..	..	..	..
York	..	..	..	30	..	30	40	208	..
Leeds	..	..	..	..	..	..	336	..	..
Bradford	..	..	18	9	9	30	..	..	..
Newcastle	..	..	24	168	..	28	56	126	60
Sunderland	..	..	..	300	..	..	..	..	..
Tynemouth	..	23	.	46	45	120	..	..	..
Carlisle	..	..	6	81	34	42	..	48	63
Sheffield	..	..	..	42	..	224	253	84	208
Christchurch	..	..	..	..	109	36	..	..	..
Landguard Fort	32	39	5	..	..	36	..	20	28
Edinburgh Castle	181	360	42	42	32	24	16	12	..
Piershill	..	..	..	..	..	296	..	..	..
Leith Fort	21	..	44	74	60	12	7	14	9
Berwick	..	720	..	..	..	..	..	..	..
Stirling	..	..	..	10	179	136	195	..	27
Glasgow	..	..	..	..	792	..	..	..	..
Ayr	..	..	132	300	..	..	..	..	..
Paisley	..	..	..	..	240	..	..	..	..
Hamilton	..	..	364	..	..	..	136	..	..
Dumbarton	..	..	24	90	..	..	..	..	..
Fort Augustus	..	..	..	..	48	118	..	..	..
Aberdeen	..	..	..	552	..	..	..	..	..
Dundee	..	31	122	104	34	..	..	..	8
Perth	..	..	..	257	267	70	..	..	..
Fort George	..	..	..	..	..	1,400	..	..	..
Dublin :—									
Royal Barracks	..	116	362	689	502	4	55	..	189
Arbour Hill, Cavalry	..	..	22	16	22	..	..	..	..
„ „ Infantry	..	..	..	31	..	..	..	..	..
Island Bridge	..	26	41	..	113	222	..	..	176
Ship Street	32	24	64	31	234	144	81	..	..
Portobello	..	..	..	56	223	98	8	300	2
Richmond*	..	..	243	443	644	..	..	..	..
Beggars' Bush	..	..	..	..	..	413	..	..	..
Pigeon House Fort	..	34	15	18	132	..	..	..	..
Aldborough House	..	..	..	40	..	42	35	12	146
Linen Hall	230	291	302	101	170	..	..	..	..

* The numbers for Richmond Barracks represent the *actual occupants* of the rooms who exceeded the regulation number by 294 men.

TABLE A.—Showing the Number of Men in Barracks, &c.—*continued.*

NAME OF BARRACK.	Under 250 Cubic Feet.	250 to 300 Cubic Feet.	300 to 350 Cubic Feet.	350 to 400 Cubic Feet.	400 to 450 Cubic Feet.	450 to 500 Cubic Feet.	500 to 550 Cubic Feet.	550 to 600 Cubic Feet.	Over 600 Cubic Feet.
	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.	No. of Men.
Limerick Castle	..	..	..	204	..	..	..	..	..
„ Ordnance Barrack	..	..	44	..	..	120	..	..	..
„ New	..	..	..	392	153	324	..	..	..
Templemore	..	..	..	390	735	..	..	..	..
Cahir	..	..	204	187	..	..	..	..	..
Clonmel Infantry	..	..	69	236	61	..	..	110	..
„ Artillery	..	..	..	56	105	..	..	..	..
Waterford Infantry	..	..	..	384	..	..	..	..	..
Waterford, Artillery	..	30	90	..	..	..	..	..	..
Duncannon Fort	..	88	88	..	10	..	..	2	..
Kilkenny	..	..	228	204	..	..	154	..	..
Newbridge	..	..	..	320	512	..	..	..	..
Carlow	..	..	30	134	29	11	..	..	..
Birr	..	..	476	629	..	..	..	..	..
Cork, Cavalry	..	..	..	..	..	171	..	.	..
„ Infantry	..	..	..	..	1,755	..	..	..	..
Cat Fort	..	..	36	46	18	..	..	..	..
Elizabeth Fort	..	..	..	180	..	..	..	..	..
Ballincollig	..	..	..	168	..	220	..	..	..
Carlisle Fort	..	..	..	60	..	..	..	..	..
Camden Fort	..	..	165	..	..	..	..	..	..
Spike Island	..	..	..	..	..	112	..	..	..
Haulbowline	..	..	..	98	..	..	..	..	..
Bandon	..	..	..	80	..	20	..	..	..
Kinsale	..	..	..	6	448	..	..	..	..
Charles Fort	..	8	45	201	71	16	..	32	..
Buttevant	..	..	..	435	475	..	..	..	..
Mallow	3	18	41	26	..	..	..	..	..
Tralee	..	..	..	391	..	..	..	..	..
Fermoy, New	..	..	..	1,152	..	..	..	..	..
„ Cavalry	66	132	..	..	..	..	..	..	..
„ Old, Infantry	..	22	416	854	..	..	..	..	..
Longford, Cavalry	..	..	..	..	..	19	56	77	16
„ Artillery	..	..	..	17	..	53	36	..	..
Mullingar	..	..	..	901	..	..	..	..	..
Galway Castle	..	20	..	20	..	..	80	..	..
„ Shamble	..	..	178	10	68	..	..	..	..
Athlone, Artillery	..	..	..	..	88	..	..	..	..
„ Cavalry	..	..	..	..	..	74	..	36	33
„ Infantry	..	..	94	205	204	103	..	35	7
Belfast, Infantry	..	..	..	..	840	..	..	..	..
„ Artillery	..	..	72	32	..	..	..	..	..
Enniskillen, Main	..	40	130	80	18	..	..	..	..
„ Castle	..	..	26	43	6	..	6	..	3
„ Redoubt	..	..	..	..	9	14	40	..	..
Derry	..	..	..	..	40	137	95	..	..
Dundalk	16	..	..	336	..	..	..	..	..
Newry	..	150	490	..	..	..	..	..	..
Naas	..	..	..	336	..	..	..	..	..
Total in Barracks	1,335	4,485	9,375	19,687	16,650	13,739	6,886	2,653	2,003
HUTS.									
Brompton	..	..	..	528	..	..	..	..	..
Woolwich, Royal Engineers	..	90	..	..	..	..	..	..	..
„ Hut Encampment	..	1,008	..	..	..	..	..	..	..
Shorncliffe	..	..	4,800	..	..	..	..	..	..
Chichester	..	..	462	..	..	..	..	104	6
Total in Huts	..	1,098	5,262	528	..	..	..	104	6

TABLE B.

NUMBER of BARRACK ROOMS and the PRESENT REGULATION ACCOMMODATION in each Permanent BARRACK inspected, the ACCOMMODATION at 600 Cubic Feet per MAN, and the NUMBER of MEN for whom there is DEFICIENCY of ACCOMMODATION at that RATE.

NAME OF BARRACK.	Number of Barrack Rooms.	Present Regulation Number of Men.	Number of Men at 600 cubic feet per Man.	Deficiency of Accommodation in Men.
Wellington	89	1,354	1,134	220
St. George's	31	476	414	62
Knightsbridge Cavalry	50	505	428	77
Hyde Park Magazine	5	79	49	30
Regent's Park	33	363	363	—
Portman	23	483	276	207
St. John' Wood	11	220	121	99
Towers	41	732	587	145
Croydon	18	460	333	127
Hounslow	29	232	174	58
Windsor :—				
Cavalry	34	291	223	68
Infantry	43	922	579	343
Hampton Court :—				
(Old Barrack)	2	73	54	19
(New do.)	6	48	48	—
Chatham	176	2,700	1,336	1,364
Spur Battery	6	36	25	11
Brompton	111	1,725	1,124	601
St. Mary's Casemates	47	1,128	690	438
Woolwich	213	3,508	2,750	758
Portsmouth :—				
Anglesea	53	954	794	160
Clarence	65	912	746	166
Cambridge	52	1,012	797	215
Colewort Infantry	14	238	120	118
Artillery	7	185	144	41
Royal Engineers	3	99	90	9
Point Battery	4	80	60	20
Fort Moncton	30	289	133	156
Fort Cumberland	33	621	253	368
Blockhouse Fort	5	92	92	—
Haslar	23	346	295	51
Winchester	119	1,666	1,055	611
Dover Castle :—				
Keep Yard	8	241	129	112
Cliff Casemates	9	414	287	127
Spur Battery	15	245	109	136
Dover Western Heights	51	1,071	816	255
Drop Redoubt	3	75	57	18
Citadel Casemates	25	654	654	—
Walmer :—				
North Infantry	17	436	334	102
South ditto	23	397	305	92
Cavalry	10	72	56	16
Shorncliffe Royal Artillery	8	104	88	16
Hythe	19	268	195	73
Canterbury :—				
Cavalry	30	270	240	30
Artillery	15	225	149	76
Permanent Infantry	41	820	533	287
Ditto North Gate	21	420	307	113
Maidstone	20	360	230	130
Hulme	40	400	320	80
Salford	61	885	750	135
Burnley :—				
Cavalry	12	108	72	36
Infantry	11	132	77	55
Bury	20	312	264	48
Stockport	10	160	114	46

TABLE B.—Showing the Present Regulation Accommodation, &c.—*continued.*

NAME OF BARRACK.	Number of Barrack Rooms.	Present Regulation Number of Men.	Number of Men at 600 cubic feet per Man.	Deficiency of Accommodation in Men.
Ashton	20	302	253	49
Preston	75	1,114	912	202
Brighton :—				
Cavalry	31	402	314	88
Infantry	18	288	180	108
Exeter :—				
Cavalry	24	184	156	28
Artillery	28	336	244	92
Bristol :—				
Infantry	20	320	260	60
Cavalry	10	108	91	17
Devonport :—				
Raglan	42	958	798	160
Mount Wise	15	257	214	43
Granby Artillery	6	144	144	—
Ditto Infantry	10	144	99	45
Bull Point	6	96	78	18
Plymouth :—				
Citadel	97	1,083	645	438
Prince of Wales' Redoubt	4	72	56	16
Maker Barrack	9	166	135	31
Picklecombe	9	96	79	17
St. Nicholas Island	16	130	75	55
Birmingham	20	180	160	20
Coventry	16	192	145	47
Weedon	32	456	355	101
Northampton	16	208	144	64
Liverpool, North Fort	8	200	160	40
Ditto Recruiting	14	148	123	25
Chester	15	284	262	22
Gravesend	7	51	33	18
Tilbury Fort	14	201	123	78
York	29	308	303	5
Leeds	28	336	308	28
Bradford	16	180	150	30
Newcastle	26	462	371	91
Sunderland	15	300	195	105
Tynemouth	10	234	164	70
Carlisle	18	274	222	52
Sheffield	48	811	713	98
Christchurch	11	145	104	41
Landguard Fort	18	160	110	50
SCOTLAND.				
Edinburgh Castle	72	709	457	252
Piershill	37	296	259	37
Leith Fort	22	241	154	87
Berwick	72	720	360	360
Stirling	16	484	391	93
Glasgow	66	792	528	264
Ayr	36	432	277	155
Paisley	16	240	176	64
Hamilton	31	500	329	171
Dumbarton	13	114	74	40
Fort Augustus	32	166	138	28
Aberdeen	46	552	368	184
Dundee	11	299	179	120
Perth	27	382	273	109
Victoria Street	6	212	156	56
Fort George	207	1,400	1,146	254
IRELAND.				
Dublin, Royal Barracks	183	1,917	1,288	629
Arbour Hill :				
Cavalry and Infantry	6	91	55	36
Island Bridge	25	578	486	92

TABLE B.—Showing the Present Regulation Accommodation, &c.—*continued.*

NAME OF BARRACK.	Number of Barrack Rooms.	Present Regulation Number of Men.	Number of Men at 600 cubic feet per Man.	Deficiency of Accommodation in Men.
Ship Street	41	610	435	175
Portobello	40	687	576	111
Richmond	80	1,036	824	112
Beggar's Bush	25	413	337	76
Pigeon House Fort	17	199	136	63
Aldborough House	20	275	258	17
Linen Hall	128	1,094	531	563
Limerick :—				
New Barrack	73	869	622	247
Ordnance	10	164	120	44
Castle	12	204	132	72
Templemore	75	1,125	724	401
Cahir	23	391	241	150
Clonmel :—				
Infantry	34	476	335	141
Artillery	9	161	106	55
Waterford :—				
Infantry	22	384	242	142
Artillery	6	90	54	36
Duncannon Fort	24	188	96	92
Kilkenny	30	586	384	202
Newbridge	52	832	552	280
Carlow	17	204	130	74
Birr	65	1,105	659	446
Cork Barracks	136	1,926	1,420	506
Cat Fort	5	100	60	40
Elizabeth Fort	18	180	60	120
Ballincollig	34	388	284	104
Carlisle Fort	4	77	50	27
Camden Fort	—	165	100	65
Spike Island Casemates	12	112	90	22
Haulbowline	4	98	56	42
Bandon	12	100	66	34
Kinsale	57	454	340	114
Charles Fort	45	344	220	124
Buttevant	65	910	638	272
Mallow	13	88	46	42
Tralee	23	392	253	139
Fermoy :—				
New	75	1,152	764	388
Cavalry	18	198	84	114
Old Infantry	82	1,282	822	460
Longford :—				
Cavalry	12	168	131	37
Artillery	7	106	82	24
Mullingar	53	901	572	329
Galway :—				
Castle	12	120	62	58
Shamble	32	256	168	88
Athlone	50	879	640	239
Belfast :—				
Infantry	42	840	630	210
Artillery	8	104	62	42
Enniskillen :—				
Main Barrack	27	268	158	110
Castle	7	84	57	27
Redoubt	6	63	53	10
Londonderry	14	272	218	54
Dundalk	22	352	227	125
Newry	50	640	344	296
Naas	21	336	210	126
Total Barracks 162	5,339	75,801	53,806	21,995

TABLE C.

STATE of the VENTILATION in each Barrack inspected, in comparison with the NUMBER of INMATES, the AMOUNT of OVERCROWDING, and the NUMBER of ROOMS, the STRUCTURE, and LOCAL POSITION of each BARRACK.

I.—BARRACKS in which we found no Means of Ventilation provided.

Name of Barrack.	Present Regulation Number of Men.	Approximate average space per man.	Number of Rooms.	Position of Barracks and Structure of Rooms.
		Cubic Feet.		
Chatham Barracks	2,700	296	176	Exposed. Rooms back to back. Structure bad.
Brompton Barracks	1,725	390	111	Do. do. do. not good.
Woolwich	3,508	470	213	Open, built in squares. Back to back rooms. 22 basement rooms unfit for occupation. Many rooms over stables.
Portsmouth Clarence	912	490	65	Enclosed among dwellings. Rooms low, very bad.
Fort Cumberland	621	244	33	Open airy situation. All casemates. Tolerable.
Point Battery	80	450	4	Do. Casemates in a confined yard.
Fort Moncton	289	276	30	Open situation. Casemates and rooms over.
Haslar Barracks	346	512	23	Detached barrack rooms. One flat only. Good.
Shorncliffe Artillery	104	507	8	Situation high and exposed.
Western Heights, Dover	1,071	457	51	Do. do. Rooms go through and through. Good.
Drop Redoubt „	75	456	3	Do. do. Casemates. Tolerable.
Dover Castle, Spur Battery	245	267	15	Casemates divided into two flats. Very bad.
Keep-yard Barracks	241	321	8	Airy position. Barracks old, gloomy, and bad.
Walmer South Barracks	397	461	23	Low position but open. Rooms go through and through.
Royal Artillery, Canterbury	225	397	15	Suburban, open. Rooms have a corridor on one side. Not good.
Northgate Barracks „	420	438	21	Do. do. Serjeants' bunks obstruct light and ventilation in the men's rooms.
Bury	312	508	20	High and airy. Construction good. Rooms go through and through.
Ashton	302	503	20	Country. do. do.
Brighton Infantry	288	375	18	Enclosed among houses. Structure and position bad. Unfit for occupation.
Exeter Artillery	336	436	28	Country situation. Airy. Rooms have windows only on one side.
Bristol (Horfield)	428	491	30	Do. do. Infantry rooms go through and through. Cavalry rooms back to back, over stables.
Plymouth Citadel Barracks	1,083	357	97	High and airy. Casemates, not very good. Rooms back to back. Some good, some bad.
Do. Maker Barracks	197	411	12	High and exposed. Casemates not good.
„ No. 4 Redoubt				
„ Picklecombe Fort	96	494	9	Close to the sea. Casemated rooms. Tolerable.
„ St. Nicholas Island	130	346	16	Airy position. Barrack rooms back to back. bad.
„ Raglan Barracks	958	500	42	Suburban. Some rooms too dark. Others have windows on opposite sides. Distance between windows too great. Serjeants' bunks in men's rooms.
„ Artillery Barracks	144	600	6	Suburban. Good rooms, but over stables.
„ Mount Wise	257	500	15	Do. Rooms in detached blocks. Some too dark.
„ Bull Point	96	487½	6	Position open and airy. Rooms go through and through. Good.
Liverpool North Fort	200	480	8	Close to the Mersey. Rooms not good.
„ Recruiting	148	499	14	High and airy. A first class dwelling-house.
Gravesend	51	388	7	Low, damp position. Rooms low, dark, and bad.
Bradford	180	500	16	Position, high, airy, healthy. Rooms go through and through. Good.

TABLE C.—State of the Ventilation, &c.—*continued.*

Name of Barracks.	Present Regulation Number of Men.	Approximate average space per man.	Number of Rooms.	Position of Barracks and Structure of Rooms.
		Cubic Feet.		
Edinburgh Castle - - -	709	387	72	Very exposed. New barracks badly constructed. Inner corridor. Men's rooms have one window. Deep, dark area on one side. Barrack not healthy.
Leith Fort - - - - -	248	372½	22	Close to the sea. Inner corridors. Structure not good.
Berwick-on-Tweed - - -	720	300	72	High and airy. Rooms back to back, low, dark, and bad.
Stirling Castle - - -	484	485	16	Palace and parliament-house appropriated as barrack-rooms. Those in the palace bad, with galleries and beds in them all round. Situation high and healthy.
Ayr - - - - - - -	432	385	36	On the sea shore. Back to back rooms. Tolerable.
Dumbarton Castle - -	114	389	13	Position airy. Lower barrack rooms bad. Upper barrack has tolerable rooms.
Fort Augustus - - -	166	499	32	Open, airy situation. Rooms back to back. Not good. Out of repair.
Dundee - - - - -	299	359	11	High and exposed. Rooms go through and through. Tolerable.
Fort George -	1,400	491	207	Situation low, on the sea shore. Construction complex. Inner corridors. Rooms have windows on one side.
Dublin, Royal Barracks - -	1,917	398	183	Situation in town. Built in squares. Rooms with windows on one side and a corridor on the other. Cavalry rooms over stables. Bad.
„ Arbour Hill - -	91	362	6	Formerly a prison; now a bad barrack. Unfit for occupation.
„ Part of Beggars Bush -	413	489	25	Low position. Construction good. Windows on opposite sides of rooms.
„ Pigeon-house Fort -	199	410	17	In Dublin Bay. Rooms with windows on opposite sides.
„ Aldborough House -	275	565	20	A good private residence.
„ Linen Hall - -	1,094	290	128	Totally unfit for a barrack.
Templemore - - - -	1,125	386	75	In the open country. Situation good and healthy. Rooms go through and through, with opposite windows.
Clonmel { Infantry - -	476	422	34	Position suburban. Rooms open out of a corridor. Not very good. Artillery rooms better.
Clonmel { Artillery - -	161	408	9	
Waterford Artillery - -	90	360	6	Suburban. Rooms go through and through. Several basement rooms unfit for occupation.
Kilkenny - - - -	586	393	30	Country situation. Structure good and healthy. Rooms go through and through. Windows on opposite sides.
Newbridge - - - -	832	398	52	In the country. Men's rooms separate from stables. Good. Windows back and front.
Birr - - - - - -	1,105	358	65	In the country. Rooms go through and through. Windows back and front. Situation good.
Carlow - - - - -	204	382	17	In the country. A bad cavalry barrack. Rooms over stables.
Duncannon Fort - - -	188	306	24	Overhangs the sea. Rooms dark, not good.
Cork - - - - -	1,926	442	136	High situation. Rooms go through and through.
„ Elizabeth Fort - -	180	200	18	Very bad. Not fit for occupation.
„ Camden Fort - -	165	364		Overhangs the sea. Tolerable rooms.
„ Haulbowline - -	98	343	4	In Cork harbour. Not good.
Kinsale - - - -	454	449	57	Healthy position. Plan and construction good. Rooms go through and through.
Charles Fort - - - -	344	384	45	High situation over the sea. Structure of rooms bad.
Tralee - - - -	392	390	23	Suburban. Rooms go through and through.

TABLE C.—State of the Ventilation, &c.—*continued.*

Name of Barrack.	Present Regulation Number of Men.	Approximate average space per man.	Number of Rooms.	Position of Barracks and Structure of Rooms.
		Cubic Feet.		
Buttevant - - - -	910	420½	65	Suburban. Rooms go through and through.
Mallow - - - -	88	313½	13	A small country barrack. Not good.
Fermoy, New Barrack - -	1,152	398	75	Airy, healthy position. Rooms good. Windows on opposite sides.
„ Old do. - -	1,282	384	82	Do. do. Rooms not so good.
Longford Cavalry - -	168	468	12	Suburban. Some rooms tolerably good, others dark.
„ Artillery - -	106	464	7	Country position. Rooms with opposite windows. Good.
Mullingar - - - -	901	380	53	In the country. Rooms go through and through. Good.
Galway Castle - - -	120	310	12	A town barrack. Very bad.
Shamble - - - -	256	393	32	Embedded among houses. Rooms very bad.
Athlone Cavalry - - -	148	543	8	Suburban. Rooms go through and through. Good.
„ Infantry - - -	577	419	31	Do. do. Rooms not so good.
„ Castle - - -	66	345	6	In the town. Rooms bad.
Belfast Artillery - - -	104	370	8	Suburban. Rooms have windows on opposite sides.
Enniskillen Main - - -	268	353	27	Situation low, on the banks of a lake. Neighbourhood filthy. Rooms back to back.
„ Redoubt - -	63	504	6	Position high and airy. Rooms good.
Newry - - - -	640	323	50	Suburban. Rooms open out of a corridor. Dark. Not good.
Dundalk - - - - -	352	387	22	Suburban. Best cavalry barrack we have seen. Men separated from horses. Rooms go through and through.
Naas - - - - -	336	375	21	Country. Rooms go through and through. Construction very good.

II.—BARRACKS in which the Means of Ventilation provided were deficient, or defective in principle and inefficient in operation.

Name of Barrack.	Present Regulation Number of Men.	Present approximate average space per man.	Number of Rooms.	Positions of Barrack and Structare of Rooms.
		Cubic Feet.		
Wellington Barracks - -	1,354	502	89	Houses on one side. Rooms partly back to back, partly opening out of corridors. Structure complicated.
Tower „ - -	732	481	41	Banks of the Thames. Rooms back to back.
St. George's „ - -	476	521	31	Completely enclosed among high buildings. Rooms go through and through.
Portman „ - -	483	342	23	Completely enclosed among houses. Not fit for occupation.
Hyde Park Cavalry - -	505	508	50	Suburban. Rooms open out of corridor. Over stables. Bad.
Regent's Park - -	363	650	33	Close to the canal. Rooms over stables. Inner corridors. Not good.
St. John's Wood - - -	220	230	11	Open situation. Rooms out of corridor. Not good.
Magazine, Hyde Park - -	79	372	5	Open. Rooms go through and through. Good.
Windsor Cavalry - - -	291	459	34	Country situation Rooms over stables. Central corridor. Not good.
„ Infantry - - -	922	376	43	Nearly surrounded by houses. Rooms go through and through. Not good.

TABLE C.—State of the Ventilation, &c.—*continued.*

Name of Barrack.	Present Regulation Number of Men.	Present approximate average space per man.	Number of Rooms.	Position of Barracks and Structure of Rooms.
		Cubic Feet.		
Hampton Court Old Barrack -	73	444	2	Country. Rooms over stables. Not good.
„ New Barrack -	48	580	6	Do. do. Open out of corridor.
Croydon - - - -	460	434	18	Situation low and not healthy. Rooms not good.
Hounslow - - - -	232	450	29	Country. Low, badly drained. Rooms open out of corridors. Rooms over stables.
Coventry - - - -	192	432	16	An old inn. Rooms over stables. Very bad.
York - - - - -	308	590	29	Country. Rooms over stables. Open out of inner corridors.
Spur Battery, Chatham - -	42	357	12	Casemates. Very bad.
St. Mary's Casemates do. -	1,128	319	47	Very bad.
Portsmouth Colewort - -	238	302	14	Among houses. Rooms low, dark, and not good.
„ Cambridge - -	1,012	474	52	Back to back rooms. Situation low and among houses.
„ Blockhouse Fort -	92	600	5	Over the sea. Casemates, tolerably good.
„ Anglesea - -	954	499	53	Surrounded by houses. Back to back rooms.
„ Royal Engineers -	99	545	3	Open. Rooms, attics, not very good.
„ Royal Artillery -	185	467	7	Rooms low. Not very good.
Maidstone - - - -	360	384	20	Suburban. Rooms detached from stables. Rooms not good.
Hulme - - - - -	400	480	40	Suburban. Rooms over stables. Open out of corridors. Not good.
Burnley { Cavalry - -	108	400	12	Do. do. do. Bad.
Burnley { Infantry - -	132	350	11	Do. Rooms go through and through.
Preston - - - - -	1,114	491	75	Country situation. Rooms go through and through. Infantry rooms good. Cavalry rooms over the stables.
Brighton Cavalry - - -	402	469	31	In the country. Rooms over stables. Internal corridor.
Exeter Cavalry - - -	184	509	24	Suburban. Rooms over stables. Inner corridor. Not good.
Northampton - - -	208	415	16	Do. do. do.
Weedon - - - -	456	467	32	Country. Cavalry rooms back to back, over stables.
Tilbury - - - -	201	367	14	Marshy situation. Small rooms except one. Altogether, not good.
Newcastle - - - -	462	482	26	Suburban. Rooms over stables. Not good.
Winchester - - - -	1,666	380	119	High. Suburban. Complicated structure. Rooms have windows on one side only.
Hythe - - - - -	268	437	19	Low situation under a hill. Rooms go through and through. Tolerable.
Dover Citadel Casemates -	654	580	25	High and airy. Very good casemates.
„ Cliff Casemates - -	414	416	9	Cut out of the rock. Very long, dark, and damp. Should not be occupied but in emergency.
Walmer Cavalry - - -	72	467	10	Low situation. Rooms over stables. Enter from a central corridor.
„ North Barracks - -	436	460	17	Low situation. Built in blocks. Plenty of windows. Good.
Canterbury Cavalry - -	270	533	30	Suburban. Rooms over stables. Dark inner corridor.
„ Permanent Infantry	820	390	41	Do. Windows on opposite sides.
Salford - - - -	885	429	61	Suburban. Rooms go from back to front. Good.
Stockport - - - -	160	427	10	Suburban. Elevated. Do. do. Not good.
Plymouth, Prince of Wales Redoubt.	72	466	4	Healthy position. Good casemates.
Devonport, Granby Infantry -	144	412	10	In the town. An old barrack. Not good.
Birmingham - -	180	533	20	In the town. Rooms over stables. Inner corridor. Tolerable.

TABLE C.—State of the Ventilation, &c.—*continued.*

Name of Barrack.	Present Regulation Number of Men.	Present approximate average space per man.	Number of Rooms.	Position of Barracks and Structure of Rooms.
		Cubic Feet.		
Chester - - - - -	284	553	15	Suburban. Airy. Rooms open out of corridor. generally good.
Sheffield - - - - -	811	527	48	A new barrack. Cavalry rooms over stables. Windows on both sides. Rooms good.
Leeds - - - - - -	336	550	28	Suburban. Rooms over stables. Inner corridor.
Sunderland - - - - -	300	390	15	On the sea shore. Rooms go through and through.
Tynemouth - - - - -	234	419	10	High and airy. Rooms not very good. Several old in construction.
Carlisle - - - - -	274	486	18	Suburban and airy. Windows on opposite sides.
Piershill - - - - -	296	525	37	Low. Near irrigated meadows. Rooms over stables. Open out of an inner corridor.
Glasgow - - - - -	792	400	66	In the town. Back to back rooms. Not good.
Paisley - - - - -	240	440	16	Suburban. Rooms go through and through.
Hamilton - - - - -	500	395	31	Suburban. Cavalry rooms over stables. Central corridors. Infantry rooms have windows on one side only.
Aberdeen - - - - -	552	400	46	In the town. Back to back rooms.
Perth - - - - - -	382	429	27	Suburban. Rooms out of corridor.
Dublin, Ship-street (part of) -	610	444	41	Surrounded by houses. Some rooms back to back, others have windows on opposite sides. Position not good.
„ Richmond - - -	1,036	477	80	Suburban. Rooms go through and through.
„ Island Bridge Old Barrack	578	504½	25	Low situation. Rooms, attics over stables; some rooms not fit for occupation.
„ Portobello - - -	687	416	40	Low. Suburban. Rooms partly over stables.
Limerick Castle - - -	204	388	12	Overhangs the Shannon. Through and through rooms.
„ New Barrack - -	869	429	73	Suburban. Rooms go through and through. Some very good.
„ Ordnance - -	164	439	10	In the town. Through and through rooms.
Cahir - - - - - -	391	370	23	In the country. Men's rooms separate from stables. Windows on both sides. A good barrack.
Waterford Infantry - -	384	378	22	In the town. Through and through rooms.
Cork, Cat Fort - - -	100	360	5	Neighbourhood filthy. A small recruiting barrack.
„ Ballincollig - -	388	440	34	In the country. Through and through rooms.
„ Carlisle Fort - -	77	400	4	Overhangs the sea. Airy situation.
„ Spike Island - -	112	482	12	Casemates. Not very good. Situated in Cork harbour.
Athlone Artillery - - -	88	443	5	Suburban. Rooms one story high.
Belfast Infantry - - -	840	450	42	Do. Through and through rooms. Not very good.
Londonderry - - - -	272	481	14	High and airy situation. Through and through rooms.
Enniskillen Castle - - -	84	407	7	Low. On the banks of a lake. Rooms over gun sheds. Windows on opposite sides.
Bandon - - - - -	100	396	12	A small country barrack. Not good rooms.

III.—BARRACKS in which the Means of Ventilation provided were correct in principle and tolerably efficient in action.

Name of Barrack.	Present Regulation Number of Men.	Present approximate average space per man.	Number of Rooms.	Position of Barracks and Structure of Rooms.
		Cubic Feet.		
Island Bridge New Barrack -	168	605	6	Low situation. Rooms over stables, but good. Windows on both sides.
Part of Ship Street - }	About 450	444		
Part of Beggars Bush - }		489		

TABLE D.

DAILY CONSUMPTION of FUEL per HEAD, and the Nature and State of the COOKING APPARATUS in different BARRACK COOK-HOUSES and HOSPITAL KITCHENS.

Kitchens.	Number of Men Cooking.	Daily amount of Coal consumed per Man.	Nature of Cooking apparatus.	State of apparatus.
St. George's Barracks - -	305	All gas, equal to 5 lbs. of coal.	9 boilers and 2 ovens, all heated by gas.	Jets out of order, waste of gas, ventilation very bad.
St. John's Wood „ - -	188	Coal and gas equal to 3 lbs. of coal.	6 boilers, 2 gas ovens.	Good, except ventilation of ovens.
Tower of London „ - -	557	Coal and gas equal to 2 lbs. of coal.	16 boilers, 3 gas ovens.	Furnace doors broken, brickwork very bad, kitchen badly drained.
„ Artillery „ - -	31	2lb. 1oz.	3 boilers - -	Good.
Hyde Park Magazine Barracks	47	1 11	3 boilers, 1 oven -	Furnace doors broken.
Knightsbridge „ No. 1. -	73	2 4	5 boilers, 1 oven -	1 boiler, and door frames cracked.
„ „ „ 2. -	60	1 13½	6 boilers - -	Door frames broken, no oven.
„ „ „ 3. -	60	1 13½	6 boilers - -	In good condition. No oven.
„ „ „ 4. -	70	2 7	5 boilers, 1 oven -	Good. Oven not large enough.
„ New roasting oven	—	0 2		
Kensington Barracks, Cavalry	48	1 7⅓	3 boilers, 1 oven -	New. Kitchen very dark.
„ „ Infantry	100	1 4	4 boilers, hot plates and oven.	Kitchen too hot. Boilers removed to out-house.
Regent's Park „ - -	120	1 14⅓	14 boilers, double oven.	Oven up 6 weeks.
Buckingham Palace Barracks -	37	2 7	2 boilers, 2 ovens -	Quite new. Kitchen too small.
Portman - - - -	300	1 2⅓	6 boilers - -	Very bad.
Horse Guards, Cavalry - -	50	1 3	2 copper boilers and steamer.	Very good.
„ Infantry - -	50	1 3	2 copper boilers and steamer.	Very good.
Wellington Barracks - 1.	577	1 6	16 boilers, 2 ovens	In two kitchens, out of order.
„ „ - 2.	—	Gas and coke equal to 1lb. 0 oz.	4 Soyer's stoves, 2 gas ovens.	New.
Duke of York's School - -	500	0 13	4 steam pans, 3 ovens.	Very good, kept in good order.
„ Hospital - -	60	Unlimited.	2 steam pans, fire for roasting.	Good.
Chelsea „ - -	470	„	3 coppers and roasting range.	Old fashioned.
CHATHAM.				
Fort Pitt Hospital - - -	500	Coal and gas equal to 1 lb. 10 ozs. of coal.	Boilers and Dean's gas ovens.	Kitchen very clean.
Garrison „ - - -	300	Coal and gas equal to 2 lbs. of coal.	6 boilers, gas stove, ovens.	Boilers in a bad state.
Brompton „ - - -	80	Coal and gas equal to 5lbs. 11⅓ ozs. of coal.	Boilers and gas stove.	Boilers useless.
Melville „ - - -	230	1lb. 4oz.	3 boilers, roasting range, and ovens.	Good.
St. Mary's Invalid Depôt -	400	1 0	20 boilers - -	No soot doors.
Chatham Barracks, No. 1. -	300	1 2	17 boilers - -	Out of order and badly set.
„ „ „ 2. -	670	0 11	14 boilers - -	Some boilers will not heat, doors broken, &c.
„ „ „ 3. -	329	1 2	14 boilers - -	No soot doors. Out of order.
„ „ „ 4. -	300	1 2	14 boilers - -	Lids and brickwork bad. No place for coals, and kitchens dirty in consequence.
„ „ Bake-house -	—	0 2⅓	2 seven bushel ovens.	Cannot be better.

Daily consumption of fuel per head, &c.—*continued.*

Kitchens.	Number of Men Cooking.	Daily amount of Coal consumed per Man.	Nature of Cooking apparatus.	State of apparatus.
Brompton Barracks, No. 1. -	254	1lb. 2½oz.	16 boilers and hot plate.	Doors out of order. Lids bad.
„ „ „ 2. -	36	1 9	12 boilers - -	All out of order.
„ „ „ L. -	73	2 13¼	16 boilers and hot plate.	Out of repair. Meat baked four times a week in town.
„ „ „ D. -	113	1 0	16 boilers - -	Lids bad. Bake out.
„ „ North Square	—	0 6	12 boilers, 1 brick oven.	All in good order.
„ „ Huts, No. 1.	121	0 15	7 boilers - -	Very good and clean.
„ „ „ „ 2.	174	1 0½	7 boilers - -	Doors out of order. Bake out.
Chatham Marine, Cook-house -	730	1 12	3 large boilers -	Very old fashioned.
„ „ Bake-house -	—	0 3	2 12-bushel ovens -	Very good.
Woolwich Hospital - - -	450	0 6	9 boilers, 2 hot plates, 2 ovens.	Requires repairs.
„ Sappers' Huts - -	60	2 0	3 boilers, 1 brick oven.	Good. Oven very good.
„ Marine Barracks -	520	1 2	26 kitchens, 1 range, and 1 boiler in each.	Very good. Men dine in kitchens.
„ „ Hospital -	300	0 12⅓	1 cooking range -	Good. Boilers require dampers.
„ Huts, No. 1. - -	87	1 12	8 boilers, 1 range -	Not good. Very dirty.
„ „ „ 2. - -	300	0 14	8 boilers, 1 oven.	Good.
„ „ „ 3. - -	200	1 0	8 boilers - -	One cracked. Badly set.
„ „ „ 4. - -	300	0 15	8 boilers, 1 oven -	Oven badly constructed.
„ Artillery Barracks, No. 3.	1,200	0 8½ (All these bake out 3 times a week.)	16 boilers - -	Out of order and dirty.
„ „ „ „ 5.	600	1 1	14 boilers - -	Clean, and in good repair.
„ „ „ „ 7.	750	0 7	10 boilers - -	Good.
„ „ „ „ 8.	500	0 8	2 stacks, small boilers.	Bad.
„ „ „ „ 10.	400	1 2¼	24 boilers	Not very good. Badly set.
Shorncliffe Hospital - -	200	1 12	5 steam pans, range and oven.	Steam apparatus excellent.
Hythe Barrack - - -	240	1 2½	8 boilers	Very bad repair. Bake for one-third in town.
Walmer „ South - -	232	0 6	16 boilers, 1 oven -	In very bad order. Oven too small.
„ „ North - -	350	1 4	7 boilers - -	Could be re-set to burn one-third less fuel.
„ Hospital - - -	100	1 13	10 boilers and oven	Only partly in use.
„ Naval Hospital - -	400	1 4	4 boilers and oven -	Oven good.
Canterbury Barracks:— Permanent Infantry, A.	141	1 3⅕	10 boilers - -	Clean, but badly constructed. One half bake out, as the coals will not answer.
„ „ „ B.	400	1 2¼	10 boilers - -	100 bake out. Coals will not suffice.
„ „ Line, - A.	150	1 4	10 boilers - -	Bad. Two companies obliged to bake out.
„ „ Cavalry, A.	108	1 2¾	10 boilers - -	Badly constructed. Bake out.
„ „ B.	84	1 4	10 boilers - -	Coals will not last.
„ „ Centre Cavalry.	122	1 5⅓	20 boilers - -	Badly constructed. Obliged to bake out to make the coals last.
Dover Barracks, Casemates -	69	1 10¼	5 boilers, 1 oven -	Boilers good. Oven bad.
„ Citadel, No. 1. - -	111	1 4⅔	8 boilers - -	Ventilation not good.
„ „ „ 2. - -	147	1 2⅔	8 boilers - -	Doors broken. Coals not sufficient.
„ Drop Redoubt - -	150	1 4	4 boilers - -	Whole bad.
„ Hospital - - -	100	3 3	2 small ranges and oven.	Clean. Like a private kitchen.
Brighton Barracks - - -	263	1 0	20 boilers, a new oven.	Boilers good. Want re-setting.
„ „ Hospital -	53	Unlimited.	2 boilers, range, and oven.	Clean and good.
„ „ Pavilion -	150	1 8	7 boilers, 1 double oven.	Good. Oven new. Well constructed.
Shoreham Fort - - -	17	Unlimited.	2 boilers, range, no oven.	

Daily consumption of fuel per head, &c.—*continued.*

Kitchens.	Number of Men Cooking.	Daily amount of Coal consumed per Man.	Nature of Cooking apparatus.	State of apparatus.
Eastbourne Depôt - - -	6	6lb. 10oz.	Good range - -	Consumption of coals large.
„ Redoubt No. 1. -	100	0 12¾	6 boilers, 1 double oven.	Same as Brighton.
„ „ „ 2. -	40	0 14	6 boilers, as above -	
ALDERSHOT CAMP.				
North, A. - - - -	367	0 14	Capt. Grant's stove, boilers and oven, plates cracked, lids bad.	The ladles are not large enough; they are not used.
„ B. - - - -	387	1 2	Do. very dirty -	No water near it.
„ C. - - - -	250	1 2½	Do. clean - -	The 36th came from Chichester; like the old boilers best, not being so dirty.
„ D. - - -	300	0 14⅔	Do. do. - -	
„ F. - - - -	76	2 11	Do. clean - -	Only one end used.
„ I. - - - -	90	1 12½	Do. cracked, and boilers broken.	
	80	1 0		
„ K. - - -	110	1 1	Do. and opened -	Only one end used.
„ L. - - - -	200	1 6		
„ Q. - - - -	225	1 6	Do. very clean -	Hospital. This is one that has been altered, by having an oven placed in the middle, and doing away with two boilers. It does not answer, a large fire at each end having to be forced to heat the oven.
South, A. - - - -	260	1 2½	Do. plates cracked and dirty.	No corporal in charge.
„ B. - - - -	320	1 1½	Do. do. -	Lids very bad.
„ C. - - - -	280	1 0¼	Do. do. -	Occupied by the West York. Some of the men understand cooking; they complain of the plates not being close together, which lets in the air, and thus requires more coal.
„ D. - - - -	218	1 1⅓	Do. do. -	Lids very bad.
„ H. - - - -	585	0 12⅙	Do. cracked, but well kept.	Not large enough for the number.
„ I. - - - -	90	1 12½	Do. do. -	Cracked. One end only used. Not enough coals.
„ M. - - - -	260	0 14	Do. do. - -	Clean.
„ Q. - - - -	410	0 12¾	Do. do. cracked -	Double row of boilers, with oven recently erected under the superintendence of Captain Grant; the oven bakes differently at times, depending on the wind, and never well from there being too much steam in it; the ventilator cannot be opened, because the soot falls on the meat; they must bake every day to have their rations properly; average 210 in oven, the fire lighted at 6, meat put in about 10, and taken out 10 minutes past 12. Frying pans and a permanent cook.
„ R. - - -	218	1 7½	Do. do. do.	Not coals enough.
„ S. - - -	710	0 14½	Do. do. cracked pans with holes.	22nd — Just came in from Preston. No corporal in charge. A very large fire made, as the men said to get the end boilers to boil; no water under the grate. The men do not like them equal to the old boilers at Preston, not knowing how to use them; for the same number at Preston 50 boxes were used.
„ T. - - - -				
„ V. - - - -	138	1 6½	Do. do. do.	

Daily consumption of fuel per head, &c., – *continued.*

Kitchens.	Number of Men Cooking.	Daily amount of Coal consumed per Man.	Nature of Cooking apparatus.	State of apparatus.
Aldershot Camp—*continued*				
South X. - - - -	237	1lb. 11½oz.	Capt. Grant's stove, boiler, and oven, cracked pans with holes.	4th Dragoon Guards.—Complain of dirt.
„ Y. - - - -	150	1 9⅔	Do. do. bad -	Only one end used. Permanent cook. Royal Artillery.
„ Z. - - - -	190	0 15	Do. do. do.	Hospital. Not hot water enough.
PERMANENT BARRACK.				
Centre Block.				
Captain Grant's, Nos. 3, 4. -	640	1 4	Do. do. do.	
ST. GEORGE'S, LONDON.				
Captain Grant's - - -	137	2 5½	Do. do. do.	Quite new.
WOOLWICH.				
Captain Grant's No. 1. - -	400	0 14½	Do. do. do.	Plates cracked. Oven does not heat properly or regularly. Meat has to be constantly shifted. Two boilers nearest oven do not cook.
ALDERSHOT CAMP.				
Permanent Barracks, common boilers and oven, East block, No. 4.	138	1 7	Do. do. do.	
„ West block, Nos. 1, 2.	540	1 4	8 boilers, and brick oven.	7 doors cracked.
„ „ „ 3.	70	4 0	Do. do. do.	Oven does not bake. 5 doors cracked.
„ „ „ 4.	62	3 0	Do. do. do.	Cooks well. 6 doors cracked.
„ Field Battery „ 1.	200	1 1	3 boilers and oven	Very clean and good.
„ „ „ 2.	200	1 1	Do. do. do.	Do. do. do.
„ „ Hospital -	76	2 4	Range, oven, two boilers, 3 Soyer's stoves.	Tins bad.
„ „ Huts -	130	1 3	2 boilers, range, and oven.	
METROPOLITAN INSTITUTIONS.				
St. Bartholomew's Hospital -	1,000	Coal and gas equal to 10¼ oz. of coal.	2 gas ovens, gas plate, 3 pans heated by steam.	Good. Steam supply complete.
Middlesex „ -	200	4lb. 0oz.	Steam pans - -	Good, but badly constructed.
St. George's „ -	200	1 2	Steam pans, range, and oven with gas.	Good, except gas stove.
Foundling „ -	300	3 0	Do. do. and oven -	Not well fitted up.
Christ's „ -	1,000	0 8	6 ovens, steam pans	Very good.
Blind School - - - -	184	1 3½	Boilers, hot plates, ovens.	A pattern to all institutions.
Stranger's Home - - -	130	0 8	A modern kitchener	Stews, ovens not used.
Lincoln's Inn Hall - - -	300	4 8	Range, hot plates, boilers.	Good.
Temple „ „ - - -	150	7 0	Do. ovens, stoves	Good, but old fashioned.
St. Luke's Union - - -	300	1 12	4 case pans, (steam)	New.
Holborn „ - - -	600	0 8	3 iron pans, 1 case pan.	Very bad.
Clerkenwell „ - - -	500	1 2	4 double case pans	Bad and badly fitted up.
West London „ - - -	400	1 0	4 iron pans - -	Bad.
Islington „ - - -	400	1 8	3 boilers, a small range.	Very bad.
Chelsea „ - - -	500	0 8	6 pans - - -	Boiler consumes little fuel.
Bethnal Green Union - -	900	Coke equal to 5 oz. of coal.	Steam pans - -	Good, all but the steam escapes.
St. George's „ - -	400	1 0	Case boilers and ovens.	Good.
Whitechapel „ - -	600	6 10	Boilers, direct fire -	Bad.
Strand „ - -	200	0 10	Copper pans (steam)	Very bad.
Hackney „ - -	600	0 9	Steam pans - -	Good.

TABLE E.

DIGEST of the SANITARY DEFECTS in BARRACKS described in our interim Reports, together with the Improvements required, the Estimates for Sanitary Works, Items and Amounts sanctioned by the Secretary of State, and items and Amounts postponed, up to 31st March 1860.

(NOTE.—Wherever the Amounts are not entered, the Estimates have not yet been received from the Commanding Royal Engineers.)

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
WELLINGTON BARRACKS.	£	£	£
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
89 / 1,354 / 1,134 / 220			
1. 600 cubic feet per man to be given	—	—	—
2. Ventilating shafts and inlets. Present inlets near the floor to be closed. Ventilation of gas burners and of non-commissioned officers' rooms	500	500	—
3. More baths to be provided	477	477	—
4. Drying apparatus for wash-houses	126	126	—
5. Ventilation of kitchens and additional means of cooking	150	150	Not executed.
6. Reconstruction of latrines and urinals, with divisions, half doors, and glass tiles on the roof	58	58	—
7. Abolition of ash-pits, and daily removal of barrack refuse	Executed by the Engineering Department.	156	—
8. Remodelled grates	205	205	—
9. Improved water supply	162	162	—
ST. GEORGE'S BARRACKS.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
31 / 476 / 414 / 62			
1. 600 cubic feet per man to be given	—	—	—
2. Additional air shafts and proper inlets for air to the barrack rooms	269	269	—
3. Women's wash-house to be better lighted and ventilated. Drying stoves to be provided	46	46	—
4. Roasting apparatus in the kitchen to be improved	Done by Engineering Department.		
5. Latrines to have divisions and half doors, glass tiles on the roof. Urinals to be supplied with water	184	184	—
6. Ablution rooms to be better lighted. Wooden gratings to stand on. An increased supply of baths	142	142	—
7. Ash-pit to be abolished, and refuse to be removed daily	Done by Engineering Department.		
8. Guard room to be better lighted, warmed, and ventilated	22	22	—
9. Ventilating shoemakers' shops	6	6	—
WATERLOO BARRACK, TOWER.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
41 / 732 / 587 / 145			
1. 600 cubic feet per man to be given	—	—	—
2. Ventilating shafts and inlets for the barrack rooms. Ventilation of non-commissioned officers' rooms. Kitchen, school room, library, guard room, and lock-up to be ventilated	480	480	—
3. Artillery ablution room to be better lighted, and to have gratings and a bath. Bath accommodation to be increased	280	280	—
4. Barrack room windows to be enlarged	683	683	—
5. Thames water to be disused and a better water supply provided	425	425	—
6. Women's wash-house to have a drying closet	7	7	—
7. Ash-pits to be abolished, and the refuse to be removed daily	—	—	—
8. Latrines to be ventilated, to have divisions and half doors, and urinals to be ventilated and supplied with water	127	127	—
9. Improvements in kitchens, including roasting ovens	168	168	—
10. Remodelled grates	170	170	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
ST. JOHN'S WOOD BARRACK.	£	£	£
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
11 / 220 / 121 / 99			
1. 600 cubic feet per man to be given	—	—	—
2. Barrack rooms to be ventilated by shafts and inlets. Ventilation of non-commissioned officers' rooms	73	73	—
3. Increased bath accommodation	24	24	—
4. Drying stove to the wash-house to be provided	64	64	—
5. Latrines to be ventilated and supplied with divisions and doors. Urinals to have water laid on	46	46	—
6. Ash-pit to be abolished, and refuse to be removed daily	—	—	—
7. Substituting roasting oven for gas oven	21	21	—
PORTMAN STREET BARRACKS.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
23 / 483 / 276 / 207			
This barrack recommended to be evacuated as unfit for occupation.			
MAGAZINE BARRACK, HYDE PARK.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
5 / 79 / 49 / 30			
1. 600 cubic feet per man to be given	—	—	—
2. Ventilation shafts for barrack rooms. Ventilation of guard room	34	34	—
3. A wash-house with drying stove to be provided	170	170	—
4. Kitchen to have means of roasting and baking	66	66	—
5. Latrines to have divisions and a flushing apparatus. Latrine to be provided for guard room	104	104	—
6. Coal store and ash-pit to be removed further from the barrack rooms. Cleaning shed to be boarded	97	97	—
7. Improved water supply	237	237	—
KNIGHTSBRIDGE CAVALRY BARRACK.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
50 / 505 / 428 / 77			
1. 600 cubic feet per man to be given	—	—	—
2. Barrack rooms, non-commissioned officers' rooms, married rooms, and workshops to be ventilated by shafts and inlets. Additional ventilation for cells and guard room	421	421	—
3. Stables to be ventilated by shafts through the roof. Stable doors opening into passages to be built up, and new doors to be opened into the court-yard	219	219	—
4. Kitchens to have means of roasting or baking	50	50	—
5. Improvments in latrines	106	106	—
6. Two ablution rooms with four baths	227	227	—
7. Horse infirmary to be separated from staff officers' quarters	346	346	Not executed.
8. Wash-houses to have drying stoves	87	87	—
9. Other improvements in wash-houses	9	9	—
REGENT'S PARK BARRACK.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
33 / 363 / 363 / —			
1. Accommodation to be re-arranged to equalize the cubic space	—	—	—
2. Barrack rooms and workshops to be ventilated by shafts and inlets	155	155	—
3. Windows to be made to light the long passages	107	107	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works	Items and Amounts Sanctioned.	Items and Amounts Postponed.
REGENT'S PARK BARRACK—*continued.*	£	£	£
4. Parade ground to be under-drained	278	278	—
5. Bath accommodation and ablution rooms to be enlarged. Water supply to be increased	339	339	—
6. Kitchen to be provided with means of baking and roasting	42	42	—
7. Laundry to be provided with drying stove	60	60	—
8. Latrines to have divisions and doors	55	55	—
9. Manure pits to be raised and paved	104	104	—
10. Remodelled grates	40	40	—
11. Alteration in drains	12	12	—
KENSINGTON PALACE NEW BARRACKS. 60 cavalry. 200 infantry.			
Alteration in drains	127	127	—
WINDSOR CAVALRY BARRACK.			

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
34	291	223	68

1. 600 cubic feet per man to be given	—	—	—
2. Barrack rooms to be ventilated by shafts and inlets	160	160	—
3. Corridors to be lighted and ventilated by ventilating skylights in the roof, and corresponding gratings in the floor to be introduced for admitting light and ventilation to the corridors on the floors below.	—	—	—
4. A baking and roasting oven to be put up in the kitchen	70	70	—
5. Bath accommodation. Improving ablution rooms	892	892	—
6. Manure to be removed at short intervals	—	—	—
7. Latrines to have divisions of seats and doors	61	61	—
8. A drying stove for the wash-house	50	50	—
9. Urinals	22	22	—
10. Remodelled grates	170	170	—
11. Reducing ashpits	5	5	—
WINDSOR INFANTRY BARRACK.			

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
43	922	579	343

1. 600 cubic feet per man to be given	—	—	—
2. Ventilating shafts of the barrack rooms to be straightened. Inlets and additional windows to be provided. Non-commissioned officers' rooms to be ventilated	161	161	—
3. Light and ventilation of ablution rooms to be improved, or new ablution rooms and baths to be provided	415	415	—
4. Oven in the kitchen to be ventilated	—	—	—
5. Privies to be converted into water-latrines, with divisions of seats and half-doors. Urinals to be reconstructed	143	143	—
6. Ash-pit to be abolished, and an iron cart for the daily removal of barrack refuse substituted	—	—	—
7. Drying closet to be provided	58	58	—
8. Guard room to be ventilated	10	10	—
9. Remodelled grates	84	84	—
10. Ventilating cells	27	27	—
HAMPTON COURT CAVALRY OLD BARRACK.			

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
2	73	54	19

1. 600 cubic feet per man to be given	—	—	—
2. Ventilation to be improved. Staircase to be ventilated through the roof. Guard room and stables to be ventilated	100	100	—
3. Roasting oven for kitchen	48	48	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
HAMPTON COURT CAVALRY OLD BARRACK—*continued.*	£	£	£
4. A wooden partition to be thrown across the larger room	—	—	—
5. Privies to be reconstructed as water latrines, with divisions of seats and doors	101	101	—
6. Bath required, and pegs for ablution rooms	73	73	—
7. Drying stove for wash-house	43	43	—
8. Improved water supply	128	128	—

HAMPTON COURT CAVALRY NEW BARRACK.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
6	48	48	—

1. Barrack rooms to be ventilated by shafts and inlets	32	32	—
2. Room doors to be moved to the end furthest from the fire-places	—	—	—
3. Bath and pegs in ablution room	16	16	—
4. Roasting oven to be provided for kitchen	30	30	—
5. Drying stove for wash-house	30	30	—
6. Barrack to be drained. Sewage to be removed to an outfall. Privies to be reconstructed as water latrines, with divisions of seats and half doors. Improving the dung pit	67	67	—
7. Improved water supply	180	180	—

CROYDON BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
18	460	333	127

1. Reduction of inmates to give 600 cubic feet per man	—	—	—
2. Barrack rooms to be ventilated by shafts and inlets. The four shed barrack rooms to be ventilated through the roof, to have additional light, and an additional fire-place	297	297	—
3. Ablution rooms to be put in repair, properly paved, and additional bathing accommodation provided	70	70	—
4. A baking and roasting oven to be provided for each kitchen	Done by Engineering Department.	—	—
5. Latrines to have divisions	Done by Engineering Department.	—	—
6. Ash-pits to have covers			
7. Remodelled grates	109	109	—
8. General improvements	118	118	—
It would be better to evacuate this barrack.			

HOUNSLOW CAVALRY BARRACK.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
29	232	174	58

1. Number of men to be limited to six per room	—	—	—
2. Barrack rooms and stables to be ventilated by shafts and inlets	204	204	—
3. Barrack to be drained, cess-pits to be abolished, and an offensive ditch to be covered	230	230	Not executed.
4. Bath accommodation to be provided. Ablution room to have beads, gratings, and pegs	165	165	—
5. Wash-houses to have drying stoves, light, and ventilation	123	123	—
6. Privies to be reconstructed as water latrines. Urinals to be improved. Guard room privy to be removed	220	220	—
7. Cook-houses to have roasting ovens	48	48	—
8. School, chapel, guard room, and shops to be ventilated	121	—	121
9. Increased water supply	300	300	—
10. Remodelled grates	216	216	—
11. Building boundary	131	131	—
12. Enlarging forge	43	43	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
CHATHAM BARRACKS.	£	£	£
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
176 / 2,700 / 1,336 / 1,364			
1. 1,364 men to be removed out of the rooms, so as to give 600 cubic feet per man	—	—	—
2. Each barrack room to be ventilated by a shaft and inlets. Guard rooms, lock-up rooms, schools, and library to be ventilated	1,112/4	1,112/4	—
3. Asphalted floors to be boarded	1,202	1,202	—
4. Cess-pits to be abolished, and drainage improved. Privies to be reconstructed as water latrines, with divisions. Urinals to be reconstructed and supplied with water	1,576	—	1,576
5. Additional water supply to be provided	1,097	1,097	—
6. Foul bedding and hair stores to be removed from under barrack rooms, and reconstructed elsewhere	434	434	—
7. Better ablution rooms to be provided, or rooms to be improved by light and ventilation, pegs, and gratings	178	178	—
8. Baths to be provided	188	188	—
9. Ash-pits to be abolished, and the barrack refuse to be collected and removed daily in iron carts	700	—	700
10. Guard room to be enlarged to give 600 cubic feet per man	174	174	—
11. A drying room with stoves to be provided	—	—	—
12. A covered drill shed to be provided	660	660	—
13. Laundry to be reconstructed	2,050	2,050	—
14. Gas burners to be ventilated	160	160	—
CHATHAM SPUR BATTERY CASEMATES. Recommended to be given up.			
BROMPTON BARRACKS.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
111 / 1,725 / 1,124 / 601			
1. To remove 601 men out of the rooms, in order to give 600 cubic feet per man	—	—	—
2. Barrack rooms and school rooms to be ventilated by shafts and inlets	760	760	—
3. Additional water supply to be provided	—	—	—
4. Privies to be converted into water latrines, with divisions of seats and doors. Cess-pits to be abolished, and the drainage improved	656	—	656
5. Roofs to be guttered where required. Under-ground water-tanks to be abolished, and water cisterns to be provided above ground	900	900	—
6. Kitchens to be provided with the means of roasting and baking meat	242	242	—
7. South Square barrack rooms to be floored with wood, and to have additional light	867	867	—
BROMPTON HUT BARRACKS.			
1. Water latrines and drainage to be provided	1,008	—	1,008
2. Ventilation to be improved by ridge ventilators	125	125	—
3. A covered drill shed	390	390	—
ST. MARY'S CASEMATES.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
47 / 1,128 / 690 / 438			
1. That 438 men be removed from the casemates, so as to give 600 cubic feet per man	—	—	—
2. Casemates to be ventilated by shafts, perforated zinc in the fan-lights, and gas burners to be ventilated	340	340	—
3. Lower casemates to be floored with wood	1,428	1,428	—
4. Cook-houses to have means of baking and roasting meat	170	170	—
5. Wash-house to have wooden gratings, proper tubs, and a laundry stove	78	78	—
6. Privies to be converted into water latrines with flushing apparatus	382/9/6	—	382/9/6
7. Guard room and lock-up room to be ventilated	5	5	—
8. Gas burners to be ventilated	50	50	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
MAIDSTONE BARRACKS.	£	£	£
Number of Rooms: 20 — Regulation Number of Men: 360 — Accommodation at 600 Cubic Feet per Man: 230 — Deficiency of Accommodation in Men: 130			
1. To remove 130 men out of the rooms, so as to give 600 cubic feet per man	—	—	—
2. Ventilation of barrack rooms, guard room, and lock-up by shafts and inlets. Non-commissioned officers' rooms to have Arnott's ventilators and inlets	148/10	148/10	—
3. Reconstruction of privies as water latrines with drainage. Cess-pits to be abolished. Urinals to be provided with water	1,305	—	1,305
4. Roasting oven for the cook-house	150	—	150
5. Drying room for the wash-house. Fixed tubs, and place for ironing	420	—	420
6. Lavatories to have skylights, gratings, and baths, 1 to every 100 men	360	—	360
7. Iron carts to be substituted for ash-pits	232	—	232
8. Manure pits to be removed from the vicinity of barrack rooms and hospital	—	—	—
9. Additional light for the school-room	—	—	—
TILBURY FORT.			
Number of Rooms: 14 — Regulation Number of Men: 201 — Accommodation at 600 Cubic Feet per Man: 123 — Deficiency of Accommodation in Men: 78			
1. To remove 78 men, in order to give 600 cubic feet per man	—	—	—
2. Ventilation of barrack rooms by shafts and inlets. Ventilation of guard room. Fire grates to be remodelled. Ventilation of lock-up and cells	505	—	505
3. Ablution rooms to be properly supplied with water, beads to the tables, gratings, pegs, and ventilation through the roof. Two baths with water laid on to be provided	46	—	46
4. Women's wash-house to have tubs, gratings, water laid on, a drying and laundry stove, and to be lighted and ventilated through the roof	83	—	83
5. Privies to be reconstructed as water latrines, with divisions, half doors, light, and ventilation. Urinals to be supplied with water	207	—	207
6. A sluice to be provided for keeping the moat full of water	Since constructed.		
7. Additional water supply	340	—	340
NEW TAVERN FORT, GRAVESEND.			
Number of Rooms: 7 — Regulation Number of Men: 51 — Accommodation at 600 Cubic Feet per Man: 33 — Deficiency of Accommodation in Men: 18			
1. Rooms to be ventilated by shafts and inlets. Windows to be made to open at top. Guard room and lock-up to be ventilated by shafts. Guard room grate to be remodelled so as to warm the air	102	—	102
2. An oven for the kitchen	10	—	10
3. Gratings and pegs for the ablution rooms	4	—	4
4. Women's wash-house to have a drying stove	—	—	—
5. Privies to be reconstructed as water latrines, with divisions, half-doors, light, and ventilation. To be drained to the river. Cess-pits to be abolished, and drains to be trapped. Laying on water (Whole barrack requires rebuilding.)	603	—	603
WOOLWICH BARRACKS.			
Number of Rooms: 213 — Regulation Number of Men: 3,508 — Accommodation at 600 Cubic Feet per Man: 2,750 — Deficiency of Accommodation in Men: 758			
1. To remove 758 men out of the rooms, in order to give 600 cubic feet per man	—	—	—
2. Ventilation of barrack rooms in the right and left wings, front range, guard room, lock-up, and library, by shafts and inlets	1,389	1,389	—
3. Ventilation of stables, and of barrack rooms over stables, in the rear ranges, and in the east and west squares: additional windows	1,745	1,745	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
WOOLWICH BARRACKS—*continued.*	£	£	£
4. Reconstruction of the privies as water latrines, with divisions, half doors, light, and ventilation	350	350	—
5. Ash-pits to be abolished, and iron carts substituted. More frequent removal of stable dung	50	—	—
6. Three new cooking ranges	616	616	—
7. One bath for every 100 men	1,350	1,350	—
8. Improvements in latrine buildings and one bath	25	25	—
9. Additional windows	22	22	—
WOOLWICH HUT BARRACKS.			
42 Huts - 1,008 Men.			
1. Four men to be removed out of each hut	—	—	—
2. Roasting ovens for each cook-house	80	80	—
3. Gratings, and other improvements for the lavatories	40	40	—
4. Baths, one for every 100 men	600	—	600
5. More frequent collection and removal of stable dung and barrack refuse	—	—	—

ANGLESEA BARRACKS, PORTSEA.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
53	954	794	160
1. 160 men to be removed out of the rooms, so as to give 600 cubic feet per man	—	—	—
2. Barrack rooms, guard room, school room, and library to be ventilated by shafts and inlets. Ventilation of gas burners	650	650	—
3. Cess-pits to be abolished. Privies to be converted into water latrines and drained, to have divisions of seats and half-doors. Water-closets for officers' quarters. Urinals to be improved and supplied with water	1,150	1,150	—
4. Roasting and baking oven to be provided for the kitchen	100	100	—
5. Wooden gratings for the ablution room Baths (1 to 100 men) to be provided	160	160	—
6. Ashpit to be reduced in size and covered	55	55	—
7. Watercloset for commanding officer's quarters	48/12/7	48/12/7	—

ROYAL ENGINEER BARRACK, PORTSEA.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
3	99	90	9
1. 9 men to be removed from No. 1 room	—	—	—
2. Rooms to be ventilated by shafts and inlets	—	—	—
3. Abolition of cess-pit, and water latrine with drainage to be substituted	—	—	—
4. Gratings for the lavatory	—	—	—
5. Bath to be provided	—	—	—
6. Rooms to be lighted with gas	—	—	—
Total estimate	17	17	—

COLEWORT ROYAL ARTILLERY BARRACK, PORTSMOUTH.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
7	185	144	41
1. 41 men to be removed from the rooms	—	—	—
2. Rooms to be ventilated by shafts and inlets	—	—	—
3. Cess-pits to be abolished and water latrines provided	—	—	—
4. Baths to be provided	—	—	—
5. A drying stove for the wash-house	—	—	—
6. A roasting and baking oven for the kitchen	—	—	—
7. Laying on gas to tailors shop and cutting rooms	—	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
COLEWORT INFANTRY BARRACK.	£	£	£
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
14 / 238 / 120 / 118			
1. 118 men to be removed from the barrack rooms	—	—	—
2. Ventilation of barrack rooms and school rooms by shafts and inlets. Ventilation of guard room	—	—	—
3. Barrack to be drained. Privies to be reconstructed as water latrines	—	—	—
4. Kitchen to be provided with roasting oven	—	—	—
5. Additional bath accommodation to be provided	—	—	—
6. Ash-pit to be removed, and an iron cart substituted	—	—	—
7. Wash-house to be improved, and a drying stove provided	—	—	—
Total estimate for both the Colewort Barracks	786/6/4	786/6/4	—
CAMBRIDGE BARRACK, PORTSMOUTH.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
52 / 1,012 / 797 / 215			
1. 215 men to be removed from the rooms	—	—	—
2. Rooms to be ventilated by shafts and inlets. Gas burners to be ventilated	—	—	—
3. Privies to be reconstructed as water latrines	—	—	—
4. Iron cart to be substituted for ash-pit	—	—	—
5. Baking and roasting oven for kitchen	—	—	—
Total amount for items 2 to 5	1,554	1,554	—
CLARENCE BARRACK, PORTSMOUTH.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
65 / 912 / 746 / 166			
1. 166 men to be removed from the rooms	—	—	—
2. Ventilation of barrack rooms, guard room, and school room by shafts and inlets	—	—	—
3. Barrack to be drained and cess-pits abolished	—	—	—
4. Reconstruction of privies as water latrines with divisions and half-doors	—	—	—
5. Reconstruction of urinals, with water laid on	—	—	—
6. Substitution of iron carts for ash-pits	—	—	—
7. Roasting oven for kitchen	—	—	—
8. Additional baths with water to be provided	—	—	—
9. Wash-house to be provided with fittings and a drying closet or stove			
10. Gas to serjeant's mess and kitchen	—	—	—
Total for items 2 to 10	337/12/6	337/12/6	—
FORT CUMBERLAND.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
33 / 621 / 253 / 368			
1. That 368 men be removed out of the casemates	—	—	Services postponed, as the barracks are given over to the Royal Marines.
2. Casemates to be ventilated by shafts and inlets	251	—	
3. Privies to be reconstructed as water latrines, self-discharging at low tide	1,936	—	
4. A better ablution room to be provided	80	—	
5. Roasting oven for the kitchen	60	—	
POINT BATTERY, PORTSMOUTH.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
4 / 80 / 60 / 20			
1. To remove 20 men out of the casemates	—	—	—
2. Casemates to be ventilated by a shaft, inlets, and grates	—	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
POINT BATTERY, PORTSMOUTH—*continued.*	£	£	£
3. Kitchen to be provided with a small range with roasting oven -	—	—	—
4. A water latrine to be substituted for the privy - - -	—	—	—
5. A bath to be provided, and water laid on to the ablution room -	—	—	—
Total for items 2 to 5 - - - -	190	190	—
BLOCK HOUSE FORT, GOSPORT.			
Number of Rooms: 5 — Regulation Number of Men: 92 — Accommodation at 600 Cubic Feet per Man: 92 — Deficiency of Accommodation in Men: —			
1. Ventilation of casemates by shafts and inlets - - -	—	—	—
2. A cooking range with roasting oven to be provided for the kitchen	—	—	—
3. A bath to be provided - - - - - -	—	—	—
4. Privy to be converted into a water latrine - - - -	—	—	—
Total for these four items - - -	40	40	—
FORT MONCKTON, GOSPORT.			
Number of Rooms: 30 — Regulation Number of Men: 289 — Accommodation at 600 Cubic Feet per Man: 133 — Deficiency of Accommodation in Men: 156			
1. To remove 156 men out of the rooms and casemates - -	—	—	—
2. The rooms and casemates to be ventilated by shafts and inlets -	84	84	—
3. Drainage of the Fort to be improved - - - -	—	—	—
4. Removal of privies and their reconstruction as water latrines in a better situation, with divisions and half-doors - - -	—	—	—
5. Roasting and baking oven for the kitchen - - - -	42	42	—
6. A laundry stove for the wash-house - - - -	—	—	—
7. Two baths to be provided - - - - - -	—	—	—
For other items except Nos. 2 and 5 - - -	107	107	—
HASLAR BARRACK, GOSPORT.			
Number of Rooms: 23 — Regulation Number of Men: 346 — Accommodation at 600 Cubic Feet per Man: 295 — Deficiency of Accommodation in Men: 51			
1. Ventilation of barrack rooms and school rooms by turrets in the roof and inlets, perforated zinc for ventilators - - -	—	—	—
2. Barrack to be drained and cess-pits abolished - - -	—	—	—
3. Removal of privies and their reconstruction on a better site as water latrines, with divisions and half doors - - - -	—	—	—
4. A baking and roasting oven for the kitchen - - -	—	—	—
5. Three baths to be provided - - - - - -	—	—	—
6. Ash-pit to be placed further from the buildings and more frequently emptied - - - - - - - -	—	—	—
7. A drying stove for the wash-house - - - - -	—	—	—
Total for these seven items - - -	470/14/1	470/14/1	—
WINCHESTER BARRACKS.			
Number of Rooms: 119 — Regulation Number of Men: 1,666 — Accommodation at 600 Cubic Feet per Man: 1,055 — Deficiency of Accommodation in Men: 611			
1. To remove 611 men out of the rooms. Dark barrack rooms to be appropriated for other purposes - - - - -	—	—	—
2. Improvements in ventilation. Barrack to be lighted with gas -	—	—	—
3. Kitchens to be reconstructed in a better situation, and to be provided with roasting ovens - - - - -	—	—	—
4. Ablution rooms to be removed from basements, and reconstructed in a better position. To be provided with baths, and a covered communication with the barrack - - - - -	—	—	—
5. Drainage of latrines to be improved - - - -	—	—	—
6. Improved surface drainage - - - - - -	100	100	—
7. Other improvements - - - - - -	2,000	2,000	—
Total for items 1 to 5 - - - -	1,515	1,515	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
CHICHESTER BARRACKS.	£	£	£
Number of Rooms: 42 — Regulation Number of Men: 572 — Accommodation at 600 Cubic Feet per Man: 440 — Deficiency of Accommodation in Men: 132			
1. To remove 132 men out of the huts - - - - -	—	—	—
2. Ventilation of each hut by a shaft and inlet for admitting air, to be warmed by a remodelled grate. Ventilation of non-commissioned officers' mess room and tailor's shop by Arnott's ventilator and inlets. Ventilation of chapel school through the ridge. Ventilation of library and infant school by shafts. Ventilation of guard room and cells to be improved - - - - - -	468	468	—
3. Drainage of the ablution rooms to be improved. Gratings, pegs, a head to the table, and a ventilating skylight, to be provided for each ablution house. Also one bath for every 100 men, with water laid on - - - - - - -	130	130	—
4. Women's wash-house to be ventilated through the roof. Water to be laid on to the tubs; a drying stove and means of ironing linen to be provided. (Proposed to build a new laundry) - -	600	600	—
5. Cook-houses to have each a roasting oven, and a skylight in the roof	130	130	—
6. The whole barrack area to be under-drained. Cess-pits to be abolished, and privies reconstructed as water latrines, with divisions, half doors, light, and ventilation. Urinals to be provided and supplied with water - - - - - -	3,055	—	3,055
7. Dung-pit and ash-pits to be filled up to the level, paved and drained	24	24	—
BRIGHTON CAVALRY BARRACKS.			
Number of Rooms: 31 — Regulation Number of Men: 402 — Accommodation at 600 Cubic Feet per Man: 314 — Deficiency of Accommodation in Men: 88			
1. Reduction of the numbers of men in all the rooms to the extent stated - - - - - - - -	—	—	—
2. Corridor to be lighted and ventilated by two shafts carried up to the roof, with ventilated skylights above, and perforated glass panes to be put into the upper row of all the windows in the corridor and staircases. Troop rooms above the stables to have the covers removed from the ventilating shafts, and each shaft to be carried above the roof. Where there are no shafts a wooden shaft to be carried from the ceiling to above the roof. Each attic room to be ventilated by a louvred ventilating turret carried up through the ridge. Each troop room to have one inlet for air with a perforated zinc cornice. The blank window in each troop room to be opened and glazed. Non-commissioned officers' rooms to have their ventilation improved in the same manner as that of the troop rooms. School-room to be ventilated by a louvre through the roof, and one of Cundy's stoves to heat the air admitted. Tailor's shop to be ventilated by a shaft and inlet. Guard room to have a shaft and remodelled grate. Canteen tap-rooms to be ventilated by silk flap ventilators in the chimneys and perforated panes in the windows - - - - - -	247	247	—
3. Stables to be ventilated by a shaft lined with zinc carried from each corner above the roof. Stable windows to be enlarged -	190	190	—
4. Stables to be drained - - - - - -	47	47	—
5. Barrack room grates to be remodelled to save heat - - -	410	410	—
6. A ventilated gas-burner to be introduced into every barrack room -	160	—	160
7. A second ablution house to be built, four baths to be introduced, two in each house, with water laid on. Pegs to be provided in the present ablution house, and ventilation through the roof -	267	—	267
8. Women's wash-house to be provided with fixed tubs, and water laid on. Boilers to be re-set, and means of drying and getting up linen provided - - - - - - -	122	—	122
9. Barrack drainage to be improved. Privies to be reconstructed as water latrines, with divisions of seats, half-doors, light, and ventilation; and to be drained, and the sewage disposed of in one of the ways mentioned. All water-closets to be drained, and the cesspits abolished. Urinals to be reconstructed, and supplied with water.	Under consideration with reference to the question of outlet.		

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
BRIGHTON CAVALRY BARRACKS—*continued.*	£	£	£
10. Litter sheds	331	—	331
11. Manure pits to be filled up to the level. Ash-pits to be abolished, and arrangements made for the daily cleansing of the barracks	144	—	144
12. Guard room privy to be converted into a water latrine, urinal to be drained and supplied with water, and proper means of ablution to be provided	5	—	5
BRIGHTON INFANTRY BARRACKS.			
Number of Rooms: 18 — Regulation Number of Men: 288 — Accommodation at 600 Cubic Feet per Man: 180 — Deficiency of Accommodation in Men: 108			
This barrack should be given up. It would be much better to erect huts for the men than keep them in it. We have no doubt that part of the heavy sick and death rate from zymotic disease on the station is due to this barrack. If, however, it must be used, we should advise the following sanitary improvements to be carried out without delay :—			
1. Reduction of the number of men from 16 to 10 men per room	—	—	—
2. Ventilation of every barrack room and the school-room by a shaft and two inlets for air. Ventilation of the staircase by perforated panes of glass in the windows. Fire-grates to be re-modelled	215	—	215
3. A ventilated gas burner to be introduced into each barrack-room	102	—	102
4. Ablution house to be lighted by glass slates in the roof, and to have pegs put up. Two baths with water laid on to be provided	32	—	32
5. Wash-house to have fixed tubs and water laid on; and a drying stove and means of ironing linen to be provided	13	—	13
6. Privies to be reconstructed as water latrines, with divisions of seats, half-doors, light, and ventilation, and the cesspit filled up	172	—	172
7. Ashpit to be filled up, and an iron cart provided for the collection and daily removal of barrack refuse	39	—	39
8. Officers' quarters in the Pavilion stables to be abandoned	—	—	—
SHORNCLIFFE CAMP.			
192 Huts — 4,800 Men.			
1. Three men to be removed out of each hut	—	—	—
2. Roasting and baking ovens for all the cook-houses requiring them	500	500	—
3. Ablution rooms to have gratings, pegs, and better drainage for the tables	95	95	—
4. Water supply to be increased to afford water for baths. One bath for every 100 men to be provided	400	400	—
5. Urinals to be removed from the inside of the latrines	300	300	—
6. Wash-houses to have drying stoves and means of ironing linen	—	—	—
7. Prison cells to be better ventilated, and prison latrines to be improved	—	—	—
8. Day room and drill sheds	1,600	—	1,600
ROYAL ARTILLERY BARRACKS, SHORNCLIFFE.			
Number of Rooms: 8 — Regulation Number of Men: 104 — Accommodation at 600 Cubic Feet per Man: 88 — Deficiency of Accommodation in Men: 16			
1. To remove 16 men out of the barrack rooms, two per room	—	—	—
2. Ventilation of each room by shafts and inlets	24	24	—
3. Remodelling the fire-grates to warm the air admitted	72	—	72
4. Privies to be reconstructed as water latrines, and drained, or iron boxes with deodorizing to be substituted. Urinals to be improved	215	215	—
5. Two baths to be provided	20	20	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
HYTHE BARRACKS.	£	£	£
Number of Rooms. 19 — Regulation Number of Men. 268 — Accommodation at 600 Cubic Feet per Man. 195 — Deficiency of Accommodation in Men. 73			
1. To remove 73 men out of the barrack rooms	—	—	—
2. Rooms to be ventilated by shafts and inlets, and by hanging the windows to open at top. Ventilation of guard room and meat house	442	442	—
3. Remodelling the fire-grates	120	120	—
4. Paving and guttering to be repaired and surface drainage improved	70	70	—
5. Two baths to be provided. Pegs to be put up in the ablution room	40	40	—
6. A roasting oven for the cook-house	50	50	—
7. Latrine to have divisions. Urinals to be supplied with water	34	34	—
8. Improved laundry accommodation to be provided	300	300	—
9. Married quarters to be ventilated by Arnott's valves	—	—	—
10. Improved water supply	190	190	—
DOVER, WESTERN HEIGHTS.			
Number of Rooms. 51 — Regulation Number of Men. 1,071 — Accommodation at 600 Cubic Feet per Man. 816 — Deficiency of Accommodation in Men. 255			
1. To remove 255 men out of the barrack rooms	—	—	—
2. Ventilation of barrack rooms, guard rooms, canteen, serjeants' mess, and library, by shafts, inlets, &c.	390	390	—
3. Improving the latrines and drainage, trapping gulley grates, supplying urinals with water, and ventilating them	140	140	—
4. Cook-houses to have means of roasting and baking meat	200	200	—
5. Women's wash-house to have a drying stove	Will be carried out in connexion with the new married quarters.		
6. Barrack refuse to be collected and removed in iron carts	105	—	105
7. One bath for every 100 men to be provided	360	360	—
8. Guard room at the foot of the shaft to be ventilated and enlarged; adjoining privy to be converted into a water latrine	30	30	—
9. Water latrine and urinal for 2nd infantry guard room	120	120	—
10. Improvement in tailors' shop and lock-up room	15	15	—
11. Cisterns in ablution rooms	50	50	—
DOVER, DROP REDOUBT.			
3 Casemates — 25 Men.			
1. Ventilation by silk flap valves and inlets	4	4	—
2. Grates to be remodelled, to warm part of the admitted air	40	40	—
3. Privies to be used as water latrines and ventilated through the roof. Urinals to be supplied with water	Will be carried out as soon as the drainage is completed.		
4. Half doors to be provided	10	10	—
5. Pegs to be placed in the lavatory. More light to be given	5	5	—
6. Improved urinals	3	3	—
DOVER CITADEL.			
Number of Rooms. 25 — Regulation Number of Men. 654 — Accommodation at 600 Cubic Feet per Man. 654 — Deficiency of Accommodation in Men. —			
1. Re-arranging the beds in the casemates to give 600 cubic feet per bed	—	—	—
2. Improving the ventilation by Arnott's silk flap valves into the chimneys, and by perforated glass panes at the top of all the highest casemate windows	10	10	—
3. Guard rooms, lavatories, privies, and urinals to be ventilated through the roofs	—	—	—
4. Fire-grates to be remodelled	300	—	300
5. Water to stand in the troughs of the latrines; divisions and half doors to be provided	20	20	—
6. Supplying all urinals with water	—	—	—
7. Substituting iron carts for ash-pits	105	—	105

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
DOVER CITADEL—*continued.*	£	£	£
8. Providing bath rooms and baths in the proportion of one bath to 100 men	270	—	270
9. Providing a baking and roasting oven in every cook-house	100	100	—
10. Introducing reflectors to throw light into the ablution room and cook-house of the long casemates	15	15	—
11. Drying-stoves for wash-houses — A laundry will be provided in the new married quarters.			
12. Ventilation of ablution rooms, &c.	20	20	—
13. Steam power for improved water supply	1,000	—	1,000
DOVER CASTLE, SPUR BATTERY CASEMATES.			
Number of Rooms: 15 — Regulation Number of Men: 245 — Accommodation at 600 Cubic Feet per Man: 109 — Deficiency of Accommodation in Men: 136			
1. To remove 136 men out of the casemates	—	—	—
2. Floors dividing the seven casemates to be removed	70	70	—
New floors with ventilation below them substituted	350	350	—
3. Casemates to be ventilated by shafts and inlets. Remodelled grates	49	—	49
4. Guard room to be similarly ventilated and warmed	67	67	—
5. Latrines to have divisions and half doors; also additional light	5	5	—
6. Baths to be provided	—	—	—
DOVER, KEEP YARD BARRACKS.			
Number of Rooms: 8 — Regulation Number of Men: 241 — Accommodation at 600 Cubic Feet per Man: 129 — Deficiency of Accommodation in Men: 112			
1. 112 men to be removed out of the barrack rooms	—	—	—
2. Barrack rooms, school room, and library to be ventilated and warmed by shafts, inlets, and additional windows	155	155	—
And remodelled grates	—	—	—
3. Roasting oven for the cook-house	60	60	—
4. Improvement of ablution room and providing pegs	10	10	—
5. Baths to be provided	360	360	—
6. Iron carts to be substituted for the ash-pits	347	—	347
7. A drying stove for the women's wash-house	—	—	—
8. Cess-pits to be abolished	—	—	—
9. Latrines to be ventilated	3	3	—
10. Officers' quarters to have waterclosets and drainage instead of cess-pits	200	200	—
These barracks require to be entirely reconstructed.			
DOVER CLIFF CASEMATES.			
Number of Rooms: 9 — Regulation Number of Men: 414 — Accommodation at 600 Cubic Feet per Man: 287 — Deficiency of Accommodation in Men: 127			
1. 127 men to be removed out of the casemates	—	—	—
2. Ventilation of long casemates by perforated glass panes in the upper portion of all the windows, silk flap valves in the chimneys, and by a hollow beam to supply fresh air carried along the ceiling	60	60	—
3. Ventilation of guard room	2	2	—
4. Ventilation of kitchen to be improved, and a roasting oven provided	53	53	—
5. Remodelled fire-grates	110	—	110
6. Ash-pit to be abolished and the refuse removed daily	—	—	—
7. Latrine to be ventilated, and the means of flushing improved	20	20	—
These casemates are only fit for occupation during siege. Proper barracks for the men should be provided.			

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
WALMER, SOUTH BARRACKS.	£	£	£
Number of Rooms. 23 — Regulation Number of Men. 397 — Accommodation at 600 Cubic Feet per Man. 305 — Deficiency of Accommodation in Men. 92			
1. 92 men to be removed out of the barracks, and 600 cubic feet per man to be given for the remainder	—	—	—
2. Ventilation of rooms and married quarters by shafts and inlets	312	312	
Guard room and lock-up, to be similarly ventilated and to have remodelled grates	22	22	—
3. Remodelled fire-grates to warm the air	309 10	—	309 10
4. Barracks to be drained; cesspits filled up, privies reconstructed as water latrines, with divisions and half doors; urinals to be supplied with water	Dependent on the drainage works about to be carried out.		
Latrines to be ventilated and to have doors	65	65	—
5. The kitchen ovens to be improved so as to roast meat. Cooking tins to be provided	10	10	—
6. Ventilation of cook-house	15	15	—
7. Ablution rooms to be ventilated by shafts and perforated panes. Gratings to be provided	58	58	—
8. A bath room, with one bath for every 100 men	180	180	—
9. Ablution room to be repaved	40	40	—
10. Iron carts to be substituted for ash-pits	113	—	113
11. Drying stove for the wash-house, and enlarging the building	250	—	250
12. Barrack rooms to be lighted by gas, and the burners to be ventilated	300	—	300
WALMER, CAVALRY BARRACKS.			
Number of Rooms. 10 — Regulation Number of Men. 72 — Accommodation at 600 Cubic Feet per Man. 56 — Deficiency of Accommodation in Men. 16			
1. 16 men to be removed out of the barrack rooms	—	—	—
2. Ventilation of the barrack rooms and guard room by shafts and inlets	130	130	—
3. Remodelled grates to warm the air	96	—	96
4. Ventilation of stables by shafts and perforated glass windows	105	105	—
5. Barrack to be drained, and the privy to be reconstructed as a water latrine, with divisions and half doors	Will be done when the projected drainage is carried out.		
6. A roasting oven for the cook-house and new boilers	70	70	—
7. An ablution and bath room with two baths	100	100	—
8. A drying stove, and enlarging women's wash-house	120	120	—
9. Ash cart to be provided and spaces paved	39	—	39
WALMER, NORTH BARRACKS.			
Number of Rooms. 17 — Regulation Number of Men. 436 — Accommodation at 600 Cubic Feet per Man. 334 — Deficiency of Accommodation in Men. 102			
1. 102 men to be removed from the rooms	—	—	—
2. Ventilation of barrack rooms and library by silk flap ventilators and perforated glass panes	65	65	—
3. Remodelled grates	66	—	66
3. Guard room to be ventilated by shaft and inlet, and remodelled grate	11	11	—
4. Barrack to be sewered, and cesspits abolished. Reconstruction of privies as water latrines, with divisions and half doors. Urinals to be reconstructed, and supplied with water	Will be done when the projected drainage is completed.		
5. Ablution room to be ventilated by a shaft and perforated panes; to have gratings, and one bath for every 100 men	115	115	—
6. Cook-house oven to be made capable of roasting meat	1	1	—
7. Women's wash-house to be reconstructed or repaired, and provided with utensils, drying stove, &c.	300	—	300
CANTERBURY, CAVALRY BARRACK.			
Number of Rooms. 30 — Regulation Number of Men. 270 — Accommodation at 600 Cubic Feet per Man. 240 — Deficiency of Accommodation in Men. 30			
1. 30 men to be removed from the barrack rooms	—	—	—
2. Ventilation of barrack rooms by shafts and inlets	384	384	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
CANTERBURY CAVALRY BARRACKS—*continued.*	£	£	£
3. Corridor to be lighted and ventilated by ventilating skylights -	60	60	—
4. Workshops to be lighted and ventilated through the roof - -	25	25	—
5. Urinals to be roofed over and supplied with water - - -	—	—	—
6. Ventilation of non-commissioned officers' rooms and married quarters by silk flap valves and perforated frames. Windows to be made to open at top - - - - - - - -	50	50	—
7. Stables to be ventilated by shafts and perforated glass panes -	144	144	—
CANTERBURY, ROYAL ARTILLERY BARRACK.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
15 / 225 / 149 / 76			
1. 76 men to be removed out of the barrack rooms - - -	—	—	—
2. Rooms to be ventilated by shafts and inlets, and to have additional windows where required - - - - - -	472	472	—
CANTERBURY, NORTH GATE BARRACKS.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
21 / 420 / 307 / 113			
1. To remove 113 men from the barrack rooms - - -	—	—	—
2. Each room to be ventilated by a shaft and inlets, and additional light to be provided where necessary - - - - - -	This item is included in the Estimate for ventilating the Royal Artillery Barracks.		
CANTERBURY, PERMANENT INFANTRY BARRACKS.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
41 / 820 / 533 / 287			
1. 287 men to be removed out of the barrack rooms - - -	—	—	—
2. Ventilation of each room by a shaft - - - -	500	500	—
The following works to be executed throughout the whole Barrack Establishment of Canterbury :—			
1. Barrack to be drained and supplied with water. Cess-pits to be abolished. Privies to be reconstructed as water latrines, with divisions and half doors. Urinals to be reconstructed and supplied with water - - - - - - - -	10,222	—	10,222
2. Ash-pits to be abolished, and a service to be organized for the daily collecting and removing of barrack refuse by iron carts - -	854	—	854
3. Cook-houses to be supplied with baking and roasting ovens - -	440	440	—
4. Bath rooms with one bath for every 100 men to be provided -	850	—	850
5. Also gratings and pegs to be provided for the ablution houses -	30	30	—
6. All women's wash-houses to have drying stoves, places for ironing linen, and gratings, (proposed to provide five laundries) - -	1,000	—	1,000
7. Guard rooms to be ventilated by shafts and inlets - - -	60	60	—
8. Barracks to be lighted with gas - - - - - -	—	—	—
9. Providing cleaning rooms - - - - - -	840	—	840
PLYMOUTH CITADEL.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
97 / 1,083 / 645 / 438			
1. To remove 438 men from the barrack rooms and casemates. Rooms in the basement of the Chaplain's range to be evacuated and struck off the barrack room construction - - - -	—	—	—
2. Casemates to be ventilated by silk flap valves and inlets. Window space to be enlarged - - - - - -	212/12/5	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
PLYMOUTH CITADEL—*continued.*	£	£	£
3. All fire-grates to be remodelled, and floors of casemates to be	1,315 13/5	—	—
4. Barrack rooms to be ventilated by shafts and inlets. Staircases boarded to be ventilated by perforated glass panes. Non-commissioned officers' rooms to have silk flap ventilators. Guard room to be ventilated by silk flap valves and inlets. School rooms, library, and workshops to be ventilated by shafts and inlets. Canteen rooms to be ventilated by silk flap valves and perforated glass panes	826/0/9¼	—	—
5. Barrack room fire-grates to be remodelled	—	—	—
6. Ventilated gas burners to be introduced throughout the barracks	580 17/10	—	—
7. Ablution rooms to be ventilated, and to have pegs	9/1 10¾	—	—
8. A bath house with one bath for every 100 men	129 3/10	—	—
9. Women's wash-houses to be ventilated by shafts and perforated glass panes, to have fixed tubs, laundry stove, and table for getting up linen	106/12/7	—	—
10. Cook-houses to be ventilated	29 13/2	—	—
11. Iron carts to be substituted for ash-pits	128 0 3	—	—
12. Privies to be reconstructed as water latrines, with divisions, half-doors, light, and ventilation	491/6/4	—	—
PLYMOUTH, PRINCE OF WALES'S REDOUBT.			
Number of Rooms: 4 — Regulation Number of Men: 72 — Accommodation at 600 Cubic Feet per Man: 56 — Deficiency of Accommodation in Men: 16			
1. To reduce the number of men by 16 at ordinary times	—	—	—
2. Air diffusers to be placed over the inlets	7/13/8	—	—
3. A roasting oven to be supplied for the kitchen	11/6/10	—	—
4. Privies to be reconstructed as water latrines, with divisions and half doors	193 15/10¼	—	—
5. Drains to be trapped	6/1/11½	—	—
6. Ash-pits to be abolished, and the refuse to be removed daily by an iron cart	42/2/10½	—	—
PLYMOUTH, MAKER BARRACK.			
Number of Rooms: 9 — Regulation Number of Men: 166 — Accommodation at 600 Cubic Feet per Man: 135 — Deficiency of Accommodation in Men: 31			
1. 600 cubic feet per man to be given	—	—	—
2. Ventilation of barrack rooms by shafts and inlets. Serjeants' rooms to have silk flap ventilators. Guard room to have silk flap ventilator and one inlet. Fire-grates to be remodelled	140/19/7	—	—
3. One bath to be provided, with water laid on	15/0/3	—	—
4. Reconstruction of women's wash-house, with boiler, tubs, drying stove, &c.	194/11/8	—	—
5. New cook-house with roasting oven	174/12 6	—	—
6. Privies to be reconstructed as water latrines, with divisions and half doors	87 0/4	—	—
7. Gulley grates to be trapped	20/18/2	—	—
8. Ash-pit to be abolished, and barrack refuse to be removed daily out of the enclosure	11/2/1	—	—
PLYMOUTH, No. 4. REDOUBT.			
3 Casemates — 31 Men.			
1. Casemates to be ventilated by silk flap valves and inlets	8/17/5½	—	—
2. Benches, gratings, and pegs for the ablution house	13/7 0	—	—
3. A roasting oven for the kitchen	13/4/8½	—	—
4. A water latrine in place of present privy. Urinal to be supplied with water	65/7/10	—	—
5. Ash-pit to be removed outside the enclosure	8/14/1	—	—
PLYMOUTH, No. 5. REDOUBT.			
1. Ventilating soldiers' rooms as in No. 4 redoubt	8/17/5½	—	—
2. Ovens for baking and roasting	8/19/7½	—	—
3. Iron barrow to be substituted by ash-pit	8/14/1	—	—

Sanitary Defects and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
PLYMOUTH, PICKLECOMBE BARRACKS.	£	£	£
Number of Rooms: 9 — Regulation Number of Men: 96 — Accommodation at 600 Cubic Feet per Man: 79 — Deficiency of Accommodation in Men: 17			
1. Inmates to be limited to 79 in ordinary times	—	—	—
2. Barrack rooms to be ventilated and warmed by large silk flap valves, hollow beams, and perforated panes	15/8/2½	—	—
3. Privy to be reconstructed as a water latrine, with divisions, half doors, light and ventilation	—	—	—
4. Ablution house to have a bead to the table, pegs, and one bath with water laid on	57/9/5¼	—	—
5. Perforated panes in the windows	15/7/3	—	—
6. Cook-house to be ventilated by a shaft and perforated panes, and to have a roasting oven	16/19/10¼	—	—
PLYMOUTH, ST. NICHOLAS' ISLAND BARRACKS.			
Number of Rooms: 16 — Regulation Number of Men: 130 — Accommodation at 600 Cubic Feet per Man: 75 — Deficiency of Accommodation in Men: 55			
1. 55 men to be removed out of the barrack rooms	—	—	—
2. Barrack rooms to be ventilated by shafts and inlets; passages and staircases by a shaft and perforated glass panes. Canteen tap room to have a silk flap valve. Additional windows in barrack rooms	96/9/11¾	—	—
3. Pegs and one bath for the ablution room	13/7/0	—	—
4. Cook-house to have a roasting oven, and ventilation through the roof by a louvre and perforated glass panes	17/11/2	—	—
5. Dust-heap to be abolished, and proper dust-shoot with covered receptacle to be provided	13/8/6	—	—
6. Privies to be reconstructed as water latrines, with divisions, half doors, light and ventilation	45/7/4¾	—	—
DEVONPORT, RAGLAN BARRACKS, SOUTH WING.			
Number of Rooms: 42 — Regulation Number of Men: 958 — Accommodation at 600 Cubic Feet per Man: 798 — Deficiency of Accommodation in Men: 160			
1. 160 men to be removed out of the 42 barrack rooms	—	—	—
2. Barrack rooms to be ventilated by shafts and inlets; the staircases by louvres and perforated glass panes; the non-commissioned officers' rooms by a silk flap valve; the guard room by a silk flap valve and inlet; the serjeants' mess and library by 2 inlets; staff-serjeants' quarters by silk flap valves; canteen tap-room by two inlets. Gas burners to be ventilated. Remodelling the fire-grates to warm the air admitted, (558*l.* 2*s.* 11½*d.*)	947/4/2	—	—
3. Pegs for the ablution houses, and one bath for every 100 men	362/12/10½	—	—
4. Cook-houses to have roasting ovens	Executed by the Engineering Department.		
5. Privies to be reconstructed as water latrines, with divisions and half doors			
6. Additional light and ventilation to latrines. Urinals to be supplied with water	31/14/11	—	—
7. Iron carts to be substituted for ash-pits	140/9/4	—	—
The north wing of Raglan barracks was not finished at the time of our inspection. It required the same additions in the way of sanitary works as the south wing, with the sole exception, that there is no separate canteen to ventilate, and the non-commissioned officers' rooms were partly ventilated. The total cost of the sanitary works for the north wing is	1,459/2/0	—	—
DEVONPORT, MARRIED SOLDIERS' QUARTERS.			
1. Lower corridors to be ventilated by shafts	20/14/11¼	—	—
2. Upper end windows to have perforated panes	6/8/0½	—	—
3. Two skylights in upper corridors	71/6/5½	—	—
4. Two floor-lights in each corridor	26/16/1	—	—
5. Skylights over each window of verandah	128/6/8	—	—
6. Cook-houses to be converted into ablution and ironing rooms	55/6/3¾	—	—
7. Ash-pit to be abolished and iron cart provided	43/18/8½	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
DEVONPORT, NEW ARTILLERY BARRACKS.	£	£	£
6 Rooms - - 144 Men.			
1. Barrack rooms to be ventilated by louvred shafts through the ridge and by inlets. Staircases and ablution rooms to be ventilated by perforated glass panes. Water cisterns in the staircases to be covered. Ventilation of non-commissioned officers' rooms by silk flap valves. Guard room to have a shaft and inlet. Passage to the cells to have perforated glass panes. Cook-house and workshops to have louvres through the roof - - - - -	78/4/5¾	—	—
2. Stables to be ventilated by shafts - - - - -	71/6/2¾	—	—
Officers' stables, do. - - - - -	8/7/4½	—	—
3. Two baths to be provided, with water laid on - - -	60 7 2	—	—
4. A roasting oven for the cook-house - - - -	Executed by the Engineering Department.		
5. Privies to be reconstructed as water latrines, with divisions, half doors, and additional light. Urinals to be supplied with water -	79/19/8½	—	—
6. An iron cart to be substituted for the ash-pit. Manure heap to be better placed, and litter sheds provided - - - -	195/0/4½	—	—
7. Barrack rooms to be lighted with gas - - - -	Executed by the Engineering Department.		
8. Ventilation of gas burners - - - - - -	16/0/1¾	—	—
9. Remodelled grates - - - - - - -	94/12/8½		
DEVONPORT, GRANBY INFANTRY BARRACK.			
Number of Rooms: 10 — Regulation Number of Men: 144 — Accommodation at 600 Cubic Feet per Man: 99 — Deficiency of Accommodation in Men: 45			
1. To remove 45 men out of the barrack rooms - - -	—	—	—
2. Rooms to be ventilated by shafts, inlets, and additional window space. Staircases to have perforated panes. Serjeants' rooms to have silk flap valves - - - - - -	182/10/10	—	—
Remodelled fire grates - - - - - - -	—	—	—
3. Ventilated gas burners to be introduced into the barrack rooms -	193/10/9¾	—	—
4. Ablution room to have light through the roof, perforated glass panes, pegs on the walls, and a bead to the table. An additional ablution room with one bath to be constructed - - -	80/8/1¼	—	—
5. Cook-houses to have a roasting oven - - - -	Since executed by Engineering Department.		
Light and ventilation through the roof of the cook-houses - -	14/18/0	—	—
6. Women's wash-house to have fixed tubs, water laid on, a drying closet, and ventilation - - - - - -	135/6/11	—	—
7. Cesspits to be abolished; privies to be reconstructed as water latrines, with divisions, half-doors, light and ventilation. Urinals to be reconstructed and supplied with water - - -	177/18/7¾	—	—
8. Ash-pit to be abolished, and refuse removed daily in an iron cart -	48 3 0	—	—
DEVONPORT, MOUNT WISE BARRACKS.			
Number of Rooms: 15 — Regulation Number of Men: 257 — Accommodation at 660 Cubic Feet per Man: 214 — Deficiency of Accommodation in Men: 43			
1. 43 men to be removed out of the barrack rooms - - -	—	—	—
2. Barrack rooms to be ventilated by shafts and inlets. Darker barrack rooms to have windows or skylights. Dark staircases to have a window with perforated glass panes or a skylight. Windows to be made to open at top. Guard room to be ventilated by a shaft and inlet. Lock-up to have an inlet. Cells to have shafts. Library, school room, and workshops to have shafts and inlets. Serjeants' rooms to have silk flap valves. Canteen to have an additional window and a silk flap valve. Barrack room grates to be remodelled - - - - - -	828/8/2¾	—	—
3. Rooms to be lighted with gas - - - - -	Since executed by Engineering Department.		
Burners to be ventilated - - - - - -	33/3/4	—	—
4. Ablution room to have pegs, perforated glass panes, and two baths -	50/13/0¼	—	—
5. Women's wash-house to have fixed tubs, water laid on, a drying stove, gratings, and glass tiles in the roof - - -	124/9/10	—	—
6. Cook-house to have a ventilated roasting oven - - -	Since executed by Engineering Department.		

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
DEVONPORT, MOUNT WISE BARRACKS—*continued.*	£	£	£
Cook-house to have glass tiles in the roof and perforated glass panes in the windows	7/8/2¼	—	—
7. Privy to be reconstructed as a water latrine, with divisions, half-doors, light, and ventilation. Urinal to be reconstructed and supplied with water	92/13/9	—	—
8. An iron cart to be substituted for the ash-pit	48/3	—	—

DEVONPORT, BULL POINT BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
6	96	78	18

1. To remove 18 men out of the barrack rooms	—	—	—
2. Barrack rooms and reading room to have shaft and inlets. Non-commissioned officers' rooms to have silk flap valves. Staircases to have perforated glass panes. Canteen tap-rooms and guard rooms to have silk flap valves. Cells to have shafts and inlets. Barrack and guard room grates to be remodelled	—	—	—
3. Ablution room to have glass tiles in the roof, water laid on, pegs, and one bath	—	—	—
4. Cook-house to have a roasting oven, and glass tiles in the roof	—	—	—
5. Women's wash-house to have a louvre and glass tiles, fixed tubs, water laid on and a drying stove	—	—	—
6. Privies to be reconstructed as water latrines, with divisions and half doors. Urinals to be supplied with water	—	—	—
7. Ash-pits to be removed outside the enclosure	—	—	—
Total amount for the 6 preceding items	231/15/7¼	—	—
Note. For Devonport sub-district a deduction of 20*l.* 5*s.* 8*d.* per cent. must be made as per-centage off the triennial Contract Schedule.			
One-tenth to be added for contingencies	—	—	—

EXETER CAVALRY BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
24	184	156	28

1. Reduction of number of men to the extent shown above	—	—	—
2. Ventilation and lighting of the corridors by two plastered shafts, the square of the breadth of the corridor, carried up from the ceiling to the roof, the shaft to be covered above by a ventilating sky-light. Perforated glass panes to be put into the upper sash of the end windows of the corridor	133/19/1	133/19/1	—
3. Each barrack room to be ventilated by a shaft carried from the ceiling to above the roof, and by an inlet and perforated zinc cornice. The library and reading room to be similarly ventilated	92/14/8	92/14/8	—
An additional window to be opened in every barrack room having at present only one window	72/7	72/7	—
Every non-commissioned officers' room to have a silk flap ventilator into the chimney. Serjeants' mess room to be ventilated by a silk flap ventilator and by perforated panes in the windows	7/11/10	7/11/10	—
Barrack rooms to have remodelled grates	286	286	—
Guard room to be ventilated by a shaft and inlet for air. Fire grate to be altered to warm part of the air admitted; additional light to be afforded by a skylight	14/10/11	14/10/11	—
Canteen tap-rooms to be ventilated by silk flap ventilators, perforated glass panes, and by making the upper sash of the windows to open	3/18	3/18	—
Stables to be ventilated by shafts lined with zinc, and inlets; and to have more window space	345/1/8	345/1/8	—
4. Kitchens to be provided with ventilated roasting ovens	Since erected by Engineering Department.		
Kitchens to have additional window space, and to be ventilated by a shaft and perforated glass panes	21/1/3	21/1/3	—
5. Ablution houses to be provided with pegs; to be lighted by glass slates, and to be ventilated by a louvre in the roof, and by perforated glass panes in the windows	8/11/5	8/11/5	—
6. A bath house, with two fixed baths and water laid on, to be provided	86/8	—	86/8
7. Women's wash-house to be enlarged, and provided with fixed tubs and water laid on, and with a drying stove. Perforated glass panes to be introduced into the upper sash of each window	248/5/11	—	248/5/11

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
EXETER CAVALRY BARRACKS—*continued.*	£	£	£
8. New buildings for the latrines to be lighted and ventilated through the roof. The divisions to be carried higher up. Urinals to be supplied with water	30/6/5	30/6/5	—
9. Converting women's privies into water latrines	66/10/0	—	66/10/0
10. Gas and a ventilated gas-burner to be introduced into each barrack room	390/12/6	—	390/12/6
11. Remodelling fire-grates	286/0/0	286/0/0	—
Lastly. Married quarters and a library are much required at these barracks	—	—	—

EXETER ARTILLERY BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
28	336	244	92

1. Reduction of the number of men in each barrack room to the extent specified above	—	—	—
2. Opening 62 additional windows through the back wall of the barrack rooms. Also in the back wall of each staircase on the northern side of the enclosure	204/12	204/12	—
3. Ventilation of each barrack room by a shaft and two inlets for air as described. Ventilation of each staircase by a shaft from the ceiling, and by perforated glass panes in the windows. Ventilation of the guard-room by a shaft and inlet. Ventilation of the non-commissioned officers' room and tap room in the canteen by a silk flap valve into the chimney, and by a perforated glass pane in the upper sash of each window	155/13/10	155/13/10	—
Remodelling of the barrack room and guard room grates, to save heat	330	330	—
4. Ablution and bath houses to be constructed closer to the men's rooms	Included in annual Estimate.		
5. Women's wash-houses to have additional light through the roof, fixed tubs, and drying and laundry stoves	351/3	—	351/3
6. Each cook-house to have a ventilated roasting oven provided	—	—	—
7. The barrack to be sewered to an outlet in one of the modes suggested. All privies within the enclosure to be reconstructed as water latrines, with divisions, half doors, light, ventilation, and drainage. Cess-pits to be abolished. A urinal, privy, and ablution room to be provided at the guard room	1,042/6/2	—	—
8. Converting soldiers' privies into water latrines	—	300	—
9. Converting officers' and canteen privies	90	—	90
10. Manure pits to be filled up to the surface level. Manure and barrack refuse to be collected and removed daily	271/6/1	—	271/6/1
Lastly. Married quarters, a day room, and reading room ought to be provided	—	—	—

GLOUCESTER HOTEL RECRUITING BARRACK, BRISTOL.

1. The whole barrack to be cleansed, limewashed, and repaired where necessary, and all the glass in the windows of barrack rooms overlooked by neighbouring dwelling-houses be obscured	30	—	30
2. A large size silk flap ventilator to be placed in every chimney in the barrack rooms, and one perforated glass pane in every window	11/12/6	11/12/6	—
3. Drying room to be ventilated as described, and be provided with a stove	15/8/10	15/8/10	—
4. Guard room and lock-up to be ventilated, and the boarding removed from the guard room window	3/2	3/2	—
5. The staircases to have additional ventilation at the skylights	Since executed by the Engineering Department.		
6. Part of the kitchen to be converted into a proper ablution room and bath room, and the floor drained and levelled	Do.	—	—
7. Privies to be reconstructed as water latrines, with divisions of seats and half doors, and the urinals supplied with water	25	25	—

HORFIELD BARRACKS, BRISTOL.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
30	428	351	77

1. Reduction of numbers in the barrack rooms of both cavalry and infantry barracks to the extent shown above	—	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
HORFIELD BARRACKS, BRISTOL—*continued.*	£	£	£
2. Ventilation of all the barrack rooms by shafts and inlets, as described. Ventilation of the non-commissioned officers' rooms by silk flap ventilators in the chimneys. Ventilation of the staircases by perforated glass panes in the windows. Ventilation of the guard room by a shaft and inlets. Ventilation of the library and reading room by a shaft and inlets	163 2/11	163/2/11	—
3. Remodelled grates	350	350	—
4. Ablution houses to have a bead to the ablution tables; to have pegs and gratings, and additional ventilation by perforated panes in the windows	7/15/6	7/15/6	—
5. Baths, with water laid on, to be provided in the proportion of one bath to 100 men	121/10	—	121/10
6. A laundry and drying stove to be provided for the women's washhouses	84/1/3	—	84/1/3
7. Infantry wash-house to have additional light through the roof, and the cavalry wash-house to have a louvre in the roof for ventilation	6/2	6/2	—
8. Cook-houses to be supplied with ventilated roasting ovens	Since executed by the Engineering Department.		
9. Cavalry cook-house to be ventilated by a shaft and perforated panes	5/11	5/11	—
10. All cess-pits within the barrack enclosure to be abolished, and all the privies to be converted into water latrines, with divisions of seats, half doors, light, and ventilation. Urinals to be supplied with water for cleansing	622/0/0	622/0/0	—
11. The doors between the stables and the staircases in the cavalry barracks to be built up	21/8	—	21/8
12 Stables to be ventilated by shafts carried from the corners to above the roof	237/15/6	237/15/6	—
13. Barrack room walls to be quicklime washed at the customary intervals of time and only scraped occasionally	To be done once in 6 months, according to medical regulations.		
14. Iron carts, &c., for removing refuse	73/3/11	—	73/3/11
15. Hot plate for cavalry cook-house	19/14/6	19/14/6	—
16. Two baths with water laid on	Since executed.	—	—

HULME CAVALRY BARRACKS.

Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
40	400	320	80
1. Reduction of number of men in the barrack rooms to the extent shown above	—	—	—
2. Ventilation of the stables by shafts and inlets for air	225	225	—
3. Ventilation of the corridors to be improved by additional lighting shafts, carried from the ceiling to the existing skylights, and by providing permanent ventilation under all the skylights	65	65	—
4. Ventilation of the barrack rooms, guard room, and school room by shafts and inlets. Ventilation of all the workshops and library by a large Arnott's silk flap ventilator into the chimney, and by ventilating panes in the windows	282	282	—
5. Reconstruction of all the privies, and their conversion into water latrines, with divisions, half-doors, &c., as recommended. Also the urinals to be supplied with water for cleansing	565	—	—
6. Kitchens to be supplied with roasting ovens, and to have additional windows, with louvred panes, for lighting and ventilation	183	183	—
7. Women's wash-house to be supplied with drying stove, and to be better lighted	Executed by Engineering Department.		
8. Lavatory to be supplied with foot gratings, pegs, and forms. Bath accommodation to be increased to the extent of one bath for every 100 men	27	27	—
9. Ash-pits to be replaced by iron carts, and stable manure to be more frequently removed	299	—	—
10. Paving of the long back yards behind the stables to be re-laid with square sets, and suitable gutters for surface drainage	1,077	—	—
11. Introduction of the town water to all parts of the barrack	294	374	—
12. A day room for the men ought to be provided	—	—	—

SALFORD INFANTRY BARRACKS.

Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
61	885	750	135
1. Reduction of number of men to the extent indicated in the table	—	—	—
2. Ventilation of every barrack room by a shaft and inlets for air, and also of the school room, guard room, and cook-houses	538	538	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
SALFORD INFANTRY BARRACKS—*continued.*	£	£	£
3. Increase of bathing accommodation and pegs and gratings to be provided for the lavatory	510	—	—
4. Latrines to be reconstructed, with proper water receptacles, water to be laid on for flushing, also divisions and half doors to be provided, and additional ventilation and lighting to be introduced. Urinals to be provided with water	787	—	—
5. Kitchens to be provided with roasting ovens	Since executed by Engineering Department		
6. Wash-house to be provided with drying stoves	Included in annual estimates		
7. Ashpits to be done away with, and refuse to be collected and removed daily in iron carts	298	—	—
8. Gas to be introduced where required	12	12	
Lastly. Married quarters are much wanted in this barrack. Day-rooms and drill sheds are also required	—	—	—

BURNLEY BARRACKS.

Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
23	240	149	91

1. Reduction of numbers of men in each room to the extent stated	—	—	—
2. Ventilation of the sleeping rooms by shafts and inlets; ventilation and lighting of the passages by skylights	179	179	—
3. Remodelled grates	274	—	—
4. Ventilation of the stables by air shafts and perforated glass panes	147	147	—
5. Reconstruction of privies, and substitution of water latrines with flushing arrangements, divisions of seats, half doors, and additional light. Urinals to be supplied with water	240	—	—
6. Roasting oven for the kitchen	Executed by the Engineering Department.		
7. The boilers to be reconstructed	31	31	—
8. Ablution rooms to be enlarged and supplied with pegs and gratings, and with a bath and foot pans	7	7	—
9. Back yard to be repaved with square sets and guttered	776	—	—
10. Ash-pits to be removed. Iron carts and daily removal of all manure and other refuse to be substituted	58	—	—
11. New saddlers' shop to be provided	—	—	—
12. Barracks to be lighted with gas	—	—	—

BURY BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
20	312	264	48

1. Reduction of numbers in the barrack rooms to the extent stated	—	—	—
2. Every barrack room, and the guard room, to be ventilated by shafts and inlets for air	170	170	—
3. Remodelled grates for warming the air admitted	286/4/10	—	—
4. Lavatories to have gratings for the feet, and pegs to hang coats on, and an additional bath to be placed in the lavatory on the infantry side	31	31	—
5. Women's wash-houses to have drying stoves provided	Included in annual estimate.		
6. Cook-houses to be supplied with roasting ovens	Executed by Engineering Department.		
7. A better water supply to be provided by bringing in the town water	198	198	—
8. Reconstruction of privies by converting them into water latrines, and removing the drainage to a distance in one of the modes suggested. Also supplying the latrines with divisions and half doors, light and ventilation	456	—	—
9. Iron carts to be substituted for the ash-pits, and manure depôts to be improved as suggested	274	—	—
10. Gas to be introduced, and a ventilated gas-burner placed in every barrack room	327	—	—
11. Laying water mains to barracks	60	60	—
Lastly. Day rooms and covered drill sheds should be provided, and married quarters built for the regulation number of married soldiers' families	—	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
STOCKPORT BARRACKS.	£	£	£
Number of Rooms. 10 — Regulation Number of Men. 160 — Accommodation at 600 Cubic Feet per Man. 114 — Deficiency of Accommodation in Men. 46			
1. Reduction of numbers in each barrack room, to give 600 cubic feet per man	—	—	—
2. Ventilation of every barrack room, and of the guard room, by shafts and inlets, as described	94	94	—
3. Ablution room to be ventilated, and pegs and gratings to be provided. A bath, supplied with water, to be provided	55	49	—
4. Cook-house to be ventilated by glass louvres in the windows. Boilers to be improved, and a roasting oven to be provided	71	71	—
5. Privies to be reconstructed, and converted into water latrines, with means of flushing. Urinals to be supplied with water	70	—	—
6. A drying stove to be provided for the women's wash-house	Included in annual Estimates.		
7. Improved water supply	105	—	—
8. The other requirements, namely, a day-room, covered drill shed, school room, cleaning room, library and married quarters should also be attended to, and the barracks should be lit with gas	—	—	—
ASHTON BARRACKS.			
Number of Rooms. 20 — Regulation Number of Men. 302 — Accommodation at 600 Cubic Feet per Man. 253 — Deficiency of Accommodation in Men. 49			
1. Reduction of numbers of men in the rooms, so as to leave 600 cubic feet of space per man	—	—	—
2. Ventilation of the barrack rooms, guard room, school room, and library by shafts and inlets for air	170	170	—
3. Remodelled grates to warm the air admitted	286/4/10	—	—
4. An additional bath to be provided in one of the lavatories, and the lavatories to have gratings and pegs	31	31	—
5. A drying stove for each wash-house	Inserted in annual Estimate.		
6. A roasting oven for each cook-house	Since executed by the Engineering Department.		
7. Water supply to be improved by enlarging the barrack supply main	131	—	—
8. Privies to be converted into water latrines, with suitable drainage for the disposal of the soil. Divisions of seats, half doors, and sufficient light to be provided	456	—	—
9. Barrack refuse to be collected, and removed in iron carts, instead of being kept in ash-pits	269	—	—
10. Barrack to be lit with gas, by a ventilated burner in each room	327	—	—
Rooms for married soldiers are much required, as are also a day room and drill shed	—	—	—
FULWOOD BARRACKS, PRESTON.			
Number of Rooms. 75 — Regulation Number of Men. 1,114 — Accommodation at 600 Cubic Feet per Man. 912 — Deficiency of Accommodation in Men. 202			
1. Reduction of numbers in the barrack rooms to the extent pointed out	—	—	—
2. Ventilation of all the barrack rooms and stables, by shafts and inlets for air, of the sections specified	980	980	—
3. The chapel, school, guard room, and tailor's shop to be ventilated as described	25	—	—
4. The ablution rooms to be provided with gratings for the men to stand on, and with additional pegs. Bathing accommodation to be provided in the proportion of one bath to every 100 men	323	—	—
5. A roasting oven of sufficient size to be provided for each of the cook-houses	Since erected by Engineering Department.		
6. Additional ventilation for the cook-houses to be provided	80	—	—
7. Wash-houses to be provided with a drying apparatus	Otherwise estimated for.		
8. Increased water supply to be provided	1,177	—	—
9. Sewerage and drainage to be improved, as pointed out, and all cesspits near the barracks to be abolished	—	—	—
10. Privies in the barracks and married quarters to be reconstructed as water latrines, with divisions and half doors, and light in the proportion of one and a half square foot of glass for every seat. Urinals to be supplied with water for cleansing	540	—	—
11. Stables to be ventilated, as described	—	—	—

Sanitary Defects, and Improvement required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
FULWOOD BARRACKS, PRESTON—*continued.*	£	£	£
12. A service to be organized for collecting and removing the barrack refuse in iron carts, daily, and ash-pits to be discontinued -	608	—	—
13. Gas to be introduced into all the barrack rooms - - -	Since executed by Engineering Department.		
14. Ventilating gas burners - - - - - -	93	93	—
Day rooms and drill sheds should be provided. It would also improve the married quarters to add an oven to each grate - -	—	—	—

NORTH FORT BARRACKS, LIVERPOOL.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
8	200	160	40
1. Reduction of the numbers of men from 25 to 20 per room - -	—	—	—
2. Ventilation of each barrack room by an Arnott's silk-flap ventilator in the chimney, by two inlets for air, and a remodelled grate. Ventilation of the staircases by a ventilating lantern and perforated panes. Gas-burners to be ventilated. Guard room to be ventilated in the same manner as the barrack rooms. Library, school-room, and serjeants' mess to be ventilated as described. Serjeants' rooms to have ventilators for the gas-burners, and Arnott's ventilators - - - - - -	289	—	—
3. A roasting oven to be introduced into the kitchen - - -	32	—	—
4. Women's wash-house to have ventilation, - - - -	1	—	—
A laundry and drying stove - - - - - -	—	—	—
5. One bath, with water laid on, to be provided - - -	14	—	—
6. Privies to be re-constructed as water latrines, with divisions of seats half doors, light, and ventilation - - - - - -	Since executed.		
7. Ash-pit to be abolished - - - - - -	93	—	—
8. Ditch to be drained - - - - - - -	40	—	—

RUPERT HOUSE BARRACK, LIVERPOOL.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
14	148	123	25
1. Spreading the recruits through the rooms to give as near as may be 600 feet of cubic space - - - - - -	—	—	—
2. Introducing a large silk-flap ventilator into the chimney of each barrack-room, and to open permanently the ventilators into the closed-up chimneys in two of the rooms. Introducing a pane of perforated zinc into the upper row of each room window, and into the upper row of each passage and stair-window. Providing a ventilating funnel and tube to each gas-burner - - -	64	—	—
3. Re-arrangement of the bath accommodation as recommended above -	12	—	—
4. Repairing the kitchen range - - - - -	3	—	—
5. Conversion of serjeants' privy into a watercloset. Providing a urinal. Abolition of ash-pit, and substitution of iron cart for it -	59	—	—

CHESTER BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
15	284	262	22
1. Reduction of numbers of inmates in the barrack rooms to the extent stated - - - - - - -	—	—	—
2. Improvement of the ventilation and warming of all the barrack rooms, by shafts, inlets, and remodelled grates, as described. Ventilating all the non-commissioned officers' rooms by silk-flap ventilators into the chimneys. Ventilating and warming the guard room by a shaft, inlet, and remodelled grate. Improving the ventilation of the school-room and library by a shaft and remodelled grate. Ventilating all the passages in the soldiers' barracks by perforated glass or zinc panes in the windows - -	386	—	—
3. Workshops and storerooms in the basement of the lower ward barracks to be abandoned, and better ones provided - -	220	—	—
4. Gas to be laid on. Barrack rooms to be lighted with ventilated gas-burners - - - - - - -	439	—	—
5. Town water supply to be laid on to the lavatories. Upper ward lavatory to be lighted and ventilated through the roof. Lower ward lavatory to be ventilated through the roof - - -	65	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Item. and Amounts Sanctioned.	Items and Amounts Postponed.
CHESTER BARRACKS—*continued.*	£	£	£
6. Three baths, with water laid on, to be provided for the barracks -	27	—	—
7. Cook-houses to be supplied with ovens. Upper ward cook-house to be lighted by skylights - - - - - -	88	88	—
8. Converting harness room into women's wash-house - -	68	68	—
9. Women's wash-house to be fitted up with fixed tubs - -	8	—	—
10. A drying stove to be provided - - - - -	—	—	—
11. Latrines to be reconstructed with water receptacles on Macfarlane's principle. The accommodation to be extended, divisions of seats, half doors, light, and ventilation to be provided. Urinals to be reconstructed; ordnance storekeeper's water-closet to be better supplied with water; defective drainage from the upper ward to be improved as suggested - - - - -	78	—	—
12. Ash-pit in front of the upper ward barracks to be abolished, and provision made for daily removal of the barrack refuse - -	43	—	—
Lastly, the deficiencies in these barracks bearing on the health and comfort of the men are as follows:—Day-rooms, covered drill-shed, cleaning rooms, canteen, and married soldiers' quarters -	—	—	—

SHEFFIELD BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
48	811	713	98
1. Reduction in the number of men in the barrack rooms to the extent stated - - - - - - - - -	—	—	—
2. Improving the ventilation of all the barrack rooms, workshop, library, &c., by enlarging the openings of the present outlet shafts, as recommended, by providing additional outlets by Arnott's silk-flap ventilators in the chimneys, and additional inlets for air between the windows. Ventilating the serjeants' rooms by Arnott's silk-flap ventilators. Improving the ventilation of the stables by additional inlets for fresh air. Covers of the cell ventilators to be removed. Inlets for air to be supplied to the guard-rooms. Canteen passage windows to have perforated panes of glass. All the gas-burners to be provided with ventilating funnels and tubes into the chimneys - - - - - -	1,140	—	—
3. Manure and dust pits in the arches under the upper parade ground to be removed, other ash-pits to be done away with, and iron carts for daily removal of the refuse to be introduced - - -	488	—	—
4. Ablution rooms to have light through the roof, beads to the tables, gratings, and pegs. Eight baths with water laid on to be provided	172	—	—
5. Cook-houses to be lighted through the roofs - - -	20	—	—
6. Women's wash-houses to have light and ventilation provided through the roofs; water to be laid on to the tubs, gratings for the feet to be provided, and a drying stove put up in each wash-house -	73	—	—
7. Privies to be re-constructed as water latrines on Macfarlane's principle, with seats, divisions, half doors, light, and ventilation. Urinals to be supplied with water. Waterclosets in officers' quarters to be removed from their present position, and reconstructed - - - - - - - -	1,033	—	—
8. Drainage of infantry parade ground - - - -	1,431	212	—

BIRMINGHAM CAVALRY BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
20	180	160	20
1. Reducing the number of men per room from 9 to 8 - -	—	—	—
2. Lighting and ventilating the corridor by two shafts and ventilating skylights, as described, and by perforated glass panes in the corridor and staircase windows - - - - -	41/10	41/10	—
3. Ventilating the men's rooms, serjeants' mess, school-room, and guard room, by a shaft carried from the ceiling of each room to above the roof, and by a perforated zinc cornice placed over the present inlets. Perforated glass panes to be placed over the present doors	179	179	—
4. An additional window to be opened at the dark end of each room, and the doors to be removed to the opposite ends of the rooms -	200	200	—
5. A ventilating funnel and tube to be provided for each gas-burner -	12	12	—
6. Fire-grates to be remodelled to warm part of the admitted air -	257/15	257/15	—
7. Non-commissioned officers' rooms and the library to be ventilated by silk-flap ventilators into chimneys - - - -	8/15	8/15	—
8. Tailors' shop to be ventilated by a shaft and inlet - - -	—	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
BIRMINGHAM CAVALRY BARRACKS—*continued.*	£	£	£
9. Canteen taproom and non-commissioned officers' room to be ventilated by silk flap ventilators and by perforated glass panes in the upper window sashes	4	4	—.
10. Guard room cells to be ventilated by a shaft through the roof	30	30	—.
11. Stables to be ventilated by a shaft from each corner, as described, and to have additional window space	272/10	272/10	—
12. Riding school to have skylights in the roof, and louvres in the ridge for ventilation	35	35	—.
13. Stables to be provided with litter sheds	332	—	—
When repaving is required, the ground in front of the stable doors to be paved with square setts	—	—	—
14. Water to be obtained from the town mains	195/5	—	—
15. Two new ablution houses, suitably provided with lavatory arrangements, and one bath in each, with water laid on, to be erected instead of the present ablution houses	378	—	—
16. Latrines to have Macfarlane's apparatus	162	—	—
17. The privies at the tailors' shop and canteen to be drained, converted into water latrines, and the cess-pits filled up	14/10	—	—
18. Lower end of the parade ground to be drained	80	—	—
19. Women's wash-house to be enlarged and ventilated by a louvre, to have fixed tubs with water laid on, a drying stove, and means of ironing linen	560/10	—	—
20. Manure heaps and ash-pit beside the lower parade ground to be filled up to the level of the ground, paved, and drained	71/10	—	—
21. Ash-pit behind the hospital to be abolished, and an iron cart substituted	38	—	—
COVENTRY CAVALRY BARRACKS.			
Number of Rooms: 16 — Regulation Number of Men: 192 — Accommodation at 600 Cubic Feet per Man: 145 — Deficiency of Accommodation in Men: 47			
1. Reduction of numbers of men in each room to the extent stated	—	—	—
2. Ventilation of each barrack room, married soldiers' room, non-commissioned officers' mess room, guard room, workshops, and the library and school-room, by a shaft carried from the centre of the ceiling to above the roof, and by an inlet for air. The louvres opening from the barrack rooms into the passage to be reversed, passage windows to be made to open, and perforated glass panes to be put in the passage windows. Barrack room and guard room grates to be remodelled	309	309	—
3. Stables to be ventilated by a shaft lined with zinc, carried from each corner to above the roof	200	200	—
4. Additional light to be given to the stables where practicable	42	—	42
5. Riding school to have two skylights in the roof	18	—	18
6. Gas to be introduced into each barrack room	159/10	—	159/10
7. Ablution room to have a bead put to the table, gratings and pegs to be provided. Two baths, with water laid on, to be placed in the recess, and a skylight to be put in the roof	49/10	49/10	—
8. Women's wash-house to have fixed tubs with water laid on, and a drying and laundry stove	390/10/0	—	—
9. Water to be laid on over the barrack, from the town water supply	147	147	—
10. Privies to be drained, and reconstructed as water latrines with divisions, half doors, light and ventilation, and the cess-pits abolished	156/10	156/10	—
11. Manure heap and ash-pit to be filled up to the level, paved, and drained, and provision to be made for the daily removal of manure and refuse	84	—	84
12. All drains to be trapped	14	14	—
13. Urinals to be reconstructed	19/10	19/10	—
14. Ribbed glass to cell windows	2/10	—	—
NORTHAMPTON ARTILLERY BARRACKS.			
Number of Rooms: 16 — Regulation Number of Men: 208 — Accommodation at 600 Cubic Feet per Man: 144 — Deficiency of Accommodation in Men: 64			
1. Reduction of the number of men in the rooms to the extend stated	—	—	—
2. Ventilation of each soldiers' room by a shaft and inlet and by a remodelled grate. An additional window to be opened in each room. Doors to be removed to the end of the room furthest from the fire	399	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
NORTHAMPTON ARTILLERY BARRACKS—*continued.*	£	£	£
3. Corridors to be lighted by glass panes in the upper part of the partitions of the soldiers' rooms. Pensioners and stores to be removed from the men's blocks, and the corridor end window restored. Each end window and each stair window to have panes of perforated glass introduced. Staircases to be ventilated by louvres through the roof	30	—	—
4. Attics to be ventilated by louvres in the ridge, and to have additional light by means of skylights	33	—	—
5. A ventilated gas-burner to be introduced into each barrack-room	205	—	—
6. Stables to be ventilated by shafts from each corner carried above the roof	120	—	—
7. School-room to be ventilated by a shaft and inlet. Tailors' shop to be ventilated by a silk flap ventilator into the chimney. Guard room to be ventilated by a shaft and inlet, and to have a remodelled grate, and the cells by shafts and inlets as described. Canteen taprooms to be ventilated by silk flap ventilators and perforated glass panes in the windows. Non-commissioned officers' rooms to be ventilated by silk-flap ventilators. Cook-houses to be ventilated by shafts	62	—	—
8. Two ablution rooms, with a bath in each and water laid on, to be provided	Since executed.		
9. Wash-house to be improved as described	300	—	—
10. Town water supply to be laid on to the barracks	193	—	—
11. Whole barrack to be drained to an outlet. Privies to be reconstructed as water latrines, with drainage, divisions of seats, half doors, light, and ventilation, and all cesspits to be filled up. Drainage of stables and of parade ground to be improved. Urinals to be reconstructed and supplied with water	605	—	—
12. Dung-pits and ash-pits to be filled up to above the level of the ground, paved and drained	89	—	—

WEEDON CAVALRY AND INFANTRY BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
32	456	355	101

1. Reduction of numbers in all the barrack rooms to the extent stated	—	—	—
2. Ventilation of all the rooms over the stables by louvres in the ridge and inlets for air constructed as described. Ventilation of the men's rooms in the East and West Barracks by shafts and inlets. Ventilating funnels and tubes to be supplied to the gas-burners. All staircase windows to have perforated glass panes in the upper sashes. Canteen tap-room and non-commissioned officers' rooms to have silk flap ventilators in the chimneys, and perforated panes in the windows	476	142	110
3. Stables to have increased window space, and to be ventilated by shafts carried up from each of the corners to above the roof. Guard room and lock-up to have a ventilating shaft through the roof and an inlet for air	252	—	252
4. All the barrack room and guard room grates to be reconstructed to warm part of the admitted air	245	—	245
5. Ablution accommodation to be extended and improved. Water to be laid on constantly to the tables. Gratings and pegs to be provided, and ventilation to be introduced through the roof. Baths with water laid on to be provided in the proportion of one bath to every 100 men	200	—	200
6. Women's wash-house to be provided with fixed tubs and water laid on, and to have gratings and a drying and laundry stove. Light and ventilation to be afforded through the roof	450	—	450
7. Cook-houses to have additional light by skylights	20 10	—	20 10
8. Water supply to be increased and distributed over the barracks as described	1,440	—	1,440
9. Privies to be reconstructed as water latrines; to have light, ventilation, divisions of seats, and half doors; to be drained to an outlet, and the sewage disposed of in one of the modes suggested. All drains and gully grates to be trapped. Urinals to be reconstructed and supplied with water	641	—	641
Lastly. The deficiencies in accommodation but especially that of married quarters, should be supplied as soon as practicable.			

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
	£	£	£
LEEDS CAVALRY BARRACKS.			
Number of Rooms: 28 — Regulation Number of Men: 336 — Accommodation at 600 Cubic Feet per Man: 305 — Deficiency of Accommodation in Men: 28			
1. Reduction of the numbers of men in each room to the extent stated	—	—	—
2. Ventilating and lighting the corridors by shafts with skylights, as described, and by perforated glass panes in the corridors and stair windows	70	70	—
3. Ventilating the men's rooms by shafts and inlets, and by remodelled grates. Removing the doors of the men's rooms from their present position to the other end of the room; guard room and library to have shafts and inlets, as described; the library and guard room to have remodelled grates	242	242	—
4. Introducing gas into all the barrack rooms, school-rooms, library, &c.	88	88	—
5. Ventilating the stables by shafts carried up from the corners to above the roof	282	282	—
6. Improving the paving and drainage of the stables	2,352	—	—
7. Ventilating the workshops, serjeants' mess, school-rooms, defaulters' room; infant school-room to have air introduced round the stove. Ventilating the canteen tap-room and non-commissioned officers' room by silk flap ventilators and perforated glass panes. Ventilating and lighting the riding house by louvres along the ridge and by skylights	104	104	—
8. Yards behind the stable ranges to be repaved with square sets, properly guttered, and the drains trapped	1,145	—	—
9. Ash-pits and manure heaps to be removed, litter sheds to be constructed against the back boundary walls, yards to be widened by obtaining additional ground, if possible	—	—	—
10. Ablution houses to be supplied with pegs, and to have perforated glass panes in the upper row of each window. Four baths with water laid on to be provided	15	15	—
11. Present cook-houses to be ventilated by louvres, or to be reconstructed, widened, and ventilated	35	35	—
12. Cavalry exercising ground to be under-drained	300	300	—
13. Latrines to have receptacles in which water will stand, and to have half doors. Urinals to be improved and supplied with water	158	158	—
14. Women's wash-house to have fixed tubs and water laid on, a drying stove and ventilation through the roof	130	130	—
15. Cesspits to be abolished and drainage provided	80	80	—
BRADFORD MOOR BARRACKS.			
Number of Rooms: 16 — Regulation Number of Men: 180 — Accommodation at 600 Cubic Feet per Man: 150 — Deficiency of Accommodation in Men: 30			
1. Reduction of the inmates in the barrack rooms and huts to the extent stated, and the evacuation of the old buildings	—	—	—
2. Ventilation and warming of the barrack rooms, and huts by shafts, inlets, and remodelled grates. Passages and staircases to be ventilated by perforated glass panes in the windows. Small rooms and infant school-room in the barrack blocks, and the library, to be ventilated by silk flap ventilators Huts to be ventilated by shafts, inlets, and remodelled grates. Passage leading to cells to be ventilated by perforated panes	194/10	194/10	—
3. A new ablution house, with two baths, to be provided for the barrack blocks. Ablution house behind the huts to have gratings, pegs, and ventilation through the roof	147/10	147/10	—
4. Parade ground to be drained	66	66	—
5. Water supply to be improved	In progress.		
6. Latrines to be reconstructed, with receptacles to hold water and proper divisions, half doors, and ventilation. Urinals to be supplied with water	Cannot be done till water is obtained.		
7. The new ash-pit to be filled up to the level of the ground, paved and drained. The old ash-pits and manure pits behind the barrack blocks to be abolished	5	5	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
YORK CAVALRY BARRACKS.	£	£	£
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
29 / 308 / 303 / 5			
1. The small reduction of numbers in attic No. 3 as stated	—	—	—
2. Ventilation and lighting the corridors by two shafts the square of the breadth of the corridor, carried up to the ridge, plastered inside, and covered above by ventilating skylights. Panes of perforated glass to be put into the corridor windows	68	68	—
3. Each barrack room to have an additional window at the dark end, and the door to be removed to the end of the room furthest from the fire. Each room to be ventilated by a shaft and inlet, and to have a remodelled grate. School-room to be ventilated by a shaft and inlet. Non-commissioned officers' rooms to be ventilated by silk flap ventilators	308	308	—
4. Roofs of attics to be lined and plastered inside. The unimproved attic to have additional dormer windows, and ventilation through the roof. Both attics to have skylights to increase the light where required. Non-commissioned officers' mess kitchen to be ventilated through the roof	129	129	—
5. Stables to be ventilated by shafts as described, and to have windows placed over the doors	250	250	—
6. Litter sheds to be provided	160	—	160
7. Library and reading room to be ventilated by silk flap ventilators, and a glass louvre in the upper window sash. Canteen tap-room and non-commissioned officers' room to be ventilated by a silk flap ventilator and perforated glass panes in the windows. Workshops to be ventilated through the roof. Riding school to have additional light and to be ventilated through the roof. Guard room to be ventilated by a shaft and remodelled grate. Passage leading to the cells to be ventilated by panes of perforated glass	84	84	—
8. Ablution room to have ledges put to the tables, gratings and pegs supplied, and panes of perforated glass in the windows. Present baths to be removed. Bath rooms to be improved, and two proper baths with water laid on put up in each	36	36	—
9. Wash-houses to be provided with drying and laundry stoves. One of the wash-houses to have fixed tubs, with water laid on, gratings, and ventilation, similar to those in the improved wash-house	200	31	For fixed tubs gratings and ventilation.
10. Cook-houses to be ventilated by perforated panes in the windows	3	—	3
11. Barrack drainage to be improved, and a better outlet obtained if possible. Cess-pits to be abolished. Privies to be drained and reconstructed as water latrines, with divisions of seats, half doors, light, and ventilation	Postponed until the question of an outlet is determined.		
12. Surface drainage to be improved by under draining the exercising ground	72	—	72
13. And by better paving and guttering behind the stables	706	—	706
14. Manure pits and ash-pits to be removed to a greater distance from the barrack rooms, and to be properly constructed, paved, and drained, or the whole barrack refuse to be removed daily	88	88	—
15. Proper litter sheds to be provided	160	—	160
NEWCASTLE BARRACKS.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
26 / 462 / 371 / 91			
1. Reduction of overcrowding in each room to the extent stated in the table	—	—	—
2. Ventilation of each barrack room by shafts, inlets, and remodelled grates; ventilation of the non-commissioned officers' rooms by silk flap ventilators in the chimneys; ventilation of the stables by shafts from the corners of the ceiling carried up through the roof; ventilation of the library, chapel, school, and infant school; ventilation of the guard rooms by shafts, inlets, and remodelled grates; ventilation of the provost cells and serjeants' quarters; ventilation of the canteen tap-rooms by silk flap ventilators; ventilation of the workshops; ventilation of the barrack room staircases by perforated panes	—	—	—
3. Ablution rooms under ranges K. and B. to have ventilating shafts carried up from the corners to above the roofs. All the ablution houses to have beads to the tables, gratings, pegs, and forms. Five baths, with water laid on, to be provided	—	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
NEWCASTLE BARRACKS—*continued.*	£	£	£
4. Women's wash-houses to have roof ventilation, fixed tubs with water laid on, gratings, and drying and laundry stoves	—	—	—
5. Privies to be reconstructed as water latrines, with divisions, half doors, light, and ventilation. Urinals to be properly reconstructed and supplied with water	—	—	—
6. Manure heaps and ash-pits to be removed from their present position and reconstructed at safe distances from the barracks, with proper paving and drainage, to be raised above the level of the ground, and arrangements made for conveying away the whole refuse daily	—	—	—
7. Litter sheds to be constructed on the site of the present manure heaps and ash-pits	—	—	—
This barrack, as a whole, is by no means in good condition, and owes to its exposed position, and not to its structure or sanitary arrangements, any measure of health the troops may enjoy in it	—	—	—
SUNDERLAND BARRACKS.			
Number of Rooms: 15 — Regulation Number of Men: 300 — Accommodation at 600 Cubic Feet per Man: 195 — Deficiency of accommodation in Men: 105			
1. Removing seven men out of each barrack room	—	—	—
2. Ventilating each room by shafts, inlets, and remodelled grates. School-room to be similarly ventilated. All the non-commissioned officers' rooms and the library to have Arnott's silk flap ventilators in the chimneys. Guard-room to have a shaft and remodelled grate. Canteen to be ventilated by silk flap ventilators and perforated panes in the non-commissioned officers' room and tap-room. Gas-burners in the canteen to be ventilated	—	—	—
3. A ventilated gas-burner to be placed in all the barrack rooms, school-room, and library	—	—	—
4. Ablution rooms to have ledges put to the tables, gratings and pegs, and ventilating skylights in the roofs. Two baths would be enough for the reduced strength consequent on giving 600 cubic feet per man	—	—	—
5. Accommodation for washing clothes to be extended, fixed tubs, with water laid on, and drying and laundry stoves to be provided			
6. Privies to be reconstructed as water latrines, with suitable water receptacles, and to have light and ventilation through the roofs, divisions of seats, and half doors	—	—	—
7. Ash-pits to be improved by raising the bottoms above the level of the ground, draining and paving them, and providing for frequent removal of the refuse	—	—	—
8. New cook-house to have more light through the roof	—	—	—
TYNEMOUTH CASTLE BARRACKS.			
Number of Rooms: 10 — Regulation Number of Men: 234 — Accommodation at 600 Cubic Feet per Man: 164 — Deficiency of Accommodation in Men: 70			
The following sanitary improvements are applicable to all the Barracks in Tynemouth Castle; but even if they were all carried out, we should not advise the rooms in range A. to be constantly occupied. They are not healthy rooms, and should only be used on emergency	—	—	—
1. Reduction of numbers in all the rooms to the extent stated	—	—	—
2. Ventilation and warming of the barrack rooms and library by shafts and inlets, and remodelled grates as described; staircases to be ventilated by shafts and perforated panes; gas-burners to be ventilated; canteen tap-room and non-commissioned officers' room to be ventilated by silk flap ventilators and perforated panes; serjeants' rooms to have silk flap ventilators into the chimneys; guard room fire-grate to be improved so as to throw out more heat, in the manner advised for the other rooms in A. range	120	120	For ventilation of barrack rooms.
3. Ablution rooms to be provided with pegs, gratings, and ledges to the tables. The two baths authorized to be put up, and water to be laid on to them	—	—	—
4. Women's wash-house to have fixed tubs, gratings, and a drying and laundry stove	—	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
TYNEMOUTH CASTLE BARRACKS—*continued.*	£	£	£
5. New cookhouse, with proper means of roasting, baking, and boiling, to be erected in place of the present one - - - -	—	—	—
6. Privies to be reconstructed as water latrines, on Macfarlane's principle, and to have water laid on, divisions of seats, half doors, light, and ventilation. Urinals to be reconstructed and supplied with water - - - - - - - - -	—	—	—

CARLISLE CASTLE BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
18	274	222	52

1. Reduction of the numbers of men in each room to the extent stated			
2. Ventilation of each barrack room in ranges B. and E. by shafts, inlets, and remodelled grates. Staircases in these ranges to be ventilated by a shaft through the ceiling and by perforated panes in the windows. An additional window to the back to be opened in the staircases of range B. - - - - - -	—	—	—
Ventilation of the rooms in ranges A. and G. by shafts and inlets, if possible, or, if not possible, by Arnott's ventilators and perforated zinc panes. Ventilation of the rooms in range K. by Arnott's silk flap ventilators into the chimneys, perforated glass or zinc panes in the windows, and remodelled grates. Ventilation of the school-room by a shaft and inlet. Ventilation of the guard room by a shaft. Improving the ventilation and warming of the cells -	—	—	—
All non-commissioned officers' rooms to be ventilated by Arnott's ventilators. Barrack serjeant's house to have a window at the back. Canteen tap-room and non-commissioned officers' room to be ventilated by Arnott's ventilators and perforated glass panes in the windows - - - - - - - -	—	—	—
3. Ventilated gas-burners to be introduced into all the barrack rooms - - - - - - - -	—	—	—
4. Ablution rooms to be improved by being ventilated through the roof, and having gratings, pegs, and beads to the ablution tables provided - - - - - - - - -	—	—	—
5. Two baths with water laid on are to be provided - - -	—	—	—
6. Women's wash-house to be improved by ventilation through the roof, and to have fixed tubs, gratings, and a drying and laundry stove -	—	—	—
7. Cookhouse to have additional light admitted - - -	—	—	—
8. Drainage of the parade ground to be improved Privies to be entirely reconstructed as water latrines on Macfarlane's principle, with divisions of seats, half doors, light, and ventilation, and to be properly drained. Canteen privy to be reconstructed as a water latrine, properly drained. Proper urinals to be provided - -	—	—	—
Ashpit at the soldiers' privies to be abolished, and an iron cart for daily removal of the refuse to be substituted - - -	—	—	—
Lastly. Legal steps ought to be taken to suppress the smoke nuisance complained of - - - - - - - -	—	—	—

EDINBURGH CASTLE BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
72	709	457	252

1. Reduction of the number of inmates in the barrack rooms to the extent shown in the preceding tables - - - -	—	—	—
2. Ventilation and lighting of the staircases and corridors of the new barrack, by gratings in the floors of the corridors, windows at the ends, louvres in the roof, and perforated glass panes - -	339	—	—
3. Ventilation and warming of all the barrack rooms, school-rooms, serjeants' mess, and workshops, by shafts and remodelled grates; barrack rooms in the "New Barracks" to be provided with inlets near the ceiling; ventilation of the barrier guard room, the fire-grates to be remodelled to warm the air and to prevent smoke; canteen to have perforated glass panes in the windows - -	1,318	—	—
4. Ablution rooms to have beads to the tables, and pegs. One bath to be provided for the old barrack - - - - -	38	—	—
5. Cook-houses to be provided with means for baking and roasting meat - - - - - - - -	335	335	

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
EDINBURGH CASTLE BARRACKS—*continued.*	£	£	£
6. Privies to be reconstructed as water latrines on Macfarlane's principle, with divisions of seats, half doors, light, and ventilation. The drains leading from them to be ventilated. Improved urinals with water laid on to be provided - - - -	158	—	—
7. Ash-pits, if possible, to be entirely removed, and the barrack refuse to be taken away daily. Otherwise the ash-pits to be covered and provided with hoppers. Ash-pit near the provost cells to be entirely removed - - - - - - -	25	—	—
8. Women's wash-house to be provided with fixed tubs, and water laid on, and a drying and laundry stove - - - -	245	—	—
PIERSHILL BARRACKS.			
Number of Rooms: 37 — Regulation Number of Men: 296 — Accommodation at 600 Cubic Feet per Man: 259 — Deficiency of Accommodation in Men: 37			
1. Steps to be taken for having the open sewers in the vicinity of the barracks covered, and the nuisance from the gasworks abated -	—	—	—
2. Reducing the regulation number of men from 8 to 7 per room -	—	—	—
3. Completing the lighting, ventilation, and warming of the men's rooms by opening an additional window to the external air in each room - - - - - - - -	500	—	—
Providing an inlet for fresh air through the outer wall of each room close to the ceiling, and remodelling the fire-grates to warm part of the admitted air in winter. The room doors to be moved to the end farthest from the fire - - - - - -	360/15	—	—
All the non-commissioned officers' rooms to be provided with Arnott's valves into the chimneys - - - - - -	16/10	—	—
The serjeants' mess and the library to be ventilated by shafts and inlets - - - - - - - -	3	—	—
The school-room to be ventilated by converting one of the chimney flues into a ventilating shaft, as suggested, and by two inlets for air and a remodelled grate - - - - -	9/10	—	—
The new workshops and the canteen tap-room to be ventilated by Arnott's ventilators and perforated panes - - -	6	—	—
Guard room and lock-up to be ventilated through the roof. Guard room to have a remodelled grate - - - -	13	—	—
4. Stables to have shafts carried from the corners of the ceiling above the roof; their surface drainage to be improved; temporary stables to have additional ventilation through the roof; riding school to have sufficient light and ventilation through the roof -	580	—	—
5. Ablution tables to have ledges; pegs and forms to be put in the ablution rooms, and the number of baths to be increased to three -	25	—	—
6. Women's wash-house to be provided with fixed tubs and water laid on, also with a laundry and drying stove, and to have light and ventilation through the roof - - - - -	Provided for in annual estimate.		
7. All the latrines to be reconstructed on Macfarlane's principle; if practicable, with larger divisions of seats and half doors; the buildings to be suitably lighted and ventilated - - -	300	—	—
8. Ash-pits and manure heaps to be filled up above the level, and to be paved and drained; ash-pits to be covered and provided with hoppers	50	—	—
LEITH FORT.			
Number of Rooms: 22 — Regulation Number of Men: 248 — Accommodation at 600 Cubic Feet per Man: 154 — Deficiency of Accommodation in Men: 94			
1. Reduction of the number of men to the extent shown in the table -	—	—	—
2. Ventilation and lighting of the passages by ventilating skylights over shafts in the upper passages and gratings in the floor below. Perforated glass panes to be put into the stairs and passage windows; wall obstructing the ventilation referred to to be removed or perforated - - - - - - -	154/10	—	—
3. Dark barrack rooms to have additional windows. All the barrack rooms to be ventilated and warmed by shafts, inlets, and remodelled grates. School-room and serjeants' mess to be similarly ventilated. Guard room to be ventilated by a shaft and remodelled grate. Canteen to be ventilated by shaft and perforated panes of glass. Collar maker's shop to be ventilated and lighted through the roof	475	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
	£	£	£
LEITH FORT—*continued.*			
4. Present ablution room, cook-house, and women's wash-house to be ventilated by shafts and perforated glass panes. Ablution room to have a bead to the table, and gratings and pegs	44	—	—
5. Ablution room, women's wash-house and kitchen to be removed and reconstructed outside the barrack range. Two baths to be provided for the new ablution room, and fixed tubs, with water laid on; gratings and a drying and laundry stove to be provided in the new wash-house	580	—	—
6. Drainage to be examined, and the defect near the hospital remedied	5	—	—
7. Latrines to have larger divisions between the seats, and half doors. The latrine building to be lighted and ventilated through the roof	20	—	—
8. Litter sheds to be provided for the stables	290	—	—

BERWICK-ON-TWEED BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
72	720	360	360

1. To reduce the number of men on the construction of each room from 10 to a maximum of 5 men per room	—	—	—
2. To ventilate each room by a shaft, inlet, and remodelled grate, and remodelled grate, and to close up the openings between the rooms. To ventilate the staircases and passages by shafts from the ceilings and perforated panes. Guard-room to be ventilated by a shaft and remodelled grate. Passage leading to the lock-up cells to have an opening over the door and perforated glass panes in the window at the end	1,420	—	—
3. Ablution room and bath room, with three baths and water laid on, to be provided	90	—	—
4. A suitable laundry with fixed tubs, and water laid on, and a drying and laundry stove, to be provided	215	—	—
5. Cook-houses to be reconstructed and supplied with ovens	320	—	—
6. Ash-pits to be removed from their present position, and reconstructed at a greater distance from the barrack rooms	80	—	—
7. Tailors' shop to be lighted and ventilated	25	—	—
8. Privies to be reconstructed on Macfarlane's principle	270	—	—

STIRLING CASTLE.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
16	484	391	93

1. Removing the men from the galleries of the palace rooms, and removing the galleries altogether	40	—	—
2. Reducing the number of men in all the Parliament House rooms to the extent shown in the table	—	—	—
3. Ventilating the Palace rooms by glass louvres in the top window panes. Ventilating the Parliament House rooms by shafts from the ceilings to above the roof, and by louvred openings over the doors. Ventilating the staircases by louvres and perforated panes. Serjeants' rooms to have perforated glass panes in the windows. Cundy's stoves to be used for warming the barrack rooms	284	—	—
4. Flagged floors of the lower barrack rooms to be boarded	115	—	—
5. Bathing accommodation to be extended up to four baths with water laid on	30	—	—
5. Women's wash-house to be provided with fixed tubs, gratings, water laid on, and a drying stove	98	—	—
6. Ash-pits to be supplied with Macfarlane's hopper	5	—	—
7. Both guard rooms to be ventilated by louvres through the roof and remodelled grates	28	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items nd Amounts Postponed.
GLASGOW INFANTRY BARRACKS.	£	£	£
Number of Rooms: 66 — Regulation Number of Men: 792 — Accommodation at 600 Cubic Feet per Man: 528 — Deficiency of Accommodation in Men: 264			
1. Reduction of the number of inmates from 12 men to 8 men per room	—	—	—
2. Ventilation of all the staircases and passages by louvres carried from the ceiling of the stair through the roof, and by perforated glass panes in the windows. Ventilation of all the barrack rooms by a large-sized Arnott's ventilator into the chimney, and by louvre boards placed in the circular openings from the staircase, the boards being arranged to throw the inflowing current up to the ceiling. Similar louvre boards to be provided for the openings in the library, school-room, and infants' school; the two latter to be provided with Arnott's ventilators. All the circular openings between the rooms to be closed. Serjeants' rooms to have Arnott's ventilators in the chimneys. Guard-room to be ventilated by a shaft carried through the roof, and louvre boarding to be placed 6 inches below the opening of the shaft, to throw any accidental down draft up to the ceiling. Guard-room grate to be remodelled, to warm part of the air admitted. Canteen tap-room and non-commissioned officers' room to be ventilated by an Arnott's ventilator into the chimney - - - -	197/8	—	—
3. Ablution-rooms to be provided with gratings, pegs, and forms, and to be ventilated by perforated glass panes in the windows. Five baths, and water laid on, to be provided - - - -	248	248	—
4. Cook-houses and wash-houses to be ventilated in one of the ways pointed out - - - - - - - -	80	—	—
5. Urinals to be reconstructed, and supplied with water - -	51	51	—
6. Ash-pits to be abolished, and carts for the daily collecting and removal of the refuse to be substituted - - - -	114	—	—
These barracks will, it is hoped, be speedily replaced by others.			
GLASGOW RECRUITING BARRACKS.			
1. Ventilation of the rooms by converting one of the chimneys into an outlet shaft in the manner described, by introducing Arnott's ventilators into all the other chimneys, including the guard-room, and a pane of perforated glass into the upper row of each window; ventilation of the staircases and passages by shafts and perforated panes - - - - - - - - -	71/8	—	—
2. Ventilation of the waterclosets in the wash-houses by shafts; ventilation and lighting of the latrines by a louvre and skylight -	16/10	—	—
AYR INFANTRY BARRACKS.			
Number of Rooms: 36 — Regulation Number of Men: 432 — Accommodation at 600 Cubic Feet per Man: 277 — Deficiency of Accommodation in Men: 155			
1. Reduction of the numbers of men in each room to the extent specified	—	—	—
2. Ventilation of each room by a shaft carried from the ceiling to above the roof. An inlet for air to be provided for each room. The openings between the rooms to be closed up. The staircase to be ventilated by a louvred shaft, and perforated panes in the windows. The admitted air to be warmed in winter by remodelling the grates - - - - - - - - -	492	—	—
3. Gas and a ventilated gas-burner to be introduced into every barrack room - - - - - - - - -	301	—	—
4. Two of the cook-houses to be provided with ovens, to be ventilated by perforated glass panes, and to have a new door to the open air, and the present doors into the passage closed - - -	104	—	—
5. Two ablution rooms to be made out of two cook-houses, to be ventilated in a similar manner, and a similar change in the doors to be made. Three baths with water laid on to be provided -	Executed by the Engineering Department.	280	
6. Women's wash-house to be provided with fixed tubs, and water laid on, gratings, and a drying and laundry stove. More light to be given - - - - - - - - -	135	—	—
7. Town water supply to be introduced - - - -	—	—	—
8. All privies to be reconstructed as water latrines on Macfarlane's principle, and their contents disposed of in one of the ways mentioned	Executed by Engineering Department.	123	

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
AYR INFANTRY BARRACKS—*continued.*	£	£	£
9. All cess-pits to be abolished, and the ash-pits to be filled up to above the level of the ground, and to be properly paved and drained. Urinals to be reconstructed, and supplied with water - -	60	—	—
10. Ventilation of guard room to be improved by a shaft and remodelled grate, and the ventilation of the cells by openings in the ceiling and ridge, as described - - - - -	14	—	—
PAISLEY INFANTRY BARRACKS.			
Number of Rooms: 16 — Regulation Number of Men: 240 — Accommodation at 600 Cubic Feet per Man: 176 — Deficiency of Accommodation in Men: 64			
1. Reduction of the number of men in each room to the extent specified above - - - - - - -	—	—	—
2. Ventilation of each room, and of the library and school-room, by a shaft, inlets, and remodelled grates. Guard room to have a ventilator in the roof. Canteen tap-room and non-commissioned officers' rooms to have Arnott's ventilators in the chimneys, and perforated panes in the windows - - - - -	148/6	—	—
3. The ablution room to have more light and ventilation through the roof. A bead to be put to the table. Pegs to be supplied. An additional bath to be put up besides the one authorized - -	13/4	—	—
4. Women's wash-house to have fixed tubs, a grating for the feet, and a drying stove - - - - - - -	130	—	—
5. Cook-house to have a roasting oven put up, and to have a skylight and louvre in the roof - - - - - -	40	—	—
6. Privies to be drained to an outlet in one of the ways suggested, and to be reconstructed as water latrines on Macfarlane's principle -	Since executed by Engineering Department.	80	
7. The urinals to be reconstructed, and supplied with water - -	20	—	—
8. Ashpits to be filled up, paved, and drained, and their contents removed at short intervals - - - - -	35	—	—
HAMILTON CAVALRY AND INFANTRY BARRACKS.			
Number of Rooms: 31 — Regulation Number of Men: 500 — Accommodation at 600 Cubic Feet per Man: 329 — Deficiency of Accommodation in Men: 171			
1. Numbers of men in each cavalry barrack room to be reduced from 8 to 7 men per room, and in the infantry barracks from 26 to 15 men per room - - - - - - -	—	—	—
2. Rooms in the cavalry barrack to have each one inlet for air and a reset grate. End windows in the passages to have perforated glass panes. Saddlers' and shoemakers' shops to have Arnott's ventilators. School-room ventilation to be improved by converting one of the chimney flues into a ventilating shaft, as described. Two inlets for air and a remodelled grate to be provided. Library to be ventilated like the barrack rooms. Infantry barracks to have two inlets for fresh air. One chimney to be closed, and the flue converted into a foul-air shaft, as described. The other fire-place to be remodelled. Arnott's ventilators to be removed from the existing shafts. Doors in the cavalry barracks to be removed to the end of the room furthest from the fire - - -	323/12	—	—
3. Baths to be provided - - - - - -	60	—	—
4. Infantry cook-house to have an oven - - - -	45	—	—
5. Women's wash-house to be enlarged, to be better ventilated, and to have fixed tubs, water, gratings, and a drying and laundry stove -	350	—	—
6. Riding school to be ventilated through the ridge of the roof -	60	—	—
7. All the privies within the barrack boundary to be drained, and reconstructed on Macfarlane's principle, and the cess-pits to be abolished. The ash-pits and dung heaps to be raised a little above the level of the surface, and to be paved and drained -	190	—	—
8. Canteen tap-room and non-commissioned officers' rooms to have Arnott's ventilators, and perforated glass panes for ventilation -	5/11	—	—
9. Cavalry guard room to have a Muir's ventilator in the roof, and a remodelled grate, to warm the air in the guard room and cells. Each cell to have an outlet shaft through the roof. Infantry guard room to have a remodelled grate - - - -	16/10	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
DUMBARTON CASTLE BARRACKS.	£	£	£
Number of Rooms: 13 — Regulation Number of Men: 114 — Accommodation at 600 Cubic Feet per Man: 74 — Deficiency of Accommodation in Men: 40			
1. Reduction of the number of men in each barrack room to the extent shown in the table	—	—	—
2. Ventilation of the rooms by shafts, inlets, and remodelled grates. Ventilation of the upper barrack staircase by a shaft and perforated panes. Lower barrack staircase to have perforated panes in the windows. Non-commissioned officers' rooms to have Arnott's ventilators in the chimneys. Guard room to have a shaft and remodelled grate. All windows to be made to open at top	210	—	—
3. Gas and a ventilated gas-burner to be introduced into each barrack room	220	—	—
4. An ablution room, with tables, basins, &c., to be provided for the upper barrack. The ablution room in the lower barrack to be properly walled, lighted, and fitted up, and one bath with water laid on to be provided	155	—	—
5. Cook-houses to be provided with a roasting oven each, and to be properly ventilated	35	—	—
6. Town water to be introduced as soon as possible	300	—	—
7. All the privies to be reconstructed as water latrines on Macfarlane's principle, with proper divisions, half doors, light and ventilation, and drained. Urinals to be reconstructed and supplied with water	70	—	—
FORT AUGUSTUS.			
Number of Rooms: 32 — Regulation Number of Men: 166 — Accommodation at 600 Cubic Feet per Man: 138 — Deficiency of Accommodation in Men: 28			
These barracks are unfit for occupation in their present state. To put them in tenantable repair, to supply defects and sanitary improvements, would cost about	4,068	—	—
ABERDEEN INFANTRY BARRACKS.			
Number of Rooms: 46 — Regulation Number of Men: 552 — Accommodation at 600 Cubic Feet per Man: 368 — Deficiency of Accommodation in Men: 184			
1. Reduction of the regulation number of men from 12 men to 8 men per room	—	—	—
2. Ventilating every barrack room by a shaft carried from the ceiling to above the roof, and, if possible, by an inlet near the ceiling of each room, or by converting the opening from the staircase into an inlet as described. The grates to be remodelled to warm part of the admitted air. Circular openings in the partition wall between the rooms to be closed. Additional ventilation to be given to the staircase by perforated glass panes in the windows. Serjeants' mess to have an Arnott's ventilator. Library and school-room to be ventilated like the barrack rooms	812	—	—
3. Ablution rooms to have beads to the tables, pegs, and four baths; and to have shafts carried up through the roof for ventilation	82/10	—	—
4. Cook-houses to have shafts carried up from the ceiling to above the roof	20	—	—
5. Women's wash-house, if possible, to be removed and reconstructed out of the barrack buildings, or to be improved as suggested	500	—	—
6. Privies to be reconstructed as water latrines on Macfarlane's principle, with divisions of seats, half doors, light, and ventilation. Proper urinals, supplied with water, to be constructed at the same time	150	—	—
7. Ash-pit near the stable to be abolished. The other ash-pit to be removed if possible, or to be filled up, paved, drained, and covered in as described	12	—	—
8. Canteen tap-room to be ventilated by Arnott's ventilators	2	—	—
9. Guard room to be ventilated by a shaft and remodelled grate	25	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
THE FORT, ABERDEEN.	£	£	£
Accommodation - - - 40 men.			
1. Giving the men on all ordinary occasions, as nearly as may be, 600 cubic feet per man - - - - - - -	—	—	—
2. Improving the ventilation by having the inlets permanently open, by Arnott's chimney ventilators, and by perforated panes in the windows. Firegrates to be remodelled - - - -	—	—	—
3. Cess-pit to be abolished, and the privy to be constructed as a water latrine on Macfarlane's principle, and drained to the sea, or its contents removed daily by a cart, as is done at Glasgow -	—	—	—
DUNDEE BARRACKS.			
Number of Rooms. 11 — Regulation Number of Men. 299 — Accommodation at 600 Cubic Feet per Man. 179 — Deficiency of Accommodation in Men. 120			
1. Reduction of the number of men in each room to the extent stated -	—	—	—
2. Ventilation of each room by a shaft formed out of the spare chimney, and in rooms 10 and 11 by separate shafts. Inlets and remodelled grates to be also provided. Staircases to be ventilated by perforated panes in the windows. Ventilation of the non-commissioned officers' rooms, and the canteen tap-room, by Arnott's ventilators. Guard room to be ventilated through the roof, and to have its grate remodelled to warm the air in the guard room and cells, as described. Library and school-room be ventilated by shafts and inlets. All the barrack room gas-burners to be ventilated - - - - - - - -	252	—	—
3. Ablution rooms to be supplied with pegs. Two baths, with water laid on, to be provided - - - - - -	24	—	—
4. A ventilated roasting oven to be put up in the cook-house -	30	—	—
5. Women's wash-house to have fixed tubs with water laid on, gratings to stand on, a drying and laundry stove, and roof ventilation -	205	—	—
6. Privies to be drained and reconstructed as water latrines with divisions, half-doors, light, and ventilation. Cess-pits to be abolished. One ash-pit to be retained for the barrack, to be raised a little above the level of the ground, paved, drained, and covered. Urinals to be supplied with water - - - - -	138	—	—
PERTH BARRACKS.			
Number of Rooms. 27 — Regulation Number of Men. 382 — Accommodation at 600 Cubic Feet per Man. 273 — Deficiency of Accommodation in Men. 109			
1. Number of men in each ten-men room to be reduced from 10 to 7; and in each twenty-six men room to 19 - - - -	—	—	—
2. Each of the barrack rooms to be ventilated by a shaft and inlet for air, and by a remodelled grate, in the manner described. Corridors to have their ventilation improved by shafts carried through the roof, and perforated glass panes in the windows. Each barrack room to have a ventilated gas-burner. Serjeants' quarters to have Arnott's silk-flap ventilators in the chimneys. Library to have one of its chimney shafts converted into a ventilating shaft. The fire grate in the other chimney to be remodelled, and an inlet for fresh air close to the ceiling to be provided. Guard room to be ventilated by a shaft, inlet, and remodelled grate. Canteen tap-room and non-commissioned officers' room to be ventilated by Arnott's silk-flap valves and perforated glass panes. Stables to be ventilated by shafts from the corners carried above the roof. Riding school to be ventilated by raising the ridge tiles, and to have more light by skylights or windows - - - - - -	581	—	—
3. Ablution tables to have ledges, and pegs to be put up in the ablution rooms - - - - - - - -	2/10	—	—
4. Four baths, with water laid on, to be provided - - -	62	—	—
5. Cook-houses to be supplied with ventilated roasting ovens - -	20	—	—
6. Women's wash-house to have fixed tubs with water laid on, a drying and laundry stove, and ventilation through the roof - -	20	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
PERTH BARRACKS—*continued.*	£	£	£
7. Privies to be reconstructed on Macfarlane's principle, to be properly lighted and ventilated, and to be drained into the town sewers. Urinals to be reconstructed and drained. Cess-pits to be filled up. The bottom of the ash-pit to be raised above the level, and to be paved and drained - - - - - - -	225	—	—
VICTORIA STREET RECRUITING BARRACKS.			
Number of Rooms: 6 — Regulation Number of Men: 212 — Accommodation at 600 Cubic Feet per Man: 156 — Deficiency of Accommodation in Men: 56			
1. Rooms 1, 2, and 5 to be struck off the construction, as being unfit for occupation in their present state, and the construction in rooms 3 and 4 to be fixed at 100 men, in the proportions given above -	—	—	—
2. These latter rooms to be ventilated by shafts, inlets, and remodelled grates, and to be lighted with gas. Serjeants' quarters to have Arnott's ventilators - - - - - -	50	—	—
3. An ablution and bath room, with benches, basins, water laid on, one bath, gratings, and pegs, to be provided - - - -	180	—	—
4. A ventilated roasting oven to be put up in the kitchen - -	15	—	—
5. Privies to be removed from their present position, and reconstructed as water latrines - - - - - - - -	250	—	—
FORT GEORGE.			
Number of Rooms: 207 — Regulation Number of Men: 1,400 — Accommodation at 600 Cubic Feet per Man: 1,146 — Deficiency of Accommodation in Men: 254			
1. Reducing the number of men in each room to the extent shown in the table - - - - - - - - -	—	—	—
2. The smaller barrack rooms on the two first floors of the ranges to be ventilated by a shaft, inlet, and remodelled grate, each. Larger rooms to have a shaft, two inlets, and a remodelled grate. Rooms on the top floors to be ventilated by a louvre through the roof, an inlet, and remodelled grate. Passages and corridors to be ventilated by three louvres carried up from the ceiling of the upper corridor to above the roof. The lantern over the well at the end of each corridor to have fixed louvres for ventilation. Each passage and stair window to have perforated glass panes in the upper sash. All the barrack room windows to be made to open above and below. Large barrack rooms on the upper floors to have more light by skylights. Officers' kitchens to be ventilated by a shaft and inlets. Serjeants' mess to be ventilated by an opening into the disused chimney. Non-commissioned officers' rooms and library to have an Arnott's silk-flap ventilator into the chimney. Chapel school to be ventilated through the roof, as described. Infant school to have a shaft and inlet. Ablution rooms to be ventilated by perforated panes, and by converting the disused chimney shafts into ventilating shafts, as described - -	1,700	—	—
3. Women's wash-houses to be removed out of the barrack ranges. The detached wash-house to be reconstructed or extended, to afford all the required accommodation, and to have fixed tubs with water laid on, gratings, boilers, and a drying and laundry stove - -	400	—	—
4. A bath-house, with eleven baths and water laid on, to be provided -	600	—	—
5. Present men's cook-houses to be ventilated by louvres in the windows and shafts - - - - - - - -	75	—	—
6. Detached cook-houses to be provided as soon as practicable - -	1,500	—	—
7. The whole drainage to be reconstructed. Impervious drains to be laid down to the sea. All existing drains and cess-pits to be filled up and abolished. Officers' water-closets to be provided. Men's latrines to be reconstructed on Macfarlane's principle, with divisions of seats, half doors, light, and ventilation. Wells to be cleansed. Water to be laid on from the spring, or additional wells to be sunk - - - - - - - -	3,400	—	—
8. Ash-pit to be filled up, paved, and drained, as described, or the whole refuse to be removed once a day out of the fort - - -	10	—	—
9. Non-commissioned officers' room at the canteen to be ventilated -	2	—	—
10. Guard-room to have a remodelled grate and perforated glass panes for ventilation - - - - - - - -	10	—	—
Lastly. The casemates to be improved as suggested, if they are to be used at all for men's quarters - - - - -	840	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
ROYAL BARRACKS, DUBLIN.	£	£	£
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
183 / 1,917 / 1,288 / 629			
1. Reduction of the number of men in all the barrack rooms to the extent specified	—	—	—
2. Raising the roofs of the cavalry attics and enlarging the windows, to give additional light and air	1,295	—	1,295
3. Opening additional windows, or enlarging windows in the darker rooms of the squares, wherever it is practicable to do so	160	—	160
4. Ventilation of all the corridors leading to the barrack rooms in the squares by perforated glass panes in the upper sash of each window. Carrying a large louvre shaft from the top of each staircase to above the roof of the range	74/10	74/10	—
5. Ventilating all the barrack rooms and the infant school-room by a shaft carried from the ceiling to above the roof, and by an inlet to the open air, protected within the room by a perforated zinc cornice for diffusing the air. Ventilation of the guard rooms, lock-up rooms, and cells by shafts and inlets as suggested. All the barrack room and guard room grates to be remodelled to save heat	2,126/10	2,126/10	—
6. Ventilating the attic barrack rooms over the cavalry stables by louvres through the ridge and inlets at the eaves. Ventilating the stables under these rooms by shafts carried up from each corner to above the roof	290	290	—
7. Attic room grates to be remodelled	195	—	195
8. All flagged floors in barrack rooms to be boarded over, or the flags to be removed and wooden floors laid down	1,620	—	1,620
9. All the gas-burners to be ventilated by funnels and tubes carried into the nearest chimney or ventilating shaft	375	—	375
10. Ablution room under the barrack rooms in the cavalry range to be removed; ablution accommodation to be extended. Ablution rooms to have additional light through the roof, and pegs and gratings where required. Water to be laid on	520	—	520
11. A bath-house, with one bath to every 100 men, and water to be laid on	700	—	700
12. Present women's wash-houses to be provided with fixed tubs and water laid on, laundry and drying stoves and light through the roof	725	—	725
13. A ventilated roasting oven to be provided for each cook-house	100	100	—
14. More light to be given through the roof of cook-house	120	—	120
15. Tailors' workshops to be ventilated through the roof, and shoemakers' shops to have more light	15	15	—
16. Water supply to be extended and laid on all over the barracks	Since completed		
17. All the privies to be reconstructed as water latrines with divisions of seats, half doors, light, and ventilation. Urinals to be reconstructed and supplied with water. All untrapped drains and gulley grates to be trapped	1,089	—	1,089
18. Ash-pits to be abolished and iron carts substituted. Stable manure to be collected and removed in barrows	290	—	290
SHIP STREET BARRACK, DUBLIN.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
41 / 610 / 435 / 175			
1. Reduction of the number of men in the barrack rooms to the extent pointed out	—	—	—
2. Improving the ventilation in the rooms which have shafts and inlets by enlarging the opening of the foul air shaft to double the section of the flue, and by replacing the covers of the inlets by perforated zinc. Rooms with shafts and no inlets to be provided with inlets. Rooms with neither shafts nor inlets to be provided with both. Stairs to be ventilated by shafts from the top ceiling and by perforated glass panes in the windows. Ventilation of the library and reading room, and of the adult and infant school-rooms, to be improved as described. Serjeants' room to have silk-flap ventilators in the chimneys, and improved grates. Serjeants' mess to be ventilated by a shaft and inlets	193/14/8	193/14/8	—
3. Kitchens to have panes of perforated glass in the window	7/13	—	7/13
4. All the barrack room grates to be remodelled	720	—	720
5. Gas and ventilated gas-burners to be introduced into all the rooms	660	—	660
6. Ablution room to have pegs and gratings and a ledge to the table. Additional baths to be provided in the proportion of one bath to every 100 men	100	—	100

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
SHIP STREET BARRACK, DUBLIN—*continued.*	£	£	£
7. Women's wash-house to be provided with fixed tubs and a drying and laundry stove. Water tank in the floor to be repaired or removed	90	—	90
8. Privies to be reconstructed as water latrines, with divisions of seats, half doors, light and ventilation - - - - -	165/5	165/5	—
9. Ash-pits to be removed, and provision made for the daily collection and removal of barrack refuse - - - - -	33	—	33
ARBOUR HILL BARRACKS, DUBLIN.			
Number of Rooms: 6 — Regulation Number of Men: 91 — Accommodation at 600 Cubic Feet per Man: 55 — Deficiency of Accommodation in Men: 36			
1. Removing all the men out of them, except 55 - - -	—	—	—
2. Opening additional windows and skylights, and ventilating the rooms by shafts and inlets - - - - - -	150	150	—
3. Reconstructing the privies as water latrines, with drainage - -	40	—	40
ISLAND BRIDGE OLD BARRACK, DUBLIN.			
Number of Rooms: 19 — Regulation Number of Men: 410 — Accommodation at 600 Cubic Feet per Man: 318 — Deficiency of Accommodation in Men: 92			
1. The number in each barrack room to be reduced to the extent pointed out in the preceding table - - - -	—	—	—
2. Each barrack room to be ventilated by shafts and inlets for air. The married quarters and school-room to be similarly ventilated; the window space in all the rooms to be increased in one of the methods pointed out. Ventilation and lighting to be afforded to the stairs and upper passages by skylights. Ventilated gas burners. Remodelled fire-grates to be put up in the rooms, canteen tap-room to have more light, and to be ventilated by a silk-flap ventilator and perforated panes - - - - - -	1,070/5	1,028	—
3. Gas to be introduced - - - - - -	Since executed by the Engineering Department.		
4. Stables to be ventilated by a shaft carried up from each corner to above the roof of the buildings, and by perforated panes in the windows	249/16	—	—
5. One of the ablution houses to have pegs put up and more light. Four baths, with water laid on, to be provided - - -	27	—	27
6. Cook-houses to have ventilated roasting ovens, and - - -	Since executed.		
7. More light through the roof - - - - - -	8	—	8
8. A suitable laundry to be erected for the whole barrack - -	Proposed to be executed in connexion with married quarters.		
9. The barrack to be properly drained, all the cess-pits abolished, and the privies to be reconstructed as water latrines, with division of seats, half doors, light, and ventilation. Urinals also to be reconstructed and supplied with water - - - -	800	—	800
10. Surface drainage to be improved by paving the stables and ground along the barrack ranges with square sets and proper channelling	1,200	—	1,200
11. Manure heaps to be removed to a distance from the men's rooms, and manure to be more frequently taken away - - -	—	—	—
12. Ash-pits to be removed, and arrangements made for the daily collection and removal of the barrack refuse by iron carts - -	43	—	43
ISLAND BRIDGE NEW BARRACK.			
Number of Rooms: 6 — Regulation Number of Men: 168 — Accommodation at 600 Cubic Feet per Man: 168 — Deficiency of Accommodation in Men: None.			
1. Enlarging the openings into the foul-air shafts in the soldiers' rooms to double the sectional area of the shaft, and protecting the opening by a grating. Enlarging the inlets and covering them with perforated zinc diffusing cornices. Improving the ventilation of the stables by perforated panes in the windows. Barrack room and guardroom grates to be remodelled - - -	165/4	—	165/4
2. Increasing the light in the ablution room by a skylight, and providing baths with water laid on - - - -	Since authorized in annual Estimate.		

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
ISLAND BRIDGE NEW BARRACK—*continued.*	£	£	£
3. Additional ventilation to be given to the cook-house by enlarging the louvre and by perforated panes in the windows	9	—	9
4. Water supply to be improved along with that of the old part of Island Bridge Barrack	550	—	550
5. Privies to be enlarged and reconstructed as water latrines, with divisions of seats, half doors, light, and ventilation	82	—	82
6. Wash-house to have fixed tubs and water laid on, and means of drying and getting up linen to be provided	150	—	150
7. Barrack refuse to be removed daily and the ash-pit abolished. Entrance to dung pit to be enlarged	31	31	—

BEGGARS BUSH BARRACKS, DUBLIN.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
25	413	337	76

1. Reduction of the regulation number of men in the barrack rooms to the extent stated. Reduction of the regulation number of men in the huts from 25 to 18 men per hut	—	—	—
2. All the barrack rooms unprovided with shafts and inlets to have each a shaft carried from the ceiling of the room to above the roof, and two inlets for air with perforated zinc cornices, one on either side the room close to the ceiling between the windows. Guard-room to be ventilated by a shaft and inlet. Tailors' shop to be ventilated through the roof	143/13	143/13	—
3. Ventilation of each hut and of the temporary school hut, by enlarging the opening in the ridge through which the stove pipe passes, so as to leave an area of 12 square inches per man of outlet; the opening to be protected from rain by a louvred turret			
4. Remodelled grates to be introduced into the barrack rooms and guard-room	486	—	486
5. Additional light to be given to the lower barrack rooms by inserting slabs of glass in the roof of the verandah over each window	45	—	45
6. Gas and a ventilated gas-burner to be introduced into each barrack room	37	—	37
7. Ablution rooms to have additional light by glass slates in the roof. Six additional cold baths, with water laid on, to be provided	143	—	143
8. Cook-house to be ventilated by a louvre through the roof	6	6	—
9. Latrines if possible to have half doors, and additional light through the roof. The privy in the provost's establishment to be drained and converted into a water latrine. The cess-pit to be abolished	19/1	—	19/1
10. Ash-pits to be abolished and iron carts substituted for collecting and removing the refuse	37	—	37

PIGEON HOUSE FORT, DUBLIN.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
17	199	136	63

1. Reduction of the regulation numbers in all the barrack rooms to the extent stated	—	—	—
2. Ventilation of each of the larger barrack rooms by a shaft and one inlet for air; ventilation of each of the five and six men rooms by a large-sized silk-flap ventilator into the chimney, and by an inlet for air; ventilation of the library and reading room by a shaft and inlet; loopholes to be used for inlets in the manner pointed out; each non-commissioned officers' quarter to have a silk-flap ventilator into the chimney; the staircases and passages leading to the men's rooms to be ventilated by perforated panes in the windows; the larger guard-room to be ventilated by a shaft through the roof, the smaller guard-room by a silk-flap ventilator into the chimney; lock-up to be ventilated by a roof ventilator; school-room to have silk-flap ventilators into the chimneys, and inlets for air; remodelled grates for saving fuel and heating part of the admitted air to be provided for the rooms; canteen tap to have a silk-flap ventilator into the chimney	487/0/6	—	487/0/6
3. Ablution room to have additional light and ventilation through the roof, to be provided with gratings and pegs, and to have a bead put to the table. Two baths with water laid on, to be provided	50/11/9	—	50/11/9
4. Women's wash-house to be provided with fixed tubs and water laid on, a drying and laundry stove, and ventilation through the roof	124	—	124

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
PIGEON HOUSE FORT, DUBLIN—*continued.*	£	£	£
5. Cook-house to have a roasting oven put up in it, and - -	Since executed by Engineering Department.		
6. Additional light to be admitted through the roof - - -	5	—	5
7. Water supply to be increased as suggested - - - -	850	—	850
8. Privies to be re-constructed as water latrines, with divisions of seats, half doors, light, and ventilation; cess-pit to be abolished; urinals to be re-constructed and supplied with water - -	156	—	156
ALDBOROUGH HOUSE, DUBLIN.			
Number of Rooms: 20 — Regulation Number of Men: 275 — Accommodation at 600 Cubic Feet per Man: 258 — Deficiency of Accommodation in Men: 17			
1. Ventilation of all the rooms by silk-flap ventilators and perforated panes in the windows. Guard room, lock-up, and cells to be ventilated - - - - - - - -	30	—	30
2. Re-arranging the accommodation to give 600 cubic feet to each bed, and removing the married quarters out of the soldiers' rooms into rooms by themselves - - - - - - -	—	—	—
3. Providing an ablution room and plunge bath for the recruits -	75	—	75
4. Re-constructing the privies as water latrines, with divisons of seats, half doors, light and ventilation, and supplying the urinals with water. The ash-pit to be abolished, and the refuse removed daily - - - - - - - - -	170	—	170
LINEN HALL BARRACK, DUBLIN.			
Number of Rooms: 128 — Regulation Number of Men: 1,094 — Accommodation at 600 Cubic Feet per Man: 531 — Deficiency of Accommodation in Men: 563			
This building being totally unfit for a barrack, we consider it unnecessary to recommend any improvements to be attempted. The building ought to be given up forthwith.			
RICHMOND BARRACKS, DUBLIN.			
Number of Rooms: 80 — Regulation Number of Men: 1,036 — Accommodation at 600 Cubic Feet per Man: 824 — Deficiency of Accommodation in Men: 212			
1. Reduction of the number of inmates in all the barrack rooms to the extent stated, and reducing the inmates of each hut from 25 to 18, the regulation number - - - - - -	—	—	—
2. All the barrack rooms having a disused chimney to be ventilated by an opening into the flue double the area of the flue. The opening to be covered by a grating, and by two inlets for air with perforated zinc cornices, one inlet on each side the barrack room. Rooms that have no spare chimney flue, to be ventilated by a wooden shaft, carried from the ceiling to above the roof, and by two inlets. The serjeants' mess, reading-room, and infants' school to be similarly ventilated. The huts to be ventilated by a louvre in the ridge - - - - - - - - -	930	930	—
3. Grates to be remodelled - - - - - - -	924	—	924
4. All the gas-burners to be ventilated - - - - -	294	—	294
5. Ablution houses to have gratings and additional light, and more baths to be provided - - - - - - -	208	—	208
6. Laundry to have additional light through the roof - - -	8	—	8
7. Cook-houses to be ventilated, a kitchen for the provost establishment	192	—	192
8. Tailors' and shoemakers' shops to have skylights, and to be ventilated by shafts through the roof, and two inlets - - -	104	—	104
9. Roof of the verandah where it passes over the barrack room windows to be constructed of glass - - - - - - -	112	—	112
10. All the privies belonging to the barrack and married quarters to be drained and reconstructed as water latrines, with divisions, half-doors, light, and ventilation, and all the cess-pits to be abolished. Urinals to be reconstructed and supplied with water - -	669/15	669/15	—
11. All ash-pits to be abolished, and the refuse to be collected and removed daily in iron carts - - - - -	76	—	76

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
PORTOBELLO BARRACKS.	£	£	£
Number of Rooms: 40 — Regulation Number of Men: 687 — Accommodation at 600 Cubic Feet per Man: 576 — Deficiency of Accommodation in Men: 111			
1. Reduction of numbers in the barrack rooms to the extent stated -	—	—	—
2. Two additional windows to be opened in each of the cavalry barrack rooms over the stables - - - - - -	9	—	9
3. Each of the barrack rooms over the stables to have two shafts carried up from the middle line of the ceiling, to above the roof, and four inlets for air, two on each side, with perforated zinc cornices -	108	108	—
4. Each of the other barrack rooms in which there is a disused fire-place to have it bricked up and an opening into the chimney-flue to be made close to the ceiling, with an area double that of the chimney-flue. Each of these rooms to have two inlets with perforated zinc cornices, one inlet on each side the room - - - -	116	116	—
5. The 8-men room to have a shaft carried from the ceiling to above the roof, and one inlet for air. All the staircases to be ventilated by panes of perforated glass in the upper window sashes. Each non-commissioned officers' room to be ventilated by a silk-flap ventilator into the chimney flue. Each hut to be ventilated by a louvred turret in the ridge. The library and reading rooms to be ventilated by a shaft and inlet. Remodelled grates for warming part of the admitted air to be introduced in the barrack rooms and guard rooms. Riding school to be ventilated by louvres in the ridge and inlets in the gables, and to have additional light from the roof - - - - - - - - -	821	—	821
6. Guard rooms to have additional ventilation by an inlet for air -	3	3	—
7. Stables to have shafts lined with zinc, to be carried from the ceiling to above the roof - - - - - - - -	320	320	—
8. A ventilating funnel and tube to be provided for each gas-burner in the barrack rooms - - - - - -	236	—	236
9. An additional ablution room to be provided. One of the present ablution rooms to have more light through the roof. Baths to be provided in the proportion of one bath to 100 men, and water to be laid on - - - - - - - -	217/15	—	217/15
10. Women's wash-houses to be provided with fixed tubs and water laid on, gratings for the feet, additional light, and laundry and drying stoves - - - - - - - - -	546	—	546
11. Cook-houses to be provided with ventilated roasting ovens -	Since executed by Engineering Department.	—	—
12. All the existing privies to be reconstructed as water latrines, with divisions of seats, half doors, light, and ventilation. To be properly drained, and all the cess-pits filled up and abolished. Urinals to be reconstructed with slate divisions and water laid on, ash-pits to be abolished and carts substituted. Surface cleaning of the barrack to be better attended to. Manure and other refuse to be more frequently removed. Manure heaps to be better placed -	980	—	980
Lastly. Married soldiers' quarters are much required in these barracks. At present married people are obliged to live in some wretched cottages outside the barrack gate, in a low damp situation on the banks of the canal, where high rents are paid for the worst description of accommodation, and much sickness arises in consequence.			
LONGFORD CAVALRY BARRACKS.			
Number of Rooms: 12 — Regulation Number of Men: 168 — Accommodation at 600 Cubic Feet per Man: 131 — Deficiency of Accommodation in Men: 37			
1. Reduction in the numbers of men in the barrack rooms to the extent indicated in the preceding table - - - - -	—	—	—
2. Ventilation of the men's rooms in houses D. and E. by shafts and inlets, as described; ventilation of the non-commissioned officers' rooms by silk-flap ventilators into the chimneys; ventilation of the staircases and passages by perforated glass panes in the top of each stair window - - - - - -	86	—	—
3. Remodelled grates - - - - - - -	100	—	—
4. Ventilation and lighting of the large rooms in the "Mews" barrack by a large shaft four feet square, carried up from the ceiling of each room at the dark end, through the roof; the shaft to be covered above by a ventilating lantern. Or, if this cannot be done, light to be obtained by additional windows, and ventilation by shafts of the usual construction carried from the ceiling to			

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amount Sanctioned.	Items and Amount Postponed.
LONGFORD CAVALRY BARRACKS—*continued.*	£	£	£
above the roof. Each of the large rooms to have two inlets for air. Rooms 2 and 9 in the "Mews" barrack to have each a silk-flap ventilator and one inlet for air. All the other occupied rooms to have silk-flap ventilators into the chimneys. Staircase, passages, and lobby in this barrack to be ventilated through the roof	55/15	—	—
5. Remodelled grates	50	—	—
6. School-rooms to have each two inlets for air and remodelled grates. Passage of the provost establishment to be ventilated by perforated glass panes. Provost-serjeant's quarters to have a silk-flap ventilator	28/10	—	—
7. Canteen tap-room to have a silk-flap ventilator and perforated glass panes. Guard room to be ventilated by a shaft and remodelled grate	32	—	—
8. Gas to be laid on to the barrack, and one or more ventilated gas-burners to be put into each barrack room	350	—	—
9. Ablution room under the "Mews" barrack to be better drained	5	—	—
10. An additional ablution room to be built	190	—	—
11. Two baths, with water laid on, to be provided	Since executed by the Engineering Department.		
12. Women's wash-house to have additional ventilation; to be provided with fixed tubs, and water laid on; gratings for the feet, and a drying and laundry stove	202/10	—	—
13. Ventilation of the cook-house to be improved	3	—	—
14. Barrack privies to be supplied with water and reconstructed as water latrines, with divisions of seats, half doors, light and ventilation, and the cess-pits to be abolished. Privies in the provost establishment to be drained, supplied with water, reconstructed as water latrines, and the cess-pit to be abolished	162	—	—
15. Officers' quarters to be supplied with waterclosets	320	—	—
16. Ash-pit to be raised, paved, and drained	16	—	—
17. Riding school to have glass slabs in the roof	10	—	—
18. Stables to be better lighted and ventilated, and the paving to be relaid with square setts	—	—	—

LONGFORD ARTILLERY BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
7	106	82	24

1. Reduction of the number of occupants in the barrack rooms as pointed out	—	—	—
2. Ventilation of all the rooms by shafts and inlets. Ventilation of the guard room	46	—	—
3. Remodelled grates	175	—	—
4. Gas and a ventilated gas-burner to be provided for each room	300	—	—
5. An ablution room with one bath to be provided, also a women's wash-house, with the means of washing linen	Since executed by the Engineering Department.		
6. A drying closet for ditto	80	—	—
7. Privies to be reconstructed as water latrines on Macfarlane's principle, with divisions of seats, half-doors, light and ventilation, and their contents to be disposed of in one of the ways pointed out	380	—	—

ATHLONE ARTILLERY BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
5	88	65	23

1. Reduction of the number of men in each barrack room to the extent shown in the table	—	—	—
2. Ventilation of each barrack room by converting one of the chimney flues into a foul-air shaft, by providing two inlets for air, one on each side of the room, and by remodelling the fire-grate to warm part of the admitted air. Each serjeants' room to have an Arnott's silk-flap ventilator placed in the chimney. The guard room to have a skylight, and to be ventilated by a shaft and remodelled grate. Cells to be ventilated by a shaft through the roof, as described. Cook-house to be ventilated by a louvre in the roof	181/2/6	—	—
3. Ventilated gas-burners to be introduced into each barrack room	Included in annual estimate.		
4. Ablution room to have gratings and pegs supplied	6/10	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
ATHLONE ARTILLERY BARRACKS—*continued.*	£	£	£
5. One bath to be put up, with water laid on - - - -	Since executed by Engineering Department.		
6. Privies to be reconstructed as water latrines, with divisions of seats, half doors, light, and ventilation. Urinals to be supplied with water - - - - - - - - -	45	—	—

ATHLONE CAVALRY BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
8	148	134	14

1. Number of men in each room to be reduced to the extent shown in the preceding table - - - - - - -	—	—	—
2. Men's rooms to be ventilated by converting the chimney flue of one of the fireplaces into an outlet shaft, by making an opening into it close to the ceiling, double its sectional area, and by blocking up the fireplace. Each room to have two inlets for fresh air, one on each side, close to the ceiling. The fire-grate of each room to be remodelled to warm part of the air admitted. Non-commissioned officers' rooms to be ventilated by a silk-flap ventilator into the chimney. Room over the archway to have an inlet for air, close to the ceiling. Passages and stairs to have panes of perforated glass in the upper window sashes - - - - - -	245/5	—	—
3. Ventilated gas-burners to be introduced into each barrack room -	Included in annual estimate.		
4. Ablution room to be ventilated through roof, and the drainage of it improved. Ablution table to have a ledge. Pegs and gratings to be supplied - - - - - - - -	5	—	—
5. One bath with water laid on to be supplied - - -	Since executed by Engineering Department.		
6. Privies to be reconstructed as water latrines, with receptacles in which water will stand. Divisions of seats, half doors, light, and ventilation to be provided, and the paving to be relaid - -	47	—	—
7. Women's wash-house to be provided with a louvre in the roof, fixed tubs with water laid on, and a drying and laundry stove - -	200	—	—
8. Cook-house to be ventilated through the roof, and to have an oven put up - - - - - - - - -	19	—	—
9. Stables to be better lighted by skylights - - - -	55	—	—
10. Paving and surface drainage to be improved - - -	450	—	—

ATHLONE INFANTRY BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
31	577	403	174

1. Number of men per room to be reduced to the extent shown in the table - - - - - - - - -	—	—	—
2. Rooms in houses J. and K. to have each two ventilating shafts and four inlets for air, with two remodelled grates. The other barrack rooms to have one shaft and two inlets, with remodelled grates. Staircases to be ventilated by a louvred shaft from the top of each, carried through the roof, and by perforated glass panes in the upper window sashes. Additional light to be given to all dark rooms wherever practicable. Non-commissioned officers' rooms to have silk flap ventilators into the chimneys. School rooms to be ventilated like the barrack rooms by shafts, inlets, and remodelled grates; additional light to be admitted to them by skylights or otherwise. Canteen tap-room and serjeants' room to have ventilation by a silk-flap ventilator into the chimney, and by perforated panes to the windows. Guard room to have a skylight, and to be ventilated by a shaft and remodelled grate - - -	1,635/15	—	—
3. A ventilated gas-burner to be introduced into each barrack room, school room, reading room, and library - - - -	Included in annual estimate.		
4. Ablution room to be reconstructed nearer the men's rooms, and a bath room, with six baths and water laid on, to be provided -	230	—	—
5. Women's wash-house to be provided with fixed tubs, water laid on, and a drying stove - - - - - -	250	—	—
6. Flagging and draining yard in front of infantry serjeants' quarters -	9	9	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
ATHLONE CASTLE BARRACK.	£	£	£
Number of Rooms: 6 — Regulation Number of Men: 66 — Accommodation at 600 Cubic Feet per Man: 38 — Deficiency of Accommodation in Men: 28			
1. Number of men per room to be reduced to the extent shown in the table	—	—	—
2. Rooms in the tower to be better lighted and ventilated by enlarging the skylight and increasing the area of the ventilating shaft. Remodelled fire-grates, for warming part of the air admitted, to be provided. The other barrack rooms to have silk-flap ventilators in the chimneys, and Sherringham's ventilators for inlets. Guard room to be lighted by a skylight, and to be ventilated by a shaft and remodelled grate	236	—	—
3. A ventilated gas-burner to be put into each room	Included in annual estimate.		
4. Privy to have division of seats. The ash-pit to be improved as suggested	12	—	—
MULLINGAR BARRACKS.			
Number of Rooms: 53 — Regulation Number of Men: 901 — Accommodation at 600 Cubic Feet per Man: 572 — Deficiency of Accommodation in Men: 329			
1. Reduction of the numbers of men in each class of rooms to the extent shown in the preceding table of accommodation	—	—	—
2. Ventilation of each barrack room and of the serjeants' mess-room, library, tailors' shop, orderly room, quartermaster-serjeants' and serjeant-majors' quarters, by an opening into the blank chimney in each room, double the sectional area of the chimney, close to the ceiling, and by two inlets for air, one on each side, close to the ceiling	120	—	—
3. Each barrack room to have a remodelled grate to warm part of the admitted air in winter	1,450	—	—
4. Non-commissioned officers' rooms to have silk-flap ventilators into the chimneys	25	—	—
5. Stairs to be ventilated by shafts carried from the ceiling to above the roof, and by perforated panes in the windows	55	—	—
6. Kitchens to be ventilated by shafts carried above the roof, and by glass louvres in the windows	40	—	—
7. Canteen tap-room and non-commissioned officers' tap-room to be ventilated by silk-flap ventilators into the chimneys, and by perforated panes in the windows	5	—	—
8. Guard room to be ventilated by a shaft through the roof, and to have a remodelled grate as described	28	—	—
9. Cells to have small foul-air shafts carried from their ceilings to above the roofs, and the passages to be warmed by a Cundy's stove	61	—	—
10. Ablution rooms to be lighted and ventilated through the roof, and to be provided with gratings and pegs	29	4	For gratings.
11. A bath-house, with baths in the proportion of one bath to 100 men, and water laid on, to be provided	36	—	—
12. Women's wash-houses to have skylights, fixed tubs, with water laid on, gratings, laundry, and drying stoves	260	—	—
13. Water supply to be extended and improved	30	—	—
14. Privies to be drained, or the refuse disposed of in one of the ways pointed out, and to be reconstructed as water latrines, with divisions and seats, half doors, light, and ventilation. Cess-pits to be abolished; urinals to be supplied with water	122	—	—
15. Ash-pits to be removed, and provision made for collecting and taking away the barrack refuse every day	43	—	—
Lastly. The deficiencies noted above ought to be supplied as soon as practicable, but the sanitary works recommended are of immediate importance, and should be all carried out at once	—	—	—
GALWAY CASTLE BARRACK.			
Number of Rooms: 12 — Regulation Number of Men: 120 — Accommodation at 600 Cubic Feet per Man: 62 — Deficiency of Accommodation in Men: 58			
1st, and most important, reducing the numbers of men on the construction from 120 to 62	—	—	

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
GALWAY CASTLE BARRACK—*continued.*	£	£	£
2. Flooring the lower barrack rooms with wood	130	—	—
3. Ventilation of each room by a shaft, two inlets, and remodelled grate, as described. Ventilation of the staircase by a shaft and perforated glass panes	110	—	—
4. Gas to be laid on and a ventilated gas-burner put up in each room	116	—	—
5. Town water supply to be laid on	—	—	—
6. All the privies to be reconstructed as water latrines, with divisions of seats, half doors, light, and ventilation; also to be drained, and all cess-pits abolished. A urinal supplied with water to be constructed	131	—	—
7. The ash-pit to be removed, and all stable manure and other refuse to be taken away daily	—	—	—
8. Cook-house to be ventilated at the roof, and an oven to be put up	60	—	—
9. An ablution house, with one bath and water laid on, to be provided	131	—	—
10. Guard room to be ventilated by a shaft and remodelled grate	9	—	—
This barrack should be evacuated with as little delay as possible.			

GALWAY SHAMBLE BARRACK.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
32	256	168	88

1. Reduction of the numbers in each barrack room to the extent shown in the table	—	—	—
2. Ventilation of each room and of the library, by a shaft and inlet and a remodelled grate. Ventilation of the guard rooom by a shaft and remodelled grate. Ventilation of the stairs by a shaft through the roof and perforated glass panes in the window	337	—	—
3. Barrack to be lighted with gas, and a ventilated gas-burner to be placed in each room and in the library	238	—	—
4. Horses to be removed and the stables to be converted into an ablution room. Bathing accommodation to be provided in one of the ways suggested	162	—	—
5. A women's wash-house to be provided	59	—	—
6. Kitchen to have a roasting oven and to be ventilated by a shaft carried through the roof. Ash-pit to be altered as described, or removed	30	—	—
7. Latrines to be seated, and provided with divisions, half doors, light, and ventilation	51/10	—	—
This barrack should be evacuated as speedily as possible.			

LIMERICK NEW BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
73	869	622	247

1. Reduction of the number of men in all the barrack rooms, to the extent specified	—	—	—
2. Providing an inlet for air over the centre window on each side of the barrack rooms, and diffusing the air through perforated zinc cornices	175	175	—
3. Remodelled grates, for warming the air in winter, to be introduced into every barrack room	528	—	—
4 Serjeants' rooms to be ventilated by an Arnott's silk-flap ventilator into the chimney	18	18	—
5. Ventilation of chapel school, guard rooms, and canteen to be improved as suggested. Stables to be ventilated by shafts through the roof, and by perforated glass in the windows	37	—	—
6. Canteen tap-room to be ventilated by an Arnott's silk-flap ventilator, and by perforated panes of glass into the upper sash of the windows	1/17	—	—
7. Introducing a ventilated gas-burner into every barrack room	123	—	—
8. Providing day rooms for the men	1,600	—	—
9. Constructing a bath room, with baths, in the proportion of one bath to every 100 men, having water laid on	270	—	—
10. Women's wash-house to be improved as suggested, or a suitable laundry, with boilers and water laid on, fixed tubs, drying closet, laundry stove, &c., to be provided; also a place for ironing linen, gratings, and additional light and ventilation through the roof	290	—	—
11. Ventilating grate in guard room	11	—	—
12. Enlarging defaulters' room	39	39	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
LIMERICK NEW BARRACKS—*continued.*	£	£	£
13. Additional workshops for tailors and shoemakers	290	290	—
14. New ovens in the barrack cook-houses to be ventilated, so as to roast meat	—	—	—
15. Cleaning sheds and drill sheds to be provided	1,500	—	—
16. All cess-pits within the barrack precincts to be abolished. All privies to be converted into water latrines, supplied with water, and drained. To be re-constructed with divisions of seats and half doors, and the buildings to be suitably lighted and ventilated through the roof. Urinals to be supplied with water	1,000	—	—
17. Ash-pits to be removed, and iron carts substituted, for the daily collection and carrying away of all barrack refuse	84	—	—
Lastly. Married quarters ought to be provided	—	—	—

ROYAL ARTILLERY BARRACK, LIMERICK.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
10	164	120	44
1. The basement rooms to be struck off the construction, as being unfit for barrack rooms			—	—	—
2. Four men to be removed out of each of the other barrack rooms			—	—	—
3. Each barrack room to be ventilated by an opening into the built-up chimney double its area, and by inlets for air as described. Basement room to be ventilated by a silk-flap chimney ventilator. Fire-grates in barrack rooms to be remodelled. Guard room to be ventilated by a shaft, an inlet for air being afforded by a re-modelled grate			151/17	44	For ventilation
4. A ventilated gas-burner to be introduced into every barrack room			10	—	—
5. A bath, with water laid on, to be provided. Lavatory to have additional light through the roof			21	21	—
6. Women's wash-house to be improved, by having fixed tubs, with water laid on, and a drying stove			180	—	—
7. A roasting oven to be supplied to the cook-house			32	32	—
8. All the privies to be reconstructed as water latrines, and drained; to have divisions, half doors, and increased light. All cesspits to be abolished			200	—	—
9. Urinals to be supplied with water			5	—	—
10. Better arrangements for collecting and removing the barrack refuse and horse manure			51	—	—
The question as to providing increased accommodation for married soldiers in these barracks should be considered, along with that of making a similar provision for the New Barracks; but in any case the accommodation is required.					

LIMERICK CASTLE BARRACK.

Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
12	204	132	72
1. Reduction of the number of men in each barrack room from 17 to 11			—	—	—
2. A ventilating opening to be made into each of the disused barrack room chimneys, close to the ceiling of the room as described. Two inlets for air to be provided for each barrack room, one on either side, and the air to be diffused by a perforated zinc cornice			41	—	—
3. The barrack serjeant's quarters to be ventilated by a shaft carried up from the back of each room, and warm air to be admitted by re-modelling the grates			10	—	—
4. Guard room to be ventilated by a shaft through the roof, and by an inlet covered with perforated zinc close to the ceiling			1/15/6	—	—
5. The grates of all the barrack rooms, and of the guard room to be remodelled, to warm part of the admitted air in winter. The canteen tap-room to be ventilated by an air shaft, and perforated glass panes			188/12	—	—
6. A ventilated gas-burner to be introduced into every barrack room			18	—	—
7. A bath room, with two baths, to be constructed			75	—	—
8. Women's wash-house to be provided with fixed tubs, with water laid on, and a drying stove, and more light to be admitted			226/6	—	—
9. All the privies to be reconstructed as water latrines, with divisions of seats and half-doors. Urinals to be supplied with water			100	—	—
10. Additional light to be admitted to the cook-houses and wash-houses			8	—	—
11. The ash-pit to be removed, and the barrack refuse to be collecte and removed daily in an iron cart			45	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
TEMPLEMORE BARRACKS.	£	£	£
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
75 / 1,125 / 724 / 401			
1. Reduction of the numbers of men in each barrack room to the extent specified	—	—	—
2. Ventilating every barrack room by converting the blank chimney into a ventilating shaft, with an opening, having a section double that of the shaft, and by inlets for air through perforated zinc cornices, as described	202	202	—
3. Ventilating the staircases by opening a window to the back, and by a perforated glass pane in the upper sash of the stair windows	52/10	—	—
4. Ventilating the serjeants' rooms by a silk-flap ventilator in the chimney	28	28	—
5. Ventilating the serjeants' mess, infant school, reading room, and guard room, by shafts and inlets, as described. Ventilating the canteen rooms by silk-flap ventilators in the chimney and by perforated panes in the windows	76	76	
6. Remodelled fire grates, to save fuel and warm part of the admitted air in winter, to be provided for all the barrack rooms	1,227/15	—	—
7. Ablution rooms to be ventilated, and provided with pegs	16/18	—	—
8. A bath house, with a bath for every 100 men, and water laid on, to be provided	197	104	—
9. Cook-houses to have additional light and ventilation through the roof	180	180	—
10. And each house to be provided with a roasting oven			
11. Extension of the drill shed	1,000	—	—
12. Workshops to be enlarged and improved as suggested, or to be rebuilt	530	—	—
13. Wash-house accommodation to be extended. Ventilation to be provided by louvres in the roof. A drying room and means of getting up linen to be provided	600	—	—
14. Collecting water from roof of centre range in a large tank, to supply wash-house and ablution room	550	—	—
15. Bringing water to barracks from springs and distributing it	3,000	—	—
16. Abolishing cesspits, converting privies into water latrines; providing filtering bed and all necessary sewers; supplying water to urinals	2,700	—	—
17. Providing waterclosets to officers' quarters	3,000	600	—
18. Trapping gully gratings in barrack square	28	28	—
19. Removing ashpits and providing iron carts	91	—	—
20. Conversion of old guard room into married soldiers' quarters	—	150	—
CLONMEL BARRACKS.			
Number of Rooms. / Regulation Number of Men. / Accommodation at 600 Cubic Feet per Man. / Deficiency of Accommodation in Men.			
43 / 637 / 441 / 196			
1. Reduction of numbers in the barrack rooms of both barracks, to the extent specified	—	—	—
2. Ventilation of the barrack rooms in both barracks, by shafts and inlets for air	223	181	—
3. Remodelling the grates	492	—	—
4. Drainage to be constructed from the privies of both barracks, and all cess-pits to be abolished. Present privies to be reconstructed as water latrines, with water tanks and means of flushing. Seats to be divided, and to have half doors. Light to be provided in the proportion of one and a-half square foot per seat. Roof ventilation by louvres. Urinals to be supplied with water	300	200	—
5. Surface drainage of barrack enclosure	250	50	—
6. Water latrine and urinal for cells	150	—	—
7. Cook-houses in both barracks to be supplied with roasting ovens, and to be ventilated at the roof by louvres	110	110	—
8. An additional window is required in one of the infantry cook-houses	12	—	—
9. Wash-house of the Infantry Barracks to have proper washing troughs, drying and laundry stove, and gratings to stand on provided. Its ventilation to be improved by a louvre in the roof. A similar wash-house to be provided for the Artillery Barrack, or infantry wash-house to be made sufficient for both barracks	650	—	—
10. Ablution rooms of both barracks require additional pegs, and additional roof ventilation	15	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
CLONMEL BARRACKS—*continued.*	£	£	£
11. A bath room is required for both barracks, with one bath for every 100 men	300	22	—
12. A ventilated gas-burner to be introduced into every barrack room of both barracks	30	—	—
13. Day rooms and covered drill sheds are required for the men	—	—	—
14. The water supply to be improved	500	—	—
15. Both guard rooms to be better lighted, by additional window space, and to be ventilated at the roof	21	—	—
16. Ashpits to be abolished, and daily collection and removal of refuse substituted	120	—	—
Besides these requirements for health, the barracks have need of married quarters, workshops, and cleaning rooms; and the parade ground might be advantageously raised and drained.			
CAHIR BARRACKS.			
Rooms: 23 — Regulation Number of Men: 391 — Accommodation at 600 Cubic Feet per Man: 241 — Deficiency of Accommodation in Men: 150			
1. Reduction of the number of men in each barrack room from 17 to 11 in the ground floor rooms, and from 17 to 10 in the upper rooms	—	—	—
2. Additional ventilation of each barrack room, by two inlets for air to be diffused through perforated zinc, as described. Each non-commissioned officers' room to be ventilated by an Arnott's silk-flap ventilator introduced into the chimney. Guard room, school-room, and library to be ventilated by shafts and inlets for air, and to have the grate remodelled. Canteen to be ventilated	100	80	—
3. The fire grates to be remodelled for warming air	288	—	—
4. Stables to have additional light and ventilation as described	536	—	—
5. Lavatories and bath rooms, with baths in the proportion of one bath for every 100 men, with water laid on, to be constructed in a convenient position for the men's rooms. Present lavatories, with the water cisterns belonging to them, to be removed out of the serjeants' rooms	487	—	—
6. Barrack to be thoroughly drained to a proper outlet. All privies to be reconstructed as water latrines, with drainage and means of flushing, with divisions and half doors, and to be placed in more convenient localities. Cess-pits to be abolished and filled up. Urinals to be improved and supplied with water	950	330	—
7. The water supply to be improved, by diverting the stream of water as suggested, and providing tanks for its distribution to latrines, lavatories, baths, wash-houses, &c.	257	257	—
8. Wash-house to be enlarged, and supplied with a drying and laundry stove	350	87	—
9. Kitchens to be provided with roasting ovens	70	70	—
10. Lock-up room	150	150	—
Lastly. Married quarters and a drill shed are required in this barrack. Workshops should be constructed, and, as there is plenty of land, means should be provided for amusing the men, such as cricket, skittles, a ball court, &c.			
WATERFORD INFANTRY BARRACK.			
Number of Rooms: 22 — Regulation Number of Men: 384 — Accommodation at 600 Cubic Feet per Man: 242 — Deficiency of Accommodation in Men: 142			
1. Reduction of numbers in the barrack rooms to the extent stated above	—	—	—
2. Improvement of the ventilation and warming in all the barrack rooms by inlets	65	65	—
Remodelled grates	276	—	—
3. To improve the ventilation of the school-room and library	11/5	—	—
4. To enlarge the guard room, and improve the grate in the guard room, to warm the admitted air	161	—	—
5. To relay the surface paving, and improve the surface draining and guttering	220	20	—
6. To improve the water supply	120	—	—
7. To re-construct all the privies as water latrines, with water tanks, and means of flushing and drainage, to provide divisions of seats and half doors, and to light and ventilate the buildings from the roof, to drain the urinals, and supply them with water for flushing	410	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
WATERFORD INFANTRY BARRACK—*continued.*	£	£	£
8. To improve the drainage of the wash-house and to provide a drying stove	140	—	—
9. Ventilated roasting ovens to be provided in two of the cook-houses	10	—	—
10. To introduce gas, with ventilated burners, into the barrack rooms	450	—	—
11. To ventilate and provide more light for the lavatories, and to provide three baths, with water laid on, also to remove the pegs from over the basins, and replace them on the back wall	30	—	—
12. To abolish the ash-pits, and provide iron carts for the daily collection and removal of the barrack refuse	120	—	—
Lastly. A covered drill shed, additional workshops, and a suitable proportion of married quarters should be provided.			

WATERFORD ARTILLERY BARRACK.

Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
6	90	54	36

1. Evacuation of the barrack rooms in the basement, and the removal of six men out of each of the remaining barrack rooms	—	—	—
2. Ventilation of each barrack room by shafts and inlets for air	33	33	—
3. Ventilation of the guard room through the roof, and remodelling the grates in the barrack rooms and guard room as described. Tailors' shop to be similarly ventilated	129	—	—
4. Gas to be laid on, and a ventilated gas-burner to be introduced into each barrack room, and into the kitchens	300	—	—
5. The barrack to be sewered and all cess-pits to be abolished, and all drains properly trapped. Privies to be reconstructed as water latrines, with drainage into the sewers and means of flushing. Light to be provided for the privies, in the proportion of one and a half square foot of glass per seat. Ventilation at the roof to be provided, and divisions of seats and half doors	490	10	—
6. Urinals, with water laid on, to be constructed	30	—	—
7. A lavatory and bath room to be constructed, with one bath, and water laid on	170	170	—
8. Better accommodation for washing linen, and a drying and laundry stove to be provided	250	—	—
9. Cook-houses to be supplied with ventilated roasting ovens	50	50	—
10. A covered drill shed and cleaning shed to be provided	450	—	—
11. Water supply to be improved, to admit of its being constantly laid on to the privies, lavatory, and bath room, kitchens, wash-houses, hospital, &c.	215	—	—
Lastly. We would recommend the whole question, as regards this barrack, to be considered with reference to extending the accommodation. The present stables are excellent examples of good and healthy stable construction, and the barrack accommodation should be extended and improved, so as to make the whole establishment as complete as possible. We were informed that the requisite extent of land could be easily obtained for such a purpose	—	—	—

CORK BARRACKS.

Number of Rooms.		Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
Cavalry	19	171	133	38
Infantry	117	1,755	1,287	468
Total	136	1,926	1,420	506

1. Reduction of the numbers of men in each barrack room and hut to the extent specified	—	—	—
2. Ventilation of all the barrack rooms, serjeants' mess room, and workshops, by shafts and inlets for air. Ventilation of unventilated guard rooms in a similar manner. Ventilation of the infants' school, library, reading room, and canteen by silk-flap ventilators into the chimney, and by perforated glass panes in the windows. Ventilation of the barrack staircases by shafts from the top of the staircase, carried above the roof, and by perforated glass panes in the windows. Additional ventilation in the lock-up cells. All the barrack room and guard room grates to be remodelled, to save heat and to warm part of the admitted air in winter	4,560	—	—
3. Gas and a ventilated gas-burner to be introduced into every barrack room	1,942	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	ems and Amounts Sanctioned.	Items and Amounts Postponed.
CORK BARRACKS—*continued.*	£	£	£
4. A bath-house to be built, with bath accommodation in the proportion of one bath for every 100 men, and water laid on	512	—	—
5. A suitable laundry, with means of getting up linen, to be constructed, and till this is done each wash-house to be provided with a drying-stove	820	—	—
6. Each cook-house to be provided with a roasting oven	213/17	—	—
And to have additional light by windows or skylights, and a louvre for ventilation in the roof	165	—	—
7. Water supply to be improved in connexion with the barrack drainage, and water to be laid on for latrines, baths, urinals, &c.	1,750	—	—
8. All privies in the barracks to be reconstructed as water latrines, with divisions of seats, half doors, light, and ventilation. The water latrines to be drained, and the sewage conveyed to an outlet in one of the ways suggested. All cess-pits within the barrack precincts to be abolished. A water latrine to be provided at the main guard. Urinals to be improved and supplied with water	2,675	—	—
9. Officers' quarters to be provided with waterclosets	3,450	—	—
10. Ash-pits to be removed, and the barrack refuse to be collected and taken away daily in iron carts	310	—	—
11. The provost serjeants' quarters to be extended	150	—	—
CAT FORT.			
Number of Rooms: 5 — Regulation Number of Men: 100 — Accommodation at 600 Cubic Feet per Man: 60 — Deficiency of Accommodation in Men: 40			
1. That the accommodation in this barrack be reduced to 60 men in the manner pointed out	—	—	—
2. That two air bricks, with perforated zinc cornices, be introduced into each room, between the windows, as inlets for air. The fire grates to be remodelled	256/10	—	—
3. A lavatory to be built, with space for one bath, and water laid on	250	—	—
4. The privy to be reconstructed as a water latrine, with drainage light, ventilation, division of seats, and half doors, and the cess-pit to be abolished	275	—	—
5. Women's wash-house to have a boiler and drying stove	313	—	—
6. Cook-house to be provided with an oven	150	—	—
7. Gas to be introduced, and a ventilated gas-burner to be placed in every barrack room	150	—	—
FORT ELIZABETH.			
Rooms: 18 — Regulation Number of Men: 180 — Accommodation at 600 Cubic Feet per Man: 60 — Deficiency of Accommodation in Men: 120			
1. The ground floor to be taken, from the construction, as being unfit for occupation, and five men to be removed out of each of the remaining barrack rooms	—	—	—
2. Windows with perforated glass panes to be opened through the external wall of the two upper corridors	120	—	—
3. An additional window to be made to each barrack room, instead of the small opening in the back wall. A window to be made from each barrack room into the corridor	125	—	—
4. Each barrack room to be ventilated by a shaft, carried up from the ceiling to the roof, and by perforated glass panes in the windows. The fire grates to be remodelled to save heat	380	—	—
5. An ablution house to be built, with space for one bath, with water laid on	250	—	—
6. Additional light to be given to the cook-house, and an oven to be provided for roasting meat	23	—	—
7. Privy to be drained and reconstructed as a water latrine, with drainage, division of seats, half doors, light, and ventilation. Cess-pit to be abolished	190	—	—
8. Guard house to be ventilated by an inlet	9	—	—
9. Gas and a ventilated gas-burner to be introduced into each barrack	200	—	—
10. Removing wall opposite barrack room windows	15	—	—
11. Water from water company's mains	170	—	—
(*It would be much better to evacuate this barrack altogether.*)			

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
ROYAL ARTILLERY BARRACKS, BALLINCOLLIG.	£	£	£
Rooms: 34 — Regulation Number of Men: 388 — Accommodation at 600 Cubic Feet per Man: 284 — Deficiency of Accommodation in Men: 104			
1. Reduction of numbers of men in the barrack rooms and in the guard room to the extent stated	—	—	—
2. Introducing a ventilating shaft into all the barrack rooms where there are none; continuing all the present ventilating shafts above the roof of the building; providing an inlet for air between every two windows, and covering the inlets with short perforated zinc cornices	450	—	—
3. Remodelling the room grates, to save fuel and to heat part of the inflowing air in winter	923	—	—
4. Ventilating and warming the guard room and lock-up by means of shafts and inlets, and by remodelling the guard room grate; ventilating the workshops by silk-flap ventilators and perforated glass panes, and the serjeants' mess by a shaft and inlet for air; ventilating the library and canteen, by silk-flap ventilators in the chimney and by perforated glass panes in the windows	114/15	—	—
5. Ventilating the school-room by an open space round the stove pipe where it passes through the ceiling, and additional light to be given by a skylight	28	—	—
6. A day room and covered drill shed to be provided for the men	350	—	—
7. Present ablution houses to be provided with pegs	5	—	—
8. Wash-houses to be provided with fixed tubs, and water laid on; and with a drying closet or a drying and laundry stove: additional light to be given by windows or skylights	700	—	—
9. Each cook-house to be provided with a roasting oven	73	73	—
10. And a cooking range to be provided for the serjeants' mess kitchen	18	—	—
11. Water supply of barrack to be increased by deepening the wells or from the river, and all the roof water to be saved for washing	1,378	1,378	—
12. Privies to be reconstructed as water latrines, supplied with water and drained in one of the modes stated, also to have division of seats, half doors, light, and ventilation; urinals to be increased in number, and supplied with water	1,750	—	—
CARLISLE FORT.			
Four rooms — 77 men.			
1. That the two long barrack rooms, including that occupied by convicts, be ventilated by two shafts and four inlets for air to each room, and that windows be opened in the back of the upper room. That each of the other barrack rooms have a shaft and inlet for air provided, and an additional window and remodelled grate	279	—	—
2. That the water supply be improved	174	—	—
3. That the privies be converted into water latrines, with drainage, divisions of seats, light, and ventilation, and the cess-pits abolished	56	—	—
4. That an ablution room, with one bath and water laid on, be provided	156	—	—
5. That a roasting oven be introduced into one of the kitchens	40	40	—
CAMDEN FORT. 165 men.			
1. Each barrack room and the guard room to be ventilated by a shaft and inlets. Grates to be remodelled. Additional windows to be opened in the barrack rooms where practicable, on the side opposite the present windows	229	—	—
2. An ablution room with one bath to be provided	190	—	—
3. Privies to be reconstructed as water latrines, drained, and supplied with water	55/6	—	—
4. A roasting oven for the kitchen	80	80	—
SPIKE ISLAND CASEMATES. 112 men.			
1. To reduce the numbers in the casemates, to give as nearly as may be 600 cubic feet per man, as soon as sufficient accommodation has been provided to admit of this being done	—	—	—
2. To improve the ventilation of the occupied casemates, by perforated panes of glass over the doors, and to provide ventilation in the new casemates, as suggested	0/16/6	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
SPIKE ISLAND CASEMATES—*continued.*	£	£	£
3. To provide a roasting oven for the kitchen	50	50	—
4. To provide a bath in the ablution house	10	—	—
5. To reconstruct the soldiers' privies as water latrines, with divisions of seats, half doors, light, and ventilation	55/6	—	—
6. To provide a drying stove for the women's wash-house	3	—	—
7. Water supply to be improved	47	—	—
HAULBOWLINE BARRACKS.			
Four rooms — 98 men.			
1. Reduction of numbers, as stated	—	—	—
2. Ventilation of the rooms by shafts and inlets for air. Ventilation of the passage	83	—	—
3. Erection of an ablution room containing one bath	150	150	—
4. An oven to be provided for the cook-house	40	40	—
5. Additional light and ventilation to be introduced	2	—	—
6. Abolition of the ash-pit, and reconstruction of privies as water latrines, with means of flushing, and divisions and half doors	69/6	—	—
7. To improve the ventilation of the married quarters in the tower	2	—	—
BANDON BARRACKS.			
Number of Rooms: 12 — Regulation Number of Men: 100 — Accommodation at 600 Cubic Feet per Man: 66 — Deficiency of Accommodation in Men: 34			
1. Reduction in the number of inmates in these rooms, to afford, as near as may be, 600 cubic feet per man	—	—	—
2. Improving the light of the darker rooms, by enlarging windows, or opening additional windows at the back	66	—	—
3. Ventilating every barrack room, and the guard room, by a shaft carried from the ceiling to above the roof, and by an inlet for air into each room, and by remodelling the grates, as described	502	—	—
4. Ventilating the stables by four shafts, one at each corner, carried above the roof of the cavalry range, and by perforated glass panes in the windows. The stables also to have more window space provided	300	—	—
5. Cook-house to have a roasting oven introduced, and to have additional ventilation through the roof	30	—	—
6. All the privies to be drained, and reconstructed as water latrines, in the manner pointed out. The urinals to be supplied with water	740	—	—
7. An ablution and bath room, with one bath, and water laid on, to be erected in a convenient locality	300	—	—
KINSALE BARRACKS.			
Number of Rooms: 57 — Regulation Number of Men: 454 — Accommodation at 600 Cubic Feet per Man: 340 — Deficiency of Accommodation in Men: 114			
1. The number of men in each barrack room to be reduced from eight to six, and in each hut from 25 to 20	—	—	—
2. Each barrack room, the guard room, school-room, library, and serjeants' mess to be ventilated by a shaft carried from the ceiling of the room to above the roof, and by two inlets for air, one on each side, with perforated zinc cornices for diffusing the current. A skylight to be placed in the roof of the upper flat barrack rooms. The ventilation of the huts to be improved, by leaving a circular space round the stove pipe where it passes through the roof, and by louvres in each end above the doors. The canteen tap-room to be ventilated by a silk-flap ventilator, and by perforated panes in the windows	700/18	—	—
3. Remodelled grates to be introduced into the barrack and guard rooms	1,700	—	—
4. Ablution rooms to be erected, and four baths, with water laid on, to provided	460	—	—
5. Suitable laundry accommodation to be provided in one of the ways pointed out	520	—	—
6. A roasting oven to be put up in each cook-house. The boilers to be repaired, and additional light and ventilation to be provided through the roof	165	135	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
KINSALE BARRACKS—*continued.*	£	£	£
7. The barrack to be thoroughly drained to the sea. All the cesspits to be abolished. All the privies to be reconstructed as water latrines, with sufficient light and ventilation, divisions of seats, and half doors. Urinals to be reconstructed and supplied with water for cleansing	950	—	—
8. The guard room to be provided with a lock-up	260	—	—
And to be enlarged, or the number of men on guard to be reduced, to give 600 cubic feet to every man sleeping in it	—	—	—
9. Water supply	720	—	—

CHARLES FORT, KINSALE.

Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
45	344	220	124

1. Reduction of the numbers of men in the barrack rooms, casemates, and huts to the extent specified	—	—	—
2. Ventilation of each of the barrack rooms, by a shaft and two inlets for air. Ventilation of the casemates by silk-flap ventilators into the chimneys, and by perforated glass panes in the circular windows. Ventilation of the huts by circular openings round the stove pipes, and by louvred openings in the gables. Ventilation of the guard room by a shaft and inlet. Ventilation of the canteen tap-room by a silk-flap ventilator into the chimney, and by perforated glass panes in the windows	343	—	—
3. Cutting away the earth behind the upper range of barrack rooms to a depth of twelve inches below the level of the ground floor, and flagging the area for drainage. Converting the corridor into an open arcade, and opening windows into it from all the barrack rooms. Opening additional windows in other barrack rooms, on the side opposite the present windows, where practicable	560	—	—
4. Draining and improving the present ablution house, by laying on water, and constructing additional ablution accommodation for the other barrack houses. Providing one bath for every 100 men	720	—	—
5. Removing the present women's wash-house, and constructing a proper laundry in another situation	250	—	—
6. Providing an additional cook-house, with means of boiling and roasting meat	—	—	—
7. Providing a roasting oven for the present cook-house	110	110	—
8. And giving it additional light by a window, and also ventilation through the roof	22	—	—
9. Converting all the privies into water latrines, with drainage to the sea, with light, ventilation, divisions of seats, and half doors. Providing urinals properly supplied with water. Removing the ash-pit, and abolishing all cess-pits. The ditch also to be drained. Improved water supply	975	—	—

TRALEE INFANTRY BARRACKS.

Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
23	392	253	139

1. Reduction of numbers of men in the barrack rooms and huts to the extent stated, which can be effected at once, by the erection of additional huts in front of the barrack	—	—	—
2. Ventilation of every barrack room, by an opening made into the disused chimney, of double the sectional area of the chimney. Inlets for air, with perforated zinc cornices, to be made between the windows. The guard room to be ventilated by a shaft, and the grate to be remodelled. Chapel school to have additional roof ventilation	128	—	—
3. Grates to be remodelled	1,100	—	—
4. Bath room, with four baths, and water laid on, to be constructed. This room to contain additional lavatory space	320	—	—
5. Barrack drainage to be improved; all cess-pits to be filled up, and all privies to be reconstructed as water latrines, with drainage and means of flushing, divisions of seats, half doors, light, and ventilation. Surface drainage and paving to be improved, and all drains to be trapped. Urinals to be supplied with water	844	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
TRALEE INFANTRY BARRACK—*continued.*	£	£	£
6. A roasting oven to be erected in each kitchen, and one of the kitchens to be ventilated as suggested	120	120	—
7. Women's wash-house to be fitted up with fixed tubs, gratings, &c., and to have a drying and a laundry stove provided	600	—	—
8. Ventilation of No. 2 cook-house	10	—	
9. Steam fitment for do.	75	75	—
Lastly. The use of the ground within the barrack enclosure should be restored to the men. The other requirements as to married quarters. A day room, cleaning room, and covered drill shed, &c., should also be supplied	—	—	—

BUTTEVANT INFANTRY BARRACK.

Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency in Accommodation in Men.
65	910	638	272

1. Reduction of numbers in the barrack rooms and huts to the extent specified	—	—	—
2. Ventilation of every barrack room, by an opening into every disused chimney, when there are two chimneys to a room, or by a ventilating shaft where there is only one chimney, and by inlets for air, with a perforated zinc cornice placed between the windows	140	—	—
3. Fire-grates to be remodelled	1,450	—	—
4. Ventilation of the non-commissioned officers' rooms, by a silk-flap ventilator into the chimney. Library to be ventilated by an opening into the disused chimney, and by an inlet, like the barrack rooms. Guard room and chapel school to be ventilated. A window to be made in the back wall of each staircase, and the windows in the schoolmaster's house to be enlarged	232	—	—
5. Additional lavatory accommodation to be provided. Lavatory on the north-west side to have a wooden ceiling under the floor of the water tank above it. Pegs to be provided. Additional baths to be provided, in the proportion of one bath to every 100 men	487	—	—
6. A women's wash-house, with boilers, fixed tubs, and drying closet, &c., of an adequate size, to be provided	950	—	—
7. Removing kitchens	208	208	—
8. Kitchens to have roasting ovens	100	100	—
9. And to be ventilated by shafts and perforated glass panes	6	—	—
10. Water supply to be re-arranged, to afford sufficient water for latrines, wash-houses, baths, &c.	827	—	—
11. Deepening well	30	30	—
12. Parade ground to be under-drained	600	—	—
13. Privies to be reconstructed, drained, and converted into water latrines, and the sewage disposed of by irrigation or filtration. Latrines to be lighted and ventilated, and to have divisions of seats and half doors	800	—	—
14. Urinals to be supplied with water	120	—	—
Lastly. Married quarters, day rooms, cleaning shed, covered drill shed, and workshops ought to be provided	—	—	—

MALLOW INFANTRY BARRACK.

Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
13	88	46	42

1. Reduction of the numbers of men in each room to the extent stated	—	—	—
2. Ventilation of each barrack room by a shaft and inlet for air. Ventilation of guard room by a large silk-flap ventilator into the chimney	100/9	—	—
3. Fire-grates in the barrack and guard rooms to be remodelled	190	—	—
4. Kitchens to be ventilated by a shaft carried up above the roof of the barrack, and by glass louvres in the windows, and a roasting oven to be provided	65	—	—
5. A lavatory and bath room with one bath, and water laid on, to be constructed	130	—	—
6. A proper wash-house, with boilers, fixed tubs, and drying stove, to be provided	580	—	—
7. Privies to be reconstructed as water latrines, with suitable drainage, and water laid on	160	—	—
8. Water supply to be increased, to enable these improvements to be carried out	—	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
FERMOY NEW BARRACK.	£	£	£
Number of Rooms: 75 — Regulation Number of Men: 1,152 — Accommodation at 600 Cubic Feet per Man: 764 — Deficiency of Accommodation in Men: 388			
1. Reduction of numbers of men in the barrack rooms to the extent stated	—	—	—
2. Ventilation of all the barrack rooms by shafts and inlets for air. Ventilation of the guard rooms and workshops in a similar manner. Ventilation of the staircases by a shaft through the roof and perforated glass panes. All the serjeants' rooms to be ventilated by a silk-flap ventilator into the chimney. Canteen to be ventilated by silk-flap ventilators into the chimney, and by perforated glass panes	502	5/16/8	For guard room.
3. Every barrack room and serjeants' room to be lit by a ventilated gas-burner. Introducing gas	1,230	—	—
4. Remodelled grates to be provided for all the rooms	1,750	—	—
5. Lavatories to be better ventilated by perforated glass panes. A ledge to be placed on the bench of the lavatory on the east side of the barracks	20	—	—
6. A bath-house, with fixed baths in the proportion of one bath to every 100 men, with water laid on, to be provided	400	—	—
7. Wash-houses to be provided with fixed tubs, drying closets, and laundry stove, and with means for ironing linen. (A new laundry proposed)	850	—	—
8. A roasting oven to be supplied to each cook-house, louvres for ventilation, and skylights to be inserted in the roofs	241	165	—
9. All the privies within the barrack precincts to be converted into water latrines, with sufficient drainage, with divisions of seats and half doors, and sufficient light and ventilation. Water supply to be improved for this purpose. All cess-pits to be abolished. A water latrine is required for the guard room. All urinals to be supplied with water	180	—	—
10. The barrack refuse to be collected and removed daily, and ash-pits abolished	450	—	—
11. Day rooms lit with gas, and suitable recreation for the men to be provided. A ball court is required	—	—	—
12. Covered drill sheds, for wet weather, to be erected	300	—	—
13. Improving water supply	110	—	—
Lastly. Married quarters should be built on some convenient ground near the barracks	—	—	—
FERMOY OLD BARRACK.			
Rooms: Cavalry 18, Infantry 82 — Regulation Number of Men: 198, 1,282 — Accommodation at 600 Cubic Feet per Man: 84, 822 — Deficiency of Accommodation in Men: 114, 460			
Total 100 — Regulation Number of Men: 1,480 — Accommodation at 600 Cubic Feet per Man: 906 — Deficiency of Accommodation in Men: 574			
1. Reduction of numbers in all the barrack rooms, to the extent stated	—	—	—
2. Rehanging window sashes to open below	1,145	—	—
3. Ventilation of all barrack rooms by shafts and inlets for air as described	830	—	—
4. Barrack room staircases to be ventilated by shafts and perforated glass panes. Staff serjeants' quarters, serjeants' mess rooms, and canteen rooms, to be ventilated by silk-flap ventilators in the chimneys, the two latter also by inlets for air. Library rooms to be ventilated by a silk-flap ventilator in the chimney, and inlets for air. School-rooms to be ventilated by shafts and inlets for air	112	—	—
5. Fire-grates to be remodelled	2,300	—	—
6. Guard rooms to be ventilated by shafts, and the grates to be remodelled	65	—	—
7. Barracks to be lit with gas, and a ventilated gas-burner to be introduced into every barrack room	1,300	—	—
8. Day rooms, properly furnished, to be provided for the men	—	—	—
9. Ablution houses to have perforated glass panes introduced into the windows	4	—	—
10. A bath-house to be erected, with baths in the proportion of one bath to 100 men, and water laid on	400	—	—
11. Water supply to be augmented and improved	600	—	—
12. All privies to be reconstructed as water latrines, with drainage and water supply, and divisions of seats and half doors. Cess-pits to be abolished. Urinals to be reconstructed and supplied with water. The guard room requires a latrine and urinal	320	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
FERMOY OLD BARRACK—*continued.*	£	£	£
13. Main-drain for barrack officers' quarters to be provided with waterclosets	1,600	—	—
14. Wash-houses to be provided with fixed tubs, laundry and drying stoves, and means of getting up linen. Additional light and ventilation to be provided for these houses, and the floors to be properly drained	950	—	—
15. Each cook-house to be provided with a roasting oven	220	220	—
16. And additional light and ventilation	76	—	—
17. A covered drill shed to be provided	300	—	—
18. Additional light and ventilation for the cavalry stables	230	—	—
19. Improved drainage for canteen	14	14	—
20. Barrack refuse to be collected and removed daily	450	—	—
Lastly. Married quarters ought to be provided, and suitable workshops, and a good lock-up room erected	—	—	—
We ought to notice the condition of the officers' mess establishment in this barrack. In many important points, its construction is most defective, and we would strongly recommend that better accommodation be provided.			

KILKENNY BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
30	586	384	202
1. Reduction of numbers of men in all the barrack rooms to the extent stated	—	—	—
2. Ventilation of all the infantry barrack rooms by making an opening into the chimney of the disused fireplace, close to the ceiling, the opening to have the same sectional area as the chimney. Inlets for air to be provided, one on either side the room between the windows close to the ceiling. Each opening to be covered by a cornice with perforated zinc to diffuse the air. Serjeants' mess to be ventilated in a similar manner. All the serjeants' rooms to be ventilated by a silk-flap ventilator into the chimney. The rooms in the cavalry barracks to be ventilated by air shafts carried from the ceiling to above the roof, and by inlets between the windows, as described. Stables to be ventilated by shafts and perforated panes in the windows. Chapel school to be ventilated as described. Staircases to have additional windows, and to be ventilated by air shafts from the ceiling to above the roof, and by perforated panes in the windows	336*	336	—
3. Each barrack room to have gas and a ventilated gas-burner	143	—	—
4. Slate benches in the ablution houses to have ledges put to them, and fixed baths to be put up in the proportion of one bath to every 100 men	144	—	—
5. Wash-house to be drained, and to be fitted up with fixed tubs and a drying stove	210	—	—
6. Ovens to be provided for the cookhouses	112	112	—
7. Cleaning sheds and drill shed to be provided	—	—	—
8. Privies to be converted into water latrines, with drainage, divisions of seats, half doors, light and ventilation, and all cesspits to be abolished	410	—	—
9. Surface drainage and guttering near the barracks to be improved	89	—	—
10. Urinals to be improved and supplied with water for cleansing. The urinals under the cavalry barrack rooms to be removed and reconstructed elsewhere	85	—	—
Lastly. Accommodation should be provided for married soldiers	—	—	—

* This sum includes the hospital.

NEWBRIDGE BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
52	832	552	280
1. Reduction of numbers of men in each barrack room to the extent stated. The number of men in each hut to be reduced to twenty	—	—	—
2. Ventilation of each barrack room by an opening made near the ceiling into the blank chimney, the opening to have double the area of the chimney. An inlet for air to be made between the windows, back and front, and to be covered with a short perforated zinc			

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
NEWBRIDGE BARRACKS—*continued.*	£	£	£
cornice within the room. Staircases to be ventilated by shafts through the top ceiling and roof, and by perforated glass panes in the windows. Non-commissioned officers' rooms to be ventilated by a silk-flap ventilator into the chimney. Huts to be ventilated by swing windows over the end doors, and by louvres above the windows at each end. All barrack rooms used as library, school-rooms, serjeants' mess, &c. to be ventilated into the blank chimney, and to have inlets like the barrack rooms. Canteen tap-room to be ventilated by a silk-flap ventilator and by perforated glass panes. Guard rooms to be ventilated by shafts through the roof and inlets for air	1,504	717	—
3. All the barrack room grates to be remodelled, to save heat	—	—	—
4. Lavatory accommodation to be extended, and made commensurate with the wants of the barrack. Gratings and pegs to be supplied. Fixed baths, with water laid on, to be provided in the proportion of one bath to every 100 men	288	63	—
5. Wash-houses to be ventilated, and to be properly fitted up with fixed tubs, gratings, and means of drying and getting up linen	1,200	—	—
6. Each cook-house to be provided with a roasting oven	60	60	—
7. Cleaning sheds and covered sheds for drill to be provided	—	—	—
8. Water supply to be extended and improved	3,220	—	—
9. The whole drainage of the barracks to be improved, and conducted to an outlet for irrigating land or to the river. All privies to be reconstructed as water latrines, properly drained, with divisions of seats, half doors, light, and ventilation. Officers' quarters to be provided with waterclosets; soil pits to be abolished. Urinals to be reconstructed, drained, and supplied with water. All drains to be trapped. Privy and cess-pit in the provost yard to be removed, and a water latrine substituted. Water latrine to be constructed for guard room	3,436	—	—
10. Water-closets for officers' quarters	2,359	1,000	—
Lastly. Married quarters ought to be provided for the regulation proportion of married soldiers	—	—	—

BIRR BARRACKS.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
65	1,105	659	446

1. Reduction of the numbers of men in the barrack rooms to the extent pointed out above	—	—	—
2. Ventilation of every barrack room and of the library, tailors' shops, and infant school, by an opening into the blank chimney near the ceiling, and by two inlets near the ceiling, one on each side between the windows; the inlets to be covered with a perforated zinc cornice. Ventilation of each barrack staircase by a shaft through the roof, and by perforated glass panes in the windows. Ventilation of all the non-commissioned officers' rooms by a silk-flap ventilator into the chimney. Ventilation of the guard rooms by shafts and inlets. Ventilation of the canteen rooms by silk-flap ventilators in the chimneys and by louvred panes in the windows. Grates in all the barrack rooms and guard rooms to be remodelled to save fuel, and heat part of the fresh air in winter	1,045	472	—
3. A day room and covered drill shed to be provided	—	—	—
4. Additional lavatory accommodation to be provided. Pegs and gratings required for each ablution house. Baths to be provided with water laid on, in the proportion of one bath for every 100 men	590	93	—
5. Women's wash-houses to be entirely reconstructed, with proper accommodation for washing, drying, and getting up linen	824	—	—
6. Kitchens to be sufficiently ventilated by shafts and by perforated glass panes in the windows	147	—	—
7. Larger ovens, ventilated, for roasting meat to be provided	72/5	72/5	—
8. Water supply to be increased	156	—	—
9. Drainage to be extended, to include the privies, women's wash-houses, &c., and an outlet to be obtained, either by irrigating grass land or into a natural outlet, in the manner described. All privies within the barrack enclosure to be reconstructed as water latrines, with divisions of seats, half doors, light, and ventilation. Urinals to be improved and supplied with water. A water latrine and urinal to be provided for the chapel school, and a water latrine and ablution accommodation to be provided for the guard rooms. All drains to be trapped	1,606	1,606	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
BIRR BARRACKS—*continued.*	£	£	£
10. Officers' stables to have additional window space with perforated glass panes and a shaft for ventilation - - - -	—	—	—
Lastly. Accommodation for married soldiers is required. The chapel school requires a porch; also air to be admitted over the smoke flues under the flooring and round the stoves, and ventilating openings to be made in the ceiling - - - -	—	—	—
CARLOW BARRACK.			
Number of Rooms: 17 — Regulation Number of Men: 204 — Accommodation at 600 Cubic Feet per Man: 130 — Deficiency in Accommodation in Men: 74			
1. Reduction of inmates in each room to the extent stated in the preceding table - - - - - - - -	—	—	—
2. Ventilation of all the soldiers' rooms by shafts and inlets for air; ventilation of the corridors by perforated panes of glass in the windows; ventilation of the staircase by perforated panes and by a louvred turret; ventilation of the guard room by a shaft and inlet; ventilation of the stables by shafts and perforated glass panes - - - - - - - - -	723	—	—
3. Fire-grates to be remodelled to warm part of the admitted air -	—	—	—
4. Additional window space to be given in the one-windowed barrack rooms and in the guard room - - - - - -	—	—	—
5. The walls and ceilings of the barrack rooms, corridors, staircase, and stables, to be cleansed, scraped, and washed with quicklime -	14	—	—
6. Ablution house to be supplied with pegs and gratings, and with additional light and ventilation. Two baths to be provided, with water laid on - - - - - - - -	76	—	—
7. Women's wash-house to be provided with fixed tub, gratings, and a drying stove - - - - - - - -	157	—	—
8. Cook-houses to have roasting ovens supplied - - - -	33	—	—
9. The privies to be reconstructed as water latrines, with divisions and seats, half doors, light, and ventilation, and drained. The cess-pits to be abolished. The urinal to be reconstructed and supplied with water. Removing manure heap - - - -	230	—	—
Lastly. The pitch paving of the stables and immediate vicinity of the stable doors is insufficient for the preservation of due cleanliness, and square setts ought to be substituted when the paving is next under repair - - - - - - - -	—	—	—
DUNCANNON FORT.			
Number of Rooms: 24 — Regulation Number of Men: 188 — Accommodation at 600 Cubic Feet per Man: 96 — Deficiency of Accommodation in Men: 92			
1. Adaptation of the Ordnance stores and armoury as additional barrack accommodation, by increasing the light, where deficient, supplying fire-grates, and ventilating the buildings by shafts and inlets -	216	—	—
2. Evacuation of the basement barrack rooms, and reduction of numbers in the other barrack rooms to the extent specified above -	—	—	—
3. Opening additional windows into imperfectly lighted rooms, and ventilating all the rooms in the manner specified. The passages and staircases to be ventilated by perforated glass panes in the windows - - - - - - - -	458	—	—
Remodelled grates - - - - - - - -			
4. The chapel and guard room to be ventilated, and to have remodelled grates for warming the air in winter - - - -			
5. Kitchen to be provided with a roasting oven, and to be ventilated by perforated glass panes, and lighted by reflectors - - -	53	—	—
6. Water supply to be increased by an additional well and tank, by collecting the rain water, and by pipes for distribution - -	566	—	—
7. A lavatory, with two baths, and water laid on, to be provided -	417	—	—
8. Wash-house to be reconstructed, and to have a drying stove provided	125	—	—
9. All drains to be trapped. All privies to be reconstructed as water latrines, and provided with means of daily flushing. Arrangements to be made for the daily removal of the barrack refuse -	542	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
BELFAST INFANTRY BARRACK.	£	£	£

Number of Rooms. and Huts.		Regulation Number of Men.	Proposed Accommodation in Men.	Deficiency of Accommodation in Men.
Barracks	42	840	630	210
Huts -	17	425	255	170
Total -	59	1,265	885	380

1. Reduction of the number of men in all the barrack rooms and huts to the extent shown in the preceding table - - -	—	—	—
2. Completing the ventilation of the barrack rooms by carrying a shaft from the ceiling of each room above the roof, and by providing louvres for the present inlets to throw the air towards the ceiling. Barrack room grates to be remodelled to warm part of the air admitted. Non-commissioned officers' rooms to be ventilated by Arnott's ventilators into the chimneys. Stairs to be ventilated by louvres through the roof, and perforated glass panes in the windows. One of the chimneys in the infants' school to be made into an outlet shaft, and the fire-grate of the other to be remodelled. Library and tailors' shop to be ventilated by shafts and remodelled grates. Chapel school to have ridge ventilation, and inlets for air near the stoves. Canteen tap room to have more windows if possible, and a remodelled grate and outlet shaft. Guard room to have light through the roof, and a shaft and remodelled grate. Lock-up to have a shaft through the roof; barrack rooms, kitchen, &c. to be lighted with gas; the ablution room to have beads to the table. The number of baths to be raised to nine - - -	2492/10	—	—
3. Present women's wash-house to be ventilated by glass louvres in the windows, fixed tubs with water laid on, and a drying stove to be put up, or a larger laundry to be provided - - -	362	—	—
4. Cook-house to be ventilated by a shaft 12 inches square, carried from the ceiling to above the roof - - - - -	9	—	—
5. Latrines to be reconstructed on Macfarlane's principle, with divisions, light, ventilation, and if practicable half doors. Barrack drainage to be improved. Open ditch in front of the hospital to be covered over, and the small pond in the barrack master's garden to be filled up or covered over - - - - - -	575	—	—
6. Ash-pit to be covered, and provision to be made for the daily removal of refuse - - - - - - - -	73	—	—

BELFAST ROYAL ARTILLERY BARRACK.

Number of Rooms.	Regulation Number of Men.	Accommodation at 600 Cubic Feet per Man.	Deficiency of Accommodation in Men.
8	104	62	42

1. Reduction of the number of men in each room to the extent shown in the preceding table - - - - - -	91	—	—
2. Ventilation of the barrack rooms by converting one of the chimney flues into a ventilating shaft, by closing it up below and making an opening into the shaft close to the ceiling double its sectional area. Two inlets for fresh air to be provided close to the ceiling of each room. Staircases to be ventilated by shafts through the ceiling and perforated panes in the windows. Non-commissioned officers' rooms to have Arnott's ventilators into the chimneys. Barrack rooms to have additional windows at the back - -	198	—	—
3. Privies to be reconstructed as water latrines with drainage, divisions of seats, half doors, light, and ventilation, and all cess-pits to be filled up - - - - - - - -	123	—	—
4. Women's wash-house to have additional light and ventilation, fixed tubs and a drying stove - - - - - -	20	—	—
5. Cook-house to have additional light through the roof - -	7/10	—	—
6. Guard rooms to be ventilated by shafts and remodelled grates. Cells to have shafts and inlets. One of the guard rooms to have more light through the roof - - - - - -	27	—	—
7. Ventilation of the stables to be improved, and the manure heap near the hospital to be removed. Providing ash-cart - - -	53	—	—
8. Bath in ablution room - - - - - - -	60	60	—
9. Introducing gas - - - - - - - -	150	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
MAY STREET RECRUITING BARRACK.	£	£	£
The best thing to do with May Street barrack would be to give it up; but as it may not be possible perhaps to do this, every precaution should be taken to make it healthy; *with this view we would recommend:—*			
1. Removing the front buildings, to throw the court open	—	—	—
2. Ventilating all the rooms by shafts and inlets, and making all the windows to open; ventilating the serjeants' quarters by Arnott's ventilators	18	—	—
3. Boarding the floor of the lower room	50	—	—
4. Removing the ash-pit and cess-pit, and reconstructing the privies as water latrines	37/10	—	—
5. Providing a bath with water laid on	9	—	—
6. Allotting as a rule as nearly as may be 600 cubic feet of space for each recruit	—	—	—
7. Ash cart	33	—	—
LONDONDERRY INFANTRY BARRACK.			
Rooms - 14 / Huts - 12 / Total - 26 — Regulation Number of Men: 272 / 300 / 572 — Accommodation at 600 and 400 Cubic Feet: 218 / 180 / 398 — Deficiency of Accommodation in Men: 54 / 120 / 174			
1. Reduction of the numbers of men in the rooms and huts to the extent stated	—	—	—
2. Ventilation of the barrack rooms by providing shafts, inlets, and remodelled grates; ventilation of the school-room, library, and serjeants' mess, in a similar manner; ventilation of the non-commissioned officers' rooms by Arnott's ventilator in the chimney; ventilation of the passages and stairs by perforated glass panes; ventilation of the guard room by a shaft through the roof, and a remodelled grate; additional ventilation for the huts through the ridge	193	—	—
3. Gas-burners to be introduced into the barrack rooms	160	—	—
4. Pegs to be provided for the ablution room. Three additional baths with gratings and forms to be provided	33	—	—
5. Women's wash-house to have fixed tubs with water laid on, a drying and laundry stove, gratings to stand on, and more light and ventilation through the roof	156	—	—
6. Cook-houses to have skylights in the roofs	8	—	—
7. Ash-pits to be reduced in size; the bottom to be raised above the level of the ground, and to be paved and drained; to be covered and provided with a hopper	25	—	—
8. All the privies to be reconstructed as water latrines, with drainage and water supply. To have divisions of seats, half doors, light, and ventilation; and all cess-pits within the barrack enclosure to be abolished. Officers' privies to be converted into waterclosets	480	—	—
ENNISKILLEN MAIN BARRACK.			
27 — Regulation Number of Men: 268 — Accommodation at 600 Cubic Feet per Man: 158 — Deficiency of Accommodation in Men: 110			
1. Reduction of the number of men in all the barrack rooms of the main building, and in the stable barrack rooms, so as to give, as nearly as may be, 600 cubic feet per man	—	—	—
2. Ventilation of the barrack rooms in the main building by shafts, inlets, and remodelled grates, and by making all the windows to open at top. Ventilation of the stairs by louvres through the roof, and perforated glass panes in the windows. Ventilation of the stable barrack rooms by louvres in the ridge, and inlets at the eaves; additional light to be given to these rooms. Ventilation of the school room by converting one of the chimney flues into an outlet foul-air shaft; providing inlets for fresh air, and remodelling the other fire-grates. Ventilation of the infants' school room by Arnott's valves. Guard room to have a louvre in the roof, and a remodelled grate; passage to the cells to have more air admitted to it. Tap-room and non-commissioned officers' room in the canteen to have Arnott's valves in the chimneys	600	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
ENNISKILLEN MAIN BARRACK—*continued.*	£	£	£
3. Ablution room to have ventilation through the roof and two baths -	23	—	—
4. Women's wash-houses to have fixed tubs, water, and means of drying and getting up linen - - - - - - -	173	—	—
5. One of the cook-houses to have roof ventilation - - -	3	—	—
6. Armourer's shop to have the windows enlarged - - -	5	—	—
7. Privies to be reconstructed as water latrines, on Macfarlane's principle ; to be supplied with water and drained into the lake ; also to have divisions, half doors, light, and ventilation. Ash-pit to be removed to another part of the enclosure - - -	215	—	—
ENNISKILLEN CASTLE BARRACK.			
Number of Rooms: 7 — Regulation Number of Men: 84 — Accommodation at 600 Cubic Feet per Man: 57 — Deficiency of Accommodation in Men: 27			
1. Reduction of the number of men in each room to the extent stated -	—	—	—
2. Ventilation of the rooms by shafts, inlets, and remodelled grates. Serjeants' rooms to be ventilated by Arnott's valves in the chimneys. Stair windows to have perforated panes - - -	64	—	—
3. Ablution room to be supplied with pegs; and one bath, with water laid on, to be provided - - - - - - -	11	—	—
4. Cook-house to have an oven, and to be ventilated by a shaft and perforated glass panes in the windows - - - -	4	—	—
5. Women's wash-house to be provided with fixed tubs, water laid on, and a drying stove ; also, to be ventilated by a shaft and perforated glass panes - - - - - - - -	72	—	—
6. Privies to be improved in the respect suggested, and to have divisions of seats, half doors, light, and roof ventilation - - -	45	—	—
7. Stables to have more light, and the manure heap to be contracted in size, filled up above the level of the ground, paved and drained -	29	—	—
8. Guard room to have an Arnott's valve in the chimney, an inlet close to the ceiling, and remodelled grate. Ventilation of cells to be improved - - - - - - - - -	20	—	—
ENNISKILLEN REDOUBT BARRACK.			
Number of Rooms: 6 — Regulation Number of Men: 63 — Accommodation at 600 Cubic Feet per Man: 53 — Deficiency of Accommodation in Men: 10			
1. Reducing the number of beds on the construction to the extent stated above - - - - - - - - -	—	—	—
2. Ventilating all the rooms by shafts, inlets, and remodelled grates -	62/10	—	—
3. Providing an oven or cooking range for the kitchen - -	12	—	—
4. Providing an ablution and bath room with one bath - -	31	—	—
5. Reconstructing the present privies as water latrines on Macfarlane's principle, and draining them to the lake - - - -	83	—	—
6. Providing a watercloset, if the building is used for a hospital -	40	—	—
Lastly. If it be considered unadvisable to use the redoubt for a hospital, a new hospital should be built, as the present one in the castle is quite unfit for its purpose - - - - -	—	—	—
NEWRY INFANTRY BARRACKS.			
Number of Rooms: 50 — Regulation Number of Men: 640 — Accommodation at 600 Cubic Feet per Man: 344 — Deficiency of Accommodation in Men: 296			
1. Reduction of the number of inmates in the barrack rooms to the extent shown in the table - - - - - - -	—	—	—
2. Ventilation of all the corridors by louvres through the roofs and perforated panes in the windows. Ventilation of the barrack rooms by shafts, inlets, and remodelled grates, and by openings into the corridors. Ventilation of the small two-men rooms by Arnott's valves. Library, school-room, and guard room to have shafts, inlets, and remodelled grates. Canteen tap-room to have an Arnott's ventilator - - - - - - - -	365/7/6	—	—
3. Gas to be laid on to the barrack rooms, &c. - - -	298	—	—
4. Baths in the proportion of one bath to 100 men to be provided -	132	—	—

Sanitary Defects, and Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
NEWRY INFANTRY BARRACKS—*continued.*	£	£	£
5. Women' wash-house to be provided with fixed tubs, water laid on, and a drying and laundry stove - - - - -	164	—	—
6. Cook-houses and guard house to have more light - - -	17	—	—
7. All cess-pits within the barrack boundary to be abolished. All privies to be reconstructed as water latrines on Macfarlane's principle, and the outlet to be arranged, so that the contents of the latrines can be discharged into a tight iron tank, from which the sewage matter can be removed daily in a water-tight cart -	583/10	—	—
DUNDALK CAVALRY BARRACK.			
Number of Rooms: 22 — Regulation Number of Men: 352 — Accommodation at 600 Cubic Feet per Man: 227 — Deficiency in Accommodation in Men: 125			
1. That the number of men per room be reduced to the extent stated -	—	—	—
2. That each barrack room be ventilated by a shaft; two inlets, one on each side, and a remodelled grate. That each staircase be ventilated by a louvre through the roof. That each non-commissioned officers' room be ventilated by an Arnott's ventilator. That the school-room, saddlers' quarter, and shoemakers' shop be ventilated by a shaft and inlet. That the canteen tap and non-commissioned officers' room be ventilated by Arnott's ventilators and perforated glass panes. The guard room to have a shaft and remodelled grate, and more air to be admitted to the cells -	442	—	—
3. That the present cook-houses and wash-houses be provided with shafts and perforated panes, but that they be removed to detached buildings as soon as possible, and a proper laundry constructed -	940/10	—	—
4. Stables to have more light, in the manner recommended - -	62	—	—
5. Ablution and bath rooms to be provided with pegs and forms. One additional bath to be fitted up - - - - -	15	—	—
6. Privies to be reconstructed as water latrines on Macfarlane's principle, with divisions of seats, half doors, light, and ventilation; drained to an outlet, or their contents removed daily, as suggested. Surface drainage to be improved by square setts opposite the men's quarters. Forge to be better paved. Ash-pit to be raised above the level, paved, drained, and covered, as suggested. Urinals	491	—	—
NAAS INFANTRY BARRACK.			
Number of Rooms: 21 — Regulation Number of Men: 336 — Accommodation at 600 Cubic Feet per Man: 210 — Deficiency of Accommodation in Men: 126			
1. To remove 126 men out of the barrack room - - -	—	—	—
2. Barrack room and school-room to be ventilated by closing up one of the fire flues, and converting the chimney flue into a ventilating shaft, and by two inlets for air. Library to have a shaft and inlet. Guard room to have a shaft. All of these rooms to have remodelled grates. Staircases to be ventilated by shafts through the roof and perforated glass panes. Non-commissioned officers' room and canteen rooms to have Arnott's valves - - -	—	—	—
3. Ablution room to have a bead to the table, pegs, and forms, and two baths with water laid on - - - - - -	—	—	—
4. Women's washhouse to have fixed tubs, water laid on, gratings, ventilation, and a drying stove - - - - -	—	—	—
5. Cook-houses to have additional light and ventilation through the roof, and the ovens to be ventilated - - - -	—	—	—
6. Privies to be reconstructed as water latrines on Macfarlane's principle, and their contents flushed out and removed. The buildings to be lighted and ventilated. Provost privy to be converted into a water latrine. All cess-pits to be filled up - - -	—	—	—
7. Ash-pits to be raised above the level, paved, drained, and covered -	—	—	—

TABLE F.

NUMBER of BEDS in each HOSPITAL inspected, for every 100 Cubic Feet of Space, from under 400 to 1,200 Cubic Feet and upwards.

NAME OF HOSPITAL.	Under 400 Feet.	400 and under 500.	500 and under 600.	600 and under 700.	700 and under 800.	800 and under 900.	900 and under 1,000.	1,000 and under 1,100.	1,100 and under 1,200.	Over 1,200.
	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.
Regent's Park	—	—	—	18	12	—	—	—	—	—
Hyde Park	—	—	—	—	—	—	—	6	18	—
Croydon	24	—	8	—	—	—	—	—	—	—
Hounslow	—	—	20	14	3	—	—	—	—	1
Windsor — Cavalry	—	—	—	—	36	—	—	—	—	—
Windsor — Infantry	—	—	—	—	27	29	—	—	—	—
Portsmouth, Garrison Hospital.	—	—	6	254	49	7	—	—	—	—
Haslar	—	—	—	20	20	—	—	—	—	—
Woolwich	—	—	—	27	66	299	—	78	—	—
Chatham, Garrison Hospital.	—	—	72	260	—	—	—	—	—	—
Chatham, Fort Pitt	—	—	—	241	—	—	—	—	—	—
Maidstone	—	—	—	—	—	32	—	20	—	—
Dover Castle	—	72	—	—	—	—	5	—	—	1
„ Western Heights, West Wing.	—	6	6	40	—	—	—	2	—	—
„ Western Heights, East Wing.	—	6	6	40	—	—	—	—	—	—
Shorncliffe	—	—	—	—	300	—	—	—	—	—
Hythe	—	—	12	24	—	—	—	—	—	—
Canterbury, A. Div.	—	—	—	16	60	—	—	—	—	—
„ B. „	—	—	—	16	60	—	—	—	—	—
Walmer	—	—	4	12	43	40	—	—	—	—
Maker, Plymouth	—	—	24	—	—	—	—	—	—	—
Stoke, General Hosp'l.	—	—	—	—	154	—	264	6	—	—
Tilbury Fort	—	15	15	—	—	—	—	—	—	—
Gravesend	—	9	12	6	—	—	—	—	—	—
Exeter — Cavalry	—	—	—	17	16	—	—	—	—	—
Exeter — Artillery	—	—	—	4	—	6	20	—	—	—
Bristol (Horfield)	—	—	—	24	16	—	—	1	—	—
Hulme Cavalry	—	—	—	—	—	—	—	40	—	—
Ashton	—	—	—	12	18	—	—	—	—	—
Bury	—	—	12	—	18	—	—	—	—	—
Salford	—	—	—	40	48	—	—	2	—	3
Burnley	8	8	—	—	—	—	—	—	—	—
Stockport	—	11	14	3	—	—	—	—	—	—
Preston — Cavalry	—	—	—	—	16	—	—	—	—	—
Preston — Infantry	—	—	—	—	32	36	12	—	—	—
Brighton	—	—	5	24	24	—	—	—	—	—
Chichester	—	—	—	—	64	—	—	—	—	—
Birmingham	—	—	15	5	—	—	—	—	—	—
Coventry	—	—	—	—	—	—	—	22	—	1
Northampton	—	7	—	6	—	—	—	—	—	—
Weedon	—	—	5	35	—	—	—	—	—	—
Winchester	—	—	—	7	92	40	—	—	—	—
York	—	—	—	22	—	—	—	—	—	—
Leeds	—	—	—	25	—	—	—	—	—	—
Bradford	—	8	4	4	—	—	—	—	—	—
Newcastle — Cavalry	—	—	—	16	10	—	—	—	—	—
Newcastle — Infantry	—	—	—	20	5	3	—	—	—	—
Tynemouth	—	—	4	23	—	—	—	—	—	—
Sunderland	—	23	—	5	—	—	—	—	—	—
Carlisle Castle	2	18	—	—	—	—	—	—	—	—
Liverpool, North Fort	—	—	25	—	—	—	—	—	—	—
Chester Castle	—	—	23	—	—	—	—	—	—	—
Sheffield — Infantry	—	—	—	—	—	58	—	—	—	—
Sheffield — Cavalry	—	—	—	—	—	32	—	—	—	—
Edinburgh Castle	—	—	—	30	32	—	—	—	—	—
Piershill	—	—	—	—	28	2	2	—	—	—
Leith Fort	—	—	3	28	—	1	—	—	—	—
Berwick-on-Tweed	—	32	8	—	—	—	—	—	—	—
Stirling	—	—	14	19	—	6	—	—	—	—
Ayr	—	—	—	36	—	—	4	—	—	—

TABLE F.—Showing the NUMBER of BEDS in each HOSPITAL inspected, &c.—*continued.*

NAME OF HOSPITAL.	Under 400 Feet.	400 and under 500.	500 and under 600.	600 and under 700.	700 and under 800.	800 and under 900.	900 and under 1,000.	1,000 and under 1,100.	1,100 and under 1,200.	Over 1,200.
	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.	No. of Beds.
Aberdeen	—	—	—	20	20	—	—	—	—	—
Fort George	—	—	—	—	56	16	—	—	—	—
Glasgow	—	—	80	—	—	—	—	—	—	—
Hamilton	—	—	3	—	18	—	—	—	—	—
Paisley	—	—	—	—	32	—	—	—	—	—
Perth	—	4	—	20	—	—	—	—	—	—
Dumbarton	12	—	—	—	—	—	—	—	—	—
Dundee	—	—	—	—	—	—	30	2	—	—
Dublin, General Military Hospital.	—	—	—	54	114	16	—	15	—	—
Arbour Hill Regimental	—	—	208	—	—	—	—	—	—	—
Ship Street, Dublin	—	—	4	—	40	4	—	—	—	—
Portobello, „	—	—	—	72	—	—	—	—	—	—
Richmond, „	—	—	16	52	—	—	—	—	—	—
Beggar's Bush, „	—	—	—	30	—	—	—	—	—	—
Pigeon House Fort, Dublin.	—	—	8	9	—	—	—	—	—	—
Carlow	—	—	12	—	—	—	—	—	—	—
Naas	—	—	30	—	—	—	—	—	1	—
Mullingar	—	—	32	32	—	—	—	—	—	—
Cork	—	—	40	88	36	—	—	—	—	—
Queenstown Gen. Hos.	—	88	—	—	—	—	—	—	—	—
Carlisle Fort	—	—	6	—	—	—	—	—	—	—
Ballincollig	—	—	50	—	—	—	—	—	—	—
Waterford	—	24	—	—	—	—	—	—	—	—
„ Artillery	—	—	6	—	—	—	—	—	—	—
Duncannon Fort	4	4	—	—	—	—	—	—	—	—
Birr	12	40	60	—	—	—	—	—	—	—
Buttevant	—	81	—	—	—	—	—	—	—	—
Mallow	—	—	4	4	—	—	—	—	—	—
Athlone	—	80	6	—	—	—	—	—	—	—
Longford, Cavalry	—	—	—	10	5	5	—	4	—	—
Galway	4	22	9	5	—	—	—	—	—	—
Clonmel	—	54	—	—	—	—	—	—	—	—
Newbridge	20	40	40	—	—	30	—	—	—	—
Kinsale	—	40	—	—	—	—	—	—	—	—
„ Charles Fort	—	—	24	—	—	—	—	—	—	—
Bandon	—	—	—	4	—	4	—	—	—	—
Limerick, Ord.	10	—	10	—	—	—	—	—	—	—
„ Castle Hosp'l.	—	—	20	—	—	—	—	—	—	—
„ New „	—	—	—	—	98	—	—	—	—	—
Cahir	—	4	16	8	5	—	—	—	—	—
Kilkenny	—	22	22	23	14	—	—	—	—	—
Fermoy, New	—	4	48	14	—	—	—	—	—	—
„ Old	—	—	15	140	—	—	—	—	—	—
Templemore	—	—	32	48	—	—	—	—	—	—
Tralee	—	—	18	—	—	—	—	—	—	—
Belfast	—	—	—	—	80	—	—	—	—	—
Enniskillen	—	18	19	—	—	—	—	—	—	—
Derry	—	—	—	14	—	16	—	—	—	—
Dundalk	—	—	20	8	—	—	—	—	—	—
Newry	—	60	2	—	—	—	—	—	—	—

TABLE G.

Present WARD ACCOMMODATION and its DEFICIENCY in each HOSPITAL inspected.

Name of Hospital.	Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Space.
Knightsbridge Cavalry	3	24	24	—
Regent's Park Cavalry	—	30	18	12
Windsor Cavalry	4	36	24	12
Windsor Infantry	10	56	36	20
Croydon	4	32	12	20
Hounslow Cavalry	6	38	20	18
Hythe	4	36	18	18
Western Heights, Dover	12	104	50	54
Dover Castle	7	78	33	45
Walmer	8	99	64	35
Canterbury	20	152	94	58
Maidstone Cavalry	5	52	37	15
Chatham Garrison	38	332	172	160
Fort Pitt, Chatham	10	241	128	113
Tilbury Fort	4	30	13	17
New Tavern Fort, Gravesend	3	27	11	16
Woolwich Garrison	72	470	304	166
Chichester	4	64	40	24
Portsmouth Garrison	25	316	185	131
Haslar	4	40	22	18
Maker Barrack, Plymouth	2	24	14	10
General Hospital, Stoke, Devon	20	424	327	97
Winchester	13	139	94	45
Brighton Cavalry	5	53	32	21
Exeter Cavalry	6	33	18	15
Exeter Artillery	6	30	22	8
Horfield, Bristol	7	41	27	14
Hulme Cavalry	7	40	40	—
Salford Infantry	12	93	59	34
Bury	4	30	20	10
Stockport	4	28	12	16
Burnley	3	16	6	10
Ashton	4	30	18	12
Fulwood, Preston	12	96	66	30
York Cavalry	4	22	12	10
Leeds Cavalry	4	25	14	11
Bradford Moor	4	16	6	10
North Fort, Liverpool	3	25	11	14
Chester Castle	4	23	12	11
Sheffield	9	90	64	26
Birmingham Cavalry	3	20	10	10
Coventry Cavalry	3	23	19	4
Northampton Artillery	2	13	6	7
Weedon	6	40	22	18
Newcastle Cavalry	6	26	14	12
Sunderland	4	28	13	15
Tynemouth Castle	5	27	14	13
Carlisle Castle	4	20	5	15
Edinburgh Castle	4	62	40	22
Piershill	4	32	18	14
Leith Fort	6	32	17	15
Berwick-on-Tweed	7	40	18	22
Stirling Castle	4	39	21	18

TABLE G.—Showing the Ward Accommodation, and its Deficiency in each Hospital—*continued.*

Name of Hospital.	Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Space.
Glasgow	5	80	40	40
Ayr	4	40	22	18
Paisley	4	32	21	11
Hamilton	3	21	13	8
Dumbarton Castle	3	12	3	9
Aberdeen	4	40	24	16
Dundee	4	32	26	6
Perth	3	24	14	10
Fort George	6	72	48	24
Military General Hospital, Dublin	15	199	129	70
Arbour Hill, Dublin	40	208	104	104
Ship Street, Dublin	8	48	30	18
Portobello, Dublin	8	72	40	32
Richmond, Dublin	8	68	36	32
Beggar's Bush, Dublin	3	20	12	8
Pigeon House Fort, Dublin	4	17	10	7
Kilkenny	9	81	38	43
Newbridge	10	100	40	60
Birr	12	112	49	63
Carlow	2	12	6	6
Duncannon Fort	2	8	3	5
Naas	4	31	15	16
Cork	20	164	90	74
Ballincollig	7	50	30	20
General Hospital, Queenstown	16	88	47	41
Kinsale	6	40	16	24
Charles Fort, Kinsale	4	24	8	16
Tralee	2	18	8	10
Buttevant	9	81	38	43
Mallow	2	8	4	4
Fermoy (New)	7	66	32	34
Fermoy (Old)	16	155	82	73
Limerick (New)	10	98	62	36
Limerick Ordnance	4	20	6	14
Templemore	10	80	40	40
Cahir	5	33	17	16
Clonmel	6	54	21	33
Waterford	4	24	8	16
Waterford Artillery	2	12	6	6
Longford	6	24	16	8
Mullingar	8	64	32	32
Galway Castle	7	40	15	25
Athlone	13	86	33	53
Belfast	9	80	55	25
Londonderry	4	30	20	10
Enniskillen	3	37	14	23
Newry	7	62	25	37
Dundalk	6	28	12	16

TABLE H.

DIGEST of the SANITARY DEFECTS in HOSPITALS, described in our Interim Reports, together with the Improvements required, the Estimates for Sanitary Works, Items and Amounts sanctioned by the Secretary of State, and Items and Amounts postponed, to 30th June 1860.

[NOTE.—Whenever the Amounts are not entered, the Estimates have not yet been received from the Commanding Royal Engineer.]

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
GUARDS HOSPITALS.	£	£	£
The hospitals of the Brigade of Guards are provided for out of the stock purse of the Guards and are regimental property. Those of the Grenadiers and Coldstreams were badly constructed hospitals, hardly fit for sick, but they have been rebuilt since the time of our inspection. The hospital of the Scots Fusilier Guards is a good hospital, comparatively, except in its local position which is not good.			
TOWER HOSPITAL.			
1. 1,200 cubic feet per bed to be given	—	—	—
2. Ventilation of wards by shafts and inlets	—	—	—
3. Urinals behind the hospital to be supplied with water	—	—	—
4. Kitchen to be ventilated	—	—	—
5. Thames water to be cut off from the kitchen	—	—	—
This hospital has been made by throwing a number of low-ceiled confined rooms of dwelling houses together. It is very unfit for sick and better accommodation should be provided. Estimate rendered for new hospital	6,960	—	—
KNIGHTSBRIDGE CAVALRY BARRACK HOSPITAL.			
This hospital is very badly placed, with high walls close to it. Wards have no thorough ventilation. Store rooms dark and damp. Ash-pit under the windows	—	—	—
These defects to be remedied as far as practicable, but a new hospital in a better position is urgently required. Estimate for removal	3,360	—	—
WINDSOR CAVALRY HOSPITAL.			
1. A bath room and lavatory to be provided	40	40	—
2. An exercising ground for convalescents	—	—	—
3. New privy to be removed to a better site	—	—	—
4. 1,200 cubic feet per bed to be given	—	—	—
5. Ventilation of wards to be improved by shafts and inlets	23	23	—
6. Remodelled grates	—	—	—
WINDSOR INFANTRY HOSPITAL.			
1. 1,200 cubic feet per bed to be given	—	—	—
2. Ditch outside the boundary wall to be drained and covered	—	—	—
3. Lavatory and bath room to be provided	38	—	—
4. Ventilating shafts for some of the wards	36	36	—
5. A roasting oven for the kitchen	—	—	—
6. Stores and a hospital serjeants' quarter	—	—	—
CROYDON BARRACKS HOSPITAL.			
1. 1,200 cubic feet per bed to be given	—	—	—
2. Bath to be provided	50	50	—
3. A roasting oven for the kitchen	—	—	—
Hospital bad. Ought to be evacuated and the barrack removed	—	—	—
HOUNSLOW CAVALRY HOSPITAL.			

Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet.	Deficiency in Bed Spaces.
6	38	20	18

1. 18 beds to be removed out of the wards	—	—	—
2. Wards to be ventilated by shafts and inlets	26	26	—
3. Waterclosets to be reconstructed and drained and ventilated, and the cess-pit abolished	28	28	—
4. Additional bath and lavatory accommodation to be provided	30	30	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
SHORNCLIFFE CAMP HOSPITAL.	£	£	£
A wooden hospital for 300 sick in five buildings, each containing 6 wards with 10 beds per ward.			
1. An exercising ground for convalescents	100	100	—
2. Accommodation for sick wives and children of soldiers	Since provided.	—	—
HYTHE HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 36 — Number of Beds at 1,200 Cubic Feet: 18 — Deficiency in Bed Spaces: 18			
1. Additional ventilation of wards by shafts from the ceilings through the roof, and inlets for air. Front door to be re-opened	36	36	—
2. Reduction of beds to half their present number. This could easily be done. The average force at the barracks is 233, which ought never to yield sick enough to occupy thirty-six beds at one time. A safe rule would be to distribute the current sick as equally over the space as possible, and if this were done, and the extra beds removed, it is very probable that each patient would have about 1,200 cubic feet of space	—	—	—
3. Kitchen range to be replaced by a better one	50	50	—
4. Waterclosets to be improved. Urinal and privy in the yard to have a better water supply and more frequent flushing	30	30	—
5. Lavatory and bath room with fixed bath, and hot and cold water, to be provided	150	150	—
6. Additional water supply	Included in estimate for Barrack water supply.		
WESTERN HEIGHTS HOSPITAL, DOVER.			
Number of Wards: 12 — Present Regulation Number of Beds: 104 — Number of Beds at 1,200 Cubic Feet: 50 — Deficiency in Bed Spaces: 54			
1. Reduction of numbers of beds, as shown in the table	—	—	—
2. Ventilation of each ward by a shaft carried up from the ceiling to the roof, with inlets for air near the ceiling properly protected by wire gauze or perforated zinc. Upper window sashes to be made to open	110	110	—
3. Also ventilation of the passages and staircase by a shaft and perforated glass panes	—	—	—
4. Grates to be remodelled to heat the air	70	—	70
5. Cess-pits to be filled up; privies to be converted into water latrines, and to be drained into the proposed sewers	60	60	—
6. An iron cart to be substituted for the ash-pits	105	—	105
7. Bath rooms, with baths and hot and cold water, and lavatories adjoining them, to be provided	300	300	—
8. An enclosed exercising ground for convalescents to be provided	Included in annual estimate.		
9. Racks for pack store to be provided	12	12	—
10. Hospital to be extended and accommodation for the sick of married soldiers' families to be provided	—	—	—
DOVER CASTLE HOSPITAL.			
Number of Wards: 7 — Present Regulation Number of Beds: 78 — Number of Beds at 1,200 Cubic Feet: 33 — Deficiency in Bed Spaces: 45			
We recommend that this hospital be extended on a plan to include every improvement. But the following requirements are necessary for the present building:—			
1. Reduction of number of beds, as pointed out	—	—	—
2. Ventilation of wards by shafts and inlets for air	20	20	—
3. Remodelled grates	24	—	24
4. Abolishing the cess-pool, and draining the hospital buildings to the sea. Additional waterclosets. Ablution and bath room to be provided	225	225	—
5. Ventilating the present waterclosets by shafts and inlets for air, and by a window, until better closets are constructed outside the building	11	11	—
6. Abolition of ash-pit, and daily removal of refuse	39	—	39
7. Proper pack, provision, and other stores, also a room for orderlies, are very much required	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
WALMER HOSPITAL.	£	£	£
Number of Wards. / Present Regulation Number of Beds. / Number of Beds at 1,200 Cubic Feet each. / Deficiency in Bed Spaces.			
8 / 99 / 64 / 35			
1. Sewerage along with the other buildings. Abolition of cess-pits, and converting privies into water latrines	Included in barrack estimate.		
2. Reduction of number of beds, as recommended	—	—	—
3. Ventilation of wards by shafts and inlets for air, and improvement in fireplaces, as suggested	130	130	—
4. Also ventilation of watercloseets	20	20	—
5. Removal of small wards from staircases, and ventilation of staircases as suggested	11	11	—
6. Stoves to warm stairs	36	36	—
7. Abolition of ash-pit, and daily removal of refuse	152	—	152
8. Hospital to be separated from barrack by a suitable enclosure	70	—	70
CANTERBURY HOSPITAL.			
Number of Wards. / Present Regulation Number of Beds. / Number of Beds at 1,200 Cubic Feet each. / Deficiency in Bed Spaces.			
20 / 152 / 94 / 58			
1. Watercloseets, lavatories, and bath rooms to be provided for each flat	500	500	—
2. Existing privies to be converted into water latrines and drained	Included in barrack estimate.		
3. Each ward to be ventilated by a shaft and inlet at the ceiling, and the air to be warmed by remodelling the grates	300	300	—
4. A cubic space of 1,200 cubic feet, as near as may be, to be set apart for each patient, and fifty-eight beds to be removed from the wards	—	—	—
5. A suitable laundry to be provided instead of the present wash-houses	200	200	—
5. Proper kitchen ranges and boilers for cooking diets to be provided	20	20	—
7. Pack store, bedding store, and provision store to be provided	400	—	400
8. An itch ward to be provided	120	120	Since included in plan for extending the hospital.
MAIDSTONE CAVALRY HOSPITAL.			
Number of Wards. / Present Regulation Number of Beds. / Number of Beds at 1,200 Cubic Feet each. / Deficiency in Bed Spaces.			
5 / 52 / 37 / 15			
1. Ventilation of wards by shafts and inlets for air. Ventilation of the central staircase by a louvre in the roof	31/10	31/10	—
2. Reduction of numbers of beds from fifty-two to thirty-seven, so as to give 1,200 cubic feet for each	—	—	—
3. Present watercloseets to be replaced by others of better construction	20	20	—
4. Baths, with a covered communication with the hospital, to be supplied	48	—	—
5. Privy in back yard to be converted into a water latrine, and a small iron cart to be provided in lieu of the ash-pit	210	—	—
6. Foul linen closet to be provided	21	—	—
7. Accommodation to be provided to enable the orderlies to sleep out of the wards	85	—	—
CHATHAM GARRISON HOSPITAL.			
Number of Wards. / Present Regulation Number of Beds. / Number of Beds at 1,200 Cubic Feet each. / Deficiency in Bed Spaces.			
38 / 332 / 172 / 160			
1. 160 beds to be removed out of the wards	—	—	—
2. Ventilation of the wards and corridors by shafts and inlets	280	280	—
Remodelled grates for wards	245	—	—
3. Watercloseets to be improved and more provided	Since performed.		
4. All privies to be abolished and water latrines substituted ash-pits, to be abolished and iron carts substituted	219	—	—
5. Urinals to be provided	7	7	—
6. Increased water supply	To be carried out along with barrack supply.		

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
	£	£	£
CHATHAM GARRISON HOSPITAL—*continued.*			
7. Kitchens to be remodelled	Since carried out.		
8. Ablution and bath rooms to be provided	—	—	—
9. Convalescents' day and dining room to be provided	1,250	1,250	Not executed.
10. A covered walk for convalescents	390	390	—
This will never be a good hospital, even when improved	—	—	—
FORT PITT HOSPITAL, CHATHAM.			
Number of Wards: 10 — Present Regulation Number of Beds: 241 — Number of Beds at 1,200 Cubic Feet each: 128 — Deficiency in Bed Spaces: 113			
1. Removal of 113 beds from the wards	—	—	—
2. Removing the orderlies' beds from the sick wards to another building, their presence there and in all hospitals being contrary to sound principles of administration, discipline, and humanity	225	226	—
3. Ventilating the wards by the windows if the number of beds be reduced as stated above	—	—	—
4. The whole hospital to be sewered. Cess-pits and privies abolished, and waterclosets and water latrines substituted. Waterclosets to be removed from their present position, and to be reconstructed, together with lavatory and bath accommodation at the end of the wards	2,453	2,453	—
5. All superfluous buildings to be removed to admit air to the spaces between the wards	150	—	—
6. A proper cooking range to be put up in the kitchen	Since provided.		
7. Improved water supply	—	—	—
8. Day room to be provided	90	90	—
9. Improving stores	—	—	—
CASEMATE HOSPITAL, FORT PITT.			
We found six miserable casemates in a deep sunk area behind the curtain of the fort, used for sick, and affording only 354 cubic feet per bed. They are not fit for human habitation at all. The privies are in a pestilential state, and there is no drainage. It is astonishing this place should ever have been sanctioned for sick. We recommend it to be immediately evacuated	—	—	—
BROMPTON BARRACK HOSPITAL.			
This barrack has regulation accommodation for 1,725 men, and it has no hospital, except temporary wards obtained by the mis-appropriation of barrack rooms from which 384 men have been displaced, to be crowded into the other rooms of the barrack	—	—	—
The only remedy for this evil is to provide a proper hospital. Both healthy men and sick men are injured by the present arrangement	—	—	—
TILBURY FORT HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 30 — Number of Beds at 1,200 Cubic Feet each: 13 — Deficiency in Bed Spaces: 17			
1. Ventilation of wards and staircase by shafts and inlets	11	—	—
2. Remodelling the ward grates	22	—	—
3. Removing 17 beds from the wards	—	—	—
4. Ventilation of staircase	5	—	—
This hospital is not well adapted for sick on account of its malarial position	—	—	—
NEW TAVERN FORT HOSPITAL, GRAVESEND.			
Number of Wards: 3 — Present Regulation Number of Beds: 27 — Number of Beds at 1,200 Cubic Feet each: 11 — Deficiency in Bed Spaces: 16			
This hospital hardly admits of being improved. Another hospital is urgently required. The present wards should be ventilated by shafts and inlets	18	—	—
But above all they should be evacuated as soon as possible	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
WOOLWICH GARRISON HOSPITAL.	£	£	£
Number of Wards: 72 — Present Regulation Number of Beds: 470 — Number of Beds at 1,200 Cubic Feet each: 304 — Deficiency in Bed Spaces: 166			
1. Ventilation of all the corridors, passages, staircases, and wards by shafts and inlets. These improvements would be equally available if the building should be eventually turned into a barrack. Additional windows to be made for the wards, making the windows in the convalescent wards to open at top. Remodelled grates -	658	586	—
2. Gas and a ventilated gas-burner to be introduced into each ward -	765	765	—
3. Reduction of numbers of sick to the extent pointed out in the preceding table, and the provision of temporary hospital accommodation to supply the deficiency - - - - -	—	—	—
4. Accommodation for sick prisoners to be restricted to wards facing the south - - - - - - - -	—	—	—
5. Better lavatory and bath accommodation near the wards, by appropriating a small ward on each flat for the purpose - -	670	670	—
6. Privies in the court behind the hospital to be converted into water latrines, with suitable means of flushing - - - - -	310	310	—
7. Providing ward for sick prisoners - - - - -	30	—	—
8. Fitting up No. 6 prisoners ward - - - - -	5	5	—
9. Additional windows in three wards - - - -	51	51	—
10. Erecting a new guard room and removing guard room out of the hospital - - - - - - - - -	500	500	—
In this hospital the very objectionable custom prevails of the orderlies sleeping in the wards with the sick. It would be very advisable to make some arrangements by which this could be avoided -	—	—	—
CHICHESTER BARRACK HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 64 — Number of Beds at 1,200 Cubic Feet per Bed: 40 — Deficiency in Bed Spaces: 24			
1. The sick in the four wards to have as near as may be 1,200 cubic feet per bed - - - - - - -	—	—	—
2. Each ward to be ventilated by a louvred shaft carried up from the ceiling, as described, and by two inlets for air. Passage to be ventilated by two shafts from the ceiling. Ventilation to be introduced beneath the floors. All windows to be made to open at top. Grates to be remodelled to warm part of the admitted air	87	87	—
3. A fixed bath with hot and cold water laid on, to be provided in the ablution room. Gratings for the feet to be provided. Ablution room to be connected, if possible, by a covered communication with the hospital - - - - - - - -	222	222	—
4. The whole hospital drainage to be improved, along with the barrack drainage, and carried to the same outlet. Cess-pits to be abolished, and the privies to be reconstructed as water latrines, and connected with the hospital by a covered passage - - - -	135	—	135
5. Roof guttering to be put round the whole hospital - - -	37	37	—
PORTSMOUTH GARRISON HOSPITAL.			
Number of Wards: 25 — Present Regulation Number of Beds: 316 — Number of Beds at 1,200 Cubic Feet each: 185 — Deficiency in Bed Spaces: 131			
1. To remove 131 beds from the wards - - - -	—	—	—
2. Staircases to be lighted and ventilated through the roof. Wards to be ventilated by shafts and additional inlets from the staircases, to supply air to the middle of the wards - - - -	160	160	—
3. Warming by remodelled grates and stoves - - - -	—	—	—
4. Ablution and bath accommodation to be provided - - -	50	50	—
5. Abolition of cess-pit and reconstruction of the privy as a water latrine with drainage - - - - - -	—	—	—
FORT CUMBERLAND HOSPITAL.			
Wards to be ventilated by shafts and inlets - - - -	5	5	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
HASLAR BARRACK HOSPITAL.	£	£	£
Number of Wards: 4 — Present Regulation Number of Beds: 40 — Number of Beds at 1,200 Cubic Feet each: 22 — Deficiency in Bed Spaces: 18			
1. To remove 18 beds from the wards	—	—	—
2. Ventilation of each ward by shafts and inlets	17	17	—
3. Ablution and bath accommodation to be provided	270	270	—
4. Watercloscts with drainage to be provided			
Orderlies to sleep out of the wards	—	—	—
PLYMOUTH CITADEL TEMPORARY HOSPITAL.			
1. The hospital accommodation in the citadel consists of two small rooms, in one of which two sick are accommodated, and in the other three sick. They are intended merely as places to which a slight case or two of disease may be sent before being transferred to the general hospital at Devonport. The accommodation is otherwise quite unsuited for a hospital	—	—	—
We recommend :—			
That the rooms be provided with a shaft and inlet each for ventilation	3/15/7	—	—
MAKER BARRACK HOSPITAL, PLYMOUTH.			
Number of Wards: 2 — Present Regulation Number of Beds: 24 — Number of Beds at 1,200 Cubic Feet each: 14 — Deficiency in Bed Spaces: 10			
1 Reduction of the number of beds from 12 to 7 in each ward	—	—	—
2. Ventilation of the wards by a silk-flap ventilator into the chimney. Ventilation of the kitchen by perforated panes, and ventilation of the passage by a shaft and perforated panes	6/5/11	—	—
3. Providing a watercloset and abolishing the cess-pit	26/3/9½	—	—
ST. NICHOLAS ISLAND HOSPITAL, PLYMOUTH.			
A single room used as a temporary ward; but otherwise quite unfit for sick. It can be improved as follows :—			
1. A shaft and inlet for ventilating the sick ward	3/18/6	—	—
2. A shaft and perforating panes for ventilating the kitchen, and a new cooking range	9/17/7½	—	—
BULL POINT BARRACK HOSPITAL, DEVONPORT.			
A single room for the temporary reception of sick men	—	—	—
It requires ventilation by an Arnott's valve and glass louvres in the windows	—	—	—
GENERAL HOSPITAL, STOKE, DEVON.			
Number of Wards: 20 — Present Regulation Number of Beds: 424 — Number of Beds at 1,200 Cubic Feet each: 327 — Deficiency in Bed Spaces: 97			
1. Reduction of the number of beds to the extent stated above	—	—	—
2. Ventilation of each ward to be improved by a silk-flap ventilator into each chimney, and by two inlets for air, as described; remodelling the ward grates to save heat; inserting panes of perforated glass into the upper sash of each staircase window	281/8/3	—	—
3. Extending the projecting building behind each pavilion, providing in it a fixed bath, with hot and cold water, for each flat of the pavilions; providing a lavatory with fixed basins, and hot and cold water, with separate hot and cold water taps, for drawing water for use in the wards; improving the watercloscts, by interposing a lighted and ventilated lobby between them and the wards, and providing a urinal in connexion with the watercloset; ventilating the soil pipes of the closets, by carrying a small pipe from them above the roof of the building. Better accommodation to be provided for the orderlies	8,739/18/10½	—	—
4. Gas to be introduced	289/17/6½	337	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
GENERAL HOSPITAL, STOKE, DEVON—*continued.*	£	£	£
5. Improving the hospital drainage by abolishing the cess-pit, and ventilating the outlets immediately above high-water mark - -	35/14/1	—	—
6. Reconstructing the urinals outside the hospital, removing the ash-pits, and arranging for the daily removal of the hospital refuse -	100/3/2¾	—	—
Lastly. Proper stores should be erected, and the whole space within the pavilions used for sick - - - - - -	1685/19/6¼	—	—
WINCHESTER BARRACK HOSPITAL.			
Number of Wards: 13 — Present Regulation Number of Beds: 139 — Number of Beds at 1,200 Cubic Feet each: 94 — Deficiency in Bed Spaces: 45			
1. Removing 45 beds from the wards - - - - - -	—	—	—
2. Ventilating the wards and corridors by shafts and inlets - -	14	14	—
3. Providing water-closet, baths, &c. - - - - - -	29	29	—
4. Improving the hospital drainage, and abolishing the cess-pit -	—	—	—
5. Removing the orderlies' beds from the wards and providing sleeping space elsewhere - - - - - - - -	—	—	—
6. Providing Flavell's kitchener - - - - - -	22/11/0	22/11/0	—
BRIGHTON CAVALRY HOSPITAL.			
Number of Wards: 5 — Present Regulation Number of Beds: 53 — Number of Beds at 1,200 Cubic Feet each: 32 — Deficiency in Bed Spaces: 21			
1. Reduction of number of sick in each ward to the extent pointed out	—	—	—
2. Ventilation of all the wards by a shaft from the ceiling to above the roof, and by inlets as described. Remodelling the ward grate to save heat - - - - - - - - -	65	65	—
3. Introducing gas into the building, and supplying a ventilating gas-burner to each ward - - - - - - -	23	—	23
4. An ablution and bath room, with a proper hospital ablution table, having fixed basins, and a bath, with hot and cold water laid on, to be provided in the manner pointed out - - - -	64	64	—
5. Hospital to be drained, and the cess-pits abolished. Privies in the yard to be reconstructed as a water latrine, with drainage. Privy and cess-pit in front of the hospital to be removed - -	Part of the barrack drainage.		
6. Ash-pit to be filled up, and the refuse to be taken away daily -	3	3	—
7. Wash-house to be improved - - - - - -	69	—	69
Lastly. The hospital should be extended to afford the required accommodation for the strength, and a ward should be set apart for the sick of soldiers' families - - - - - - -	—	—	—
EXETER CAVALRY HOSPITAL.			
Number of Wards: 6 — Present Regulation Number of Beds: 33 — Number of Beds at 1,200 Cubic Feet each: 18 — Deficiency in Bed Spaces: 15			
1. Reduction of the number of beds to the extent stated, to give 1,200 cubic feet to each patient - - - - - - -	—	—	—
2. Ventilation of the staircase and corridor by perforated glass panes in all the windows, and by additional windows with perforated glass panes in the lobbies leading to the waterclosets - - -	6/7/10	6/7/10	—
3. Ventilation of each ward by a shaft and two inlets for air, with perforated zinc cornices. Fire-grates to be altered to warm part of the air admitted - - - - - - - -	90/13/4	90/13/4	—
4. Ventilation of the kitchen by a shaft and perforated glass panes -	4/12/1	4/12/1	—
5. Ventilation of the wash-house by a louvre. Means of drying and getting up hospital linen to be added to the wash-house. (Estimate for rebuilding.) Privy in the yard to be reconstructed as a water latrine, and the cess-pit abolished - - - -	237/17	—	237/17
6. A bath room and lavatory, with one bath and hot and cold water, to be provided - - - - - - - -	42/10	—	42/10

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
EXETER ARTILLERY HOSPITAL.	£	£	£
Number of Wards: 6 — Present Regulation Number of Beds: 30 — Number of Beds at 1,200 Cubic Feet each: 22 — Deficiency in Bed Spaces: 8			
1. Reduction of numbers of sick to the extent shown in the table -	—	—	—
2. Ward windows to be made to draw down at top - - -	Since executed.		
3. Ventilation of each ward by a shaft, and two inlets for air. Ventilation of the staircase by a shaft through the ceiling, and by perforated panes in the window. Ward grates to be remodelled -	94/16/7	94/16/7	—
4. The hospital to be drained along with the barrack, cess-pits to be abolished - - - - - - - -	Included in barrack drainage estimate.		
5. Privies converted into waterclosets, properly ventilated, and with water laid on - - - - - - - -	55	55	—
6. Bath room to be re-arranged, the present bath removed, and a proper bath, with hot and cold water laid on, provided instead. Lavatory accommodation to be likewise provided - - - - -	52	Since executed.	
7. Wash-house to be ventilated through the roof, and to have fixed tubs, with water laid on, and a drying and laundry stove provided -	20/12/7	20/12/7	—
8. Kitchen to be ventilated through the roof, and to have a proper cooking range - - - - - - - -	17/2/7	17/2/7	—
While recommending these improvements as essential for this hospital, we must at the same time express our decided opinion that the buildings would be best applied to the purposes of married quarters, in which case a new hospital would have to be built - -	—	—	—
GLOUCESTER HOTEL BARRACK HOSPITAL, BRISTOL.			
A small fourth or fifth rate dwelling-house, rented for a hospital. Small, crowded, inconvenient bed-rooms, instead of wards. Very unfit for treating sick. Little can be done to improve it - -	—	—	—
1. Each room used for sick to be ventilated by a silk-flap ventilator, and by a perforated glass pane, and means to be taken to ventilate the staircase - - - - - - - -	5/2/6	5/2/6	—
2. The drain from the privy to be trapped - - - - -	—	—	—
HORFIELD BARRACK HOSPITAL, BRISTOL.			
Number of Wards: 7 — Present Regulation Number of Beds: 41 — Number of Beds at 1,200 Cubic Feet each: 27 — Deficiency in Bed Spaces: 14			
1. Reducing the number of beds in each ward to the extent stated -	—	—	—
2. Ventilating each ward by a shaft from the ceiling to above the roof. Ventilating each passage by a shaft, and by perforated panes in the stair windows, and placing a swing window over the door of each end ward. Ventilating the kitchen by a shaft and perforated panes - - - - - - - -	19/18/6	19/18/6	—
3. Providing a proper fixed bath and ablution basins, with hot and cold water laid on - - - - - - -	40	—	40
4. To provide a watercloset entering from the staircase - -	—	—	—
To substitute a proper water latrine for the existing flushed privies in the yard. Ash-pit to be abolished, and the hospital refuse to be collected and removed daily in an iron barrow or otherwise -	20	—	20
5. Laying on water, and providing a drying and laundry stove for the wash-house - - - - - - - -	13/10	—	13/10
HULME CAVALRY BARRACK HOSPITAL.			
Number of Wards: 7 — Present Regulation Number of Beds: 40 — Number of Beds at 1,200 Cubic Feet each: 40 — Deficiency in Bed Spaces: None.			
1. Ventilating all the wards and corridors by shafts and inlets, as described - - - - - - - - -	33	33	—
2. Remodelling the fire-places in the wards, to warm a portion of the air admitted - - - - - - - -	—	—	—
3. Improved drainage of the back yard - - - - -	9	9	—
4. Removal of ash-pit, and conversion of the privy of the itch ward into a watercloset, with light and ventilation - - - -	89	—	89
5. Waterclosets, urinals, and lavatories, to be constructed for each flat of the hospital, and a fixed hot and cold bath to be supplied to the bath-room. Present urinals to be supplied with water - -	193	—	193

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
HULME CAVALRY BARRACK HOSPITAL—*continued.*	£	£	£
6. Kitchen to be lighted by additional window space, and ventilated by louvres in the roof	2	2	—
7. Stores to be improved or supplied where wanting	—	—	—
Lastly. It would be very advisable to provide a room in some convenient position, not in the hospital (where there is no accommodation), for receiving the sick of soldiers' families	—	—	—
SALFORD INFANTRY HOSPITAL.			
Number of Wards: 12 — Present Regulation Number of Beds: 93 — Number of Beds at 1,200 Cubic Feet each: 59 — Deficiency in Bed Spaces: 34			
1. Reduction of the number of beds to the extent shown in the table	—	—	—
2. Ventilation of every ward by a shaft from the ceiling carried up to the roof, and inlet. The ward grates to be remodelled, so as to admit warmed air into the wards in winter	150	—	150
3. Watercloset, lavatory, and bath room, with hot and cold water laid on, to be provided within the hospital. Water latrines to be constructed in lieu of the privy	458	Since executed under barrack annual estimate.	
4. A new kitchen cooking range (one of Howell's, or Burridge and Headle's) should be provided	29	Ditto.	—
5. Gas to be introduced into the wards	Service since carried out.		
Ventilation of burners	12	12	—
6. Ash-pit to be removed	110	—	110
Lastly. It would be very advisable to provide a room for sick women and children	—	—	—
BURNLEY BARRACK HOSPITAL.			
This is a small, badly constructed, defective building, hardly suitable for treating serious cases of disease, and quite inadequate for the barrack. It may be somewhat improved by the following measures :—			
1. Reduction of beds, so as to give, as nearly as may be, 1,200 cubic feet for each bed	—	—	—
2. Ventilation of wards	3	3	—
3. Construction of a suitable watercloset, improvement of existing privy, and abolition of the cess-pit	115	—	115
4. An oven for the kitchen	17	17	—
5. A fixed bath, with hot and cold water laid on	30	30	—
BURY BARRACKS HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 30 — Number of Beds at 1,200 Cubic Feet each: 20 — Deficiency in Bed Spaces: 10			
1. Reduction of number of beds, and allotting 1,200 cubic feet to each	—	—	—
2. Ventilation of the wards by shafts and inlets. Ventilating shaft for the kitchen	40	40	—
Reconstruction of grates	—	—	—
3. Watercloset to be built out, with access from the first floor of the hospital. Privy of the itch ward to be converted into a watercloset, and the privies in the yard to be converted into a water latrine	234	—	234
4. Bath room to be improved, a fixed bath and lavatory accommodation provided	66	66	—
5. Water supply to be provided	Provided for in barrack estimate.		
6. Roasting bracket to be put up in the kitchen, and the scullery boiler to be repaired	Service since performed.		
7. Wards to be lit with gas by ventilated burners	59	—	59
8. A room to be set apart for the sick of soldiers' families	—	—	—
STOCKPORT BARRACK HOSPITAL.			
Number of Wards: — — Present Regulation Number of Beds: 28 — Number of Beds at 1,200 Cubic Feet each: 12 — Deficiency in Bed Spaces: 16			
1. Reduction of numbers, and setting apart 1,200 cubic feet for each bed	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
STOCKPORT BARRACK HOSPITAL—*continued.*	£	£	£
2. Ventilating wards by shafts and inlets for air	35	35	—
3. Increasing the light and ventilation of the staircase, by opening an additional window at the end	5	5	—
4. Providing a watercloset and bath within the hospital. Converting the privies in the yard, under the hospital, into a water latrine	82	—	82
5. Removing ash-pits, and providing for daily collection and removal of refuse	43	—	43
6. Removing the kitchen from within the hospital, and providing another kitchen	113	113	—
7. A water tap and sink are required in the surgery	5	5	—

ASHTON BARRACKS.

Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Spaces.
4	30	18	12

1. Twelve beds to be removed from the wards	—	—	—
2. Wards to be ventilated and warmed by shafts, inlets, and remodelled grates. Kitchen to be ventilated by a shaft	40	40	—
3. Watercloseets to be provided. Privies to be converted into water latrines	234	—	234
4. Bath and ablution room with a bath and ablution table to be constructed	56	56	—
5. Gas and a ventilated gas-burner to be introduced into the wards	59	—	59
Provision to be made for receiving the sick of soldiers' families	—	—	—

FULWOOD BARRACK HOSPITAL, PRESTON.

Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Spaces.
12	96	66	30

1. Reduction of the numbers in each ward, so as to allow as near as may be 1,200 cubic feet per bed	—	—	—
2. Ventilation of all the wards by shafts and inlets	122	122	—
3. Remodelled grates. Improving the drainage and water supply of the hospital along with those of the barracks	Included in Estimate for Barrack.		
4. Gas-burners to be ventilated	23	23	—
5. Accommodation for the sick of soldiers' families should be provided	—	—	—
6. It would be advantageous to place a door in the passage leading to the watercloseets, to prevent any effluvia from them from entering the hospital	—	—	—

YORK CAVALRY HOSPITAL.

Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Spaces.
4	22	12	10

1. Reduction of regulation number of sick in each ward to the extent stated	—	—	—
2. Ventilation of the three small wards by silk-flap ventilators and inlets. Ventilation of the larger wards by converting one of the chimneys into a foul-air shaft, and by two inlets for fresh air as described. Kitchen to have a shaft and perforated glass panes for ventilation. Staircase to be ventilated by a louvre through the roof, and by perforated panes in the windows. Grates to be remodelled	35	35	—
3. Additional light to be given to the dark watercloset	2	2	—
4. A bath room with a fixed bath, and hot water and cold water laid on, and an ablution table to be provided	110	110	—
5. Hospital to be drained to a proper outlet along with the barracks. The hospital privies to be drained and converted into a water latrine, and the cess-pit to be abolished	Part of the Barrack drainage.		

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
LEEDS CAVALRY HOSPITAL.	£	£	£
Number of Wards: 4 — Present Regulation Number of Beds: 25 — Number of Beds at 1,200 Cubic Feet each: 14 — Deficiency in Bed Spaces: 11			
1. Reduction of the number of beds in the wards to the extent stated above	—	—	—
2. Ventilation of the wards by shafts and inlets; perforated glass panes to be inserted in the corridor windows. Remodelled grates to be put into the two larger wards	32	32	—
3. Lavatory and bath room to be re-arranged, and to have a covered communication with the hospital. A proper ablution table and a fixed bath, with hot and cold water laid on, to be provided	117	117	—
4. Gas-burners to be introduced into the wards. The offensive gutter and drain in front of the hospital to be done away with	15	15	—
5. Drainage of the exercising ground has been already recommended. Its proximity to the hospital affords an urgent reason for the improvement being carried out if the hospital is to be left where it is	Since authorized.		
BRADFORD MOOR BARRACK HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 16 — Number of Beds at 1,200 Cubic Feet each: 6 — Deficiency in Bed Spaces: 10			
This hospital is a row of miserable cottages. It is just such a place as sick people are sent out of to hospital. It ought to be abandoned as speedily as as possible. In the meantime:—			
1. Ten beds should be removed out of the wards	—	—	—
2. Each ward should have an Arnott's valve and an inlet for ventilation	5	5	—
NORTH FORT HOSPITAL, LIVERPOOL.			
Number of Wards: 3 — Present Regulation Number of Beds: 25 — Number of Beds at 1,200 Cubic Feet each: 11 — Deficiency in Bed Spaces: 13			
1. Reduction of the number of inmates in each ward to the extent shown in the table. Ventilating each ward for the reduced number of sick by a silk-flap ventilator in the chimney, by two of Sherringham's ventilators, and by remodelling the fire-grates to warm part of the admitted air in winter. Ventilating the gas-burners by funnels and tubes into the chimney. Ventilating the waterclosets to the external air, and if possible affording them some light. Ventilating the staircase and passages by perforated glass panes in the top range of the upper window sashes. Ventilating the kitchen by perforated glass panes	96	—	—
2. Abolishing the ash-pit, and providing for the daily removal of the hospital refuse	42	—	—
3. A bath room with one fixed bath, hot and cold water laid on, and an ablution table to be provided	50	—	—
CHESTER CASTLE HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 23 — Number of Beds at 1,200 Cubic Feet each: 12 — Deficiency in Bed Spaces: 11			
The improvements required for the present buildings are:—			
1. Reduction of the numbers of sick in each ward to the extent shown above	—	—	—
2. Ventilation of the wards by shafts and inlets, and remodelled grates	93	—	—
3. A ventilated gas-burner to be introduced into each ward	8	—	—
4. A projecting building to be erected behind the hospital to contain an ablution and bath room, and a watercloset. Privies in the back yard to be reconstructed as water latrines. Urinals also to be reconstructed and supplied with water. Ash-pit in the hospital yard to be removed, and all the refuse taken away daily	290	—	—
5. A new cooking range to be provided for the hospital kitchen	30	—	—

Digest of Sanitary Defects, and the Improvements required	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
SHEFFIELD BARRACK HOSPITALS.	£	£	£
Number of Wards: 9 — Present Regulation Number of Beds: 90 — Number of Beds at 1,200 Cubic Feet each: 64 — Deficiency in Bed Spaces: 26			
1. Reduction in the number of beds in each ward to the extent stated above	—	—	—
2. Improving the ventilation of each ward by enlarging the opening of the outlet shaft, and by providing inlets for fresh air. Ventilating the passages by shafts and perforated glass panes. Ventilating the gas-burners into the chimneys	169	—	—
3. Bath to be partitioned off from the ablution room	12	—	—
4. Watercloset to be reconstructed on a better principle. Privies in the hospital yard to be reconstructed as water latrines. Ash-pit to be removed, and provision made for the daily collection and removal of the hospital refuse	184	—	—
5. Wash-houses to be improved as suggested	21	—	—
6. A proper orderlies' room with windows to the external air to be provided for the infantry hospital	29	—	—
BIRMINGHAM CAVALRY HOSPITAL.			
Number of Wards: 3 — Present Regulation Number of Beds: 20 — Number of Beds at 1,200 Cubic Feet each: 10 — Deficiency in Bed Spaces: 10			
1. Reduction of numbers of sick in the existing wards to the extent stated, and providing additional ward space by removing the store from the upper floor, and, if possible, the kitchen to a detached building	—	—	—
2. Ventilating the passage and staircase, by altering the windows, and by perforated panes, as described. Introducing a silk-flap ventilator into the chimney of each smaller ward, and a ventilating shaft into the larger ward. Remodelling the grates. Ventilating the kitchen by a shaft carried from the ceiling to above the roof	58	58	—
3. Providing, if possible, a small bath room and ablution room, with hot and cold water laid on, and a covered communication from the hospital	112	112	—
4. Glazing the roof of the verandah where it passes over the ward window. Lighting the latrine by a skylight	7/10	7/10	—
COVENTRY CAVALRY HOSPITAL.			
Number of Wards: 3 — Present Regulation Number of Beds: 23 — Number of Beds at 1,200 Cubic Feet each: 19 — Deficiency in Bed Spaces: 4			
1. Reduction of the number of beds to give 1,200 cubic feet per bed	—	—	—
2. Ventilation to be improved by providing a shaft and by covering the inlets in the lower ward with perforated zinc diffusing cornices. Two shafts and four inlets for air to be provided in the upper large ward. Small upstairs ward to have a silk-flap ventilator into the chimney and one inlet for air. Ward windows to be made to open at top. Ward grates to be remodelled	53	53	—
3. Water to be laid on. A watercloset, bath, and ablution room with hot and cold water laid on, to be provided. Cess-pit in the yard to be abolished, and the privy drained and converted into a water latrine. Ash-pit to be removed	170/10	170/10	—
NORTHAMPTON ARTILLERY HOSPITAL.			
Number of Wards: 2 — Present Regulation Number of Beds: 13 — Number of Beds at 1,200 Cubic Feet each: 6 — Deficiency in Bed Spaces: 7			
1. That 1,200 cubic feet be allowed to each patient, and that the hospital be extended to allow this amount	380	—	—
2. The wards to be ventilated by shafts and inlets, and to have remodelled grates	30	—	—
3. That the passage and staircase be ventilated by a louvre in the roof	10	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
NORTHAMPTON ARTILLERY HOSPITAL—*continued.*	£	£	£
4. That an addition be made to the building accessible from the staircase, to contain a watercloset, a bath with hot and cold water, and an ablution table	250	—	—
That the privy in the yard be converted into a water latrine, drained, and the cess-pit filled up	7	—	—
5. That a better water supply be provided for the hospital, along with that for the barracks	—	—	—
6. That gas be introduced and a ventilated gas-burner put up in each ward	10	—	—
WEEDON BARRACK HOSPITAL.			
Number of Wards: 6 — Present Regulation Number of Beds: 40 — Number of Beds at 1,200 Cubic Feet each: 22 — Deficiency in Bed Spaces: 18			
1. Reduction of the number of beds in each ward to the extent specified	—	—	—
2. Ventilation of each ward by shafts and inlets as described. Ventilation of the staircase by a shaft and perforated glass panes. Ventilation of the bath room and wash-house through the roof. Reconstruction of the ward grates so as to warm part of the admitted air	127	127	—
3. A ventilated gas-burner to be introduced in each ward	5/10	5/10	—
4. Bath-room to be re-arranged, the existing bath filled up, a proper bath with hot and cold water laid on to be provided, and a proper hospital ablution table	92	92	—
5. Wash-house to be provided with fixed tubs and water laid on, gratings for the feet, and a laundry stove	100	100	—
6. Present waterclosets to be reconstructed with improved soil pans and a constant water supply	15	15	—
7. Privy in the yard to be reconstructed as a water latrine with drainage, and the cess-pit to be filled up. The hospital drainage and water supply to be improved along with those of the barrack, and all drains to be trapped	29	29	—
8. Hospital ash-pit to be abolished, and the refuse collected and removed daily	30	30	—
NEWCASTLE CAVALRY HOSPITAL.			
Number of Wards: 6 — Present Regulation Number of Beds: 26 — Number of Beds at 1,200 Cubic Feet each: 14 — Deficiency in Bed Spaces: 12			
1. Removing two beds out of each ward	—	—	—
2. Carrying each ventilating shaft separately above the roof and terminating it with a louvre; removing the covers from the shafts within the wards; providing suitable inlets for air; remodelling the ward grates; ventilating the stairs and passages by glass louvres or perforated panes	—	—	—
3. Providing a ventilating gas-burner for each ward	—	—	—
4. Providing an ablution room, bath room, and two waterclosets in a projection behind the stairs	—	—	—
5. Providing a new kitchen range, and ventilating the kitchen through the roof	—	—	—
6. Providing fixed tubs for the wash-house, and the means of drying linen	—	—	—
7. Reconstructing the privies as water latrines; providing a proper urinal; and improving the drainage	—	—	—
8. Removing the ash-pit, and providing for the daily collection and removal of the hospital refuse	—	—	—
NEWCASTLE INFANTRY HOSPITAL.			
This building has not been much used as a hospital; but it has been so used, and stands on the construction as a hospital. It is utterly unfit for sick, and cannot without rebuilding be made fit	—	—	—
The only recommendation we have to make is, that it be struck off the construction altogether	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
SUNDERLAND BARRACK HOSPITAL.	£	£	£
Number of Wards: 4 — Present Regulation Number of Beds: 28 — Number of Beds at 1,200 Cubic Feet each: 13 — Deficiency in Bed Spaces: 15			
1. Removing 15 beds out of the wards	—	—	—
2. Ventilating the wards by shafts, inlets, and remodelled grates, and ventilating the passage by perforated panes in the window	—	—	—
3. Introducing a ventilated gas-burner into each ward	—	—	—
4. Providing a watercloset connected with the hospital	—	—	—
5. Providing a bath and a proper ablution table, with hot and cold water laid on	—	—	—
6. Converting the privies in the yard into water latrines, and removing the ash-pit	—	—	—
7. Providing a ventilating skylight for the dead-house	—	—	—
TYNEMOUTH CASTLE HOSPITAL.			
Number of Wards: 5 — Present Regulation Number of Beds: 27 — Number of Beds at 1,200 Cubic Feet each: 14 — Deficiency in Bed Spaces: 13			
1. Removing all quarters and offices, except those for sick, out of the building, and converting the rooms into wards	—	—	—
2. Reducing the number of sick in the present wards, and distributing them over the building, so as to give, as near as may be, 1,200 cubic feet per bed	—	—	—
3. Ventilating the wards by shafts, inlets, and remodelled grates; ventilating the passage and staircase by a shaft through the roof and perforated panes in the windows	—	—	—
4. Ventilating the gas-burners	—	—	—
5. Providing a bath and ablution table, and laying on water to the hospital	—	—	—
6. Converting the privies into water latrines	—	—	—
7. Providing a cooking range for the hospital kitchen	—	—	—
CARLISLE CASTLE HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 20 — Number of Beds at 1,200 Cubic Feet each: 5 — Deficiency in Bed Spaces: 15			
1. To extend the hospital so as to afford the required per-centage of sick accommodation at 1,200 cubic feet per bed, with ablution and bath room, watercloset, &c.; and until this is done, to make temporary provision for the sick by a hospital hut or otherwise	—	—	—
2. To open windows in the back walls of the present wards, to make all windows open at top, and to ventilate the wards and staircases by shafts and inlets, as described	—	—	—
EDINBURGH CASTLE HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 62 — Number of Beds at 1,200 Cubic Feet each: 40 — Deficiency in Bed Spaces: 22			
1. Reduction of the number of beds in each ward to ten	—	—	—
2. Ventilation and warming of each ward by a shaft and remodelled grate. Ventilation of the kitchen by a shaft	53	—	—
3. A Macfarlane's ablution table to be placed in the bath room	11	—	—
PIERSHILL BARRACK HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 32 — Number of Beds at 1,200 Cubic Feet each: 18 — Deficiency in Bed Spaces: 14			
1. Reducing the number of inmates in the wards as shown above	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
PERSHILL BARRACK HOSPITAL—*continued.*	£	£	£
2. Completing the ventilation and warming of the larger wards by converting one of the chimney flues into a ventilating shaft and remodelling the fire-grate in the other fire-place (the one in the outer wall). Removing the partition in the ward above the kitchen, and ventilating the ward by a shaft, inlet, and remodelled grate; ventilating the small ward by an Arnott's valve and an inlet; ventilating the waterclosets by windows on opposite sides and a shaft through the roof; ventilating the kitchen by a shaft through the ceiling and roof, and by perforated glass panes; ventilating the staircase and passages by a shaft and perforated glass panes	42	—	—
3. Improving the construction of the waterclosets, and ventilating the latrines in the yard	20	—	—
4. Providing a covered connexion between the new ablution and bath room and the hospital; providing a bead for the ablution table	75	—	—
5. Hospital wash-house to have fixed tubs and means of drying	120	—	—
6. Pack store to have racks provided	5	—	—
LEITH FORT HOSPITAL.			
Number of Wards: 6 — Present Regulation Number of Beds: 32 — Number of Beds at 1,200 Cubic Feet each: 17 — Deficiency in Bed Spaces: 15			
1. Ward No. 1. to be struck off the construction, and three beds each to be removed out of wards 2, 3, 4, and 5	—	—	—
2. Wards 2 and 3 to be provided with foul-air shafts, inlets, and remodelled grates. Wards 4 and 5 to be provided with foul-air shafts and remodelled grates, and the floor ventilators to be closed. Staircases to be ventilated through the roof	66	—	—
3. A lavatory and bath room, with bath ablution table, with sunk basins, and hot and cold water, to be provided and connected with the hospital	150	—	—
4. A hospital wash-house, with means of washing and drying linen, to be provided, detached from the hospital	150	—	—
5. Kitchen to be ventilated by a shaft nine inches square, carried above the roof, and by perforated glass panes in the window	—	—	—
6. Waterclosets to be ventilated by shafts and inlets. Latrine in the yard to be properly lighted and ventilated	5	—	—
7. The ash-pit near the hospital to be removed	50	—	—
BERWICK-ON-TWEED HOSPITAL.			
Number of Wards: 7 — Present Regulation Number of Beds: 40 — Number of Beds at 1,200 Cubic Feet each: 18 — Deficiency in Bed Spaces: 22			
1. The number of beds in all the wards to be reduced to the number given in the preceding table	—	—	—
2. Ward windows to be enlarged and sashes to open at top. Staircase to be ventilated by a shaft through the ceiling, and perforated glass panes in the windows. Wards to be ventilated by shafts, inlets, and remodelled grates. Waterclosets to be ventilated by shafts and perforated glass panes	315	—	—
3. Kitchen to be ventilated by a shaft and perforated glass panes, and to be provided with a suitable range and oven	95/10	—	—
4. An ablution room and bath to be provided, and hot and cold water laid on to them	105	—	—
5. Hospital wash-house to be reconstructed	80	—	—
STIRLING CASTLE HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 39 — Number of Beds at 1,200 Cubic Feet each: 21 — Deficiency in Bed Spaces: 18			
1. Reducing the number of beds in each ward to the extent shown in the table	—	—	—
2. Ventilating each ward by a shaft and inlets, and remodelled grates. Ventilating the staircase by a louvre and perforated glass panes	74	—	—
3. Laying on hot water to the bath and ablution room	35	—	—
4. Improving the ventilation of the waterclosets	4	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
GLASGOW BARRACK HOSPITAL.	£	£	£
Number of Wards: 5 — Present Regulation Number of Beds: 80 — Number of Beds at 1,200 Cubic Feet each: 40 — Deficiency in Bed Spaces: 40			
1. Reducing the number of beds in each ward to the extent pointed out above	—	—	—
2. Removing the recruiting duty out of the hospital, restoring the rooms occupied by it to the hospital, and arranging the accommodation so as to have as much ward space as possible	—	—	—
3. Ventilating each ward by converting one chimney into an outlet shaft, and by placing louvres over the present ceiling ventilators, as described. Remodelling the grates, to warm part of the admitted air. Ventilating the staircase by a shaft and perforated panes. Ventilating the watercloseets by shafts, and the serjeants' and orderlies' rooms by Arnott's ventilators	50	—	—
4. Providing ablution accommodation within the building	40	—	—
5. Removing the ash-pit, and providing a barrow for the daily removal of the refuse	20	—	—
AYR BARRACKS HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 40 — Number of Beds at 1,200 Cubic Feet each: 22 — Deficiency in Bed Spaces: 18			
1. Reduction of the number of sick to the extent shown above	—	—	—
2. Ventilation of the two large wards, by converting one chimney flue into a ventilating shaft, and by two inlets for air. One fire-grate to be remodelled to warm part of the air admitted. The two smaller wards to be ventilated by Arnott's silk-flap ventilators, and by one inlet each. Stair and passage windows to be ventilated by perforated panes	24	—	—
3. A ventilated gas-burner to be introduced into each ward	Included in estimate for barracks.		
4. An addition to the hospital to be made capable of containing a bath with hot and cold water, the former supplied from the kitchen, an ablution table, and a watercloset	225	—	—
5. All cess-pits to be abolished, and the hospital privies drained, and reconstructed with a Macfarlane's water latrine	70	—	—
6. Hospital wash-house to have fixed tubs and water laid on, and to be better lighted and ventilated	12	—	—
7. A proper water supply to be provided for the hospital	Since executed		
8. Kitchen to be provided with a proper cooking range	12	—	—
PAISLEY BARRACKS HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 32 — Number of Beds at 1,200 Cubic Feet each: 21 — Deficiency in Bed Spaces: 11			
1. Reduction of the number of beds to the extent stated above	—	—	—
2. Ventilation of the wards by shafts and inlets. Ventilation of the kitchen, corridors, wash-house, and dead-house, through the roof	45	—	—
3. A watercloset, a bath, and an ablution table with hot and cold water, to be provided in connexion with the hospital. Privies in back yard to be reconstructed, and drained on Macfarlane's principle. A urinal to be provided. Ash-pit to be removed out of the hospital yard	246	—	—
4. Kitchen to be provided with a new cooking range and oven, and to be ventilated through the roof	—	—	—
HAMILTON BARRACKS HOSPITAL.			
Number of Wards: 3 — Present Regulation Number of Beds: 21 — Number of Beds at 1,200 Cubic Feet each: 13 — Deficiency in Bed Spaces: 8			
1. Extension of the ward space, and reduction of the number of beds in the present wards to the amount shown in the table	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
HAMILTON BARRACKS HOSPITAL—*continued.*	£	£	£
2. Ventilation of the wards by shafts, inlets, and remodelled grates, and by an Arnott's ventilator and inlet for the small ward as described. Ventilation of the staircase by perforated panes. Ventilation of the dead-house	30	—	—
3. Space to be obtained over the kitchen for a bath room, ablution room, and watercloset. Privies in the yard to be drained, and reconstructed as water latrines. Cess-pit to be abolished, and the ash-pit removed	171	—	—
4. An exercising ground for convalescents to be provided	180	—	—
DUMBARTON CASTLE HOSPITAL.			
Number of Wards: 3 — Present Regulation Number of Beds: 12 — Number of Beds at 1,200 Cubic Feet each: 3 — Deficiency in Bed Spaces: 9			
1. That it be considered to what extent the ward space could be enlarged by additions to the building	330	—	—
2. That the present wards be ventilated by Arnott's ventilators, and by a Sherringham's ventilator in each, and that a window be opened in the back wall of each ward. That the stair be ventilated by a shaft through the roof, and that perforated panes be put into the passage and stair windows	7	—	—
3. That an oven be added to the kitchen	—	—	—
4. That the present privies be converted into water latrines	35	—	—
Lastly. That it be considered whether in the event of an extension of the hospital being carried out, accommodation, however limited, might not be found for an ablution table and bath, and for the hospital serjeant	—	—	—
HOSPITAL, FORT AUGUSTUS.			
This hospital consists of five rooms, two downstairs and three upstairs in an attic, all in a dilapidated state. The downstairs rooms have brick floors	—	—	—
There is no accommodation for sick except these rooms. There is neither kitchen, surgery, serjeants' room, ablution room, bath, nor watercloset. In fact, there is nothing of an hospital except the name	—	—	—
Estimated cost of repairs and additions	372	—	—
ABERDEEN BARRACK HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 40 — Number of Beds at 1,200 Cubic Feet each: 25 — Deficiency in Bed Spaces: 16			
1. Reduction of the number of beds per ward to the extent shown above	—	—	—
2. Ventilation of the wards by shafts, inlets, and remodelled grates. All the ward windows to be made to open at top. Ventilation of the staircase by a louvre through the roof. Ventilation of the kitchen by a shaft and perforated glass panes	222	—	—
3. Ash-pit in the yard to be removed	2	—	—
4. Wash-house to be fitted up	70	—	—
5. Upper watercloset to be ventilated by shafts and perforated panes	5	—	—
6. A bath room with one bath, and an ablution table, both with hot and cold water laid on, to be provided	80	—	—
7. Gas-burners to be ventilated by funnels and tubes into the chimney	12	—	—
DUNDEE BARRACK HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 32 — Number of Beds at 1,200 Cubic Feet each: 26 — Deficiency in Bed Spaces: 6			
1. Removing two beds out of each of the three larger wards	—	—	—
2. Ventilating these three wards by shafts carried from the ceiling to above the roof; by converting the present ventilating beams into inlets as described, and by remodelling the fire-grates. Small ward to be ventilated by an Arnott's silk-flap valve and a Moore's louvred pane. Gas-burners to be ventilated	56	—	—
3. Hospital wash-house to be removed outside the building	125	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
DUNDEE BARRACK HOSPITAL—*continued.*	£	£	£
4. Kitchen to be ventilated by a shaft carried from the ceiling to above the roof, and by perforated panes. A new cooking range to be provided	26	—	—
5. A bath and ablution room, with hot and cold water laid on, to be provided by enlarging the projections behind the staircase. Ventilation of the watercloset to be more effectually cut off from that of the staircase	140	—	—
6. Privies in the yard to be drained, and reconstructed on Macfarlane's principle	45	—	—
PERTH BARRACKS HOSPITAL.			
Number of Wards: 3 — Present Regulation Number of Beds: 24 — Number of Beds at 1,200 Cubic Feet each: 14 — Deficiency in Bed Spaces: 10			
1. Reduction of the number of beds in each ward to the extent specified above	—	—	—
2. Ventilation of Wards 1 and 2 by shafts, inlets, and remodelled grates, and of Ward No. 3 by an Arnott's silk-flap ventilator and one inlet. Ventilation of the staircase by a shaft and perforated glass panes in the windows	43	—	—
4. A ventilated gas-burner to be put into each ward	3	—	—
5. An ablution and bath room to be erected, and an ablution table and one bath with hot and cold water laid on to be provided	100	—	—
6. Wash-house to be provided with fixed tubs, water, gratings, and means of drying linen	100	—	—
7. Kitchen to be furnished with a ventilated roasting oven	8/10	—	—
8. Watercloseets to be ventilated through the roof. Urinal to be reconstructed and supplied with water. Privies in the back yard to be reconstructed as a water latrine on Macfarlane's principle, and drained; cess-pit to be filled up, and ash-pit to be removed. Hospital refuse to be collected and removed daily	20	—	—
VICTORIA STREET BARRACK HOSPITAL, PERTH.			
The hospital provided for this barrack, which has regulation accommodation for 212 men, consists of a few miserable small low-roofed cottage rooms, hardly fit for occupation by people in health, and quite unfit to treat disease in. It would be a mere waste of money to try to improve the place, and we have no recommendations to make on the subject	—	—	—
Estimate for removing buildings and erecting a suitable hospital	700	—	—
HOSPITALS, FORT GEORGE.			
Number of Wards: 6 — Present Regulation Number of Beds: 72 — Number of Beds at 1,200 Cubic Feet each: 48 — Deficiency in Bed Spaces: 24			
1. Reduction of the number of beds per ward to the extent shown in the table	—	—	—
2. Ventilation of each ward by a shaft, inlets, and remodelled grate. Ventilation of the staircases by perforated glass panes. Serjeant's room to be ventilated by a silk-flap ventilator	90	—	—
3. Ablution room to be lighted and ventilated through the roof, and provided with an ablution table having hot and cold water laid on. Two baths, and hot and cold water laid on, to be provided. The ablution and bath room to be connected with the hospital by a covered passage	60	—	—
4. Two watercloseets, placed in a projection behind and opening from the staircases, to be provided. Water latrines in the yard to have light and ventilation through the roof	120	—	—
5. A dead-house and hospital wash-house to be provided	Since authorized.	206	—
6. The well from which impure water is derived to be closed, and a better water supply to be provided for the hospital	350	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
MILITARY GENERAL HOSPITAL, DUBLIN.	£	£	£
Number of Wards: 15 — Present Regulation Number of Beds: 199 — Number of Beds at 1,200 Cubic Feet each: 129 — Deficiency in Bed Spaces: 70			
1. Reduction of the number of beds to the extent stated above -	—	—	—
2. Ventilation of all the wards by shafts and inlets, and of the stairs and passages by shafts from the ceilings of the staircases, and perforated glass panes in the windows. Orderlies' rooms to be ventilated by silk-flap ventilators in the chimneys. Remodelling the ward grates - - - - - - - -	406/7	406/7	—
3. Lowering the sills of the ward windows to within three feet of the floor, which is most important - - - - - -	456	456	—
4. Gas and a ventilated gas-burner to be introduced into each ward -	300	300	—
5. Better bath accommodation to be provided - - - - -	122	—	122
6. A roasting oven to be put up in the kitchen - - - -	Since executed.		
7. Water supply to be increased in amount - - - - -	—	—	—
8. Cess-pits to be abolished, and the privies reconstructed as water latrines. Drying closet at the laundry to be ventilated by a shaft through the roof - - - - - - - -	Since executed		
ARBOUR HILL REGIMENTAL HOSPITALS, DUBLIN. (EIGHT IN NUMBER.)			
Total Number of Wards in the 8 Hospitals: 40 — Total Present Regulation Number of Beds in the 8 Hospitals: 208 — Total Number of Beds in the 8 Hospitals at 1,200 Cubic Feet each: 104 — Deficiency in Bed Spaces in the 8 Hospitals: 104			
Improvements required in each hospital:—			
1. Reduction of the number of beds in all the wards to one half -	—	—	—
2. Ventilation of the wards by shafts, inlets, and remodelled grates -	654	—	654
3. Ventilation and lighting of the stairs through the roof - -	120	—	120
4. Gas-burners to be ventilated - - - - -	100	—	100
5. A bath and ablution room to be provided for each hospital. Water supply to be extended and improved - - - - -	Provided in Barrack Annual Estimate.		
6. Privies behind the hospitals to be drained and converted into water latrines, and the cess-pits to be abolished - - - -	99	—	99
SHIP STREET BARRACK HOSPITAL.			
Number of Wards: 8 — Present Regulation Number of Beds: 48 — Number of Beds at 1,200 Cubic Feet each: 30 — Deficiency in Bed Spaces: 18			
1. The numbers of beds should be reduced to the extent stated above	—	—	—
2. The wards should be ventilated by shafts and inlets as described, and the kitchen should have perforated glass panes in the window -	57/7/6	57/7/6	—
3. A few pegs should be put up in the lavatory to hang the men's clothes on while washing or bathing - - - -	0/6/0	0/6/0	—
PORTOBELLO BARRACK HOSPITALS, DUBLIN, (ARTILLERY AND CAVALRY).			
Number of Wards: 8 — Present Regulation Number of Beds: 72 — Number of Beds at 1,200 Cubic Feet each: 40 — Deficiency in Bed Spaces: 32			
1. Reduction in the number of beds to the extent specified - -	—	—	—
2. Ventilation of the wards by shafts and inlets as described, and by openings over the doors where there are none at present. Ventilation of the passages and stairs by panes of perforated glass in the windows. Grates to be remodelled - - - -	171	171	—
3. A ventilating funnel and tube to be placed over each gas-burner in the wards - - - - - - - -	9	9	—
4. The projections containing the waterclosets to be extended to afford space for a bath and ablution room for each hospital. One bath, with hot and cold water laid on, to be provided in each hospital, and also a proper ablution table. Waterclosets and bath rooms to be separated from the staircase by a ventilated lobby, with a window on each side - - - - - - -	234	234	—
5. Kitchens to be ventilated by shafts and perforated glass panes in the windows - - - - - - - -	8	8	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
PORTOBELLO BARRACK HOSPITAL, DUBLIN—*continued.*	£	£	£
6. Each kitchen to have a proper cooking range put up	Since executed.		
7. All cesspits to be abolished; the privies in the back yard to be reconstructed as water latrines, with divisions of seats, half doors, light and ventilation, and to be drained	96	—	96
8. The dung-pit of the infirmary stables to be removed to a greater distance, and arrangements to be made for keeping the surface of the forage yard always clean	20	20	—

RICHMOND BARRACK HOSPITALS, DUBLIN.

Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Spaces.
8	68	36	32

1. Reduction of the number of beds in each ward to the extent stated	—	—	—
2. Improving the ward ventilation by an opening into the disused chimney, and by remodelling the ward grates. Ventilating the staircase and passages by shafts and perforated glass panes	102/12	102/12	—
3. A ventilating funnel and tube to be placed over each gas-burner	—	—	—
4. An ablution and bath room with one bath, and hot and cold water laid on, to be provided for each hospital	154	154	—
5. Kitchens to be ventilated by shafts from the ceilings, and by perforated glass panes in the windows	7/3	7/3	—
6. Privies in the hospital yards to be reconstructed as water latrines, to be drained and the cess-pit abolished. Additional light to be given to these latrines through the roof	9	9	—
7. Hospital refuse to be removed daily	—	—	—
8. Pack store to be provided with racks	8	8	—
These improvements are urgently required for the present buildings, but after they are carried out they will leave the hospital accommodation totally insufficient for the strength in barracks	—	—	—

BEGGAR'S BUSH BARRACK HOSPITAL, DUBLIN.

Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Spaces.
3	24	12	8

1. Reducing the number of beds in the hospital and canteen to the extent stated	—	—	—
2. Improving the ventilation of the hospital wards by enlarging the opening into the ventilating shafts, and providing for the ventilation of the canteen wards by glass louvres in the windows, or by shafts and inlets. Ventilating the hospital staircases by a shaft from the ceiling through the roof, and by perforated glass panes in all the stairs and lobby windows. Ventilating the water-closets by shafts from the ceiling through the roof	115	109 5	5/15
3. Ventilating the kitchen by a shaft and perforated glass panes	Since executed.		
4. Remodelling the ward fire-grates	—	—	—
5. A gas-burner to be introduced into each ward, and ventilated by a funnel and pipe into the chimney	3/10	—	3/10
6. Privy in the yard to be reconstructed as a water latrine with drainage, and the cess-pit to be abolished. Urinal to be reconstructed and supplied with water	Since provided for.		
7. Ash-pit to be done away with, and the refuse removed daily	—	—	—

PIGEON HOUSE FORT HOSPITAL, DUBLIN.

Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Spaces.
4	17	10	7

1. Reduction of numbers in the wards to the extent specified	—	—	—
2. Ventilation of the staircase and passages by glass louvres in the windows. Ventilation of the wards by silk-flap ventilators and inlets	8/8	—	8/8
3. Ward grates to be remodelled	—	—	—
4. Kitchen to be removed from its present position and reconstructed with proper cooking arrangements and other conveniences, and to be ventilated by a shaft and perforated glass panes	7/4	—	7/4
5. Water supply to be extended and improved	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
PIGEON HOUSE FORT HOSPITAL, DUBLIN—*continued.*	£	£	£
6. A bath room with one bath, and hot and cold water laid on, to be provided, and an ablution table to be put up in it - - -	177	—	177
7. Privy in the yard to be reconstructed as a water latrine, and a urinal supplied with water to be attached to it - - -	101/12/6	—	101/12/6
ALDBOROUGH HOUSE HOSPITAL, DUBLIN.			
To be abandoned, as being totally unfit for sick.			
LINEN HALL BARRACK HOSPITAL, DUBLIN.			
To be abandoned, as being totally unfit for sick.			
KILKENNY BARRACK HOSPITAL.			
Number of Wards: 9 — Present Regulation Number of Beds: 8 — Number of Beds at 1,200 Cubic Feet each: 38 — Deficiency in Bed Spaces: 43			
1. Reduction of the number of beds in each ward, to give 1,200 cubic feet per bed - - - - - - - -	—	—	—
2. Ventilation of the wards and of the kitchen, by shafts and inlets, as described - - - - - - - -	Since carried out.		
3. A new cooking range and sink to be provided for the kitchen -	30	—	—
4. Privy, ash-pit, and cess-pit in the yard to be removed - -	9	—	—
5. A properly-drained water latrine to be substituted, and arrangements to be made for daily removal of all the hospital refuse -	Carried out.		
This hospital is ill adapted for sick both from its structure, position, and neighbourhood. It would be better to build another.			
NEWBRIDGE BARRACK HOSPITAL.			
Number of Wards: 10 — Present Regulation Number of Beds: 100 — Number of Beds at 1,200 Cubic Feet each: 40 — Deficiency in Bed Spaces: 60			
1. The removal of sixty beds out of the hospital, and the reduction of the number of beds in the huts from fifteen to twelve in each. Orderlies to be removed from wards - - - -	—	—	—
2. Ventilation of each ward by converting one of the chimneys into a ventilating shaft by an opening of double the sectional area made close to the ceiling into the chimney, and by blocking up the fireplace of the chimney. Two inlets for air covered by perforated zinc cornices to be provided in each ward. Staircases to be ventilated by shafts through the ceiling, and by perforated glass panes in the windows. Kitchens to be ventilated by a shaft carried from the ceiling above the roof, and by glass louvres in the windows. Ward over the kitchen to be ventilated by a shaft and inlets. Ward grates to be remodelled - - - - -	Since executed. 113		
3. A lavatory, with fixed bath, and hot and cold water laid on, and two water closets to be provided in a situation easily accessible from the wards - - - - - - - -	650	—	—
4. A proper laundry to be provided - - - - -	250	—	—
5. Kitchen to be provided with range capable of cooking hospital diets - - - - - - - - -	60	7/3 0 for an oven.	—
6. Water supply and drainage to be improved along with those of the barracks - - - - - - - -	Included in special estimate.		
7. The cess-pit and ash-pit in the yard to be abolished, and the privy converted into a water latrine, and an additional water latrine to be provided for the officers. Iron barrows to be provided for the daily collection and removal of refuse. Urinal to be supplied with water - - - - - - - -	230	—	—
These measures, if carried out, will remove the more obvious defects of this hospital, but nothing short of reconstruction would make it suitable for a force of 1,200 men, if such a force is to be maintained in this barrack - - - - - - -	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
BIRR BARRACK HOSPITAL.	£	£	£
Number of Wards: 12 — Present Regulation Number of Beds: 112 — Accommodation at 1,200 Cubic Feet per Bed: 49 — Deficiency in Bed Spaces: 63			
1. Reduction of the number of beds to the extent stated, removed of orderlies' beds out of the wards, and removal of the prison ward out of the building	—	—	—
2. Ventilating the wards by an opening into each blank chimney, and by two inlets in the opposite walls as described. Hanging all the windows with weights and pulleys. Remodelled grates	388	84	—
3. Additional watercloseta, bath room with fixed bath, and hot and cold water laid on, and a lavatory to be constructed in connexion with the staircases. Privies in the yard to be drained and reconstructed as water latrines	1,090	—	—
4. A proper kitchen range and hot-water boiler to be put up, and the kitchen to be ventilated by a shaft and perforated glass panes	60	—	—
5. Water supply to be improved along with the barrack supply	26	26	—
6. Drainage to be improved along with the barrack drainage. Open ditch behind the hospital to be covered over or drained and filled up	182	182	—
7. Ash-pit in the yard to be abolished, and the refuse to be collected and removed daily	70	—	—
8. Exercising ground, with a covered walk and seats for convalescents, to be provided	339	—	—
9. The soldiers' drying ground to be removed away from the hospital	2	—	—
10. A ventilated gas-burner should be introduced into each ward	—	—	—
Lastly. In any reconstruction of this hospital, accommodation for the sick of soldiers' families ought to be provided	—	—	—
CARLOW BARRACK HOSPITAL.			
Number of Wards: 2 — Present Regulation Number of Beds: 12 — Number of Beds at 1,200 Cubic Feet each: 6 — Deficiency in Bed Spaces: 6			
1. Three beds to be removed out of each ward	—	—	—
2. Wards to be ventilated by shafts and inlets. Staircase to have a window and a ventilating shaft with perforated panes in the window. Kitchen to have a shaft and perforated panes for ventilation	26	—	—
3. Privy and cess-pit to be removed and a watercloset and bath provided	273	—	—
DUNCANNON FORT HOSPITAL.			
The wards are nothing more than two barrack rooms, intended to hold eight sick in a space where three ought to be. They are destitute of nearly all hospital conveniences. We propose to improve them as follows :—			
1. To extend the accommodation by taking in barrack rooms to give 1,200 cubic feet per bed	—	—	—
2. Ventilation of the wards by shafts, perforated panes, and remodelled grates	115	—	—
3. Providing a fixed bath	74	—	—
NAAS BARRACK HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 31 — Number of Beds at 1,200 Cubic Feet each: 15 — Deficiency in Bed Spaces: 16			
1. Removing one half of the beds out of the wards	—	—	—
2. Ventilating the wards by converting one of the chimney flues into a foul air shaft, providing two inlets for fresh air close to the ceiling on opposite sides of each ward, and remodelling the ward fire-grates ; ventilating the staircase by a shaft and perforated panes	—	—	—
3. Kitchen to be provided with an oven or a proper cooking range, and to have a shaft carried from the ceiling to above the roof	—	—	—
4. A watercloset to be provided. The privy in the yard to be drained and converted into a water latrine, and the cess-pit and ash-pit to be abolished	—	—	—
5. A bath and ablution room to be provided, and also a bath and a Macfarlane ablution table with hot and cold water laid on	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
CORK BARRACK HOSPITALS.	£	£	£
Number of Wards: 20 — Present Regulation Number of Beds: 164 — Number of Beds at 1,200 Cubic Feet each: 90 — Deficiency in Bed Spaces: 74			
1. The reduction of beds in each ward to the extent specified above -	—	—	—
2. Ventilation of every ward by a foul-air shaft, and by two inlets for air. Reconstruction of the ward grates, to save heat and to warm part of the admitted air in winter. Ventilation of each staircase by a louvred shaft through the roof, and by perforated panes in the windows. Ventilation of the kitchen by an air shaft and glass louvres in the windows - - - - - - -	645 10	—	—
3. Gas to be introduced, and a ventilated gas-burner to be provided for every ward - - - - - - - -	—	—	—
4. Lavatories for convalescents to be provided. Bath room to be improved, and additional baths, with hot and cold water laid on, to to be provided - - - - - - - -	750	96/15	—
5. Water tank to be removed out of the kitchen - - -	4	19	—
6. The whole hospital to be sewered to an outlet, along with the barracks - - - - - - - - -	Included in the Barrack Estimate.		
7. All cess-pits to be abolished, the ash-pit in the yard to be removed, and the privies to be reconstructed as water latrines - -	328	—	—
8. Watercloscts to be provided for the centre of the building - -	420	—	—
9. Covered seats for convalescents to be put up in the yard - -	8	—	—
Lastly. In adding to the hospital, it would be well to provide accommodation for the sick of married soldiers' families - -	—	—	—
BALLINCOLLIG BARRACK HOSPITALS.			
Number of Wards: 7 — Present Regulation Number of Beds: 50 — Number of Beds at 1,200 Cubic Feet each: 30 — Deficiency in Bed Spaces: 20			
1. Reduction of number of sick to give 1,200 cubic feet per bed -	—	—	—
2. Ventilation of all the wards by shafts and inlets for air. Fire-grates to be remodelled, to warm the air in winter; skylights for light and ventilation to be placed in the roof of the halls. Staircase to be ventilated by perforated glass panes in the windows - -	252/10	—	—
3. A fixed bath, with hot and cold water laid on, and an ablution table to be provided - - - - - - -	120	—	—
4. Privies in the yard to be reconstructed as a water latrine, and drained. The drainage to be improved as suggested, and the cess-pit abolished - - - - - - -	270	—	—
5. Water supply to be improved - - - - -	Included with that of the Barrack.		
6. The stores should be fitted up with drawers, shelves, racks, &c., as pointed out - - - - - -	12	—	—
Lastly. It would be very advisable to provide a room to receive cases of illness occurring among the families of married soldiers -	—	—	—
GENERAL HOSPITAL, QUEENSTOWN.			
Number of Wards: 16 — Present Regulation Number of Beds: 88 — Number of Beds at 1,200 Cubic Feet each: 47 — Deficiency in Bed Spaces: 41			
1. Reduction of numbers in each ward, to the extent specified -	—	—	—
2. Ventilation of each ward, by shafts and inlets for air, by remodelled grates, and by opening additional windows. Ventilation of the staircases by shafts and perforated glass panes - - -	404	—	—
3. Ventilation of the kitchens and stores by shafts and inlets. A trapped sink to be provided in each kitchen - - -	53	—	—
4. Construction of watercloscts, one for each wing; and converting the privies into water latrines. Improved water supply. Providing divisions for the baths, and seats and pegs in the bath room - - - - - - - -	171	—	—
Some of the chimneys in this building smoke to such an extent as to give rise to serious inconveninece. This defect should also be remedied - - - - - - - -	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
SPIKE ISLAND HOSPITAL.	£	£	£
This hospital is constructed on very defective principles and ought never to be used for sick soldiers. The building would be better adapted for other purposes.			
BANDON BARRACK HOSPITAL.			
A small defective hospital, very little used; contains two four-men wards, one of which is used by the hospital serjeant.			
1. Ventilation of the wards by shafts and inlets; also ventilation of the kitchen by a shaft and inlet - - - - -	30	—	—
2. A proper cooking range to be put up in the kitchen - -	15	—	—
3. A watercloset to be provided - - - - -	70	—	—
KINSALE BARRACK HOSPITAL.			
Number of Wards: 6 — Present Regulation Number of Beds: 40 — Number of Beds at 1,200 Cubic Feet each: 16 — Deficiency in Bed Spaces: 24			
1. To remove all the beds out of the hospital except sixteen - -	—	—	—
2. To ventilate each ward, by a shaft carried from the ceiling to above the roof, and by an inlet for air; to ventilate the staircases, by shafts through the ceilings and roof; to ventilate the kitchen, by a shaft from the ceiling - - - - - -	60	—	—
3. To provide two waterclosets, a fixed bath, and lavatory. To convert the privy in the yard into a water latrine, and to remove the ash-pit - - - - - - - -	420	—	—
4. To provide a proper cooking range, and to open additional window space for the kitchen - - - - - -	32	—	—
CHARLES FORT HOSPITAL, KINSALE.			
Number of Wards: 4 — Present Regulation Number of Beds: 24 — Number of Beds at 1,200 Cubic Feet each: 8 — Deficiency in Bed Spaces: 16			
1. Two-thirds of the beds to be removed from the wards - -	—	—	—
2. Wards to be ventilated by shafts and inlets - - -	100	—	—
3. Privy and cess-pit to be abolished. A watercloset with drainage, and ablution and bath room, to be provided - - - -	250	—	—
4. Kitchen to have a cooking range - - - - -	20	—	—
This is a very bad hospital. It is a mere refuge for a sick man from his barrack room - - - - - -	—	—	—
TRALEE BARRACK HOSPITAL.			
Number of Wards: 2 — Present Regulation Number of Beds: 18 — Number of Beds at 1,200 Cubic Feet each: 8 — Deficiency in Bed Spaces: 10			
1. Reduction of beds to four in each ward of the hospital, and allotting 1,200 cubic feet per bed in the sick room in the officers' quarters -	—	—	—
2. Ventilation of wards, both in the hospital and in the officers' rooms misappropriated for sick - - - - -	8	—	—
3. A suitable kitchen range for cooking diets - - - -	14	—	—
4. Improving the drainage and constructing a watercloset connected with the wards - - - - - -	245	—	—
A very bad hospital, condemned as unfit for sick 12 years ago. Part of the sick have to be treated in the officers' quarters - -	—	—	—
BUTTEVANT BARRACK HOSPITAL.			
Number of Wards: 9 — Present Regulation Number of Beds: 81 — Number of Beds at 1,200 Cubic Feet each: 38 — Deficiency in Bed Spaces: 43			
1. Reduction of the number of beds in all the wards, to the extent specified - - - - - - -	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
BUTTEVANT BARRACK HOSPITAL—*continued.*	£	£	£
2. Ventilation of all the wards, by openings into the disused chimneys, where there are two, or by an air shaft in the wards with one chimney. A pane of perforated glass to be inserted into every ward window frame. Ward grates to be remodelled. Stairs to be ventilated	231/2	51/2	For ventilation of wards.
3. A building, accessible under cover, to be erected for a bath room, watercloset and lavatory for the sick, with a fixed bath, and hot and cold water laid on	480	—	—
4. New kitchen ranges, with oven and hot plate, to be erected in the kitchens. A ventilating shaft to be carried up from the ceiling of each kitchen and perforated glass panes to be placed in the windows	48	—	—
5. Water supply to be improved, as described, and water tanks covered	Being carried out.	37	—
6. Cess-pit to be abolished, and privy in the yard to be converted into a water latrine	94	—	—
Lastly. The other requirements stated are also necessary, but they can only be properly carried out by extending the hospital	—	—	—

MALLOW BARRACK HOSPITAL.

Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Spaces.
2	8	4	4

1. Throwing down the front court wall to improve the ventilation	—	—	—
2. Removing privy and cess-pit out of the yard	10	—	—
3. Abating the nuisance from pigs under the hospital wall	25	—	—
4. Diverting an open sewer from beneath the hospital, and converting it into a proper drain	20	—	—
5. Removing the barrack serjeant's quarter out of the hospital. A bath, watercloset, and kitchen range to be provided	110	—	—
6. Additional windows to be opened. Ward to be ventilated, and fire-grates remodelled	40	—	—
7. Half the beds to be removed out of the wards	—	—	—
These requirements are sufficient to show how unfit this building is for sick, or indeed for human habitation	—	—	—

FERMOY NEW BARRACK HOSPITAL.

Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Spaces.
7	66	32	34

1. That the number of beds in each ward be reduced, so as to give 1,200 cubic feet per bed	—	—	—
2. That each ward be ventilated by an opening into the disused chimney shaft double the section of the shaft. An inlet for air, with a perforated zinc cornice, to be made in the wall close to the ceiling, on each side of the ward. Ophthalmic ward to be ventilated by a shaft and inlet. Ward grates to be remodelled	240	—	—
3. A new cooking range to be placed in the kitchen	45	—	—
4. A ventilated gas-burner to be introduced into each ward	15	—	—
5. A closed corridor to be erected, to connect the bath room and latrine with the hospital	80	—	—
6. Latrines to have seats and divisions provided	12/10	—	—
7. Cess-pit to be abolished, and the hospital to be thoroughly drained along with the barracks	—	—	—
Lastly. A temporary sleeping place should be set apart at once for the orderlies, who ought forthwith to be removed out of the wards	—	—	—

FERMOY OLD BARRACK HOSPITAL.

Number of Wards.	Present Regulation Number of Beds.	Number of Beds at 1,200 Cubic Feet each.	Deficiency in Bed Spaces.
16	155	82	73

1. The number of beds in each ward to be reduced to the extent stated, and the orderlies to be removed out of the wards and have separate sleeping rooms provided for them	—	—	—
2. All the wards to be ventilated by shafts and inlets for air; the fire grates to be remodelled; and perforated panes to be introduced into the windows of the corridor and kitchens	542/10	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
FERMOY OLD BARRACK HOSPITAL—*continued.*	£	£	£
3. That gas be supplied to the building, and a ventilated gas-burner introduced into every ward	420	—	—
4. That the hospital be drained along with the barrack, and all cess-pits filled up	360	—	—
5. That watercloscts of better construction be supplied, and that the privy in the hospital yard be reconstructed as a water latrine, with suitable seats, divisions, and half doors, and suitably drained	98	—	—
6. That the hospital be supplied with water sufficient for all purposes, either by improving the wells or by bringing water from a distance, as suggested	Included in Barrack Estimate.	209	
Lastly. Unless the building is to be given up, and new hospital accommodation provided, it will be necessary to extend it to double its present size, and to provide, in addition, for the reception of the sick of soldiers' families, bath rooms and lavatories being at the same time constructed for the entire establishment	—	—	—
LIMERICK NEW BARRACK HOSPITAL.			
Number of Wards: 10 — Present Regulation Number of Beds: 98 — Number of Beds at 1,200 Cubic Feet each: 62 — Deficiency in Bed Spaces: 36			
1. Reduction of beds in the wards, to give 1,200 cubic feet per bed	—	—	—
2. Ventilation of the larger wards by Arnott's ventilators, by perforated panes, and by a swing window over each door, as pointed out. Small wards to be ventilated by a shaft and perforated glass panes. Also the fire-grates in all the wards to be reconstructed, to economize heat and to warm part of the admitted air in winter	202	—	—
3. Passages and wards to be lit with gas, the latter by ventilated gas-burners	16/8	—	—
4. Waterclosets, lavatories, and bath rooms, with hot and cold water, to be constructed for each flat, beyond the line of the buildings, as recommended	600	—	—
5. The privy in the hospital yard to be converted into a water latrine, with divisions of seats, half doors, and plenty of light	100	—	—
6. Wash-house to be provided with means of drying and getting up linen	—	—	—
Lastly. Provisions ought to be made for accommodating sick wives and children of soldiers	—	—	—
LIMERICK ORDNANCE HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 20 — Number of Beds at 1,200 Cubic Feet each: 6 — Deficiency in Bed Spaces: 14			
1. Reduction of number of beds from twenty to six	—	—	—
2. Opening additional windows into the wards and staircase. Ventilating the wards as described. The ward grates to be remodelled The staircase to be ventilated by a shaft through the ceiling and roof, by an additional window, and by perforated glass panes in the upper sash of the windows	8	8	—
3. The hospital to be drained, the privy to be removed, the cess-pit abolished, and a watercloset substituted	75	30 for water latrine.	—
4. A bath room, with fixed bath, and hot and cold water laid on, along with a lavatory, to be provided	80	80	—
The only good thing in the arrangements of this hospital is that there is no ash-pit, and that all the refuse is removed daily, a procedure which ought to be imitated in all barracks and hospitals. To make the hospital suitable for sick it would have to be rebuilt on a better site	—	—	—
LIMERICK CASTLE HOSPITAL.			
This hospital is so bad that it would be a mere waste of public money to attempt to improve it	—	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
TEMPLEMORE BARRACK HOSPITALS.	£	£	£
Number of Wards: 10 — Present Regulation Number of Beds: 80 — Number of Beds at 1,200 Cubic Feet each: 40 — Deficiency in Bed Spaces: 40			
1. The number of beds in the wards to be reduced to one half -	—	—	—
2. The wards to be ventilated by an opening into the chimney shaft, and by inlets for air, as recommended. The staircases to be ventilated by louvres through the roof, and by perforated glass panes in the windows; and the kitchen by a shaft through the roof, and by glass louvres in the windows. The ward fire-grates to be remodelled - - - - - - - -	193/10	—	—
3. A bath room, lavatory, and water closets to be provided, and connected with the hospital - - - - - - -	284	—	—
4. The hospital to be drained, the cess-pits in the yard abolished; the privies converted into water latrines, and the ash-pit removed -	243	—	—
5. The hospital to be supplied with water - - - - -	150	—	—
6. The wash-house to be furnished with a drying stove - -	150	—	—
CAHIR BARRACK HOSPITAL.			
Number of Wards: 5 — Present Regulation Number of Beds: 33 — Number of Beds at 1,200 Cubic Feet each: 17 — Deficiency in Bed Spaces: 16			
1. Reduction of number of beds to the extent specified - -	—	—	—
2. Ventilation of the wards as recommended, and remodelling of the grates - - - - - - - - -	87/10	11	—
3. Out-building, having a covered connexion with the wards, to be erected to contain waterclosets, bath, and lavatory. Privies in the yard to be converted into water latrines. The cess-pit to be abolished, and the hospital to be drained along with the barrack -	360	—	—
4. Water supply to be laid on at the same time as that of the barrack -	—	—	—
5. Covered seats and a verandah to be provided for convalescents in the hospital yard - - - - - - -	60	—	—
6. Iron barrow for receiving and removing hospital refuse - -	11	—	—
Lastly. The question of hospital accommodation for the sick of married soldiers' families ought to be considered along with the question of providing quarters for married people. Taking into account the size of the barrack, one ward would probably be enough for such a purpose - - - - - - - -	—	—	—
CLONMEL BARRACK HOSPITAL.			
Number of Wards: 6 — Present Regulation Number of Beds: 54 — Number of Beds at 1,200 Cubic Feet each: 21 — Deficiency in Bed Spaces: 33			
1. Reduction of number of beds to the extent stated above - -	—	—	—
2. Ventilation of all the wards by shafts and inlets for air. Ventilation of the kitchen by an air shaft - - - - -	34	34	—
3. Remodelled grates - - - - - - - -	75	—	—
4. A proper bath room to be built, with a bath, and hot and cold water laid on. A lavatory should also be provided in the same room -	200	—	—
5. Repair of the water closets. Privy to be drained and converted into a water latrine - - - - - - -	110	—	—
6. The ashpit to be removed, and the hospital refuse to be collected and removed daily - - - - - - -	11	—	—
7. Each ward, and the passages, kitchen, &c., to have gas-burners ventilated - - - - - - - - -	10	—	—
Lastly. The hospital extended to afford the requisite space for the sick, and also for sick wives and children of soldiers - - -	—	—	—
WATERFORD INFANTRY HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 24 — Number of Beds at 1,200 Cubic Feet each: 8 — Deficiency in Bed Spaces: 16			
1. To reduce the number of beds, to give 1,200 cubic feet to each -			
2. To ventilate each ward by a shaft and inlets - - -	15	15	—
3. Remodelled grates - - - - - - - -	45	—	—
4. To lay on water to the hospital - - - - -	30	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
WATERFORD INFANTRY HOSPITAL—*continued.*	£	£	£
5. To construct a watercloset for the sick, and to convert the present privy into a water latrine	250	—	—
6. To construct a bath room and lavatory	200	—	—
7. To improve the cooking arrangements	12	—	—
8. To provide accommodation for convalescent exercising	100	—	—
9. Provision store	50	—	—
WATERFORD ARTILLERY HOSPITAL.			
This hospital is intended for 12 beds where there is hardly space for six. It is bad in site, bad in construction, greatly over-crowded and deficient in almost every hospital convenience. In mere temporary use it may be improved as follows, but it ought to be evacuated as speedily as possible	—	—	—
1. Ventilating the wards by Arnott's valves and perforated panes	2	—	—
2. Allowing 1,200 cubic feet per bed and removing the remaining beds	—	—	—
3. Providing a watercloset	—	—	—
LONGFORD BARRACK HOSPITAL.			
Number of Wards: 6 — Present Regulation Number of Beds: 24 — Number of Beds at 1,200 Cubic Feet each: 16 — Deficiency in Bed Spaces: 8			
1. Reduction of the number of beds in the wards to the extent stated above	—	—	—
2. Ventilation of the wards by shafts, inlets, and remodelled grates, and ventilation of the staircase by perforated glass panes in the windows	211	—	—
3. A ventilated gas-burner to be introduced into each ward	Otherwise provided for.		
4. Hospital to be properly drained. Privies to be reconstructed as water latrines on Macfarlane's principle. Two waterclosets, an ablution room, with a bath and hot and cold water laid on, to be built in connexion with the wards	289	—	—
5. A proper wash-house to be provided	80	—	—
MULLINGAR BARRACK HOSPITAL.			
Number of Wards: 8 — Present Regulation Number of Beds: 64 — Number of Beds at 1,200 Cubic Feet each: 32 — Deficiency in Bed Spaces: 32			
1. Reduction of the number of beds in each ward from eight to four	—	—	—
2. Ventilation of each ward by a shaft carried from the ceiling to above the roof, and by two inlets for air as described. Fire-grates to be remodelled. Stairs to be ventilated by a shaft of 12 inches square, carried through the roof, and by panes of perforated glass in the stair and passage windows. Kitchens to be ventilated by a shaft and panes of perforated glass in the windows	260	—	—
3. Waterclosets, a lavatory, and bath room with one bath and water laid on, to be provided for each hospital, and to be accessible from the stairs. Present hospital privies to be reconstructed as water latrines; the drainage to be disposed of as recommended for the barracks, and the existing cess-pit abolished	333	—	—
4. Manure pit near the hospital, belonging to officers' stables, to be removed	2	—	—
GALWAY CASTLE HOSPITAL.			
Number of Wards: 7 — Present Regulation Number of Beds: 40 — Number of Beds at 1,200 Cubic Feet each: 15 — Deficiency in Bed Spaces: 25			
1. Reducing the number of beds per ward to the extent shown in the table	—	—	—
2. Altering the interior by throwing down the partitions of the passages and those between the wards, as described. Scraping and lime-washing the whole of the interior walls and ceilings	21	—	—
3. Ventilating the wards by shafts, inlets, and remodelled grates, and making all the windows to open above and below. Ventilating the staircase by a shaft and perforated glass panes	132	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
GALWAY CASTLE HOSPITAL—*continued.*	£	£	£
4. Introducing a properly ventilated gas-burner into each ward -	57	—	—
5. Providing an ablution and bath room, with one bath, and hot and cold water laid on, within the building - - - -	50	—	—
6. Reconstructing the privies as water latrines, with drainage, and abolishing the cess-pit, connecting these latrines with the hospital by a covered passage. Removal of the large grating in the yard, and substituting for it properly trapped gulley a little below the level of the surface - - - - - -	140	—	—
ATHLONE BARRACK HOSPITAL.			
Number of Wards: 13 — Present Regulation Number of Beds: 86 — Number of Beds at 1,200 Cubic Feet each: 33 — Deficiency in Bed Spaces: 53			
1. To remove 53 beds out of it, in the proportions per ward given in the table, and to remove the orderlies' beds out of the wards -	—	—	—
2. To ventilate each ward by a shaft, two inlets, and a remodelled grate, and each staircase by a shaft and perforated glass panes -	467	—	—
3. To introduce a ventilated gas-burner into each ward - -	—	—	—
4. To provide an ablution room with a bath, and hot and cold water laid on - - - - - - - -	500	—	—
5. Privies in the back yard to be reconstructed as water latrines, with receptacles in which water will stand - - - -	50	—	—
6. Ash-pit to be removed, and the hospital refuse to be collected and taken away daily - - - - - -	43	—	—
Lastly. We beg to state, that rather than incur the cost of these works for the present hospital, it would in our opinion, be more for the interest of the service to provide a new hospital - -	—	—	—
BELFAST BARRACK HOSPITAL.			
Number of Wards: 9 — Present Regulation Number of Beds: 80 — Number of Beds at 1,200 Cubic Feet each: 55 — Deficiency in Bed Spaces: 25			
1. Reduction of the number of beds per ward to the extent specified -	—	—	—
2. Ventilation of all the wards by shafts, inlets, and remodelled grates as described. Ventilation of the staircase by a shaft and perforated glass panes - - - - - - - -	105/10	—	—
3. Gas to be laid on over the hospital, and a burner to be introduced into each ward - - - - - - -	100	—	—
4. Ablution room to have a proper ablution table, and a fixed bath with hot and cold water laid on - - - - -	145	145	—
5. Wash-house to be lighted and ventilated through the roof, and to have a drying stove put up - - - - -	64	—	—
6. Kitchen to be ventilated by a shaft and perforated glass panes -	10	—	—
7. Watercloset to be examined and improved. Privy in the yard to be reconstructed as a water latrine and better lighted - -	64	—	—
8. Ash-pit to be abolished, and iron cart provided - - -	34	—	—
9. Pack store to be provided with racks - - - -	10	—	—
10. Alteration in hospital privy sewer - - - -	11	11	—
Lastly. The question of providing hospital accommodation for the sick of soldiers' families ought to be considered at the same time as the question of providing married quarters for the barracks - -	—	—	—
LONDONDERRY BARRACK HOSPITAL.			
Number of Wards: 4 — Present Regulation Number of Beds: 30 — Number of Beds at 1,200 Cubic Feet each: 20 — Deficiency in Bed Spaces: 10			
1. Reduction of the number of beds in each ward to the extent shown in the table, and appropriating the unfinished upper flat for sick -	202	—	—
2. Ventilating and warming all the wards by shafts, inlets made out of the hollow beams, and remodelled grates. Ventilating the kitchen a shaft and perforated panes, and the passages by perforated panes	90	—	—
3. Introducing gas into the wards - - - - -	35	—	—
4. Providing an ablution and bath room with a fixed bath, a Macfarlane's ablution table, and hot and cold water laid on - - -	160	—	—
5. Abolishing the cess-pit in the yard, and converting the privy into a watercloset. Hospital ash-pit to be removed - - -	42	—	—

Digest of Sanitary Defects, and the Improvements required.	Total Estimate for Sanitary Works.	Items and Amounts Sanctioned.	Items and Amounts Postponed.
ENNISKILLEN BARRACK HOSPIEAL.	£	£	£
Number of Wards: 3 — Present Regulation Number of Beds: 37 — Number of Beds at 1,200 Cubic Feet each: 14 — Deficiency in Bed Spaces: 23			
1. Number of beds to be reduced from 37 to 14	—	—	—
2. Wards to be ventilated by shafts, inlets, and remodelled grates, the staircase by a shaft and perforated glass panes, and the kitchen by perforated panes	59	—	—
3. An ablution room, with a table, a bath with hot and cold water laid on, to be provided	31	—	—
4. A water-closet to be provided, and the hospital drained	96	—	—
5. A proper cooking range to be put up in the kitchen	12	—	—
6. Hospital storeage to be improved	83	—	—
NEWRY BARRACK HOSPITAL.			
Number of Wards: 7 — Present Regulation Number of Beds: 62 — Number of Beds at 1,200 Cubic Feet each: 25 — Deficiency in Bed Spaces: 37			
1. Reduction of the number of beds in each ward to the extent stated above	—	—	—
2. Removing the partitions between the staircase and wards, ventilating the staircase through the roof, and warming it by a Cunday's or some similar stove	29	—	—
3. Ventilating the wards by shafts, inlets, and remodelled grates of the usual construction	126	—	—
4. Providing a range or oven for, and ventilating the kitchen	43	—	—
5. Providing an ablution and bath room, and an ablution table, and bath with hot and cold water laid on to both	18	—	—
6. Abolishing the present privy and cess-pit, and providing a drained water-closet; the drainage to be carried into the barrack drainage, without passing under the hospital	193	80	—
7. Providing a hospital wash-house, with means of drying linen	289	—	—
There is, of course, no space in which to receive the sick of soldiers' families, a deficiency which should be supplied when the hospital is extended	—	—	—
DUNDALK BARRACK HOSPITAL.			
Number of Wards: 6 — Present Regulation Number of Beds: 28 — Number of Beds at 1,200 Cubic Feet each: 12 — Deficiency in Bed Spaces: 16			
1. Reduction of the number of beds to two in each ward	—	—	—
2. Ventilation of each ward by a shaft, inlet, and remodelled grate; windows to be hung with cords and pulleys	60	—	—
3. A bath and ablution room, with one bath and an ablution table, with hot and cold water laid on, to be built over the kitchen, communicating with the hospital	320/10	—	—
4. The serjeants' room to have a window to the back	5	—	—
5. A hospital wash-house to be provided	289	—	—
6. Privies in the yard to be reconstructed as water latrines, and drained to an outlet. Laying on water	34	—	—
7. Macfarlane's urinal	11	—	—

Table I.

Sanitary Improvements completed or in progress up to 30th June 1860, in accordance with the Recommendations of the Commission, abstracted from the Returns received from the Commanding Royal Engineers, for each of the under-mentioned Stations

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks
London District:				
Wellington Baracks	89 barrack rooms, ventilated; inlets at the floor closed. Non-commissioned officers' rooms ventilated. Gas burners, ventilated Additional baths provided. Drying apparatus for wash-houses Urinals improved. Latrines improved. Ashpits abolished Ventilating grates for barrack rooms. Guard rooms ventilated. Water supply improved	- -	None.	
St. George's Barracks	31 barrack rooms ventilated. Wash-house improved, and drying stove provided. Cooking apparatus improved. Latrines and urinals improved. Ablution rooms improved. More baths provided. Ashpit improved. Guard room and shoe-maker's shop ventilated	- -	None.	
Waterloo Barrack, Tower	41 barrack rooms ventilated. Non-commissioned officers' rooms, kitchen, school room, library, guard room, and lock-up ventilated. Barrack room windows enlarged Water supply improved. Drying closet for wash-house Water latrines provided Means of roasting meat provided in the kitchen Ventilating fire grates	- -	None.	
St. John's Wood Barracks	11 barrack rooms and the non-commissioned officers' rooms ventilated. Increased bath accommodation. Drying stove for wash-house. Latrines and urinals improved. Parade ground better drained. Ashpit improved Roasting oven for cook-house	- -	None.	
Magazine Barrack, Hyde Park	Five rooms and guard room ventilated. Wash-house provided. Roasting oven for kitchen. Latrines improved, and latrine provided for guard room. Ashpit removed Water supply improved	- -	None.	
Knightsbridge Cavalry Barrack	50 barrack rooms, the non-commissioned officer's rooms, married quarters, and workshops ventilated Stables ventilated, and position of doors altered Improved cooking apparatus for cook-house Improvements in latrines. Two ablution rooms, and four baths provided Drying stoves and other improvements in wash-houses	- -		

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
London District—*cont.*				
Regent's Park Cavalry Barrack	33 barrack rooms and the workshops ventilated. Additional windows to passages Parade ground under-drained. Bath and ablution accommodation extended Improved water supply. Roasting oven for kitchen. Drying stove for wash-house. Improvement in latrines. Improvement in manure heaps Ventilating fire grates for rooms Improvements in drainage	—	—	
Kensington Palace New Barrack	Improvement in drainage	—	—	
Windsor Cavalry Barrack	34 barrck rooms ventilated Roasting oven for kitchen. Baths provided. Improved ablution arrangements Improvements in latrines. Drying stove for wash-house Urinals provided. Ventilating fire-grates for rooms Ashpits improved	- -	None.	
Windsor Infantry Barrack	43 barrack rooms ventilated; also non-commissioned officers' rooms Improved ablution rooms and baths Water latrines provided. Urinals re-constructed Drying closet for wash-house Ventilation of guard room and cells Ventilating fire grates for barrack rooms	- -	None.	
Hampton Court Cavalry, Old Barrack	Two barrack rooms ventilated Roasting oven for kitchen. Water latrines provided. Baths provided, and ablution room improved Drying stove for wash-house Improved water supply	—	—	
Hampton Court Cavalry, New Barrack	Six barrack rooms ventilated Bath provided, and ablution room improved. Roasting oven for kitchen. Drying stove for wash-house. Barrack drained Privies re-constructed as water latrines Dung pit improved Improved water supply	—	—	
Croydon Barracks	18 barrack rooms ventilated. Ablution rooms improved. Baths provided Roasting oven for kitchen Latrines improved Ashpits improved Ventilating fire grates for rooms	- -	None.	
Hounslow Cavalry Barrack	29 barrack rooms ventilated Stables ventilated Baths provided Ablution rooms improved. Wash-house improved. Water latrines provided. Urinals improved Roasting oven for cook-house. School, chapel, guard room, and shops ventilated Improved water supply. Ventilating fire grates for rooms Building boundary wall Enlarging forge	- -	No.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Chatham District:				
Chatham Barracks	Main guard room enlarged to afford 600 cubic feet per man Two drill sheds. Ventilation of 180 barrack rooms, orderly room, guard rooms, lock-up, two school-rooms, and library by shafts and inlets. Ventilation of gas-burners. Boarded floors substituted for asphalted floors in barrack rooms. Foul bedding store provided. Additional light and ventilation to ablution rooms. Four additional baths, gratings, and pegs New and complete laundry establishment for the barracks	- -	None	The required cubic space per man could only be given at Chatham by reducing the strength above 40 per cent., or by erecting new barracks in that proportion.
Garrison Hospital	Thirty-eight wards in garrison hospital ventilated by shafts and inlets. Urinals in water-closets of ditto. Covered walk for convalescents' ditto. Reconstruction of kitchen do.			
Fort Pitt Hospital	Improvements in kitchen of Fort Pitt hospital. Ditto provision and bedding store ditto			
St. Mary's Casemates	Ventilation of gas-burners. Boarded floors substituted for asphalted floors. Roasting ovens in two kitchens. Improvements in wash-houses. Ventilation of guard room	- -	None.	
Brompton	Ventilation of 113 barrack rooms, lock-up room, and guard room, by shafts and inlets. Boarded floors substituted for asphalted floors. Additional light to some barrack rooms. Bake-house erected, with oven for roasting meat Tank tower for unlimited supply of water to Chatham, Brompton, the huts, St. Mary's casemates and the garrison hospital Under-ground water tanks abolished, and tanks above ground for rain water provided	-	None.	
Hut Barracks	Ventilation of 20 huts. Dril shed erected	-	None.	
Maidstone Barracks	Ventilation of 20 barrack rooms by shafts and inlets. Additional light by sky-lights. Ventilation of non-commissioned officers' rooms	-	None.	
Maidstone Hospital	Ventilation of hospital, 5 wards. Reconstruction of hospital water-closets	—	—	
Dover District:				
Spur Battery	Floors dividing the casemates into two flats removed. Wooden floors substituted for asphalte floors in the casemates and guard room. Eight casemates, guard room, and privies ventilated. More light given to the latter. Two ovens put up	Ventilating grates for these rooms supplied by the contractor, but not yet set	None.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Dover District—*cont.*				
Keep Yard - -	Ventilation of seven barrack rooms by shafts and inlets - Ventilation of non-commissioned officers' rooms - - Windows enlarged to increase the light. Additional ventilation, light and pegs to ablution rooms. New bath rooms and five cold water baths. Oven for kitchen. Cess-pits of officers' quarters abolished. Water-closets and drainage provided. Ventilation of three latrines. A women's wash-house with drying stove provided - -	Ventilating grates supplied; two set.	None.	
Cliff Casemates -	Ventilation of nine casemates by foul air flues and perforated glass panes. Ventilation of kitchen. Two ovens for roasting and baking. Ventilation and flushing of two privies, and latrines improved -	Ventilating grates supplied, but not yet set -	None.	
Guard Room, New Entrance - -	Ventilation by perforated glass panes and Arnott's ventilator.			
Dover Castle Hospital - - -	Ventilation of four wards by shafts and inlets. Ventilation of water-closets. Abolition of cess-pits. Two water-closets, two baths, and two ablution rooms added to left wing. Additional light to privy -	Ventilating grates supplied, but not yet set -	None.	
Dover, Western Heights - -	Ventilation of 51 barrack rooms by shafts and inlets. One guard room, eight ablution rooms, and four urinals ventilated - - - Two ovens for roasting. Additional ablution rooms, and ten cold water baths - - Cisterns for these rooms - - Washing and drying establishment - - - - Half doors to latrines - - Sewer at the bottom of grand shaft ventilated - - Gulley traps for gratings. New guard room and cells, and water latrines at foot of grand shaft - - - Water latrine and urinal for 2nd infantry guard room - Lock-up room of 2nd infantry converted into tailor's shop, and tailor's shop into cells -	Ventilating grates supplied, but not yet set -	None.	
Drop Redoubt -	Ventilation of four casemated barrack rooms by perforated panes, and eight ventilating fire-grates. Light and pegs to ablution room. Divisions and half doors to latrines. Two new slate urinals - -	- -	None.	
Citadel - - -	20 casemates ventilated by perforated glass panes. Chappuis' reflectors fixed to give light to ablution room and cook-house in long casemates. Ventilation of four ablution rooms. One bath. Oven for baking. Half doors to latrines -			
Western Heights Hospital - -	12 wards and the passages ventilated by shafts. Upper window sashes made to open. Pack-store racks - - -	Ventilating fire-grates supplied, but not yet set -	None.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Dover District—*cont.*				
Hythe	Shafts and inlets for air in 12 barrack rooms, one guard room and meat house. New sashes and frames for barrack room windows. Ablution rooms, two baths, and pegs. A roasting oven for kitchen. Divisions, half doors, and extra light to latrines Reconstruction of urinals Shafts for air in guard room and meat house Laundry and drying stove Repairing paving in back yard Increased water supply	Remodelling 12 fire-grates for heating air in barrack rooms	None.	
Hythe Hospital	Ventilation of four wards Two baths provided New kitchen range with oven and boiler Alteration of watercloset Ventilation of kitchen and surgery	-	None.	
Shorncliff Permanent Barracks	Ventilation of eight barrack rooms One bath Privies converted into water latrines Urinal reconstructed Barrack room fire-grates remodelled to warm the admitted air	- -	None.	
Shorncliff Temporary Barracks	Eight roasting ovens put up Alteration of ablution benches Gratings and pegs in ablution rooms Forty baths put up Reconstruction of 10 urinals Wooden gratings to women's wash-house			
Shorncliff Hospital	Exercising ground for convalescents			
Canterbury Cavalry	Ventilation of 30 barrack rooms, one serjeants' mess, and one school-room, by shafts and inlets. 22 ventilating fire-grates fixed Ventilation of stables by shafts and perforated panes Ventilation and lighting of two central corridors Ventilation of 23 non-commissioned officers' rooms, and married quarters. Light and ventilation to three workshops	Other ventilating fire-grates supplied, but not yet fixed	None.	
Canterbury Royal Artillery and North Gate	Ventilation of 32 barrack rooms, serjeant's mess, and libraries by shafts and inlets. Additional light to barrack rooms	- -	None.	
Permanent Infantry	Ventilation of 42 barrack rooms	Ventilating fire-grates supplied, but not yet fixed	None.	
Canterbury, the whole Barracks	Five new cooking apparatus Pegs and gratings for ablution rooms Ventilation of four guard rooms	—	—	
Canterbury Hospital	Ventilation of 20 wards by shafts, inlets, and ventilating fire-grates. Ventilation of guard room. Two new cooking ranges for kitchens	- -	None.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Dover District—*cont.*				
Walmer South Infantry - -	Ventilation of 24 barrack rooms. Ventilating fire-grates supplied and fixed. Ventilation of four married soldiers' attics, and of non-commissioned officers' rooms - - - -	- -	None.	
	Ventilation of cook-houses -			
	Improved means of roasting meat			
	Ablution rooms repaved, ventilated, provided with pegs and gratings. Bath houses with four cold water baths -			
	Divisions, light, and ventilation for latrines. Ventilation of guard room and lock-up by shafts and remodelled grates -			
Walmer Cavalry -	Ventilation of 10 barrack rooms by shafts and inlets. Ventilating fire-grates supplied and fixed. Ventilation of two non-commissioned officers' rooms.	- -	None.	
	Ventilation of stables by shafts and perforated panes. Ventilation of kitchen, ablution room, and bath room. Oven for roasting, and three boilers -			
	2 cold water baths in bath house			
Walmer, North Infantry - -	Ventilation of 12 barrack rooms, library, and seven non-commissioned officers' rooms. One ventilating fire-grate supplied and fixed - - -	-	None.	
	Ventilation of guard room by shaft, and remodelled fire-grate			
	Ventilation of latrine - -			
	Ventilation, grating, benches, paving, repairs, &c., of ablution rooms - - -			
	Cook-house ventilated - -			
	Oven made to roast. Bath-house and four baths put up -			
Walmer Hospital -	Ventilation of seven waterclosets	-	None.	
	Removal of small wards out of the stairs, and ventilation and warming of staircases - -			
	The whole of the barracks at Walmer have been lighted with gas.			
Exeter District:				
Exeter Cavalry Barrack - -	Ventilation of 24 barrack rooms, library, and reading room by shafts and inlets - -	- -	None.	
	Ventilation and lighting of two inner corridors - -			
	Ventilating one guard room, 12 non-commissioned officers' rooms, serjeants' mess, and three canteen rooms - -			
	26 ventilating fire-grates provided for barrack rooms, library, and guard room - -			
	15 additional windows for barrack rooms - - -			
	Ventilation of 10 troop and 6 officers' stables and additional light to ditto by 24 windows -			
	Ventilation and additional light for two kitchens. Two roasting ovens - - -			
	Ventilation of two ablution rooms			
	Ventilating and lighting two latrines - - -			
	Reconstructing four urinals -			

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Exeter District—*cont.*				
Exeter Cavalry Hospital	Ventilating six hospital wards Remodelling six fire-grates to warm admitted air Ventilating two passages and corridors Two additional windows to water-closet lobbies Ventilating kitchen and cooking range provided	- -	None.	
Exeter Artillery Barrack	Ventilating 28 barrack rooms and three non-commissioned officers' rooms. Remodelling 29 fire-grates to warm admitted air. Ventilating eight staircases and one guard room Providing 61 additional windows Ventilating three canteen rooms Constructing four ablution and four bath rooms Two ventilating ovens provided for cook-houses Ventilation of four ablution rooms and two wash-houses Four privies reconstructed as water latrines. Drainage outlet reconstructed	- -	None.	
Exeter Artillery Hospital	Ventilating six hospital wards by shafts, inlets, and remodelling six fire-grates Ventilating staircase and kitchen Providing a new cooking apparatus Ventilating wash-house and providing suitable apparatus Converting two privies into water latrines Reconstruction of bath room and providing one bath Drainage of hospital Ward windows made to draw down at top	- •	None.	
Horfield Barracks, Bristol	Ventilation of 30 barrack rooms, 18 non-commissioned officers' rooms, reading room, and guard room. Ventilating eight staircases Remodelling 32 fire-grates Improving seven ablution rooms, cook-houses, and wash-houses Ventilation of 18 troop and six officers' stables Two baths with water laid on Two ventilating roasting ovens for cook-houses. Hot plate in cavalry cook-house Six privies converted into water latrines. Drainage reconstructed	- -	None.	
Horfield Hospital	Ventilation of six hospital wards, one staircase, and one kitchen. Two water-closets provided	- -	None.	
Gloucester Hotel Barrack, Bristol	Ventilation of 11 barrack rooms, one guard room, and cell Drying room for great coats One bath provided	- -	None.	
Gloucester Hotel Hospital	Ventilating two hospital wards and staircase	- -	None.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Western District:				
Raglan Barracks	Providing baths in ablution room Ovens to each cook-house Macfarlane's water latrines	Remodelling fire-grates.	Nil.	
New Artillery Barracks	Introduction of gas Oven for cook-house	Do.	Nil.	
Granby Barracks	Introduction of gas Oven for cook-house	Do., and re-constructing privies.	Nil.	
Mount Wise Barracks	Introduction of gas Oven for cook-house Privies re-constructed as water latrines	Remodelling fire-grates.	Nil.	
General Military Hospital, Stoke	Introduction of gas, with ventilated burners	Remodelling fire-grates.	Nil.	
Bull Point Barracks	Oven for cook-house	Do.	Nil.	
Plymouth Citadel	Oven for cook-house	Do., providing baths, one for every 100 men.	Nil.	
Maker Barracks	Nil	Remodelling fire-grates.	Nil.	
Portsmouth District:				
Anglesea Barracks	Ventilation of 54 barrack rooms, library, and guard room Ventilation of gas-burners Abolition of cess-pits, and six privies converted into water latrines. 10 water-closets provided for officers. Five urinals improved and supplied with water Six roasting ovens provided for soldiers, one for officers Baths provided Ablution rooms improved Two ash-pits reduced in size and two covered	-	None.	
Colewort Barracks	Ventilation of 24 barrack rooms Drainage; three water latrines, and three officers' water-closets provided. Ablution rooms improved Three baths provided Four roasting ovens in cook-house Laundry improved Ash-pit improved	Remodelling fire-grates	None.	
Cambridge Barracks	Ventilation of 27 barrack rooms. Six fire-grates remodelled Ventilation of gas-burners Ablution-room improved. Four baths provided. Latrines and ash-pits improved. Three officers' water-closets provided. A new kitchen and six roasting ovens provided Ventilation of kitchen, library, and reading room	Remodelling fire-grates	None.	
Clarence Barrack	Ventilation of 64 barrack rooms Six new latrines with drainage constructed, or improved. Ash-pit reduced and covered in. Two iron carts provided Five roasting ovens for kitchen Three baths provided. Ablution room improved	-	None.	
Point Battery	Ventilation of four casemates Remodelling four fire-grates New kitchen range Ablution room with bath provided Privies converted into water latrines. One officers' water-closet. Ash-pit improved	-	None.	

Barracks.	Sanitary Works Completed	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Portsmouth District—*cont.*				
Garrison Hospital	25 wards ventilated, and four warm air stoves placed in stairs Ablution room improved, and four baths with hot and cold water, one shower bath and four cold water baths provided	- -	None.	
Auxiliary Hospital	Three wards ventilated, ablution room improved, and two baths provided - - -	- -	None.	
Block-house Fort, Gosport - -	Five barrack rooms ventilated - Guard room ventilated. Cupboards placed in soldiers' rooms Oven for roasting put up in the kitchen - - - One bath, one ablution room - Privies improved - -	Providing ventilating fire-grates	—	
Haslar Barrack -	Ventilation of 36 barrack rooms. Cupboards provided. Chapel school improved. New ablution room built. Baths provided - - - Oven provided in cook-house - Ash-pits improved - -	Providing ventilating fire-grates	—	
Haslar Barrack Hospital.	Four wards ventilated - - Ablution room built, with bath. Oven provided in kitchen -	Providing ventilating fire-grates	None.	
Fort Monckton -	Ventilation of 20 casemates and upper rooms. Cupboards provided. Roasting ovens for cook-house. Ash-pits improved - Baths provided - - -	Providing ventilating fire-grates -	None.	
Winchester Barrack	145 rooms ventilated - - Gas introduced. Cupboards provided - - - Six roasting ovens in cook-houses - - - - Four ablution rooms lighted and slightly improved - - Guard room and school ventilated 96 married quarters erected, with laundry complete - -	- -	None.	
Winchester Hospital	Ventilation of 12 wards. Ablution room improved. Two baths provided. Two warm air stoves in passages - -	- -	None.	
Chichester Barracks	Four barrack rooms ventilated and provided with remodelled grates - - - Nine married soldiers' barracks ventilated - - - Two school-rooms and serjeants' mess, guard room and cells ventilated - - - Four roasting ovens in cook-houses - - - Two cook-houses ventilated - Six baths provided - - Ablution rooms, kitchens, and ash-pits improved, and new laundry erected - -	- -	None.	
Chichester Hospital	Ventilation of six wards - Six remodelled fire-grates - Ablution room improved, covered way constructed, and gutters provided - - - Ablution room, kitchen, and dead-house ventilated -	- -	None.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Woolwich District:				
Woolwich	Ventilation of barrack rooms in east and west squares, front and rear ranges, by shafts and inlets Ventilation of guard rooms, lock-up rooms, and library Ventilation of non-commissioned officers' rooms and workshops, in all 241 rooms Putting in 16 additional windows 35 baths with water laid on Reconstruction of privies as water latrines Reconstruction of urinals Introducing one Benham's improved cooking apparatus. Ditto one Radley's improved cooking apparatus. Ditto one Benham's ditto	-	None.	Four additional baths estimated for.
	Roasting ovens in cook-houses of hut barracks Improvements in ablution room of ditto	-	-	One bath estimated for.
Woolwich Hospital	Ventilation of wards, corridors, staircase, and passages. Additional windows to large wards Baths and ablution rooms accessible from the wards, with hot and cold water Fitting up and altering the position of prisoners' wards Reconstruction of latrines with water supply Introducing gas over the hospital Guard room removed from within the hospital, and a new guard room erected outside	-	None.	
Yorkshire District:				
York Cavalry	Ventilation of 26 barrack rooms, guard room, and school-room, by shafts and inlets Ventilation of non-commissioned officers' rooms and mess room Ventilation and lighting of passages by perforated glass panes, shafts, and skylights Attics plastered, and additional dormers, and ventilation through the roof	Remodelling fire-grates	None.	
	Ventilation and lighting of stables by shafts and additional windows Ventilation of forge, shoeing shed, tailors', shoemakers', and armourers' shops, library, and reading room, canteen tap, and non-commissioned officers' room. Riding school, skylights and ventilation through the roof Ablution rooms improved, bath rooms improved, and two baths provided with water laid on Manure pits filled up and new ones provided at a greater distance from the barracks	Drainage of barrack	None.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Yorkshire Dist.—*cont.*				
York Hospital -	Ventilation of four wards by shafts, inlets, and remodelled grates - - -	- -	None.	
	Ventilation of staircase and kitchen - - -			
	Additional window for water-closet - - - -			
	A bath and ablution room constructed, with fixed bath and ablution tables, supplied with hot and cold water, and covered passage from the hospital -			
Leeds Cavalry -	Ventilation of 28 barrack rooms by shafts, inlets, and remodelled grates - - -	- -	None.	
	Ventilation of non-commissioned officers' rooms - -			
	Ventilation and lighting of corridors by shafts, skylights, and perforated panes - -			
	Ventilation of library, guard room, serjeants' mess, tailors' and saddlers' shop, adult and infant school room, canteen, cells, paving and drainage of stables - - -			
	Riding school lighted and ventilated - - - -			
	Stables ventilated by shafts in each corner - - -			
	Gas introduced into barrack rooms - - -			
	Ventilation of cook-houses -			
	Cavalry exercising ground under-drained - -			
	Improvements in ablution room. Two baths - - -			
	Reconstruction of three latrines and urinals - - -			
	Improvements in women's wash-house - - -			
	Abolition of cess-pits and drainage of barrack - -			
Leeds Cavalry Hospital - - -	Ventilation of four wards by shafts, inlets, and Arnott's ventilators - - -	- -	None.	
	Ventilation of passage - -			
	Introducing gas into wards -			
	Erecting lavatory and bath room. One bath with hot and cold water - - -			
	Gutter and drain in front of hospital covered - - -			
Bradford - -	Ventilation of 20 barrack rooms, and guard room by shafts and inlets. Passages ventilated, huts ventilated -	- -	None.	
	Non-commissioned officers' rooms ventilated - - -			
	Passage to cells ventilated -			
	Parade ground under-drained -			
	New ash-pit filled up to the level of the ground, paved, and drained - - -			
	Old ash and manure pits removed, and ground levelled - -			
	Erection of ablution room with two baths - - -			
	Improving ablution room of hut barracks - - -			
Bradford Hospital -	Ventilating four wards -	- -	None.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Manchester District:				
Ashton Barracks	Ventilation of 20 barrack rooms, guard room, school-room, and library Improvement in ablution room. One bath. Two ovens	- -	None.	
Ashton Hospital	Ventilation of five hospital wards and kitchen Providing bath room, one bath and lavatory	- -	None.	
Bury Barracks	Ventilation of 20 barrack rooms, guard room, library, and school room by shafts and inlets Improvement in ablution rooms One bath. Two roasting ovens Laying on town's water	- -	None.	
Bury Hospital	Ventilation of five wards and kitchen Providing bath room, one bath and lavatory	- -	None.	
Burnley Barracks	Ventilation of 23 barrack rooms and corridors, reconstruction of boilers. Two roasting ovens Improvement in ablution rooms. Bath provided Ventilation of stables	- -	None.	
Burnley Hospital	Ventilation of three wards. Oven for kitchen. One fixed bath	- -	None.	
Manchester Cavalry Barrack	Ventilation of 40 barrack rooms, guard room, school, workshops, and library Ventilation of corridors Ventilation of 20 troop and 60 officers' stables Improvements in lavatory One bath provided Cook-houses better lighted. Two roasting ovens and new boilers Introducing town's water	- -	None.	Four foul-air shafts were recommended for each stable, but only one was authorized and supplied.
Manchester Cavalry Hospital	Ventilation of seven wards Lighting and ventilating kitchen Drainage of back yard improved	- -	None.	
Manchester Infantry	Ventilation of 59 barrack rooms, school-room, guard room, and cook-houses. Three roasting ovens Laying on gas to six rooms	- -	None.	
Manchester Infantry Hospital	Ventilation of eight wards New cooking range in kitchen Ventilation of gas-burners	- -	None.	
Preston Barracks	Ventilating 75 barrack rooms, stables, chapel school, and tailors' shop Four baths Ventilation of cook-houses. Four roasting ovens Ventilation of gas-burners	- -	None.	
Preston Hospital	Ventilation of 12 wards Ventilation of gas-burners	- -	None.	
Stockport Barrack	Ventilation of 10 barrack rooms, library, and guard room Improving ablution room A bath provided A roasting oven for cook-house	- -	None.	
Stockport Hospital	Ventilation of four wards Additional windows Removing kitchen outside the hospital Water tap to sink in surgery	- -	None.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Midland District:				
Birmingham Barracks	21 barrack rooms ventilated and 20 fire-grates remodelled 16 new windows in dark ends of rooms Perforated glass panes over doors Ventilation of 40 gas-burners Additional window space in stables Ditto in riding school Ventilation of six non-commissioned officers' rooms, serjeants' mess, school-room, guard room, and cells. 14 stables, library, and canteen Additional window space in 14 stables Two corridors lighted and ventilated	-	None.	
Birmingham Hospital	Roof of verandah glazed, and latrine furnished with skylight Three wards and kitchen ventilated Three fire-grates remodelled Staircase and passage ventilated Bath and ablution room, with hot and cold water laid on provided	-	None.	
Coventry Barracks	Ventilation of 16 barrack rooms Two remodelled grates in barrack rooms Louvres in passages reversed Ablution rooms improved, and skylights provided Company's water laid on	Ventilation of stables. Beads for ablution benches. Laying on water to baths	None.	
Weedon	34 barrack rooms, four non-commissioned officers' rooms, two guard rooms, and canteen ventilated Ventilating gas-burners 13 remodelled fire-grates introduced Stables ventilated	Inlets for air in east and west lofts	None.	
Weedon Hospital	Six wards ventilated and remodelled fire-grates introduced, gas-burners ventilated. Wash-house and bath-room ventilated. Water latrines and two water-closets provided. New bath put up. Ash-pits abolished, and cart supplied. Drains trapped	Hot water pipes for baths. Drying closet, boilers, &c. for wash-house; ventilation of staircase.	None.	
North British District:				
Leith Fort	New oven for cook-house	None.	None.	
Edinburgh Castle	Benham's cooking apparatus	None.	None.	
Ayr Barracks	Converting two kitchens into ablution rooms, with baths, water laid on, ventilation, &c. Privies re-constructed as water latrines. Urinals re-constructed. Water laid on to barracks	None.	None.	
Glasgow Recruiting Barrack	Building an oven	None.	None.	
Glasgow Barrack	Ablution houses fitted up with Macfarlane's basins Baths provided. Ashpits covered. Urinals provided	None.	None.	
Hamilton Barrack	Providing water latrines instead of privies	None.	None.	
Ditto Hospital	Providing water latrines	None.	None.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospials.	Remarks.
North British District —*cont.*				
Paisley Barrack -	Privies re-constructed as water latrines - - -	None.	None.	
Stirling Castle -	Kitchen ventilated - -	None.	None.	
	Bath provided - - -			
	Flagged soldiers' rooms boarded			
Aberdeen Hospital -	Bath provided - - -	None.	None.	
Aberdeen Four-Gun Battery - -	Water latrine - - -	None.	None.	
Fort George Hospital - -	Dead house and wash-house provided - - -	—	—	
Dublin District:	105 barrack rooms ventilated -	Ventilation of other barrack rooms in progress		
	Guard room ventilated - -			
	Ventilation of corridors and staircases in Palatine square -			
Royal Barracks -	Ventilation of 36 stables -	Ventilation of other corridors and staircases in progress	None.	
	Additional lightto soldiers' rooms and shoemakers' shop -			
	Two improved urinals constructed - - -			
	Opening additional windows -			
	Removing manure pit - -			
Portobello Barracks - -	Ventilation of 40 barrack rooms, 22 non-commissioned officers' rooms, and 3 guard rooms -	- -	None.	
	Ventilation of stables under barrack rooms - - -			
	Waterclosets provided for artillery hospital - - -			
Portobello Hospital - - -	Ventilation of eight wards -	- -	None.	
	Waterclosets for cavalry hospital			
	Two baths provided - -			
Beggars Bush Barracks - -	Ventilating 15 barrack rooms and 1 guard room - -	- -	None.	
Beggars Bush Hospital - -	Ventilating ward, staircase, and waterclosets - - -	- -	None.	
Ship Street Barrack	Ventilating 39 barrack rooms, 11 non-commissioned officers' rooms, 2 serjeants' mess rooms, and 2 school rooms - -	- -	None.	
	Reconstruction of 3 latrines -			
Ship Street Hospital	Ventilating 11 wards and 2 kitchens - - -	- -	None.	
	Lighting staircases in old barracks			
	Perforated glass panes in windows - - -			
	Ventilation of stables - -			
Island Bridge Barracks - -	Ventilating 12 barrack rooms, and 2 serjeants' rooms -	-	None.	
	Additional windows in ground floor rooms - - -			
	Additional light and ventilation in 2-story buildings -			
	Ventilation of canteen - -			
Richmond Barracks	Ventilating 74 barrack rooms and 1 serjeants' mess, 1 reading room, and 1 infant school -	- -	None.	
	Reconstruction of privies and urinals - - -			
	Racks for pack store - -			
	Ventilating and lighting privies			
	Constructing ablution and bath room - - - -			
Richmond Hospital	Converting disused chimneys into foul air shafts - -	- -	None.	
	Four wards supplied with ventilating fire-grates - -			
	Ventilating 15 wards, staircases, and passages - -			
Royal Military Infirmary - -	Lowering sills of ward windows	- -	None.	
	Introducing gas, with ventilation over burners - -			

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Cork District:				
Cork Barracks	14 ovens for cook-house 8 baths provided	Improvement of surface drainage in rear of cavalry stables	Nil.	
Cork Hospital	Ablation room, with 13 basins provided Two general baths and two shower baths New kitchen range Water tank removed out of kitchen	Nil.	Nil.	
Ballincolig Barrack	Four ovens and two water tanks provided	Deepening two wells. Sinking two wells.	Nil.	
Ditto Hospital	Provision store fitted up	Nil.	Nil.	
Kinsale Barracks	Three ovens provided	Nil.	Nil.	
Charles Fort ditto	One oven for cook-house	Nil.	Nil.	
Spike Island ditto	One oven for cook-house	Nil.	Nil.	
Camden Fort ditto	One oven for cook-house	Nil.	Nil.	
Carlisle Fort ditto	One oven for cook-house	Nil.	Nil.	
Haulbowline ditto	Ablation room and bath room provided Oven for cook-house	Nil.	Nil.	
Fermoy Old Barracks	Four baths Four ovens 82 rooms ventilated Guard house re-constructed and ventilated	Nil.	Nil.	
Fermoy Cavalry Barracks	18 rooms ventilated	—	—	
Fermoy Old Hospital	18 wards ventilated Ablation room, with two baths, and hot and cold water laid on	Improving water supply.	Nil.	
Fermoy New Barrack	Three baths Three ovens 78 barrack rooms ventilated Guard room and lock-up ventilated	Re-construction of one privy.	Nil.	
Fermoy New Hospital	11 wards ventilated	Nil.	Nil.	
Buttevant Barrack	Two ovens Temporary ventilation of guard room and lock-up	Nil.	Nil.	
Ditto Hospital	Nine wards ventilated	Re-construction of hospital privies	—	
Tralee Barracks	Two ovens in cook-house	Nil.	Nil.	
Ditto Hospital	Ventilation of two wards	Nil.	Nil.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Curragh District:				
Newbridge Barrack	Ventilation of 52 barrack rooms and one guard room Two baths provided Two ovens in cook-houses Seven waterclosets in officers' quarters	Nil.	Nil.	
Ditto Hospital	10 wards ventilated	Nil.	Nil.	
Parsonstown Barracks	108 barrack rooms and two guard rooms ventilated Four baking ovens	Nil.	Nil.	
Parsonstown Hospital	12 wards ventilated Two bath rooms Renewing window sashes Covering open drain in rear of hospital Improving water supply	Nil.	Nil.	
Kilkenny Barrack	42 barrack rooms and two guard rooms ventilated Four waterclosets in officers' quarters Two bath rooms Two ovens for cook-houses	Nil.	Nil.	
Ditto Hospital	Nine hospital wards ventilated Four waterclosets for hospital One bath room One oven in kitchen	Nil.	Nil.	
Duncannon Fort Hospital	Ventilation of two wards	—	—	
Limerick District:				
Limerick New Barracks	72 barrack rooms and 24 serjeants' rooms ventilated Two guard rooms ventilated Two orderly rooms, ditto Gas introduced Two ovens in cook-house Chapel school ventilated	None.	None.	
Limerick Hospital	10 hospital wards ventilated Gas introduced	None.	None.	
Artillery Barracks	10 barrack rooms ventilated One guard room, ditto One orderly room, ditto One serjeant's room, ditto One infants' school, ditto One bath room and bath provided One water latrine Gas introduced	None.	None.	
Ditto Hospital	Four wards ventilated One bath Hospital drained Gas introduced	None.	None.	
Limerick Castle Barracks	Ventilation of barrack serjeant's quarters, guard room, and canteen	None.	None.	
Templemore Barracks	Ventilation of— 71 barrack rooms 37 serjeants' rooms One serjeants' mess One reading room One infant school One lecture room One guard room Seven baths provided Three ovens erected and cook-house ventilated Drainage improved Waterclosets for officers' quarters Canteen ventilated	None.	None.	

Barracks.	Sanitary Works Completed.	Sanitary Works in Progress.	Progress made in affording 600 Cubic Feet per Man in Barracks, and 1,200 Feet in Hospitals.	Remarks.
Limerick District—*cont*				
Templemore Hospital	10 wards ventilated	None.	None.	
Cahir Barrack	Ventilation of— 24 barrack rooms 15 serjeants' rooms One guard room One school room One library One canteen Water latrine erected Oven for cook-house One cell and dry room for guard house One tailor's shop erected Fire-grates remodelled in barrack rooms and library	Improving water supply. Constructing filtering tank for sewage.	—	
Ditto Hospital	Five hospital wards ventilated Wash-house enlarged and light improved	None.	None.	
Clonmel Barrack	Ventilation of 39 barrack rooms and eight serjeants' rooms Wash-house improved One bath erected One oven for cook-house One cook-house ventilated and better lighted Gas introduced	Converting privies into water latrines.	None.	
Clonmel Hospital	Seven wards ventilated Kitchen, store room, surgery, serjeants' room, and passages ventilated Gas introduced	—	—	
Waterford Infantry Barrack	23 barrack rooms ventilated One school-room, ditto One oven for cook-house Urinals re-constructed	None.	None.	
Waterford Infantry Hospital	Four wards ventilated	—	—	
Waterford Artillery Barracks	Ventilation of— 8 barrack rooms One guard room Two staff serjeants' quarters Drains trapped One oven for cook-house Two baths and ablution room provided	—	—	
Waterford Artillery Hospital	Ventilation of two wards and one surgery Watercloset and bath room constructed	—	—	
Belfast District:				
Belfast Infantry Hospital	Alteration of privy sewer	—	—	
Newry Hospital	Removal of old privies	—	—	
Enniskillen Marine Barrack	New cook-house erected	—	—	

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OF

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