A manual of public health for the use of local authorities, medical officers of health, and others / by W.H. Michael, W.H. Corfield, and J.A. Wanklyn ; edited by Ernest Hart.

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Publication/Creation

London : Smith, Elder, 1874.

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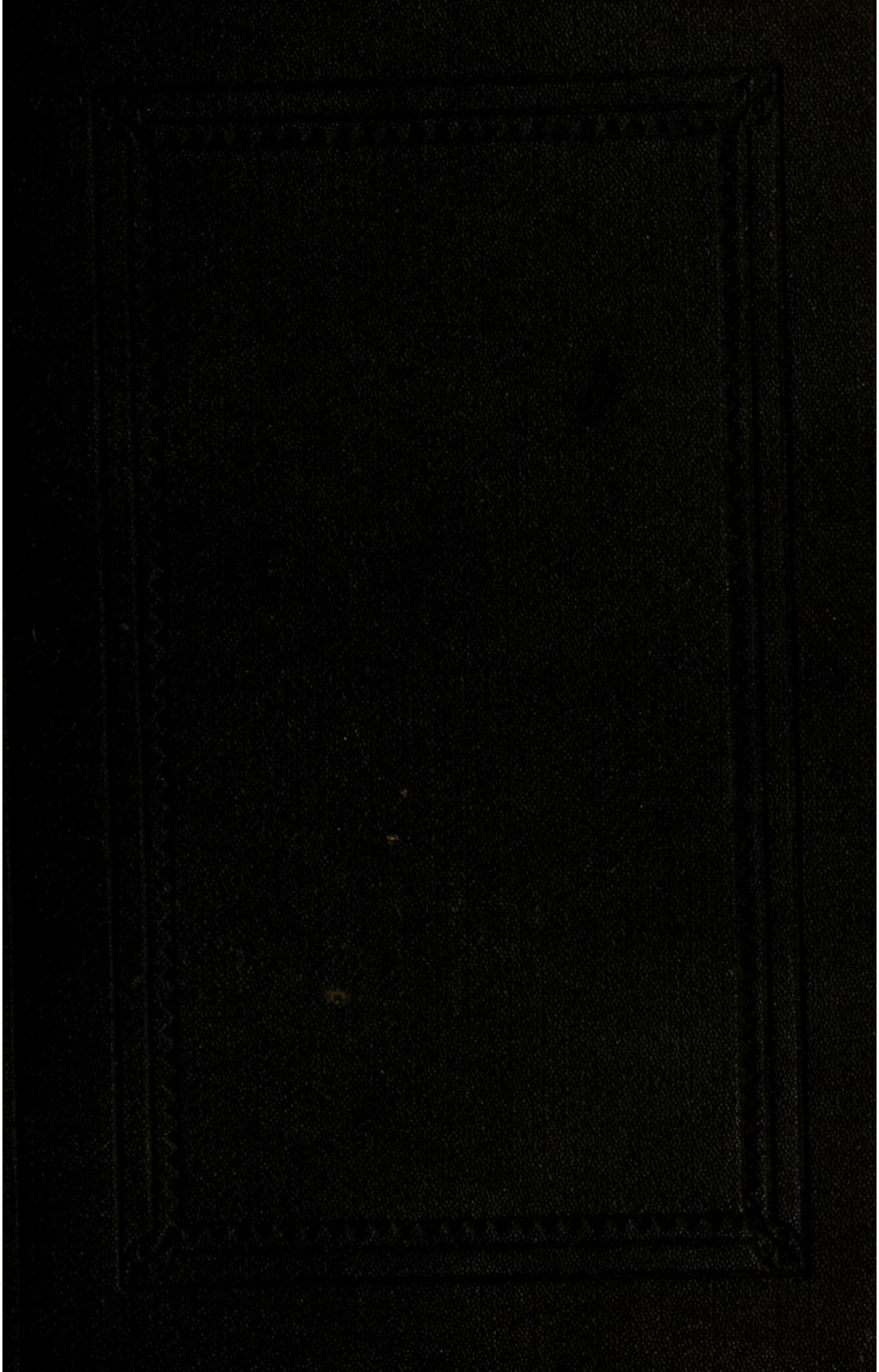

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MANUAL OF PUBLIC HEALTH

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MANUAL OF PUBLIC HEALTH

FOR THE USE OF

LOCAL AUTHORITIES, MEDICAL OFFICERS OF HEALTH

AND OTHERS

BY

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LONDON

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INTRODUCTION

THOSE who are called upon to carry out duties connected with the Public Health Act of 1872, have to deal with subjects involving three separate kinds of knowledge,—legal, medical, and chemical. The duties are so multifarious, and to many now engaged in them they are so novel, that it seemed advantageous, in the production of a Manual of Public Health, to secure the assistance of three gentlemen severally experienced in each of the branches of knowledge involved. Hence the origination of this manual, in which I have had the advantage of the collaboration of three able and well-known authorities. Although I am responsible for the general construction and editorial supervision of the work, and for whatever faults may exist in it, such merits as may be found in its execution will of course be properly ascribed to the authors and not to the editor.

The pressing avocations of its contributors have caused a regrettable delay in the production of it.

ERNEST HART.

59 QUEEN ANNE ST.
November 24, 1873.

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MANUAL OF PUBLIC MEDICINE.

CHAPTER I.

THE CENTRAL AUTHORITIES.

THE supreme authority in all matters relating to public health is, by an Act of Parliament passed in the year 1871, lodged in the Local Government Board. This Board, which has its seat at Gwydyr House, Whitehall, consists of a President, appointed by Her Majesty, and of the following *ex-officio* members, viz. :—

Local Government Board.

The Lord President of Her Majesty's Most Honourable Privy Council, all Her Majesty's principal Secretaries of State for the time being, the Lord Privy Seal, and the Chancellor of the Exchequer. Besides these, it has a parliamentary and a permanent Secretary. By the same Act have been transferred to the newly constituted central authority all the powers and duties of the Poor Law Board, so far as such powers and duties refer to England, and all the functions relating to public health hitherto devolving upon the Secretary of State or the Privy Council. All the returns relating to rates, tolls, or dues, other than those affecting the public revenues, which are required to be sent to any other department of the Government, are to be sent in duplicate to the Local Government Board. By the Sanitary Act, passed in the year 1866, a general power of control over the acts of all Local Authorities is given to the Board, and if any complaint be made to it of the default of any such authority as to sufficient sewerage, or adequate water supply, by which the health of the inhabitants of the

Constitution.

Powers and duties.

Supervision of Local Authorities.

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district is endangered, or if the roads or footways are improperly or inefficiently repaired or cleansed, or if there is any default in enforcing the provisions of the Sanitary Acts, the Local Government Board may direct an enquiry as to the allegations in any such complaint, and has power to order the execution of any works necessary to remedy the default which has been proved. This is a very powerful means of remedy in the hands of inhabitants or owners; for should they fail to obtain relief from the Local Authority of the district in which they reside or have property, they can at once, either separately or conjointly, address a memorial to the Local Government Board, which is always ready to make full enquiry into grievances alleged by inhabitants against Local Authorities. If the Board should make an order directing a Local Authority to perform any duty not hitherto properly discharged, or to execute any works necessary for the maintenance of the health of a district, and the Local Authority should fail to perform the duty ordered, or to execute the works within the time specified in the order of the Board, then the Board has power to appoint some person or persons, and, if necessary, to change such persons from time to time, and by them to execute the works or discharge the neglected duties. When this happens, the Local Authority will have to bear the whole expense incurred by the persons appointed by the Local Board to execute the works, together with all the costs of the proceedings. The Local Government Board appoints inspectors, who hold the enquiries which have just been noticed, and who also attend meetings of Local Boards throughout the country, in order to watch their proceedings, and to advise Local Authorities on any matters incident to the working of the various complicated and numerous Acts of Parliament by which they are constituted, and whose provisions they have to enforce. Besides appointing these officers, the Local Government Board has power to determine the salaries and to issue directions as to the duties of all officers appointed by Local Authorities, where any portion of the salaries of these officers is paid out of funds raised by Parliament. But Local Authorities, much disliking any such control, generally prefer to pay the whole

Enquiry as to default of Local Authorities.

Order to execute works.

Inspectors.

Control of officers of Local Authorities.

of the salaries of their officers, which leaves them entirely unrestricted as to the amount to be paid and the duties to be discharged by these officials, and it also enables them without appeal to dismiss any officer whenever they may be so disposed. Much of the previous sanitary legislation of the country is contained in Local Improvement Acts. In many of these the provisions have become obsolete, either because of the extended knowledge we possess of hygiene, or on account of the limitations as to rating powers contained in them, although now these limitations so far as relates to sanitary matters are entirely removed. The Local Government Board has power by provisional order to change these provisions, either modifying or entirely repealing them. A provisional order is practically an Act of Parliament, as no order of this kind is of any validity until it has been confirmed by the Legislature. The various matters which may be settled by the Local Government Board by provisional order are alterations in existing Local Improvement Acts, alterations of areas, powers to be granted to Local Authorities to acquire lands compulsorily for the various purposes required in carrying out sanitary operations, such as land for town improvements, for sewers, for outfall of sewers, for precipitation of sewage, or for intermittent filtration or sewage irrigation. Local Authorities may by agreement acquire lands for these purposes, either by purchase or on lease; but when the owners are unwilling to part with their property, then the Local Authority has no resource but to apply for a private Act of Parliament, or to the Local Government Board for a provisional order, authorising the purchase and compelling the sale. Provisional orders are also granted for joining two or more districts or two or more authorities, for certain purposes more easily accomplished by joint action, into one authority for these purposes. Where it is necessary to raise large sums of money for carrying out works of a permanent character, such as sewerage, water supply, and the like, and such expenditure will be more than one year's assessable value of the district, then before raising the money it will be necessary to obtain a provisional order. This provi-

Local Improvement Acts.

Provisional orders.

Acquirement of lands.

Junction of districts.

Permanent works.

Borrowing powers.

sional order may grant a power of borrowing equal to two years' assessable value of the district.

Formation of Local Boards.

So also in applying the provisions of the Local Government Act to any district on the application of any Local Board or the majority of owners and ratepayers, or upon petition that any portion of a district should be separated from such district, there must be a provisional order, and in

Boundaries.

any similar case arising out of the boundaries of districts being undefined, or various authorities coexisting where it is desirable there should be but one, then and in all such cases there is power lodged in the Local Government Board to grant a provisional order. Before, however, such

Petition for provisional order.

provisional order is granted, a petition is to be lodged at the

Notices and advertisements.

Local Government Board office; notices and advertisements are to be issued explicitly stating what is purposed to be done, and what powers are asked for. Upon the receipt of

Enquiry.

this petition the Local Government Board directs an enquiry to be held in the district from whence the petition has emanated, and at such enquiry a full hearing is given to any one showing any claim to appear as supporting or preventing the granting of the prayer of the petition. It is, in fact, an open court in which any one having any interest whatever in the district, whether as owner or ratepayer, may be heard fully in support of his views. The inspector appointed to hold this inquiry at its conclusion makes his

Report.

report to the Local Government Board, and a copy of such report is sent to the Local Authority, and may be

Appeal.

obtained by any inhabitant. It has happened in some cases that parties dissatisfied with the report of the inspector have obtained a second enquiry, when the central authority has, in accordance with the prayer of a petition emanating from the dissentients, ordered a fresh enquiry by an engineer with a legal assessor, before whom evidence is again taken—in fact amounting to an appeal, and concluding with a report to the Local Government Board, which would then, upon both the reports sent in, determine what course it would adopt. The statute gives power to the Local Government Board either to grant provisional orders as asked for or to modify the requests of the petitioners in the order granted; this would be taken to

include also the power to refuse the application, which is frequently the case. But it is more than doubtful whether the Local Government Board has power to issue a provisional order wider than the petition upon which it is granted. Should the application be acceded to, then the order is introduced into a bill for confirmation by Parliament. This bill is promoted by the Local Government Board, and passed by them through the Legislature, unless any petition is presented against it, in which case it becomes subject to all the incidents of private legislation, is referred to a select committee, and is investigated in precisely the same manner as a private bill. The petitioners employ their counsel and parliamentary agents, and must bring up their witnesses in support of the provisional order, as the whole charge of the bill becomes lodged in their hands, and, unless the bill is passed by both Houses, the provisional order is of no value; for all such orders, as before stated, must be confirmed by Parliament before they become operative. They then have paramount authority, like all acts of the Legislature, but in any case, even before confirmation, they cannot be reviewed by any court; this is also the case with all orders made by the Local Government Board. These orders, which refer to the general business of sanitary authorities, may be granted by the Local Government Board on a great variety of subjects, and are also final and conclusive on the subjects respecting which they treat. These are, as before partially alluded to, supervision and regulation of the duties of all sanitary authorities and their officers, regulation of funds raised for sanitary purposes, and alteration of areas for sewerage and other purposes within certain limits. The more extensive powers in this direction need, however, a provisional order. But sufficient has been said to show how extensive are the powers lodged in the Local Government Board, and that the Board is competent to enquire into and remedy any grievance arising in the exercise of the powers of local sanitary authorities or arising from their default. Besides these powers the Public Health Act of 1872 diverts from the Board of Trade to the Local Government Board all their powers and duties under the Alkali Act 1863. These

Result of enquiry.

Confirmation of provisional order.

Opposition in Parliament.

Practice.

Effect of provisional order.

Orders of Local Government Board.

Transference of powers to Local Government Board. Alkali Act.

powers and duties include the appointment of inspectors to watch over alkali works, in order to provide for the better condensation of muriatic acid gas, and also give a general power to the Board to sanction rules and annex penalties for the breach of such rules by workmen employed in the manufacture. By the same Act the powers of the Board of Trade with respect to the supervision of the metropolitan water supply are also lodged in the Local Government Board. All the powers, duties, and acts which are vested in, imposed on, or required to be done by the Home Secretary in relation to turnpike roads and paths, highways, and hedges in England and Wales are also transferred to and imposed on the Local Government Board. These powers chiefly refer to supervision of the accounts of bodies charged with repairs of the roads; but in addition the Board has transferred to it all powers and duties with respect to—

Metropolitan water supply.

Turnpike and other roads.

The Registration of Births, Deaths and Marriages,
Public Health and Local Government,
Drainage and all Sanitary Matters,
Baths and Washhouses,
Public Monuments,
Town Improvements,
Artizans' and Labourers' Dwellings,

and Local Taxation so far as the Home Secretary is concerned, and the powers and duties of the Privy Council as to Prevention of Disease and Vaccination.

CHAPTER II.

LOCAL AUTHORITIES.

Sanitary Districts.

THE Public Health Act of last Session has divided the whole of England into sanitary districts, presided over respectively by a local authority, either urban or rural.

Urban and rural authorities.

Urban authorities are either in Boroughs, the Town Council, or in Board of Health Districts, Local Boards of Health, established under the Public Health Act, 1848, or Local Boards under the provisions of the Local Government Act, 1858, or Commissioners appointed under local Acts, passed for the improvement of the districts over which they act. All other parts of the country are to be in future, so far as public health is concerned, under the direction and control of the Board of Guardians of the Union in which the district or parish is situate. But if any part of a Union is in an urban district, then the guardians of such portion do not act in sanitary matters.

Committees of rural authorities.

The guardians have the power to appoint committees of their own number, to whom they may delegate for their year of office all their powers. One third of the number of such committee are to be *ex officio* guardians, if so many exist, and the appointment of such committee to which is delegated all the powers for the time being of the sanitary authority, must be made at a meeting of the guardians specially convened for the purpose.

Parochial Committees.

They have likewise the power to appoint parochial committees, either composed wholly of guardians, or of guardians and ratepayers, that is ratepayers of the parish, or contributary place for the sanitary government of which the parochial committee is appointed.

Committee the agent of authority.

This committee is only the agent of the rural sanitary authority appointing it, which remains liable to any duty or obligation devolving upon it, should the parochial committee make default, in its discharge of

such duties and obligations. The committee must carry out any regulations imposed by the rural authority, which has also the power to alter the constitution, or altogether dissolve the committee, whenever it thinks fit. There will no longer therefore be difficulty in knowing who is the sanitary authority of any district, as it must for all sanitary purposes be either in boroughs, the town council, or in towns where the Local Government Acts are in force, the Local Boards, or in towns which have a local Act, either the commissioners under the Act, or one of the bodies before enumerated, to whom in many cases the powers have been transferred. The great difference existing between the two kinds of local authority is mainly with respect to vesting of existing sewers, supervision of streets, roads, and buildings, the former of which are in rural districts under the control of highway boards, surveyors of highways, or turnpike trusts, while the powers of regulating the line of buildings, width of streets, &c. contained in the Local Government Acts, are not conferred on rural authorities, although the Local Government Board may transfer to any rural authority any or all of the powers of an urban authority. Their ordinary powers and duties are confined to providing a proper supply of water, getting rid of the sulliage of their district, preventing or removing nuisances, regulating common lodging-houses, enforcing sanitary measures in times of epidemic visitation, and supervising bakehouses. In the metropolis, except for certain purposes in the City of London, which is governed by a special Commission of Sewers, sanitary measures are regulated by the Metropolitan Management Act 1855, which came into operation on January 1, 1856. By this Act the whole of London, including the City of London, which is to be taken to mean all parts at the time under the jurisdiction of the Commissioners of Sewers, is divided into districts, these districts including either a single parish, or several parishes, or parishes and districts united together, to form a district under the Act. The vestry in all these parishes was made elective, and in cases with more than 2,000 rated householders were divided into wards, and a certain number of vestrymen, in proportion to the number of rated inhabi-

Control of Committees.

Different powers of urban and rural authorities.

Metropolitan Board of Works.

District Boards.

tants in each parish allotted to each. The vestry thus constituted elects a prescribed number of representatives to form a District Board, who act as a Local Board for their district. Each vestryman must have a qualification by being rated to the extent of 40*l.* to the relief of the poor, except when the number of poor rate assessments of 40*l.* does not exceed one-sixth of the whole, then the qualification is reduced to 25*l.* Each of these district boards sends either one or two representatives to make up the Metropolitan Board of Works, which acts as the sewer authority, regulating streets, and generally has powers to make, widen, or improve streets, roads, or ways, and may expend for any of these purposes any sum not exceeding 50,000*l.*, without any consent, and exceeding that sum with the consent of the Commissioners of Her Majesty's works and buildings; if exceeding 100,000*l.*, not without the previous sanction of Parliament.

Election by Vestries.

Rating qualifications.

Work executed by Metropolitan Board of Works.

Members to form a Local Board as an urban sanitary authority, are elected from, and by the ratepayers, who have been on the rate book for one whole year, and who have paid all rates except those due within six months of the election; and this holds good even when the rates are compounded for and paid by the owner, the right of all occupiers being specially reserved as to any franchise or right of voting. Any ratepayer may nominate for the office of member any other ratepayer or ratepayers, within the prescribed number residing within the district, or within seven miles, and possessed of real or personal estate, or both to the value of not less than 500*l.* in districts containing less than 20,000 inhabitants, or not less than 1,000*l.* in districts where the population exceeds 20,000; or it is sufficient if the nominated member of a Local Board is rated to the poor rate, at an assessment of not less than 15*l.* in districts containing less than 20,000 inhabitants, or not less than 30*l.* in districts exceeding 20,000 of population.

Election of members of Local Boards.

Qualifications.

The Returning Officer, who in the first instance, upon the appointment of a Local Board is nominated by the Local Government Board, but who is afterwards almost uniformly the Chairman of the Local Board, except when he is himself a candidate, publishes a notice of every

Returning Officer.

Notice of Election.

election of members, stating the number and qualifications required of members, and the mode of voting. These notices are published, and affixed to places in the district where notices are usually exhibited. If there should be

Nomination.

such a number of ratepayers nominated as exactly fills up the vacancies, then the persons nominated are declared by the Returning Officer to be duly elected members for three years; but subject to a third of the members retiring every year. Should a greater number be nominated than the number of vacancies to be filled up, then an election takes

Voting Papers.

place by means of voting papers, which are delivered at the residences of the owners and occupiers of the district three days before the day of election, which is the day when the voting papers are collected by persons specially appointed

Agent of Candidate.

for the purpose by the Returning Officer. If it be so wished by any candidate, a person appointed to act as his agent may accompany the person who delivers or collects the voting papers, after giving one day's notice of an intention to send such an agent. A ratepayer nominated is not compelled to serve the office of member of a Local Board. An intimation should be given to the Returning Officer of

Refusal to serve.

a refusal to serve, if possible before the collection of the voting papers. This might save the necessity of counting up the votes, or would enable the Returning Officer to declare elected the next candidate having the largest number of votes, supposing the refusing ratepayer to be himself among the returned candidates.

If the refusal to serve comes from a candidate after election it will be the duty of the Local Board itself as in any

Casual vacancies.

other casual vacancy to elect a ratepayer in place of the member elected. This can be done by the Local Board, either from the candidates or from the body of ratepayers at their discretion. Upon the voting papers being

Casting up of votes.

collected, it becomes the duty of the Returning Officer to attend at the office of the Local Board the next day, and on as many succeeding days as may be necessary, there and then

Decision as to validity of votes.

to add up the votes. He has the power of striking off any votes which he thinks bad, and his decision is final as to their

Declaration of members elected.

validity. Having done this he declares who are elected, and lays the voting papers and a certificate of his returns

before the next meeting of the Local Board. This certificate and the voting papers are preserved in the office of the Local Board, and are open to public inspection for six months. The scale of voting by ratepayers or owners is regulated by what is known as Sturges Bourne's Act, and is as follows :—

Preservation of voting papers.

Scale of voting.

When the rateable value is under £50, one vote,
„ £50 and under £100, two votes,
„ £100 „ £150, three votes,
„ £150 „ £200, four votes,
„ £200 „ £250, five votes,
over £250, six votes,

and this is the greatest number of votes which can be given for one property by a ratepayer; but the owner can give an equal number: therefore where the owner is also the occupier there may be a franchise of twelve votes lodged in one person. All owners, however, must before an election send in a claim to vote to the clerk of the Local Board, when they will be duly registered and a voting paper sent to them as owners, and this application must be renewed each year. Should it, however, happen through negligence or oversight that a voting paper has not been sent to an owner or occupier, then any person claiming to vote must himself call on the Returning Officer before the day of election, and in his presence fill up a voting paper, which the Returning Officer is bound to supply and take charge of. It will be thus seen that a Returning Officer fills a very important office. He cannot be himself a candidate, although Chairman of the Local Board, and is bound by heavy penalties faithfully to discharge the duties of his office. Should he be at any time disqualified to act, either through his being a candidate, through illness, or other sufficient cause, the Local Board have power to appoint some one else to conduct the election, and this must be carefully observed or the election will be void.

Claim of owners to vote.

Failure to supply voting paper.

Appointment of Returning Officer by Local Board when office vacant.

The successful candidates have a notice served on them of their election by the Returning Officer, who also notifies the result to the public by placards exhibited at the places where parochial notices are usually affixed. Each member of a Local Board, before he acts, must sign a

Notice of Election.

Declaration by Members.

declaration which is to be witnessed by two other members of the Board, that he is possessed of the necessary property or rating qualification to act as a member; this declaration is to be filed, and any one making one falsely is guilty of a misdemeanour. The election of any member after he has acted, may be impeached by a writ of *quo warranto*, sued out in the Court of Queen's Bench, and the member may then either resign his seat or defend it, which it need hardly be said may be a very costly process.

Quo warranto.

Disqualification of Members.

The qualification of a member will be lost if he becomes a bankrupt or insolvent, or if he compounds with his creditors, or holds or accepts any office of profit under or becomes a contractor to the Board. He will also be incapable of continuing a member if he be absent from the district for more than six months at a time, unless in case of illness. But a member does not become disqualified owing to the sale or lease of any lands, or the loan of any money to a Local Board. A member may be interested in Joint Stock Companies which have contracts with the board without losing his qualification; but he must not, without the consent of the Local Government Board, vote upon any question in which his company is interested. This dispensation of the Local Government Board refers mainly to water companies and other bodies of a like public nature. Members voting after being disqualified subject themselves to a penalty of £50. In some cases Boards may consist of selected as well as elected members. It has already been stated that where there is a Town Council, this body becomes the Local Board. There is no special election as a Local Board, but the Town Council elected by ballot are, by the Public Health Act, at once constituted as the Local Board. It sometimes happens that there may be a district larger than a borough, or two boroughs may possibly form a district: in any such case the Town Council has power to select members to form, joined to elected members, a board for the district. There may also be unions of districts for various purposes, notably to provide an efficient water supply, or an outfall for the sewerage of several districts, or to provide land for sewage irrigation for the same, in these cases a joint sewer

Members of Joint Stock Companies.

Penalty for voting after disqualification.

Selected members.

Unions of Districts.

Joint Boards.

authority may be created. This joint Board will exercise its powers only for the conjoint work, that is the work in which all the constituent districts are interested, leaving all the internal arrangements of the various districts in the hands of the individual Boards. Thus in the case of providing a main sewer for two or more districts, all the contributory sewers and drains within the districts would be constructed and superintended by the several Boards, while the main artery would be constructed and supervised by the joint Board.

Meetings.

A Local Board at its first meeting appoints a chairman, who presides over the meetings of the Board and has a casting Vote. If absent any member may be appointed to act as Chairman; one third of the number of members forms a quorum, and the meetings must be held at least once a month. A Local Board being a corporation should provide a common Seal. It has power to appoint such officers as may be requisite to carry out the business of the board; specially, a Clerk, Treasurer, Surveyor, Medical Officer of Health and Inspector of Nuisances. It has also power to appoint committees, to whom may be entrusted various sections of the duties belonging in the aggregate to the Board itself; but all the minutes passed by such Committees should come up for confirmation by the Board and all acts done should emanate from a resolution of the Board itself. The minutes of the Board meetings are to be carefully kept; they may be confirmed and signed at a subsequent meeting; but minutes of committees should be entered at the time of meeting and signed if possible at the time and by the Chairman then presiding, and by all the members of the Committee who are present. It is very desirable that a Code of standing orders should he formed as it will be found much to facilitate business to have good rules laid down for its conduct, which rules should be rigidly adhered to.

Common Seal.

Officers.

Committees

Minutes.

Standing Orders.

Standing orders should be so framed as to deal with the time at which meetings are to be held; regulations as to calling special meetings; directions as to conduct of meetings and attendance of members; provisions as to entering minutes and as to safe custody of plans, papers, &c. in reference to the business of the board; provisions as to

authentication and signing of notices, documents, etc.; declarations of duties of officers; rules for conduct of business between meetings of Local Authority; regulations as to payments and receipts of monies; and to collection of rates.

Any departure from strict conformity to the duties and obligations of Local Boards is sure sooner or later to entail trouble on the members and may result in a serious pecuniary loss. It is well, therefore, in every act done or order given to be fortified by the counsel and opinion of the legal adviser of the Board who is most usually, and should always be, the Clerk also. Inspectors of the Local Government Board can now attend meetings of Sanitary authorities and it is hoped that in cases of difficulty much help may be derived by Local authorities from their co-operation and assistance. There is another authority constituted by the Act of last Session and which may be permanently appointed by provisional order of the Local Government Board, namely a port authority to watch over the health of any port and to inspect the shipping in any harbour, with any other powers and duties which the order may direct and enjoin. This in cases of epidemic visitations may prove to be a provision of great utility, as it will remove the difficulties of conflicting authorities and provide at once for the treatment of cases of epidemic disease occurring in ports and harbours or on board shipping within three miles of the coast. A port authority will, subject to the express provision of the provisional order by which it is constituted, have all the powers of the Sanitary Acts.

Inspectors at meetings of Sanitary Authorities.

Port Authorities.

Commissioners under local Acts.

Commissioners under local acts are appointed in accordance with the provisions of the Acts themselves, except when the powers are transferred to the Town Council or to a Local Board when their elections and meetings are governed by the rules already set out as appertaining to these bodies.

Rural Sanitary Authorities.

Ex officio Guardians.

Rural sanitary authorities are in all cases the Guardians of the Union or such portion of them as belong to the Union exclusive of any portion of any urban district contained within it. The Board of Guardians consists of *ex officio* members who are the Justices of the Peace residing

in the parish and acting for the county, riding, or division in which the parish is situate, and a certain number of Elected Guardians. The election of Guardians is regulated by the Poor Law Acts and is in all essential particulars the same as the election of Local Boards and it has been already pointed out how they may discharge their duties either by themselves, by Committees of their own body, or by parochial Committees.

Election of Guardians.

There is yet another body which can act authoritatively under the common law to remedy or prevent injury to the public health. This is the Court Leet in every manor, consisting of a committee of the inhabitants of each place, such committee not being less than twelve in number. The powers of the Court Leet are thus set out by ancient authority: 'If there be any ways, waters, ditches, or paths straited, or stopped, or turned out of the right course to a wrong course, unto the noysance of the King's people, ye shall do as to wit. Also of all butchers, fishers, or any other victuallers that sell victuals corrupt and not wholesome for man's body, ye shall do as to wit of them.' Any nuisance existing within the manor can be presented to the Court Leet, which may meet annually and as often thereafter as may be necessary, in order that the nuisances complained of may be remedied. There are still some powers with respect to roads, and watching and lighting, lodged in vestries; but to them we shall refer subsequently; and in some instances under special acts vestries may still be urban sanitary authorities.

Court Leet.

Powers still lodged in Vestries.

CHAPTER III.

OFFICERS AND POWERS OF LOCAL AUTHORITIES.

Officers of Sanitary Authorities.

To carry out properly the duties of local authorities good officials are indispensable. Upon their efficiency must largely depend the standard of public health of the district, seeing that it is impossible for local authorities, however competent they may be as administrators, to act as the Executive in carrying out the various Acts of Parliament which regulate their authority and define their duties. It is requisite for urban authorities to establish, with the consent of the Local Government Board, a series of bye-laws, and it is important to note here that these bye-laws must be most carefully framed, as they will have no validity if the powers sought to be exercised by virtue of them exceed those conferred by the Act of Parliament, of and to which they should be the exponents and adjuncts. They should be framed with due regard to the character and wants of the district, and it will be the duty of the Clerk, in carrying on the business of the Sanitary Authority, to see their provisions strictly enforced, and not exceeded either by the Board itself, or its officers. A form of such bye-laws is annexed.

Bye-Laws.

The form of Bye-Laws which is here given is, with some trifling alterations adopted by all the Local Boards in England, and is of so much importance as defining the relative duties of Urban Authorities, their officers, and the public, that it is deemed advisable to print it *in extenso*.

—— URBAN SANITARY AUTHORITY.

BYE-LAWS, made and ordained by the Urban Sanitary Authority for the District of , pur-

suant to the powers and provisions contained in the Public Health Act, 1848, and the Local Government Act, 1858, and the Public Health Act, 1872.

As to the Level, Width, &c., of New Streets, and Sewerage thereof.

Width and level of new streets.

I. EVERY new street shall be laid out and formed of such width and at such level as the Urban Sanitary Authority shall in each case determine.

Every new street, being a carriage road, shall be laid out and formed at least wide, and the Urban Sanitary Authority shall determine in each case what proportion of the width of such street shall be laid out as carriageway and footway respectively.

Every new street, not being a carriage road, shall be laid out and formed at least feet wide, and there shall be one entrance at least to every such street, of the full width thereof, and open from the ground upwards; provided always, that when any street shall exceed the length of one hundred feet, it shall be at the option of the Urban Sanitary Authority to determine whether such street shall or shall not be laid out and formed of sufficient width for a carriage road.

Modification of width of streets in certain cases.

II. In any case in which an open space shall be left along one or both sides of any new street throughout its whole length in front of the houses, or in which any new street shall not be the principal or only approach to dwelling-houses, or in any special cases, the Urban Sanitary Authority may allow of a reduction of the widths herein specified for such streets, whether carriage roads or not, as they shall see fit.

The width of new streets shall be taken to mean the whole space dedicated to the public, exclusive of cellar-flaps, or of any steps or projections therein, and measuring at right angles to the course or direction of such streets.

Height of buildings in new streets.

III. No building shall be erected on the side of any new street which shall exceed in height the distance from the front of such building to the opposite side of such street; nor shall the height of any building so erected be at any time subsequently increased so as to exceed such distance.

In estimating the height of buildings, the measurement shall be taken from the level of the centre of the street immediately opposite the building, up to the parapet or eaves of the roof.

Drainage of new streets.

IV. The proposed level and width of any new street having been approved by the Urban Sanitary Authority, the Surveyor shall specify the depth and inclination, form, size, materials, and other particulars of the sewers and their appurtenances, according to which the works for the proper drainage of such street, and of the adjoining properties, shall be carried out.

Construction of new streets.

V. The mode of construction of every new street, and the materials to be employed, shall be subject to the approval of the Urban Sanitary Authority.

Thickness of walls.

VI. The walls of every new building shall be constructed of such thicknesses as shall be approved by the Urban Sanitary Authority, and the foundations shall rest on solid ground, concrete, or other solid substructure, to be approved by the Urban Sanitary Authority.

Materials of external walls.

VII. The external and party or side walls of every new building shall be constructed of brick, stone, or other hard and incombustible substances, unless the Urban Sanitary Authority shall otherwise allow in cases in which it may appear to them that no danger would exist of the spread of fire.

Walls carried through roofs.

VIII. Any external or party wall of a new building, the roof or gutter of which shall adjoin any other house or building, shall be carried up above such roof or gutter to form a parapet of not less than twelve inches in height, measured at right angles to the slope, and above the covering of such roof, or above the highest part of such gutter.

Woodwork in external or party walls.

IX. No joists, beams, or other woodwork fixed in or upon any external or party wall,—except beams or bressummers and story-posts under the same, and frames of doors and windows of shops,—shall be brought within four inches at least of the external face of such wall, unless with the previous sanction of the Urban Sanitary Authority.

Roofs.

X. The roof or flat of every new building, and every gutter, dormer, and other work or construction connected

therewith, except the doors, door-frames, windows, and window frames of such dormer and other construction, shall be formed of or externally covered with incombustible materials, except in special cases when otherwise allowed by the Urban Sanitary Authority.

Chimneys and flues.

XI. The chimneys and flues of every building shall be constructed in such mode, and of such materials and dimensions, and of such height above the level of the nearest street, as shall be approved by the Urban Sanitary Authority. All hearths and slabs shall be properly bedded in incombustible materials. No timber or woodwork shall be placed within six inches of the inside face of any chimney or flue, and the brickwork or stonework of such chimney or flue shall be properly rendered. No wooden plugs shall be driven nearer than nine inches to the inside of any chimney or flue.

No openings shall be made in any chimneys or flues for any purpose, nor shall any pipe be fixed in any new building for conveying smoke, heated air, steam, or hot water, except in the manner approved by the Urban Sanitary Authority.

Exempted buildings.

XII. The following buildings and works shall be exempt from the operations of these Bye-Laws :—

Common gaols, prisons, houses of correction, and places of confinement connected therewith under the inspection of the inspectors of prisons, county lunatic asylums, sessions-houses, and other public buildings belonging to or occupied by the justices of the peace of the county, city, or borough in which the same are situate, buildings belonging to any canal, dock, or railway company, and used for the purposes of such canal, dock, or railway, under the provisions of any act of parliament, all buildings, not being public buildings, and not exceeding in height thirty feet, as measured from the ground-floor, and not exceeding in extent 125,000 cubic feet, wholly in one occupation, and distant at least thirty feet from the opposite side of the nearest street or alley, whether public or private, and at least thirty feet from the nearest buildings, and from the ground of any adjoining owner, all buildings not exceeding in extent 216,000 cubic feet, and not being public buildings

and distant at least fifty feet from the opposite side of the nearest street or alley, whether public or private, and at least fifty feet from the nearest buildings, and from the ground of an adjoining owner.

Space about buildings to secure ventilation.

XIII. Every building to be erected and used as a dwelling-house, or as a school, shall have in the rear, or at the side thereof, or partly at the rear and partly at the side, an open space or open spaces exclusively belonging thereto, to the extent of at least* square feet in the whole, free from any erection thereon above the level of the ground. And the distance across such open space between every such building and the opposite property at the rear or side shall be ten feet at least; if such building be either two stories or twenty feet in height above the level of such open space, the distance across shall be fifteen feet; if such building be three stories or thirty feet in height, it shall be twenty feet; if more than three stories or forty feet in height, it shall be twenty-five feet; but no open space, either in the rear or at the side of such building, is to be taken into account as forming part of or making up the total of * square feet above required, unless there shall be at least one door or window on each story of such building opening on to such open space. When, however, thorough ventilation of such open space and buildings is secured, or when on the rebuilding of houses within the town, these dimensions and regulations cannot be adhered to without considerable sacrifice of property, they may be modified in special cases at the discretion of the Urban Sanitary Authority.

Space not to be built upon.

XIV. Wherever any open space has been left belonging to any building, when the sanction of the Local Board has been obtained for its erection, such space shall never afterwards be built upon, or covered over wholly or in part, without the approval of the Urban Sanitary Authority.

Height of rooms.

XV. In any building to be erected, every habitable room, except rooms in the roof, shall be in every part eight feet in height at the least from the floor to the ceiling, and every habitable room in the roof of any such building shall

* This must differ according to the character of the district.

be at the least eight feet in height from the floor to the ceiling throughout not less than one-half the area of such room.

Windows.

XVI. Every habitable room shall have at least one window directly opening on to the external air, and the total area of such window or windows, clear of the sash-frame, shall be at the least one-tenth of the area of every such room, and the top of one at least of such windows shall be not less than seven feet six inches above the floor, and the upper half at least shall be made to open the full width.

Special ventilation of small rooms.

XVII. Every habitable room hereafter built of less area than 100 superficial feet, and without a fire-place, shall be provided with special means of ventilation, by air-shaft or otherwise, as the Urban Sanitary Authority may determine.

Ventilation of public buildings.

XVIII. Every new public building, or any building intended or adapted for the reception of more than 200 persons, shall be supplied with means of ventilation and egress, to be approved by the Urban Sanitary Authority.

Drainage of houses and approval of materials.

XIX. All houses and buildings which, in the opinion of the Urban Sanitary Authority, are without sufficient drainage, shall be drained in the most effectual manner which may be practicable; and the mode of drainage, and all materials intended to be used in the construction of the drainage of buildings, shall be subject to the approval of the Urban Sanitary Authority.

Construction of house drainage.

XX. The drains of all houses and buildings shall consist of glazed stone-ware or fire-clay pipes or other equally suitable material, to be approved of by the Surveyor, and they shall be of such dimensions, and shall be connected with the sewers in such manner as the Surveyor shall direct. They shall be laid with water-tight joints, and beneath houses they shall be embedded in and surrounded with well puddled clay. No right-angle junctions, whether vertical or horizontal, shall be formed.

Ventilation of house drainage.

XXI. Proper ventilation shall be provided in the drainage of every house, by special pipe or shaft, or by such other method as the Surveyor may direct. All other inlets to the house drains shall be properly trapped, with stone-ware or other traps to be approved by the Local Surveyor.

Drainage of subsoil, and prevention of damp.

XXII. The house drainage shall be so constructed, either with additional earthenware pipe drains or otherwise, as to drain the subsoil of the premises, whenever the dampness of the site appears to the Urban Sanitary Authority to render this necessary. And all rain-water shall be so drained or conveyed from the roofs of buildings, as to prevent its dripping on to the ground and causing dampness in the walls.

Water-closets, earth-closet, and privies.

XXIII. The situation, dimensions, materials, and construction of every water-closet, earth-closet, and privy shall be subject to the approval and be altered according to the requirements of the Urban Sanitary Authority; and if any occupier or person having a right of using the same water-closet, earth-closet, or privy shall not alter the same when required by the Urban Sanitary Authority, then it shall be lawful for the Urban Sanitary Authority to alter the same at the expense of such occupier or person, and such expense shall be recovered in the same manner as the penalties imposed by these Bye-Laws.

Every water-closet, earth-closet, or privy shall have an opening of not less than twelve square inches, as near to the top as practicable, communicating directly with the external air, or shall be otherwise furnished with sufficient means of ventilation.

Cesspools.

XXIV. No cesspool shall be allowed except when unavoidable and by special leave of the Urban Sanitary Authority when it shall be constructed in such situation and in such manner as the Urban Sanitary Authority shall direct. It shall in every case be made water-tight. It shall be arched or covered over, and a pipe or shaft for ventilation shall be carried up from it, or from the drain communicating with it from the water-closet or privy.

Ashpits.

XXV. The situation, dimensions, materials, and construction of every ash-pit shall be subject to the approval and be altered according to the requirements of the Urban Sanitary Authority; and if any occupier or person having a right of using the same ash-pit shall not alter the same when required by the Urban Sanitary Authority, then it shall be lawful for the Urban Sanitary Authority to alter the same at the expense of such occupier or person, and such expense shall be recovered in the same manner as

the penalties imposed by these Bye-Laws, and every such ash-pit shall be of sufficient size to contain the ashes and dry refuse likely to accumulate between the prescribed visits of the scavenger.

Certificate of completion of new houses.

XXVI. No new house shall be occupied until the house drainage has been made and completed, nor until such house has been certified by the Urban Sanitary Authority, or their officer authorised to give such certificate, after examination, to be in every respect conformable to their Bye-Laws.

Building unfit for human habitation.

XXVII. In any case where it is certified to the Urban Sanitary Authority by the officer of health of the district, by the Local Surveyor, by the Inspector of Nuisances, or by any two medical practitioners, that any building or part of a building erected since the constitution of the district is unfit for human habitation, or to be used as a school, factory, or workshop, the Urban Sanitary Authority may, by their order, affixed conspicuously on the building, or part of the building, declare that the same is not fit for human habitation, or to be used as a school, factory, or workshop, and such building or part of a building shall not, after a date therein to be specified, be inhabited or so used, and any person who, after the date or time mentioned in such order, lets or occupies or uses as aforesaid, or continues to let, occupy, or use, or knowingly suffers to be occupied or used as aforesaid, such building or part of a building, shall be liable for every such offence to a penalty, not exceeding twenty shillings, for every day during which the same is so let, occupied, or used as aforesaid; provided always, that if at any time after such order made, the Urban Sanitary Authority shall be satisfied that such house has become or been rendered fit for human habitation, or such school, factory, or workshop, fit to be used as aforesaid, they may revoke their said order, and the same shall thenceforth cease to operate.

Notices, plans, etc., of new streets.

XXVIII. Every person who shall intend to make or lay out any new street, whether the same shall be intended to be used as a public way or not, shall give one month's notice to the Urban Sanitary Authority of such intention, by writing delivered to the Surveyor, or left at his office, and shall at

the same time leave or cause to be left at the said office a plan and section of such intended new street, drawn to a scale of not less than one inch to every forty-four feet; and every such plan shall show thereon the names of the owners of the land through or over which such street shall be intended to pass; the level, width, direction, the proposed mode of construction, the building line, the proposed name of such intended new street, and its position relatively to the streets nearest thereto; the size and number of the intended building lots, and the proposed sites, height, class and nature of the buildings to be erected therein, and the proposed height of the division and fence-walls thereon, and the proposed plan and dimensions of the sewers, and shall contain the name and address of the person intending to lay out such new street, and be signed by him or his duly authorised agent.

Every such section shall show thereon the level of the present surface of the ground above some known fixed datum, the level and rate or rates of inclination of the intended new street, and sewers and drains, the level and inclinations of the streets with which it will be connected, and the level of the lowest floors of the intended new buildings.

Notices, plans, etc., of new buildings.

XXIX. Every person who shall intend to erect any new building shall give a fortnight's notice to the Urban Sanitary Authority of such intention, by writing delivered to the Local Surveyor, or left at his office, and shall, at the same time, leave, or cause to be left, at the said office, detail plans and sections of every floor of such intended new building, drawn to a scale of not less than one inch to every eight feet, showing the position, form, and dimensions of the several parts of such building, and of the water-closet, earth-closet, privy, cesspool, ash-pit, well, and all other appurtenances; and such plans and sections shall be accompanied by a description of the materials of which the building is proposed to be constructed, of the intended mode of drainage, and means of water-supply. All plans, sections and drawings shall be sent in on drawing paper, tracing cloth or paper, and shall be drawn in ink, and the same shall belong to the Urban Sanitary Authority and be deposited with the Surveyor.

A block plan shall be left at the same time, drawn to a scale of not less than one inch to every forty-four feet, showing the position of the buildings and appurtenances of the properties immediately adjoining, the width and level of the street, the level of the lowest floor of the intended building, and of the yard or ground belonging thereto. The plan shall show also the proposed lines of house drainage, and their size, depth, and inclination.

Inspection of works by Local Surveyor.

XXX. The Surveyor shall inspect any works or buildings in progress of construction at any reasonable time that he may think fit, or that he may be required to do so by the Urban Sanitary Authority; but the person laying out the work, or the builder, shall give two days' notice in writing to the Surveyor before the commencement of such work, and before any foundations of new buildings, or any sewers or drains, are covered up; and the like notice shall be given after the works have been completed, which may have been required by the Surveyor to be done in amendment of any irregularity, and before such works shall be covered up.

Notice by Local Surveyor in case of irregularity.

XXXI. If in doing any work, or erecting any building, anything is done contrary to the rules herein contained, or anything required by those rules is omitted to be done; or if the Surveyor, on surveying or inspecting any building or work, finds that the same is so far advanced that he cannot ascertain whether anything has been done contrary to the rules herein contained, or whether anything required by such rules has been omitted to be done;

The Surveyor shall, within six hours after such survey or inspection, give to the builder or person engaged in erecting such building, or in doing such work, notice in writing, requiring such builder or person, within forty-eight hours from the date of such notice, to cause anything done contrary to the rules herein contained to be amended; or to do anything required to be done by such rules, but which has been omitted to be done; or to cause so much of any building or work as prevents such Local Surveyor from ascertaining whether anything has been done, or omitted to be done, as aforesaid, to be to a sufficient extent cut into, laid open, or pulled down.

Notice of completion of works and buildings.

XXXII. Within one month after any work or building of which notice was given has been completed, the builder or person by whom such work has been done shall give notice to the Local Surveyor thereof, and the surveyor shall forthwith proceed to survey such building or work, and shall report to the Urban Sanitary Authority thereon.

Power to remove new works or buildings not approved by the Board.

XXXIII. The Urban Sanitary Authority shall by their order approve or disapprove of proposed new works or buildings within the times severally specified herein for the deposit of notices thereof, and the owner or person intending to erect any new street or building shall give the notices hereby required; and if any owner or person shall construct any works contrary to the provisions herein contained, the Urban Sanitary Authority, after calling upon such owner or person to show cause why the works so constructed should not be removed, altered, pulled down, or otherwise dealt with, may, if they think fit, have such work removed, altered, pulled down, or otherwise dealt with as the case may require; and the expenses incurred by them in so doing shall be repaid by the offender, and be recoverable from him in a summary manner, as provided by the Public Health Act, 1848.

Penalties.

XXXIV. Any person offending against any of the above bye-laws shall forfeit and pay for every such offence a penalty not exceeding five pounds, and in case of a continuing offence a further penalty not exceeding forty shillings for each day after written notice of the offence from the Urban Sanitary Authority or their authorised officer.

Penalty on workmen, etc.

XXXV. If any workman, labourer, servant, or other person employed in or about any new works, wilfully, and without the privity or consent of the owner or person causing such work to be done, does anything in or about such works contrary to the provisions herein contained, he shall, for each such offence, incur a penalty not exceeding fifty shillings.

As to the Regulations of Slaughter-houses, pursuant to the Powers, &c., of the Local Government Act, 1858:—

Slaughter-houses to be

XXXVI. The occupier of every slaughter-house within the said district shall cause the same to be well paved and

laid with proper slopes towards a gully-hole, and sufficiently ventilated, to the satisfaction of the Officer of Health appointed for the time being by the Urban Sanitary Authority; and shall cause the whole of the internal brick or plaster surface of such slaughter-house to be thoroughly lime-washed, at least twice in every year—that is to say, in the months of April and September; and shall cause the wainscoting of such slaughter-house to be painted and kept clean.

paved and ventilated, and to be lime-washed.

XXXVII. Every occupier of a slaughter-house shall provide and keep a sufficient number of tubs, boxes, or vessels, with tight and close-fitting covers thereto, constructed to the satisfaction of the Urban Sanitary Authority, for the purpose of receiving and conveying away all manure, garbage, and filth, and shall in all cases, except as hereinafter provided, immediately after the killing and dressing of any cattle in such slaughter-house, cause all such manure garbage, and filth, to be placed in such tubs, boxes, and vessels; and such tubs, boxes, and vessels, together with their contents, shall be removed to such place, at such interval of time, with such precautions, and within such hours, as may be, from time to time, fixed by the Urban Sanitary Authority; and all the blood arising from the slaughtering of cattle shall be put into separate tubs or vessels with close-fitting covers, and shall be carried away from the slaughter-house without delay, and shall not be permitted to flow in the channel or sewer, or open street: Provided always, that no blood shall be put into the same tubs or vessels in which the manure, garbage, or other filth are put: Provided also, that the manure, garbage, and other filth shall not be kept or carried away in such tubs, boxes, and vessels, where impermeable covered drains are provided for carrying away the same.

Storage and removal of filth, cleansing of slaughter-houses.

All the tubs and vessels which are used for the removal of any manure, garbage, and filth, and all the tubs and vessels which are used for the removal of blood from any slaughter-house, shall, immediately after being used for such removal, be thoroughly emptied, cleansed, and purified, and the floor of such slaughter-house shall then be also effectually scoured and cleansed; and the whole shall

generally be kept in such a condition that neither within the slaughter-house, nor without it, shall there be any offensive smell arising therefrom.

Every slaughter-house to be supplied with water, and to be cleansed.

XXXVIII. The occupier of every slaughter-house shall provide the same with an adequate supply of water; and shall cause the same to be thoroughly washed and cleansed within three hours after the completion on each day of any slaughtering and dressing of cattle therein; and shall not make nor permit to be made, nor suffer to exist, any cess-pool within such slaughter-house.

Hides and skins to be removed.

XXXIX. Every occupier of such slaughter-house shall remove, or cause to be removed, from such slaughter-house, the hides and skins of any cattle that shall be slaughtered therein, together with the blood and offal, either on the same day or on the day next after such cattle shall have been slaughtered.

Diseased or unsound cattle not to be slaughtered.

XL. The occupier of every such slaughter-house shall not slaughter, or suffer to be slaughtered therein, any diseased or unsound cattle; and in case of any diseased or unsound cattle being brought to such slaughter-house, he shall forthwith give information thereof to the Inspector of Nuisances.

Members and officers of the Local Board to have access to every slaughter-house.

XLI. All members and authorised officers of the Urban Sanitary Authority shall have free access to every slaughter-house at all times, for the purpose of examining into the condition of the same with regard to the cleanliness, ventilation, and management thereof.

Pigs or other animals in slaughter-houses.

XLII. No occupier of any slaughter-house shall permit or suffer any pigs or other animals to be kept in any slaughter-house, or premises adjacent thereto, except for the purpose of being fasted previous to killing; and no occupier of any slaughter-house shall keep or retain any cattle in such slaughter-house for a longer period than forty-eight hours, previous to the slaughtering of the same.

Dogs in slaughter-houses.

XLIII. The occupier of any such slaughter-house shall not keep, or permit to be kept, in such slaughter-house or premises, any ferocious dog, unless such dog shall be securely fastened or muzzled.

Registered slaughter-houses.

XLIV. The occupier of every registered slaughter-house shall cause the word 'slaughter-house,' together with the

number corresponding with the number under which such slaughter-house shall be registered in the register kept for that purpose by the Urban Sanitary Authority, to be painted or otherwise inscribed, to the satisfaction of the said Urban Sanitary Authority on, over, or adjoining to the outside of the door or entrance to such slaughter-house, and there kept and continued, free from any obliteration or defacement.

Bye-laws to be affixed in every slaughter-house if required.

XLV. The occupier of every slaughter-house shall, if desired by the said Urban Sanitary Authority or their Surveyor, cause a copy or extract of or from any of these Bye-Laws which relate to slaughter-houses, written or printed in large characters, and provided by and at the expense of the Local Board, to be affixed in some conspicuous part of such slaughter-house, and to be at all times continued in such place; and if such copy, or extract, or any part thereof, should be obliterated or defaced, such occupier shall forthwith affix in the same conspicuous place another copy in lieu thereof.

Penalties

XLVI. Every occupier of any slaughter-house within the said district, who shall in any respect fail to comply with either of the foregoing Bye-Laws applicable thereto, or in anywise offend against the same, or who, after due notice from the Urban Sanitary Authority, requiring such slaughter-house to be lime-washed and cleansed, shall neglect so to do, or who shall at any time refuse to allow any officer or servant of the Urban Sanitary Authority an inspection of the premises, shall forfeit and pay for each and every such offence, any sum not exceeding the sum of *Five Pounds*; and a further penalty of *Ten Shillings* for every day during the continuance of the offence after written notice thereof from the Urban Sanitary Authority. The said penalties to be recovered and applied as the statute directs.

As to Prevention of Nuisances arising from Rubbish, and Keeping of Animals:—

Nuisances from filth, &c. Interior of buildings.

XLVII. All occupiers of any premises within the district shall whitewash, wash, or otherwise cleanse and keep free

from filth, and cleansed, the interior of such premises, so that no offensive smell shall proceed from the same.

Yards, &c., where animals are kept.

XLVIII. All occupiers of any yards, places, or premises where horses, cattle, pigs, or other animals are kept, either constantly or occasionally, shall provide upon such premises, to the satisfaction of the Urban Sanitary Authority or their authorised officer, a proper receptacle for dung, manure, and all other solid refuse arising on the premises, and a trapped drain for carrying off all urine and other liquid drainage from such premises, or into such receptacle; and if no means for the removal of such dung, manure, and other solid refuse be provided by the Urban Sanitary Authority, every such occupier shall himself remove all such dung, manure, and other refuse, at such interval of time, with such precautions, and within such hours as may from time to time be fixed by the Local Board.

Refuse, &c., in improper places.

XLIX. No person shall deposit, throw, or allow to run, lodge, or accumulate upon the surface of any street, square, court, highway, or place, or on any waste or unoccupied ground, or in any uncovered drain, ditch, watercourse, sink, pond, water trough, or other collection of water, or expose or cause to be exposed in any other manner whatever within the district, any animal or vegetable matter, sewage, waste liquid, fish, offal, ordure, blood, bones, manure, shells, broken glass, china, or earthenware, dust, ashes, house refuse, waste refuse, rubbish, dirt, or runnings from any manufactory, or other offensive or noxious matter whatever, without the special leave of the Local Board.

Exceptions.

L. Provided always, that no person shall be liable to a penalty for throwing or depositing any sand or ashes in the time of frost upon any footway to prevent accidents, or any manure, or other materials in the time of frost, upon the course of water pipes, in order to prevent the water therein from being frozen, or any clean litter or other materials in order to prevent noise, in case of sickness.

Rubbish, &c. during progress of buildings.

LI. Provided also, that no person shall be liable to any penalty for throwing or depositing on any street, square, court, highway, alley, footway, or other public passage, any rubbish, dirt, or materials, used in or occasioned by the building, rebuilding, or repairing of any house or building,

in cases where such person shall, to the satisfaction of the authorised officer of the Urban Sanitary Authority, enclose the space where such deposit is made, within a sufficient fence; and shall, where directed so to do by such officer, as aforesaid, lay down with proper materials a sufficient temporary footway for foot-passengers, communicating with the foot-causeway at each end thereof, and fenced off from the remaining portion of the street or thoroughfare by a good or sufficient rail; the whole enclosure and temporary footway to be so constructed as to leave sufficient room for a passage of coaches, waggons, and the ordinary traffic through the said street or thoroughfare, and to be approved of by the said officer.

Removal of excepted things.

LII. No person shall be entitled to claim exemption from the liabilities attached to any offence against the 49th bye-law under either of the above provisoes, unless such person shall cause the sand, ashes, manure, litter, rubbish, dirt, enclosing boards, temporary footways, rails, and other materials enumerated in the said provisoes, to be promptly and effectually removed as soon as possible after the cessation of the cause which occasioned their deposit or erection.

Exception as to manure, &c., in farming operations.

LIII. Provided also, that no occupier of any farm, or arable or pasture land, who shall use, deposit, or dispose of the dung or manure made or employed by him in farming operations, according to the usual course of husbandry, shall be liable to the penalty imposed by the 49th bye-law, where such dung and manure is not mixed with any night-soil or matter which shall have been removed from any privy, water-closet, or cesspool, and where such dung or manure is not deposited, or left in any heap or midden at, or upon, any place or places within 200 yards of any street or continuous line of houses.

Exception to ashes in brick-fields.

LIV. Provided also that the 49th bye-law shall not be taken to prohibit the deposit of ashes or other materials used or required in the manufacture and preparation of bricks, where such ashes and other materials are deposited only in the brickfields or places where such manufacture or preparations are, and may be lawfully carried on, and are not mixed with any animal or vegetable refuse, or other offensive and noxious matter.

Not to limit 59th section of Public Health Act.

LV. Provided also, that nothing in the 49th bye-law contained, shall be taken to limit in any manner the power conferred by the 59th section of the Public Health Act upon the Inspector of Nuisances, to order the occupier of any premises whatever, whereon there shall be any accumulation of manure, dung, soil, filth, or other offensive or noxious matter, to remove the same within twenty-four hours after notice duly sent to such occupier requiring such removal.

Carrying night-soil &c., through street.

LVI. Where any nightsoil, sewage, or any contents of any cesspool, or any other offensive or noxious matter, has to be carried in or along any street, thoroughfare, or place within the district, it shall be carried in vessels properly covered, and no part thereof shall be allowed to fall on the street or surface.

Time, and mode of ditto.

LVII. No nightsoil, sewage, or other contents of any cesspool, nor any other noxious or offensive matter shall be conveyed through any street or thoroughfare within the district, except within such hours as may be, from time to time, fixed by the Urban Sanitary Authority, nor at any time, except in carts properly covered and secured against any escape of the contents thereof, or any issue of offensive smells from the same, to the satisfaction of the Urban Sanitary Authority.

Offensive matter dropped in streets, &c.

LVIII. If, in the course of emptying any privy, water-closet, or cesspool, or of removing nightsoil, the contents of any cesspool, or other offensive matter, any of such nightsoil, contents, or other matter should be dropped, spilled, or slopped in any streets, passages, highways, or thoroughfares within the district, the person or persons who are engaged in effecting such emptying or removal shall well and carefully sweep and cleanse the place on which such matter shall have been dropped, spilled, or slopped as aforesaid, and shall effectually remove such sweepings therefrom, within the hours fixed by the Urban Sanitary Authority for such emptying and removal as aforesaid.

Carts, &c., not to remain in streets.

LIX. No cart, waggon, or carriage used for the purpose of receiving and removing nightsoil, sewage, or other matter from any cesspool, shall be suffered to stand or remain in any public street, passage, highway, or thorough-

fare, for any longer time than shall be necessary for the loading thereof.

When occupiers to remove refuse.

LX. Every occupier of premises in any part of the district in which the Urban Sanitary Authority shall not from time to time give notice that they will cause all refuse to be removed, shall remove from such premises (and in such a manner as not to create a nuisance in the process of removal) all the refuse from such premises (at least once in every week), and shall in the meantime provide, to the satisfaction of the Urban Sanitary Authority, means of storing the said refuse, so that it shall not become a nuisance to the occupants of the premises on which it arises, or to the other inhabitants of the district.

As to Cleansing Footways, &c., Removal of Refuse, and Cleansing Privies.

Offensive privies, &c.

LXI. In case any privy, water-closet, earth-closet, or cesspool within the district shall be in a foul or offensive state, so as to require cleansing or emptying, and notice under the hand of the Inspector of Nuisances, or other authorised officer of the Urban Sanitary Authority, shall be given to the occupier, or left at his place of abode or business, or left with any householder entitled to the use of the said privy, water-closet, or earth-closet, requiring such occupier or householder to cleanse or empty the same within a time to be therein mentioned, and such occupier or householder shall neglect or omit to comply with such notice, then and in every such case the occupier or householder to or for whom such notice shall have been given or left as aforesaid shall, for every such neglect or omission, forfeit and pay such sum as shall be hereinafter provided; and the filth and soil of the said water-closet, earth-closet, privy, or cesspool may forthwith, after the expiration of such notice, be removed by the Inspector of Nuisances, or other authorised officer of the Urban Sanitary Authority at the expense of such occupier or householder, and such expense shall be recovered in the same manner as the penalties imposed by these Bye-Laws.

Emptying privies, &c.

LXII. No person shall empty, or assist in emptying, any privy, water-closet, cesspool, or similar receptacle of offen-

sive matter within the district, without the use of such deodorisers, and the employment of such other means of preventing disagreeable or hurtful effects therefrom, as shall be directed by the Urban Sanitary Authority, or any of their authorised officers.

Discretionary power in the Board.

LXIII. In all cases in these Bye-Laws where rules are laid down to be strictly adhered to, it shall be lawful for the Urban Sanitary Authority, in any particular and special case, to relieve from or modify the laws, in such manner as in their discretion shall meet such particular or special case.

Penalties.

LXIV. Any person offending against any of the above Bye-Laws, or who shall do any act thereby forbidden to be done, or who shall omit to do any act thereby required to be done by him, or who shall prevent or oppose the inspection hereinbefore provided for by the authorised officers of the Urban Sanitary Authority, shall forfeit and pay for every such offence a penalty not exceeding five pounds, and, in case of a continuing offence, a further penalty, not exceeding the sum of forty shillings, for each day after written notice of the offence from the Urban Sanitary Authority or their authorised officer; such penalties to be recovered and applied as the statute directs.

Given under the Seal of Office of the said Urban Sanitary Authority and under the hands of Five of the Members thereof, the day of

Seal of the Urban Sanitary Authority.

... ...
... ...
... ...
... ...
... ...

Five of the Members of the Urban Sanitary Authority.

... ...

Clerk to the Urban Sanitary Authority.

Confirmed—

... ...

HOME OFFICE, WHITEHALL.

Duties of Clerk.

The Clerk will have to sign notices on behalf of the Board, to take and preserve minutes of the Board meetings and of all committees, and to assist by his advice and opinion in all measures, taken by the Board. It is impossible, in the present state of the law, to urge too strongly and continuously on all local authorities the necessity of adhering to its very letter, as the courts are most unwilling to allow any restrictions on owners of dealing with private property beyond that expressly sanctioned by statute. Any attempt, therefore, to act in the '*spirit*' of the Sanitary Acts must be avoided.

The Clerk will be able to appear in all proceedings instituted by or against the local authority, and will generally, between the meetings of the local authority, carry on the business subject to such control by committees or otherwise as the local authority may appoint and determine. The Clerk to a rural sanitary authority will be the Clerk of the Union.

Treasurer.

The Treasurer must in no case be the Clerk or his partner. He may well be the Banker of the Board, but there is nothing in his office which needs be specially adverted to as differing from the duties of the treasurer of any corporation or large company.

Accounts of Sanitary Authority.

The accounts of an urban authority are to be audited, if in a corporate district, by the borough auditor, otherwise by the Poor Law auditor of the district.

Auditor.

The Auditor gives public notice of his audit; the accounts are open for inspection for seven days to ratepayers, and he has power to strike out of the accounts any items which appear to him improper, and to surcharge those members of the Sanitary authority who have authorised the payment.

Surcharges.

Appeal against decision of Auditor.

This power is subject to an appeal either to the Court of Queen's Bench or to the Local Government Board, which last body can treat the matter in dispute upon equitable considerations, apart from a strict and technical view of the legality of the payments.

Costs of proceedings thrown on Members.

Very serious liabilities may be incurred by members of sanitary authorities not acting strictly within the scope of their authority; for besides the power of surcharge lodged in the auditor, proceedings in equity may be instituted to prevent expenses being thrown on the rates, thus adding very heavy costs to the first charge falling on

those who have consented to payments not authorised by law. These disputed items of account have largely, in the past, consisted of monies paid for the promotion of or opposition to Bills in Parliament not injuriously affecting the property of the local authority instituting the proceedings, although of importance to the interests of the ratepayers, and incidentally bearing upon the powers and duties of the local authority, such as Water and Gas Bills. These questions will be set at rest in the future by the Bill of last session, which enacts that before incurring any such expenses a special vote of the governing body, passed by an absolute majority, after ten days' notice by public advertisement, and in cases of promotion of Bills a further special resolution shall be passed, and also as to opposition or promotion, a vote of consent of the ratepayers and owners of the district at a public meeting shall be taken, in the manner provided in the Local Government Act, 1858, for the adoption of that Act. This involves the necessity, if required, of taking a poll of the district. The accounts being audited, a report is sent by the Auditor to the Clerk of the Sanitary Authority, and an abstract of the accounts is published in the local papers; a copy of the accounts is to be transmitted to both the Home Secretary and to the Local Government Board, who will, upon application, furnish to any Sanitary Authority a blank form of accounts. It is better, if possible, to have all accounts made up to the 31st day of March in each year. The accounts of all rural sanitary authorities are audited in every respect in the same manner as their accounts are audited in their capacity as guardians of the poor. Any monies received or paid by overseers on account of any rural authority are to be audited in the same manner as the accounts of overseers collecting or paying any monies for the purposes of the Acts relating to the relief of the poor, and a copy of such accounts are to be transmitted to the Local Government Board. The office of Surveyor to a sanitary local authority is one of great importance. Upon his ability and intelligence will very largely depend the success of sanitary work. He will have to report upon all applications for laying out new streets, building new houses, making con-

What are disputed items of account.

Borough Funds Bill, 1872.

Report of Auditor.

Abstract of Accounts to be published.

Transmission of Accounts.

Time for making up Accounts.

Accounts of rural Sanitary Authorities.

Overseers' Accounts.

Surveyor.

His duties.

nections with sewers, and improvements of the district generally; and where works are done in the district, will have to superintend their execution, and report upon their completion to his Board. If works ordered as private improvements by the authority are not carried out by the parties upon whom the order is made, it will be his duty to execute them either by day-work under his own superintendence, or, if of the value or amount of £100, then by a contractor appointed by the local authority after public tender. He has the power, upon receiving written authority from the Board, to enter into any premises and examine and lay open any drains or watercourses, &c., in order to remedy or prevent a nuisance. He will, in an urban district, as regards highways in the district, be in the same position as a surveyor of highways, his Board being constituted the surveyor, and will have the power to do all ministerial acts which a surveyor of highways can perform. He is to make estimates for the Board before any rates or contracts are made or entered into, and under sanction of his report, stating it to be necessary, the local authority will have power to carry their sewers into, through, or under any lands whatsoever. The bye-laws of a Local Board will also entail heavy duties and responsibilities on the Surveyor, and it is only by his constant watchfulness, specially in cases of new buildings, that sanitary regulations can be properly and efficiently carried out, and the authority protected from unseemly contention with the ratepayers. It is now imperative on every sanitary authority, whether urban or rural, to appoint, either by itself or in combination with the authorities of other sanitary districts, a Medical Officer of Health, such first appointment not to be for a longer period than five years. The Act of 1872 provides that this officer shall be a duly qualified medical practitioner; but, beyond this, requires no other qualification for the office, and unless the Local Government Board pays out of the public revenues a portion of the salary, it has no control over the appointment and salary of, or duties to be discharged by, the Medical Officer of Health. This officer, like the Surveyor, may be also the Inspector of Nuisances

Entry into premises.

Highways.

Estimates.

Bye-Laws.

Medical Officer of Health. Appointment.

Qualification.

Salary and duties.

and has all the powers, whether so appointed or not, lodged in that office. The duties of a Medical Officer of Health, not being authoritatively declared, will depend much on the sanitary authority by whom he is appointed. In theory he should be the mainspring of action in all sanitary matters but there is such jealousy of medical interference and control not only among sanitary authorities but also on the part of their constituents, as materially to limit the scope of his action and interference. It is believed, and rightly so, that large expenses will always follow the appointment if recommendations certain to be the result of careful sanitary inspecton of any district are to be carried out. In order to avoid this many authorities affix to the appointment so small a salary as to make the duties merely nominal in order to discharge their obligation without entailing any further cost on the district. In theory the Medical Officer of Health should be the health officer of the district, the director of a system of what may be called medical police. That is, he should know, by reports promptly sent to him by medical practitioners, of any case of infectious or contagious disease, especially when endemic or epidemic, occurring in his district. The register of deaths should be either under his control or always open to his inspection, and he should constantly supervise all the streets and buildings of his district, condemning the latter when unfit for human habitation, and reporting those requiring alterations and amendments, in order to prevent injury to health or life. He should dictate the conditions necessary to be observed in common lodging-houses, manufactories, slaughter-houses, or other buildings of public or quasi-public character. He will be expected periodically to report on the health and mortality of his district, to visit any places brought under his notice by the inspector of nuisances, to examine food supposed to be unwholesome, and take proceedings, or attend to give evidence before the magistrate when the owner or seller of unwholesome food is summoned for that offence. In general, although contrary to all right action in sanitary matters, in the present state of the law and public feeling on the subject, the less obtrusive the action of a medical officer of health, the better will his

Minutes of G. B. of H.

employers and the public be satisfied. Under the Public Health Act, 1848, it was a part of the duty of the General Board of Health, then in existence to declare what should be the functions performed by the Officer of Health, and the following circular, issued by that Board in 1851, will show the view then entertained, and this will be at the present time a most useful guide to those authorities who wish sanitary measures to be efficiently supervised by a competent officer. Following the minute of the General Board of Health will be found the Regulatious issued by the Local Government Board, 1872, as to the duties of the Officer, and the two documents may be usefully compared.

Minutes as to Duties of Officers of Health, issued by the General Board of Health. 1851.

Duties of the Officer of Health, as directed by the General Board of Health, under the 40th section of the Public Health Act, 1848.

Whereas it has of late been ascertained by public inquiries into the sanitary condition of towns, that the causes which produce excessive sickness and premature mortality, are definite, palpable, and preventible, and that although such causes press with peculiar intensity on the humbler classes they often severely afflict every other class; and whereas many diseases break out and spread without the knowledge that they are produced or aggravated by common and preventible causes, and it is found by experience that many such diseases give distinct warning of their approach, and may, by prompt attention to such warning, be arrested in their further development and spread; and whereas from the want of due means of giving such knowledge and warning, excessive mortality prevails, especially in the more densely peopled parts of towns; and whereas by the 40th section of the Public Health Act, it is enacted that the Local Board of Health may from time to time, if they shall see fit, appoint, with the sanction of the General Board of Health, a fit and proper person, being a legally qualified medical practitioner or a member of the medical profession, and to be called the

Officer of Health, who shall be removable by the said Local Board, and shall perform such duties as the General Board of Health shall direct :—

Now, therefore, we, the said General Board, do hereby, under our hands and official seal, direct that the following duties shall be performed by Officers of Health, appointed pursuant to the above section ; provided that any of such duties as may involve the visiting of private premises be performed by consent of the occupier or other person in charge of such premises.

General scope of duties.

1. The general duties of the Officer of Health will comprise the duty of giving instructions and directions for the removal or prevention of causes of disease common to several persons, and also for the prevention or removal of causes of disease to individuals, where those causes come within the province of local administration under the Public Health Act.

Not to extend to services provided for by private practice.

2. Except in cases where existing disease may be alleviated by the immediate removal of any of the hereinafter specified causes, the general duties of the Officer of Health shall in no case comprehend treatment for the cure or alleviation of disease.

Primary duties in regard to common or epidemic disease.

3. The Officer of Health shall take all practicable means to obtain the earliest information of the occurrence of cases of fever, of whatsoever type, of small-pox, measles, or other epidemic, endemic, or contagious disease.

Visitation of places where epidemic diseases occur.

4. On obtaining information of the occurrence of cases of sickness or death from any such disease, he shall immediately visit the spot.

House to house visitations to ascertain the numbers affected by premonitory symptoms.

5. He shall examine and ascertain, by house-to-house visitation or otherwise, whether others besides those who have died are affected, and he shall give such warning or instructions to the persons affected as may be calculated to induce them to have recourse to medical treatment, or take such measures as the circumstances of the epidemic or other species of disease may appear to require.

Duties in respect to vaccination.

6. In case of an outbreak of small-pox, he shall inquire whether any person living in or near the premises are unvaccinated, and urge on the Guardians the duty of seeing that all unvaccinated persons are vaccinated under the

3 & 4 Vict. c. 29, and 4 & 5 Vict. c. 32, and take steps to discover unvaccinated persons, and secure their vaccination with the least possible delay. He shall also inquire under what circumstances the outbreak originated; carefully investigating the history of the first case, and the mode in which the disease was propagated. He shall inquire into and report upon the causes which have tended to impede the practice of vaccination, or to render the vaccination ineffectual, and the circumstances which may render re-vaccination desirable.

Instructions as to inmates of overcrowded rooms.

7. In case of the occurrence of any epidemic disease amongst the occupants of any single room occupied by one family, or by more than one lodger, or tenements otherwise overcrowded, the Officer of Health shall give instruction for the removal of the sick, or the diminution of the overcrowding, or for the prevention, by such means as may be available, of the spread of the disease.

Instructions in cases of death from epidemic diseases.

8. In the case of a death in any room occupied as a living or sleeping room by survivors, he shall give instructions either for the removal of the corpse to some house or place of intermediate reception to await the funeral rites, or for the removal of the occupiers.

Duties in cases of death.

9. In all cases of death, he shall give such instructions to the survivors as he may be authorised to give under any Act of Parliament as to the care of the body, as to the sort of coffin to be used for the prevention of noxious evaporations, and the removal and interment of the body, with such precautions as may be required for the protection of the public health.

Inquiries as to conditions causing or favouring the spread of epidemics.

10. He shall, after having given such instructions as aforesaid, in such order as he may deem necessary, examine into cases of typhus or other epidemic, endemic, or contagious disease, and inquire whether such disease was caused or aggravated by anything which is capable of removal in or about the premises, the living or sleeping rooms, or places of work of the persons attacked, and shall notify the same to the persons responsible for the nuisance; as in the case of accumulations of filth, noxious cesspools, house-drains, or sewers of deposit, to the officers responsible therefor; he shall also, where necessary, give in-

structions for lime-washing or the application of deodorising or disinfectant mixtures or substances.

Instructions for inquiries as to epidemics amongst children in schools.

11. In the case of small-pox, or any other contagious or epidemic disease attacking any child who has frequented any school, he shall, as early as may be practicable, visit such school, and inquire and examine whether there be symptoms of the infection or prevalence of the disease amongst the other children, and give such instructions and advice as may appear to be necessary for the prevention of the spread of the disease.

Instructions for inquiries as to epidemics amongst workpeople in factories and workshops.

12. In the case of the like disease attacking any worker (whether young or adult) in any factory or place of work with others, he shall visit such place of work, and inquire and examine whether there be symptoms of the disease amongst the workers, and give such instructions or advice as may appear to be necessary for the prevention of the spread of the disease.

Instructions as to communication with ministers of religion, medical officers, and others.

13. Besides his own frequent visitation and inspection of those parts of his district which are the most likely to be the seats of disease, in order that he may ascertain as early as possible the actual occurrence of any form of zymotic disease, he shall maintain a constant communication with the Inspector of Nuisances for the district (whose reports he shall examine, and give such instructions thereon as will best insure the speedy discovery of all causes injuriously affecting the public health), with the ministers of religion, the registrar of his district, and the Union medical officers; and shall from time to time examine the medical weekly returns, and the registers of sickness and mortality furnished by the district medical officers.

14. He shall appoint and notify convenient times at which, when not prevented by extraordinary duties, he will personally attend daily, or at such times as may be convenient, at his office, or other convenient place, to receive information in respect to the occurrence of epidemic disease or matters affecting the public health within the district.

Instructions as to inquiries into conditions predisposing

15. Inasmuch as the ordinary seats of epidemics are also the localities of other classes of disease which shorten life such as scrofula, and its frequent concomitant pulmonary

consumption, he shall further make a special examination of the conditions which produce a predisposition to this class of disease as well as to epidemics within the district.

to scrofulous and pulmonary complaints.

16. In his inspection of schools, manufactories, or workshops, he shall take note of the children, young persons, and workpeople, who may appear to be pallid, feeble, sickly, or in a peculiarly low condition of health, and inquire whether such condition has been produced by overcrowding, by defective ventilation, imperfect cleansing, or any other removable cause of debility or disease.

Inspections of schools.

17. He shall himself exercise such a superintendence over measures of prevention or alleviation which he may have recommended as will enable him to ascertain whether they have been properly and effectually performed; and if he find any deficiency or delay in the execution, he shall make inquiry into the cause thereof, and report the same to the Local Board of Health.

Duties in respect to works of amendment recommended by him.

18. He shall perform all the duties imposed upon him by any bye-laws of the Local Board, whether of inspection or otherwise, in respect of lodging and slaughter-houses, and any other matter affecting the public health in respect of which Local Boards may have framed bye-laws under the Public Health Act; and in visiting any tenements in pursuance of such bye-laws, he shall from time to time make such visits by night, or at such times as the inmates are assembled, and observe and report on the state and action of the means of ventilation in such places.

19. Whilst public works of sanitary improvement or cleansing are in progress, such as the removal of cesspools for the formation of new drainage or sewerage works, the cleansing out of town ditches, watercourses, ponds, or canals, he shall give such instructions as to the time and mode of conducting the operations, the application of water, lime, deodorizing or disinfecting substances; and any other means of protecting the public from noxious or offensive emanations as may appear to him to be requisite.

Duties in respect to the construction of works of sanitary improvement.

20. He shall, upon any complaint, or upon the emission of any offensive or noxious smell, or the accumulation of deposits in drains or sewers, report upon the same to the Local Board of Health, or to such officer as may be ap-

Duties in case of complaints or noxious effects from works.

pointed by the Local Board to receive and act upon such complaint.

Duties in respect to noxious trades and processes.

21. On the occurrence of atmospheric pollution from any offensive process or trade carried on in any manufactory, yard, house, or premises within his district, he shall inquire into the cause, and report on the appropriate means for the prevention of such noxious smells and emanations. In case of the refusal or neglect of the occupier or proprietor to adopt the measures recommended, or other effectual remedies, or in case of the manufacturing process being of such a nature as not to admit of any effectual remedy, he shall then observe and collect the evidence of the injurious effect of the process in question on health, shall be prepared to adduce such evidence whenever called upon by the proper authorities, and shall otherwise assist those authorities by all the means in his power in their efforts for the abatement of the nuisance.

To inquire as to the fact as well as the cause of death where there is no medical certificate.

22. In cases where there is no medical certificate, or where, from anything that appears, the deceased died without any regular medical attendance, it shall be the duty of the Officer of Health to examine into and determine as closely as he may the cause, as well as the fact, of the death.

Duties in case of violent deaths.

23. In the case of deaths suspected to be from violence, accident, neglect, or carelessness, or when from other circumstances he may deem it desirable, he shall notify the same in writing to the Coroner, and shall present a copy of such notification to the Local Board at their next meeting, and shall in all cases, where practicable, render such services as may be requisite to aid the investigations of coroners or magistrates.

Attendance at the meeting of the Local Board of Health.

24. He shall attend at all meetings of the Local Board of Health, and report to them his proceedings during the intervals between their meetings.

Duties as to keeping a diary and register of complaints.

25. He shall keep a diary, in which he shall make an entry of his visits, and notes of his observations and instructions thereon, which diary he shall produce, whenever required, both to the Local and to the General Board of Health; he shall also keep a register of complaints or representations made to him, to be called "The Officer of

Health's Application Book," in which shall be recorded the date and nature of every application made to him, the date of its examination, and the result of such examination, and shall produce such book whenever required both to the Local and General Board of Health.

To inform General Board in certain cases.

26. On the occurrence or discovery of any source of injury to the public health, or of any epidemic disease, he shall, besides warning the Local Board thereon, send information thereof to the General Board of Health.

To report quarterly.

27. He shall from the best information he can obtain, make a report not less frequently than once a quarter, of the nature and amount of sickness and death which have prevailed during the quarter.

To report on the progress of works of amendment.

28. He shall, in such report, describe the progress and effects of any works of amendment which may have been commenced or executed.

To report annually on the health of the district.

29. He shall also prepare annually, a printed report and tabular return of the ascertained sickness as well as mortality of the district for the year, distinguishing therein the sickness and mortality of the several streets, squares, courts, lanes, yards, and alleys; and for this purpose, where there is a survey of the district, he shall be furnished by the Local Board, with a tracing or copy of the same, on which he shall mark the seats of epidemic or other disease; and such report shall set forth the amount of epidemic sickness or mortality which has prevailed in the district, as compared with former years, amongst different classes of persons, and in different localities of the district, and also a comparison of such rate of sickness and death, with the rates of sickness and death amongst other classes and in other places, and any instructions in the way of warning, or for prevention or mitigation of sickness, which the facts may suggest, as well as the particulars of any death which may have occurred from epidemic, endemic, or contagious disease, the amount and causes of infantile mortality (that is, of children under five years of age), and the nature and amount of sickness and death which may have occurred from causes which appear to be preventible, and within the recognised province of public administration, or that appear requisite to be brought within it.

Topics of the Annual Report.

Circulation of reports.

30. The annual and quarterly reports shall be printed, and a copy given to each member of the Local Board, and two copies shall be transmitted to the General Board of Health, and one to the office of the Registrar-General, and the Poor Law Board, as well as to each member of the Boards of Guardians, and to each of the medical officers, and incumbents of the several parishes within the district; and it shall otherwise be circulated for the information of the inhabitants of the district, as may be provided by the Local Board of Health.

Given under our hands, and under the Seal of the General Board of Health, this Twelfth day of February, in the year of our Lord One thousand eight hundred and fifty-one.

L.S. (Signed) Ashley.
Edwin Chadwick.
T. Southwood Smith.

Minutes as to Duties, &c., of Medical Officers of Health issued by the Local Government Board, 1872–3.

Section I.—*Qualification.*

Art. 1.—No person shall be qualified to be appointed to the office of Medical Officer of Health under this Order, unless he shall be registered under 'The Medical Act of 1858,' and shall be qualified by law to practise both medicine and surgery in England and Wales, such qualification being established by the production to the Sanitary Authority of a diploma, certificate of a degree, licence, or other instrument granted or issued by competent legal authority in Great Britain or Ireland, testifying to the medical or surgical, or medical and surgical, qualification or qualifications of the candidate for such office.

Provided that the Local Government Board may, upon the application of the Sanitary Authority, dispense with so much of this Regulation as requires that the Medical Officer of Health shall be qualified to practise both medicine and surgery, if he is duly registered under the said Act to practise either medicine or surgery.

SECTION II.—*Appointment.*

Art. 1.—A Statement shall be submitted to the Local Government Board, showing the population and extent of the District for which the Sanitary Authority propose to appoint the Medical Officer or Medical Officers of Health, and the salary or remuneration intended to be assigned; and where the circumstances render desirable the appointment of one Medical Officer of Health for two or more Sanitary Districts, Statements shall, in like manner, be submitted to the Local Government Board, showing the names of the Districts to be combined for that purpose, the population and extent of each District, the mode in which it is intended that the appointment shall be made, whether jointly or severally by the Sanitary Authorities of those Districts, and the amount of salary or remuneration proposed to be assigned to the officer appointed.

Art. 2.—When the approval of the Local Government Board has been given to the proposals submitted to them, the Sanitary Authority or Authorities shall proceed to the appointment of a Medical Officer of Health accordingly.

Art. 3.—No appointment of a Medical Officer of Health shall be made, unless an advertisement giving notice of the day when such appointment will be made shall have appeared in some public newspaper circulating in the District or Districts, at least seven days before the day on which such appointment is made: Provided that no such advertisement shall be necessary for the appointment of a temporary substitute.

Art. 4.—Every such appointment hereafter made shall, within seven days after it is made, be reported to the Local Government Board by the Clerk to the Sanitary Authority, or, in the case of a joint appointment, by the Clerk to one of the Sanitary Authorities by whom the appointment is made.

Art. 5.—Upon the occurrence of a vacancy in such office, the Sanitary Authority or Authorities shall proceed to make a fresh appointment, which shall be reported to the Local Government Board as required by Sect. II. Art. 4. of this Order; but if the Sanitary Authority or Authorities desire to make any fresh arrangement with respect to the

District or the terms of the appointment, they shall, before filling up the vacancy, supply the particulars of the arrangement to the Local Government Board in the manner prescribed by Sect. II Art. 1., in regard to the first appointment, and if the approval of the Local Government Board be given, absolutely or with modifications, the Sanitary Authority or Authorities shall then proceed to fill up the vacancy according to the terms of the approval so given.

Art. 6.—If any Officer appointed under this Order be at any time prevented by sickness or accident, or other sufficient reason, from performing his duties, the Sanitary Authority or Authorities, as the case may be, may appoint a person qualified as aforesaid to act as his temporary substitute, and may pay him a reasonable compensation for his services; and every such appointment shall be reported to the Local Government Board as soon as the same shall have been made.

Section III.—*Tenure of Office.*

Art. 1.—Every Officer appointed under this Order shall continue to hold office for such period as the Sanitary Authority or Authorities appointing him may, with the approval of the Local Government Board, determine, or until he die, or resign, or be removed, by such Authority or Authorities with the assent of the Local Government Board, or by the Local Government Board.

Provided that the appointments first made under this Order shall not be for a period exceeding five years.

Art. 2.—Where any such Officer shall have been appointed after the passing of the Public Health Act, 1872, for one or more Sanitary Districts, and any change in the extent of the District or Districts, or in the duties, salary, or remuneration, may be deemed necessary, and he shall decline to acquiesce therein, the Sanitary Authority or Authorities by whom he was so appointed may, with the consent of the Local Government Board, but not otherwise, and after six months' notice in writing, signed by their Clerk or Clerks, given to such Officer, determine his office.

Art. 3.—No person shall be appointed who does not

agree to give one month's notice previous to resigning the office, or to forfeit such sum as may be agreed upon as liquidated damages.

Section IV.—*Duties.*

The following shall be the duties of the Medical Officer of Health in respect of the District for which he is appointed; or if he shall be appointed for more than one District, then in respect of each of such Districts :—

1. He shall inform himself as far as practicable respecting all influences affecting or threatening to affect injuriously the public health within the District.
2. He shall inquire into and ascertain by such means as are at his disposal the causes, origin, and distribution of diseases within the District, and ascertain to what extent the same have depended on conditions capable of removal or mitigation.
3. He shall by inspection of the District, both systematically at certain periods, and at intervals as occasion may require, keep himself informed of the conditions injurious to health existing therein.
4. He shall be prepared to advise the Sanitary Authority on all matters affecting the health of the District, and on all sanitary points involved in the action of the Sanitary Authority or Authorities; and in cases requiring it, he shall certify, for the guidance of the Sanitary Authority or of the Justices, as to any matter in respect of which the Certificate of a Medical Officer of Health or a Medical Practitioner is required as the basis or in aid of sanitary action.
5. He shall advise the Sanitary Authority on any question relating to health involved in the framing and subsequent working of such bye-laws and regulations as they may have power to make.
6. On receiving information of the outbreak of any contagious, infectious, or epidemic disease of a dangerous character within the District, he shall visit the spot without delay and inquire into the causes and circumstances of such outbreak, and advise the persons competent to act as to the measures which may appear to him to be re-

quired to prevent the extension of the disease, and so far as he may be lawfully authorized, assist in the execution of the same.

7. On receiving information from the Inspector of Nuisances that his intervention is required in consequence of the existence of any nuisance injurious to health, or of any overcrowding in a house, he shall, as early as practicable, take such steps authorized by the Statutes in that behalf as the circumstances of the case may justify and require.

8. In any case in which it may appear to him to be necessary or advisable, or in which he shall be so directed by the Sanitary Authority, he shall himself inspect and examine any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour, exposed for sale, or deposited for the purpose of sale or of preparation for sale, and intended for the food of man, which is deemed to be diseased, or unsound, or unwholesome, or unfit for the food of man; and if he finds that such animal or article is diseased, or unsound, or unwholesome, or unfit for the food of man, he shall give such directions as may be necessary for causing the same to be seized, taken, and carried away, in order to be dealt with by a Justice according to the provisions of the Statutes applicable to the case.

9. He shall perform all the duties imposed upon him by any bye-laws and regulations of the Sanitary Authority, duly confirmed, in respect of any matter affecting the public health, and touching which they are authorized to frame bye-laws and regulations.

10. He shall inquire into any offensive process of trade carried on within the District, and report on the appropriate means for the prevention of any nuisance or injury to health therefrom.

11. He shall attend at the office of the Sanitary Authority, or at some other appointed place, at such stated times as they may direct.

12. He shall from time to time report, in writing, to the Sanitary Authority, his proceedings, and the measures which may require to be adopted for the improvement

or protection of the public health in the District. He shall in like manner report with respect to the sickness and mortality within the District, so far as he has been enabled to ascertain the same.

13. He shall keep a book or books, to be provided by the Sanitary Authority in which he shall make an entry of his visits, and notes of his observations and instructions thereon, and also the date and nature of applications made to him, the date and result of the action taken thereon and of any action taken on previous reports, and shall produce such book or books, whenever required, to the Sanitary Authority.

14. He shall also prepare an annual report, to be made at the end of December in each year, comprising tabular statements of the sickness and mortality within the District, classified according to diseases, ages, and localities, and a summary of the action taken during the year for preventing the spread of disease. The report shall also contain an account of the proceedings in which he has taken part or advised under the Sanitary Acts, so far as such proceedings relate to conditions dangerous or injurious to health, and also an account of the supervision exercised by him, or on his advice, for sanitary purposes over places and houses that the Sanitary Authority has power to regulate, with the nature and results of any proceedings which may have been so required and taken in respect of the same during the year. It shall also record the action taken by him, or on his advice, during the year, in regard to offensive trades, bakehouses, and workshops.

15. He shall give immediate information to the Local Government Board of any outbreak of dangerous epidemic disease within the District, and shall transmit to the Board, on forms to be provided by them, a Quarterly Return of the sickness and deaths within the District, and also a copy of each annual and of any special report.

16. In matters not specifically provided for in this Order, he shall observe and execute the instructions of the Local Government Board on the duties of Medical Officers of

Health, and all the lawful orders and directions of the Sanitary Authority applicable to his office.

17. Whenever the diseases Prevention Act of 1855 is in force within the District, he shall observe the directions and regulations issued under that Act by the Local Government Board, so far as the same relate to or concern his office.

Section V.—*Remuneration.*

Art. 1.—The Sanitary Authority or Authorities, as the case may be, shall pay to any officer appointed under this Order such salary or remuneration as may be approved by the Local Government Board; and where such officer is appointed for two or more districts, the salary shall be apportioned amongst the Districts in such manner as the said Board shall approve.

Provided that the Sanitary Authority or Authorities, with the approval of the Local Government Board, may pay to any such officer a reasonable compensation on account of extraordinary services, or other unforeseen circumstances connected with his duties or the necessities of the District or Districts for which he is appointed.

Art. 2.—The salary or remuneration of every such officer shall be payable up to the day on which he ceases to hold the office, and no longer, subject to any deduction which the Sanitary Authority or Authorities may be entitled to make in respect of Sect. III., Art. 3; and in case he shall die whilst holding such office, the proportion of salary (if any) remaining unpaid at his death shall be paid to his personal representatives.

Art. 3.—The salary or remuneration assigned to such officer shall be payable quarterly, according to the usual Feast Days in the year, namely, Lady Day, Midsummer Day, Michaelmas Day, and Christmas Day; but the Sanitary Authority or Authorities may pay to him at the expiration of every calendar month such proportion as they may think fit on account of the salary or remuneration to which he may become entitled at the termination of the quarter.

Given under our Seal of Office, this Eleventh day of November, in the year One thousand eight hundred and seventy-two.

JAMES STANSFELD,
President.

JOHN LAMBERT,
Secretary.

Opposition to Sanitary Improvements.

The greatest opposition to health measures has come in the past from holders of small cottage property. It is not merely the payment of increased general district rates which must ensue from putting streets, alleys, courts, and gutters in order, and providing adequate main drainage and water supply; but that which presses most heavily is the amount of costs which come under the head of private improvement expenses.

The medical officer of health, finding fever, small-pox or diarrhœa prevailing in a row of cottages, reports, as the result of his examination to the Local Board, that the water supply is defective, the sulliage soaking into the ground, the floors of the cottages broken, uneven, sodden, and the cottage itself in bad repair; thereupon comes an order to connect each cottage with the main drainage if within 100 feet of the houses, to make water-closets, and to provide efficient water supply, besides putting the house reported on into proper repair. This often means an expenditure of from £10 to £20 per house; and if the work be not done by the owner after order of the local authority, then it is carried out by the surveyor, and the expense charged upon the owner. This may be, it is true, spread over a number of years as a private improvement rate, but it involves so much difficulty and trouble to collect these private improvement rates that the expenses incurred are generally sought to be recovered summarily. When, as is unfortunately too common, the greatest possible profit is sought to be wrung out of these miserable habitations of the poor, it will occasionally entail great opposition to have the profits of two or three years suspended by the necessity to meet expenses incurred for benefits undesired and unappreciated. Undesired and unappreciated in too many cases by the occupiers themselves, for those most requiring care are the most unwilling to be

Private improvement expenses.

Private improvement rate.

cared for, and the most regardless of the simplest precautions to preserve health and ensure comfort. It is true these expenses are the results of accumulations of long years of neglect, but they are none the less heartily protested against. While the owners of this class of property have large influence in returning members to the local legislature we can hardly wonder that Boards representing them and their views should look with more than doubt and distaste at sanitary measures recommended by Medical Officers of Health.

Cottage proprietors.

Reaction as to Sanitary Measures.

The Legislature itself, and Central Boards created by it, have to some extent participated in these feelings, and the instructions given to Medical Officers of Health in 1851, which have been printed *in extenso*, pp. 39 *et seq.*, are far in advance of those more recently issued.

Remedies.

Intermediate Authorities.

The remedy for this indisposition to adopt necessary sanitary measures must either be sought in a higher class constitution of sanitary authorities—with some intermediate authority to enforce what may be necessary to the public health of the district, or enactments which shall make the Medical Officer of Health independent of the local authority with power in the intermediate and Central Boards to inquire into any of his recommedations which are not carried out, and with power, if judged expedient, to enforce, and, if necessary, to execute them, charging the cost on the defaulting authority. Besides this, we must earnestly desire such an education of the great mass of people who are the most to be benefited by sanitary measures, as shall make them more ready to appreciate and more anxious to further by their co-operation what is undertaken for their good.

Statutory duties of Officer of Health.

Filthy houses.

Overcrowding.

The statutory duties of the Officer of Health are to report upon houses in a filthy or unwholesome condition, and thereupon the local authority may order such whitewashing, cleansing or purifying as may tend to prevent or check infectious or contagious diseases. In the same way, if he report that any house is so overcrowded as to be dangerous or prejudicial to health the local authority may commence proceedings before justices who may make any order to abate the overcrowding complained of, and have also power

to inflict a fine not exceeding 40*s*. on the offending party —under the Artizans' and Labourers' Dwelling Act which is applied to all urban authorities, the Medical Officer of Health may report on any premises, whether built before or after the constitution of the district, that is on any dwelling-house or inhabited building, with its yard, garden, outhouses, &c., and upon his report and that of the surveyor, after opportunity being afforded to the owner to make any objection to the reports of these officers, such works are to be executed by the owner or by the district, as may be determined by the local authority to be necessary. Against this order there is an appeal to Quarter Sessions.

Artizans' and Labourers' Dwelling Act.

Upon the written representation of four or more householders living in or near any street that anywhere in the neighbourhood they believe any premises to be in a condition dangerous to health, the Officer of Health is forthwith to inspect such premises and to report on them; but the absence of any such representation will not excuse him from inspecting and reporting any premises which ought to be put into a proper condition. Besides these enactments, the Officer of Health or Inspector of Nuisances may, at all reasonable times, inspect and examine any animals or food, and in case any such food or animals be in a condition improper for human use, he has power to order their seizure, and to cause them to be brought before a justice, who has power to order that they be destroyed. The person offering such animals or food for sale may be fined £20, or imprisoned, without the option of a fine, for three months. The Medical Officer of Health or Inspector of Nuisances is protected in the discharge of these duties; for any one obstructing him or any of his assistants in their execution may be fined £5.

The Inspector of Nuisances is not the least important of the officers to be appointed by the local authority, and great care should be bestowed on the selection of a proper person to fill the post.

Inspector of Nuisances.

Where the superintendent of police of a district discharges the duties, there is the advantage of his having the whole police force as subordinates, and from the nature of their ordinary daily and nightly work they must

Police as Inspectors.

necessarily become acquainted with many of the grievances upon their beats calling for remedy. Still they have many other functions to discharge, and it is doubtful whether the benefit is not greater by appointing one person as inspector of lodging-houses and nuisances, whose whole time should be given to the discharge of the duties of the office. In these, tact and discretion are quite as necessary as intelligence. It would be incredible, were it not too painfully true, how averse the general public is to be subject to any sanitary inspection, however much it is intended to enure to their benefit; and this specially in the case of the poor, who seem to think it a duty to discourage and deprecate interference. To overcome this prejudice is essential to an adequate discharge of duty. The Inspector must join the greatest civility with equal firmness, in order to obtain admission into premises the state of which can only be learned by an examination from within. The Inspector should, whenever practicable, act only under express directions and sanction of the Board or its officers, and should take upon himself no responsibility or interference beyond the scope of his duties. It is essential that the inhabitants should know where complaints may be received; there should, therefore, be fixed times when the Inspector may be seen in his office, and a book for entry of complaints should always be accessible. All letters of complaint received by him should be at once communicated to the Clerk, and every verbal complaint entered immediately in his presentment book. This book should always be presented either to the local authority at its meeting, or to the committee appointed by the Board for the purpose of dealing with nuisances. A record should be kept by him of all services of notices, and matters not specifically dealt with at any time should be from time to time brought forward to prevent them being absolutely lost sight of and neglected. It will be his duty to inspect animals and food, and where necessary to submit to the Medical Officer of Health or to an analyst, where one is appointed in his district, under the Adulteration of Food Act, any animals or food which may appear to him to be unsuitable for human use or food. The standing orders, to which reference has been already made,

One Inspector for a district.

Hindrances to Sanitary Work.

Notices to Inhabitants. Complaints, where to be received.

Presentment book.

Standing orders.

should provide for such accord among the various officers of the local authority, and such combined action where necessary, as would prevent the possibility of conflict, and ensure to the subordinate officer at all times the counsel and support of the Surveyor, Clerk, and Medical Officer of Health. Subjoined are the Regulations issued by the Local Government Board as to the duties of Inspector of Nuisances :—

To the Guardians of the Poor of the several Unions, Parishes, and Places in England and Wales, in which such Guardians act as a* Rural Sanitary Authority under the Public Health Act, 1872 :—

And to all others whom it may concern.

Whereas by Section 10 of 'The Public Health Act, 1872,' it is enacted that it shall be the duty of every Rural Sanitary Authority to appoint from time to time an Inspector or Inspectors of Nuisances, for the purposes of the Sanitary Acts ;

And whereas it is thereby further enacted that the Local Government Board shall have the same powers as they have in the case of a District Medical Officer of a Union, with regard to the qualification, appointment, duties, salary, and tenure of office of Officers of Sanitary Authorities, any portion of whose salary is paid out of moneys voted by Parliament ; and that the same person may, with the sanction of the Local Government Board, be appointed the Inspector of Nuisances for two or more Sanitary Districts, by the joint or several appointment of the Sanitary Authorities of such Districts :

Now we, the Local Government Board, deeming it expedient that Regulations should be made with respect to the appointment, duties, salary, and tenure of office of Inspectors of Nuisances appointed by Rural Sanitary Authorities, in all those cases where any portion of the salary of any such officer is paid out of moneys voted by Parliament, do hereby order and direct as follows :

SECTION I.—*Appointment.*

Art. 1.—A statement shall be submitted to the Local Government Board, showing the population and extent of

* The Regulations for Urban Sanitary Authorities are precisely similar.

the district for which the Sanitary Authority propose to appoint the Inspector or Inspectors of Nuisances, and the salary or remuneration intended to be assigned; and where the circumstances render desirable the appointment of one Inspector of Nuisances for two or more Sanitary Districts, statements shall, in like manner, be submitted to the Local Government Board, showing the names of the Districts to be combined for that purpose, the population and extent of each District, the mode in which it is intended that the appointment shall be made, whether jointly or severally by the Sanitary Authorities of those Districts, and the amount of salary or remuneration proposed to be assigned to the Officer appointed.

Art. 2.—When the approval of the Local Government Board has been given to the proposals submitted to them, the Sanitary Authority or Authorities shall proceed to the appointment of an Inspector or Inspectors of Nuisances accordingly.

Art. 3.—No appointment of an Inspector of Nuisances shall be made under this Order unless notice has been given at one of the two ordinary meetings next preceding the meeting or meetings at which the appointment is to be made by the Sanitary Authority or Authorities, as the case may be, such notice being duly entered on the Minutes, or unless an advertisement, giving notice of the day when such appointment will be made, shall have appeared in some public newspaper circulating in the District or Districts, at least seven days before the day on which such appointment is made: Provided that no such notice or advertisement shall be necessary for the appointment of a temporary substitute.

Art. 4.—Every appointment hereafter made shall, within seven days after it is made, be reported to the Local Government Board by the Clerk to the Sanitary Authority, or, in the case of a joint appointment, by the Clerk to one of the Sanitary Authorities by whom the appointment is made.

Art. 5.—Upon the occurrence of a vacancy in such office, the Sanitary Authority or Authorities shall proceed to make a fresh appointment, which shall be reported to the

Local Government Board as required by Section 1. Art. 4. of this Order; but if the Sanitary Authority or Authorities desire to make any fresh arrangement with respect to the District or the terms of the appointment, they shall, before filling up the vacancy, supply the particulars of the arrangement to the Local Government Board, in the manner prescribed by Section 1. Art. 1. in regard to the first appointment, and if the approval of the Local Government Board be given, absolutely or with modifications, the Sanitary Authority or Authorities shall then proceed to fill up the vacancy according to the terms of the approval so given.

Art. 6.—If any officer appointed under this Order be at any time prevented by sickness or accident, or other sufficient reason, from performing his duties, the Sanitary Authority or Authorities, as the case may be, may appoint a fit person to act as his temporary substitute, and may pay him a reasonable compensation for his services; and every such appointment shall be reported to the Local Government Board as soon as the same shall have been made.

Section II.—*Tenure of Office.*

Art. 1.—Every Officer appointed under this Order shall continue to hold office for such period as the Sanitary Authority or Authorities appointing him may, with the approval of the Local Government Board, determine, or until he die, or resign, or be removed, by such Authority or Authorities with the assent of the Local Government Board, or by the Local Government Board.

Provided that the appointments first made under this Order shall not be for a period exceeding five years.

Art. 2.—Where any such Officer shall be appointed for one or more Sanitary Districts, and any change in the extent of the District or Districts, or in the duties, salary, or remuneration, shall be deemed necessary, and he shall decline to acquiesce therein, the Sanitary Authority or Authorities by whom he was so appointed, may, with the consent of the Local Government Board, but not otherwise, and after six months' notice in writing, signed by their Clerk or Clerks, given to such Officer, determine his office.

Art. 3.—No person shall be appointed who does not agree to give one month's notice previous to resigning the office, or to forfeit such sum as may be agreed upon as liquidated damages.

Section III.—*Duties.*

The following shall be the duties of an Inspector of Nuisances in respect of the Sanitary District for which he is appointed, or if he shall be appointed for more than one district, or for a part of a District, then in respect of each of such districts, or of such part:—

1. He shall perform, either under the special directions of the Sanitary Authority or (so far as authorized by the Sanitary Authority) under the directions of the Medical Officer of Health, or in cases where no such directions are required, without such directions, all the duties specially imposed upon an Inspector of Nuisances by the Sanitary Acts, so far as the same are in force in the District, or by the Orders of the Local Government Board.
2. He shall attend all meetings of the Sanitary Authority when so required.
3. He shall by inspection of the District, both systematically at certain periods, and at intervals as occasion may require, keep himself informed in respect of the nuisances existing therein that require abatement under the Sanitary Acts.
4. On receiving notice of the existence of any nuisance within the district, or of the breach of any bye-laws or regulations made by the Sanitary Authority for the suppression of Nuisances, he shall, as early as practicable, visit the spot, and inquire into such alleged nuisance or breach of bye-laws or regulations.
5. He shall report to the Sanitary Authority any noxious or offensive businesses, trades, or manufactories established within the District, and the breach or non-observance of any bye-laws or regulations made in respect of the same.
6. He shall report to the Sanitary Authority any damage done to any works of water supply, or other works belonging to them, and also any case of wilful or negligent

waste of water supplied by them, or any fouling by gas, filth, or otherwise, of water used for domestic purposes.

7. He shall from time to time, and forthwith upon complaint, visit and inspect the shops and places kept or used for the sale of butchers' meat, poultry, fish, fruit, vegetables, corn, bread, or flour, or as a slaughter-house, and examine any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour, which may be therein; and in case any such article appear to him to be intended for the food of man, and to be unfit for such food, he shall cause the same to be seized, and take such other proceedings as may be necessary in order to have the same dealt with by a Justice: Provided, that in any case of doubt arising under this clause, he shall report the matter to the Medical Officer of Health, with the view of obtaining his advice thereon.
8. He shall, when and as directed by the Sanitary Authority, procure and submit samples of food or drink, and drugs suspected to be adulterated, to be analyzed by the analyst appointed under the Adulteration of Food Act, 1872, and upon receiving a certificate stating that the articles of food or drink, or drugs, are adulterated, cause a complaint to be made, and take the other proceedings prescribed by that Act.
9. He shall give immediate notice to the Medical Officer of Health of the occurrence within his District of any contagious, infectious, or epidemic disease of a dangerous character; and whenever it appears to him that the intervention of such Officer is necessary in consequence of the existence of any nuisance injurious to health, or of any overcrowding in a house, he shall forthwith inform the Medical Officer thereof.
10. He shall, subject in all respects to the directions of the Sanitary Authority, attend to the instructions of the Medical Officer of Health with respect to any measures which can be lawfully taken by him under the Sanitary Acts for preventing the spread of any contagious, infectious, or epidemic disease of a dangerous character.
11. He shall enter from day to day, in a book to be provided by the Sanitary Authority, particulars of his in-

spections and of the action taken by him in the execution of his duties. He shall also keep a book or books, to be provided by the Sanitary Authority, so arranged as to form, as far as possible, a continuous record of the sanitary condition of each of the premises in respect of which any action has been taken under the Sanitary Acts, and shall keep any other systematic records that the Sanitary Authority may require.

12. He shall at all reasonable times when applied to by the Medical Officer of Health, produce to him his books, or any of them, and render to him such information as he may be able to furnish with respect to any matter to which the duties of Inspector of Nuisances relate.

13. He shall, if directed by the Sanitary Authority to do so, superintend and see to the due execution of all works which may be undertaken under their direction for the suppression or removal of nuisances within the District.

14. In matters not specifically provided for in this Order, he shall observe and execute all the lawful orders and directions of the Sanitary Authority, and the orders which the Local Government Board may hereafter issue, applicable to his office.

15. Where more than one Inspector of Nuisances shall be appointed by a Sanitary Authority, such Authority, with the approval of the Local Government Board, may either assign to each of the inspectors a portion of the district, or may distribute the duties of Inspector of Nuisances amongst such inspectors.

Section IV.—*Remuneration.*

Art. 1.—The Sanitary Authority or Authorities, as the case may be, shall pay to any Officer appointed under this Order such salary or remuneration as may be approved by the Local Government Board; and where such Officer is appointed for two or more Districts, the salary shall be apportioned amongst the Districts in such manner as the said Board shall approve.

Provided that the Sanitary Authority or Authorities, with the approval of the Local Government Board, may pay to any such Officer a reasonable compensation on

account of extraordinary services, or other unforseen circumstances connected with his duties or the necessities of the District or Districts for which he is appointed.

Art. 2.—The salary or remuneration of every such Officer shall be payable up to the day on which he ceases to hold the office, and no longer, subject to any deduction which the Sanitary Authority or Authorities may be entitled to make in respect of Sect. II. Art. 3; and in case he shall die whilst holding such office, the proportion of salary (if any) remaining unpaid at his death shall be paid to his personal representatives.

Art. 3.—The salary or remuneration assigned to such Officer shall be payable quarterly, according to the usual Feast days in the year, namely, Lady Day, Midsummer Day, Michaelmas Day, and Christmas Day; but the Sanitary Authority or Authorities may pay to him at the expiration of every calendar month such proportion as they may think fit, on account of the salary or remuneration to which he may become entitled at the termination of the quarter.

Given under our Seal of Office, this Eleventh day of November, in the year One thousand eight hundred and seventy-two.

JAMES STANSFELD, *President.*
JOHN LAMBERT, *Secretary.*

In order to meet the costs incurred by Sanitary Authorities there is an unlimited power of rating. All limitations in local rating in local acts, so far at least as the sanitary work of sanitary authorities is concerned, having been removed by the Public Health Act, 1872. The only limits now existing are in respect of the Artizans' Dwellings Act, which must not exceed 2*d.* in the pound, and the Libraries' Act, which is limited to 1*d.*

The rates which are levied by Urban Sanitary Authorities are:—

1st. General District Rates.
2nd. Highway Rates.
3rd. Private Improvement Rates.

These are levied on an assessment of properties founded

on the poor rates assessment, but it is in the power of the Urban Authority, if dissatisfied with this valuation, to appoint its own valuer to make a separate assessment. Practically this is the only rate which the Urban Sanitary Authority can be required to make, and it is advisable that so far as possible this should be the extent of the uses of its powers.

To this rate there are certain exemptions. Thus land used as arable, pasture or meadow ground, &c., tithes, docks, canals, railways, constructed under the power of an act of Parliament, and reservoirs, are only rated at one-fourth of their assessable value, while churches, chapels, ragged and sunday schools, mines (except coal mines), volunteer storehouses, and some literary and scientific societies, are altogether exempt.

But these exemptions so far as land, docks, railways, &c., are concerned, do not apply where, as happens in some cases, a highway rate is levied independently of and in addition to the general district rates.

The occupier generally pays the rates, but the local board may contract with the owner for their payment by the latter. When the rateable value of the premises does not exceed 10*l.* or where the premises are let to weekly or monthly tenants or in separate apartments, or where the rents are collected more frequently than in quarterly payments; in any of these cases the urban authorities may make a reduction of not less than one-fifth and not exceeding one-third, except where the owner undertakes to pay whether the premises be occupied or vacant, when they have the power to reduce the payment to one-half the ordinary amount. Where this agreement is carried out any franchise belonging to the occupier is preserved. It is also in the power of the local authority to excuse from payment of a portion or all of any rates on the ground of poverty or other cause of a similar character. These rates are all to be made to cover expenses which have been incurred or are proposed to be incurred within six months of the time of levying the rates, that is, either six months retrospectively, or upon an estimate of what will be required during the ensuing six months.

Private inprovement rates have been elsewhere sufficiently alluded to.

The expenses incurred by a rural sanitary authority are divided under two heads :—

1st. General expenses.

2nd. Special expenses.

General expenses, other than private improvement expenses, are the expenses incident to carrying on the work of the sanitary authority, disinfection, conveyance of infected persons, and all other expenses not declared to be special expenses.

Special expenses are those incurred for the construction of sewers and providing water supply in any contributing place within the district, and all other expenses in respect to any contributing place determined by order of the local government board, to be special expenses. Where any joint work is done the local authority may apportion the expenses of construction and maintenance of the works in such proportion as it deems to be fair, and these will be special expenses as applicable to each of the contributing places. The local government board have a power to revise this apportionment. General expenses are to be paid out of a common fund, and when requisite the overseers will have to pay the amount of such requisition of the local authority out of the poor rates, and as to special expenses out of a rate to be made and levied in accordance with the provisions of the Sewage Utilization Act, 1867. That is with the exemption as to land, railways, &c., being rated only to one-fourth of the assessable value as already pointed out as existing in the case of a general district rate.

If the overseers do not comply with the precept of the sanitary authority and pay over the amount required, then proceedings can be taken against them to recover the money summarily. All sanitary authorities have power to borrow money for permanent works with the sanction of the local government board. The amount is however limited to one year's assessable value of the district, such amount to be repaid in thirty years. This power may, however, be enlarged by provisional order to two years' assessable value and the period of repayment may be extended to fifty years.

CHAPTER IV.

ROADS AND WAYS.

Urban Authorities as surveyors of highways.

EVERY urban authority is constituted surveyor of highways, and in virtue of such office has exclusive control over all the highways in its district. That is, all roads repairable by the inhabitants at large. They have, as a local authority, no jurisdiction over turnpike roads, but should any such road become out of repair through default of the trustees it will become the duty of the local authority to put it in order, the cost being defrayed by a highway rate which differs from the special district rate before referred to inasmuch as it is levied on all rateable property equally without exemption or deduction; this was a liability formerly incident to a parish or township, but where a parish or township becomes divided into districts under sanitary authorities, only that part of the parish constituted as an urban sanitary authority within which the turnpike road is situated can be called on to contribute towards the expenses of repair.

Turnpike roads.

Public roads between districts.

Where a public road forms a boundary of a district, the presumption will be that up to the *medium filum viæ* the road belongs to and is repairable by the district it adjoins and of which it forms the boundary.

Public roads.

A very important distinction as to roads is to be borne in mind when considering the question of maintenance and repair. It may be generally stated that a local authority has only power, out of the general district rates, to repair and maintain those roads which were public before the constitution of the district, that is, with the exception of any other roads which may have been taken up by the sanitary authority and declared to be public since its formation; but in all cases where roads were public highways before

the date of the establishment of a sanitary authority, then owners and occupiers cannot be called on for any other contribution except that which they make in common with all ratepayers to the general district rate. This is the main reason why so many streets, courts and alleys remain uncared for and in an unsanitary condition. The great cost which would fall on the rates, to put these in proper repair, deters sanitary authorities from undertaking, on account of its magnitude, a work of the first necessity, and a foolish economy in this respect naturally entails complaints from ratepayers who in the more obvious duty of their representatives see neglect, without appreciating the saving of expense they would themselves urge. This is a most false economy, for if the streets, roads and ways of a town or district are allowed to become or to remain so out of repair as to become receptacles for filth or to afford by their inequalities depressions in which foul water accumulates, it is in vain to look for beneficial results from other sanitary measures. It should therefore be the very first performance of duty on the part of a sanitary authority to put in order and afterwards to keep the foot and carriage ways of its district in thorough repair and cleanly condition by watering, removing obstructions and clearing any filth, snow &c., not only for the direct advantage necessarily following to the health of the district, but also as showing by the attention bestowed on the exterior of dwellings what is expected from the inhabitants as to those parts of their habitations which are exclusively under their own control. Keeping the streets and roads in repair may be done either by the servants of the authority, or by contractors appointed and paid by the local authority, who may contract either for scavengring alone or conjoined with removal of ashes and refuse from dwellings, which should be carefully and systemically performed. So the work of reflagging, paving, curbing, channelling, &c., may either be done by day work or by contract, but no contract above the sum of £10 can be entered into without the particulars being reduced to writing, and no contract for any sum amounting to £100 can be accepted without giving 10 days public notice and inviting tenders for the work. The local authority may at the same time receive tenders for keep-

Contributions of owners and occupiers.

Maintenance and repair.

Contractors.

ing any of the work they execute in repair for a term of years if the surveyor has recommended this course to be desirable.

New roads.

New roads may be made by the owner of any property for public use through his land by agreement with the sanitary authority. This may be done at the expense of the person making the road, or, with the consent of two thirds of the sanitary authority, any portion of the expenses may be paid out of any fund at their disposal for public improvements, and after the road has been completed in accordance with the agreement, it will become a public highway repairable at the public expense. Where an urban sanitary district is a municipal borough, under the Local Government Acts, and there is a surplus of the borough fund, such surplus not arising from a borough rate, the Town Council may vote any portion of such surplus to be expended in the improvement of the borough, either by expending the money in drainage works, enlargement of streets, or otherwise, in order to carry out the provisions of the Sanitary Acts. The form of bye-laws before printed at page 16, contains directions as to the making and laying out of new streets. Besides this the sanitary authority may by agree-

New streets.

ment purchase premises either to make new streets or to improve old ones, and this being a permanent work, will be paid for out of monies borrowed for that purpose with the sanction of the Local Government Board. If this is to be done compulsorily it will require a provisional order, as in all cases where land is sought to be acquired otherwise than by agreement. But in most towns there are many streets which are not repairable by the inhabitants at large, that

Private streets.

is, private streets. In order to determine whether they are to be repaired by the sanitary authority out of the rates or by the private owner, it must be ascertained whether they were public highways at the date of the constitution of the district. This is the date when the Public Health Statutes came into force in the district either by Order in Council or by the order of the General Board of Health confirmed by provisional order, or in cases where there existed Improvement Commissioners, by resolution of such commissioners, or by any of the other powers by which the Local Government

Acts can be adopted, such as resolutions of the majority of ratepayers, etc.

Rural authorities.

Under the present state of the law, if at any time a rural district under a rural authority, which now has no control over streets and roads, wishes to have such power, or it appears desirable to the Local Government Board that it should be changed into an urban authority, or ratepayers assessed to one tenth of the rateable value make application to that effect, then all or any of these powers as to roads may be given to the rural authority. But in future, without the consent of the Local Government Board, the Local Government Acts cannot be adopted in any rural district. These powers have been referred to as they have an all important bearing at the present time on streets not highways repairable at the public expense. In all such cases the urban authority has power to call on the owners or occupiers of any street which in their opinion is not in a proper condition, to sewer, level, pave, flag, curb, channel, provide the means of lighting, and to metal and make good both foot-way and carriage-way, and even where the foot-path has been a public way the same powers may be exercised. If the notices thus served be not complied with, then the local authority can do the work and as in all other cases where work is done by a local authority as to which the onus of execution is imposed on owners or occupiers, the expenses may be recovered from the owners or occupiers, either summarily or as private improvement expenses, in such proportion according to their frontage on to the street as may be settled by the Surveyor, and if there be any dispute, then by arbitration in the manner provided by the Public Health Act, 1848. It is, however, to be noted that incumbents and ministers of churches and chapels and the churches and chapels themselves are exempted from payment and the local authority may undertake the work and pay the expenses incident to the frontages occupied by these buildings. When any private streets are thus properly put in order they may be declared, within certain formalities as to notice, etc., public highways, and thereafter be repairable and repaired at the public expense. Besides this, an urban autho-

Adoption of Local Government Acts.

Paving new streets.

Private improvement expenses.

Adoption of private streets.

Altering roads.

rity may alter and amend bridges, make agreements with turnpike trustees for repairing portions of their roads, or removing toll bars within two miles of the centre of the town, and generally may do all such acts as would tend to improve the ways of the district, if, by so doin ; t interfere with no private rights. If they do so it must be either by agreement and compensation, or by provisional order or private Act of Parliament, as in the case of other lands of which they wish to possess themselves. In any case no sanitary authority can lessen any rights, or acquire land or property, or dispossess any person of any privilege without making due compensation. And all interference with private rights or property for a supposed public advantage should be attempted in a conciliatory spirit and without an assumption of claim to disregard private possession, which will more than anything else defeat the intentions, however good, of a sanitary authority and interpose serious obstacles to public progress and advancement.

Private rights.

Roads declared public highways in rural districts.

No new road or way can in future be deemed or taken to be a highway, repairable by the public at large, without three months' notice being given to the surveyor, to whose satisfaction, and also that of the justices, it must be completed and be kept in repair for twelve months, and in addition there must be a vote of the vestry, adopting it as of sufficient utility to the inhabitants of the parish to justify its being kept in repair. If the vestry decide against making the road, a justice may then summon the party purposing to make the road before him, and he will determine whether or no the road should become a public way. These powers of the vestry may now be exercised by the sanitary authority. In the case of any owner desiring to dedicate a new road, the consent of the sanitary authority in an urban district is an essential pre-requisite, and if it is not satisfied with the condition of the road, the certificate of justices will be of no avail. But before entirely or partially closing any way, whether foot-path or carriage-way, with the view to its diversion, certain points must be observed. The surveyor must request the view of two justices, who, if of opinion that the new way would be nearer or more commodious to the public, will

Urban districts.

Diversion of roads.

certify that they have viewed the highway, and their opinion as to its being nearer or more commodious to the public. There must be a consent in writing from the owner of the land through which the new highway is to be made, as also a notice exhibited on the spot, and advertised for four successive weeks in a newspaper circulating in the county, and also for four Sundays on the door of the church in every parish in which the highway is situate. There must be a plan also by a competent surveyor, setting out the old and new highways by metes, and bounds, and measurements. The various documents, certificates, plans, &c., are then lodged with the clerk of the peace of the county, who reads them in open court, and they are then enrolled among the records of the court of Quarter Sessions. If any rate-payer is aggrieved by any street being out of repair, or improperly cleansed, he should make complaint in writing to the clerk of the sanitary authority; for if it be a public road, it is the duty of the authority to have it put in a proper state of repair out of the public funds; if it be a private street, then the authority should call on the owner to do the necessary work. In case of default after due notice has been given to the local authority by written complaint, a memorial should be addressed to the Local Government Board soliciting their interference. In this way due attention to local matters may be enforced on the sanitary authority. The statutory powers given to gas, water, and telegraph companies to interfere with roads will be noticed under the various chapters dealing with these matters. They are much the same as those given to sanitary authorities to deal with the property belonging to these companies, and may be stated to be a general power to do what is necessary in the public interest, doing as little damage as possible, and not permanently interfering with the flow of gas or water, &c. Obstructions in the streets and nuisances are provided against by the Town Police Clauses Act, 1847, which inflicts a penalty of 40*s.*, or imprisonment for fourteen days, for offences which cause obstructions, annoyances, or danger to the residents or passengers therein. The local authority have also power to require owners to take down or secure buildings, walls, or anything affixed

Streets out of repair.

Default of sanitary authority.

Gas and water companies pipes.

Obstructions in streets.

Securing buildings.

thereto which are in a ruinous or dangerous state, and the surveyor may at once put up a hoarding or fence for the protection of passengers. All expenses are to be paid by owners, who may be also indicted for a public nuisance, if there is any danger of the building, &c. falling on the public highway. Where houses are dangerous to health, they will fall under the duties already pointed out as appertaining to the Medical Officer of Health, and the local authority must see to their being put into such a condition as will make them fit for habitation without injury to health.

Rural districts

In rural districts, under a rural authority, roads will remain, as to their government, in the same position as before the passing of the Public Health Act, 1872. It is, however, to be remembered that the rural authority is both the sewer and nuisance authority of the district, and as such, except as to the maintenance of the roads, will have ample power to provide for the health of the inhabitants. It cannot make stringent bye-laws, such as would be applicable to streets in the crowded thoroughfares of a town, but in all the particulars essential to the sanitary condition of roads and buildings will be found practically to be possessed of sufficient scope of authority.

CHAPTER V.

SEWERS.

Sewers vested in urban authority

WHEREVER there is an urban authority, there all the sewers existing at the time of the constitution of the district, or afterwards constructed, are vested in the sanitary authority. This is not so with rural authorities, which, although by the Public Health Act, 1872, made the sewer authority, have no control over sewers existing before they were so constituted, except in so far as they take over the powers of sewer authorities constituted under the Sewage Utilization Act, 1865, when these bodies have constructed sewers under that Act. Highway Boards who have made drains and sewers under the Highways Act for road drainage, or acting as the local authority under the Nuisances Removal Acts, have constructed sewers and drains to avoid or remedy nuisances, have still control over these. This is a state of the law which urgently calls for alteration, and which must continue to create difficulty in rural parishes. It is hardly clear what is the exact definition of a sewer or of a drain; but the former may be said to be the larger channels used for the removal of water or fluid sulliage of all kinds, while the term drain is more properly applicable to a small sewer used for removing fluid from one block of building. On a sanitary authority is cast by law the duty of providing adequate sewers for draining the district; on the private individual the duty of providing outlets competent to drain his property into the sewers provided at the public cost. This duty, we have already seen, applies to roads equally with buildings. Sewering a district may be divided into two parts, the collecting of sewage and its disposition. The former requires

Highway Boards.

Difficulties in present state of the law.

Sewers and drains: definition.

Duties of sanitary authorities as to sewage.

Collection of sewage.

Outfall.

merely mechanical engineering which can always be accomplished when once the outfall is determined. The latter, a matter of great and apparently increasing difficulty, a difficulty which can be removed by no general legislation, as it is impossible to suppose that any public measure could be passed by the Legislature which would confer on sanitary authorities the necessary power. Sewage outfall means the acquirement of land, either by agreement or compulsorily. It is only the *quantity* of land necessary to be taken which will differ, whatever plan may be adopted to prevent sulliage being or becoming a nuisance. Where water is used as the carrier, there will of necessity be a large quantity daily to be disposed of. This cannot be turned with safety into rivers, however large their volume, without some preparatory process of defæcation. Now, whether this process be chemical or mechanical, whether chemical substances or mechanical means be used for precipitation and deposition, or the earth itself by means of irrigation or filtration be the medium employed, land is ultimately the essential requisite. In the present state of the law, land may be acquired by agreement either by purchase or on lease; but it is only in a very few instances that land under these conditions is available. Whatever may be the stringency of laws against creating a nuisance by the means adopted by local authorities, there is a very general dislike to the proximity of sewage works by owners of property, and by owners of adjoining or adjacent properties. Compulsory acquirement of land is therefore the almost universal necessity. To acquire the requisite land compulsorily by public statute, without enquiry into the merits of every individual case, is totally beyond the province or power of general legislation, and would not be for a moment tolerated. We must, then, fall back on the law as it is, which gives to local authorities the power to acquire land compulsorily by provisional order or by a private Act of Parliament. The steps necessary to accomplish either of these have been already briefly sketched out, and they must in every instance be followed by sanitary authorities, except where land can be obtained by agreement. The local authority must be governed by the necessities of the process to be

Acquirement of land.

Disposal of sewage.

Sewage Works.

General legislation impossible.

adopted as to the quantity of land to be taken. Once having obtained the requisite powers, the local sanitary authority would proceed to construct the main sewer. For this purpose, the local authority has power to purchase any rights as to sewers vested in any person, and, for the purpose of constructing new sewers, may enter upon any lands whatever where, upon the report of the Surveyor, it may be shewn to be necessary. If without their district, whether it be an easement or possession of land absolutely, there must, if assent be withheld, be a provisional order, and three months' notice given to owners of an intention to take lands, and also to all parties interested either in the roads or properties adjoining, or who would be likely to be interested in the works to be constructed. All these parties may object against the proposed works to the Local Government Board. But within the boundaries of the district, so far as main sewers are concerned, the local authority has absolute power. This is otherwise as to subsidiary sewers intended to drain a block of buildings, or as to drains. These must pass through the property of the person whose premises are to be drained, or through a public street or road, unless by consent of the owner of any other land. The public sewers thus constructed are to be maintained by the local authority, who can alter, arch over, or improve them, and if necessary may discontinue, close up, and destroy any they may deem to have become unnecessary. If, however, they by so doing deprive any one of the lawful use of any sewer, they must provide another as effectual for his use as the one of which he is deprived. It is further to be noticed that should any premises be sufficiently drained before the construction of any new sewers, it is then the duty of the local authority to deduct from the amount of rates otherwise chargeable in respect of such premises a sum which shall appear to be just. The sewers are to be so cleaned by the sanitary authority as that no nuisance shall arise from them, and that they shall not be injurious to health; and this is accomplished by providing for such rapid transmission of their contents, without detention, to the outfall, as that no gases shall be given off from the sewage matter passing along them,

Quantity of land to be taken.

Three months' notice.

Subsidiary sewers.

Private drains.

Maintenance of public sewers.

Substituted sewers.

Allowance for adequate sewers.

Cleansing sewers.

Rights of owner and occupier.

deposit of solid matter being thus prevented. Any owner or occupier of premises within the district has a right to cause his drains to empty into the sewers of the authority of the district, but he must give notice to the authority, and must comply with their regulations, and also must do the work under the control of their surveyor, or some other person appointed by the local authority; otherwise he will, if neglecting these regulations, be subject to a penalty of £20, and the local authority may close any communication he has, without their consent, made with the sewer.

Regulations as to junctions with sewers.

Unauthorised communications.

No one can cause any sewer or drain to communicate with any sewer of the local authority without their written consent, and if any one does so without authorization, then a penalty of £5 will become forfeited to the Local Board, and a further penalty of £2 a day for every day during which the offence is continued after notice in writing has been served to discontinue the connection.

Interference.

Nothing is to be allowed to interfere with the sewers of the authority, and if anything is erected or constructed in any way interfering with the sewers, the authority may alter or remove it, charging the expense on the offender.

Compulsory drainage.

Into their sewers the local authority may cause all buildings within 100 feet to be drained, or into the sea if within that distance, otherwise a covered cesspool must be constructed at such a distance from the house as the Local Board may direct; and no house can be erected, or old house rebuilt, which has been pulled down to or below the ground-floor without providing proper means of drainage by covered drains, in accordance with a report of the Surveyor. But this is generally made a part of the bye-laws which usually provide that, with the plan sent in for a new house, there shall be also a plan of the intended drainage. The use of sewers provided by a local authority is not confined to persons living within the district, for others living in premises adjoining or near to a sewer may make an agreement with the local authority for payment for the use of the sewer. The payment may be a yearly sum to be determined by arbitration. This may be by one arbitrator if both parties concur in the appointment, otherwise each party selects an arbitrator, or the amount

may be settled by the Justices. All disputes as to the amount of compensation may in this way be determined by two Justices; but their determination cannot extend to determine the right to compensation when this is disputed. The local authority, upon the report of their surveyor, may not only cause drainage to be constructed for any premises, but also a water-closet, earth-closet, privy, and ash-pit, if either of these be wanting; and if, after notice, the owner or occupier fail to comply with the requirements of the local authority, the work may be executed by them and the cost recovered as private improvement expenses.

Water-closets, &c.

All factories and warehouses must have a sufficient number of water-closets and privies under heavy penalties, and the local authority is bound to see that these and all other conveniences in the district, as well as sewers and drains, are kept in such a condition as not to be a nuisance or injurious to health. To do this, large powers are given to all sanitary authorities. Upon their written authorization, the Surveyor, with as many assistants as he may require, is empowered not only to enter into premises after 24 hours' notice in writing, or in cases of emergency without any notice whatever, but he may also open any ground in order to examine into the condition of drains, water-closets, privies, and cesspools. The expenses of doing this will have to be borne by the local authority if it should turn out to have been unnecessary; otherwise it will fall on the owner or occupier.

Factories, &c.

Examination of sewers and drains.

In addition to this there is also power, if necessary, to enter, examine, and lay open any lands for the purpose of making plans, surveying, measuring, taking levels, or examining the course of any sewers, but this can only be done on the order of two justices after notice to the owner or occupier. After the order has been obtained, 24 hours' notice must be given, except in cases of emergency, and the entry made between 10 in the forenoon and 4 in the afternoon. So also as regards gas companies, water companies, and telegraph companies, whose powers will be noticed hereafter, there is power lodged in the local authority to alter the position of their mains or pipes, doing as

Examination of lands.

little injury as possible. But there is a power lodged in the Secretary of State for War, without any legal proceeding, to alter roads and sewers under the powers granted by the Defence of the Realm Act, 1866. There is a power in the Public Health Act, 1848, given to four-fifths of the inhabitants of any parish or place containing less than 2,000 inhabitants, to determine at a public meeting called by the churchwardens and overseers to close up ponds, ditches, sewers, &c., and to provide sewers, wells, or pumps. This has now ceased to be valuable, as the rural authority, under the act of 1872, can do this and all other works necessary for sewering the district and providing an adequate water supply. It has been shown that the sewers of a local authority cannot be in any way interfered with by any private individual; but if, in the course of executing any work by corporations or companies empowered by Act of Parliament to navigate or use any river, canal, &c., it becomes necessary to alter or divert any sewers, &c., they may do the work upon providing and substituting other sewers, &c. Their work must be certified as adequate to the satisfaction of the Surveyor, and must be paid for by themselves. A sanitary authority may agree with an adjacent authority for the execution of works in the adjoining district, and may carry out any works it might execute in its own, making such payment as may be mutually agreed upon. Adjacent sanitary authorities may, by agreement, and with the consent of the Local Government Board, who may, if they think it necessary, direct an enquiry, cause the sewers of one district to be used by the other district for purposes of outfall. There is a proviso to this enactment that, so far as practicable, storm water should be kept from flowing from the sewers of the higher into the sewers of the subjacent district. Also, to prevent, after any such agreement, the authority of the higher district allowing other districts to use its system of sewers, thus casting a great burden on the subjacent district. The Local Government Board may, after enquiry, upon the petition of a sanitary authority, also issue a provisional order for the junction of two or more districts for sewerage purposes. It remains to be seen how

Powers of inhabitants as to closing drains, &c.

Powers of rural authority.

Interference with sewers.

Navigation, Corporations, or Companies.

Agreements with subjacent authorities.

Use of sewers by adjoining district.

Storm waters.

Protection of subjacent districts.

Junction of authorities.

this power will work in the face of the opposition generally set up by local authorities against any combined action.

Consolidation of present enactmenst.

But all these attempts at arrangement clearly show how necessary it is to have some comprehensive enactments, after due enquiry as to watersheds and drainage areas, by which boundaries for sewerage purposes might be defined. It is continually happening that a district remains unsewered, or very partially drained, on account of the physical impossibility of finding an outfall within its own area; while a combined system would act most beneficially for many districts in effectually providing means of sanitary improvement at the same time ultimately diminishing the cost of the works.

CHAPTER VI.

WATER SUPPLY.

Local Boards.

BEFORE the passing of the Sanitary Act, 1866, Local Boards were the only authorities upon whom was laid the obligation to supply water to the public. By the Sewage Utilization Act, 1865, sewer authorities were constituted in every parish, the vestry being clothed with the requisite authority where no other Board charged with the duty of attending to drainage already existed. These powers as to drainage were, by the Sanitary Act, 1866, extended to water, and thenceforth in every part of England the sewer authority became also charged with the responsibility of providing an adequate supply for the inhabitants of its district. The words of the Act of 1866 are, that the sewer authority may, if they think it expedient so to do, provide a supply of water for the use of the inhabitants of the district by

Constitution of sewer authorities.

Powers of Sewer Authorities.

1. Digging wells
2. Making and maintaining reservoirs, and
3. Doing any other necessary acts;

and they may themselves provide a supply, or contract with any other person or companies for a period not exceeding three years to furnish the same. This would seem to leave the matter quite in the discretion of the sewer authority as to taking any measures to provide water supply; but by the 49th section of the same act, to which allusion has already been made, it is provided that where complaint is made to one of her Majesty's Secretaries of State (now the Local Government Board) that a sewer authority or local board has made default in providing its district with a supply of water

Default.

in cases where danger arises to the health of the inhabitants from the insufficiency or unwholesomeness of the existing supply of water, and a proper supply can be procured at a reasonable cost, then the Secretary of State (the Local Government Board), if satisfied of the truth of the complaint after enquiry, may order such supply to be provided, or the Board may itself, by persons appointed for the purpose, do the requisite works and charge the same on the defaulting authority. We have already seen that all distinctions as to sewer authorities are now done away with, that all the country is divided into urban and rural districts under sanitary authorities, and it is a duty attaching to each of these, and a duty of paramount importance in respect to the health of the inhabitants of the respective districts, to provide an adequate supply of pure and wholesome water. What has already been described as to mode of proceeding on the part of inhabitants in other cases of default applies here, and no difficulty need be experienced in getting immediate attention from the Local Government Board to any complaint of insufficient water-supply in any district, when such complaints addressed to the local authority have been allowed to pass unheeded and unredressed. But while the Legislature has thus imposed a duty as to water, the powers and regulations as to providing a supply are inadequate. There is not sufficient provision for compulsory individual supply or adequate power to prevent one district interfering wrongfully with the water-shed of another to its great detriment. Land may be acquired by agreement, or leased for water purposes either within or without the district of a sanitary authority. This proceeding is subject to no restriction, except that sanction must be obtained from the Local Government Board for borrowing any money which may be required for the execution or construction of any works. Land may be taken compulsorily, both within and without the district, for water purposes, either by provisional order or private Act of Parliament, but all the disadvantages attendant on this mode of procedure when used for sewerage purposes are here present, with the additional difficulties arising from the necessity of providing compensation for all persons whose rights are interfered with by any

Order thereon.

Urban and rural districts.

Complaint to Local Government Board.

Provisions for supply.

Land.

Difficulties.

Compensation.

works proposed to be executed by a sanitary authority on any stream. These difficulties, however great, must be dealt with and overcome by a sanitary authority, as it is impossible to preserve the health of any district with an inadequate or impure supply of water.

Water Companies.

What has been here written refers to districts where there is in existence no water company established for the purpose of providing a supply. Where a company exists, and adequately supplies the district, the sanitary authority has no case for interference, although the exigencies of public service renders it always desirable that sanitary authorities should have control over what is essential to a right discharge of their duties; but should the company fail to do all that is reasonably required by a sanitary authority, then the authority can, with the consent of three-fifths of the shareholders of the water company, purchase the undertaking, or may themselves construct waterworks, any differences arising as to the reasonableness of the requirements of the sanitary authority, or the cost, to be settled by arbitration. With respect to any powers to be exercised by a sanitary authority in possessing themselves of water, there is a great distinction to be drawn between water flowing in recognised streams and that which is merely on the surface, or contained in underground channels. In the first case, if any wells sunk by the Local Board, or any works constructed by them, interfere with the water, compensation will have to be paid to the persons whose supply is interfered with; in the latter case this will not be the case although the underground water by being diverted may have dried up a stream in which the water has before that time flowed In water as such there can be no property, every one can use it in whose land it is or flows, but its course cannot be stopped, it must be allowed still to flow on for the benefit of owners of land below, through which the stream naturally passes. This is a right belonging to every riparian proprietor, who may do what he will with the water in his own land so that he does not prevent it from flowing on to the next proprietor below him. Thus it will be at once seen that if sanitary authorities wish to possess themselves of the exclusive use of any stream they

Purchase of water.

Undertakings by Sanitary Authorities.

Ownership of water.

Property in water.

Riparian proprietors.

must buy up the rights of all persons below the point where their works are to be constructed, through whose lands the water in its usual course flows, or they must provide water compensation in such a manner as may be agreed on by the parties. A sanitary authority may call on any owner of premises to provide a proper supply of water if, upon the report of the surveyor it appear that the premises are without such sufficient supply, and if the sanitary authority can supply the water at a rate not exceeding 2*d.* per week, or not exceeding the water rate of any local act in force in the district. If the notice to obtain a supply remains unattended to, the sanitary authority may do the requisite work and obtain payment as in the case of other private improvement expenses: or the expense incurred may be recovered from such owners in a summary manner. With respect to lodging houses without a proper supply of water, the local authority can compel a proper supply to be furnished if it can be done at a reasonable rate. If their order is not complied with, the lodging house can be removed from the register. A sanitary authority has the same power to lay water mains in the streets and roads where it supplies water, as it has to construct and lay sewers, but a water company must have parliamentary sanction before it can legally take up the streets and roads for laying its pipes; without this it is liable to an indictment at common law, and possibly afterwards to an injunction to restrain its action in the future. Water companies, like gas companies, can only carry on their works upon sufferance without a private act or provisional order; with either of these is always incorporated the Water-works Clauses Act which, except in so far as they are modified by the special act, regulate the future conduct of the undertaking. All water companies are bound to keep in their pipes a supply of pure and wholesome water, and, unless it is otherwise provided in the private act, this supply is to be constant and at such pressure as will make the water reach the top story of the highest houses within the limits of the special act, unless the enactment specially provides otherwise. In effect it may be said that, with very few exceptions, this provision is altered in every private act, and the water

Compensation.

Compulsory supply of water.

Recovery of expenses.

Lodging houses.

Water-pipes in streets.

Water Companies.

Constant supply.

High pressure.

Intermittent supply.

is only laid on in districts where the supply is governed by gravitation to the top of those houses in the district which are below the level of the bottom of the reservoir, and this only for a certain time in the day. This gives rise to the

Cisterns.

necessity for storing the water for at least a day's use, and this has been a constant source of mischief and disease in poor houses. Even the rich, in the most expensive and well constructed houses, owing to want of care, are not altogether exempt from injury from this cause. The Committee of

Evil effects of storing water in houses.

the House of Commons which was appointed in 1867 to enquire into the Water Supply of the east of London reported that 'the cisterns for the purpose of storing water for consumption is probably a more fertile source of impurity than any pollution of the river from which the water is drawn. Decaying animal or vegetable bodies, or other impure matter may easily find their way into a cistern, and are more likely to engender disease than any impurity existing in the water before it flows into the cistern.'

In well-regulated houses the cisterns are of course frequently drawn dry, and properly cared for, but as cleanliness decreases, it is found that the cisterns are allowed to become more and more foul, until the lowest state is reached, when the water is stowed in tubs and otherwise in the most disgusting condition, which cannot but be injurious to health, and a cause of the diseases which are found to prevail in the worst regulated parts of London. On the other hand, an intermittent supply of water without cisterns not only deprives the inhabitants of the supply they ought to receive, but from the want of adequate storage it is kept in pails and other small receptacles, in rooms and places where it is

Royal Sanitary Commissions' report on water supply.

liable to much contamination. The Royal Sanitary Commission of 1869, reporting in 1871, says, 'In houses of the rich the cisterns are frequently more or less unsatisfactory, perhaps not free from effluvia, caused by drainage-pipes, whilst in the more confined and less cared for houses of the lower, middle, and working class they are often the receptacle of putrid matter.' This led them further to report, 'We think that Parliament should, as much as possible, insist on the constant service which the general statutes have enjoined.' But there has been much difficulty in determining how to

adopt the constant system, so as to prevent waste or misuse of water. It may be taken that a full supply of water in towns is 20 gallons per head of population per day, but with improper fittings, if the water were at constant high pressure, the dwellings of the poor would be flooded. It must be remembered that it is quite as important, from a sanitary point of view, to get the water away from a poor man's house as to bring it there. Experience has definitively proved that a very large per centage of disease, notably disease of a scrofulous or tuberculoid character, is due to the wet subsoil upon which imperfectly drained houses are built. Where the constant system is in operation rules and regulations have been adopted, which, when properly carried out, will confer great benefit without bringing with it any of the anticipated evils. These rules and regulations are of so much importance that they are subjoined in extenso.

Ordinary daily supply.

Flooding of premises.

Cause of disease.

Constant Water Service in force in the City of Norwich—Rules and Regulations.

1. The company will, at their own cost, lay down and maintain all the lead or other branches extending from their main to the side of the public highway in which such main is situate; and will, at their own cost, carry the pipe through the frontage wall (if there be one), and six inches beyond, or otherwise equivalently allow fifteen inches in length for the owner's or occupier's plumber to connect his work to.

2. The owner or occupier must, at his own expense, lay down and maintain all the pipes and apparatus upon his premises or for his use, and of the strengths and descriptions, and subject to the rules following, that is to say:—

a. Such pipes must, unless otherwise agreed, be of lead, and of not less than the following weight, namely:—

inch.	lbs.
$\frac{3}{8}$	5 per yard.
$\frac{1}{2}$	7 ,,
$\frac{5}{8}$	9 ,,
$\frac{3}{4}$	11 ,,
1	16 ,,
$1\frac{1}{4}$	$22\frac{1}{2}$,,

NOTE.—Owners and occupiers, before laying on the water or making alterations in their apparatus, are requested to inquire at the company's offices the sizes of the pipes proper to be used, that such sizes may be duly proportioned to the pressure of water in the company's mains in the district and thus useless expense be prevented.

b. The drawing (bib) stop and ball cocks must be strong and of hard brass, and the better to secure watertightness, of the kinds from time to time sanctioned and approved by the company; and unless and until due notification to the contrary, the drawing cocks must be of the best and now approved kind of those called 'Screw Down Cocks,' as manufactured by Messrs. Guest & Chrinies, and Messrs. Stocks, Brothers and Taylor, with leather faces not liable to turn on the seat; and in courts of houses and other exposed places, must be protected by an iron casing, and be made to open with keys. And the ball taps must be of the best and now approved kind, as manufactured by Messrs. Lambert & Sons. Till otherwise notified, no other description of cock must be used without the previous and express permission of the company.

c. Every cistern must be absolutely watertight, and be provided with a ball cock, and proper means of access and inspection, but must not have an overflow or waste pipe; and if any such should exist, the same must be removed, or effectually and permanently closed before the water is turned on; but nevertheless as exceptional instances will occasionally occur in which it will be necessary to provide against the possibility of over-filling, the company will in such exceptional instances allow a detective or warning pipe to be attached to the cistern, provided that in every such case a written consent must be first obtained from the manager of the company, stating the fact of such consent, and the position in which the detective or warning pipe must be fixed; and in every such case the work must be executed under the immediate superintendence of an officer of the company, and in the manner stated. On no account whatever can the water of the company be allowed to communicate with any cistern or place intended or used for the reception of rain water.

d. Water Closets.—Every pan closet must be provided with a full and complete apparatus, comprising a ball cock and a service cistern, fitted with a boot or division, to be carried as high as the top of the cistern and capable of containing not more than one and a half gallons of water, when filled within three inches of the top, and two proper valves, so arranged as to let down not more than one boot or division full of water at each pull, or be capable of allowing the water to run to waste either by intention or neglect; and must also have a down pipe of lead from the cistern to the basin of not less than one and a quarter inch in diameter, and weighing nine pounds to the yard run; and a proper basin, scatterer, weighted lever, pan trap, and other appliances needful to prevent such water-closet from becoming a nuisance, and thereby inducing an undue consumption of water; and the valves must be worked by brass rods instead of by wires or chains. Every self-acting or pull down water-closet must be of a description approved by the company, and must have either a lead cistern similar to a pan closet, or a double valve cast iron service box, of a kind approved by the company and fitted with a proper cover to screw on, and internal apparatus in all respects similar to that of the boot of the pan closet above described, and a similar down pipe of lead or cast iron, and must have a proper wide rim flushing basin and trap of a kind approved by the company. No wire will be allowed to be used in the construction of these water-closets. The cast iron double valve service boxes must be provided with a ball tap of the approved kind, and of half an inch diameter where the pressure is less than forty feet effective lead; of three eighths of an inch diameter where the pressure is less than seventy feet effective lead.

NOTE.—No pipe will be suffered, under any pretence whatever, to communicate directly or indirectly with the basin or trap, or otherwise than with the cistern or service-box of a water closet or soil-pan, and the same shall be so constructed and used as to prevent the waste or undue consumption of water, and the return of foul air and other noisome or impure matter into the mains or other pipes of the company.

e. Every bath must be constructed without an overflow or waste-pipe, and must be provided with a well-fitted and perfectly water-tight apparatus, to prevent the water from flowing into and out of the bath at the same time.

f. No pipe must be laid through, in, or into any sough, drain, ash-pit, manure-hole, or other place, from which, in event of decay or injury to such pipe, the water of the company might be liable to become fouled, or to escape without observation, or without occasioning the necessity of immediate repair. In every case, in which any such sough, drain, ash-pit, manure hole, or other place as aforesaid, shall be in the unavoidable course of the pipe, such pipe shall be passed through an exterior cast-iron pipe or box, of sufficient length and strength to afford due protection to the water-pipe, and to bring any leakage or waste within the means of easy detection.

g. Every pipe and apparatus laid and fixed by or for the use of the consumer must be inspected by an officer of the company before it is connected to the company's works; and, if found not in accordance with the company's regulations, must be forthwith removed or altered.

h. Every meter (unless otherwise specially agreed) must be provided with a separate and distinct inlet-pipe, leading from the main or other pipe of the company—upon which inlet-pipe no stop-cock, except the stop-cock (if any) immediately attached to the meter, branch, drawing-cock, or other outlet, leading to or connected with the premises for the supply of which such meter is fixed, will be permitted.

3. The water supplied must not be allowed to run to waste, either wilfully or by neglect; nor must it be used for any other purpose, or to any greater extent, than shall have been agreed for.

4. No pipe must be attached to the works of the company, or to any pipe or apparatus connected therewith; nor must any alteration be made in any existing pipe or apparatus, without due notice being given to, and the consent of the proper officer of the company being first obtained.

5. The supply and use of water for the purpose of trade and manufacture must be open to inspection and admeasure-

ment whenever required; and such information must be from time to time afforded as will be sufficient to enable the company to obtain a satisfactory account of the quantity of water actually consumed, and of the pipes, cocks, cisterns, and other apparatus and conveniences for delivering, receiving, and using such water.

6. The company will, if and when so desired, execute all kinds of plumber's work connected with the supply of water to their tenants, but are nevertheless desirous that the private business of the consumers of water shall be open to all the plumbers of the city. As, however, it is essential to the protection of the interest of the consumers, as well as of the company, that such work shall be well and soundly executed, and that the directors of the waterworks company shall possess a full and satisfactory knowledge of the state of the undertaking in all its departments, it is announced that no plumber or workman will be allowed to do or perform any work connected with the supply of water, till he shall have been admitted, enrolled, and published by the directors as 'an authorised waterworks plumber,' and shall have entered into a written engagement to conform to and comply with the rules and regulations of the company in relation to the construction and management of the works and fittings, to which such rules and regulations shall from time to time apply; and all responsible master plumbers, on expressing their willingness to comply with such rules and regulations, will be admitted immediately on signing and undertaking to that effect. If at any time afterwards any such plumber shall be found guilty of wilfully breaking or evading the said rules or regulations, either by himself or his workmen, or shall refuse to communicate any information required of him in regard to any work done by him or his workmen, or under his superintendence, or on his responsibility, his name will be erased from the list of 'authorised plumbers,' and will be forthwith advertised as having been so struck off.

7. No person is to be employed in or about the waterworks, or any pipe or apparatus connected therewith, who has not been admitted 'an authorized plumber,' or whose name shall have been struck off the list as aforesaid.

8. The company will pay a reward of twenty shillings to any person who will give such information as shall lead to the conviction of any person who shall fraudulently attach any pipe or pipes to the pipes of the company or to any pipe, cistern or apparatus connected therewith, or to or into which the water of the company shall flow or proceed; or who shall fraudulently use or otherwise misappropriate the water of the company, or who shall knowingly permit the same to be fraudulently used or otherwise misappropriated.

9. The company will also adequately remunerate any person who will communicate timely information to their officers of any leakages or wastes of water, and whether the same be accidentally, negligently, or wilfully occasioned or suffered.

10. The company do not permit their officers, servants, workmen, or agents to solicit or receive any fee or gratuity whatever, and desire to be informed with respect to any infraction of this regulation, and also in respect to any act of incivility or any neglect of attention on the part of such officers, servants, workmen, and agents, or any of them.

By order of the Directors,
JOHN SULTZER, Chairman.

To Water Consumers and the Public.

The system of constant supply adopted by the Norwich Waterworks Company necessitates its own simple and proper, but, nevertheless, neither troublesome, nor inconvenient, nor expensive precaution against wastes, neglects, and frauds.

These precautions, without the observance of which a constant service becomes an impossibility, are, for the most part, embodied in the rules and regulations hereinafter set forth.

The introduction of sanitary improvements demand special remark. It is one professed object of the improvements to substitute cheap water-closets in place of common privies, and to make the system of constant supply available for the immediate removal of the refuse; nothing, however, can be more obvious than that, without the adoption of

some very adequate means of prevention, the immense consumption of water in situations where waste is productive of no inconvenience to the consumer, would not only greatly exceed the capabilities of any water-works establishment, but would also ultimately, and that inevitably, occasion the entire abandonment in this, as in several other considerable towns of the beneficial system of constant service.

In cases in which provision is made in cisterns for carrying off (as by a waste pipe or overflow) the continuous discharge consequent upon the neglect or derangement of the ball cock, or other like apparatus the waste of water may become, and indeed often has been, as enduring as the supply itself. The company, therefore, require that all waste pipes or overflows shall be effectually stopped or otherwise wholly removed (see Regulation C) from every cistern, or receptacle for water, supplied by them. Special permission will, however, be granted in case of an exceptional character for the use of a 'warning pipe,' provided the outlet of such pipe be openly placed as to attract immediate attention to any wasteful overflow that may occur, and necessitate the prompt adoption of the proper remedy.

The company trust the inhabitants of the extensive district through which their pipes ramify, and the consumers of water in particular, will cordially co-operate in giving effect to the rules and regulations above referred to since, upon the due observance of these, the permanent efficiency of the supply entirely depends.

The following are the provisions of 'The Sheffield Water works Act, 1860' (23 Vict. cap. 70) on this subject:—

Regulations for preventing waste or misuse of water.

6. The company from time to time may make reasonable regulations for the purpose of preventing the waste or misuse of water supplied by them, including regulations prescribing the nature, strength, size and position of the pipes, cocks, and other apparatus to be used, and regulations interdicting the user of any pipes, works, or other apparatus which might tend to such waste or misuse.

7. No such regulations which shall be made by the said company as aforesaid shall be valid or binding unless the same shall be allowed by and under the hands of two or

Regulations to be confirmed by justices.

more justices assembled at some petty sessions of the peace in and for the borough; and it shall be incumbent on such justices, on the request of the said company, to examine into the regulations which may be tendered to them for that purpose, and to allow of or disallow, or to modify, alter, and vary the same or any of them, as to them may seem fit: provided always that no such regulations shall be confirmed by such justices unless a copy of such regulations and notice of the company's intention to apply for a confirmation of the same, and of the time when such application is intended to be made, shall have been advertised in one or more newspapers published in the said borough one month at least, but not more than six weeks before the hearing of such application; and any party objecting to, or aggrieved by any such regulations, and giving notice of the nature of the objection to the said company ten days before the hearing of such application, may by himself, his attorney or agent, be heard thereon by the said justices; provided also that for one month at least prior to any such application for confirmation of such regulations a copy of such proposed regulation shall be deposited at the office of the Town Clerk of the borough; and it shall be lawful for all persons at all reasonable times to inspect such copy without fee or reward, and to be furnished by the said town clerk with a copy thereof or of any part thereof on payment of sixpence for every 100 words to be copied; and at and immediately prior to the allowance or confirmation of such regulations evidence shall be adduced by the company before such justices that notice of such intention as aforesaid was duly given, and that a copy of such proposed regulations had been advertised and deposited as before directed; and the production of the certificate signed by such justices shall at all times be evidence that the regulations therein mentioned or referred to have been duly confirmed, without adducing proof of the signature of such justices.

For enforcing.

8. In the event of any such regulations not being observed by any person being or about to become a customer of the company, they may refuse to supply water, or (as the case may be) may cut off the water supplied by them to him until the regulations are complied with;

provided that, except in cases of accident, emergency or necessary repairs, the company shall not, under this provision, cut off the water supplied to any customer of the company until he has had twenty-four hours' notice in writing from the secretary or other officer of the company of the intention of the company to cut off the same.

9. In the event of any difference between the company and any customer or intending customer with respect to the fact or extent of any non-compliance or alleged non-compliance with any such regulation, the difference shall be determined by two justices who shall also determine the amount of costs, if any, of or incident to such difference, and the determination thereof, to be paid to or by the company or to or by the customer, and such costs shall be enforced in the manner prescribed for the recovery of damages not specially provided for and penalties in and by 'The Company's Clauses Consolidation Act, 1845.'

10. Every person supplied with water by the company who wilfully suffers any pipe, cock, cistern, or other apparatus to be out of repair, so that the water supplied to him by the company is wasted, shall for every such offence forfeit to the company a sum not exceeding 5*l.* in addition to the expenses, if any, of the company in repairing the same.

11. Where any person supplied with water by the company, after twenty-four hours' notice in writing under the hand of the secretary or other officer of the company to repair any pipe, cock, cistern, or other apparatus, in order that the water supplied to him by the company shall not be wasted, fails to repair the same, so as to prevent the waste of water, the company may repair the same, and their expenses in that behalf shall be repaid to them by the person so suffering the same to be out of repair, and the company may recover the same as damages, and in addition to the penalty, if any, recovered for the offence.

12. If they use, or require to be used, any meter for ascertaining the quantity of water to be supplied to any person for any purpose, under the Act of 1853, and this Act, or either of them, the council may appoint a competent

person to be inspector of meters within the borough, and may from time to time, as they think fit, remove the person appointed, and appoint another person in his place; provided that nothing herein contained shall render the company liable to pay any salary or fees to such inspector, except such fees as may become payable in the event of the secretary of the company requiring the inspector to make any examination in manner hereinafter mentioned.

13. The inspector of meters appointed by the council, upon being required by notice in writing under the hand of the secretary of the company, or under the hand of any person supplied with water by the company, shall with all convenient speed, but at the expense of the party requiring the same, examine and test the measuring capacity of any meter to which such notice relates, and shall give to the secretary of the company, and also to the person for whose water supply the meter in question shall be used, a certificate under his hand setting forth whether, in his judgment, such meter does or does not measure correctly; and if he shall in such certificate state that such meter does not measure correctly, he shall further in such certificate state the extent to which it measures incorrectly, and such meter shall thereafter be held to measure the quantity which according to such certificate it is certified to measure, and the quantity of water supplied shall be calculated accordingly; provided, that such inspector shall, twenty-four hours at least before he shall proceed to any such examination as aforesaid, give to the secretary of the company, and also to the person for whose supply of water the meter in question shall be used, a notice in writing of the time and place when and where he will make such examination; and it shall be lawful for any person appointed by the company, and for the person for whose supply of water the meter in question shall be used, or any person appointed by him, to be present at such examination.

Appeal to justices from certificate of inspector.

14. In case the secretary of the company, or the person for whose water supply the meter in question shall be used, shall dispute the accuracy of the certificate of such inspector, the matter shall be referred to two justices, and in case they shall find that such certificate is incorrect,

they shall order the same to be cancelled, and the same shall thereupon be cancelled accordingly, and no proceedings shall be taken thereupon with respect to the meter to which the same shall refer; provided that no such certificate shall be cancelled as aforesaid, except within fourteen days after the date thereof.

Justices may make orders for costs.

15. In case of any such reference as aforesaid to any justices, they shall, whether they shall make such order as aforesaid or not, order by and to whom the costs of and incident to such reference and order (if any) shall be paid; and the payment of such costs by the party ordered to pay the same shall be enforced in the manner prescribed for the recovery of damages not specially provided for, and penalties, in and by 'The Companies Clauses Consolidation Act, 1845.'

Consumer to remove incorrect meter.

16. In case any meter certified as aforesaid by the inspector to be incorrect, shall belong to the person for whose supply of water the same shall be ussd, such person shall within twenty-one days after the date of the certificate of the inspector, cause such meter to be amended and rectified, or otherwise remove the same, and cause another and a correct meter to be put up in its place; and if such person shall for the said space of twenty-one days refuse or neglect to do so, the company may cut off the supply of water to such person, until the incorrect meter has been amended and rectified, or a correct meter put up in its place, and until notice in writing thereof, has been by him given to the secretary of the company.

Company to remove incorrect meter.

17. In case any meter certified as aforesaid, by the inspector to be incorrect, shall belong to the company, they shall, within twenty-one days after the date of the certificate of the inspector, cause such meter to be amended and rectified, or otherwise remove the same, and cause another and correct meter to be put up in its place; and if the company shall for the said space of twenty-one days refuse or neglect so to do, the person for whose supply of water such defective meter has been used may cause the same to be amended and rectified, or may remove the same and cause another and correct meter to be put up in its place; and the expense of amending, correcting, or

removing such incorrect meter, and of providing and putting up a correct meter, shall be borne by the company, and the amount thereof shall be recoverable as a debt from the company by the person incurring such expense, in any court of competent jurisdiction.

Penalty for obstructing inspectors.

18. Any person who shall refuse to allow the inspector of meters to examine or test any meter which he is by this Act authorized or required to examine or test, or to do anything necessary for the purpose of such examination or testing, or shall in manner prevent, obstruct, or hinder any examination or testing authorized by this Act, of any meter, shall, on conviction, forfeit a sum not exceeding five pounds, and pay all the expenses of removing the meter if the same shall be found to be incorrect.

Regulations in force at Sheffield.

Whereas, in and by 'The Sheffield Waterworks Act 1860' it is inacted, that the company of proprietors of the Sheffield Waterworks from time to time may make regulations for the purpose of preventing the waste or misuse of water supplied by them, including regulations prescribing the nature, strength, size, and position of the pipes, cocks and other apparatus to be used, and regulations interdicting the user of any pipes, works, or other apparatus which might tend to such waste or misuse. And whereas the council of the borough of Sheffield having, in exercise of their statutory powers in that behalf, required the water supplied by the company to be constantly laid on under pressure in other pipes than the main pipes of the company, the following regulations appear reasonable for the purpose of preventing such waste or misuse as aforesaid. Now, the said company of proprietors of the Sheffield Waterworks do hereby, in pursuance of the said enactment, make the following regulations (that is to say) :—

Pipes.

1. No pipe (except when and as otherwise authorized by these regulations, or by an authority given by a memorandum in writing, signed by the surveyor, or other duly authorized officer of the company) shall, after the expiration of six calendar months from the confirmation of these regulations by the justices, be used, laid or fixed by any

person other than the company for the conveyance of or in connection with the water supplied by the company, unless the same shall be of lead, and of at least the weight following, (that is to say) :—

If the internal diameter of such pipe shall not exceed three-eights of an inch, five pounds for every lineal yard of pipe;

If such diameter shall not exceed one half of an inch, seven pounds for every lineal yard of pipe;

If such diameter shall not exceed five-eights of an inch, nine pounds for every lineal yard of pipe;

If such diameter shall not exceed three-fourths of an inch, eleven pounds for every lineal yard of pipe;

If such diameter shall not exceed one inch, sixteen pounds for every lineal yard of pipe;

If such diameter shall not exceed one inch and a quarter, twenty-two pounds and a half for every lineal yard of pipe;

Provided that where the internal diameter of any such pipe shall exceed one inch, the company may require the same to be of coat iron, and of such weight as they may consider necessary.

Joints in pipes.

Every joint in any pipe used for the conveyance of or in connection with the water supplied by the company, shall, after the expiration of the said period of six calendar months, be of the kind called a plumbing joint, and not a blow-pipe joint; provided always, that the regulations hereinbefore contained shall not apply to any pipe or joint used, laid or fixed at the date of the confirmation of these regulations by the justices, unless and until such pipe or joint shall cause a waste or misuser of water supplied by the company.

Situations in which pipes are not to be laid.

2. No pipe shall, after the expiration of six calendar months from the confirmation of these regulations by the justices be used for the conveyance of or in connection with the water supplied by the company, which shall then or thereafter be laid or fixed through, in, or into any sough, drain, ashpit, or manure hole, or through, in, or into any other place where the water conveyed through such pipe may be liable to become fouled, except where such sough,

drain, ashpit, manure hole, or other place as aforesaid shall be in the unavoidable course of such pipe; and then in every such case such pipe shall be passed through an exterior cast-iron pipe or box of sufficient length and strength to afford due protection to the water pipe.

Connection of pipes with those of the company, and notice preparatory to inspection.

3. No pipe or other apparatus for the conveyance of or in connection with the water supplied by the company shall after the confirmation of these regulations by the justices, be connected with the pipes of the company, or with any pipe used for the conveyance of or in connection with the water supplied by the company, unless the same shall be in accordance with these regulations and the provisions of the Acts of Parliament relating to the company. Notice of the desire to make any such connection shall be given to the company at least seven days before the time when the same is proposed to be made, and after such notice shall have been so given, the surveyor or other duly authorized officer of the company shall have the right, at all reasonable hours in the day-time, to inspect the pipe or pipes or other apparatus proposed to be connected.

Cocks.

4. No drawing cock, stop cock, or ball cock shall, after the expiration of six calendar months from the confirmation of these regulations by the justices, be used or fixed for the conveyance of or in connection with the water supplied by the company, unless the same shall be strong and of hard brass; and no drawing cock or stop cock shall, after the expiration of such period, be so used or fixed, unless the same shall be a screw down cock, with leather faces, not liable to turn round on the seat.

Cocks in courts, &c.

5. Every cock which shall, after the expiration of six calendar months from the confirmation of these regulations by the justices, be used or fixed for the conveyance of or in connection with the water supplied by the company, and which shall be placed in a court or other exposed place, shall be protected by an iron casing, and be made to open with a moveable key.

Buried or excavated cisterns.

6. No cistern buried or excavated in the ground shall, after the expiration of six calendar months from the confirmation of these regulations by the justices, be used for the storage or reception of water supplied by the company,

unless the use of such cistern shall be allowed by the memorandum in writing, signed by the surveyor or other duly authorized officer of the company: provided always, that the regulation lastly hereinbefore contained shall not apply to any cistern in use at the date of the confirmation of these regulations by the justices, unless and until the company shall have given to or left at the last known place of abode of some person liable to pay for the water supplied to such cistern, at least three calendar months notice in writing forbidding the use of such cistern, and such notice shall have expired.

Cisterns.

7. Every cistern which shall, after the expiration of three calendar months from the confirmation of these regulations by the justices, be used for the storage or reception of water supplied by the company, shall be made and at all times maintained absolutely watertight, and shall be provided with a ball cock for the inlet-pipe thereof, and every such cistern shall be made capable of inspection.

Overflow of waste pipes to cisterns.

8. No overflow or waste pipe (other than a detective or warning pipe) shall, after the confirmation of these regulations by the justices be made or attached to any cistern used for the storage or reception of water supplied by the company, and every overflow or water pipe which shall, at the date of such confirmation, be attached to any such cistern, shall be removed or permanently closed within three calendar months next after the company shall have given to or left at the last known place of abode of some person liable to pay for the water supplied to such cistern, notice in writing requiring such overflow or waste pipe to be removed or permanently closed. And the owner of any cistern to which any other overflow or waste pipe is forbidden shall, at all times after the expiration of six calendar months from the confirmation of these rules by the justices, maintain thereto, unless the same be in a cellar or basement of any house or building, a suitable detective or warning pipe in such a position outside the house or building containing the cistern as will admit of the discharge of the water from such pipe being readily seen by the surveyor of the company, and the position of such pipe shall never be changed without previous notice to the company.

Pan water-closets.

9. Every pan water-closet, in which water supplied by the company, shall, after the expiration of six calendar months from the confirmation of these regulations by the justices, be used, shall be provided with a ball-cock and a service cistern of lead or cast-iron.

Every such cistern shall be fitted with a boot or division, such boot or division to be as high as the top of such cistern, and to be capable of containing not more than two gallons of water when filled up to within three inches of the top thereof. Every such service cistern shall have two proper alternating valves, so arranged as to let down at each pull or lift of the said valves a quantity of water not exceeding the contents of such division, and in any case not more than two gallons, and such cistern and valves shall be so arranged and contrived that water shall not be able to flow into and out of the cistern at the same time. Every such water-closet shall have a pipe of lead from the said cistern thereof to the basin of the water-closet of not less than one and a quarter inch in diameter, and weighing not less than nine pounds to every lineal yard of such pipe. Every such water-closet shall be provided with a basin, a scatterer, a weighted lever, a pan, and a trap.

Self-acting water-closets.

10. Every self-acting or pull down water-closet or soil-pan, in which water supplied by the company shall, after the expiration of six calendar months from the confirmation of these regulations by the justices, be used, shall have either a service cistern similar to that hereinbefore prescribed respecting pan water-closets, or a double-valve lead or cast-iron service box, such service box to be fitted with a proper cover to screw on, and every such service cistern or service box, as the case may be, shall be fitted with a boot or division, two alternating valves, and a lead pipe similar in all respects to the boot or division, alternating valves, and lead pipe hereinbefore prescribed respecting pan water-closets. Every such self-acting or pull down water-closet shall have a proper wide rim flushing, basin and trap, and every service box connected with a self-acting or pull down water-closet shall be provided with a ball-tap not exceeding three-eighths of an inch in diameter.

Valves and pipes to water-closets.

11. The valves in every pan, self-acting, or pull down water-closet, in which water supplied by the company shall, after the expiration of six calendar months from the confirmation of these regulations by the justices, be used, shall be worked by brass rods, at least three-sixteenths of an inch in diameter, and not by wires or chains. No pipe by which water shall be supplied by the company to any pan, self-acting, or pull down water-closet shall, after the expiration of such period, be permitted to communicate directly or indirectly with any part of any such water-closet, or with any apparatus connected therewith, except the service cistern or service box thereof.

Outlet plug to bath.

12. Every bath, in which water supplied by the company shall, after the confirmation of these regulations by the justices, be used, shall be provided with a well-fitted and perfectly water-tight ground outlet, plug, or cock.

Overflow or waste pipes to baths.

13. No overflow or waste pipe other than a detective or warning pipe shall, after the confirmation of these regulations by the justices, be made or attached to any bath in which water supplied by the company shall be used, and every overflow or waste pipe which shall, at the date of such confirmation, be attached to any such bath, shall be removed or permanently closed within three calendar months next after the company shall have given to, or left at the last known place of abode of, some person liable to pay for the water supplied to such bath, notice in writing requiring such overflow or waste-pipe to be removed or permanently closed; and the owner of any bath to which any other overflow or waste-pipe is forbidden shall, at all times after the expiration of six calendar months from the confirmation of these regulations by the justices, maintain thereto a suitable detective or warning pipe in such a position outside the house or other building containing the bath, as will admit of the discharge of water from such pipe being readily seen by the surveyor of the company, and the position of such pipe shall never be changed without previous notice to the company.

Meters.

14. Every meter which shall, after the expiration of six calendar months from the confirmation of these regulations by the justices, be used for the measurement of water sup-

plied by the company, shall be so placed as to be capable of inspection, and shall, so far as may be practicable, be placed in a situation where it cannot be affected by frost, or injured by any other means. No meter shall, after the expiration of such period, be used for the measurement of water supplied by the company which has more than one separate and distinct inlet-pipe leading from the service or other pipe of the company to such meter, and no stop-cock, branch, drawing-cock, pipe, or other outlet or apparatus, except one stop cock immediately attached to the meter, shall, after the expiration of such period, remain or be attached to the inlet-pipe of any meter used for the measurement of water supplied by the company, unless the company shall direct to the contrary by a memorandum in writing, signed by the surveyor or other duly authorised officer of the company.

In witness whereof the said company have hereunto set their common seal, this fourteenth day of September, one thousand eight hundred and sixty nine.

L. S.

We, the undersigned, two of her Majesty's justices of the peace in and for the borough of Sheffield, assembled at a petty session of the peace in and for the said borough, on the request of the company of proprietors of the Sheffield Waterworks, and in pursuance of the provisions in this behalf contained in 'The Sheffield Waterworks Act, 1860,' have examined and do hereby allow and confirm the above written regulations, subject to the modifications, alterations, and variations which we have made therein. And we certify the same accordingly. Given under our hands this nineteenth day of February, one thousand eight hundred and seventy.

THOMAS DUNN.
JOHN JOBSON SMITH.

Metropolitan Water Act, 1871.

By the Metropolis Water Act, 1871, it was enacted that the Board of Trade might require a constant supply of water to be given in any district where the metropolitan authority did not take the initiative, or where, by reason of the insufficiency of the existing supply or the unwhole-

someness of the water in consequence of its being improperly stored, the health of the inhabitants was, or was likely to be, prejudicially affected : The Board of Trade had also power given to it to confirm any regulations made by the companies for the purpose of preventing undue consumption or contamination of water, and in accordance with that power they, on the 16th of August, 1872, adopted and allowed the following regulations:—

Metropolis Water.

Regulations under the 'Metropolis Water Act, 1871,' presented to both houses of Parliament by command of Her Majesty, at the Council Chamber, Whitehall, the 10th day of August, 1872. Present: The Right Honourable Chichester P. Fortescue, M.P.

Whereas it is provided by the Metropolis Water Act, 1871, that every company subject to the provisions of that Act, shall, within six months after the passing of the said Act, make regulations for the purposes for which regulations may be made under the authority of section 26 of the Metropolis Water Act, 1852, and that the provisions of that section shall apply also to the preventing of undue consumption or contamination of water. Section 17.

And whereas by the said Metropolis Water Act, 1871, it is further provided that no such regulation shall be of any force or effect unless and until the same be submitted to and confirmed by the Board of Trade, who may institute such inquiry in relation thereto, as they shall think fit, and who, at such inquiry, shall hear the Metropolitan Authority and the company, if desiring to be heard, and the said Board shall, if they think fit, or if requested, nominate and have present at such inquiry to advise and assist them, a competent and impartial waterworks engineer. Section 22.

And whereas it is by the said last-mentioned Act also provided that no such regulations shall be confirmed by the Board of Trade, unless notice in that behalf shall have been given by the company to which the same relates, or by such person as the Board of Trade direct, in the 'London Gazette,' and in two daily morning newspapers circulated within the limits of the said Act one month at least before

the inquiry, and that one month at least before any such inquiry is held, a copy of the regulations in question shall be sent by such company, or person, to the office of the Metropolitan Authority, and the same shall for one month be kept open during office hours at the respective offices of the Metropolitan Authority and of the said company, to the inspection of all persons without fee or reward.

And whereas the Metropolitan Water Companies and the Tottenham Local Board made regulations, in accordance with the provisions of the above-named Act, and submitted the same to the Board of Trade for confirmation, and duly advertised and deposited the same with the Metropolitan Authorities.

And whereas the Metropolitan Board of Works and the Corporation of the city of London, being Metropolitan Authorities under the said last-mentioned Act, submitted objections to the said regulations, and it was deemed expedient that an inquiry should be held in relation thereto.

And whereas by the Board of Trade Inquiries Act, 1872, it is provided that wherever in any Act of Parliament it is directed that an inquiry shall be held or instituted by the Board of Trade, the same shall be deemed to have been duly held or instituted, if conducted by any person or persons duly authorised in that behalf by the president of the said Board, by writing under his hand or under the hand of one of the secretaries of the said Board.

And whereas the Board of Trade under the powers conferred upon them as aforesaid, appointed the Rt. Hon. Lord Methuen, Henry Whatley Tyler, Esq., late Captain Royal Engineers, and Robert Rawlinson, Esq., C.E., C.B., to hold an inquiry in relation to the regulations so submitted to them by the companies, and by the Tottenham Local Board.

And whereas the said inquiry has been held, and the said Metropolitan Authorities, and the companies and the Local Board have been heard at the inquiry.

And whereas, as the result of such inquiry, it has appeared expedient to the Board of Trade to allow such and so many of the said regulations as are contained in the schedule hereto annexed, with such modifications and alterations as are shown in the said schedule.

Schedule referred to in the above Minute. Regulations made under the Metropolis Water Act, 1871.

1. No 'communication-pipe' for the conveyance of water from the water-works of the company into any premises shall hereafter be laid until after the point or place at which such 'communication-pipe' is proposed to be brought into such premises shall have had the approval of the company. Place of communication-pipe.

2. No lead pipe shall hereafter be laid or fixed in or about any premises for the conveyance of or in connexion with the water supplied by the company (except when and as otherwise authorised by these regulations, or by the company), unless the same shall be of equal thickness throughout, and of at least the weight following, that is to say :— Weight of lead pipes.

Internal Diameter of Pipe in Inches.	Weight of Pipe in lbs. per lineal Yard.
$\frac{3}{8}$-inch diameter.	5 lbs. per lineal yard.
$\frac{1}{2}$ " "	6 " "
$\frac{5}{8}$ " "	$7\frac{1}{2}$ " "
$\frac{3}{4}$ " "	9 " "
1 " "	12 " "
$1\frac{1}{4}$ " "	16 " "

3. Every pipe hereafter laid or fixed in the interior of any dwelling-house for the conveyance of, or in connexion with, the water of the company, must, unless with the consent of the company, if in contact with the ground, be of lead, but may otherwise be of lead, copper, or wrought iron, at the option of the consumer. Interior pipes.

4. No house shall, unless with the permission of the company in writing, be hereafter fitted with more than one 'communication-pipe.' No more than one communication-pipe to each house.

5. Every house supplied with water by the company (except in cases of stand pipes) shall have its own separate 'communication-pipe.' Provided that, as far as is consistent with the special Acts of the company, in the case of a group or block of houses, the water-rates of which are paid by one owner, the said owner may, at his option, have Every house, with certain exceptions, to have its own communication pipe.

one sufficient 'communication-pipe' for such group or block.

No house to have connexion with fittings of adjoining house.

6. No house supplied with water by the company shall have any connexion with the pipes or other fittings of any other premises, except in the case of groups or blocks of houses, referred to in the preceding regulation.

Connexion to be by ferrule or stop-cock.

7. The connexion of every 'communication-pipe' with any pipe of the company shall hereafter be made by means of a sound and suitable brass screwed ferrule or stop-cock with union, and such ferrule or stop-cock shall be so made as to have a clear area of waterway equal to that of a half-inch pipe. The connexion of every 'communication-pipe' with the pipes of the company shall be made by the company's workmen, and the company shall be paid in advance the reasonable costs and charges of and incident to the making of such connexion.

Material and joints of external pipes.

8. Every 'communication-pipe' and every pipe external to the house and through the external walls thereof, hereafter respectively laid or fixed, in connection with the water of the company shall be of lead, and every joint thereof shall be of the kind called a 'plumbing' or 'wiped' joint.

No pipe to be laid through drains, &c.

9. No pipe shall be used for the conveyance of, or in connexion with, water supplied by the company, which is laid or fixed through, in, or into any drain, ashpit, sink, or manure-hole, or through, in, or into any place where the water conveyed through such pipe may be liable to become fouled, except where such drain, ashpit, sink, or manure-hole, or other such place, shall be in the unavoidable course of such pipe, and then in every such case such pipe shall be passed through an exterior cast-iron pipe or jacket of sufficient length and strength, and of such construction as to afford due protection to the water-pipe.

Depth of pipes under ground.

10. Every pipe hereafter laid for the conveyance of, or in connexion with, water supplied by the company, shall, when laid in open ground, be laid at least two feet six inches below the surface, and shall in every exposed situation be properly protected against the effects of frost.

No connexion with

11. No pipe for the conveyance of, or in connexion with,

water supplied by the company, shall communicate with any cistern, butt, or other receptacle used or intended to be used for rain-water. rain water receptacle.

12. Every 'communication-pipe' for the conveyance of water to be supplied by the company into any premises shall have at or near its point of entrance into such premises, and if desired by the consumer within such premises, a sound and suitable stop-valve of the screw-down kind, with an area of water-way not less than that of a half-inch pipe, and not greater than that of the 'communication-pipe,' the size of the valve within these limits being at the option of the consumer. Stop-valve.

If placed in the ground such 'stop-valve' shall be protected by a proper cover and 'guard-box.'

13. Every cistern used in connexion with the water supplied by the company shall be made and at all times maintained water-tight, and be properly covered and placed in such a position that it may be inspected and cleansed. Every such existing cistern, if not already provided with an efficient 'ball-tap,' and every such future cistern shall be provided with a sound and suitable 'ball-tap' of the valve kind for the inlet of water. Character of cisterns and ball-taps.

14. No overflow or waste-pipe other than a 'warning-pipe' shall be attached to any cistern supplied with water by the company, and every such overflow or waste-pipe existing at the time when these regulations come into operation shall be removed, or at the option of the consumer shall be converted into an efficient 'warning-pipe,' within two calendar months next after the company shall have given to the occupier of, or left at the premises in which such cistern is situate, a notice in writing requiring such alteration to be made. Waste pipes to be removed or converted into warning pipes.

15. Every 'warning-pipe' shall be placed in such a situation as will admit of the discharge of the water from such 'warning-pipe' being readily ascertained by the officers of the company. And the position of such 'warning-pipe' shall not be changed without previous notice to and approval by the company. Arrangements of warning-pipes.

16. No cistern buried or excavated in the ground shall be used for the storage or reception of water supplied by Buried cisterns prohibited.

the company, unless the use of such cistern shall be allowed in writing by the company.

Butts prohibited.

17. No wooden receptacle without a proper metallic lining shall be hereafter brought into use for the storage of any water supplied by the company.

Ordinary draw-tap.

18. No draw-tap shall in future be fixed unless the same shall be sound and suitable and of the 'screw-down' kind.

Draw-taps in connexion with stand-pipes.

19. Every draw-tap in connexion with any 'stand-pipe' or other apparatus outside any dwelling-house in a court or other public place, to supply any group or number of such dwelling-houses, shall be sound and suitable and of the 'waste-preventer' kind, and be protected as far as possible from injury by frost, theft, or mischief.

Boilers, water-closets, and urinals to have cisterns.

20. Every boiler, urinal, and watercloset, in which water supplied by the company is used (other than waterclosets in which hand flushing is employed), shall, within three months after these regulations come into operation, be served only through a cistern or service-box and without a stool-cock, and there shall be no direct communication from the pipes of the company to any boiler, urinal, or watercloset.

Water-closet apparatus.

21. Every watercloset-cistern or watercloset service-box hereafter fitted or fixed in which water supplied by the company is to be used, shall have an efficient waste-preventing apparatus, so constructed as not to be capable of discharging more than two gallons of water at each flush.

Urinal-cistern apparatus.

22. Every urinal-cistern in which water supplied by the company is used other than public urinal-cisterns, or cisterns having attached to them a self-closing apparatus, shall have an efficient 'waste-preventing' apparatus, so constructed as not to be capable of discharging more than one gallon of water at each flush.

Watercloset down-pipes.

23. Every 'down-pipe' hereafter fixed for the discharge of water into the pan or basin of any watercloset shall have an internal diameter of not less than one inch and a quarter, and if of lead shall weigh not less than nine pounds to every lineal yard.

Pipes supplying watercloset to communi-

24. No pipe by which water is supplied by the company to any watercloset shall communicate with any part of such

watercloset, or with any apparatus connected therewith, except the service-cistern thereof. cate with cistern only.

25. No bath supplied with water by the company shall have any overflow waste pipe, except it be so arranged as to act as a 'warning-pipe.' Bath to be without overflow pipe.

26. In every bath hereafter fitted or fixed the outlet shall be distinct from, and unconnected with, the inlet or inlets; and the inlet or inlets must be placed so that the orifice or orifices shall be above the highest water level of the bath. The outlet of every such bath shall be provided with a perfectly water-tight plug, valve, or cock. Bath apparatus.

27. No alteration shall be made in any fittings in connexion with the supply of water by the company without two days' previous notice in writing to the company. Alterations of fittings.

28. Except with the written consent of the consumer, no cock, ferrule, joint, union, valve, or other fitting, in the course of any 'communication-pipe,' shall have a waterway of less area than that of the 'communication-pipe,' so that the waterway from the water in the district-pipe or other supply-pipe of the company up to and through the stop-valve prescribed by Regulation No. 12, shall not in any part be of less area than that of the 'communication-pipe' itself, which pipe shall not be of less than a half-inch bore in all its course. Waterway of fittings.

29. All lead 'warning-pipes' and other lead pipes of which the ends are open, so that such pipes cannot remain charged with water, may be of the following minimum weights, that is to say:— Weight of lead pipes having open ends.

½-inch	(internal diameter)	. .	3 lbs. per yard.
¾ „	do.	. .	5 „
1 „	do.	. .	7 „

30. In these regulations the term 'communication-pipe' shall mean the pipe which extends from the district pipe or other supply pipe of the company up to the 'stop valve' prescribed in the regulation No. 12. Definition of 'communication pipe.

31. Every person who shall wilfully violate, refuse, or neglect to comply with, or shall wilfully do or cause to be done any act, matter, or thing, in contravention of these Penalties.

regulations, or any part thereof, shall for every such offence, be liable to a penalty in a sum not exceeding 5*l*.

Authorised officer may act for company.

32. Where under the foregoing regulations any act is required or authorised to be done by the company, the same may be done on behalf of the company by an authorised officer or servant of the company, and where under such regulations any notice is required to be given by the company the same shall be sufficiently authenticated if it be signed by an authorised officer or servant of the company.

Existing fittings.

33. All existing fittings, which shall be sound and efficient, and are not required to be removed or altered under these regulations, shall be deemed to be prescribed fittings under the 'Metropolis Water Act, 1871.'

Alteration or repeal of regulations.

These regulations above set out are binding until a metropolitan authority, or ten consumers of the water supplied by any company, apply for their repeal or alteration, when the Board of Trade may appoint a competent engineer to enquire into and report to it as on the expediency of repealing or altering them, and the Board of Trade may thereupon make such further regulations, repeal, or alterations as they think fit.

Water for fires.

When a company supplies water under Parliamentary restrictions in any district, they may be obliged to keep some portion of their service continually charged with water; thus, in Cheltenham, for purposes of prevention of fire, in consequence of which there is a double series of mains: one always full, and the other only supplied intermittently. There is on all companies an obligation to fix

Fire-plug.

fireplugs at the request of the local authority; the expense to be repaid to the company. Also owners and manufacturers may require a fireplug at a convenient dis-

Future constant supply.

tance from their works or manufactory. It is easy to foresee that at no distant period constant service will become universal, and, as the evidence would appear to prove, with the result of ensuring a saving rather than a loss of water, seeing that constant high pressure will necessitate a supervision over fittings now sadly wanting, and which causes great leakage and loss, which only occurring for a short period in the day while the water is

turned on, is allowed to pass unremedied and unheeded. The ground becomes sodden, the foundation of the house or cottage continually wet, and in towns where the cesspool system has prevailed, producing, as an inevitable result, disastrous increase in sickness and mortality. And where, as at Norwich, the system of constant supply has been in operation for some years, hardly more than one-third of the water is now used as compared with that wasted under the intermittent system previously obtaining.

Right of owner and occupier to demand supply.

Any owners or occupiers of houses may demand a supply of water from any company under certain regulations, but the amount of water-rate they would pay must amount at least to one-tenth of the expense of providing and lying down the pipes to give the required supply. They must also bind themselves to take the supply for three successive years at the least. But companies not under the Waterworks Clauses Act are not bound to give or continue any supply, and they cannot by any legal tribunal be compelled to do so. It should be noticed that a supply of water for domestic purposes does not include a supply of water for cattle, or for horses or carriages which are kept for sale or hire by a common carrier, or a supply for any trade manufacture or business, or for watering gardens, or for fountains, or for any ornamental purpose. For domestic purposes, any owner or occupier may demand a supply in any street where the mains of the company are laid, having paid or tendered the water-rate which would be due for such supply. The person requiring the supply must pay for the service pipe, which is not to be more than half an inch in bore. After giving six days' notice, the consumer may discontinue his supply and take up his pipes, but if he does any damage, he will have to pay the amount of such damage as compensation to the company. Should the occupier remove the pipes without this notice, he will subject himself to a penalty of £5. Where, however, the annual value of any house does not exceed £10, then, under similar circumstances to those above stated, it will be the duty of the company to provide and lay down communication pipes, and to keep them in repair; but for this outlay and service a reasonable annual

Water for domestic purposes.

Pipes and Fittings.

rent may be charged. The pipes and fittings remain the property of the company, and are not liable to distress; but the owner of the house may at any time make them his property by paying their cost to the company.

Liability of owners of small tenements.

Owners will be liable for payment of water rates where the rateable value of the premises is below £10. All such payments in the first instance by owners instead of occupiers makes no disqualification for voting on the part of the occupier and does not in any way invalidate any franchise to which he would be otherwise entitled.

Penalty for failure of supply.

Water companies are liable to a penalty of £10 for failing to supply water in accordance with the Waterworks Clauses Acts, and may further be fined £2 per day for every day after notice to them in writing of their default.

Reservoirs in a dangerous state.

Order of magistrates therein.

Besides these penalties, if any one interested complains to two justices that any reservoir is in a dangerous state, the justices may, after enquiry, order any works to be executed to put the reservoir into a proper condition, or may order the company to do the necessary work under a penalty of £10 a day, during which the work remains undone.

Penalties.

Penalties for waste.

On the other hand, a penalty not exceeding £5 may be recovered against persons neglecting to provide a proper cistern, and ball, and stop cock, or allowing the water supplied by the water company to run to waste. The company are authorized to send their officers to inspect the fittings of any person supplied with water between the hours of 9 A.M. and 4 P.M. to examine whether there be any misuse or waste of water.

Consumers supplying water to non-consumers.

A consumer is not allowed to supply any other person with water or wilfully to suffer any other person to take water from his cistern or pipe unless such other person is supplied with water by the company, and his cistern or pipes happen without his default to be out of repair.

Unauthorised taking of water.

Any person unauthorized taking water is liable to a penalty of £10, and a penalty of £5 is enforced on any one wilfully injuring any of the works of a water company.

Injury to works of Water Co.

There are also penalties for allowing apparatus to be out of repair on the part of consumer.

Trade purposes.

For trade purposes water is often supplied by meter at certain rates fixed in the special Act. As yet no water meter is sufficiently trustworthy to enable water to be supplied for general purposes by measurement. What has been written on the

Water supply in rural districts.

subject of water supply may be said to apply exclusively to town districts, for in rural districts of the country the supply is often defective in both quality and quantity. The Royal Sanitary Commissioners report 'In connexion also with this branch of the subject we feel bound to direct attention to the evidence, which proves the wide prevalence of soakage from privies, cesspools and other receptacles into wells; we must also advert to the necessity of not permitting houses to be occupied in country districts without some supply of or access to wholesome water.'

Property in wells, &c.

All property in wells, fountains, and pumps, and powers in relation thereto, in any sanitary district, will belong to the sanitary authority, when there is a public supply of water provided by them.

Public cisterns.

The sanitary authority is bound to maintain all existing public cisterns, pumps, wells, and conduits which heretofore have given a gratuitous supply of water, and the authority may, if they think it necessary, construct any number of new cisterns, pumps, conduits, and other waterworks for the gratuitous use of any persons who choose to carry water away, not for sale but for their own private use, and the sanitary authority may supply with water gratuitously any public baths or wash-houses.

Gratuitous supply of water.

Restrictions on Sanitary Authorities.

Sanitary authorities being armed with great powers to prevent injury to health are not permitted themselves to do anything which would amount to a nuisance, they must not foul any watercourse by emptying sewage into it, and cannot, on account of convenience, cause the sewage to flow into any stream or river, if injury to health is likely to arise.

Thames Navigation Act.

And in the case of the Thames or the Lee they cannot allow any sewage to flow into any stream communicating with those rivers within a distance of five miles from the river itself.

Injuriously affecting rights.

They cannot by their works injuriously affect the navigation of rivers or canals, or divert or diminish an supply of water of right belonging to any such river or canal, and if by the construction of their reservoirs any mines are affected as to their working they will have to pay compensation in manner provided for by the Waterworks Clauses Act. It has been already noticed that any supply taken away from any stream will necessitate payment to millowners or others below the point at which the water is

abstracted, but that contemplates the possession of an Act of Parliament authorising the taking. When local authorities proceed under their general powers they cannot injuriously affect the supply, quality, or fall of water contained in any reservoir or stream, or any feeders of such reservoir or stream belonging to or supplying any water-works established by Act of Parliament, or in cases where any company or individual is entitled for his or their own benefit to the use of such reservoir or stream, or to the supply of water contained in such feeders, without the consent in writing of the company or corporation in whom such water-works may be vested, or of the persons so entitled to the use of such reservoirs, streams, and feeders, and also of the owners, in cases where the owners and parties so entitled are not the same persons. Further, the works of the sanitary authority must be so constructed as not to interfere with any sluices, floodgates, sewers, groynes or sea defences or other works made or to be made by commissioners of sewers appointed by the Crown, or any works of drainage and improvement, or irrigation of land. They cannot interfere with any lands vested in Her Majesty's Secretary of State for War without a written consent from these parties respectively. Generally they must not in the exercise of their powers injuriously affect any person or persons having rights in water without their written consent. On the other hand, the sanitary authority is charged with the preservation of the quality and purity of the water supplied by them, and of the water supply generally in the district. Any injury, whether wilfully or carelessly, done to their waterworks or any part of them—and water-works will be taken to include streams, springs, wells, pumps, reservoirs, cisterns, tanks, aqueducts, cuts, sluices, mains, pipes, culverts, engines and all machinery, lands, buildings, and things for supplying or used for supplying water, also the stock in trade of any waterworks company—any undue taking of water, either from the pipes or from the streams supplying their reservoirs or pipes, or any waste occurring from negligence, will subject to penalties of 5*l.* for the offence and 20*s.* for every day of its continuance. Any person bathing in any water of a sanitary authority,

Consent of parties interested.

Injury to waterworks.

or any pouring of filthy matter therein is subject to the same penalties; while any fouling of water by gas or the refuse of gas works is visited by very heavy penalties, and the sanitary authority has power to lay open and examine any pipes, conduits, and works belonging to any gas company, after giving twenty-four hours' notice, in order to examine any pipes from which any gas or other deleterious matter is supposed to be escaping or to have escaped. Any expenses attendant on these examinations will abide the result; if the sanitary authority has made a mistake they will have to pay for the experiment and all damages arising therefrom out of the general district rates; but if they discover a leakage causing injury, the gas company will have to meet all the expenses. Water pipes may be moved in the streets, either by Local Boards or other companies with parliamentary power, but they must be carefully replaced, and the flow of water must not be obstructed from flowing as freely as before the alteration. Sanitary authorities may water all or any of the streets or roads within the district, or by agreement with turnpike trustees, any turnpike road within two miles of the centre of the town or place within the district, and may make special rates for the purpose, but it is better to charge this and similar expenditure on the General District Rates.

Alteration of water pipes.

Watering streets.

CHAPTER VII.

PUBLIC AND PRIVATE LIGHTING.

Lighting of streets not compulsory.

ALTHOUGH adequate lighting of streets and ways is a most important adjunct to sanitary improvements, there is no duty cast on sanitary authorities to provide and pay for public lights. Neither is it one of the matters over which the Local Government Board has any control, or in default of which they can call on the sanitary authority, whether in town or country, to execute works, or do any act. The only compulsory duty mentioned in the Sanitary Act, is that cast on the owner or owners of new streets, when sewering, paving, &c. is ordered by the sanitary authority, and which is included in the term, 'providing means of lighting,'—whatever that may be. Whether it means pipes for conveyance of gas, or lamp-posts, and lanterns for oil or gas, has never been determined, and so far as can be learned, such provision has in no case been insisted on.

Duty of providing means of lighting in new streets.

Contracts.

sanitary authorities have the power to contract with any company or person, to light the streets and public roads and places in their district with oil or gas for any period not exceeding three years, and may pay out of the general district rates, all expenses incurred by them for this purpose.

Lamps and lamp posts.

They may also provide all lamps, posts, and other apparatus requisite for such lighting; but they have no power themselves to take up the streets or to grant permission to other persons to do so, for the purpose of laying pipes for the conveyance of gas for private lighting, and any such interference with the streets is a public nuisance, and the person or company so acting may be indicted for nuisance, as may also any householder giving authority to any person or company to take up the footway in front of his house,

Taking up streets.

for the purpose of providing him with a supply of gas. The requisite authority can only be obtained by special Act of Parliament, or provisional order under the Gas and Water Facilities Act, 1870, and any person or company acting without this authority, becomes subject to great penalties. Before the Public Health Act, 1848, it was common for Town Authorities to obtain Improvement Acts, and in these Acts there was very generally a power inserted for the Commissioners, under their private Act, to construct gas works, or to authorise them to grant permission to persons to establish gas works for public supply, and in some rare cases, for private supply also; but this power was almost exclusively confined to towns where no company was already in existence and authorised by Parliament. These Acts of Parliament were generally either superseded or more or less altered by provisional order when districts adopted the Public Health Acts; but very generally the power was retained by the Local Board to construct or authorise the construction of gas works; but although the power was retained, it has been but in very few cases exercised; it having been held by the Local Government Acts Office and by the Local Government Board, that gas works were not included within the description of permanent works for which money could be borrowed under the provisions of the Public Health Acts; and where Local Boards are the purveyors of gas for public and private lighting, it has very generally been by purchase of the works of some authorised company. These purchases have been comparatively frequent during the past few years, and there is a growing desire on the part of local authorities to possess themselves of gas undertakings in order themselves to supply gas. When a sanitary authority thus purchases a gas work, the money for the purchase is either borrowed on the security of the general district rates, or the shareholders in the purchased undertaking are paid in annuities secured in like manner. But the power to do this must be conferred by special Act of Parliament, as there is no power to transfer the undertaking of a gas company to a sanitary authority, or power to purchase and pay for the works without special legislative sanction. As the money of the ratepayers

Improvement Acts.

Alteration of Improvement Acts.

Gas Works not permanent works.

Purchase of Gas undertakings.

Payment for Gas Works.

Consumers and non-consumers.

generally, is thus used, there should be an equitable arrangement as to price to be charged to consumers of gas —for it would be manifestly unfair that non-consumers should reap a greater share of benefit by the acquisition of a large amount of profit going in diminution of their rates, while consumers, who had equally with non-consumers contributed to purchase and shared the risk of the undertaking, had to furnish the whole of the profits out of prices maintained at such a rate as to secure their acquisition. This will be more clear by considering the present position

Gas undertakings.

of authorised gas companies. The Legislature has arrived at the definite conclusion, that in a district of moderate area, it is better to have a regulated monoply for the supply

Competition.

of gas, than to have competition which has been found in all cases to work in the long run disastrously for the general interests of the public. In return for granting this monopoly of supply, joined to the right of taking up the streets for the purposes necessary thereto, the profits of a

Profits.

gas company are limited to a certain percentage on the capital invested, never exceeding 10 per cent., and now generally confined to 7 per cent., with a power to create a

Reserve fund.

reserve fund to meet extraordinary demands from accidents, &c., and to neutralize any exceptionally bad year, in order that the limited dividend might be as far as possible secured out of a price fixed by the Act as the maximum to be charged within the limits of the Act.

Supervision as to price.

Beyond the price so limited the quality of the gas is prescribed, and a power of supervision is given to gas consumers by which, when the dividend has been more than earned, the company is obliged to reduce the price to its consumers, whether public or private. Should the price be unduly maintained, any two gas consumers may appeal to the Court of Quarter Sessions, which has the power to appoint an accountant, or other competent person not being a proprietor of gas works, to examine into and ascertain the actual state and condition of the gas undertaking; and the Court can order the price to be reduced, so that it be kept only at such a rate as will ensure the dividend provided in the special Act.

Supply by Local Authorities

But it will be at once seen that these limitations do not

exist when a local authority stands in the place of a company carrying on its undertaking under parliamentary sanctions; and therefore the consumer may, unless his claims be fairly met, be placed in a worse position when a public authority supplies gas than when the same conditions are fulfilled by a private company. Subject to certain exceptions, to be mentioned hereafter, no company is bound to supply gas to any desiring consumer, or to continue the supply for any period. In this respect gas is like bread, or any other commodity sold by a tradesman, who need not sell if he does not wish to do so. And the same rule applies generally to water supply. In the same way a gas company can at any time cut off their supply from any premises, however long antecedently they may have been lighted with gas; and may also decline to give or continue a supply except security be given for payment. In some cases a gas company insist also on an incoming tenant paying any arrears of the outgoing occupier. This is, however, so great a hardship on the intending consumer, that it is now very rarely insisted on, and is specially provided against in all undertakings established since the passing of the Gas Works Clauses Acts, 1871. In some private Acts there is a provision against this charge, and also enforcing a supply of gas to any householder requiring it within a certain distance of the company's mains, and now by the Gas Works Clauses Act, 1871, which Act is applied to every new undertaking, and also by direction of the Chairman of Committees of the House of Lords, incorporated with every application to Parliament, of any company seeking for further powers, it is provided that any person within twenty-five yards of any main of the company shall receive a supply of gas at a certain specified pressure. This pressure is fixed by the special Act, which also prescribes the price, illuminating power, and quality of the gas, and provides for its being tested in such a manner as to ensure a compliance with the requirements of the Act. The quantity of gas consumed is ascertained by a meter, either wet or dry, and each meter is subjected to inspection, and must be certified as correct by an official stamp. For the purpose of examining and stamping meters,

Compulsory supply.

Security.

Pressure and quality.

Testing.

Meters. Sale of Gas Act.

Courts of Quarter Sessions or Town Councils may appoint inspectors of meters to take charge of stamps, &c., and to examine and stamp all meters. These meters may either be bought by the consumer or will be supplied by the company, who are empowered to charge a rent for their use sufficient to cover interest on their first cost and the sum necessary for their replacement, as they wear out in a few years and become incorrect and untrustworthy. Gas to the public lamps may either be supplied by measurement, when the price per 1,000 feet is to be agreed on or fixed by arbitration, or it may be arranged in such a manner as rent for so many hours' lighting, at so many feet an hour, in one annual sum; and this is often made to include the cost of cleaning, repairing, lighting, and extinguishing the lamps. It often happens that complaints are made as to the gas supplied to the public or the private consumer not being of sufficient illuminating power, or being of bad quality, or smoky, or injuring the books or pictures in the rooms in which it is employed. In all such cases it will be well to look carefully at the fittings used, as deposits continually take place, especially in the smaller pipes and about the burners, which deposits act most prejudicially on the illuminating power of the gas. This is specially the case in frosty weather, when pipes exposed to the influence of the cold may become entirely choked. It must also be remembered that, if gas smokes, the burners are defective; if goods are injured in rooms in which it is employed, it is from want of ventilation; and if the gas be impure, a small slip of paper, wetted with a solution of acetate of lead, will unmistakably detect the presence of sulphuretted hydrogen. There may be other impurities in gas—ammonia and compounds of sulphur. These are to be tested for by the gas examiner, appointed now in all Acts of Parliament; but, as of necessity the use of gas equal to the light of forty or fifty candles must necessitate the creation of considerable heat in the upper portions of the room, free exit for the heated air should always be provided; but, if the supply be defective, or any impurity is suspected, a written notice should at once be addressed to the company supplying the gas, and in most cases a ready remedy will be at once supplied. Under the Gas

Meters lit by Company.

Public lamps.

Complaints.

Acts a gas examiner may be appointed by the local authority periodically to test the gas and to ensure its being kept up to specified illuminating power and purity. Nothing will justify any gas company in creating a nuisance, and severe penalties attach to pollution of air, earth, or water by anything done in the exercise of the powers of the company. Gas companies may now obtain the requisite powers to take up streets by obtaining a provisional order from the Board of Trade, to be confirmed, as other provisional orders, by a subsequent Act of Parliament; and having obtained this power, they will be able to do all acts necessary for the carrying on of their business, but subject to reinstatement of all roads and streets, and an interference with surface or traffic, which shall do as little damage as possible. On the other hand, sanitary authorities and other incorporated companies can remove and alter the position of gas pipes; but it must be done in such a manner as shall not interfere with the flow of gas, which is to be preserved in as free a manner as before any alteration. Gas supply in the metropolis only differs from what has been before said with respect to the subject generally, that the whole area to be lighted is so districted as to be divided between several great companies, and these, by amalgamation, are constantly becoming smaller in number and larger in extent; and it is possible that at no distant period the supply on the north side of the Thames may be divided between two great companies, while on the south side a longer period may elapse before the companies there existing are similarly absorbed into two or more sources of supply.

Nuisances by Gas Co.

Taking up streets.

Alteration of gas pipes.

Metropolitan Gas supply.

Where the Public Health Statutes are not in force, that is in all districts not urban, public lighting, if desired must be provided under the provisions of the old Lighting and Watching Act of William IV. (1833). This provides that any parish or any portion of a parish, by the votes of two-thirds of the ratepayers who are present in a vestry meeting, called for the special purpose by requisition of three or more ratepayers to the churchwardens, may adopt the Act.

Public lighting in rural districts.

And thereupon the churchwardens are to call a meeting of the ratepayers, that is of persons who have been rated

for the relief of the poor for the whole year immediately preceding the meeting and who have paid all the rates except such as have been made for the antecedent six weeks.

Inspectors of lighting.

The meeting is to appoint inspectors of lighting and watching who have power to direct the overseers of the parish, or part of the parish, in which the Act has been adopted, to levy rates to cover the expenses incurred in carrying out the provisions of the Act. The inspectors may provide and keep up fire engines, and are empowered to put up lamp posts and provide lamps for lighting all the roads, streets, and places in their district with gas, oil or otherwise as they shall think necessary.

Fire Engines.

Escape of Gas, or Gas wasting, under Act of 1833.

Gas escaping from the pipes of any gas undertaking will subject undertakers to penalties; also allowing any injurious matter from any gas working, or any matter or substance produced in making or supplying gas to become a nuisance, also any fouling of water either by gas or gas workings.

Proceedings for these offences can be taken either under the Nuisances Removal Acts, the Gas Works Clauses Acts, the Public Health Acts, or the Waterworks Clauses Acts. It will not be sufficient excuse on the part of a gas company to allege that the fouling complained of was not done wilfully, or was done improperly and against the instruction of the directors or manager of the company, for any fouling or other of the above enumerated offences will be visited by penalties, however occasioned.

CHAPTER VIII.

NUISANCES.

ANYTHING is a nuisance at Common Law which infringes on or curtails the powers, rights, privileges of any one. Thus, it is a nuisance to block up or diminish the light of any window when a right to use the window has been acquired by a certain length of user. It is a nuisance to pollute the air we breathe or the water which flows in any stream, for we have a public right to the first being kept in a state of purity, and to the latter when flowing in private land the riparian owner has a right that it shall be kept free from the admixture of noxious matter, and the public have a right in all flowing water that it be kept pure; and it is a nuisance for anyone to do any act which lessens the enjoyment of any matter or thing in which there can be any property. There are many things which may be done on a man's land which are perfectly lawful so long as what is done is confined within his own premises: for example, it may be necessary in the carrying on of a business or occupation to collect a large quantity of water, and this may be no nuisance while so contained and confined, but if, escaping, it do any damage, he is bound at his peril to keep it where it is collected and in safety; and it will not be sufficient to take all reasonable and prudent precautions in order to keep it in, for he will be held liable for whatever results from the escape—and this is equally true whether it be 'beasts or water or filth or stenches.' But under the Sanitary Acts the word nuisance has a more restricted meaning, being confined to those matters which are injurious to the public health. Allowing water to collect on a railway bridge and to drop from it on to the passengers in the road beneath is a nuisance, as it lessens the enjoyment of the way to the passers-by—but inasmuch as it is not directly injurious to health it is not a nuisance within the meaning of the various

Definition of nuisance.

Air and water.

Liability for nuisance.

Nuisance as defined by the Sanitary Acts.

Sanitary Acts. It may be more correct to say that a nuisance is everywhere the same, but the mode of proceeding to remove or remedy it under differing circumstances is different. A nuisance may be so limited as to affect only a private individual in his private capacity; the remedy is then a private one—by action at law for damages, joined to a demand for an injunction to restrain its commission or continuance in the future. Or it may be of a public character, affecting the mass of the community, when an indictment should be preferred at common law; subsequently steps may be taken to obtain an injunction. But under the Sanitary Acts several matters are enumerated which are more or less directly or indirectly injurious to the public health, and to remove these various summary proceedings are to be taken in accordance with the provisions of the various Acts under which an urban or rural sanitary authority obtain their power. It has already been pointed out that by the almost obsolete court leet of the lord of the manor all common law nuisances may be proceeded against, penalties obtained against the wrong-doers, and steps taken to remove the nuisance. And it is by the authority of the common law that injunctions have been obtained against local sanitary authorities in various parts of the country restraining them from pouring into rivers the sulliage of the towns and cities over whose health they are the appointed guardians. These bodies in attempting to remove the nuisance at their door have committed the most widespread injury, polluting one of the main requisites of health, and bringing discredit on all sanitary operations. Under the Nuisances Removal Acts the word nuisance includes any premises in such a state as to be a nuisance or injurious to health; any pool, ditch, gutter, watercourse, privy, urinal, cesspool, drain, or ashpit so foul as to be a nuisance or injurious to health; any animal so kept as to be a nuisance or injurious to health; and any accumulation or deposit which is a nuisance or injurious to health. But it is provided that no such accumulation or deposit as shall be necessary for the effectual carrying on of any business or manufacture shall be punishable as a nuisance under this section, when it is proved to the satisfaction of the justices that the accumu-

Remedies.

Private nuisances.

Public nuisances.

Nuisances at common law.

Nuisance Removal Acts.

Premises.

Ditches.

Animals.

Accumulations.

lation or deposit has not been kept longer than is necessary for the purposes of such business or manufacture, and that the best available means have been taken for protecting the public from injury to health thereby.

Nuisances under the Sanitary Acts.

Under the Sanitary Act, 1866, this definition was extended to mean any house or part of a house so overcrowded as to be dangerous or prejudicial to the health of the inmates.

Factories.

Any factory, workshop, or workplace not already under the operation of any general Act for the regulation of factories or bakehouses not kept in a cleanly state, or not ventilated in such a manner as to render harmless as far as practicable any gases, vapours, dust, or other impurities generated in the course of the work carried on therein that are a nuisance, or injurious, or dangerous to health, or so overcrowded while work is carried on as to be dangerous or prejudicial to the health of those employed therein.

Fireplaces or furnaces.

Any fireplace or furnace which does not as far as practicable consume the smoke arising from the combustible used in such fireplace or furnace, and is used within the district of a sanitary authority for working engines by steam, or in any mill, factory, dyehouse, brewery, bakehouse, or gas works, or in any manufactory or trade process whatsoever. Any chimney (not being the chimney of a private dwelling-house) sending forth black smoke in such quantity as to be a nuisance.

Chimneys smoke.

Provided, first, that in places where no enactment is in force compelling fireplaces or furnaces to consume their own smoke, the foregoing enactment as to fireplaces and furnaces consuming their own smoke shall not come into operation until the expiration of one year from the date of the passing of the Act (7th August, 1866).

Secondly, that where a person is summoned before the u stices in respect of a nuisance arising from a fireplace or furnace which does not consume the smoke arising from the combustible used in such fireplace or furnace, the justices may hold that no nuisance is created within the meaning of this Act, and dismiss the complaint if they are satisfied that such fireplace or furnace is constructed in

such manner as to consume as far as practicable, having regard to the nature of the manufacture or trade, all smoke arising therefrom, and that such fireplace or furnace has been carefully attended to by the person having the charge thereof. Besides these direct nuisances, others may be reckoned as indirect, such as unwholesome food, and under the head of common nuisances, according to Blackstone, are all offences against the public order and economical regimen of the State, being either the doing of a thing to the annoyance of all the king's subjects, or the neglecting to do a thing which the common good requires. The tenth section of the Nuisances Removal Act, 1855, provides for the persons who may give notice of a nuisance. They may be any person who is aggrieved thereby, or the sanitary inspector, or any paid officer of the sanitary authority, any two inhabitants of the parish or place to which the nuisance relates, the relieving officer of the union or parish, any constable or any officer of the constabulary or police force of the district or place; if the premises be a common lodging house, any person appointed for the inspection of common lodging houses. Any notice which may be sent to the sanitary authority should be at once entered in the presentment book by the inspector of nuisances, and steps at once taken to abate the nuisance. In the Nuisances Removal Act, 1855, a form of notice is given, which may be used by persons wishing to bring a nuisance under the notice of the sanitary authority; it is in the words following, but any form of notice is sufficient if set out with sufficient distinctness to enable the sanitary authority to discover the site and character of the nuisance :—

Unwholesome food.

Blackstone's definition of nuisance.

Persons who may give notice of existence of nuisances.

Form of notice.

FORM ( ).

NOTICE OF NUISANCE.

To the &c. &c., Sanitary Authority.

I (or we) (the person aggrieved by the nuisance hereinafter described), (or the undersigned and described inhabitant, householder, sanitary inspector, &c.) do hereby give you notice, that there exists in or upon the (dwelling

house, yard, &c.) situate at (give here such description as may be sufficient to identify the premises) in the parish of in your district, under the Nuisances Removal Act, 1855, the following nuisance—(here describe the nuisance) (thus—a dwelling house or building a nuisance or injurious to health for want of a privy or drain, or sufficient means of ventilation, or so dilapidated or so filthy as to be a nuisance or injurious to health, or a drain or ditch so foul as to be a nuisance or injurious to health, or an accumulation of &c. &c., which is a nuisance or injurious to health, or swine so kept as to be a nuisance or injurious to health), and that such nuisance is caused by (here name the person, if known, or add, by some person unknown.)

Dated this day of 187 .

(Signed)

Overcrowding.

The Sanitary Act of 1866 made another and most important extension of nuisance by including in it overcrowding, but it must be observed that no proceedings can be taken under the Act unless the overcrowding take place from more than one family being the occupants of the house. The 29th section of the Nuisances Removal Act provides that whenever the Medical Officer of Health, if there be one, or if none, whenever two qualified medical practitioners shall certify to the local authority that any house is so overcrowded as to be dangerous or prejudicial to the health of the inhabitants, and the inhabitants shall consist of more than one family, the local authority shall cause proceedings to be taken before the justices to abate such overcrowding, and the justices shall thereupon make such order as they think fit and the person permitting such overcrowding shall forfeit a sum not exceeding forty shillings.

Lodging-houses in urban sanitary districts.

In districts where the Secretary of State, that is now the Local Government Board, have directed the enactment to be in force either in the City of London, or any district or parish within the area presided over by the Metropolitan Board of Works—or any municipal borough, or of any place under the Local Government Act, 1858, or any local improvement Act, or any city or town containing, according to the census for the time being in force, a population of not

less than 5,000 inhabitants, after notice to that effect in the *London Gazette*, the sanitary authority may make regulations—

Regulations.

1. For fixing the number of persons who may occupy a house or part of a house, which is let in lodgings or occupied by members of more than one family.

2. For the registration of houses thus let or occupied in lodgings.

3. For the inspection of such houses and the keeping the same in a cleanly and wholesome state.

4. For enforcing therein the provision of privy accommodation and other appliances and means of cleanliness in proportion to the number of lodgings and occupiers and the cleansing and ventilation of the common passages and staircases.

5. For the cleansing and lime-whiting at stated times of such premises.

These provisions are to apply to common lodging houses within the meaning of the Common Lodging House Acts. They are to be enforced by penalties not exceeding 40*s*. for any one offence, with additional penalty not exceeding 20*s*. for every day during which the offence continues, and two offences of overcrowding or cellar dwelling occurring within three months may lead to the permanent closing of the premises by the sanitary authority.

Penalties.

Having received notice of the existence of a nuisance on any premises, it will be necessary to examine into the complaint, and for this purpose the sanitary authority, or any of their officers, may demand to enter and inspect the same between nine in the morning and six in the evening. If entry is refused, notice is to be served on the party refusing to the effect that application will be made to a justice to get an order under his hand requiring the person having custody of the premises to admit the sanitary authority or their officer. The justice having heard on oath evidence that there is reasonable ground for believing a nuisance to exist, can then grant his order, and the entry can then be made—either to ground further proceedings, to examine the premises, to ascertain the course of drains, or inspect works ordered by justices to be executed: and

Procedure.

Entry on premises.

Notice of demand of entry.

Order of justice.

To ground proceedings.

further, they may enter and remove or abate a nuisance in case of non-compliance or an infringement of the order of justices; or to inspect or examine any carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour on the premises. They may do this at all reasonable hours, or at such hours as the business is carried on on the premises, without any previous notice. Having thus enquired into and ascertained the existence of a nuisance and its character, the sanitary authority must then serve a notice on the person who causes the nuisance, or upon whose premises it exists, to abate it to the satisfaction of the officer of the sanitary authority. This notice should specify a time within which the nuisance is to be removed or abated or discontinued. Should the time expire and the nuisance continue, then another notice should be served on the defaulting party informing them that compulsory proceedings will be taken, and a summons should then be obtained from a justice by the inspector of nuisances, requiring the persons by whose act, default, permission, or sufferance the nuisance has arisen or continues, or if the person cannot be found, then on the owneror occupier of the premises on which the nuisance arises, to appear before two justices in petty sessions, in order that the complaint may be heard and adjudicated upon. If the justices are satisfied that the nuisance still exists, or if removed, is likely to be renewed, they are to make an order in writing under their hands and seals requiring the removal of the nuisance, with all costs incurred up to the time of making the order. The order of the justices may require the person on whom it is made to provide sufficient privy accommodation, means of drainage, or ventilation, or to make safe or habitable, or to have, cleanse, whitewash, disinfect, or purify the premises which are a nuisance or injurious to health, or any part of the premises, or to drain, empty, cleanse, fill up, amend or remove the injurious pool, ditch, gutter, watercourse, privy, urinal, cesspool, drain, or ashpit which is a nuisance or injurious to health, or to provide a substitute for any of these, or to carry away the accumulation or deposit which is a nuisance or injurious to health, or to provide for cleanly and wholesome keeping of any animal, or to remove

To abate a nuisance.

To inspect food.

Notice to abate nuisance.

Time.

Compulsory proceedings.

Appearance before justices.

Order of justices to abate nuisance.

Privy accommodation.

Cleansing premises.

Removing animals.

the animal if it be impossible to keep it without creating a nuisance, and generally to do whatever is necessary to abate the nuisance within a time to be specified in the notice.

Prohibition. They may also by their order prohibit any act likely to cause the recurrence of the nuisance complained of. They may prohibit the use of any premises as a human habitation, and after having made such order, they may, when they are satisfied that the house has been so cleansed or repaired as to be fit for habitation, make another order from the date of which the house may be again let or inhabited.

Penalties. Any one acting in defiance of the order of the justices may be fined 20*s.* per day during which he acts contrary to such orders, and ten shillings a day while he declines to do any act ordered by the justices.

Entry by Sanitary Authority. After obtaining the order of the justices, the sanitary authority can itself enter the premises, either to remove or abate the nuisance condemned or prohibited, and recover the costs, not exceeding one year's rack rent of the premises, either by action in a court of law or in the county court, or summarily before justices, upon summons.

Recovery of costs.

Apportionment of penalties. The justices can divide the penalties and costs between various parties in any manner they may deem reasonable; they may excuse persons on the ground of poverty or other special circumstances; or if they consider a complaint made by the sanitary authority to have been unfounded or vexatious, they may condemn the authority to pay the costs incurred by the party against whom the complaint is made, or any part thereof.

Structural works. If structural works are required in order to abate a nuisance, the justices may order such works to be executed under the direction of the sanitary authority; but there is a power of appeal to the Quarter Sessions against such order, and, indeed, against any order under these Acts; and the order will stand over if the person against whom the order has been made within seven days takes the necessary steps to have the appeal heard and determined.

Appeal.

Works may be executed by Sanitary Authority. If in any of these cases the person by whose act or default the nuisance has arisen, or the owner or occupier of the premises, cannot be found, the sanitary authority can have the order addressed to and executed by them, and the cost defrayed out of the sanitary rates. If any manure or other thing remain in the hands of

the sanitary authority after abating the nuisance, they may sell it by public auction after not less than five days' notice, unless the delay would be injurious to health, when an order for the immediate sale or destruction of the material may be made by the justices. Any money resulting from such a sale may be appropriated in payment of the costs and expenses incurred by the sanitary authority; any surplus is to be paid over, on demand, to the owner of the material, whatever it may be. As surveyors of highways. the urban sanitary authority, and in rural districts the surveyor of highways, may make scour, cleanse, and keep open all ditches, gutters, drains, or watercourses in and through any lands or grounds adjoining or lying near to any highway, upon paying to the owner, if they are not waste or common, for any damage done. Should any ditch, gutter, drain, or watercourse used, or partly used, for the conveyance of water, filth, sewage or other matter from any house, buildings, or premises, be a nuisance, the sanitary authority, if they think it necessary, are required to lay down, either partly or entirely, a new sewer, and to keep it in good repair; they can enter lands for this purpose, and can assess all lands and buildings, to pay either at once or in payments spread over a term of years, the amount expended by them for this purpose. Should the sewer, &c., be within the jurisdiction of different sanitary authorities, then each authority can levy for the share of the expenses within its own jurisdiction which corresponds to the proportions of work executed by each. The assessment is limited to one shilling in the pound on the rateable value of the premises.

Sale of manure.

Surplus to be paid over to owner.

Cleansing ditches.

Payment of damage to owner.

Ditches requiring new outlets.

Assessment of buildings, &c.

Joint work.

Besides the nuisances before enumerated, if the medical officer of health, or any two medical practitioners, or if ten inhabitants report to the sanitary authority that any candle-house, melting-houses, melting-place or soap-house, or any building or place for boiling offal or blood, or for boiling, burning, or crushing bones, or any manufactory, building, or place used for any trade, business, process, or manufactory causing effluvium, is a nuisance or injurious to the health of the inhabitants of the neighbourhood, the sanitary authority are to obtain a summons against the parties,

Nuisances from candle or other works.

causing them to appear before two justices in petty sessions; and if, upon enquiry, it appear that the trade or business carried on by the person complained against is a nuisance, or causes any effluvium injurious to the health of the inhabitants of the neighbourhood, and that such person shall not have used the best practicable means for abating such nuisance, or preventing or counteracting such effluvia, the owner or occupier, or any person employed by the owner or occupier, may be find 5*l.* or not less than forty shillings; and upon a second conviction, 10*l.*; and for each subsequent conviction, double the amount of the penalty imposed for the preceding conviction, up to 200*l.* The justices may suspend their final determination, and the person convicted may appeal against such conviction, or, at the very commencement of the proceedings, may object to the jurisdiction of the magistrates; upon which the sanitary authority must take proceedings in law or equity in the superior courts for preventing or abating the nuisance complained of. This provision only, however, applies to the district of an urban sanitary authority. After giving a public notice, calling on persons periodically to remove manure, &c., from stables or mews, any person who neglects to do so will be liable to a penalty of twenty shillings a-day for every day that the manure is allowed to accumulate. This provision also only applies to urban sanitary districts.

Penalties.

Objection to jurisdiction of magistrates.

Periodical removal of manure.

Inspection of district.

The inspector of nuisances is bound from time to time to make inspection of the district, and to exercise the various powers for abatement and prevention of the nuisances before enumerated. In doing this he will be aided and directed by the medical officer of health, and must be in continual communication with the clerk and surveyor to the sanitary authority in order to secure their help and advice. Should the sanitary authority make default in thus carrying out their duties, the Local Government Board may authorise the chief officer of police to discharge the duties, but he will not be able to enter any house or part of a house held as a dwelling without the consent of the occupiers, or without the warrant of a justice of the peace.

Default of Sanitary Authority.

Action by police.

Disinfection.

The sanitary authority, upon the certificate of any legally qualified medical practitioner, may order any house

or any articles therein to be cleansed and disinfected in order to prevent or check infectious or contagious disease; and if the order is not obeyed, may do the work themselves, charge the expenses on the person in default, and recover penalties of not less than one shilling, and not exceeding ten shillings, for every day in which there is default. If the persons are too poor to pay, the sanitary authority may themselves do what is necessary. They may further provide a proper place for disinfecting clothes and bedding, and disinfect them free of charge, and may also provide carriages to convey infected persons either to hospitals or to their own houses, and pay the expenses incurred in such conveyance. If any person suffering from any dangerous infectious disease enter any public conveyance without previously notifying to the driver that he is so suffering, he will be liable to a penalty of £5 and all the costs to which the owner or driver may be put in consequence. No owner or driver is obliged to carry a person so suffering until they shall have been paid a sum necessary to cover any losses or expenses to which they may be put in consequence of such conveyance. If any person has been carried in any public conveyance, it must be at once properly disinfected, or the owner or driver may be fined any sum not exceeding £5.

Penalties.

Places for disinfecting clothes, &c.

Removal of sick to hospitals.

Public conveyances.

Penalties.

Public conveyances.

Persons suffering under these diseases may be removed to a hospital, if there be one provided by the sanitary authority—when the sick person is without proper lodging or accommodation or lodged in a room occupied by more than one family; or being on board any ship or vessel. For this purpose the sanitary authority may themselves provide hospitals either separately or in conjunction with other sanitary authorities, or may enter into arrangements with the managers of hospitals for the reception of any such persons within a sanitary district by making an annual payment or otherwise. Any person who wilfully exposes himself in any street, public place, or public conveyance while labouring under any infectious disease, or any person exposing, selling, or transmitting any infected clothes or bedding, may be fined £5. This does not apply to clothes transmitted for the purpose of disinfection. If

Removal to hospitals from lodgings or ships.

Provision of hospitals.

Exposure in public streets.

Transmission of clothes, &c.

Letting rooms where there has been infectious disease.

any innkeeper or other person knowingly let any room or part of a house in which there has been any person suffering from any infectious disease without having first thoroughly disinfected the room, &c., to the satisfaction of a qualified medical practitioner, he will be liable to a penalty not exceeding £20.

Penalty.

Provision of mortuaries, &c.

Akin to these powers are those given in the Sanitary Act, 1866, to the sanitary authority to provide places for the reception of dead bodies, to prevent them acting injuriously on the health of other inmates of the house in which the sick person has died, and where, from limited accommodation, it is desirable the dead should not remain among the living. The sanitary authority is also empowered to provide places where post-mortem examinations may be made when required.

Regulations as to sick on board ship.

It is important to the exercise of these powers of the sanitary authority to note that with the sanction of the Local Government Board they may lay down rules for removal to hospitals of any persons who are ill on board ship of any infectious disorder, but where there is a port authority under the Public Health Act of 1872, such powers may be executed by that authority. These laws with respect to

Permanent laws as to nuisances.

nuisances are permanently in operation, but there are others which can be put in force by the Local Government Board in sections where any part of the country is threatened with, or is affected by, any formidable epidemic, endemic, or contagious disease. These relate to the speedy interment of the dead, house-to-house visitations, and for the dispensing of medicines and affording medical aid to persons exposed to the influences before mentioned. In order to carry out these purposes, the sanitary authority may appoint and pay medical or other officers and persons to carry out any regulations and directions made and issued by the Local Government Board; and any persons who wilfully violate or neglect these, may be prosecuted or have other legal proceedings instituted against them by the local authority. Any person obstructing anyone acting for these purposes under the direction of the sanitary authority, may be fined £5. Such fines, when levied, to be appropriated to the payment of the expenses incurred in carrying

Prevention of disease, epidemics, &c.

Speedy interment of the dead.

Providing medical aid.

Payment to medical officers.

Prosecutions by Sanitary Authority.

Obstructing authority.

out the sanitary regulations made by the Local Government Board.

Payment to medical men for services rendered on board ships.

If any Poor Law Medical Officer or other medical practitioner perform any of the services required by these regulations on board any ship in any port, he is entitled to payment for such services from the captain of the ship on behalf of the owners. In case there should be any dispute as to the amount to be paid, a justice may decide what is reasonably to be paid up to £20, and a summary remedy is given to the medical attendant to recover up to that amount for services rendered.

CHAPTER IX.

GENERAL.

The Sanitary Authority will have control over various other matters not before specified. Thus, urban authorities may establish markets and market-houses, but so as not to interfere with or injure any private interests; and since the passing of the Burial Acts, in cases where the vestry have adopted them, may, at the option of the vestry, be constituted the burial board, with all the powers, rights and duties thereto attaching, and with power to levy rates in the same manner as general district rates, or may take the money out of the general district rates to meet the expenses of carrying into execution the powers of the Acts. The Sanitary Act, 1866, makes provision for a similar transfer of duties from the burial board of any district where conterminous with the district of a local board of health. This is to be done by resolution of the vestry and by agreement of the burial board. By these acts old burial grounds may be discontinued by order of the Local Government Board, and provision is made for the construction of new burial grounds either within or without the districts for which they are provided. No ground can be provided within 100 yards of a dwelling-house, without the consent in writing of the owner, lessee and occupier. Every burial ground must have part of it unconsecrated in every case, unless by unanimous resolution of the vestry; the new burial ground is to be conveyed, settled and consecrated in like manner as the old churchyard. In the burial grounds thus provided, whether in the consecrated or unconsecrated portions, the parishioners and all other parties will have exactly the same rights as they had in the old

burial ground of the parish. The Local Government Board, as well as the Bishop, will have control over the fees, which are to be identical in both portions of the cemetery; and the fee for burial of paupers to be paid to incumbents is limited to 1*s.* and in any case no greater fee than 2*s.* 6*d.* is to be paid as a fee for burial.

The following are in force as Regulations for Burial Grounds provided under the Acts 15 & 16 Vict., cap. 85; 16 & 17 Vict., cap. 134; 17 & 18 Vict., cap. 87; 18 & 19 Vict., cap. 128, and 20 & 21 Vict., cap. 81.

I.—The burial ground shall be effectually fenced, and, if necessary, underdrained to such a depth as will prevent water remaining in any grave or vault.

II.—The area to be used for graves shall be divided into grave-spaces, to be designated by convenient marks, so that the position of each may be readily determined, and a corresponding plan kept on which each grave-space shall be shown.

III.—The grave-spaces for the burial of persons above 12 years of age shall be at least 9 feet by 4 feet, and those for the burial of children under 12 years of age, 6 feet by 3 feet, or, if preferred, half the measurement of the adult grave-space, namely, 4½ feet by 4 feet.

IV.—A register of graves shall be kept, in which the name, age, and date of burial in each shall be duly registered.

V.—No body shall be buried in any vault or walled grave, unless the coffin be separately entombed in an air-tight manner; that is, by properly cemented stone or brick work, which shall never be disturbed.

VI.—One body only shall be buried in a grave at one time, unless the bodies be those of members of the same family.

VII.—No unwalled grave shall be re-opened within 14 years after the burial of a person above 12 years of age, or within 8 years after the burial of a child under 12 years of age, unless to bury another member of the same family, in which case a layer of earth not less than one foot thick shall be left undisturbed above the previously buried coffin; but

if, on re-opening any grave, the soil be found to be offensive, such soil shall not be disturbed, and in no case shall human remains be removed from the grave.

VIII.—No coffin shall be buried in any unwalled grave within 4 feet of the ordinary level of the ground, unless it contains the body of a child under 12 years, when it shall not be less than 3 feet below that level.

The control of vaccination will be in the hands of the board of guardians of any district not as the rural sanitary authority, but as appointed by the Vaccination Acts to carry out their various provisions. They may appoint and pay public vaccinators, and also appoint a public officer to prosecute parents not having their children vaccinated in accordance with the law, and penalties are provided in order to enforce its provisions, and to prevent inoculation of small-pox. Urban sanitary authorities are empowered to license, and also, if necessary, to provide slaughter-houses, and to make bye-laws and regulations for their proper conduct, and to prevent their becoming nuisances. Besides being surveyors of highways, and thus exercising control over the public highways, urban sanitary authorities direct traffic in the streets, and regulate public conveyances and hackney carriages, and may make bye-laws for that purpose. They are also enabled to construct tramways by provisional order from the Board of Trade, or to purchase them when constructed, and afterwards to lease them or take tolls for their use, but the sanitary authority has no power itself to work tramways in its district. If other parties apply for powers to construct a tramway, the consent of the local authority and road authority of district is necessary, and if not accorded the parties must obtain a special Act. The general powers of sanitary authorities as to baths and washhouses, public parks and pleasure-grounds, libraries, coaches, fires, &c., will be found set out in the table of powers. In the last Session of Parliament an Act was passed to prevent adulteration of food and drugs. By this act analysts with competent medical, chemical, and microscopical knowledge, are to be appointed. These analysts are to examine and report upon any article of food submitted to them by inspectors of nuisances or inspectors of weights and mea-

sures or inspectors of markets. Upon these reports persons may be found guilty of adulteration, and any person found guilty of selling any article which to his knowledge contains any ingredient injurious to health may be fined 20*l.*, and upon subsequent offence, the name and place of abode of the person offending may be published, at his own expense, in any manner directed by the justices. It is important to know that any substance added to increase weight will be considered as an adulteration. Any person may have any article examined by a public analyst upon payment of a fee varying from 2*s.* 6*d.* to 10*s.* 6*d.* The inspector of nuisances will probably be appointed by the local authority also inspector of lodging-houses. It is in the power of the local authority to fix rules and regulations for these houses, which are placed under their control either by the Sanitary Act, 1866, or the Common Lodging-Houses Acts. The subjoined form of regulations will supply all the information needed as to the rules which should be enforced.

——— URBAN SANITARY AUTHORITY.

Regulations for the government of Common Lodging-Houses within the and District of made by the Sanitary Authority, under the Provisions of the "Common Lodging-Houses Act, 1851."

1. That every common lodging-house shall be registered, and no greater number of lodgers shall be allowed to lodge therein than is expressed in such register; and the keeper shall cause his or her name, and the number of lodgers for which the house is registered, to be painted on a board, 3 feet long by 2 feet broad, in legible white letters, not less than two inches in height, on a black ground, which shall be conspicuously placed, and at all times exhibited on the outside of such lodging-house.

2. That the number of the family of each keeper must be considered in fixing the number of the lodgers, and a capacity of 250 cubic feet must be allowed in each sleeping-room for every lodger.

3. That the keeper of a lodging-house shall not receive

therein, or in any room thereof, a greater number of lodgers than is expressed in a ticket, signed by the inspector of common lodging-houses, according to the form at foot of these regulations, and the keeper shall hang up, in a conspicuous part of each room, a copy of such ticket, and shall keep the same at all times visible and legible.

An adequate supply of the tickets may be had on application at the office of the inspector.

4. That the keeper of such lodging-house shall reduce the number of lodgers upon receiving notice to that effect from the inspector; such notice stating therein the special cause of the same being given, but the period during which such notice shall continue in force shall not exceed one month.

5. That rooms used as kitchens or sculleries shall not be occupied as sleeping rooms, and that rooms in the basement, or below the level of the ground, shall not be used as sleeping rooms.

6. That persons of opposite sexes shall not occupy the same sleeping apartment, except married persons, or parents and their children under fourteen, or other children under ten years of age; and that two children under eight years of age are to be counted as one adult.

7. That each room occupied as a sleeping apartment shall be furnished with bedsteads, and sufficient bedding for the number of lodgers registered for each room; the bedsteads must at all times be kept in good order, and the bed linen clean.

8. That the keeper shall cause the windows of every sleeping room to be kept open to the full width thereof, from nine to eleven o'clock in the morning, and from two till four o'clock in the afternoon of every day, unless prevented by tempestuous weather, or by the illness of any inmate in such room; and during the time the windows are opened, as aforesaid, shall cause the bed clothes of every bed in such room to be turned down and exposed to the air; but in those rooms occupied by persons who work during the night and sleep in the day the windows shall be kept open from two till four o'clock in the afternoon.

9. That the keeper shall cause the floors of all the rooms, passages, and stairs to be thoroughly swept once at least in each day, and thoroughly washed once in each week, and shall cause the walls and ceilings of every room to be properly cleansed and sufficiently lime-washed twice at least in every year, during the months of April and October, and the blankets, rugs or coverlids used in such lodging-house shall be washed perfectly clean at least four times in every year, that is to say, at least once some time during the first week of each of the several months of March, June, September, and December, and at such other times as may be required by the inspector.

10. That the keeper shall cause every room to be ventilated, to the satisfaction of the inspector; and in case of fever, or any other infectious or contagious disorder occurring in any such lodging-house, the keeper shall forthwith give notice thereof to the inspector, that he may inspect the same, and direct any disinfecting process; and the keeper shall cause the blankets and bed clothes used by any person affected by such disorder to be thoroughly cleansed, and the bedding to be fumigated immediately after the removal of the person affected by such disorder, in such manner as may be ordered by the inspector; and when the district in which any such lodging-house is situate is visited or threatened by any epidemic, endemic, or contagious disease, the keeper shall make such reduction of the number of lodgers in each room as the local authority shall direct.

11. That every such lodging-house shall be furnished with a dust-bin, of sufficient size to contain the dust, ashes, and refuse that accumulates in the interval of its being cleared away, which shall not exceed two weeks.

12. That a water-closet, or privy, shall be provided for every such lodging-house, having a yard or other facilities for the erection thereof, and where such facilities do not exist, or where the closet or privy is used in common by the lodgers of two or more houses, the privy or closet must be provided in some place conveniently contiguous, to the satisfaction of the inspector; and for every twenty lodgers to be accommodated a separate closet or privy shall be provided.

13. That the drains, closets, and sinks shall be trapped, so as to prevent the effluvia coming up from the sewers or cesspools; the sink in the yard shall be so placed as to take all waste water through the drain from the closets; and the seat, floor, and walls of the water-closet or privy shall be kept free from filth, and clean in all other respects.

14. That the yards and areas of every lodging-house shall be properly paved, so as to run dry and effectually take off all waste water; and every such lodging-house shall have a proper drain, communicating with a common sewer, where such sewer is within one hundred feet of the premises.

15. That the keeper of every lodging-house shall provide such accommodation for cooking and washing, and such a supply of water for the use of lodgers, as shall be satisfactory to the inspector.

——— URBAN SANITARY AUTHORITY.

COMMON LODGING-HOUSE TICKET, No.

Lodging-House

No. of Room for which this ticket is intended, No.

Registered to accommodate *Lodgers.*

In Room No. 1	In Room No. 2	In Room No. 3	In Room No. 4	In Room No. 5	TOTAL

N.B.—By the Common Lodging-Houses Act, 1851, every person offending against any of the provisions of the Act, or of the above regulations, will be liable to a penalty not exceeding five pounds.

Sanitary Authority Regulations relating to houses let in lodgings or occupied by members of more than one family. Made pursuant to the provisions of the Sanitary Act, 1866 (29 & 30 *Victoriæ, cap.* 90, *s.* 35), *and confirmed by one of Her Majesty's principal Secretaries of State.*

1st. "For fixing the number of persons who may occupy a house, or part of a house which is let in lodgings or occupied by members of more than one family."

The number of persons who may occupy a house which is let in lodgings or occupied by members of more than one family shall be not more than the aggregate number of the persons who may legally occupy the rooms therein, and the number of persons who may occupy a room in a house which is so let or occupied shall be not more than one person to each and every three hundred cubic feet of space contained in the said room, provided that a room which is used in common by more than one family for the purpose of cooking shall not be used as a sleeping room, and provided that in the case of adults of different sexes occupying the same room as a sleeping room the number of persons who may occupy such room shall be not more than two besides children of such adults.

For the purpose of this regulation two children under twelve years of age shall be counted as one person, and every person above twelve years of age shall be considered an adult. For any infraction of the foregoing regulations the owner of the house and the person paying or liable to pay the rent of the house and the person paying or liable to pay the rent of the room shall be severally liable to the penalties hereinafter mentioned.

2nd. "For the Registration of Houses thus let or occupied in lodgings."

Whenever any house is let in lodgings or occupied by members of more than one family, the owner or the person so letting such house or part thereof or causing such house or part thereof to be so let or occupied, or receiving or collecting or being entitled to receive or to collect the rent for any part thereof shall, for the purpose of the registration of such house, upon requisition under the hand of an officer of the sanitary authority being left on the premises and within

seven days from the leaving of such requisition, give notice in writing, by leaving the same at the offices of the sanitary authority, of the following particulars relating to such house, namely:—

1. The number or name (if any) of such house, and the situation thereof.
2. The name and address of the owner and of every person receiving or collecting or entitled to receive or to collect rent in respect of any part of such house.
3. The average height, length, and breadth, in feet and inches, of each and every room therein.
4. The numbers of the inmates respectively of each and every such room.
5. The names of the several tenants or occupiers thereof.
6. The several rents payable therefor.

In case such notice be not so given as aforesaid or in case all such particulars as aforesaid are not in such notice truly set forth, the owner of the house and every person receiving or collecting or entitled to receive or to collect rent in respect of any part of such house shall severally be liable to the penalties hereinafter mentioned.

A register shall be kept at the offices of the vestry wherein shall be entered the cubical capacity of each room in any house which upon notice as aforesaid or on being inspected is found to be so let or occupied in lodgings, and also the number of inmates by whom each of such rooms may be lawfully occupied, and the name and address of the owner of such house, and of the person letting the room or receiving the rent thereof and the amount of the rent paid therefor. And the said register shall be open at all reasonable times for the inspection of any ratepayer of the parish, or owner or inhabitant of the house. An extract from such register so far as relates to the number of persons by whom any room in any such house may legally be occupied, and a copy of any regulations applying thereto, shall on being supplied by any inspector of nuisances or other officer of the vestry be kept suspended in an undefaced and legible condition on the inside of the door of the room to which they refer; and if the said extract and copy or either of them be not so kept suspended and in an undefaced and legible condition as aforesaid the owner of the house and the person receiv-

ing or collecting or entitled to receive or to collect the rent of such room and the person paying or liable to pay the rent of or occupying such room shall severally be liable to the penalties hereinafter mentioned.

3rd. "For the inspection of such houses and the keeping the same in a cleanly and wholesome state."

The medical officer of health or any inspector of nuisances or other person who may be authorised by the vestry, or by any committee of the vestry, may enter at any time any house (other than a common lodging-house) so let or occupied as aforesaid and any room therein, for the purpose of inspecting and registering the same or ascertaining the occupiers thereof, and any person who shall refuse admission to or shall obstruct such medical officer of health, inspector, or such other person as aforesaid who may be entering or endeavouring to enter such house or performing or endeavouring to perform the duty of inspecting such house, or of ascertaining the occupiers thereof or of any room therein shall be liable to a penalty not exceeding forty shillings for any one offence.

If on inspection the premises be found not to be in a cleanly and wholesome state from want of paving, whitewashing, cleansing, repairing, effective drainage, proper ventilation or of other appliances and means of cleanliness, the vestry or the sanitary committee of the vestry may, by notice under the hand of an officer of the vestry to be left on the premises require the owner to pave, whitewash, cleanse, disinfect, properly drain, ventilate and repair the said premises, and from time to time periodically or otherwise as in such notice may be mentioned to do any or all such works as in the opinion of the vestry or of the said sanitary committee shall be necessary to keep the premises in a cleanly and wholesome state, and if the requisitions of such notice as aforesaid be not complied with within the time or at the period or periods therein specified, the owner shall be liable to the penalties hereinafter mentioned.

If any animal be kept on the premises so as to render them in the opinion of the medical officer of health unclean or unwholesome, the vestry or the sanitary committee of the vestry may require the animal so kept to be removed

within such time as they may order; and if such order be not obeyed the person paying or liable to pay the rent shall be liable to the penalties hereinafter mentioned.

Whenever, in any house or room so let or occupied as aforesaid, any person is taken with or suffering from small-pox, fever, or any dangerous infectious disorder, the person paying or liable to pay the rent shall give or cause to be given immediate notice thereof at the office of the vestry, and the owner of the house and every person receiving or collecting or entitled to receive or to collect rent in respect of any part thereof, and every occupier and inmate respectively shall carry out or cause to be carried out any measures for disinfection that the medical officer of health may direct. Any person failing to obey this regulation shall be liable to the penalties hereinafter mentioned.

Whenever any person shall die in any house occupied as aforesaid from small-pox, fever, or any dangerous infectious disorder, the dead body shall forthwith be removed to some proper place away from such house; and in case any person in such house shall die from other cause than an infectious disease and the medical officer of health shall direct the dead body to be removed, such dead body shall be removed to some proper place away from the said house as and when the medical officer of health shall direct. In case any dead body be not removed as aforesaid the person paying or liable to pay the rent of the house and the person paying or liable to pay the rent of the room in which such body shall be, shall severally be liable to the penalties hereinafter mentioned.

4th. "For enforcing therein the provision of privy accommodation and other appliances and means of cleanliness in proportion to the number of lodgings and occupiers, and the cleansing and ventilation of the common passages and staircases."

Every house so let or occupied as aforesaid shall be furnished with at least one enclosed and properly constructed watercloset and also a sufficient ashpit or dustbin; and if the number of inmates be more than twenty and less than forty then with at least two such waterclosets, and so on for any greater number of inmates; and every such house shall be furnished with either a constant or a daily supply

of water, and if the supply be not constant there shall be provided to every such house for the storage of the water a clean sound covered receptacle capable of containing at least seven gallons for each several inmate, and the common passages and staircases of every such house shall be cleansed as from time to time shall become requisite, and shall be constantly kept clean, and shall be ventilated to the satisfaction of the medical officer of health. If any house so let or occupied be without such water closet or water closets or such ashpit or dustbin as aforesaid, or without either a constant or a daily water supply, or having such daily water supply be without such water receptacle as aforesaid, or if the common passages and staircases be not cleansed and kept clean as aforesaid or be not ventilated as the medical officer of health may from time to time direct, then, and in every such case, the owner of the house and every person receiving or collecting or entitled to receive or to collect rent in respect of any part thereof shall severally be liable to the penalties hereinafter mentioned.

5th. "For the cleansing and limewhiting at stated times of such premises."

All the ceilings of every house which is so let or occupied as aforesaid, and the ceilings and walls of the water closet or water closets and the walls of the yard of every such house shall be cleansed and limewhited throughout in the month of April or May in every year; and in default hereof the owner of the house and every person receiving or collecting or entitled to receive or to collect rent in respect of any part thereof shall severally be liable to the penalties hereinafter mentioned.

The penalties hereinbefore referred to for the infraction of any of the above regulations shall be a penalty not exceeding forty shillings for any one offence, with an additional penalty not exceeding twenty shillings for every day during which a default in obeying such regulations shall continue; and such penalties shall be recovered and applied as penalties under the aforesaid Sanitary Act, 1866.

A certificate according to the form B in the Schedule to these regulations, signed by the clerk of the sanitary authority, stating the entire number of lodgers allowed to sleep

in each such lodging-house, and each room of such house, and which number such house is registered to accommodate, will be supplied to the keeper of every house registered under these regulations.

SCHEDULE A.—FORM OF NOTICE.

TAKE NOTICE, that certain Regulations have been duly made by the Sanitary authority for the , under the provisions of the Sanitary Act, 1866, and approved by one of Her Majesty's principal Secretaries of State, for the Registration, Management, and Occupation of Houses let in lodgings or occupied by members of more than one family, situate within the ; and you being the keeper of the Premises, No. Street, in the Parish of within the said , so, as aforesaid, let or occupied, are hereby required, within Six weeks from this Notice, to Register such premises at the Office of the said Sanitary authority, , and if you do not have your premises so registered, you will be liable to a Penalty of Forty Shillings, with an additional Penalty of Twenty Shillings for every day during which such default shall continue. On your applying to the Clerk to the said , at the office aforesaid, your Premises will be Registered free of all charge to you.

Dated this day of one thousand eight hundred and

SCHEDULE B.

Certificate No.

HOUSE LET IN LODGINGS, OR OCCUPIED BY MORE THAN ONE FAMILY.

Street or Place
Registered to accommodate persons, as specified below.

In Room No. 1	In Room No. 2	In Room No. 3	In Room No. 4	In Room No. 5	TOTAL
In Room No. 6	In Room No. 7	In Room No. 8	In Room No. 9	In Room No. 10	

Dated this day of 18

Clerk to the said Sanitary authority.

INDEX TO STATUTES PERTAINING TO PUBLIC HEALTH,

ARRANGED CHRONOLOGICALLY.

Year	Statute	Name of Act
1844–5	7 & 8 Vict. c. 101 .	Poor Law Amendment Act
1845 .	8 Vict. c. 18 . .	Lands Clauses Act
1846–7	9 & 10 Vict. c. 74 .	Baths and Washhouses Act
1847 .	10 Vict. c. 14 . .	Markets and Fairs Clauses Act
1847 .	10 Vict. c. 15 . .	Gas Works Clauses Act
1847 .	10 Vict. c. 16 . .	Commissioners Clauses Act
1847 .	10 Vict. c. 17 . .	Waterworks Clauses Act
1847–8	10 & 11 Vict. c. 34 .	Towns Improvement Clauses Act
1847–8	10 & 11 Vict. c. 61 .	Baths and Washhouses Amendment Act
1847–8	10 & 11 Vict. c. 89 .	Towns Police Clauses Act
1848–9	11 & 12 Vict. c. 63 .	Public Health Act
1848–9	11 & 12 Vict. c. 91 .	Parish Debts and Audit Act
1849–50	12 & 13 Vict. c. 94 .	Public Health Supplemental Act
1849–50	12 & 13 Vict. c. 103 .	Poor Law Amendment Act
1851–2	14 & 15 Vict. c. 28 .	Common Lodging Houses Act
1851–2	14 & 15 Vict. c. 34 .	Labouring Classes Lodging Houses Act
1852–3	15 & 16 Vict. c. 42 .	Public Health Supplemental Act
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11 & 12 Vict. c. 63. s. 84 .	Lands . .	Purchase or lease of by agreement .	U.
24 & 25 Vict. c. 61. s. 22 .	Lands . .	Purchase of . .	U.
21 & 22 Vict. c. 98. s. 75 .	Land . .	Compulsory taking of	U.
28 & 29 Vict. c. 75. s. 7 .	Land . .	Compulsory taking of	U. & R.
30 & 31 Vict. c. 113. s. 4 .	Lands . .	Compulsory purchase of for distribution of sewage	U. & R.
30 & 31 Vict. c. 113. s. 5 .	Lands . .	Appropriation of .	U. & R.
35 & 36 Vict. c. 79. s. 41 .	Lands . .	Mortgage of .	U. & R.
11 & 12 Vict. c. 63. s. 138	Legal proceedings	Institution of .	U.
29 & 30 Vict. c. 90. s. 48 .	Legal proceedings	Appearance in .	U. & R.
11 & 12 Vict. c. 63. s. 140	Liability .	Limitation of exemption from	U.
10 & 11 Vict. c. 89. s. 39 .	Licenses .	Of hackney carriage, payment for	U.
10 & 11 Vict. c. 89. s. 40-68	Licenses .	For hackney carriage, regulations as to	U.
12 & 13 Vict. c. 94. s. 8 .	Lighting streets	Contracts for . .	U.
35 & 36 Vict. c. 79. s. 44 .	Loans . .	By Public Works Loan Commissioners	U. & R.
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35 & 36 Vict. c. 79. s. 33 .	Local Acts .	Repeal of . .	U. & R.
35 & 36 Vict. c. 79. s. 43 .	Local Acts .	Removal of limits of rating	U. & R.
35 & 36 Vict. c. 79. s. 55 .	Local Act .	Relation of general Act to	U. & R.

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24 & 25 Vict. c. 61. s. 2 .	Local Government Acts	Adoption of by Corporations	U.
35 & 36 Vict. c. 79. s. 34 .	Local Government Board	Consent when necessary	U. & R.
29 & 30 Vict. c. 90. s. 35 .	LodgingHouses	Regulations as to .	U. & R.
26 & 27 Vict. c. 40. s. 9 .	Magistrates .	Jurisdiction of .	U. & R.
35 & 36 Vict. c. 79. s. 58 .	Main Sewerage Districts	Provisional orders as to	U. & R.
18 & 19 Vict. c. 121. s. 18	Manure . .	Sale of . . .	U. & R.
29 & 30 Vict. c. 90. s. 53 .	Manure . .	Periodicalremovalof	U. & R.
11 & 12 Vict. c. 63. s. 41 .	Map of Sewage	Provision of . .	U.
21 & 22 Vict. c. 98. s. 50 .	Market Place .	Provision of . .	U.
10 & 11 Vict. c. 14 . .	Markets . .	Act	U.
10 & 11 Vict. c. 34. s. 78 .	Materials .	Sale of . . .	U.
35 & 36 Vict. c. 79. s. 10 .	Medical Officer of Health .	Appointment of .	U. & R.
35 & 36 Vict. c. 79. s. 11 .	Medical Officer of Health	Duties of . .	U. & R.
18 & 19 Vict. c. 116. s. 6 .	Medicines .	Dispensing of . .	U. & R.
31 & 32 Vict. c. 115. s. 10	Medicine .	Temporary supply of	U. & R.
23 & 24 Vict. c. 77. s. 6 .	Metropolitan Vestries and District Boards	Constituted local authorities	U. & R.
18 & 19 Vict. c. 121. s. 44	Mines . .	Saving of rights of working	U. & R.
18 & 19 Vict. c. 121. s. 45	Millowners .	Protection of . .	U. & R.
28 & 29 Vict. c. 75. s. 12 .	Money . .	Loan of . . .	U. & R.
35 & 36 Vict. c. 79. s. 41 .	Money . .	Raising of, on a mortgage of lands	U. & R.
21 & 22 Vict. c. 98. s. 57 .	Mortgages .	Issue of . . .	U.
35 & 36 Vict. c. 79. s. 41 .	Mortgages .	Of lands . .	U. & R.
29 & 30 Vict. c. 90. s. 27 .	Mortuaries .	Provision of . .	U. & R.
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18 & 19 Vict. c. 121. s. 31	Notices . .	Service of . .	U. & R.
21 & 22 Vict. c. 98. s. 34 .	Notices . .	Bye-laws as to .	U.
21 & 22 Vict. c. 98. s. 61 .	Notices . .	Authentication of .	U.
24 & 25 Vict. c. 61. s. 11 .	Notices . .	Service of . .	U.
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10 & 11 Vict. c. 34. s. 65 .	Nos. on Houses	Renewal of . .	U.
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18 & 19 Vict. c. 121. s. 17	Nuisances .	Abatement of, when persons causing same cannot be found	U. & R.

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11 & 12 Vict. c. 63. s. 64 .	Offensive trades	Regulation of .	U.
11 & 12 Vict. c. 63. s. 35 .	Offices . .	Provision and maintenance of . .	U.
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11 & 12 Vict. c. 63. s. 40 .	Officer of health	Appointment of .	U.
35 & 36 Vict. c. 79. s. 48 .	Order . .	Of Local Government Board, publication of	U. & R.
29 & 30 Vict. c. 90. s. 34 .	Owner and occupier	Recovery of costs from	U. & R.
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30 & 31 Vict. c. 113. s. 16	Parish . .	Amendment of definition of	U. & R.
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18 & 19 Vict. c. 121. s. 38	Penalties .	Recovery of . .	U. & R.
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31 & 32 Vict. c. 130. s. 38	Penalties .	Recovery of . .	U.
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35 & 36 Vict. c. 79. s. 40 .	Permanent works	Extension of meaning of	U. & R.
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TO

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9 & 10 Vict. c. 74. s. 14	Accounts .	Refusal by Baths and Washhouse Commissioners to allow inspection of	Not exceeding 5*l.*
18 & 19 Vict. c. 70. s. 15	Accounts .	Board of Commissioners refusing the inspection of	Not exceeding 5*l.*
18 & 19 Vict. c. 121. s. 36	Admission on premises	Obstruction to in executing Nuisances Removal Act	Not exceeding 5*l.*
35 & 36 Vict. c. 74. s. 1	Adulteration	Of articles of food, or drink, or drugs	1st offence not exceeding 50*l.*; 2nd offence guilty of a misdemeanour and imprisonment not exceeding 6 months with hard labour
35 & 36 Vict. c. 74. s. 2	Adulteration	Selling knowingly articles of food which have been subjected to	Not exceeding 20*l.*
35 & 36 Vict. c. 74. s. 3	Adulteration	To increase weight or bulk	Liable to penalties under foregoing sections

[1] Penalties may be recovered before the following jurisdictions :—
As to England, by any Metropolitan Police Magistrate or other Stipendiary Magistrate, sitting alone at a Police Court, or other appointed place, or by the Lord Mayor of the City of London, or any Alderman of the said City, sitting alone or with others at the Mansion House or Guildhall, and generally before any two Justices. 11 & 12 Vict. c. 43.
Appeals in almost all cases to the Court of Quarter Sessions. 11 & 12 Vict. c. 633, s. 135.

Statute	Subject	Offence	Penalty
35 & 36 Vict. c. 94. s. 19	Adulteration	Selling knowingly liquor which has been subject to mixing or causing to be mixed any deleterious ingredients with any intoxicating liquor exposed for sale	For 1st offence not exceeding 20*l.* or imprisonment not exceeding 1 month; for the 2nd and any subsequent offence not exceeding 100*l.* or imprisonment not exceeding 3 months. Where person is a licensed victualler in case of 2nd offence liable to forfeit his licence and premises
35 & 36 Vict. c. 94, s. 19	Adulteration	Licensed Victuallers convicted of pulling down placard stating the fact of	A continuing penalty not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 28	Animals .	Exposing for sale otherwise than in a market	Not exceeding 40*s.* or imprisonment for any term not exceeding 14 days
26 & 27 Vict. c. 40. s. 3	Bake-houses	Limitation of hours of labour of persons under 18 years of age, continuation of	For 1st offence not exceeding 2*l.*; for 2nd offence not exceeding 5*l.*; for a 3rd and each subsequent offence a continuing penalty of 1*l.*, but no greater penalty to be imposed than 10*l.*
26 & 27 Vict. c. 40. s. 4	Bake-houses	Neglect of cleanliness of	Not exceeding 5*l.*
26 & 27 Vict. c. 40. s. 4	Bake-houses	Order to execute works for cleanliness, non-compliance with	A continuing penalty of 1*l.*
26 & 27 Vict. c. 40. s. 4	Bake-houses	Sleeping places near to, letting of	Not exceeding 20*s.*, and for each subsequent offence a penalty not exceeding 5*l.*
26 & 27 Vict. c. 40. s. 6	Bake-houses	Authorized officer refusal to admit into	For each offence a penalty not exceeding 20*l.*
10 & 11 Vict. c. 34. s. 79	Bars .	Taking down, &c., erected across street while repairs or alterations are being made	Not exceeding 5*l.*
10 & 11 Vict. c. 89. s. 36	Bear-baiting, &c.	Keeping places for .	Not exceeding 5*l.* or imprisonment for any term, with or without hard labour, not exceeding 1 month

Statute	Subject	Offence	Penalty
10 & 11 Vict. c. 89. s. 36	Bear-baiting	Any person discovered in places kept for	Not exceeding 5*l.*
11 & 12 Vict. c. 63. s. 148	Boards .	Defacement of belonging to Boards of Health	Not exceeding 5*l.*
10 & 11 Vict. c. 89. s. 28	Book .	Exposing for sale one of an obscene nature	Not exceeding 40*s.* or imprisonment not exceeding 14 days
9 & 10 Vict. c. 74. s. 14	Books .	Refusing inspection of Under Baths and Washhouses Act	Not exceeding 5*l.*
11 & 12 Vict. c. 63. s. 21	Books .	Refusal to produce by Local Board of Health	Not exceeding 5*l.*
21 & 22 Vict. c. 98. s. 60	Books .	Refusal to produce to auditor of accounts of Local Boards	Not exceeding 40*s.*
10 & 11 Vict. c. 34. s. 82	Building materials	For keeping deposits of an unreasonable time	Not exceeding 5*l.*, and a continuing penalty of 40*s.*
10 & 11 Vict. c. 34. s. 81	Building materials	Not lighting, fencing, or enclosing, deposits of	Not exceeding 5*l.*, and continuing penalty not exceeding 40*s.* a day
15 & 16 Vict. c. 85. s. 40	Burial grounds	Committing nuisance in	Not exceeding 5*l.*
9 & 10 Vict. c. 74. s. 34	Bye-laws.	Offences under . .	Not exceeding 5*l.*
11 & 12 Vict. c. 63. s. 115	Bye-laws .	Offences against .	Not exceeding 5*l.*, and a continuing penalty not exceeding 40*s.* a day
10 & 11 Vict. c. 89. s. 20	Carpet .	Beating of in streets, except door mats, beaten before 8 o'clock in the morning	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
10 & 11 Vict. c. 89. s. 22	Carriages, &c.	Disregarding route of during divine service	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 28	Carriage, &c.	Standing longer than necessary	Not exceeding 40*s.*, or to imprisonment not exceeding 14 days
10 & 11 Vict. c. 89. s. 28	Carriage .	Free, or timber, or cross-beam, being drawn upon	Not exceeding 40*s.*, or to imprisonment not exceeding 14 days
10 & 11 Vict. c. 89. s. 28	Carriage .	Interrupting traffic in streets	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
10 & 11 Vict. c. 89. s. 28	Carts .	Riding on shafts of .	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days

Statute	Subject	Offence	Penalty
10 & 11 Vict. c. 89. s. 28	Carts .	Driving at one time more than two, &c.	Not exceeding 40*s.*, or to imprisonment not exceeding 14 days
10 & 11 Vict. c. 89. s. 28	Casks .	Cleansing of, &c., in streets	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
10 & 11 Vict. c. 89. s. 24	Cattle .	Straying in street .	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 26	Cattle .	Releasing or attempting to release from pound	Imprisonment for any term not exceeding 3 months
10 & 11 Vict. c. 89. s. 28	Cattle .	Slaughtering of, &c. .	Not exceeding 40*s.*, or to imprisonment not exceeding 14 days
10 & 11 Vict. c. 34. s. 73	Cellar doors	Occupier not making or not keeping the same in good repair	Not exceeding 5*l.*
11 & 12 Vict. c. 63. s. 67	Cellars, &c.	Occupation of, when not fulfilling certain conditions prescribed by Act	A continuing penalty not exceeding 20*s.* a day
10 & 11 Vict. c. 65. s. 58	Cemetery	Damaging . .	Not exceeding 5*l.*
10 & 11 Vict. c. 65. s. 59	Cemetery	Committing nuisance in	Not exceeding 5*l.*
10 & 11 Vict. c. 89. s. 30	Chimneys	Setting wilfully on fire	Not exceeding 5*l.*
10 & 11 Vict. c. 89. s. 31	Chimneys	Accidentally allowing to catch fire	Not exceeding 10s.
11 & 12 Vict. c. 63. s. 37	Clerk .	Holding office of treasurer to Local Board	Not exceeding 100*l.*
10 & 11 Vict. c. 89. s. 35	Coffeeshop keepers	Harbouring disorderly persons	Not exceeding 5*l.*
11 & 12 Vict. c. 63. s. 66	Common lodging houses	Receiving lodgers without registration	Not exceeding 40s.
11 & 12 Vict. c. 63. s. 66	Common lodging-houses	Refusing to admit inspector	Not exceeding 40*s.*
14 & 15 Vict. c. 28. s. 14	Common lodging houses	Offences against bye-laws	Not exceeding 5*l.*, and a continuing penalty of 40*s.* a day
16 & 17 Vict. c. 41. s. 11	Common lodging houses	Offences against Act .	In default of payment of penalty imposed, imprisonment for any term not exceeding 3 months
16 & 17 Vict. c. 41. s. 12	Common lodging houses	Third offence against Act	Disqualified to keep common lodging houses within five years or any shorter period from conviction

Statute	Subject	Offence	Penalty
29 & 30 Vict. c. 90. s. 35	Common lodging houses	Not obeying regulations as to	Not exceeding 40*s.* for every offence, and a continuing penalty of not more than 20*s.* a day
10 & 11 Vict. c. 89. s. 34	Constables	When on duty, harbouring of by licensed victuallers	Not exceeding 20*s.*
11 & 12 Vict. c. 63. s. 17	Declaration	Falsely or corruptly making	Guilty of a misdemeanour
10 & 11 Vict. c. 89. s. 28	Dirt or offensive matter	Throwing down or causing to run in street within district of Local Board	Not exceeding 40*s.*, or imprisonment for any term not exceeding 3 months
18 & 19 Vict. c. 116. s. 14	Diseases Prevention Act	Obstruction of execution of	Not exceeding 5*l.*
11 & 12 Vict. c. 63. s. 104	Distress .	Constables refusing to levy	Not exceeding 5*l.*
10 & 11 Vict. c. 89. s. 28	Dog, ferocious	Suffering to be at large when unmuzzled	Not exceeding 40*s.*, or imprisonment not exceeding 14 days
10 & 11 Vict. c. 89. s. 28	Dog, ferocious	Owner of, letting it at large, knowing same to be in a rabid state	Not exceeding 40*s.*, or imprisonment not exceeding 14 days
10 & 11 Vict. c. 89. s. 28	Dog, ferocious	Setting at large, after notice given and during time specified in such notice	Not exceeding 40*s.*, or imprisonment not exceeding 14 days
10 & 11 Vict. c. 34. s. 71	Doors .	Not making to open inwards within 8 days of notice	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 28	Door bell .	Wilfully ringing .	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
11 & 12 Vict. c. 63. s. 54	Drains,&c.	Not complying with notice to remedy nuisance in	A continuing penalty of 10*s.* a day
10 & 11 Vict. c. 89. s. 29	Drunken persons	Guilty of riotous or indecent behaviour	Not exceeding 40*s.*, for every offence, or imprisonment for a term not exceeding 7 days
11 & 12 Vict. c. 63. s. 28	Elections .	Refusal or neglect of chairman or other responsible person to conduct legally	Not exceeding 50*l.*
11 & 12 Vict. c. 63. s. 28	Elections .	Refusal or neglect of persons acting under chairman or other responsible person to conduct legally	Not exceeding 5*l.*

Statute	Subject	Offence	Penalty
10 & 11 Vict. c. 34. s. 81	Excavations	Not lighting, fencing, or enclosing	Not exceeding 5*l.*, and a continuing penalty not exceeding 40*s.*
10 & 11 Vict. c. 34. s. 82	Excavations	Continuing an unreasonable time in streets	Not exceeding 5*l.*, and a continuing penalty of 40*s.*
10 & 11 Vict. c. 34. s. 108	Factories, &c.	Fireplaces of not consuming their own smoke	A continuing penalty of 40*s.*
27 & 28 Vict. c. 48. s. 4	Factory .	Not keeping well cleansed and ventilated	Not exceeding 10*l.* nor less than 3*l.*
9 & 10 Vict. c. 74. s. 39	Fees .	Taking of by Commissioners or officers beyond their salaries	50*l.*
11 & 12 Vict. c. 63. s. 38	Fees .	Improperly taking by officers, &c.	50*l.*
10 & 11 Vict. c. 34. s. 80	Fences .	Not setting up while repairing buildings	Not exceeding 5*l.*, and a continuing penalty of 40*s.*
10 & 11 Vict. c. 89. s. 28	Firearms .	Wilful discharge of in street	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
10 & 11 Vict. c. 89. s. 28	Flower-pot	Fixing in upper window without sufficiently guarding the same	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
11 & 12 Vict. c. 63. s. 63	Food .	When unfit, exposing for sale	Not exceeding 10*l.*
18 & 19 Vict. c. 121. s. 26	Food .	When unfit, exposing for sale	Not exceeding 20*l.*
10 & 11 Vict. c. 89. s. 28	Footway .	Placing any kind of goods on, or placing any blind, &c., less than eight feet in height from the ground	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
10 & 11 Vict. c. 89. s. 28	Footway .	Hanging up goods which project into, and obstruct passage of persons	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
10 & 11 Vict. c. 89. s. 28	Footway .	Rolling or carrying any cask, &c., on, except for purpose of loading or unloading any carriage or of crossing the footway	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
23 & 24 Vict. c. 77. s. 8	Fountains	Wilful damage to .	Not exceeding 5*l.*, and a continuing penalty of 20*s.*

Statute	Subject	Offence	Penalty
18 & 19 Vict. c. 121. ss. 23, 25	Gas-washings	Pollution of water by	Not exceeding 200*l.*, and a continuing penalty of 20*l.*
10 & 11 Vict. c. 89. s. 52	Hackney carriage	Proprietor of, refusing to carry the prescribed number	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 53	Hackney carriage	Driver of, refusing to drive	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 53	Hackney carriage	Demanding more than sum agreed upon for, though less than legal fare	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 55	Hackney carriage	Driver of exacting more than legal fare	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 56	Hackney carriage	Not carrying the proper distance for a sum agreed upon	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 57	Hackney carriage	Driver of refusing, to wait or to account for deposit	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 58	Hackney carriage	Proprietor or driver of, overcharging	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 59	Hackney carriage	Proprietor or driver of, permitting persons to ride without consent of the hirer	Not exceeding 20*s.*
10 & 11 Vict. c. 89. s. 60	Hackney carriage	Acting as driver of, without consent of the proprietor	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 61	Hackney carriage	Driver of, misbehaviour of	Not exceeding 5*l.*, and in default of payment imprisonment for any term not exceeding 2 months
10 & 11 Vict. c. 89. s. 62	Hackney carriage	Leaving unattended at places of public resort	Not exceeding 20*s.*
10 & 11 Vict. c. 89. s. 63	Hackney carriage	Damage done by driver of	Not exceeding 5*l.*
10 & 11 Vict. c. 89. s. 66	Hackney carriage	Refusing to pay the fare to driver of	Recovery of fare, together with cost of application before justice
10 & 11 Vict. c. 89. s. 67	Hackney carriage	Damaging of . .	Not exceeding 5*l.*
10 & 11 Vict. c. 89. s. 40	Hackney carriages	On application for license, fraudulently framing requisition	Not exceeding 10*l.*
10 & 11 Vict. c. 89. s. 41	Hackney carriages	Proprietor of, not giving notice of change of abode	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 45	Hackney carriages	Proprietor of, plying for hire without a license	Not exceeding 40*s.*

Statute	Subject	Offence	Penalty
10 & 11 Vict. c. 89. s. 47	Hackney carriages	Drivers, acting as, and without license	Not exceeding 20*s.*
10 & 11 Vict. c. 89. s. 48	Hackney carriages	Proprietor of, neglecting to retain license of drivers in his employ or refusing to produce the same when summoned	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 64	Hackney carriages	Improper standing of	Not exceeding 20*s.*
10 & 11 Vict. c. 89. s. 28	Horse, &c.	Riding or driving upon footway of any street, &c.	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
10 & 11 Vict. c. 89. s. 28	Horse, &c.	Furious driving of .	Not exceeding 40*s.*, or to imprisonment not exceeding 14 days
11 & 12 Vict. c. 63. s. 49	House .	Rebuilding without drains, &c. . .	Not exceeding 50*l.*
11 & 12 Vict. c. 63. s. 60	House .	Neglect of notice to cleanse	Continuing penalty of 10*s.*
18 & 19 Vict. c. 121. s. 29	House .	Overcrowding . .	Not exceeding 40*s.*
29 & 30 Vict. c. 90. s. 22	House .	Not cleansing and disinfecting	A continuing penalty of not less than 1*s.*, or more than 10s. a day
29 & 30 Vict. c. 90. s. 39	House .	Letting of when infected	Not exceeding 20*l.*
21 & 22 Vict. c. 98. s. 32(2)	House refuse	Removal of or obstructing the authority in removing by any person not being the occupier of a house	Not exceeding 5*l.*
21 & 22 Vict. c. 98. s. 32(2)	House refuse	Removal of or obstructing the authority in removing by the occupier (except when produced on premises)	Not exceeding 40*s.*
10 & 11 Vict. c. 34. s. 64	Houses .	Pulling down or defacing number of	40*s.* for each offence.
10 & 11 Vict. c. 34. s. 65	Houses .	Non-renewal of numbers by occupiers	Not exceeding 40s.
10 & 11 Vict. c. 34. s. 69	Houses .	Refusal on notice to remove within 14 days projection of,	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 28	Indecency	Exposure of person so as to be an	Not exceeding 40*s.*, or imprisonment for a term not exceeding 14 days
29 & 30 Vict. c. 90. s. 25	Infectious disorder	Entering public conveyance when suffering from	Not exceeding 5*l.*

Statute	Subject	Offence	Penalty
29 & 30 Vict. c. 90. s. 29	Infectious disorder	Interference with rules, enforcing removal of persons brought by ships, suffering from	Not exceeding 5*l.*
29 & 30 Vict. c. 90. s. 38	Infectious disorder	Persons suffering from, exposure of	Not exceeding 5*l.*
29 & 30 Vict. c. 90. s. 39	Infectious disorder	Letting of houses in which there has been	Not exceeding 20*l.*
35 & 36 Vict. c. 79. s. 52	Infectious disorder	Breach of rules made under s. 52 of 29 & 30 Vict. c. 90. as to treatment of persons on board ships seized with	Not exceeding 50*l.*
11 & 12 Vict. c. 63. s. 121	Inspector.	Disobeying summons to appear before	Not exceeding 5*l.*
10 & 11 Vict. c. 34. s. 131	Inspector of nuisances	Obstruction to entering into slaughter-houses, &c.	Not exceeding 5*l.*
26 & 27 Vict. c. 117. s. 3	Inspector of nuisances	Obstruction to entering into slaughter-houses, &c.	Not exceeding 5*l.*
10 & 11 Vict. c. 89. s. 28	Kites .	Flying of . . .	Not exceeding 40*s.*, or imprisonment for a term not exceeding 14 days
10 & 11 Vict. c. 34. s. 79	Lights .	For removing when placed at night in streets undergoing alterations or repairs	Not exceeding 5*l.*
35 & 36 Vict. c. 79. s. 52	Local Government Board	Neglecting orders of	Not exceeding 50*l.*
29 & 30 Vict. c. 90. s. 35	Lodging houses	Not obeying regulations as to	Not exceeding 40*s.* for every offence, and a continuing penalty of not more than 20*s.* a day
29 & 30 Vict. c. 90. s. 53	Manure in mews, &c.	Refusal or neglect to remove accumulations of	A continuing penalty of 20*s.*
10 Vict. c. 14 s. 13	Market .	Selling elsewhere than in	Not exceeding 40*s.*
10 Vict. c. 14. s. 15	Market or fair	Selling or exposing for sale unwholesome meat in, &c.	Not exceeding 5*l.*
10 Vict. c. 14. s. 15	Market or fair	Inspector of provisions obstruction of	Not exceeding 5*l.*

Statute	Subject	Offence	Penalty
10 Vict. c. 14. s. 16	Market or fair	Keeper of, obstruction of	Not exceeding 40*s.*
10 Vict. c. 14. s. 22	Market or fair	Refusal to weigh articles for sale in on request of the buyer	Not exceeding 40*s.*
10 Vict. c. 14. s. 23	Markets or fairs	Refusal by persons appointed to weigh articles for sale	Not exceeding 40*s.*
10 Vict. c. 14. s. 26	Markets or fairs	Refusal of drivers in to take carts to be weighed	Not exceeding 20*s.*
10 Vict. c. 14. s. 27	Markets or fairs	Drivers of carts, &c., in committing frauds in weighing	Not exceeding 5*l.* for each offence
10 Vict. c. 14. s. 28	Markets or fairs	Buyers or sellers in committing frauds in weighing	Not exceeding 5*l.*
10 Vict. c. 14. s. 29	Markets or fairs	Frauds committed by the machine-keeper	Not exceeding 5*l.* in certain specified cases
10 Vict. c. 14. s. 30	Markets or fairs	Frauds committed by other persons as to weighing goods	Not exceeding 5*l.*
10 Vict. c. 14. s. 37	Markets or fairs	Taking a greater toll than authorised in	Not exceeding 40*s.*
10 Vict. c. 14. s. 40	Markets or fairs	Collector of rents, &c., in, obstruction of	Not exceeding 40*s.*
11 & 12 Vict. c. 63. s. 19	Member .	Acting when disqualified as, of local boards of health	50*l.*
11 & 12 Vict. c. 63. s. 111	Mortgages	Refusal to allow inspection of register of	Not exceeding 5*l.*
18 & 19 Vict. c. 121. s. 14	Nuisances	Contravention of order of abatement of	A continuing penalty of not more than 10*s.* a day
18 & 19 Vict. c. 121. s. 14	Nuisances	Contravention of order of prohibition of	A continuing penalty of not more than 20*s.*
18 & 19 Vict. c. 121. s. 27	Nuisances	Arising in cases of noxious trades, businesses, processes, or manufactures	On first conviction not more than 5*l.*, nor less than 40*s.* On second conviction 10*l.*, and for each subsequent conviction a sum double the amount of the penalty imposed for the last preceding conviction, but in no case to exceed 200*l.*
26 & 27 Vict. c. 117. s. 2	Nuisance .	Exposing for sale diseased and unwholesome meat, &c., so as to be a	Not exceeding 20*l.* for every animal, &c., or imprisonment for not more than three months

Statute	Subject	Offence	Penalty
18 & 19 Vict. c. 121. s. 36	Nuisances removal	Obstruction of execution of Act	Not exceeding 5*l.*
11 & 12 Vict. c. 63. s. 148	Occupier.	Refusal to permit owner to execute necessary works	Not exceeding 5*l.*
18 & 19 Vict. c. 121. s. 37	Occupier .	Obstructing owner from entering on premises to execute necessary works	A continuing penalty not exceeding 5*l.*
31 & 32 Vict. c. 130. s. 36	Occupier .	Obstructing owner from carrying Act into execution	A continuing penalty of 20*l.*
11 & 12 Vict. c. 63. s. 148	Occupiers	Refusal to disclose owners' names	Not exceeding 5*l.*
11 & 12 Vict. c. 63. s. 64	Offensive trades	Establishment of .	50*l.*, and a continuing penalty of 40*s.*
9 & 10 Vict. c. 74. s. 39	Officers .	Taking fees beyond salaries, or interested in salaries	Not exceeding 50*l.*
11 & 12 Vict. c. 63. s. 38	Officers .	Contracts when interested in or under colour of employment exacting fees	50*l.*
11 & 12 Vict. c. 63. s. 39	Officer .	Failing to account .	Distress for amount or imprisonment for three months
11 & 12 Vict. c. 63. s. 148	Officers .	Obstruction of in executing of Public Health Act, 1848	Not exceeding 5*l.*
26 & 27 Vict. c. 40. s. 6	Officer .	Inspection of bakehouses, obstruction of	Not exceeding 20*l.*
26 & 27 Vict. c. 117. s. 3.	Officer of health	Obstructing him from entering slaughterhouse, &c.	Not exceeding 5*l.*
31 & 32 Vict. c. 130. s. 35	Officer of health	Obstruction of . .	Not exceeding 20*l.*
11 & 12 Vict. c. 63. s. 28	Officer, returning	Neglecting to comply with provisions of Act	Not exceeding 50*l.*
18 & 19 Vict. c. 121. s. 36	Officer .	Wilfully obstructing .	Not exceeding 5*l.*
31 & 32 Vict. c. 130. s. 36	Officer of health	Obstruction of when executing Act	Not exceeding 20*l.*
18 & 19 Vict. c. 121. s. 14	Order of abatement. (See nuisances)	Contravention of .	A continuing penalty of not more than 10*s.*
18 & 19 Vict. c. 121. s. 14	Order of prohibition. (See nuisances)	Contravention of .	A continuing penalty of not more than 20*s.*

Statute	Subject	Offence	Penalty
18 & 19 Vict. c. 121. s. 29	Over-crowding	House, so as to be dangerous to health	Not exceeding 40*s.*
7 & 8 Vict. c. 101. s. 33.	Overseers.	Refusing to attend audit	Not exceeding 40*s.*
11 & 12 Vict. c. 63. s. 68	Pavement	Displacing	Not exceeding 5*l.*, and 5*s.* per sq. ft. displaced
9 & 10 Vict. c. 74. s. 40	Penalties.	Application of .	Residue of in borough to borough fund, in parish to rate for relief of the poor
11 & 12 Vict. c. 63. s. 123	Penalty .	Recovery of, must be within 6 months	
11 & 12 Vict. c. 63. s. 123	Penalty .	Application of .	One half to informer, one half to Local Board
14 & 15 Vict. c. 28. s. 15	Penalties	Recovery of, under Common Lodging-House Act	
21 & 22 Vict. c. 98. s. 67	Penalties	In corporate boroughs	Payable to district fund account
10 & 11 Vict. c. 89. s. 28	Pigstye .	Keeping in front of street	Not exceeding 40*s.*, or imprisonment for any term not exceeding three months
21 & 22 Vict. c. 98. s. 56	Poor rate books	Refusal by officer to allow inspection of	Not exceeding 5*l.*
29 & 30 Vict. c. 113. s. 7	Poor-rate books	Refusal by officer to allow inspection of	Not exceeding 5*l.*
10 & 11 Vict. c. 89. s. 28	Prostitution	Loitering in streets and importuning passengers for purposes of	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
11 & 12 Vict. c. 63. s. 100	Rates .	Refusal to allow inspection of	Not exceeding 5*l.*
30 & 31 Vict. c. 113. s. 18	Rates .	Non-payment of by overseers	Amount or so much in arrear raised by distress and sale of goods
11 & 12 Vict. c. 63. s. 80	Reservoir	Fouling water in .	Not exceeding 5*l.*, and a continuing penalty of 5*s.*
11 & 12 Vict. c. 63. s. 80	Reservoir	Gas manufacturer, fouling by	Not exceeding 200*l.*, and after 24 hours' notice, 20*l.* a day
11 & 12 Vict. c. 63. s. 47	Sewers, drains, &c.	Unauthorized communication with	5*l.*, and a further continuing penalty of 40*s.* a day
29 & 30 Vict. c. 90. s. 29	Ships .	Interference with rules empowering removal to hospital of persons suffering from infectious disorder brought by	Not exceeding 5*l.*

Statute	Subject	Offence	Penalty
10 & 11 Vict. c. 89. s. 28	Slate .	Throwing into street from roof or any part of any house	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
10 & 11 Vict. c. 34. s. 126	Slaughter-houses	Erecting without a license.	Not exceeding 5*l.*, and a continuing penalty of 5*l.* a day
10 & 11 Vict. c. 34. s. 127	Slaughter-houses	Using existing houses without registration	Not exceeding 5*l.*, and a continuing penalty of 10*s.*
10 & 11 Vict. c. 34. s. 128	Slaughter-houses	Breach of bye-laws for regulation of	Not exceeding 5*l.*, and a continuing penalty of 10*s.*
10 & 11 Vict. c. 34. s. 130	Slaughter-houses	During suspension of license slaughtering cattle in	Not exceeding 5*l.*, and a continuing penalty of 5*l.*
10 & 11 Vict. c. 34. s. 131	Slaughter-houses, &c.	Keeping cattle, &c., which are diseased	Not exceeding 10*l.* for every animal
10 & 11 Vict. c. 34. s. 131	Slaughter-houses, &c.	Obstruction of Inspector of	Not exceeding 5*l.*
10 & 11 Vict. c. 89. s. 28	Slide .	Making of in street upon ice or snow	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
30 & 31 Vict. c. 84. s. 32	Small pox	Person inoculating with	Imprisonment for one month
10 & 11 Vict. c. 89. s. 28	Stones .	Throwing or laying down in streets	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
10 & 11 Vict. c. 89. s. 21	Streets .	Obstruction in during public processions, &c.	Not exceeding 40*s.*
10 & 11 Vict. c. 89. s. 28	Street .	Placing line, cord, or pole across	Not exceeding 40*s.*, or imprisonment for any term not exceeding 14 days
10 & 11 Vict. c. 34. s. 64	Streets .	Pulling down or defacing name of	40*s.* for each offence
11 & 12 Vict. c. 63. s. 68	Streets .	Displacement of materials of	5*l.*, and a continuing penalty of 5*s.*
11 & 12 Vict. c. 63. s. 59	Swine, &c.	Keeping of in improper situations	40*s.*, and a continuing penalty of 5*s.* a day
18 & 19 Vict. c. 121. s. 27	Trades, noxious	Nuisance, arising from	Not exceeding 5*l.*, and a continuing penalty of 40*s.*, with double penalty for each new offence
11 & 12 Vict. c. 63. s. 37	Treasurer	Holding office of clerk to Local Board	100*l.*
30 & 31 Vict. c. 84. s. 29	Vaccination	Parent not procuring, of child	20*s.*
30 & 31 Vict. c. 84. s. 30	Vaccination	Vaccination, and parent neglecting to forward certificate	20*s.*

Statute	Subject	Offence	Penalty
30 & 31 Vict. c. 84. s. 30	Vaccination	Signing false certificate	Guilty of misdemeanour
34 & 35 Vict. c. 98. s. 7	Vaccination	Certificate of, non-transmission of	Not exceeding 20*s.*
34 & 35 Vict. c. 98. s. 7	Vaccination	Certificate of, wrongly signing, &c.	Guilty of a misdemeanour, and liable to imprisonment, with or without hard labour, not exceeding 2 years
34 & 35 Vict. c. 98. s. 10	Vaccination	Preventing public vaccinator from taking lymph from any child	Not exceeding 20*s.*
34 & 35 Vict. c. 98. s. 11	Vaccination	Parent failing to produce child	Not exceeding 20*s.*
10 & 11 Vict. c. 89. s. 28	Vault .	Leaving open . .	Not exceeding 40*s.*, or imprisonment for any term not exceeding 3 months
21 & 22 Vict. c.98.s.13(5)	Voting papers	Forging, &c., of .	Imprisonment on conviction before two justices in the common gaol or house of correction for any period not exceeding 3 months with or without hard labour
11 & 12 Vict. c. 63. s. 59	Waste water	Allowing to remain in cellars, &c.	40*s.*, and a continuing penalty of 5*s.*
11 & 12 Vict. c. 63. s. 80	Water .	Fouling of by gas of proprietors of gas works	Not exceeding 20*l.*, and a continuing penalty of 10*l.*
11 & 12 Vict. c. 63. s. 80	Water .	Fouling of . .	Not exceeding 5*l.*, and a continuing penalty of 20*s.* a day
11 & 12 Vict. c. 63. s. 80	Water .	Fouling of by proprietors of gas works, &c.	200*l.*, and a continuing penalty of 20*l.*
11 & 12 Vict. c. 63. s. 94	Water .	Cutting off, by Local Board	Not to affect penalties or liabilities
18 & 19 Vict. c. 121. s. 23	Water .	Corruption of by gas washings	200*l.*, and a continuing penalty of 20*l.*
23 & 24 Vict. c. 77. s. 8	Water .	Fouling of . .	Not exceeding 5*l.*, and a continuing penalty not exceeding 20*s.* a day
11 & 12 Vict. c. 63. s. 51	Water-closets, &c.	Omission to provide in houses	20*l.*
11 & 12 Vict. c. 63. s. 52	Water-closets	Omission to provide in factories after notice	20*l.*, and a continuing penalty of 40*s.*

Statute	Subject	Offence	Penalty
10 & 11 Vict. c. 34. s. 74	Water-spouts	Not affixing to houses, &c. within 7 days after service of order	A continuing penalty not exceeding 40*s.*
11 & 12 Vict. c. 63. s. 79	Water-works, &c.	Injury to, or diverting streams, or wasting water	Not exceeding 5*l.*, and a continuing penalty of 20*s.*
10 & 11 Vict. c. 89. s. 28	Window .	Allowing person in service to stand on the sill of, unless such window be in the sink or basement storey	Not exceeding 40*s.* or imprisonment for any term not exceeding 3 months
21 & 22 Vict. c. 98. s. 66	Works,&c.	Injury to belonging to Local Boards	Not exceeding 5*l.*
29 & 30 Vict. c. 90. s. 45	Works .	Wilful damage to belonging to sanitary authorities	Not exceeding 5*l.*
30 & 31 Vict. c. 146. s. 9	Work-shops	Refusal of admission of authorised officer to enter	Not exceeding 20*l.*
30 & 31 Vict. c. 146. s. 10	Work-shops	Obstruction of inspector from entering to inspect condition thereof	Not exceeding 20*l.*

PART II.

CHAPTER I.

ROUTINE DUTIES.

Duties of Metropolitan M. O. H.

THE duties of the Metropolitan Medical Officers of Health were originally defined by the Metropolis Local Management Act (18 and 19 Vict., cap. 120, sec. 132), as follows:—'To inspect and report periodically upon the sanitary condition of their parish or district, to ascertain the existence of diseases, more especially epidemics, increasing the rate of mortality, and to point out the existence of any nuisance or other local causes, which are likely to originate and maintain such diseases, and injuriously affect the health of the inhabitants, and to take cognisance of the fact of the existence of any contagious or epidemic diseases, and to point out the most efficacious mode of checking or preventing the spread of such diseases, and also to point out the most efficient modes for the ventilation of churches, chapels, schools, lodging-houses, and other public edifices within the parish or district, and to perform any other duties of a like nature which may be required of him or them;' and those of inspectors of nuisances, by the next section 'to superintend and enforce the due execution of all duties to be performed by the scavengers'—to enquire into complaints made by inhabitants about infringements of the provisions of the Act, or about the existence of nuisances; to report the result of such enquiry to the Vestry or Local Board, and to institute, 'subject to the direction of the Vestry or Board,' legal proceedings for the punishment of offenders against the provisions of the Act.

Duties of Inspector of Nuisances.

The Public Health Act of 1872, under which Medical Officers of Health and Inspectors of Nuisances are now being appointed outside of the metropolis, makes no at-

tempt at defining their duties, which has, however, since been done by the orders of the Local Government Board:

Duties of district M. O. H.

Duties of Medical Officer of Health.

"The following shall be the duties of the medical officer of health in respect of the district for which he is appointed; or if he shall be appointed for more than one district, then in respect of each of such districts:—

(1.) He shall inform himself as far as practicable respecting all influences affecting or threatening to affect injuriously the public health within the district.

(2.) He shall inquire into and ascertain by such means as are at his disposal the causes, origin, and distribution of diseases within the district, and ascertain to what extent the same have depended on conditions capable of removal or mitigation.

(3.) He shall by inspection of the district, both systematically at certain periods, and at intervals as occasion may require, keep himself informed of the conditions injurious to health existing therein.

To advise Sanitary Authority.

(4.) He shall be prepared to advise the sanitary authority on all matters affecting the health of the district, and on all sanitary points involved in the action of the sanitary authority or authorities; and in cases requiring it, he shall certify, for the guidance of the sanitary authority or of the justices, as to any matter in respect of which the certificate of a medical officer of health or a medical practitioner is required as the basis or in aid of sanitary action.

(5.) He shall advise the sanitary authority on any question relating to health involved in the framing and subsequent working of such byelaws and regulations as they may have power to make.

Epidemic diseases.

(6.) On receiving information of the outbreak of any contagious, infectious, or epidemic disease of a dangerous character within the district, he shall visit the spot without delay and inquire into the causes and circumstances of such outbreak, and advise the persons competent to act as to the measures which may appear to him to be required to prevent the extension of the disease, and, so far as he

may be lawfully authorized, assist in the execution of the same.

Overcrowding.

(7.) On receiving information from the inspector of nuisances that his intervention is required in consequence of the existence of any nuisance injurious to health, or of any overcrowding in a house, he shall, as early as practicable, take such steps authorized by the statutes in that behalf as the circumstances of the case may justify and require.

Inspection of food.

(8.) In any case in which it may appear to him to be necessary or advisable, or in which he shall be so directed by the sanitary authority, he shall himself inspect and examine any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour, exposed for sale, or deposited for the purpose of sale or of preparation for sale, and intended for the food of man, which is deemed to be diseased, or unsound, or unwholesome, or unfit for the food of man; and if he finds that such animal or article is diseased, or unsound, or unwholesome, or unfit for the food of man, he shall give such directions as may be necessary for causing the same to be seized, taken, and carried away, in order to be dealt with by a justice according to the provisions of the statutes applicable to the case.

(9.) He shall perform all the duties imposed upon him by any byelaws and regulations of the sanitary authority, duly confirmed, in respect of any matter affecting the public health, and touching which they are authorized to frame byelaws and regulations.

Offensive trades.

(10.) He shall inquire into any offensive process of trade carried on within the district, and report on the appropriate means for the prevention of any nuisance or injury to health therefrom.

(11.) He shall attend at the office of the sanitary authority, or at some other appointed place, at such stated times as they may direct.

Report.

(12.) He shall from time to time report, in writing, to the sanitary authority, his proceedings, and the measures which may require to be adopted for the improvement or protection of the public health in the district. He shall in like manner report with respect to the sickness and mor-

tality within the district, so far as he has been enabled to ascertain the same.

Books.

(13.) He shall keep a book or books, to be provided by the sanitary authority, in which he shall make an entry of his visits, and notes of his observations and instructions thereon, and also the date and nature of applications made to him, the date and result of the action taken thereon and of any action taken on previous reports, and shall produce such book or books, whenever required, to the sanitary authority.

Annual report.

(14.) He shall also prepare an annual report, to be made at the end of December in each year, comprising tabular statements of the sickness and mortality within the district, classified according to diseases, ages, and localities, and a summary of the action taken during the year for preventing the spread of disease. The report shall also contain an account of the proceedings in which he has taken part or advised under the Sanitary Acts, so far as such proceedings relate to conditions dangerous or injurious to health, and also an account of the supervision exercised by him, or on his advice, for sanitary purposes over places and houses that the sanitary authority has power to regulate, with the nature and results of any proceedings which may have been so required and taken in respect of the same during the year. It shall also record the action taken by him, or on his advice, during the year, in regard to offensive trades, bakehouses and workshops.

Relation to Local Government Board.

(15.) He shall give immediate information to the Local Government Board of any outbreak of dangerous epidemic disease within the district, and shall transmit to the board, on forms to be provided by them, a quarterly return of the sickness and deaths within the district, and also a copy of each annual and of any special report.

(16.) In matters not specifically provided for in this order, he shall observe and execute the instructions of the Local Government Board on the duties of medical officers of health, and all the lawful orders and directions of the sanitary authority applicable to his office.

(17.) Whenever the Diseases Prevention Act of 1855 is in force within the district, he shall observe the direc-

tions and regulations issued under that Act by the Local Government Board, so far as the same relate to or concern his office."

Duties of the Inspector of Nuisances.

Duties of district Inspector.

"The following shall be the duties of the inspector of nuisances in respect of the district for which he is appointed, or if he shall be appointed for more than one district, then in respect of each of such districts :—

(1.) He shall perform, either under the special directions of the sanitary authority, or (so far as authorized by the sanitary authority) under the directions of the medical officer of health, or in cases where no such directions are required, without such directions, all the duties specially imposed upon an inspector of nuisances by the Sanitary Acts, or by the orders of the Local Government Board.

(2.) He shall attend all meetings of the sanitary authority when so required.

Inspections.

(3.) He shall by inspection of the district, both systematically at certain periods, and at intervals as occasion may require, keep himself informed in respect of the nuisances existing therein that require abatement under the Sanitary Acts.

(4.) On receiving notice of the existence of any nuisance within the district, or of the breach of any byelaws or regulations made by the sanitary authority for the suppression of nuisances, he shall, as early as practicable, visit the spot, and inquire into such alleged nuisance or breach of byelaws or regulations.

(5.) He shall report to the sanitary authority any noxious or offensive businesses, trades, or manufactories established within the district, and the breach or non-observance of any byelaws or regulations made in respect of the same.

Water supply.

(6.) He shall report to the sanitary authority any damage done to any works of water supply, or other works belonging to them, and also any case of wilful or negligent waste of water supplied by them, or any fouling by gas, filth, or otherwise, of water used for domestic purposes.

(7.) He shall from time to time, and forthwith upon complaint, visit and inspect the shops and places kept or used

Inspection of food.

for the sale of butchers' meat, poultry, fish, fruit, vegetables, corn, bread, or flour ; or as a slaughter-house, and examine any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, or flour which may be therein ; and in case any such article appear to him to be intended for the food of man, and to be unfit for such food, he shall cause the same to be seized, and take such other proceedings as may be necessary in order to have the same dealt with by a justice. Provided that in case of any doubt arising under this clause, he shall report the matter to the medical officer of health, with the view of obtaining his advice thereon.

To procure samples for analysis.

(8.) He shall, when and as directed by the sanitary authority, procure and submit samples of food or drink, and drugs suspected to be adulterated, to be analyzed by the analyst appointed under the Adulteration of Food Act, 1872, and upon receiving a certificate stating that the articles of food or drink, or drugs, are adulterated, cause a complaint to be made, and take the other proceedings prescribed by that Act.

Epidemic diseases, &c., &c.

(9.) He shall give immediate notice to the medical officer of health of the occurrence within his district of any contagious, infectious, or epidemic disease of a dangerous character; and whenever it appears to him that the intervention of such officer is necessary in consequence of the existence of any nuisance injurious to health, or of any overcrowding in a house, he shall forthwith inform the medical officer thereof.

(10.) He shall, subject in all respects to the directions of the sanitary authority, attend to the instructions of the medical officer of health with respect to any measures which can be lawfully taken by him under the Sanitary Acts, for preventing the spread of any contagious, infectious, or epidemic disease of a dangerous character.

Books.

(11.) He shall enter from day to day, in a book to be provided by the sanitary authority, particulars of his inspections and of the action taken by him in the execution of his duties. He shall also keep a book or books, to be provided by the sanitary authority, so arranged as to form, as far as possible, a continuous record of the sanitary condition of each of the premises in respect of which any action has been taken under the Sanitary Acts, and shall

keep any other systematic records that the sanitary authority may require.

(12.) He shall at all reasonable times, when applied to by the medical officer of health, produce to him his books, or any of them, and render to him such information as he may be able to furnish with respect to any matter to which the duties of inspector of nuisances relate.

(13.) He shall, if directed by the sanitary authority to do so, superintend and see to the due execution of all works which may be undertaken under their direction for the suppression or removal of nuisances within the district. Superintend works.

(14.) In matters not specifically provided for in this order, he shall observe and execute all the lawful orders and directions of the sanitary authority, and the orders of the Local Government Board which may be hereafter issued, applicable to his office."

The essential duties, then, of the Medical Officer of Health are to inspect the sanitary condition of his district, and to report periodically upon it. He is to take special notice of the spread of epidemics, or of the means of checking them. Special attention to epidemics. But it should be observed at once that it is not his duty, but the duty of the Inspector of Nuisances, under his direction, to investigate complaints of nuisances. It is his duty, on receiving notice from any source, of the existence of conditions dangerous to health, or of the existence of infectious diseases, to instruct the Inspector of Nuisances to visit such locality and report to him upon the conditions existing there. Investigation of complaints. As a matter of fact, and in practice, the Inspector of Nuisances, on finding that an undoubted nuisance exists, at once gives a verbal notice to the owner or occupier of the premises to remove such nuisance forthwith; indicating (in ordinary cases only) the best way in which this may be done. Verbal notices. If, on visiting the place a few days afterwards, he finds that the notice has not been complied with, he fills up a printed notice in compliance with the 21st section of the Sanitary Act, 1866, stating what alterations, if any, are required, and takes it to the Vestry Clerk (or other officer) to be signed by him: this notice is either served upon the owner or occupier, or, when he cannot be found, posted on the premises. Printed notices. It is to be re-

marked that it is not necessary that the name of the owner or occupier should be mentioned in the notice. It is usual for the Inspector to issue such notices, and, in fact, the majority of such notices are issued by him, without any consultation with the Medical Officer of Health. It is obviously sufficient, in the great majority of instances, that the opinion of the Medical Officer of Health that such and such a condition of things constitutes a nuisance injurious to health, be given once for all, and in such cases the Inspector of Nuisances may and ought to act on this opinion without any further consultation with his chief; but in all cases where there is the slightest doubt as to whether the notice so served could be followed up by legal proceedings with a reasonable prospect of success, he should make a point of consulting with the Medical Officer of Health as to whether a notice should be issued or not. It is to be remembered that it is not, as a rule, a good practice to allow the Inspector to issue notices for alterations that you do not mean to insist on having carried out, although it is true that in a great number of cases you may get desirable alterations effected by issuing notices that you may not think fit to follow up afterwards by legal proceedings if disregarded.

Issued by Inspector.

Consultation with M. O. H.

If the notice served by the Inspector or Officer appointed to this duty, be not attended to within the time specified therein—which will of course vary with the extent of the work which is required to be carried out, and which in the great majority of sanitary notices is well expressed by the word "forthwith"—the Inspector notifies the fact to the Medical Officer, who then visits the place in company with the Inspector, in order to see whether he is in a position to advise the Sanitary Authority to give permission to the Inspector to apply to a Justice of the Peace for a summons against the owner or occupier of such premises. When this permission is obtained, the work required is often done without any further trouble. The Inspector, it will be remembered, has no right to apply for a summons without the instructions of the Sanitary Authority (which is often represented by a special Sanitary Committee) to do so. Such instructions are very seldom given except under the advice

Disregard of notice.

Application for summons.

of the Medical Officer of Health, who is then responsible for the result of his recommendation. Another object of his visiting the place is that he should be able, if called upon, to give evidence in a Court of Justice that a nuisance injurious to health exists there. It must be pointed out at once that it is not his duty either to take legal proceedings or to appear in Court to support them. He may have to be, and usually is, called upon to give evidence in these cases, and some Justices even insist upon his being called as a witness. It is the practice of some Medical Officers of Health to conduct cases in Court themselves. They are however taking upon themselves by so doing, a responsibility which is not properly theirs; and, in case of failure to obtain from a Justice the order required, it is plain that they are open to the charge of not having properly conducted the case. Still less is it advisable that the Inspector of Nuisances should conduct cases himself, although it is his duty to institute proceedings in the first instance. It is plainly advisable, to say the least of it, that the Vestry Clerk, or some legal adviser of the Sanitary Authority, be present to conduct the case. The persons summoned often get legally advised, and are represented by their solicitors, and it is obviously too great a responsibility for either the Medical Officer of Health, or the Inspector of Nuisances, to take upon himself to conduct cases without legal assistance. It is necessary to mention in the summons the date at which the nuisance, which is objected to, existed, and it is advisable that the date mentioned should be that of the day on which the Medical Officer visited the place; and it must also be remembered that the plea that the nuisance has been removed since that date, is of no avail. It is sufficient to prove, to the satisfaction of the Justices, that it existed on that date. In all cases an order should be prepared beforehand by the Medical Officer of Health, stating precisely the structural alterations, if any, that are necessary for the abatement of the nuisance; and the Justices should be asked to make this order. Of course, in some cases, although issuing an order, they alter the wording of the one that is submitted to them, or omit parts of it when they do not

Evidence of M. O. H.

Conduct of cases.

Legal advice.

Date mentioned.

Order ready.

consider that the necessity for all the alterations has been satisfactorily proved; but, in the majority of instances, the Medical Officer will not allow any order to be submitted to them for approval that cannot be shown to be necessary; and so, as a matter of fact, when the order is made at all, it is usually the order submitted to the Justices by the representative of the Sanitary Authority. This order should be for the removal or abatement of the nuisance, which existed at the date mentioned in the summons, within a certain reasonable time; and the Justices almost invariably rely upon the opinion of the Medical Officer of Health, or of the Inspector, as to the time that they consider reasonable in each case. If the nuisance is likely to be repeated, the order should be what is known as a 'recurring' order, in accordance with section 13 of 18 and 19 Victoria, cap. 121, which provides as follows:— 'If the Justices are of opinion that such or the like nuisance is likely to recur, the Justices may further prohibit the recurrence of it and direct the works necessary to prevent such recurrence as the case may in the judgment of the Justices require;' and if they are satisfied that the nuisance existing renders the house or building unfit for habitation, they may, if they think fit, prohibit its use for habitation until it is rendered fit for such use. Of course, when an order is made by the Justices, the representative of the Sanitary Authority asks for the costs of the case, which, if granted, have to be paid by the person summoned.* Where, however, the Justices do not consider the case proved against the person summoned, the Sanitary Authority will have to pay at any rate its own costs.

Terms of order.

'Recurring' order.

Costs.

If the order which has been made by the Justices is disregarded, the person so offending may be summoned again for neglecting to carry it out, and he is then liable, by section 14 of the Act just quoted, unless he can 'satisfy the Justices that he has used all due diligence to carry out

Neglect to carry out order.

* Such costs include the expense of procuring the summons, of serving it (if any), of making the order, the fee of the medical officer of health or other medical witness, and the costs and time-remuneration of the other witnesses who may be summoned to give evidence.

such order . . . . . to a penalty of not more than ten shillings per day during his default,' and it is, moreover, provided by the same section that 'any person knowingly and wilfully acting contrary to the said order of prohibition shall be liable for every such offence to a penalty not exceeding twenty shillings per day during such contrary action.'

Power of entry.

In certain cases the Inspector of Nuisances, or even the Medical Officer of Health, is refused admission into houses where he has ground for suspicion of the existence of a nuisance; it is then the duty of the Medical Officer of Health to apply to the Sanitary Authority for permission to be given to the Inspector to procure a Magistrate's order for forcible entry on the premises. So also, where an order for abatement of a nuisance has been made out and has not been attended to, the local authority is given power to enter such premises 'and remove or abate the nuisance condemned or prohibited, and do whatever may be necessary in the execution of such order, and charge the cost to the person on whom the order is made.'

Inspector's books.

Each Inspector should be provided with two books at least; one of these he should always carry with him, and in this he should make rough notes of his daily work; the other should be kept in the office, and in this he should make a careful entry of the premises inspected, with the date, the names of the owners, the kind of nuisance found, the action taken, and the results.

There should also be a book in the office for the entry of complaints, with all particulars, and another 'so arranged as to form, as far as possible, a continuous record of the sanitary condition of each of the premises in respect of which any action has been taken under the Sanitary Acts.'

Notice books.

There may also be, with advantage, a separate book for the entry of complaints about the non-removal of dust; and a notice book, in which a list should be made of the premises from which dust requires to be removed, this list being entered twice over on each leaf, so that half of the leaf may be sent to the contractor, while the other half, containing the duplicate list, remains in the book at the office.

The notice forms for the removal or abatement of

nuisances are often kept loose, but are much better bound in a book, the form being printed twice on each leaf; each half is then filled up similarly, and the one torn out, signed, and served, while the other remains in the book.

These books should be always kept at the office, and are best placed in the care of the Chief Inspector, where there is such an officer.

Medical Officer's note book.

The Medical Officer of Health will of course keep his private note book, in which he will enter the date and particulars of inspections made by him, with the orders given, etc., and this book will be of especial use to him, both in compiling his reports and also in preparing his evidence when he is called upon to give it; moreover, he is required by the order of the Local Government Board (before quoted) to keep such a book or books.

Reports.

The Medical Officer of Health is also required to report periodically to the Sanitary Authority the results of the work that has been carried out by himself and his Inspectors. By the 25 and 26 Victoria, cap. 102, section 43, the Metropolitan Medical Officers are required to present an annual report in the month of June; by the order of the Local Government Board the report for other districts is to be made at the end of December: but it is very desirable that the Medical Officer of Health should present a quarterly, or even a monthly statistical report of the mortality of his district. This report should be on the plan of

Mortality table.

the Registrar-General's weekly reports. It should be accompanied by a table of deaths compiled either from the local registrar's returns—which are, in London at any rate, sent to the Medical Officers by the Registrar-General, after he has used them in compiling his returns—or obtained directly from the local registrars by some special arrangement. In this table the deaths may be classed in vertical columns according to (1) diseases; (2) ages; (3) divisions of the district; (4) hospitals or other public institutions, as workhouses, etc.; and under this head a distinction should be made between persons belonging to the district, or *inhabitants*, and *strangers;* and (5) sexes: lastly a vertical column of totals. Convenient divisions of the ages are (1) under 1 year; (2) 1 and under 5; (3) 5 and under 20; (4) 20

Classification of deaths.

and under 40; (5) 40 and under 60; (6) 60 and under 80; (7) 80 and upwards. Along with the headings of 'Districts' should be placed the population of each at the last census; the average number of inmates of public institutions should also be stated; and the numbers of the sexes at the last census. In preparing this report each month, at least two blank forms will be necessary. In the first one each death as it is taken out from the original return should be entered by making a line or dot opposite to the name of the disease certified, and in the column indicating the age; another in the column headed by the name of the district—unless the death happens to have taken place in a hospital or public institution, when the line or dot should be in the special column devoted to that institution (under the heading 'Inhabitants' or 'Strangers,' as the case may be); a third line or dot in the column headed by the name of the sex; and a fourth in the column of totals. This course must be pursued for each of the deaths separately in the returns of all the districts for one week. Every fifth death in the same category, that is to say, belonging to the same disease and also to the same vertical column, is conveniently indicated by a line drawn through the four preceding dots or lines, as then, in counting up the totals, the matter is much simplified. As soon as the deaths for one week are tabulated, the number in each column should be added up and the totals checked; and when one is satisfied that no mistake has been made in the first week, one may proceed to the second, either on the same blank form, or, especially if there be a considerable number of deaths, much preferably on a second blank form, and the totals must then again be checked, so that a mistake may be discovered at the stage at which it is committed. For all the weeks that are to be reported upon, which in the case of monthly reports are either four or five (five weeks being taken for the months of March, June, September, and December), the table must be made up by placing numbers instead of lines or dots in the corresponding columns and lines of another blank form. The grand totals should then be cast up and again checked. It is convenient to enter these totals, and also those that are about to be mentioned, in red ink, as then they are

Method of compilation.

Each week's tabulation checked separately.

Entry of totals.

easily distinguished from the other numbers. Then the numbers under each order should be cast up and their totals placed opposite to the name of the order, and in the proper columns, and, in cases where there is only one disease mentioned in an order, this should also be done. It is, too, convenient to consider the headings (generally the last two in the table) viz., 'sudden deaths (cause uncertain,)' and 'cases not specified or ill defined,' as equivalent to orders, and to enter the numbers of deaths under those headings as totals in red ink. Then all the totals of the different orders should be cast up, and the results ought obviously to be the same as the original casting up of the separate diseases. It is from the totals of diseases under the different orders, that the most important information is derived with regard to the kinds of diseases which are prevalent at different times. If it be thought useful, the orders may be again cast up in each class, and those totals placed against the names of the classes. It will, however, be found that this latter proceeding is of very little practical utility, as orders grouped under each class do not include diseases which are brought about by similar causes, and, indeed, in some cases the same may also be said of diseases included in the several orders. The table should also contain a statement of the number of births registered during the time to which it relates, divided according to the districts and according to sexes, and, if possible, a statement of the average total number of births and deaths recorded during the corresponding weeks of previous years. If the report is printed, the totals in the table of mortality (written in red ink) may conveniently be printed in block type. If sickness returns can be got from the Poor Law medical officers, from public institutions, or in any other way regularly, there may be a supplementary table to include them. This, however, should be short, and contain only the principal prevalent diseases, and should be looked upon as merely supplementary to the more important table just described. It must be remembered that it can only be very incomplete until we have a general registration of sickness, and therefore its value is, at the best, but small. The monthly

Information from the totals.

Births.

Sickness returns.

report itself should be, as we have said, in the main statistical, and should state, in the first place, the death rate per thousand per annum, during the period referred to, calculated from the total number of recorded deaths of persons belonging to the district, and upon the estimated population of the district at the middle of the current year. This is approximately found by the method pursued by the Registrar-General—that is to say, by adding to the population, as enumerated at the last census, a tenth of the difference between that number and the number obtained at the previous census for each year that has elapsed since the last census; and a fortieth of that difference for each odd quarter. Thus the population of the district at the middle of 1873 is estimated, by adding to the enumerated population in April 1871, a fifth of the difference between the enumerated population in 1871 and 1861, for the two years which have elapsed up to April 1873, and a fortieth of that difference for the quarter between April 1873 and Midsummer 1873; and this estimated population should be used in calculating the death rate all through the year 1873. If the deaths of strangers are not excessive in number they may fairly be included in calculating the death rate, and may be considered to represent the deaths of those persons belonging to the district who died elsewhere. The rate thus found should then be compared with the usual death rate of the district, with that of the surrounding districts, or with some larger area in which the district is included, and also, if the district be a large one, with the general death rate of England, or of the United Kingdom, during the same period, and any excess or defect in it explained, if possible, by appropriate remarks. Next, the total number of deaths (especially of preventable diseases) in the various orders should be examined, and if the necessary materials exist, compared with the corresponding totals for corresponding periods of previous years; this will show at once the prevalence or otherwise of any particular order, or orders, of disease; and then the disease or diseases, which are unusually prevalent, or the reverse, must be noticed, and an account given of the variations in the mortality from such diseases. This is of course

Report itself.

Estimated population.

Deaths of strangers.

Comparison with other districts.'

Prevalent diseases.

especially important in the case of epidemic diseases. Such explanations as can be given of their fluctuations may be added, accompanied with suitable caution or advice us to the methods which all may use for the prevention of the spread of such diseases, and any special defects in household sanitary arrangements that have been recently brought to light may be mentioned, and the modes of remedying them described. The influence of the weather upon the death-rate should be noticed, and the diseases most liable to be affected by it pointed out; appeal being made to the table to prove the truth of the assertions. It is sometimes usual to include in this report a short account of the sanitary improvements that have been effected during the month or quarter, including the number of disinfections which have been carried out. This however is rather a matter which should be left for a special informal report to the Sanitary Committee, or other representative of the general Sanitary Authority, as it is only at their meetings that such matters can be considered in detail. The report just described, whether monthly or quarterly, ought in all cases to be printed, and the Medical Officer should urge upon the Vestry or Local Board the advisability of having this done, as it is only in this way that information of prevalent diseases, or sanitary advice concerning them, can be widely spread. Such a printed report, or the substance of it at any rate, will be copied into the local newspapers, and will so reach the hands of a great number of people who would otherwise perhaps never gain access to it. (See specimen table.)

Weather.

Sanitary improvements.

Importance of printing reports.

The annual Report should be prepared on the same plan as the monthly or quarterly ones, but should contain a more detailed account of the Sanitary work effected, and a statement of the improvements required, with a concise history of any epidemics that may have occurred during the year. This report must, in the case of the metropolitan parishes, be printed and appended to the annual report of the Vestry or district board (25 & 26 Vict. c. 102 sec. 43).

Attendance at meetings.

But in carrying out the actual business of his office the Medical Officer is required to attend all or some meetings

of the Committee whose duty it is to attend to the sanitary wants of the district. If there is a Committee assigned to this business alone, as in most large districts there will be, he will probably be required to attend all their meetings, which will be usually either fortnightly or monthly. If the sanitary administration is carried on by some general Committee, which has other business to attend to, he will only be required to attend occasionally but regularly, say once a month, unless there should be some special business demanding his attention and that of the Committee in the interval. At these meetings he will in the first place read his formal report, already described, previously to its being printed; if, however, as is generally the case, the printing of this report is a matter of course, and does not require a special permission, it may be read to the committee after having been printed, or, if they choose, be considered as read. He will then be prepared with a list of matters which he wishes to bring under the notice of the Committee; and a short account of the work carried on by the Inspectors; the number of inspections made, of orders given, of disinfections carried out, &c. (which will be prepared for him by the chief Inspector or Clerk, from the Inspectors' books); and with any report which he may have been required to make on any particular class of dwellings, or any special trade nuisances or other matters which may be ground for complaint at the moment. Amongst the matters which he will have to bring under the notice of the Committee will be also the cases in which notices for the removal of nuisances have been neglected, and it will then be his duty to ask the Committee to give authority to the Inspector to apply for a summons against the offending person or persons. He will of course be required to explain accurately the nature of the nuisance complained of, and also the evil likely to arise if such nuisance be not removed or abated. The Committee will then, unless they see any ground for believing that the complaint has been made from any personal motive, or unless they are not perfectly satisfied that the nuisance is of such a character as to warrant the institution of legal proceedings (in which case they will probably appoint a sub-committee to view the place

Business a committee meetings.

Neglect of notices.

Proceedings of the Committee.

and decide upon the course of action to be taken) grant the request. The Medical Officer should make a point, at this meeting, of receiving the instructions of the Committee with regard to any unusual steps that he may be about to take, as, for instance, the abolition of a class of nuisances that has not hitherto been made war against. He should never take up a new line without the sanction of the Sanitary Authority. If he does so he will only have himself to blame, if he finds his doings are not approved of. He must remember that he is the adviser of the authority, and not the authority itself. If his advice is not taken that is not his fault. He will never be blamed for not assuming to himself a power which he does not properly possess. On the other hand he may bring upon himself considerable obloquy by attempting to carry out reforms without first consulting those whose duty it is to manage the sanitary affairs of the district.

Position of the Medical Officer.

With regard to complaints, the Medical Officer should never encourage persons to make them *to him*. They should be made in the first instance, as a general rule, to the Inspectors, who should attend to them and get the remedy applied if possible without troubling the Medical Officer. They should, however, always feel that he can at any time be consulted, whenever they are in doubt, or whenever their authority is disputed. If there is a chief Inspector it is convenient for the sub-inspectors to refer matters in the first place to him, and he, if he thinks it necessary, should consult with the Medical Officer. It will save much trouble and considerable uncertainty to all concerned if the Medical Officer appoints a particular day or days each week for making tours of inspection with the Inspectors to investigate such matters as they may think it necessary to bring under his notice. Of course specially urgent matters will continually arise to which his attention will have to be directed at once, but it will always happen that the great majority of cases can be postponed for a day or two, so that they can all be attended to on the day devoted by the Medical Officer to that purpose.

Complaints to be made to Inspectors.

Special days for Inspections.

Mutual confidence between the Medical Officer and his subordinates is absolutely essential to successful sanitary

Mutual confidence necessary.

work; although he must accept the responsibility of everything that is done, he will of necessity have to trust them to a very considerable extent, and they should strive to show themselves worthy of his confidence; he, on the other hand, should be able and willing to assist them in their difficulties, and should endeavour to show them and his employers that his object is to do his utmost to improve the condition of the population placed under his charge and to prevent the spread of disease amongst them.

CHAPTER II.

REFUSE MATTERS.—CONSERVANCY PLANS.

Introductory.

THE Medical Officer's object must then be to find out the causes of the diseases which prevail in his district, and to inquire into all the conditions which are likely to affect the health of the inhabitants injuriously, whether by favouring the spread of special diseases, or by lowering the general health of the population, and so facilitating the contraction of diseases of any sort. He must not merely turn his attention to the prevention of the spread of epidemic diseases, although this will occupy a considerable portion of his time during the periods when they are prevalent, and may then perhaps fill up the whole of it to the exclusion of general sanitary work. But at other times there must be a continual contest going on with the conditions of the locality, whether natural or artificial, which favour endemic diseases, as well as, in many cases, the spread of epidemics. Such conditions we shall next proceed to consider in detail. It might seem reasonable to begin, first, with the natural conditions of the district, and to describe the effects of different soils, and different potable waters, upon the health of the inhabitants; but a little reflection will show that there is one condition necessary for the conservation of a healthy state in all communities, which overrides all other conditions, and thrusts itself into an importance of the first order. It is only a matter of secondary consideration whether a town is situated on a porous gravelly soil, or upon an impervious clay. We must first ask the question, applicable to all communities,—how does it get rid of its refuse matters? Indeed a moment's consideration will show that the very fact of a town's being situated on a porous soil,

Local conditions.

Importance of removal of refuse matters.

of itself a condition favourable to health, may, if the refuse matters are not satisfactorily got rid of, become a reason for the pollution of its water and the poisoning of its inhabitants by their own refuse matters. The refuse of a town consists of (1) the fouled water, which may be taken as at least equal to the water supply, and which must necessarily be got rid of, whatever be done with the other refuse matters which we come to mention next: (2) The excretal matters, consisting of the fæces and urine of human beings and of domestic animals, of which, however, the greater part is in all cases turned into the waste water: and (3) what is known as 'dust,' which contains, besides ashes, a quantity of kitchen refuse of various kinds, including much vegetable and even animal matter, which putrifies, rendering it necessary that this kind of refuse should be removed from the vicinity of habitations as soon as possible. Almost all collections of human beings then agree in one point, and that is in the removal of a large portion of their refuse matter, including the greater part of the urine, along with the foul water, which is generally turned into the nearest stream, but they differ as to the mode of disposing of the remaining excretal refuse. Two things have long been recognised—1, that these matters are valuable as manure, and 2, that they pollute the water of streams into which they are turned. But it is not even now generally understood that the method of their disposal determines to a very great extent the state of health, and the death-rate of a community. It may be said that there are two methods for the disposal of these matters, which proceed on totally different principles—one on that of *conservation*, and the other on that of *riddance*. Now assuming for the moment that the refuse excretal matters are dangerous to health when kept in and about houses, there can hardly be two opinions as to which of these principles is the correct one, and all plans for the conservation of these and other refuse matters among a population, whether in a crude condition or mixed with substances which are supposed to render them harmless or to prevent their decomposition, not only depend upon an erroneous principle, but also leave the main question, which is the disposal of the foul water, containing, as it must in all

Kinds of refuse.

Resemblance of different systems.

Opposite principles.

cases, far the larger proportion of the valuable refuse matters of towns, untouched; and there can be no question whatever that the right principle to go upon is that of riddance. The sooner we can get the refuse matters away from the vicinity of habitations, so that they shall not undergo putrid decomposition among us, poisoning the air we breathe, the better will it be for the community: it is the duty of every medical officer of health to oppose with all his might all systems which have for their object the conservation of refuse, especially of excretal, matters in crowded localities, and it is therefore his duty to advise the sanitary authority not only to insist on the abolition of cess-pits, dumb-wells, and other such receptacles, but to oppose the introduction of middens and closets of every description, in which earth, ashes, or other substances are mixed with the excretal refuse, with the object of deodorising it, and to advocate the substitution for them, wherever possible, of one or other kind of water-closet communicating with the sewers by impervious pipes. It is right here to mention that 'the construction of an earth-closet or other place for the reception and deodorisation of fæcal matters, made and used in accordance with any regulation from time to time issued by the Local Authority, shall be held to satisfy the Acts requiring the construction of a water closet.' (San. Act 1868.)

Right one.

Abolition of Conservancy.

In proof of these statements we may refer to the 9th Report of the Medical Officer of the Privy Council, where we shall find that in almost every instance, where the water-carriage system has been carried out, with the abolition of midden-heaps and cesspools, the general death rate has been lowered, often very considerably, indeed as much as 32 per cent. in two instances, and that a considerable reduction has also taken place in the death rate due to special diseases which we know to be communicated by means of excretal refuse—to wit cholera and typhoid fever. Of the first we are told that, 'cholera epidemics appear to have been rendered practically harmless in the towns examined;' towns which had mortalities of from 18 to 26 per thousand during the epidemics of 1848–49, were either not touched at all, or suffered to a very slight extent (*e.g.* a mortality of 1 to 2 per thousand) during succeeding epide-

Results of riddance.

mics, and, to show that it is not merely a coincidence, it must be stated that there is no exception to this rule. In all cases where pains have been taken to get rid of the excretal matters, which without doubt contain the poison of the disease, at once, that is to say before they begin to decompose, the reward has been that the epidemics have been 'rendered practically harmless.' In the case of enteric (typhoid) fever the same result has been attained. There is no doubt that this fever is propagated mainly if not entirely by the poisoning of the air we breathe and the water we drink by excretal matters which contain the evacuations of persons suffering from that disease. In all towns where enteric fever is prevalent there is found to be either pollution of water or of air by the decomposition of excretal matters, and in many country towns and villages where this fever is endemic, the drinking water is derived from the soil into which are sunk pervious dumb wells for the reception of the excretal matters of the population, in some instances so near to the wells that they may be said to supply them with water. It is not to be wondered at therefore that where those poisonous matters have been removed from towns before there is any chance of their decomposition, the death rate from enteric fever, and of course also the number of cases of this disease, have, like those of cholera, been diminished; and to a very remarkable degree; at one place the diminution has been no less than 75 per cent., at ten others it has been from 33 to 50 per cent., and at some others to a smaller extent. There would doubtless have been no exception to this rule had there been in all cases a free outlet for the sewage at the outfall; but in certain towns the outfall of the sewer opens into a tank from which the sewage has to be pumped, and in those instances it is backed up in the main sewers, and the products of its decomposition collect, and, ascending the pipes, distribute themselves in various ways into the interior of the houses, taking with them in many instances the poison of the disease in question; so that in a few cases, especially where sewer ventilation has not been properly provided for, the death rate from enteric fever has not decreased coincidentally with the sanitary improvements; and in two

No exception.

Enteric fever.

Diminution of death rate.

Exceptions.

Causes of.

cases there was even a slight increase, while the increase has been marked only in one instance. That in this latter case the absence of any ventilation of the sewers (the outfall being into a pumping well), was the cause of a severe outbreak of fever, 'appears to reach positive demonstration, when it is added that the fever almost exclusively attacked well-to-do houses on the higher levels, where the water-closets were inside the houses; and almost entirely spared the houses, mostly of a much poorer sort, situated on lower levels, where the closet was placed outside the house. It was not so in the times of cesspools; then these lowlying poor houses were far more attacked with fever than the others. Moreover, the fever subsided as soon as openings were made into the sewers, from certain houses where it before maintained itself for months. (9th Report, M.O.P.C., page 45.) In another place where the outfall is below the level of the river, during floods, in which case 'the sewage is backed up the main sewer for four to five hundred yards' we are told that 'occasional outbreaks of typhoid had followed times of flood, when the outfall sewer had been under water.' Although other improvements have accompanied the more speedy removal of excretal matters, it is certainly this improvement especially which has caused the diminution in the death rate from enteric fever. Any one who has investigated enteric fever cases one by one knows perfectly well that it very seldom happens that a case occurs without his being able to put his finger at once upon some sanitary defect in the arrangement of the house, almost invariably connected with the apparatus which deals with the excretal matters. Such persons will hardly require to be told that although—'many of the public improvements have coincided with the reduction of typhoid . . . it is however the purification of the atmosphere from decomposing organic matters, that has been most uniformly followed by a fall in the prevalence of typhoid.'

Want of sewer ventilation.

Causes of enteric fever.

Improved Conservancy Plans.

We have then decided against all methods for the conservation of refuse matters, but still it will be found that in many places where these methods have been at work more or less completely for a considerable time, it is difficult, if not impossible, on account of the prejudices of the inhabitants, and even of the local authorities, to get them removed, and indeed in certain places, as at Manchester, for example, one or other of these systems is resorted to with the belief that it affords a safer and more economical way of treating the refuse matters. Hence we are obliged to consider the methods that may be employed for the rendering of cesspools and middens as little objectionable as they can be, and the medical officer should make it his business to be acquainted with the various devices that are practised to this end. Cesspools originally were merely holes in the earth into which the *excreta* were conveyed, or in which they were directly deposited. They were known as dumb wells, and they are still to be found in many towns and villages in this country. The liquid part of the excreta! matters soaks into the surrounding soil, and in fact such a cesspool allows of free percolation into or out of it as the case may be. In several places these pits were made with the distinct object of allowing the foul matters contained therein to percolate as freely as possible into the surrounding soil. At some towns they were made and closed, practically speaking, for ever. At others it was usual to dig down to a water course, and allow the refuse matter to be carried away in this manner. Of course the sub-soil in which these pits were dug usually afforded the water supply of the locality, and so the latter became inevitably contaminated with organic refuse; and this still happens, for the same reasons, in many localities.

Conservancy plans retained.

Cesspools.

Water supply contaminated.

The first improvement on this state of things was making the cesspools impervious by lining them with cement. At some places the cesspool was constructed so as to contain both the liquid and the solid *excreta*, and this is the system practised in Paris and some other continental cities and towns. In others it was drained, so as to leave the solid

Improvements.

excreta more or less dry. In the former case the manure obtained is much more valuable, as it contains the urine, which in the latter is entirely lost, with the addition of any matters that it may dissolve out of the solid portions of the *excreta*. There can be no doubt that, from a sanitary point of view, drained cesspools are much better than undrained ones, and the contents of a cesspool in a tolerably dry condition are much less offensive than if the liquids are mixed with them. As Dr. Trench says:—'The perfect

Drainage of cesspools.

drainage of middens and cesspools was a great sanitary improvement. It lessened materially, though it did not entirely remove, the evils of the existing system.' If cesspools are not drained there is also a far greater chance of the sub-soil of the town becoming contaminated with the refuse matters from such cesspools as may leak or overflow. On the other hand, if cesspools are drained into the sewers it is obvious that the principle of conservation is given up,

Valuable part still in sewage.

because the more valuable part is lost, and the sewage from a town containing drained cesspools is no more fit to be turned into a river than that from one provided with water-closets. It is indeed, as a fact, often much more offensive. Where these pits are very large, as in Paris, they require to be provided with ventilating shafts reaching to the top of the house, above the eaves, or else foul air accumulates

Effects of cesspool gases.

in them; and there have been many instances of night-men having been killed, suffocated by the gases, especially the sulphuretted hydrogen, contained in the air of these places.

The French name for this suffocation is *Le Plomb*—doubtless from the manner in which persons fall when taken with it. Men who work in such atmospheres are also liable to a kind of ophthalmia (*La mitte* of the French authors); but of course the main reason why these pits require ventilating is that the foul air which collects in them will of a certainty rise through the discharge pipes and through crevices, and find its way somehow or other into the dwelling. In most continental towns they are

Methods of emptying.

emptied with considerable precautions. In the first place some disinfecting fluid is thrown down one of the discharge pipes, and then the pit is emptied, by a pump, or by means of hose leading into a partially exhausted barrel or *tonneau*.

This is all done at night. Notwithstanding that the whole of the apparatus is supposed to be air-tight, the nuisance caused by this method, is, as may be expected, very considerable. A street in which it is being carried on is almost impassable for a considerable time. Still there can be no doubt that this is an immense improvement upon the old plan still in vogue in many places, of emptying large cesspools by hand and bucket. A great improvement which has been introduced abroad consists in having the cesspool divided into two or more chambers with porous partitions between them, and so arranged that the solid refuse matters remain, comparatively speaking, dry in the one chamber, while the urine and other fluids are collected in one or more of the others—each of these chambers being provided with a ventilating shaft. In this case very little odour is to be observed in them, and also the removal and after treatment of the contents is much facilitated. Of course the soil pipes which descend from the closets to these cesspools and also the waste-pipes of sinks, &c., require to be trapped. They should descend as vertically as possible, and if they pass, as they generally will, inside the house, should be syphon trapped at the lower end where they empty themselves into the upper part of the cesspool; otherwise, if they are defective in any part, the air from the cesspool will be drawn into the house. At each closet there should be either a syphon-trap or any simple contrivance for keeping the air of the soil-pipe out of the house, and below this, if the top of the soil-pipe be not carried up to the roof of the house and left open (which is the best plan) there should be inserted a small ventilating pipe. This is, however, not done in towns on the Continent where the system is in vogue; we shall refer to it further when we come to treat of water-closets. A variety of the cesspool system has been proposed by Captain Liernur, and is called the pneumatic system. The cesspool, instead of being lined with cement, and placed underneath the courtyard of the house, or underneath the house itself, is made of cast iron, is air-tight, and is placed underneath the street where two streets cross one another, being connected with all the houses of several streets by iron pipes. The closets are made of as

Séparateurs.

Descent pipes.

Liernur's system

simple a construction as possible, and it is considered that no extra supply of water is necessary for them—the liquid refuse of the house being sufficient to keep them in order—the cesspool is emptied daily by being connected with an air-tight barrel in which a partial vacuum has been created—the end of the hose not being dipped into the contents of the cesspool, but being fastened on to the latter with an air-tight joint. The barrels containing the manure are sent directly to the farms requiring it, and are placed upon a plough of special construction, so arranged that the manure is discharged from the bung-hole of the barrel through a hollow foot behind the plough-share, while a shovel, which trails behind, closes the earth over it. This plan of applying liquid manure is worth the attention of towns where excretal refuse is collected unmixed, apart from Captain Liernur's process, which is itself only an improvement (although a considerable one) upon the cesspool system.

Disposal of manure.

As the emptying of cesspools is an expensive process, it is obviously advantageous to construct them as large as possible for the sake of economy, so that they only require to be emptied at considerable intervals of time, and this is, of course, a great objection to the system, as, indeed, to all systems which require removal by cartage. As frequent removal is of the first importance from a sanitary point of view, the most obvious improvement upon the large permanent cesspool was the provision of small moveable ones—the *Fosses Mobilles* of Paris, and the pails and tubs of some of our own towns. These temporary cesspools have been carried to considerable perfection abroad, the plan being to have one descent pipe into which the closets (which are of the simplest construction imaginable) empty their contents by means of connecting pipes. The descent pipe is straight. At the upper end is fixed a ventilating pipe, on the top of which a revolving vane, or Archimedean screw, is sometimes placed, and at the lower end the last joint rests on a slab of stone, through which the pipe is continued by means of a sliding joint made of wrought copper—the descent pipe itself being made of glazed stoneware. This sliding copper pipe fits into an aperture in the covering of the barrel (*tonneau* or *tinette*),

Importance of frequent removal.

Fosses Mobilles, &c.

so that the refuse matters fall down the pipe directly into the barrel, and by these means the pipe is kept comparatively clear, as no accumulation can take place in any part. The barrel is placed upon a small cart with wheels, which run on rails, and can be easily moved from beneath the descent pipe when full. When this is to be done, the copper pipe is slipped up a little, a cap is fitted to the end of it, another covering without an aperture placed securely on the top of the barrel, and the former one fixed on to the empty barrel which is to take its place—the whole process occupying only a few minutes. Frequently separators are placed in the interior of these barrels, and then the liquid part is sometimes carried away by a small pipe into a sewer. By this method much manure is lost; but on the other hand the barrel does not require to be moved nearly so often. Chesshire's intercepting tank is a variety of this system; by it the solid matters are retained, while the liquids flow away into the sewer; Dr. Hewlett looks upon it as 'a better form of cesspool.' A simpler plan than this, in which no descent pipe is necessary, is described in a report by Dr. Buchanan and Mr. Radcliffe, published in the twelfth report of the Medical Officer of the Privy Council. In this plan the pail or tub is placed immediately beneath the seat of the closet. At some places disinfectants are placed at the bottom of the tubs with the view of retarding decomposition and preventing offensive smells. At Rochdale, the pails are made from disused paraffin casks —each cask being cut into two. They are fitted with iron handles and tightly-fitting lids, and cost only 3*s*. 4*d*. each. They of course require to be changed frequently, and it would be well, wherever this system is at work, to insist on daily removal, the pails being placed, except in cases where closets can be easily got at by the scavenger, outside the houses, as is the practice in Edinburgh, and it being preferable to empty the contents into the carts so that there can be no possibility of the pails being changed. Dr. Trench has insisted upon this latter point, and, we think, very rightly. This is a system, which, although causing a certain amount of temporary nuisance, is, beyond all question, the least injurious, and the most thorough-

Removal of manure.

Chesshire's Intercepting Tank.

Pails and tubs.

Daily removal.

Advantages of this system.

going of all the plans which depend upon hand and cart labour for removal. In its simplest form it makes no pretence at de-odorising, and it is perfectly impossible that collections of decomposing matter can accumulate. In cases of infectious diseases the refuse matters can be thoroughly disinfected in detail; and, lastly, the manure is procured in the most available form, being unmixed with any extraneous materials. It is a variety of this system that has been practised for thousands of years in China, where all refuse matter is most carefully preserved, and it is the same system which is practised in the Department of the *Alpes Maritimes*, where the great value of excretal matters is thoroughly appreciated, and where they are used in the cultivation of corn, orange trees, green vegetables, and especially scented flowers, such as roses and violets, which are required in large quantities in the preparation of perfumes.

Utilisation.

Trough Latrines.

A useful variety of the moveable cesspool, which is especially applicable to public institutions, or, generally, in cases where closets are placed alongside of one another in a row, is that of the *Trough Latrine*, in which case an iron trough slightly inclined towards one end is placed underneath a row of seats. At the lower end is a vertical descent-pipe provided with a plug which can be lifted so as to allow the contents of the trough to be discharged at certain intervals—say once in every twenty-four hours—by the scavenger into a tub placed to receive them, or directly into the cart. The scavenger when he has done this flushes the trough with water from a tap placed there for the purpose, replaces the plug, and leaves a little water in the bottom of the trough to dilute its contents, so that they will run easily when the plug is lifted the next time. This plan is in use in the Glasgow factories, in which such a trough is placed in each storey.

'Eureka' and 'Goux' systems.

Some varieties of the pail system, known under the name of the 'Eureka system,' where some disinfectant is used, and the 'Goux' system, in which there is a small perforated pail inside the larger one—the space between the two being packed with some absorbent material—need no further notice; they are obviously merely varie-

ties of the simple pail system. In all these cases the ashes have to be removed separately, and tubs must be placed to receive them.

Improved Middens.

We have now to consider the improvements that have been made on the old midden heaps, or midden pits, those receptacles which were intended to receive the ashes and kitchen refuse of the houses, as well as the excretal matters, the object being to ensure, as far as possible, dryness of the contents. In the first place, it is plain that the receptacles themselves should, like the cesspools, be water-tight. Next, they ought to be ventilated where large, and if it be found impracticable (as it generally will be) to keep the contents dry in any other way, they should be drained from their lowest point into a common sewer. Where they are not done away with (as they certainly ought to be everywhere) the medical officer should insist on their being made as small as possible, and on their being emptied very frequently. They have been reduced to a regular system in some towns, as Manchester, Nottingham, Salford, and Hull, and the different plans are described in detail in the report before quoted. The ashes are thrown in either by a door at the side or through the hole in the seat, or by providing a hinged seat, which can be lifted so that the ashes may be thrown carefully on to the excrement, or again, by leaving a space between the floor of the closet and the front board of the seat, through which the ashes can be shot; sometimes a sifter is conveniently arranged so that the cinders are saved to be burnt again. A single midden-pit may be placed underneath a row of seats, thus resembling the *Trough Latrines* already described. They are emptied either by means of the hinged seat, or through a door below the seat, or by removing the seat, front-board and all, or better, through a door made for that purpose in the passage running along the back of a block of closets. In this latter case, the contents do not require to be carried through the house at all as they do frequently in the former. The best form of this system is at work in Hull, where the midden-pit consists of nothing but the space between the seat and the floor, the ashes being thrown in by means of a scoop, and the contents taken out by removing the front

Drained, and as small as possible.

Contrivances for throwing in ashes.

Emptying.

Best form

board and digging them out with a spade. In all these cases it is absolutely necessary that a separate closet be provided for each family; otherwise it is perfectly hopeless to expect to find them taken care of. Where plenty of ashes are thrown in, and all the slops thrown down the sinks into the sewers, the contents may be kept dry and sweet enough provided the pits and closets are sufficiently ventilated. The removal, of course, must be regular and frequent, and thus the scavengers' visits must be frequent, and this is one great objection to all plans of the sort, because it is not practicable always to place these closets, as they should be placed, at some distance from the houses, so that they can be got at without going through them. They require a considerable amount of care, and a very complete scavenging system. The manure got from them is of very little value, and there can be no doubt that the medical officer will do well to urge their abolition, especially where they are placed in the interior of houses.

Necessary conditions.

Value of manure.

Ash closets.

The 'ash-closets,' known as Morrell's and Taylor's, the 'carbon disinfecting closet' of Messrs. Weare and Co., and other contrivances of the sort are improvements in the same sense that a pail closet is an improvement on a cesspool. They provide moveable receptacles, and arrangements by which sifted ashes and disinfecting powders can be sprinkled upon the excrement; in some cases a contrivance is arranged for the separation of the urine, and for its discharge into another vessel. Moveable receptacles are always better than fixed ones, as it is plain that they cannot be made very large, and that, therefore, their contents must be carried away more frequently. We now come to the last of the conservancy methods—that known as the dry earth system. Earth of almost any kind, except chalk and sand, when carefully dried and sifted, if mixed in sufficient quantity with excremental matters and urine, completely de-odorises them, and the same earth may be used several times for this purpose. This plan, reduced to a system by the Rev. Henry Moule, has been proposed as a substitute, not only for all other dry systems, but for all systems now employed for the removal of excretal matters. It has been found to act very well where a considerable amount of care

Advantages of moveable receptacles.

Dry earth system.

is exercised, and where there can be regular and constant supervision. As it depends upon the provision continually of a sufficient supply of dried and sifted earth, and upon the receptacles being kept dry, no slops or liquids of any sort being thrown in either by accident or design, it is plain that it is not a system suitable for the interior of houses. It may be employed with advantage in small places that are not sewered, where plenty of earth can be got and the contents of the closets utilised on the spot, and also where there are temporarily large collections of people, as at reviews, shows, fairs, &c., in which cases persons must be employed whose exclusive duty it is to superintend the earth closets and the urinals, and to see that they are well supplied with dried earth. Earth closets may be also advised in certain cases in which houses are so placed that they cannot be connected with the sewers; but under other conditions, they will not be found advantageous, either from a sanitary or from an economical point of view. From a sanitary point of view, because it is not practicable to provide the supervision necessary for them, and so a certain number of them would inevitably get into a very bad form of cesspool; in fact, they obviously violate the principle with which we started, that it was of the first importance that these refuse matters should be removed as instantly as possible from the neighbourhood of dwellings; and from an economical point of view because of the great expense of procuring, drying, sifting, and carting the large amount of earth required, and of constantly removing the contents of the closets, added to the fact that the value of these contents as a manure, even after the earth has been passed several times through the closets, can be but trifling—the usual statements upon this head being manifest exaggerations. These contents are composed of fæces mixed with a large proportion of earth, and a small quantity of urine. It is absolutely impossible to supply earth enough to absorb all the urine and slops of the population; and so under this system, the most valuable part of the refuse matters must still either be collected separately in pails, or be simply allowed to run into the sewers, the result being that the earth that has passed even three times through these closets is only after all (as

Necessary conditions.

Where it may be used.

Disadvantages.

Value of contents as manure.

shown by some experiments made by Dr. Gilbert, and described in the third and fourth reports of the British Association Sewage Committee) a rich garden soil; it hardly deserves the name of manure, and will certainly not pay the cost of conveyance beyond a very short distance. In a large town it is very doubtful whether this system could be worked so as even to pay its own expenses; and we feel quite sure that any hopes of making a profit out of it under these circumstances must be delusive. The medical officer may then advise the application of the dry earth system in certain special cases; the first condition being that the closets are placed outside of the houses. It must always be remembered, in the first place, that frequent removal and constant supervision are absolutely necessary, and in the next, that even where the system is worked in the best manner possible, we are not sure that the compost is disinfected as well as de-odorised. Indeed, the effect of dry earth is certainly a preservative one, and it has yet to be shown whether the poisons of special diseases are altered in any way, or are merely preserved by being mixed with it. We know that seeds are kept, and carried for long distances in dried earth, and so it is a mere presumption to assume that substances which may, or may not, be of the nature of seeds, are destroyed by being mixed with it. It would be very interesting to know if dry earth mixed with typhoid fever stools is infectious or not, when it is dry; this we do not know; and it would also be interesting to know if such a mixture, after being kept dry for a certain time, would or would not become infectious when moistened; this we do not know: the presumption is, that it would. With such an uncertainty before us, the plain duty of those who have to advise on sanitary matters is, to oppose the introduction of this and all other conservancy systems with all their might, and not to hold out, as has been often done, delusive hopes of a pecuniary gain at the risk of damage to the health of the community at large. It will always be found necessary to have foul water drains—that is to say sewers—for all communities; and as the Indian Army Sanitary Commission said, even when speaking of barracks: 'To have two systems of cleansing stations—a foul water

Conclusions.

Preservative power of dry earth.

Necessity of sewers.

system, and a dry earth system—would simply be paying double where one payment would answer; or, if all the excreta, solid and liquid, are to be carted away, this must be done at a cost ten times greater than that which would be necessary, if all the excreta were removed by drains.' It cannot be too urgently insisted that the keeping of a particular part of the refuse matters and that a small part, to wit the exrement, out of the sewers, cannot possibly leave the sewage in a fit state to be turned into rivers; and where this is attempted to be done by means of drained middens or cesspits, the sewage is usually in a fouler condition, from being staler, than it is in towns provided with water-closets. The manure so obtained is of very little value and scarcely ever pays the cost of collection, the single exception being in the case of tubs or pails, which afford, to our mind, the best conservancy plan, both from a sanitary and economical point of view. The health of the community (the first thing to be considered) is endangered by all these plans of conservancy.

Sewage still to be dealt with.

CHAPTER III.

Water-carriage System.

Water-carriage system.

We have, lastly, the plan by which all the refuse matters of a population, with the exception of the ashes, may be removed by gravitation along with the foul water. This is known as the Water-carriage System of removal. It no doubt arose originally from the convenience which drains, originally constructed to remove surface water, afforded for the removal of excretal matters. The *Cloaca Maxima* at Rome affords us an excellent example of this. It was constructed to drain the low-lying ground about the Forum, and it does so now—an excellent pattern of durability of work. It was not intended to receive the refuse matters of the population; but its convenience for that purpose was soon found out, and it now, like the old brick drains of many of our towns, acts no longer as a mere drain, but is used as a sewer, the essential difference between drains and sewers being, that drains, intended as they are to carry off surface or subsoil waters, or both, require to be pervious, so that the water can get into them, while sewers being intended to carry foul water away, without allowing it to percolate into the surrounding soil, require to be impervious. It is plain, therefore, that old brick drains are not fitted to receive sewage properly so called, and one of the frequent duties of the Officer of Health consists in having houses that have for years been drained into one of these, connected with a new sewer. Two points have to be remembered in connection with this. The one is that it is not allowable to break up or stop up a brick drain, or any other drain, so long as it affords an outlet for houses which drain into it higher up; that is to say, so long as that part of

Cloaca Maxima.

Drains and sewers.

Abolition of old drain-sewers.

it is used: and the other is that, practically speaking, houses are not ordered to be connected with new sewers unless their existing system becomes an evident nuisance. Local authorities will not allow inspectors to take out summonses against the owners of houses merely because those houses happen to be drained, as they have been for many years, into pervious brick drains, unless some distinct nuisance (as a stoppage, or continuance of bad smells, often accompanied by an invasion of rats, or floodings of basements, or what not) can be proved. Neither would magistrates make orders except in such cases; but any of these nuisances connected with the old system of drainage may be used, and ought to be used, or a reason for insisting on the construction of impervious pipe-sewers in connection with the nearest sewer. Of course this can only be done whenever the sewer is within the prescribed distance from the house, viz., 100 feet from any part of such house. These matters, as a rule, proceed gradually. It is only occasionally that we can get the owners of a whole row of houses, or of a street, draining into one of these water-courses, to connect such houses with a new sewer, and so, one or two, here and there, often remain for many years drained in an inferior manner, and contributing to the pollution of the subsoil, and perhaps of the water of neighbouring wells.

Proof of nuisance required.

Gradual procedure.

Every point connected with the sewerage of his district, the Medical Officer should refer to the Surveyor, and on the other hand the latter will frequently consult the medical officer as to the best method of constructing sewers with a view to their efficient ventilation, &c. Sewers, even impervious pipe-sewers, ought not to run beneath the basements of houses, but with the present system of making the main sewers underneath the streets, and having the water-closets at the backs of the houses, it is obviously inevitable that the house-sewers pass underneath the house. This is, therefore, an additional reason for their being made of glazed stoneware pipes securely jointed with clay, and if the soil beneath the house be porous, especially if it be sand, they must be laid in a water-tight trench. Four or six inch pipes are used for this purpose, and four inch pipes are the smallest that should be allowed; the gradient ad-

Position of house-sewers.

vised for house-sewers is at least one in 60; the velocity of flow in them not being less than $4\frac{1}{2}$ feet in a second.

Fall of house sewers.

Wherever it can be done the house-sewer should not be joined directly with the main, but should open into a shaft rising to the surface of the ground, fitted with one or more charcoal screens, and covered over with a slab at the top,

Ventilating shafts.

apertures being left between the bricks at the upper part for the escape of sewer air. From the other side of this shaft, a pipe should pass to the main sewer, and upon this pipe, if it be thought advisable, a simple bend may be placed. As a rule, however, this is not necessary. The mouth of the house-sewer itself may be protected by having

Effects of.

a flap-trap placed upon it in the ventilating shaft. By this simple arrangement, it is impossible that there can ever be any pressure of air from the main sewer in the house sewer, as even if by any chance the flap-trap (the main use of which is in reality to prevent rats getting in) gets out of order, the air from the main sewer has plenty of opportunity for exit by the ventilating shaft, and is not driven, with force at any rate, into the house sewer. This plan is however not generally practicable in towns, and then the question

Traps.

arises, should there be a trap upon the house-sewer between the house and the main or not, and if so, what kind of a trap? No general rule can be laid down in these cases, as everything depends upon the peculiarity of the case. If the main sewers are, as they always should be, freely ventilated by special man-hole ventilators along the middle of the street so that there is no possibility of foul air accumulating in them at all, it is better not to have any kind of trap unless indeed it be a flap as before mentioned to keep rats out of the house sewer. In all traps which hold water a

Deposit in traps.

deposit occurs so that the water which remains in the traps for a few hours becomes exceptionally foul. The blocking-up of a trap is moreover merely a question of time. If, however, the main sewers are not properly ventilated, as the case in many places for two reasons, the first being, that they may have been laid upon the theory that ventilation was not required, and the second that an at-

Faulty ventilation.

tempt may have been made to ventilate them by untrapping some of the gullies at the sides of the streets

—the inevitable result of which is (especially when it is only a few openings that are thus made) so great a complaint of nuisance from the foul air that rises from these few openings close to houses that they have to be trapped again—it is well in either of these cases to trap any house-sewer that passes underneath the basement of a house, by placing a syphon bend or a dip-stone trap upon it. In all cases the house-sewer itself should be abundantly ventilated, whether it be used in connection with water-closets or not. If water-closets do not empty into it, it may be ventilated by leaving the rain-water pipes untrapped at their entrance into it, and this will generally be sufficient without a special pipe—the condition of course being that such rain-water pipes be securely jointed, and that they rise above the windows and end at a reasonable distance from them. If it be possible no pipe from the interior of a house should pass into the house-sewer. Where water-closets are used the soil pipe from them should descend outside the house: it should be made of lead, and the joint with the house-sewer must be very carefully made. It is almost impossible to connect leaden pipes with earthenware ones with absolute security, and this affords a principal reason why the soil-pipe should be outside the house. If the soil-pipe passes inside the house (as is too commonly the case) in a match-board covering, a shaft is constructed through the house, by means of which if the joint just mentioned be not secure, or if there be any flaw in the soil-pipe itself, sewer air is drawn into almost every room in the house where there is a fire burning. It passes from this shaft along the spaces between the joists and the floors, and may permeate the entire building, and this may happen when the soil-pipe is apparently quite sound through its whole length. The soil-pipe should not be trapped at its entrance into the house-sewer, and it should not be closed at the top, but should be taken right up above the eaves of the house, and made to end wide open and to act as the ventilator of the house-sewer. If the main sewer be ventilated and the house-sewer have no trap upon it, a current will be established in one direction or the other along the soil-pipe of the house-sewer and main, and an

Ventilation of house sewer.

Soil-pipes outside houses.

Results if inside houses.

Ends of soil pipe.

Free ventilation.

accumulation of foul air in any part will be absolutely impossible. It might be thought that it was advisable to insist always on keeping the air of the main sewer out of the tributary sewers, but traps are a great fallacy, and the remedy for foul air in sewer arrangements is most certainly to allow free communication with the open air at different levels. Where there are several water-closets in a house, they should be placed one over the other, and the discharge-pipes from their traps should pass at an oblique angle, or still better with a curved junction, into the soil-pipe of the house. All junctions between pipes should be curved, and the same is to be said of the junctions between the house-sewer and the main, the house-sewer should also descend more rapidly at this point. The simplest form of water-closet, and one which should be used in poor neighbourhoods, for servants' closets in basements and in like situations, consists of a conical earthenware pan with a syphon attached to it below. The end of this syphon can be jointed quite securely with the house-sewer, as junction-pipes are made especially for this purpose. This is also an apparatus which cannot get out of order, and which it is perfectly easy to clear, as the articles which get into the trap by accident, or are thrown into it purposely, can be taken out by the hand, or hooked out with a wire; and it cannot be put out of order, except by deliberately breaking a hole through it, so as to let the water run out. But the main reason that water-closets have failed and become nuisances among the careless population of several towns, is, that they have been constructed with complicated apparatus. Such closets as have been just described can be kept perfectly clean, and are, in certain towns, so kept, without any special supply of water at all—the house-slops being thrown down them. At the highest point of the syphon, beyond the bend which holds the water, a hole is often made for the insertion of a ventilating pipe, and it is far better to have one at this point for the benefit of the house-sewer than to trust to one or more rain-water pipes for its ventilation. Where such a pipe is employed, the rain-water pipe, if it fulfils the conditions already laid down, may also be left untrapped, but it is much better to make it end over the

Several W. C.'s.

Simple form of W. C.

Reason of failure of W. C.'s.

Ventilating pipe.

surface of the yard or area. It is, however, frequently found that the hole just mentioned is utilised for the purpose of discharging a sink-pipe, or the waste-pipe of a cistern, into the sewer. This is a most objectionable proceeding, and should always be discountenanced. Where the closet is supplied with water from a cistern or butt above it, the waste-pipe of such cistern or butt is frequently made to end in the pipe that supplies the pan, so that when the cistern overflows, the pan is washed by the waste water. If, as is usually the case, the same cistern supplies the drinking water of the household, this plan is objectionable, and the waste-pipe should be made to end in the open air.

Waste pipe of cistern.

The supply of water may be controlled by means of a valve, which is moved by pulling a wire, or by being attached to the door of the closet, or in certain cases to a seat which is moved by the weight of the sitter. It is obviously preferable to have it self-acting. If the water is supplied on the constant system, and cisterns are provided, or the cisterns that existed with the previous intermittent system left, the same rules will apply. Where no cistern is provided, some contrivance, such as a service-box, will be found necessary to prevent undue waste of water. For large collections of people, or where several closets are placed together in a row, instead of having a pan for each of them, a trough of sheet-iron, or of slate, or of stone, or brickwork lined with cement, may be placed all along underneath the seats with a slight inclination towards one end. At this end a pipe should join it, and a plug should be placed in the mouth of this pipe, which can be lifted up or let down with facility by the person who has the charge of the special compartment at the lower end, in which also the water-tap is placed. This compartment should be accessible to one person only, who should have the charge of it, and who, at stated intervals—say once in every twenty-four hours—should go and lift up the plug, let the contents of the trough run into the sewer, and then, letting down the plug in its place, turn on the water until there is a sufficient quantity in the trough, when the latter may, if necessary, be cleansed with a besom. As a rule, however, it will be quite sufficient to allow this water to run away

Water supply to closet

Trough closet.

Management of.

into the sewer, and then to charge the trough again with a small quantity of water. This is known as the "Trough water-closet," and has been perfectly successful in the poorer parts of large towns, and notably of Liverpool. Another form of closet suitable for collections of people is known as the "Tumbler water-closet." In this case there is a trough, as before described, in permanent connection with the sewer at the lower end, while at the upper end, in a special compartment, the water is allowed to drip from a tap by means of which the amount can be regulated accurately, into a swinging basin, which is so arranged that as soon as it is filled up to a certain point it tips over and empties its contents into the trough, thus washing it out. The supply of water to it can be regulated so that it shall upset at any interval of time that may be thought desirable, and it may be made to capsize at different intervals during different periods of the day, according to the frequency of the use of the closets during such periods. In both these cases the special compartment containing the water-trap and other apparatus must be under the control of a single responsible person.

Tumbler closet.

More complicated W. C's.

The more complicated kinds of water-closet are very varied in the details of their construction. It is only necessary here to describe the one in most general use to show its defects and the way of remedying them. It consists, like the simpler form already described, of a china or earthenware pan, which is usually conical, but is now made of several shapes, one of the best being that in which it is a kind of basin. The sides of conical pans always allow a certain amount of soil to accumulate upon them, and require a greater flushing power of water to clean them. This pan is not, as in the former case, connected with a syphon, but it opens into a large iron vessel called the "container," and it is inside this "container" that the basin which closes the extremity of the pan, and retains a certain amount of water in it, usually from three to four inches in depth, swings. The container, in its turn, opens by a vertical pipe from its lower part into a contrivance known as the D trap, so called from its resemblance to the letter D placed thus ⊐. From the upper part of this D

Container.

D trap.

trap, at one end, the leaden connecting-pipe passes, and joins it with the soil-pipe of the house, and the vertical pipe from the container passes through the flat top of the D trap down to a couple of inches or so below the level of the last-mentioned pipe. It is clear, by this description, that the D trap must necessarily hold water up to the level of the discharge pipe at the upper part of it, and that the vertical pipe from the container must end beneath the surface of this water, so that air coming from the soil-pipe into this trap is prevented by the water from getting into the container above. Now, this is on the whole a very good contrivance, but several precautions require to be taken with regard to it, and several additions require to be made to it in order to render it unobjectionable. When these precautions are taken and these additions made, it is a contrivance that can be placed with perfect safety, and almost without the possibility of a nuisance, in any part of a house, and even in the most confined situations. We do not for a moment advise this to be done as a matter of choice. The first precaution has been already mentioned, that the soil-pipe with which this apparatus is connected be, if possible, open at the top. If it is not open, and in the majority of instances it is not, then it is necessary, and absolutely necessary, that from the point at which the connecting-pipe from the D trap enters the soil-pipe, a leaden ventilating pipe of from one to two inches in diameter be carried up to the top of the house, ending, as before mentioned, above the eaves. If this is not done, although there is little fear of the pressure of air in the sewer forcing it past the water of the D trap into the container, what happens is that the putrescent organic matter contained in the air of the soil-pipe is absorbed by the water in the D trap, which is thus rendered fouler than ever, and gives off fœtid gases into the container. These collect under pressure and escape into the house as soon as the pull-up apparatus by which the basin is removed from the base of the pan is set to work, and thus a nuisance is created each time the closet is used. But even this precaution may be taken and, especially if the closet be in a confined situation, a certain amount of nuisance

Its action.

Precautions.

Results of want of ventilation.

Further precaution.

will arise from it, and this happens in the following way: When the pull-up apparatus is set at work, after the use of the closet, the water held up by the basin and the excretal matters contained therein fall into the D trap, and it is seldom that sufficient water is allowed to pass through the apparatus to flush out sufficiently this D trap. Consequently, foul water remains in it. This foul water fills the container above it with offensive gases which escape as soon as the basin is moved. To obviate this difficulty, the container itself must be ventilated, and this is done by having a hole made in the top of it, and soldering a half-inch lead pipe into it, which is carried out and made to end in any convenient manner. It has been recommended to attach two such pipes to each container, making the one end immediately outside the wall, and carrying the other up to a greater height, the object being the establishment of a continuous current of air through the container. There can be no doubt of the efficiency of this method; but we have found, as a matter of fact, that a single ventilating pipe answers the purpose perfectly well, the object being, the provision of a free escape for any foul air that may collect in the container, and the consequent prevention of its collecting under pressure therein. When this is done it is clear that on pulling up the handle, and discharging the water from the pan, there is a rush of air down after the water into the container, instead of, as in the former case, the escape of gases confined under pressure in this latter. In the improved forms of closet, instead of a basin, a plug is used, which fits the opening at the apex of the pan with an air-tight joint, the chief advantages being that the large container with its collection of foul air is no longer wanted and that paper, etc., is not caught up by the plug, as it sometimes is by the edges of the basin, and wedged in at the top of the container. It is frequently the practice to make the waste-pipe of the cistern, which supplies the closet with water, end in some part of the water-closet apparatus. It cannot, as in the simpler form of closet, be made to end in the pipe which supplies the pan, for in this case the waste water would find no means of escape, and, filling the pan, would flood the place. This pipe is therefore made to end, as

Ventilation of container.

Air-tight plugs.

Waste pipe.

a general rule, in the D trap below the surface of the water, so that it is trapped at this point, and this is the least objectionable place for it, if it is connected with the closet apparatus at all. Sometimes, however, it is made to end in the connecting-pipe between the D trap and the soil-pipe, or in the soil-pipe itself—a most objectionable proceeding, as in this case it becomes the ventilator of the soil-pipe, perhaps of the house-sewer, and perhaps of the main in the street. If the same cistern supplies the drinking-water of the house (as is frequently the case), these plans become still more objectionable, and it ought to be insisted upon, that the waste-pipes of all drinking-water cisterns should end in the open air, and should on no account be connected with any part of a water-closet apparatus, or directly connected with a drain or sewer. The violation of this principle is, we are persuaded from manifold experience, the cause of a great part of the diseases due to the poisoning of drinking water by sewer air, and not only so, but we believe that the production of these diseases directly by the inhalation of sewer air is comparatively rare in comparison with their production by the imbibition of water poisoned in the way just described. Case after case of enteric (typhoid) fever we have traced directly to this cause; and in one instance, where a whole household was stricken with diarrhœa, it was found upon examination that the waste pipe of the drinking water cistern communicated with the soil pipe of the house, and although the cistern was outside the house, the air inside it between the covering and the water was foul to a degree (being in effect the air that had risen up from the partially stopped sewer) while the water was little better, and was, without doubt, the cause of the outbreak. If the cistern is not used for the supply of drinking water, or of water for domestic purposes, it is still advisable wherever it can be done, to make the waste pipe end outside, over a roof or yard, or in a rain water pipe which is not connected with the sewer, or in any convenient manner, as then there is no chance of foul air getting up it and so into the house, because it must be remembered, that although the water is not used for drinking, still the cistern is, as a rule, inside the house, and so it is advisable

Should end in open air.

Enteric fever and diarrhœa.

that fœtid air should not be permitted to get into it.

Closets above each other.

Where closets in a large house are one above another, and open into the same soil-pipe, there is another reason for the ventilation of the soil-pipe, and in such cases it ought always to be left wide open at the top. If this is not done, it frequently happens that when the lower closet is used the rush of water down the soil-pipe will draw much of the water out of the D trap and perhaps out of the basin of the upper closet. This will also happen if any larger body of water is suddenly turned into the soil-pipe of a house. The

Wastes of baths.

wastes of baths form an example of this: if the water is discharged suddenly from a large bath into a soil-pipe the same thing happens. It is not advisable that the waste-pipes of baths should end in soil pipes; the only advantage is the washing of these latter by the water; where they do so end it is absolutely necessary that they should be so small that the water can only run in a small stream. This must be securely trapped with a strong syphon bend, and (a point often overlooked) the overflow pipe from such baths must be made to end in the waste-pipe above this syphon trap. It frequently happens that this precaution is not taken, and that the bath-room of a house in consequence becomes a nuisance. A much better plan, and one that is to be recommended for the wastes of baths and sinks is, that they should, like those of cisterns, not be connected with the soil pipe at all, but that their water should get

Sink-pipes.

into the house sewer in another way. Sinks should be placed on the outer walls of houses, so that their discharge-pipes may be carried out through the wall into the yard or area. Where a sink is not so placed, its discharge-pipe is frequently made to descend straight into the sewer, a bell-

Bell-traps.

trap being placed on the top of it. A bell-trap consists merely of an inverted cup or bell attached to a perforated plate. The plate fits into a place cut into the stone, and the inverted bell covers the mouth of the discharge-pipe, its rim dipping about half an inch into a little water contained in a groove around the end of the discharge-pipe. This contrivance is one of the most dangerous that can be imagined, as in the first place the small amount of water is (if the trap does not happen to be used frequently)

evaporated and a free passage for the sewer air is established into the house. In the next place, the soapsuds, &c., do not easily run through the perforated plate, the result being that the servant takes it off, bell and all, to allow the water to run off the sink. Of course it is frequently left off perhaps for a whole night, or even longer, and the sewer directly ventilated into the house. Cases of disease and even of death have frequently been traced to this cause. Bell traps, then, ought to be abolished, whether inside houses or in the yards. Another plan is to make a strong syphon bend upon the discharge-pipe of the sink. The objections to this plan are that the syphon does not hold much water and may become dry, and that it frequently gets stopped up. Where such a syphon is used, it is, therefore, advisable to have a contrivance for opening into it at the lowest part of the bend so as to clean it out. The best plan, whether the sink pipe can be carried outside or not, is to make it end over a large earthenware syphon trap. These syphon traps hold a considerable quantity of water, so that they do not easily get dry. They are cleaned with the greatest facility, being large enough to admit the hand. They have a loose top of earthenware with four or five holes in it, and their advantage is, that if this top is taken off the trap itself is not interfered with. These traps are now constructed with a hole in the side, above the level of the water, so that a sink-pipe or a waste pipe of any sort can be made to end in them below the perforated top, and yet above the water in the trap, and this is how such wastes should be made to end if the trap is inside the house, and how they may be made to end in any case. In this way the water is discharged by the waste-pipe independently of the perforated top of the trap, which may at any given time be accidentally stopped up, and so a flooding of the basement or of the yard is prevented. D traps are frequently used in such situations, and although far superior to bell-traps, in that they cannot easily be tampered with, they are, in our opinion, not so reliable as these large earthenware syphons, for they only contain a comparatively small quantity of water, and they are easily stopped up. Or, ordinary dip-stone traps, which are fre-

Syphon-bends.

Earthenware syphon traps.

End of sink-pipes.

Comparison with D traps.

quently used on brick-drains and for gullies, may be placed in yards: they consist of a rectangular pit, deeper than the invert or bottom of the sewer or drain, and partially divided into two parts by a stone placed vertically, which is long enough to dip two or three inches into the water and yet leave a sufficient interval between its lower edge and the bottom of the pit. The half of the pit from which the drain passes is covered by a stone slab cemented down, while the other half has a perforated plate or stone over it. The pit requires to be carefully built in and lined with cement. When the trap is placed on the course of a sewer or drain, the bottom should be curved so that the descent into the trap is abrupt and the ascent into the sewer on the other side of the dip-stone easy; while the dip-stone should not be vertical, but should incline in the direction of the flow; thus sediment will be less likely to remain in the trap.

Rain-water pipes.

Rain water pipes should as a rule be made to end on the surface of the yard or area, and should not descend directly into the sewer, unless, as before stated, they are specially constructed and allowed to act as ventilators to the sewer. It is plain, that where they end over the surface of the yard they may be conveniently used for the discharge of the wastes of cisterns, &c. Where the soil-pipe passes through the house instead of outside it, it is usual to trap it at the bottom so that it may not ventilate the house sewer through the house; but then there is all the greater necessity that it should itself be ventilated at its highest point by a special pipe, and the house-sewer will then need ventilating separately. The best plan is to carry a special pipe from the house-sewer to the highest possible point. It is the practice in some towns to provide the top of this pipe with an Archimedean screw, with the view of creating an upward current in it; Drs. Parkes and Sanderson, however, in their report on the Sanitary arrangements of Liverpool, state that they do not find that these screws make any difference to the pressure of the air in the sewers, and the great object of ventilating pipes being to prevent the possibility of any undue pressure of air in the house-sewer, it is plain that it is sufficient to leave them open at the top. The objection to using the

Soil pipe.

Archimedean screws.

ventilating pipe as a rain-water pipe or *vice versâ*, even if in the latter case the rain-water pipe is specially jointed for the purpose, is, that during heavy storms, when there is a considerable pressure of air in the sewer, the pipe no longer acts as a ventilator. The plan is then to allow no pipe either inside or outside the house to be connected with the sewer, except the soil-pipe, which should descend outside the house directly into it and should be wide open at the top, and no pipes but the discharge pipes of the water-closets themselves should be allowed to be connected with the soil-pipe, while neither the waste-pipes of cisterns, sinks or baths, should, if it can be avoided, be directly connected with any part of the water-closet apparatus, soil-pipe, or sewer.

Conclusions about pipes.

The more freely water-closets communicate with the open air the better. They may be ventilated in an infinite variety of ways, but the principle in all cases must be the provision of two openings between which a current will be established in one direction or the other. If possible, there should be a double door between them and the staircase of the house, the space between the two doors being ventilated to the open air. The best form of window for a water-closet is one that swings on a horizontal axis situated half-way between the top and bottom. M'Kinnell's ventilator is a very useful one for closets which have nothing above them, and its action is accelerated by placing the jet of gas which serves as a light at night beneath the exit shaft. This ventilator, it may be observed, consists of two shafts—one inside the other, the inside one rising into the open air to a higher level than the outside one, and having at its lower end (that is, in the room) a broad rim, between which and the ceiling a small space is left, communicating, of course, with the interval between the two pipes, so that air goes into the closet or room between the ceiling and the rim of the inner pipe, while air escapes by the inner pipe. In many cases, a single shaft may be taken either up through the roof or horizontally, or in any convenient direction, out into the open air, so that a current may be established between the window and such shaft. This shaft must be protected at the top with a wire gauze to

Ventilation of W. C's.

M'Kinnell's ventilator.

Shafts.

keep out the birds, and it may have pieces of wood or of zinc fastened to its sides inside, and inclined upwards (in a vertical shaft) so as to form receptacles for the blacks, &c., that would otherwise be brought into the closet.

Divided by a partition.

Where there is no window, this shaft may be divided by a partition, in which case a current of air will pass up one side of it and down the other, and each partition may have these shelves to catch the blacks placed alternately on one side and the other, so that the air is obliged to descend in waves. The action of such double shafts is very much promoted by making the two divisions end at different levels in the open air, and they may be even made to end at different places in the closet itself by prolonging one or other of them, and the one that is intended to act as an

Action of.

exit, that is to say, the one that is made to end externally at a higher point than the other—may have an upward current of air caused in it by placing the gas-jet or other light below it. In this way, closets in the most confined situations, without any window whatever, may be ventilated satisfactorily, and in these cases it is sometimes convenient to carry the small leaden pipe which ventilates the container out through the exit pipe of the ventilating shaft, of course making it end at some distance above the

Cover of shaft.

latter. The shaft itself will require to be covered over by same slanting top projecting over the apertures which lead into it, so that rain may be kept out of it. With out-of-door closets it is a very good plan to have holes bored along the top of the door, or even to have a piece cut off it all along the top; but with in-door closets every precaution should be taken to prevent the possibility of the introduction of air into the staircase from the closets. Of course, this precaution is still more necessary when the closet opens, as it frequently does, into a room. It is well,

Doors of closets.

indeed, to have springs on the doors of closets, to keep them always shut, and draught-preventers fastened along the posts and lintels to prevent air getting from the closet into the house. The first principle of the ventilation of a water-closet must be that it be entirely separate from that of the house.

The necessity for taking these precautions is, however,

of course less, as the ventilation of the closet apparatus and house-sewer is more complete, and, in a perfectly arranged water-closet, there is very little necessity for them, if the pan and the water in it are kept always clean.

In houses where many people are gathered together, as model lodging-houses, for example, and where the closets are each used by large numbers of people, they should be placed either externally to the building itself, being connected with it by passages from each floor, roofed, but not closed in at the sides, or they must be placed at the ends of the corridors, so as to project from the main building, in order that a cross draught may be established by having opposite windows in the corridor, between the main building and the water-closets. It is necessary that someone should be appointed to attend to them, or it will be nobody's business, and the persons using them may be required to take this duty in turn. Model lodging-houses.

Urinals.

Urinals are best made with slabs of slate, or with glazed stoneware, but however they are constructed they will necessarily become a nuisance, unless they are well supplied with water, and they are much better supplied by a small amount continuously, than by an occasional flushing with a larger one. The reason that they become foul if they are not kept constantly clean, is that the urea contained in the small quantity left on the slab, or in the basin, becomes changed into carbonate of ammonia, thus rendering the film of liquid alkaline, the result being that the phosphates and lithates are no longer held in solution, and are precipitated along with organic matters contained in the urine. These latter soon putrefy, giving off an odour, which, combined with that of the ammoniacal salt, constitutes the offensive smell of urinals. Urinals. Offensive odour.

In public places, it is sufficient that they should be well trapped, and connected with a ventilated sewer. In houses their discharge-pipe should be trapped in some way or other as soon as possible, as the pipe itself is very liable to become lined internally by an offensive deposit, and urinals that have even a small length of pipe communicating freely Discharge-pipes.

with the basin are sure to be a nuisance for this reason; and on the other hand, the discharge-pipe must not open into any pipe, as a waste-pipe or sink-pipe, communicating with some other part of the house, or an offensive smell will rise up this latter pipe; the discharge-pipe in question may be made to end below the surface of the water in the D trap of a closet, or in a ventilated soil-pipe or sewer, or still better in the open air over a trapped grating.

The forms of urinals are almost infinite in variety, the most cleanly, especially for public places, being those which consist essentially of a trough filled with water, which is continually escaping into the sewer, and being re-supplied from a cistern.

Disinfection.

A little crude carbolic acid is sometimes placed in the water supplied to a urinal (a practice now carried out at some railway stations), and other disinfectants may be used, provided they are such as keep up an acid reaction. Animal charcoal is also sometimes placed in urinals with the view of keeping them sweet.

Drainage.

It has been long known that upon the dryness or wetness of the soil upon which habitations are built, the sanitary condition of a population to a great extent depends, but it is only within the last few years that it has been ascertained by the researches of Dr. Buchanan on the results of sewerage and drainage upon the health of certain towns (see Ninth Report of the Medical Officer of the Privy Council)

Phthisis.

that one of the great causes of phthisis in a population is the dampness of the soil upon which it lives, and on the other hand we have Dr. Pettenkofer, of Munich, asserting that the distribution of cholera in a country depends entirely upon certain conditions in the level of the subsoil water. In all towns which have been so sewered that their sewers act also as drains, and are, as we have called them, 'drain sewers,' whereby the subsoil water of the town has been lowered, the death-rate from phthisis has decreased, sometimes to a very remarkable extent; in one case, that of Salisbury, the decrease having been as much as fifty per cent.: while in other towns which have been so sewered with impervious pipes throughout, that the level of their

Decrease with lowered subsoil water.

subsoil water has not been lowered, the death-rate from phthisis has not decreased, but, on the contrary, has in some cases increased. This shows us, in the first place, that brick sewers (the invert only being constructed with cement) do, as a matter of fact, act as drains, and do lower the level of the subsoil water beneath the houses; and, in the second place, that where pipes are used for mains this result is not effected, so that wherever pipes are used throughout a system of sewerage it is absolutely necessary in the majority of instances that drains should also be provided for the drying of the subsoil. It has indeed been proposed by Mr. Menzies to separate in all cases the sewage, properly so called, from the surface waters. He proposes to have a double system, consisting of impervious sewers to carry off the refuse water and excretal matters of the population, and superficial drains to carry the surface waters into the nearest water course; but this plan does not provide for the drying of the subsoil, and although it is advisable, for several reasons we need not discuss here, to keep as much extraneous water as possible out of the sewers (reserving, however, always the power of turning it into them if necessary), yet for the sake of this we must not sacrifice the drainage of the subsoil. There can be little doubt that, besides phthisis, other diseases, especially scrofula and rheumatism, are favoured by the dampness of the soil, although according to Dr. Buchanan's researches, no such influence was noticed upon lung diseases (other than consumption). It is necessary to mention that Dr. Pettenkofer considers that the spread of cholera can only take place in localities where there is a porous subsoil, containing putrescent organic matters, with a subsoil water which is liable to fluctuations of level, and that he is of opinion that enteric fever is subject to similar conditions. This makes the drainage of the subsoil a still more important consideration.

Otherwise not so.

Separate plan.

Other diseases.

NOTE.—Whatever be the state of the subsoil, the basement of each house should be rendered as dry as possible; there should be an air space between the basement floor and the ground, which should be ventilated by means of air bricks in the walls; it is a great advantage to have a layer of con-

crete three or four inches thick spread over the ground beneath the house, and when a new house is built a damp-proof course should be inserted in the walls near to the ground to prevent the rising of moisture up the walls; these latter are however matters upon which the medical officer has at present only the power to tender his advice; he has, practically speaking, no control whatever over the erection of dwelling houses.

Outfall Sewers and Treatment of Sewage.

The outlet of the main sewer of a town, called the 'outfall,' is of essential importance with regard to the health of a community; the first rule about it is, that it should be large enough to allow all the sewage which can ever be discharged from the place to pass easily through it; the next point, which is of still greater importance, is, that it should be perfectly free. In many instances, especially in towns on the seaside, or at the mouths of tidal rivers, and in other cases, the outfall is so low, that for some reason or another, sewage is blocked up in the main sewers at certain times. When outlets are made into the sea, the tide rises into them and backs the sewage up in the mains, and even occasionally into the cellars of houses. If, as is usually the case, a flap be placed at the outfall, then the sewage during the rise of the tide is collected in the outfall and main sewers, and the gases which rise from it pass upwards into the town. The same is the case when sewers empty themselves into rivers below the water line, and the same, too, is frequently the case when the outfall is into a tank, out of which the sewage has to be pumped to be got rid of; for in the latter case the pump or pumps may be out of order, or may not be sufficiently powerful to keep the sewage below the level of the outfall, when, as in wet weather, there is an excessive discharge. In all these cases, then, the freest ventilation of the main sewer in the town is more than ever necessary.

Outfall large and free.

If not free, sewage backed up.

Where there is an impediment offered to the escape of sewage from the mains, the sewering of towns has not been accompanied by the usual diminution of the death-rate from enteric (typhoid) fever, or there has even been an

Enteric fever.

increase in the death-rate from this disease, especially if in addition to this defect, the sewers have not been properly ventilated. Thus, at Chelmsford there was a slight increase in the death-rate of enteric fever after the execution of the sewerage works, and also an appearance of diptheria in the town; but the sewage is delivered into a tank by an outfall sewer which enters some six feet below ground; the result being that it occasionally accumulates in the main sewers, although precautions are taken to prevent its doing so, and is even forced up into the cellars. At Worthing, there was a very considerable increase in the death-rate from enteric fever after the sewerage arrangements were carried out. The sewage is there received into pumping works in a similar manner, and, moreover, no provision for the ventilation of the mains was at first provided, and it was observed that the fever especially attacked persons living in houses high up in the town which had the most direct communication with the sewers, and that it subsided as soon as proper ventilation of the main sewers was provided. It is, then, the duty of the medical officer to point out the danger that arises from want of free ventilation of the sewers—and also from the confinement of sewage in the outfall sewer in either of the ways just mentioned.

Instances of faulty outfalls.

The outfall of most towns is made to discharge the sewage either into the sea or into a river, and thus a great deal of fertilising material is thrown away. It is not our purpose here to discuss in detail the different methods which have been proposed for utilising the valuable matters contained in sewage—it is, however, worth while to mention that the annual value of the sewage of London has never been estimated at less than a million sterling, and that this is all thrown away—but it is with the results of this method of riddance that we have to deal. Where sewage is turned into the sea (provided the outfall is at a sufficient distance from the town, and that currents do not set towards the latter), no nuisance is likely to be experienced, but when, as in many cases, the sewage is discharged close to the town, or over the beach in front of the houses, the nuisance becomes considerable, and the danger great. Where, on the other hand, sewage is discharged into rivers, even with

Waste of manure.

Discharged into sea.

Into rivers: danger.

due provision to prevent backing up in the mains, two kinds of danger arise:—the one, the formation of banks of sewage-mud in the course of the river, which help to block up its channel, and which, when left high and dry (as in the case of a tidal river), give out pestilent emanations; and the other, from the pollution of the water itself. The banks so deposited, in the case of tidal rivers, may be formed above the outfall of the sewage, and this is the case in the Thames. A report issued in 1867 showed that even 2,000 feet above the northern outfall a considerable depth of mud had been deposited, which, from its situation, certainly came from the sewage, the thickness, in some places, of this mud being seven feet; and, since 1867, there is evidence to show that the amount of it in certain places has increased, while experiments on this head leave no doubt as to the fact, that the tide carries up the suspended matters of the sewage and deposits them considerably above the point at which they are discharged into the estuary. It is therefore plain, that in the case of a tidal river, the outfall, if into it at all, must be so far below the town that there is no chance of the sewage being brought back into the town again by the rising tide. But the next point, the pollution of rivers by their admixture with town sewage, requires more careful attention. The danger, of course, increases the smaller the bulk of the river is in comparison with that of the sewage. Small rivers may be, and frequently are, converted into open sewers, from the discharge of sewage and other refuse matters into them, and although it is difficult to determine the effect of emanations from such open sewers upon the health of a population, on account of the numerous other sources of disease among crowded populations, still there can be no doubt that the effect is bad. It is, however, when we come to consider the fact that most towns derive their water-supply in the present day from the rivers upon which they stand, that the importance of not allowing these rivers to be polluted comes into prominence, and when the medical officer is called upon to advise as to the best means of dealing with the refuse matters of a community, although it is his duty to advise in the first place that they be got rid of as speedily and as effectually as possible, it is also his

Mud-banks formed.

Pollution of rivers.

Water-supply.

duty to insist upon this being done without detriment to other towns. It has been frequently stated, and is still maintained by many, that organic matters are so speedily oxidised when brought in contact with the oxygen dissolved in river water that they are destroyed, or rather converted into innocuous substances, after a flow of a comparatively short distance. There can be no doubt that such is the case to a very great extent, but we are perfectly sure that such is not the case to the extent to which it has been stated to be so. It is impossible for us to be satisfied that all the organic matters in sewage, which may include the poisons of special diseases, are destroyed in a river, whatever be its length. We know, from Dr. Frankland's experiments, that the removal of such organic matters in this way is much slower and much less perfect than is generally supposed, and the conclusion that he came to was, that 'there is no river in the United Kingdom long enough to effect the destruction of sewage by oxidation.' It is quite clear that unless we were perfectly sure that all organic matter discharged into a river in this way was perfectly oxidised after a short flow, we should not be justified in recommending water which had been so contaminated to be used as a supply for domestic purposes. We find, from Mr. Simon's report, that the cholera, during the epidemics of London, in 1848–49, and 1853–54, was most prevalent in those places which had questionable sources of water-supply, and that the death-rate from it was lowered in places where the improved water-supply was secured. There can be no doubt whatever, that his dictum, 'it ought to be made an absolute condition for a public water-supply that it should be uncontaminable by drainage,' or, as we should say, by sewage, is the correct guide to take. It is obviously absurd to pollute water first and then resort to filtration and other expedients to make it presumably fit for drinking afterwards, yet this is what is continually done, and there is one instance of a town which turns its own sewage into the river at a particular point, and derives its water-supply from the same river a mile lower down.

Oxidation during flow.

Only proceeds slowly.

Cholera and polluted water.

But if we can no longer allow sewage to be got rid of in this way, accompanied as it is both by waste and

Treatment of sewage.

danger to the health of the communities, what is to be recommended as the best plan to deal with it? All the attempts to prepare a solid manure out of it, whether by merely straining off the suspended matters, or precipitating these together with certain of the dissolved matters by means of some other substances, and then letting the so far purified water into a stream, have only to be mentioned to

Inefficiency of precipitation methods.

be condemned as inefficient for the purpose, from both the economical and sanitary points of view. By them the valuable materials are not and cannot be utilised (the suspended matters in themselves being of very little value, and the matters which can be precipitated from solution being small in amount), while in several of these processes, either valuable materials contained in the substances added are in part lost, or worthless materials added in such quantity that the manure, such as it is, is of very little value; and, on the other hand, the water that is allowed to run into the river contains by far the greater part of the soluble matters of the sewage, and is certainly not freed from the dangerous polluting properties that the sewage originally possessed.

If then it is useless, as it appears to be, to attempt by chemical or mechanical methods, or by both combined, to render sewage sufficiently pure to be turned into watercourses which are afterwards to be used for the supply of water for domestic purposes, the only thing that remains is

Filtration and irrigation.

either to filter it through some large mass of porous material, or to turn it on to the land and use it directly as manure. The latter method has been employed for a very considerable time at various places with tolerably good results. The former one has lately come prominently into notice through the experiments of Dr. Frankland, the results of which are published in the first report of the Rivers' Pollution Commissioners (1870). The results of these experiments show that if sewage be passed downwards through filter beds of sand or soil of various kinds,

Intermittent downward filtration.

the process being conducted intermittently, it is satisfactorily purified. It was moreover found that the nitrogen which existed in the original sewage, either in organic matter or as ammonia, was found in the effluent water in the form of nitrates and nitrites; that is to say, that oxi-

dation took place during the passage through the filter. It was also shown that the process of upward filtration through the same materials did not cause such purification. The success, then, of filtration depends upon its being downward and intermittent—that is to say, ample time must be left for the introduction of air into the pores of the filtering material to ensure the oxidation of the organic matters and ammonia contained in the sewage. This plan has been applied practically on a large scale at Merthyr Tydfil, where an area of about 20 acres has been laid out in square beds and pipe-drained at a depth of about 7 feet, so as to be used as a filtering bed. It consists (according to the Fourth Report of the British Association Sewage Committee, read at Brighton in 1872) 'of a deep bed of gravel (probably the former bed of the River Taff, which is embanked upon the east side, and is raised above the valley), composed of rounded pebble of the old red sandstone and coal-measure formations, interspersed with some loam and beds of sand, forming an extremely porous deposit, and having a vegetable mould on the surface.' . . . . . 'The sewage before being turned on to the filtering-bed is screened through a bed of slag, which arrests the coarser matters. It is applied to the land intermittently, for, the area being divided into four plots or beds, it is turned on to each one for six hours at a time, leaving an interval of 18 hours for rest. The surface land was cultivated to a depth of from 16 to 18 inches, and laid up in ridges, in order that the sewage might run down the furrows, while the ridges were planted with cabbages and other vegetables.' Thus, it will be seen, that, in this case, the surface of the filtering-bed has been turned into a sewage-farm. The results of the examinations of the process, as carried out there, made by the Rivers' Pollution Commissioners, and by the British Association Committee, have been very satisfactory, so far as the *purification* of the dilute sewage there treated is concerned, and this is all that can be expected of the process; nevertheless, the fact that the surface of filtering-beds may be planted with vegetables, which will materially assist in the purification of the sewage, is a very important one, and shows, that although it cannot be said that this is a

Practically applied.

Surface of filters utilised.

Manure not all wasted.

process for the utilisation of the manure, yet it is not entirely wasted. The British Association Committee show, from the results of their analyses, that the effluent water from these filters contains, chiefly as nitrates and nitrites, the same amount of nitrogen that the original sewage had in solution, as organic nitrogen and ammonia, so that the amount retained by the filtering-beds and by the crops is approximately equal to the amount contained in the suspended matters of the sewage. They also state that during the winter the purification was more efficient than during the summer, but, that even during the summer, four-fifths of the nitrogen in the effluent water was in the form of nitrates and nitrites. It is clear, then, that if sewage can be satisfactorily purified by being passed through the soil, so that the effluent water is sufficiently pure to be allowed to flow into watercourses, the more the area of the soil is extended the greater chance will there be of more perfect purification. But in order that this may take place, it is obviously essential that the sewage should pass *through* the soil, and not merely over it, and it is also plainly as essential that unless the natural drainage of the land be quite sufficient, recourse must be had to artificial drainage, in order that the soil may not become saturated with water; for we have seen that it is necessary for filter-beds (and irrigation farms ought to be nothing more nor less than filter-beds on a very large scale) to be aerated, in order to ensure a satisfactory purification of the effluent water. Many farms have, however, been laid out upon what the British Association Committee call 'the saturation principle.' They are not underdrained. The sewage is turned on to the land at the highest point, and is allowed to flow downwards by gravitation over the surface, which it can only do as soon as it has sufficiently saturated to a certain depth the soil with which it first comes in contact. In these cases, with a sufficiently luxurious vegetation, the effluent water may be satisfactorily purified, but at other times, and especially in winter when growth is at a minimum, such is not the case, and the effluent water from farms constructed on this principle is little better than diluted sewage, and, indeed, the British Association in their Third Report mention an instance in which the water which

Extension of area.

Saturation principle.

Essentially wrong.

had passed over one field was actually rendered more impure, as regards the amount of organic matter and total solid constituents it contained, by passage over a second field. It is obvious that, by this saturation plan, the principle of filtration through aerated soil is entirely given up. The sewage-farm is converted, for the time being, into an area saturated with foul water, reliance being placed for its purification entirely upon the amount of vegetable growth. It is found that the purification effected where sewage is passed through a sufficient depth of soil into drains, as at Breton's farm, near Romford, is as great in the winter, without the aid of vegetation, as it is in the summer with it. On the other hand, it has been satisfactorily shown that purification is only very partially effected in winter, where the sewage is not made to pass through the soil. The soil must then be porous, and, if not originally so, it must be made so by the aid of ashes, &c., and, as the Committee before mentioned remark in their Third Report, 'if drainage is necessary where no water is artificially supplied to the soil, it cannot be *less necessary* after an addition to the rainfall of 100 or 200 per cent.'

Comparison of the two plans.

Necessity of drainage.

But a great deal has been urged against the general introduction of sewage farms from a sanitary point of view, and the medical officer may very probably be required to give his opinion upon the advisability of treating sewage in this manner. It is, therefore, well that we should examine a little into the evidence on this head. There can be no doubt, in the first place, that if sewage farms are made into marshes, as is the case about Milan, and as is also the case to a certain extent where the saturation principle before spoken of is adopted, the endemic diseases peculiar to marshy places may be expected to arise, and we consequently find it reported by the Sewage Commissioners that near to Milan 'the population who lived in the midst of and close upon irrigated lands are subject to the same diseases as are common wherever extensive tracts of vegetation are alternately covered with water, and then exposed, when comparatively dry, to the action of the atmosphere under a hot sun.' The same is true, as we all know, with rice and maize plantations, which are freely irrigated with

Sanitary considerations.

Must not be marshes.

water, and it has nothing whatever to do with the water being sewage water; that is to say, it occurs equally, so far as can be ascertained, where ordinary river water is used in the same way. These marsh diseases are strictly endemic, and do not extend from such irrigated meadows to the towns near. On the other hand, the evidence with regard to the probability of the spread of cholera, enteric fever, and other diseases, the poisons of which are known to be contained in human excrement, is as conclusive as possible. It was found at Milan that these diseases were not one whit more prevalent on the irrigated lands than anywhere else, and that even during three epidemics of cholera in the town and neighbourhood no case occurred upon the irrigated meadows; that is to say that diseases that we should expect might possibly be spread abroad by such a method of disposing of sewage are not spread in this way at all. Similar evidence can be produced from Edinburgh and from other places where irrigation has been practised for some time, and often not in so satisfactory a manner as could be wished. It is clear, however, that if it be so carried out, either by too much sewage being turned on to the land for too long a time, or by the sewage being allowed to flow over saturated land, as is too often done, the effluent water is but little better than sewage. The noxious organic matters contained in it not having been oxidised, danger will arise when such water is admitted into streams from which supplies of drinking water are taken, and thus we find, quite recently, that some cases of enteric fever occurred among some people near Northampton, who drank water out of a brook that had been polluted in this way; but Dr. Buchanan reported that 'out of 120 people at work upon the sewage farm itself there is no single case that can be affirmed to be fever, and the only case of illness that can be heard of is a case of diarrhœa;' and, he adds, 'there is nothing to tell of mischief done by the sewage farm itself, even to persons who were themselves employed on the farm under exceptionally favourable conditions for breathing exhalations from the sewage.' Now, there can be no doubt that this ought not to have happened at all, and that it would not

Cholera and enteric fever.

Results of saturation system.

Water of a brook polluted.

have happened had the sewage all passed through soil before being turned into the stream. Of course, if sewage containing the poison of enteric fever is turned into a stream and people drink the water of that stream afterwards, they will be liable to get enteric fever, and for this purpose it can make no difference whether the sewage is turned directly into the stream or allowed to run into it off saturated land. This case, it is hoped, will be especially useful in preventing the establishment of irrigation farms upon a false and dangerous principle. The passage of sewage through soil seems to be the most effectual way of destroying the poisons of such diseases contained in it; and it cannot be doubted that drainage improves the condition of the farm from an agricultural point of view. Indeed, in the Fourth Report of the British Association Committee, a case is given in which, on the South Farm at Tunbridge Wells, 'a field of beans was noticed, one portion of the crop being very heavy and healthy-looking, and the other very poor and stunted. On inquiry, it was ascertained that the whole field had been equally sewaged, but that the portion where the crop was so good had been drained four feet deep during last winter, the other portion being left undrained,' so that we have now sufficient evidence, both economical and sanitary, to insist that sewage-farms shall be constructed as large filter-beds. The nuisance, if any, caused in the immediate vicinity of these farms is produced entirely by the suspended matters in the sewage, which ought to be separated, in some way or other, before the latter is turned on to the land. This is usually done by allowing them to deposit in settling-tanks, which tanks also serve for the storage of any inordinate supply of sewage during wet weather, and the sludge which forms at the bottom of these tanks, together with the crust at the top, may cause a considerable nuisance, especially during its removal. It is desirable that this sludge should be de-odorised by the addition to the sewage itself of some substance which will not injuriously affect it as a manure, that is to say, if the tanks are so placed that anyone is likely to be affected by the nuisance caused during the cleaning of them. Some one or more of the precipitation processes may, perhaps, be found

Necessity of filtration.

Lesson taught.

Advantage of drainage.

Nuisance from suspended matters.

Tanks.

Deodorisation.

to answer this purpose satisfactorily. The only one we need mention, is one that only professes to deal with these suspended matters—that invented by General Scott, which consists in the addition to the sewage in the sewers in the town, of a mixture of clay and lime. The result is, that the sewage is de-odorised while in the sewers, and the precipitate which forms in the tanks contains a large excess of clay and lime, with sufficient organic matters precipitated from the sewage to burn itself into cement when placed in a kiln, the fire under it being merely started by a few coals—the process causing no nuisance, and the effluent water passing off in a condition eminently fitted to be applied to the land. The cement prepared, may also (General Scott suggests) be used as manure for land which requires the use of lime, containing, as it does, a considerable proportion of phosphoric acid. In other places it may be used as cement.

General Scott's process.

Effluent waters and cement.

It has been also stated, in the first place, that cattle will not eat the produce grown upon sewage-farms—a statement which we think will hardly be repeated; and the same may be said of the allegation, that diseases of cattle, such as the rinderpest, and the foot and mouth disease, are propagated in the same way. Evidence to the contrary has been produced, but it is not our place to discuss it here; a more important point for us, is the suggestion that entozoic diseases will be propagated to a great extent directly in cattle, and indirectly in men, through the spread of sewage over the land, by means of sewage irrigation. The original suggestion of Dr. Cobbold, that the *Bilharzia hæmatobia*, a parasite common in certain parts of Africa, and especially prevalent in the summer months, can be introduced and brought into this country in such a manner, we may dismiss at once, as Dr. Cobbold himself has shown that the embryos of this parasite are destroyed in a very short time in impure water, as ascertained by experiments, which, he says, as regards this parasite, at any rate, 'undoubtedly appear to favour the notion that little harm can result from sewage distribution, so far at least as parasitism is concerned.' But with regard to parasites to which we know that herbivorous animals are subject in this country, the question

Cattle diseases.

Entozoa.

Suggested danger.

becomes a more serious one, the suggestion being, that the ova of these parasites contained in the sewage are distributed on to the land and eaten by the cattle with their food, undergo a stage of development in them, and a still further stage in the human subject when the meat of such cattle is eaten without being properly cooked. The first question which naturally arises is, what facts are there to show that such diseases have been propagated in this way? The answer from all hands being, that there are none. Irrigation has been practised, as before stated, for many years near Edinburgh, and Professor Christison asserts that he has not been able to trace a single case of parasitic disease to this source. But we are told that entozoic diseases, especially in cattle, are not usually recognised at all, and that if they were looked for, they would, no doubt, be found. The answer to this is, that we do know in what countries entozoic diseases are particularly prevalent, and that if any such result had taken place upon any sewage-farm in the country it would undoubtedly have been found out by the farmers, or by the medical practitioners in the neighbourhood, as public attention has been now drawn to the subject for several years. But more than this, the British Association Committee instituted two kinds of experiments. The one consisted in examining the slime and mud from the bottom and sides of some sewage-carriers at the Earlswood farm. It was found that although these matters contained a considerable amount of animal life there were no ova of entozoa among them. As Dr. Cobbold says, 'the flaky vegetable tufts collected by me from the sides of the furrows occupied by sewage-currents consisted chiefly of *Batrachospermum moniliforme*, in the filaments of which were numerous active free nematodes, but no ova of any true entozoon,' and more than this, the carcase of an ox, which had been fed for 22 months upon sewaged produce grown at Breton's farm, was examined by Dr. Cobbold, Professor Marshall, and the writer, in the presence of several members of the Committee, the result being, that no trace of parasitic disease could be found in any part of the body by the most careful examination. Dr. Cobbold also points out, that upon these farms there is a remarkable absence of those molluscan and insect

Not borne out by facts.

Experiments on this point.

Negative results.

Absence of molluscs, &c.

forms of life which frequently play the part of intermediary bearers to the larvæ of entozoa—a very important point, as if these creatures are killed, or driven away, by the sewage, it is plain that many of the parasitic diseases cannot possibly be propagated by means of sewage-farms. Moreover, we have evidence to show that certain creatures, which are very destructive to crops, may be killed by irrigating the land with sewage. Thus, in the third report of the British Association Committee, we are told that a crop of American oats 'was seriously damaged, and in danger of being destroyed by the ravages of the *Oscinis vastator*, one of the smallest but most destructive of those 'grubs' and 'wire worms,' which at times cause such injury to cereal crops in this country. The remedial effects of sewage irrigation under similar circumstances having been previously observed elsewhere, two heavy dressings of sewage were applied to this bed during two successive days, the result being that the grubs were entirely destroyed, and the greater part of the crop was saved.' Whether this effect would have been produced by clean water, as well as by the foul water, we do not at present know. Again we are not sure that the impregnated ova of intestinal worms ever get alive on to the sewage-farm; being naturally inhabitants of acid excretions, they are turned into a liquid alkaline from excess of ammoniacal salts, and are churned about in it during its passage along sewers for a considerable distance: a great proportion of them is, no doubt, deposited with the sludge in the sewage-tanks; and such as do get on to the land, if the sewage is made to pass through the soil, as it ought to be, are carried down into the pores of the soil, and so disposed of. There is no need that cattle should graze on sewaged meadows, although they do so with avidity, and no evil consequences have been traced to this procedure; but with grass cut and carried to the stalls it is hardly possible to imagine any danger arising. Indeed, if human excrement is to be used at all as manure, it is obviously better, from this entozoal point of view, so to speak, that it should be distributed on the ground itself, by means of water, than that it should be spread abroad over meadow-land after the fashion in which farm-yard manure is

Destruction of wire-worms.

Vitality of ova.

Comparison with usual mode of distribution.

ordinarily distributed. But even taking the worst point of view, and supposing a certain increase of parasitic diseases from the use of sewage in this way; is not this an evil which would be far more than counterbalanced by the enormous gain to the community, especially from a sanitary point of view, which is acquired by the removal and satisfactory purification and utilisation of their most offensive refuse matters?

Advantages from worst point of view.

Dust.

Under this head we include the house refuse that accumulates in places where any system for the removal of excretal matters other than the midden and ash-pit plan is at work. This refuse consists in the main of ashes and cinders, but if this were all it would not be of great importance from a sanitary point of view. The dust-bin is, however, a convenient receptacle for all kinds of refuse—vegetable and animal. Everything that is not wanted in the kitchen is thrown into the dust-bin, and so these receptacles become a source of nuisance. This might be altogether prevented if people would have such refuse matters as are likely to produce offence burned.

Contents of dust-bins.

In places where much brick-making is going on, this dust is valuable, and contractors pay for the privilege of removing it, and then the scavenging is well done; but in places where, as in London at present, nothing can be got for the dust, and the contractor has, perhaps, even to pay for being allowed to shoot it at a particular place, it is plainly to his interest to collect as little as he can, and so the scavenging is, as a rule, very inefficiently performed, and the sanitary authority has to investigate cases of neglect or refusal to remove the dust and fine the contractor from time to time for not acting up to the provisions of his contract. As an example of this state of things, we may take the case of the parish of Islington, with about 27,000 inhabited houses. For the removal of dust from June 1866 to June 1867, the vestry received from contractors the sum of 2,200*l.*, and from June 1871 to June 1872, the vestry paid to the contractors the sum of 4,057*l.* That is to say that from the fact that the dust had become worthless the loss to the parish for 1871–2 as compared with

Value of dust very variable.

Instance of Islington.

1866–7 was no less than 6,257*l*. A plan was adopted which it would be well to adopt in all similar cases. It was as follows :—Cards with the letter 'D' printed on one side of them, and directions on the back, were sent to the inhabitants, who were instructed to place them in a conspicuous place in the front of the house—as in the window of the ground floor—whenever they wanted their dust removed, and the contractors were held liable to penalties for not removing the dust from houses in which the 'D' had been properly exhibited for a certain number of days. Another advantage of these 'D's' was that the sanitary inspectors took notice of such of them as happened to be exhibited in the streets through which they passed, and reported them daily. This, however, not being found to be sufficient, a special inspector of dust was appointed, in addition to the three sanitary inspectors—at first temporarily and afterwards permanently; the investigation of the complaints about the non-removal of dust, and the business of seeing that the contractors carried out their work according to the contracts, and removed at the earliest opportunity dust from houses about which they received special orders, being found fully sufficient to occupy one man's time. To work such a system as this requires a regular set of books and very careful management. On a complaint being received at the office that the dust requires removing from a particular house, or on the dust inspector, or one of the sanitary inspectors, reporting that such is the case, an entry is made with the date, and at the end of the day a list of such places is sent to the contractor, being written on one half of a leaf of a book kept for the purpose. Upon the other half of the leaf which remains in the book is written a counterpart of this list. The scavenger is then bound to remove the dust from these houses within a certain short time—say two days—and it is the business of the inspector to report when this is done, so that the same may be duly entered and the contractor fined, if it be thought necessary, in cases of neglect. The contractor should be bound to remove the dust from public dust bins at certain intervals —say twice a week—and to clean out all courts and alleys once a week, and this without a special notice, a general

'D' cards.

Special Inspector.

Working of system.

Public dust bins.

one given once for all being sufficient. There may also be public institutions, about which there is a general notice given for removal at certain stated intervals, and it is a finable offence to neglect any of these places. He is also bound to send a cart or carts with his name and a number upon each along every street at least once a week; the men in charge of the cart being required to cry 'dust.'

Visiting o streets.

Like all receptacles for refuse matters, dust bins should be as small as possible, so that no large collection can accumulate in them; and it would be a great improvement if they were done away with altogether, and the dust, &c., of each house placed outside in a portable receptacle of some sort for the scavenger to remove every morning. The Paris plan is certainly better than ours in this respect, for the people, late at night, simply shoot their dust into the street in front of their houses. It is well picked over during the night by the *chiffoniers*, and is all carried away early in the morning by the scavengers, who are bound to keep the streets clear of it.

Portable receptacles.

The value of dust consists, in the first place, of articles of value that are found in it, and have got there accidentally; then pickings and sortings of various sorts, such as pieces of old iron, rags, paper, bones, old bottles, &c. In the third place, what is termed 'hard core,' which is made up of broken china and earthenware, together with a quantity of miscellaneous refuse which has no special value. This is used for the making of roads. Cinders, which are used in the burning of bricks, and finer ash; and lastly, 'soft core,' consisting of the intestines of animals, and all kinds of animal and vegetable refuse matter.

Value and composition of dust.

To show the magnitude of this work, we may add that in the parish alluded to, from June 1871 to June 1872 the contractors were required in writing from the sanitary office to remove the dust from no less than 27,814 premises, and out of these orders 14,841 were in consequence of applications from parishioners.

Magnitude of the work.

It is worth while noticing here that it has been decided that 'clinker,' or refuse from fuel used in manufactures and trades, is not a trade refuse, and that the contractor is bound to remove it as dust.

Clinkers to be removed as dust.

The upshot of all this is, that when dust is valuable, nothing is easier than to get it removed satisfactorily by contractors, and they will even prosecute persons for not giving up to them the article for which they have paid—for using it on their gardens, for instance; but when dust is worthless, and especially when it becomes a cost, it is, practically speaking, impossible to get it properly removed in this way, and the sanitary authority will do well to take the matter into its own hands, and employ its own servants to remove the dust. It will thus be done cheaper and more effectually. This has already been done in certain parishes with very good effect.

Difficulty when dust is valueless.

The midden system and other similar plans solve the difficulty by mixing the ashes with the excrement and removing them both together—that is to say, they convert the ash-pit or dust-hole (which is bad in itself, and which we wish to get done away with) into a midden heap, which is ten times worse. Such a plan ought not, and we hope will not, be long tolerated anywhere.

Midden system worse.

CHAPTER IV.

WATER SUPPLY.

ALTHOUGH in many places the medical officer of health will have nothing to do with the sources of water supply, or rather will have less direct control over this than over any other part of the sanitary arrangements of the community, still in many instances it will be his duty to advise the discontinuance of certain supplies or the adoption of new ones, and besides this, he will have to combat the various sources of pollution to which water is exposed when it gets into the town and into the houses.

Medical officer to advise as to supply.

With regard to the sources of water, a few general points may be laid down. Rain is the original source of all water supplies, but the water is collected in very different ways. In the first place, wells in the subsoil of towns ought not to be used to supply water for drinking. Although it may not contain a large amount of organic matter, such water always contains the results of the oxidation of organic matter, viz., nitrates and carbonates, and may at certain times, and perhaps frequently, become noxious from the passage into it of unoxidised putrescible organic matters. In towns where there are midden heaps and cesspools, this caution against the use of subsoil water is still more necessary, as these often, to a great extent, supply the wells. In one instance which came under our notice during the investigation of an outbreak of enteric (typhoid) fever, the use of a particular pump had been pretty generally discontinued by the neighbourhood because the water became green and offensive. Shortly afterwards, when a portion of the wall behind the pump fell down, it was discovered that a midden pit, nearly full

Well water often impure.

Especially where middens and cesspools.

of semi-liquid excretal and other filth, was just on the other side of the wall, and, in fact, directly over the well from which the pump drew. But this caution is also necessary in towns that are sewered, because what with old brick drains, cesspools not yet abolished, sewers faulty in construction or accidentally damaged, leakages of gas, and a thousand other sources of impurity, the subsoil waters of a large town cannot be sufficiently pure to be safely used for domestic purposes.

But also where faulty sewers.

But if, instead of superficial wells (which may indeed go to a considerable depth in the subsoil without the character of their water being much improved), we have wells specially constructed so as to keep out the subsoil water—that is to say, lined with masonry constructed in cement, and at the bottom of these wells borings through impervious strata into water-bearing strata beneath—the circumstances of the case are quite altered. These, which are known as 'artesian wells,' often afford a very large supply of excellent water, which rises through the boring into the well, and either overflows or has to be pumped out of it. This water is derived from the rainfall of districts at some distance, where the outcrop of the water-bearing stratum tapped appears—that is to say, where this stratum comes to the surface; the water percolating through the pervious rock is confined within it when this rock is covered by an impervious stratum of clay. It is the water falling on the outcrop of the lower green sand around the London basin which descends beneath the Gault clay, and when tapped round London by borings which pass through this latter and the strata above it, will rise in these borings to a height which depends, of course, upon the height of the country from which it has come. In the same way the chalk water may be got at, and is got at, by borings through the London clay into the chalk rocks below it.

Artesian borings.

Source of their water.

Lower greens and water.

Such waters are often very hard, containing a large amount of carbonate of lime dissolved in excess of carbonic acid, but they may be easily softened on a large scale by Clark's process, which consists in the addition of sufficient milk of lime to combine with the carbonic acid

Softening by Clark's process.

dissolved in the water; the carbonate of lime which is formed being deposited, together with that formerly held in solution. Thus the water obtained by boring into the chalk has 17 or 18 degrees of total hardness on Clark's scale; whereas, after the application of this process, its hardness is only 2 or 3 degrees. Similar borings have been made into the New Red Sandstone in various parts of the country, but the water so obtained is occasionally brackish, as there are large deposits of rock salt in this formation.

A method, which ought to be resorted to more than it is, for obtaining supplies of water, is that of collecting it from a gathering ground at some distance from the place to be supplied, in a large impounding reservoir and conveying it to the town from this by pipes. Its quality in this case will, of course, depend upon that of the water of the springs and streams which supply the reservoir, and this again mainly on the rocks through which they pass, and on the nature of the surface of the gathering ground. It is necessary that water, which is to be used for drinking, should, if collected even at some distance from large towns, be made to percolate through soil before it is used. Dr. Angus Smith tells us that if it were possible to collect rain from the clouds in large quantities it would not be pure enough to be drunk without being filtered through soil. The primitive and metamorphic rocks afford the purest sources of water. Compact limestone rocks (as the mountain limestone) also afford a good supply, but of much harder water. The same may be said of many looser limestone and sandstone formations, while the water that comes from fissures in clays often contains a large amount of organic matter, and, having also as a rule a high degree of permanent hardness due to the amount of sulphate of lime that it contains, is generally unwholesome; as a matter of course water derived from peaty or marshy districts contains a large amount of organic matter, and is very unwholesome.

Gathering ground.

Necessity of filtration.

Comparison of sources.

As special impurities in waters derived from particular strata, we may mention, in the first place, magnesian salts —especially the sulphate, chloride, and carbonate—which

Special impurities: magnesian salts.

are found in waters from the dolomite, or magnesian limestone rocks, or from serpentine and rocks of its class, and in Italy from the sub-Apennine strata; and, in the next place, sulphate of lime, which is, as before said, contained in water coming from clays, some of which, as the London, Kimmeridge, Oxford, and Lower Lias clays, afford considerable quantities of it, or in water coming from localities where there are large deposits of gypsum, as at Montmartre, near Paris. The effects of the habitual use of water containing these salts will be mentioned in another section. This plan of collections from gathering grounds is a variety of one that has been long used in the East, and that was generally practised by the Romans. They simply tapped natural springs at a sufficient height above the place to be supplied, and brought the water in admirably-constructed aqueducts to distributing reservoirs in the town.

Sulphate of lime.

Roman plan.

Now we come to the method far too generally adopted, which is that of taking river water just above the town but often below other towns—water which we know has been polluted—filtering it, so as to purify it to a certain extent, and distributing it to the houses. It is only in places where there is a sufficiently large and swift stream that has not been previously polluted, that this plan is defensible. We are told that the water supplied to towns by this method, is, practically speaking, a pure drinking water, but it is perfectly obvious that the plan of taking water which we know has been polluted, and then attempting to purify it, is radically wrong and entirely at variance with the principle laid down by Mr. Simon. Since, however, this is the plan so frequently adopted, it should be insisted on, in the first place, that the water be filtered on the large scale. The passage of impure water through filtering beds of gravel and sand not only frees it from suspended impurities, but also, if performed intermittently (time being allowed for the filtering bed to become aërated) converts a large proportion of the dissolved organic matters into innocuous substances. Distributing reservoirs, no matter how the water is supplied to them, require to be covered and well ventilated, besides being very frequently cleaned, as they afford the first opportunity for the water

River water.

Wrong principle.

Filtration.

Reservoirs.

to be rendered impure in the town itself: their overflow pipes must end freely in the open air.

Distribution.

Two methods of distribution.

WATER may be distributed to the houses either on the system of constant service or on that of intermittent service. In the former case the mains are always full, and as much water as is required can be obtained at any time in the houses. In the latter case the water is only turned on for a certain time—say a few hours during the day—and so it has to be stored on the premises, in cisterns, butts, and other contrivances. Of the two systems there can be no doubt that from a sanitary point of view the constant system is far the best. The great disadvantage of the system usually adopted—the intermittent system—is that the water is exposed to sources of impurity in the cisterns and other receptacles in which it is kept. These require (of whatever material they are constructed) to be very frequently and thoroughly cleansed. They should be covered over, and those best constructed are of slate with supply-pipes of wrought iron, for Mr. Rawlinson tells us that 'wrought iron service-pipes are cheaper, stronger, and more easily fitted than service-pipes of lead.' But it must be added that leaden pipes and cisterns are not dangerous to the extent that is generally stated, for they become soon covered with a coating of carbonate and oxide of lead, which effectually prevents them from the further action of the water. This happens even with soft waters.

Intermittent system; disadvantages.

Service pipes.

We have already stated that the destination of the waste pipe of the drinking water cistern is one of the most important points to be looked to in examining the sanitary condition of a house. With the system of constant supply there is no need of cisterns, except perhaps for the supply of water closets. The water is drawn from taps placed on the rising mains, and there should be one for each storey of the house. These should be so placed that any leakage from them would cause considerable inconvenience to the inhabitants, and in the poorer parts of towns, the taps for this reason should be placed inside the houses and not outside of them. By these means and with proper inspection

Waste pipes of cisterns.

Less waste with constant system.

of fittings there is less waste of water with the constant system than with the intermittent system of supply. Where greater waste has been found to take place with the constant system, it has been when it has been adopted instead of the intermittent system with the same pipes and fittings. A difficulty which has occasionally arisen with the constant system is that the supply runs short in the upper parts of houses at a high level. This must be obviated by the use of high level cisterns in the upper storeys of these houses. They should be provided with 'warning pipes,' ending in the open air.

Quantity required.

With regard to the amount to be supplied, we have chiefly to deal with the smallest quantity that can be considered sufficient. According to Professor Rankine 'the supply of water to towns ranges in extreme cases from about 2 gallons to 600 gallons per inhabitant per day;' and he gives the following table as containing fair estimates of the average daily consumption :

	Gallons per Day.		
	Least.	Average.	Greatest.
Used for domestic purposes . .	7	10	15
Washing streets, extinguishing fires, supplying fountains, &c. .	3	3	3
Trades and Manufactures . . .	7	7	7
Total usefully consumed . . .	17	20	25
Waste under careful regulation, say .	2	2	2½
Total demand .	19	22	27½

Least amount.

The least amount, then, that should be allowed is, say 20 gallons a day, and it is well to aim at a more copious supply, especially as the waste is almost always much greater than that allowed for in the table. We may add here that the system of collecting rain water from the roofs and utilising it for the water closets, or for washing, ought to be carried out much more fully than it is, and might certainly be very easily adopted.

Effects of Impure Water.

Several of the more important diseases communicated by the use of impure water for drinking have been already mentioned. In the first place, there can be little doubt that a hard water is less wholesome, generally speaking, than a soft one. Besides being more unwholesome, it occasions a considerable waste of soap—each degree of hardness being equivalent to the waste of 2½ ounces of soap for every 100 gallons of water used, and it is also not nearly so advantageous for other domestic purposes, as making tea, boiling vegetables, &c. Perhaps the least hurtful mineral substances are the carbonates. Dr. Parkes says: 'Carbonate of lime, when not exceeding 12 to 16 grains per gallon, is not usually considered unwholesome, though it remains to be seen whether a more careful inquiry will not indicate some effect on digestion or assimilation to be produced by the constant use of such a water.' But there can be no doubt, and there is no difference of opinion about the fact that salts which cause the permanent hardness in water are injurious. To quote Dr. Parkes again: 'Symptoms which may be referred to the convenient term dyspepsia, and which consist in some loss of appetite, vague uneasiness or actual pains at the epigastrium, and slight nausea, and constipation, with occasional diarrhœa, are caused by water containing any quantity of sulphate of lime, chloride of calcium, and the magnesian salts.'

Hard *v.* soft water.

Carbonate of lime.

Other salts of lime and magnesian salts.

Besides this, there is considerable evidence to show that the habitual drinking of hard waters containing magnesian salts is the cause of goître in the localities where it is prevalent, a disease associated in many places with the fearful form of idiocy known as cretinism. (See 'Aitken's Science and Practice of Medicine,' vol. i.)

Goître and cretinism.

As a rule, then, soft waters are to be preferred to hard ones, and hard water should be softened, as far as it can be by Clark's process, before being distributed; while permanently hard water should be avoided.

Suspended substances, whether mineral or organic, are liable to produce diarrhœa, sometimes of a severe kind, and the mountain dysentery of some parts of India has been

Suspended substances.

traced to the use of water containing very fine particles of mica in suspension. Such waters, when filtered, may be quite fit to drink.

Dissolved organic matters

Water containing dissolved organic matters (especially of animal origin) in a state of putrid decomposition is liable to produce diarrhœa, and may, in certain instances, contain the poison of special diseases, as cholera, enteric fever, and, in hot climates, dysentery. One of the commonest sources of animal impurity in water is the absorption of decomposing organic matters from foul air, as before described. Water containing dissolved vegetable matters does not, it is said, produce diarrhœa, but it frequently comes from

Marsh water

marshy districts, and has then been accused of affording one of the ways in which intermittent fever, and, in tropical climates yellow fever, are produced; such water should always be avoided. The presence of more than a small amount of nitrates and nitrites in water raises a suspicion that the water has been contaminated, and one which is strengthened if salts of ammonia and chlorides are found in excess also; but the mere presence of nitrates is not a sufficient reason for the condemnation of a water as a source of supply; it should only induce a more careful search after possible sources of recent contamination.

Leaden pipes.

Certain waters, especially soft waters, and more particularly such as contain nitrates and nitrites, dissolve enough lead from leaden pipes and cisterns, or from zinc pipes containing lead, to produce toxic effects; it is, however, certain that it is very rare that water supplied for drinking has any such effect on leaden pipes and cisterns. The solution of other metals, as copper, is a purely accidental occurrence.

It remains to be added that drinking waters afford the means for the introduction into the body of certain entozoa. The ones that may be especially mentioned are the *Ascaris Lumbricoides*, the *Bothriocephalus Latus*, and the *Oxiuris Vermicularis*.

Entozoa

But the ova and embryos of these creatures are mostly swallowed when some manifestly impure water is drunk, in which cases leeches, tadpoles, and like creatures may be swallowed. Dr. Parkes states that 'in a march of the French near Oran, in Algiers, more than 400 men were at one time in hospital from swallowing leeches.'

The embryos of the common tapeworms (*tæniæ*) enter the body chiefly by means of the food.

Purification of Water.

THE water supplied to a collection of people ought not to require purification; in other words, water should be got which has not been fouled; as this is, however, seldom the case, some kind of purification has to be resorted to. In settling tanks, a good deal of the suspended matters are deposited, and the Romans found that such tanks were necessary even with the spring water with which they supplied their towns. For river water slow filtration through beds of gravel and sand must be resorted to, the result being not only the separation of the suspended matters, but the oxidation of a great part of the dissolved organic matters. Hard waters may be purified to a considerable extent by Clark's process, as already mentioned.

Filter beds.

On the small scale water may be rendered purer by filtration through animal charcoal, silicated carbon, or magnetic carbide filters, which may be placed in the cistern, or attached to the delivery pipe, or filled by hand. Boiling also affords an excellent means for purifying water, and very impure waters may be drunk with impunity if previously boiled, especially if with a few tea leaves so as to make a weak decoction, according to the plan practised in China; this should always be done during the prevalence of cholera or of enteric fever.

Boiling.

Various substances have been proposed to be added to drinking water in order to purify it, and a little Condy's fluid may be occasionally used with advantage; but it is needless to enlarge on this subject, as impure supplies must be abandoned, and as it is much more essential to see that the water is not rendered impure, as is far too often the case, in the cistern; it is ridiculous to allow the water to be contaminated first, and then seek to purify it by filters or by other contrivances, and the medical officer will chiefly have to do with the prevention of the contamination of water, whether on a large or small scale.

Avoid contamination.

CHAPTER V.

EPIDEMIC DISEASES.

PRACTICALLY speaking, the diseases under this head, of which the medical officer will take cognizance, may be divided into two classes: the first comprising small pox, scarlet fever, diphtheria, typhus and relapsing fevers, and occasionally, perhaps, measles and whooping cough; and the second one, cholera, enteric fever, and diarrhœa. In the first class the most important point in the consideration of the spread of the disease is the isolation of the patient—all these diseases being highly contagious: while, with regard to those of the second class, 'the quality of infectiveness,' as Mr. Simon says of cholera, 'belongs particularly, if not exclusively, to the matters which the patient discharges by purging and vomiting from his intestinal canal.'

Two classes.

Diseases of the first class especially attack children, although they may, any of them, attack persons of any age, and the number of deaths of children from them, as compared with those of adults, is very large indeed, with the single exception of small-pox. This exception is, however, only an apparent one, and is due to the influence which the vaccination of infants has had over the disease, for small-pox, although attacking adults more readily than the fevers to which it is allied, still is, *apart from vaccination*, more fatal to children than to adults. Sixty-one per cent. of all unvaccinated children attacked under five years of age died during the late epidemic, as against less than forty-one per cent. of unvaccinated adults.

First class fatal to children.

Apparent exception.

Of these eminently contagious diseases, typhus and relapsing fevers are propagated especially in places where

Typhus and relapsing fevers.

there is want of air, want of food, and want of cleanliness; in the over-crowded, ill-ventilated sleeping-rooms, inhabited by badly fed, half-starved, unwashed people, who breathe over and over again air saturated with fetid cutaneous, and pulmonary (not to mention any other) excretions. Small-pox, scarlet fever, and the remaining diseases of the first class are always more or less amongst us, but become epidemic at certain times from causes with which we are not acquainted. When we see a disease like small-pox, which is never totally absent from among the population, suddenly take on a character of eminent contagiousness, and spread like wildfire among the people, as illustrated by the late severe epidemic, it is plain that there is either some factor of epidemicity, which may have something to do with special meteorological or electrical conditions, but about which we know absolutely nothing, or that the poison of the disease has been reintroduced from elsewhere with somewhat different properties, being not necessarily more virulent than the poison of the preceding epidemic which has spent itself, so to speak, but being of a sufficiently different character to flourish in a population acclimatised, as it were, to the other one. The propagation of these diseases is aided by want of ventilation; scarlet fever, for instance, always spreads most in houses where there are no windows at the back. This fever has been known to travel up one side of a street from house to house until it came to a cross street, that is to say, to a place where there was free ventilation, and then to go no further. All these diseases are propagated more than anywhere else at schools, and during epidemics the greatest precautions ought to be taken in sending children to schools, especially as there is every probability that some of these diseases, if not all of them, are contagious during the period of incubation.

Epidemics.

Necessity of ventilation.

Schools.

With measles and whooping cough the medical officer of health has, generally speaking, little to do. Disinfection is not usually carried out after them. Where, however, this is undertaken, it should be carried out in the manner to be presently described for the other contagious fevers. These diseases often cause a considerable mortality

Measles and whooping cough.

among children; not directly but indirectly. They predispose to lung diseases, especially bronchitis and pneumonia, of which the children die, and the fatality from these diseases accompanies in a very striking manner the fluctuations of the mortality from diseases of the respiratory organs. They are diseases which are commonly looked upon as necessary diseases of childhood; like the other diseases of the same class, they are eminently communicable by means of infected air or clothing, and in the case of measles by means of the contagious discharges. As a general rule, one attack protects during the rest of life, and the same is true of the other diseases of this class, and also of enteric fever; but it must be remembered that there are exceptions to this rule, and that there are even persons who appear to be especially predisposed to diseases of this class. Second attacks of one or other of these diseases are not very uncommon, and third attacks are not unknown. As in the majority of instances a person is only attacked by any one of these diseases once during life, it is commonly thought a good thing for children to take measles and whooping cough and have done with them, though as no one is bound to have any one of these diseases during his life, the logic of this theory is not very clear.

Generally only one attack.

Prevention of the Spread of Epidemic Diseases.—Disinfection.

The first great preventive of the spread of these diseases is to be found in a plentiful supply of fresh air. It is at any rate plain that it is especially necessary during the prevalence of any epidemic disease to remove from the vicinity of habitations all those refuse matters that are liable to produce an impure state of the atmosphere which is known to favour the spread of these diseases. Infected rooms containing articles of clothing of various sorts, have in many cases to be inhabited almost continuously, and then it is necessary to resort to some special plans for the disinfection of such rooms and of the articles they contain. We do not propose here to enter into a scientific discussion on the relative value of different substances for this purpose, nor to adopt any one of the numerous classifications which have been proposed for

Fresh air.

Disinfection of rooms, &c.

them, but simply to point out practical methods which have succeeded where they have been systematically carried out.

In the first place persons attacked with one of these diseases (especially with a disease belonging to the first class), should be separated as completely as possible from other persons, and especially from persons who have not already suffered from the same disease, and sanitary authorities are empowered by the 37th section of the Sanitary Act, 1866, to provide "hospitals or temporary places for the reception of the sick." The sick room should contain as few articles as possible. It should be kept sweet by having a current of air passing through it, and this may generally be effected by keeping up a small fire and opening a window a little at the top, care being taken that the patient is not exposed to a draught. The room selected should be as distinct from the rest of the house as possible—that is to say, where a room can be selected at all—and should if possible not be a papered room. It is well to hang a sheet over the doorway and to keep this moistened with carbolic acid. In many cases instead of opening the window the door may be left open, and then the supply of air for the sick chamber may be forced to come from the rest of the house, the staircase into which the room opens being freely supplied with fresh air. Carbolic acid in solution or some Macdougall's powder, (carbolates of lime and magnesia) may be sprinkled about the floor. All linen that has been used by the patient should be at once placed in a vessel containing water mixed with some Condy's fluid or carbolic acid, and should afterwards be thoroughly well boiled. All the excretions from the body of the patient must be effectually disinfected. Thus for wiping the mouth and nose rags should be used and then immediately burnt. In cases of such diseases as are accompanied with skin eruptions (and this is especially applicable to small-pox and scarlet fever), the infection of the air and of articles of clothing, &c. may be very much diminished by rubbing the patient's body with olive oil, which may advantageously be impregnated with carbolic acid. This is not only useful from the point of view we are now considering but is a relief to the patient. Vessels used for receiving excretions should contain a small quantity of some powerful

Isolation.

Ventilation of the sick room.

Carbolic acid.

Excretions disinfected.

Use of oil.

disinfectant, as crude carbolic acid or a solution of green vitriol (the proto-sulphate of iron—ferrous sulphate), or some Burnett's fluid. This applies to the vessel in which the expectorations are received as well as to that used for the excretions from the bowels and kidneys. It is important that the disinfectant be placed in the vessel before it is used.

Glasses, cups, &c.

All glasses, cups, spoons, &c., used in the room require to be most carefully cleaned before being used by other persons, and a basin of water containing a little carbolic acid, or Condy's fluid, should be always ready for the attendants to wash their hands in before leaving the room.

Carbolic soap.

Carbolic acid soap may be used with advantage.

Dresses of attendants.

Dresses of attendants should be made of some glazed material which will allow as little dust as possible to adhere to it.

Washing of skin.

As soon as the patient is considered well, whether the external application of water has been resorted to by the medical attendant during the course of the disease, or not, the whole surface of the body should be well washed, carbolic acid soap being used, and this should be repeated for several days; but even for a longer period all contact with uninfected persons should (especially in the case of diseases accompanied with skin eruptions) be avoided as much as possible. With the foregoing part of the preventive measures to be adopted, the medical officer of health has unfortunately, only occasionally anything to do, and this is one of the reasons why, when diseases take on an epidemic form they spread more rapidly and more extensively among the people than they might do if sufficiently careful isolation of infected persons and places were generally carried out.

Medical officer little control over such matters.

The medical officer of health under the present *régime* only hears of the deaths that have occurred from these diseases, and, of a certain number, it is to be feared a very small proportion, of the cases of sickness from them, and it is only now and then (except during severe epidemics) that he is able to get patients removed from unsuitable localities, such as from rooms in which several persons are living, to the permanent or temporary fever hospital.

Removal to hospital.

It would be well if this could be done very much more frequently, a special conveyance being provided by the sanitary authority for the purpose—(Sanitary Act 1866, section 24). It may here be remarked that it is the

duty of the medical officer to investigate into the circumstances under which persons suffering from infectious diseases are allowed, or even in certain cases forced, to expose themselves in the public streets and even in public conveyances; being sent away, as frequently happens in the case of servants, from the places at which they have contracted the disease, to their homes at a considerable distance—perhaps in another part of the country—carrying with them the infection, and spreading it abroad along the whole line of their route. Such cases should then be diligently investigated and the offenders (if the charge can be brought home to them) summoned under the 25th section of the Sanitary Act. Of course if the persons so exposing themselves have been warned that by so doing they are committing an illegal act, then the blame rests with them.

Exposure in public places.

It now remains for us to describe the methods to be used for the disinfection of the house or room and the infected articles contained in it: and in the first place as to the formal mode of procedure* :—A notice must be given by the inspector of nuisances that the infected rooms, &c. are to be disinfected within a certain time, or forthwith. It is formally necessary in this case that a certificate be obtained from a legally qualified medical practitioner stating that in his opinion the cleansing and disinfecting of such house or part thereof and of any articles therein likely to retain infection "would tend to prevent or check infectious or contagious disease," and it is of course advisable to have this where no death has occurred, as in case of non-compliance with the order a certificate must be produced during the legal proceedings which may ensue. In cases, however, where death has been certified, it is plain that the medical officer has sufficient evidence to go upon, and then such certificate need not be made out unless there is any likelihood that the order for disinfection will not be attended to, in which case he can write the certificate himself. When the notice is disregarded, the 22nd section

Formal proceedings

Certificate of a medical practitioner.

* Such thorough disinfection should be insisted on in all cases where a room has been occupied even for a short time by a person suffering from small-pox, scarlet fever (including rubeola) or typhus fever, even when the attack has been a mild one; no distinction should be drawn.

Non-compliance with notice.

of the Sanitary Act, 1866, provides as follows:—"If the person to whom notice is so given fail to comply therewith within the time specified in the notice, he shall be liable to a penalty of not less than one shilling and not exceeding ten shillings for every day during which he continues to make default; and the Nuisance Authority shall cause such house or part thereof to be cleansed and disinfected, and may recover the expenses incurred from the owner or occupier in default in a summary manner,"—and it is further

Powers of nuisance authority.

provided under the same section that if the person upon whom the notice has been served be unable to carry out the requirements, the Nuisance Authority may do so at its own expense. (Note.—It is a strange omission in this section that power is not given to the nuisance authority to disinfect infected articles of clothing &c., and to recover the expense of so doing from the defaulter. This provision is only made with regard to the "house or part thereof.")

Entry of premises.

As the word "nuisance" under the Nuisances Removal Acts includes "premises in such a state as to be injurious to health," the powers of entry given by these Acts may be enforced, if necessary, where the Inspector has reason to suppose that the disinfection has not been carried out according to the notice (for it is well that the notice should be accompanied with a description of the way in which satisfactory disinfection may be effected.)

Dead body.

Where death has occurred, the interior of the coffin and the body itself should be well sprinkled with Macdougall's powder or with a solution of carbolic acid, and the lid firmly screwed down. The body must be looked upon as infectious and should be buried as soon as possible; not only so, but it should be insisted that no such dead body be kept in a room where persons live or sleep, and the 27th section of the Sanitary Act (1866), which provides for removal of bodies which are in such a condition as to be a nuisance, to a mortuary (where there is one), should be strictly enforced.

Disinfection of clothes, &c.

If a proper place has been provided under the 23rd section of the Sanitary Act "for the disinfection of woollen articles, clothing, or bedding which have become infected," such articles should be sent for by the Sanitary

Inspector and disinfected. This is usually done by placing them in a hot air chamber, a large iron box which can be heated by means of a furnace, or still better by gas, until the temperature of the air in it is raised to about 240° Fahrenheit. The articles are placed on shelves or rails inside this box and are there subjected for several hours to the above temperature, when they may be considered to be sufficiently disinfected. It is well however that all articles which have been much soiled by infectious discharges, especially bedding, should be burned, and where this is ordered to be done by the Sanitary Authority, in the case of poor persons, such articles must be replaced at the public expense. Where a hot air disinfecting chamber has not been provided by the Sanitary Authority, all infected articles which can be boiled should be boiled in water (to which some disinfectant may be added) for a considerable time, and other articles, such as bedding, &c., be disinfected by leaving them in the infected room (undoing the ticks and spreading about the contents in the case of bedding and mattresses) during the carrying out of the process employed for its disinfection, now to be described.

Hot air chamber.

Boiling.

For disinfecting the air of a room, and to a certain extent the things contained in it and the walls, it is necessary that some gaseous disinfectant be generated in considerable quantities in the room, and kept therein for a certain time. In order to do this all the doors but one must be tightly closed and the crevices pasted over with brown paper. Sulphurous acid, chlorine, nitrous acid, and similar disinfectants have each had their defenders, but there is no doubt that for general practical purposes, especially on a large scale, sulphurous acid as generated by the burning of sulphur, is the one which is the cheapest, simplest, and most effectual. The immense advantage which sulphur possesses by being in the solid form, and by the fact that it is not requisite to use any acid with it, can hardly be over-rated, and the ease with which disinfection by sulphurous acid is managed affords another excellent reason for its general adoption. The chimney must be also stopped up, either by pushing a bag up it, or by pasting paper over the fireplace. One or more iron vessels must then be placed in

Disinfection of rooms.

Sulphurous acid.

Method of procedure.

the room, either standing on tiles on the floor, or, still better, supported over buckets of water by means of stair rods, or pairs of tongs, or other convenient metal rods. Common roll sulphur broken into small pieces is to be placed in these, in the proportion of about one pound to every 500 cubic feet of space, and then lighted, either by moistening it with alcohol and setting fire to it with a match, or by throwing two or three live coals upon it from a shovel. The remaining door is then to be closed and the crevices on the outside pasted over with brown paper, so

Room shut up and left.

that the room is as completely shut up as possible. The sulphur burns rapidly with the oxygen of the air in the room, forming sulphurous acid gas in large quantities, and there is a considerable amount of evidence to show that this gas is capable of destroying the poisons of infectious diseases. The room should be left closed for six hours, if possible, or even longer. It should not be left shut all night on account of the possibility of accidents. The door or doors should then be opened, and as soon as it is possible to enter the room the windows should be unfastened and thrown wide open.

Infection hangs to wall papers.

The room cannot yet be considered to be thoroughly disinfected. The infectious particles, especially from such of those diseases as are accompanied with skin eruptions, settle about with the dust in different parts of the room and especially adhere to the wall-paper, and there are plenty of instances of paper-hangers who, having proceeded to pull down old papers from the walls of rooms before repapering them, have been attacked by various kinds of infectious diseases. In every case then in which a papered room has become infected it must be considered absolutely necessary, after it has been fumigated with sulphur, that

They must be stripped off and burnt.

the paper be thoroughly well washed with a solution of crude carbolic acid in water (some recommend chloralum for this purpose) and stripped off the walls and burnt: with regard, however, to varnished papers, which can be washed without being injured, the case is different, and they may be treated like an ordinary painted wall; that is to say, thoroughly well washed with a solution of carbolic acid: they need not be stripped off the walls. Then the

walls, ceiling, woodwork of the floor, and articles of furniture must be thoroughly well scrubbed with the same solution: for all these purposes the crude carbolic acid is the cheapest as well as the most effectual disinfectant. The ceiling and walls are then to be lime-whited, and the room left unoccupied and freely open to the external air for a fortnight, if possible. Very frequently, however, the room has to be re-occupied on the same day. Notwithstanding this we have never known a single case in which fever has again broken out in a room which has been so disinfected.

Ceiling and walls lime-whited.

SMALL-POX.—VACCINATION.

The above directions hold good for small-pox, "one of the most infectious of diseases," as well as for the other diseases mentioned: but in its case we have what we have not in other cases, viz., an almost infallible preventive. As Mr. Simon says, in one of his memoranda, "It is the neglect of vaccination that renders the occurrence of considerable epidemics of small-pox possible; and it is by vaccination that the spread of small-pox can most effectually be prevented or restrained." And again in another (No. 41):—

Vaccination.

Re-vaccination.—Memorandum of Privy Council.

"By vaccination in infancy, if thoroughly well performed and successful, most people are completely insured, for their whole lifetime, against an attack of small-pox; and in the proportionately few cases where the protection is less complete, small-pox, if it be caught, will, in consequence of the vaccination, generally be so mild a disease as not to threaten death or disfigurement. If, however, the vaccination in early life have been but imperfectly performed, or have from any other cause been but imperfectly successful, the protection against small-pox is much less satisfactory; neither lasting so long, nor while it lasts being nearly so complete, as the protection which first-rate vaccination gives. Hitherto, unfortunately, there has always been a very large quantity of imperfect vaccination; and in consequence the population always contains very many persons who, though nominally vaccinated and believing

Imperfect vaccination.

themselves to be protected against small-pox, are really liable to infection, and may in some cases contract as severe forms of small-pox as if they had never been vaccinated. Partly because of the existence of this large number of imperfectly vaccinated persons, and partly because also even the best infantine vaccination sometimes in process of time loses more or less of its effect, it is advisable that *all persons who have been vaccinated in infancy should, as they approach adult life, undergo* RE-VACCINATION.

Necessity of re-vaccination.

Generally speaking, the best time of life for re-vaccination is about the time when growth is completing itself, say from 15 to 18 years of age; and persons in that period of life ought not to delay their re-vaccination till times when there shall be special alarm of small-pox. In proportion, however, as there is prevalence of small-pox in any neighbourhood, or as individuals are from personal circumstances likely to meet chances of infection, the age of 15 need not be waited for; especially not by young persons whose marks of previous vaccination are unsatisfactory. *In circumstances of special danger, everyone past childhood, on whom re-vaccination has not before been successfully performed, ouyht without delay to be re-vaccinated.*

Does not require repetition.

"Re-vaccination, once properly and successfully performed, *does not appear ever to require repetition.* The nurses and other servants of the Small-Pox Hospital, when they enter the service, are invariably submitted to vaccination, which in their case generally is re-vaccination, and is never afterwards repeated; and so perfect is the protection, that though the nurses live in the closest and most constant attendance on small-pox patients and though also the other servants are in various ways exposed to special chances of infection, the resident Surgeon of the hospital, during his thirty-four years of office there, has never known small-pox affect any one of these nurses or servants.

Provision for re-vaccination.

"Legal provisions for re-vaccination are made in the 8th Section of the Vaccination Act, 1867, and in Section IV. of the Regulations which the Lords of the Council under authority of the Act issued in their order in February 18th, 1868. Under these provisions, *re-vaccination is now performed by all public vaccinators at their respective vacci-*

nating stations; and, so far as is not inconsistent with the more imperative claims for primary vaccination, *any person who ought to be re-vaccinated may, on applying to the public station of the district in which he resides, obtain re-vaccination at the public expense.*"

It is also necessary to insert in full the "MEMORANDUM on the STEPS specially requisite to be taken by BOARDS OF GUARDIANS under the VACCINATION ACT, 1869, in towns in which SMALL-POX is epidemic.

"I.—*Special Instructions to Vaccination Officers.*

"1. At times when small-pox is epidemic, the officer appointed by the Guardians to see that the provisions of the Vaccination Act are duly observed should give his first and special attention to the particular localities in which the infection exists.

"2. In order that for this purpose he may have the earliest possible information of the occurrence of cases of the disease, the Guardians should instruct their district medical officers to give him immediate notice of every fresh case of small-pox which comes under their treatment, and should also instruct the registrars of deaths to forward to him notice of each death registered from small-pox on the day on which it is registered. For convenience of transmitting such notices, each district medical officer and registrar should be supplied with forms duly stamped for post; or with post-cards adapted for the purpose. Private medical practitioners should also be invited to give similar information.

Notice of cases.

"3. In each locality in which the infection exists, the vaccination officer should proceed with the utmost possible dispatch to personally ascertain what children are unprotected by vaccination, and should use his utmost exertions to obtain the prompt vaccination of all such children. Generally speaking, he must be guided by his own judgment and by his knowledge of the locality as to the manner in which his inquiries can best be made; but in infected courts or alleys, as well as in certain kinds of streets, inquiries from house to house, and, in tenemented houses, from room to room, will be indispensable.

Vaccination of children.

Unvaccinated children.

"4. Where any child is found illegally unvaccinated (between the ages of three months and 14 years) the vaccination officer should give a notice requiring the vaccination to be done within a specified time. This time, when there is small-pox in the house, or other special risk of exposure to the contagion, should not exceed 24 hours; but in other cases some days, not exceeding a week, may be allowed. A second visit from the vaccination officer will, of course, afterwards be necessary, in order to see that his notice has been complied with.

"With regard to unvaccinated children, not yet three months old, who may be in infected localities, the vaccination officer should advise the parents not to incur the unnecessary risk of waiting for the child to complete that age before having its vaccination performed; for vaccination is performed with perfect safety on children even immediately after birth. In no house in which there is small-pox ought a child, however young, on any account to remain unvaccinated, unless on medical examination it be pronounced unfit to be vaccinated.

Re-vaccination.

"5. The vaccination officer should make it well known in infected localities that the public vaccinator is at liberty to re-vaccinate grown-up and young persons (not under 12 years of age) who have not before been successfully re-vaccinated, and who apply to him for that purpose; and that persons not vaccinated since childhood, who are likely to be exposed to contagion, ought to be re-vaccinated without delay. Above all, this is necessary for persons whose original marks of vaccination are imperfect.

"6. All notices given and representations made as above, should be accompanied with information of the provision for public vaccination in the district. If any case requiring prompt vaccination by the public vaccinator cannot, in the judgment of the vaccination officer, properly be taken to the station or residence of the public vaccinator, the vaccination officer should give to the public vaccinator immediate information of the case.

"7. Besides the above-described special proceedings in infected localities, every means should be taken, generally throughout the Union or Parish, to ensure that the infan-

tine vaccination is as complete as possible. The vaccination officer should make frequent examination of the registrars' vaccination books, and should deal with each default which he finds as speedily as possible after it has arisen.

"II.—*Special arrangements for the public Vaccination of cases of emergency.*

Special attendances.

"1. Besides the ordinary attendances for the performance of vaccination at the appointed station in each vaccination district, special attendances should, during the continuance of the epidemic, be given at a fixed hour daily for the vaccination of cases of emergency.

"2. Under the regulations of the Privy Council, Guardians, where small-pox is prevailing, are at liberty, without special authorization, to order such exceptional attendances. But as regards the place where the special daily attendance should be given, if, in the case of any district where the vaccinator's surgery or residence is not a vaccination station, the Guardians are of opinion that the ordinary vaccinating station would be less convenient for the special purpose than such surgery or residence would be, they should at once apply to the Privy Council to sanction, for a limited time, the exceptional use of the surgery or residence.

For cases of emergency.

"3. The special provision for daily attendance is designed only to meet cases of emergency; and all other cases should be reserved for the usual vaccinating day. It is on the latter regular attendance at the station that reliance must be placed, not only to maintain the usual performance of primary vaccination from arm to arm, but also to furnish the supply of lymph required for cases of re-vaccination, and for use in the special attendances; and former epidemics of small-pox have shown that to attempt at such times an indiscriminate daily performance of vaccination leads only to difficulties and disadvantages. Adherence to systematic arrangements (with exception only for special cases) is indeed of the utmost consequence at such periods; —first, because it is then of supreme importance that each primary vaccination should be done under conditions which scarcely admit of failure; and secondly, because without

system it is not possible properly to meet the large demands for re-vaccination which at such times are sure to arise, and which, unless under very particular circumstances, must always be reserved for the weekly vaccinating day.

"III.—*Isolation of the sick, and disinfection.*

"The isolation of the sick, and the disinfection of infected houses and things, are very important means of checking the spread of small-pox; and in order that such measures may be enforced, the Sanitary Act, 1866, besides imposing penalties on the exposure of infected persons, the letting of infected houses, the sale, &c., of infected things, and other acts similarly dangerous to the public health, gives in §§ 22–24, 26–28, very important powers to nuisance authorities. As the nuisance authority is in most towns a separate body from the Board of Guardians, it is not proposed in this memorandum to give any advice as to the way in which these powers can best be exercised; but, so far as the destitute classes are concerned, Boards of Guardians, as poor law authorities, have through their officers opportunities of securing disinfection and the isolation of the sick, of which full use should be made during an epidemic of small-pox."

Whether the Medical Officer of Health be required to act as vaccination inspector or not he ought to make himself acquainted with all that has to do with the prevention of small-pox as well as of other diseases, as he is required to advise on all such matters.

Few are hardy enough to deny that vaccinated people are far less subject to attacks of small-pox than unvaccinated ones, or that a greater proportion of the latter die if attacked by that disease, but it is not sufficiently generally known that re-vaccination is in most cases essential and is a far more absolute preventive than an attack of small-pox itself is; for whereas there are many cases of second and some of third attacks of small-pox, showing that some persons are extraordinarily susceptible to the disease, and whereas the second attacks are frequently worse than the first and may kill the patient, cases of small-pox after re-vaccination are *very rare indeed*, and so far as we can ascer-

Small-pox after re-vaccination very rare.

tain always very mild ones: at any rate this much is certain, that a person who has been well re-vaccinated is far less likely to die from the small-pox than one who has already had the disease.

Change of character of small-pox.

As we have elsewhere pointed out, the results of the late epidemic show us that the compulsory vaccination of infants has changed entirely the aspect of small-pox among us: the infectious diseases akin to it, as scarlet fever, measles, diphtheria, and whooping cough, are far more fatal to children than to adults; small-pox stands alone among them (enteric fever being excluded for many obvious reasons) in being at present more fatal to adults than to children; but if we consider only its fatality among *unvaccinated* people we find that it is, like the other diseases above mentioned, more fatal to children than to adults. Dr. Guy describes it as "a disease always specially greedy of the blood of children."

In short, to quote from a report already mentioned ("On the sanitary condition of the parish of St. Mary, Islington, during the year 1871"):—

Less fatal to children now.

"We should be led to think it likely that for some reason or another, fewer, far fewer children died of small-pox than ought by analogy to die, or that it was a disease which was more fatal later in life and especially between the ages of twenty and forty. Now there is no doubt that it is a disease that spares no age and therein differs in degree at any rate from the other fevers just mentioned, but from the vaccination statistics we are warranted in concluding that the comparatively small mortality among children is due to the effect of *vaccination*, and that the large number of deaths between 20 and 40 points to the necessity of *re-vaccination* at some earlier period, preferably between 10 and 15 years of age, as that is the period when least deaths occur, in other words the deaths which might have been prevented by *re-vaccination* begin to be more numerous after that period is passed.

"Unvaccinated children under one year old scarcely ever recover from small-pox: of unvaccinated children under 5 years of age admitted to various hospitals during the late epidemic 61·15 per cent. died, while of the vaccinated only

19·48 per cent. died; of unvaccinated persons of all ages 44·8 per cent. died, of vaccinated 10·15; this shows us that like the other contagious fevers, small-pox is, *apart from vaccination*, more fatal to children than to adults; or to put it still more obviously, out of 708 unvaccinated children under 5 years of age, 433 died, or 61·15 per cent., while out of 2,926 unvaccinated persons of all ages over 5 years, 1,195 died, or 40·84 per cent. The above facts I have gathered from the Report of a Committee of the Managers of the Metropolitan Asylum District, which has just been issued: now I also find there some very interesting statistics showing the effect of inefficient vaccination; among vaccinated persons the mortality varied gradually from 5·5 per cent. among those who had 5 or more vaccination marks, to 15·2 per cent. among those who had only one mark, showing conclusively the desirability of vaccination being so effectively performed as to produce several permanent cicatrices. Another very interesting fact related in the report is, that of upwards of 14,800 cases received into the hospitals only four presented proofs of having been re-vaccinated."

Inefficient vaccination.

CHAPTER VI.

OVERCROWDING.—VENTILATION.

IT IS provided by the 19th section of the Sanitary Act, 1866, that the word "nuisances" under the Nuisances Removal Act shall include "any house or part of a house so overcrowded as to be dangerous or prejudicial to the health of the inmates," and by the 35th section the nuisance authority is empowered to make sanitary regulations for lodging-houses, one of these being "for fixing the number of persons who may occupy a house, or part of a house, which is let in lodgings or occupied by members of more than one family." The Medical Officer of Health then has to decide what, in particular instances, is to be considered over-crowding. Now 300 cubic feet of space is the amount allowed by the Poor Law (Local Government) Board for every healthy person in dormitories, and as about 2,000 cubic feet per head per hour are required to purify the air respired by an individual, it follows that where only 300 cubic feet are allowed the air must be changed three times an hour at any rate. If not changed the air becomes foul from the presence in it of putrescent organic matters exhaled from the lungs and skin of the persons living in it, and it is in such an atmosphere that infectious diseases seem to find the most favourable conditions for their development and spread. Such an atmosphere, too, has the most deleterious effect on the general constitutions of the persons inhabiting it, and has even, by one author, been considered the main, if not the sole, source of phthisis. Under these conditions, moreover, the amount of oxygen is decreased, and these two circumstances, aided perhaps by insufficient food, combine in producing

Overcrowding, a nuisance.

Minimum air space.

Impure air.

that anæmic condition which is so universal among people, especially women and children, who inhabit overcrowded rooms. Lastly, the proportion of carbonic acid and of moisture in the air is increased. The excess of carbonic acid no doubt assists in deteriorating the health of the inhabitants of overcrowded rooms, which is, however, mainly attributable to the foul organic matter, and to the diminution of oxygen in the air. Three hundred cubic feet, then, should be looked upon as the minimum supposed to be allowed per individual, and this amount can, as a matter of fact, be almost invariably insisted on. In determining the amount of cubic feet which each individual has in a given room, the Inspector has merely to employ the ordinary rules of mensuration, subtracting a reasonable amount for cupboards and furniture, adding for recesses, and subtracting three cubic feet for the space occupied by each adult, and a proportionate amount for the children. If the number left be divided by the number of persons of all ages occupying the apartment, the number of cubic feet per head will be obtained. Some Medical Officers do not insist on the same amount of cubic space for children as for adults on account of the practical difficulties sometimes found in securing such an amount. We do not think it advisable to make any such distinction, especially as the amount stated as the minimum is already very low indeed. Some special enactments have been made with regard to the inhabitation of underground rooms or cellars. These are to be found in section 103 of the Metropolis Local Management Act, 1855, and section 62 of the Act of 1862, and it is the duty of the District Surveyor to see that these sections are complied with in the case of underground rooms let as separate dwellings, any room being considered to come within the provisions of the Act if there is a reasonable presumption that someone passes the night therein. Such report of the district surveyor stating the houses where cellars are inhabited, although not complying structurally with the provisions of the Act, with the names of the owners and occupiers, and the reasons for believing that such cellars are occupied separately as dwellings, is forwarded to the Medical Officer of Health of the district.

Measurement of space.

Children as much as adults.

Cellar dwellings.

District surveyor's report.

The simplest and most obvious course then would appear to be for an inspection to be made of such places by one of the inspectors, with or without the Medical Officer, to verify the statements made in the report, and for the nuisance authority to authorise the issue of notices for discontinuance in all such cases unless the provisions of the Act can be complied with. There are, however, a multitude of reasons why such a course cannot be pursued, and these arise chiefly from the great variety of conditions under which such underground rooms are met with. Some of them are so dark and damp that it is well to advise the nuisance authority to issue an order for their discontinuance as inhabited dwellings immediately. In other cases the areas can be made broader and larger, &c., without interfering with the pavement in front of the houses, there being a sufficient width of private ground between the houses and the public pavement, and in such cases the advice to give is that notice shall be issued for the discontinuance of such rooms as inhabited dwellings unless the provisions of the Act are complied with forthwith ; but in many cases it will be found that although the rooms are not so dark and damp as to induce the Medical Officer to insist strongly on energetic action being taken (it being frequently a great hardship both to the persons living in them and to the landlords to insist that such rooms shall no longer be let in the same manner as before) yet the areas do not comply with the provisions of the Act and cannot be made to do so without interfering with the public pavement, an interference which the local authorities will not always allow. It is usual then for such rooms, especially if they have ventilation at the back into a yard, as they sometimes have, to be left alone, although in all cases where the Medical Officer does not feel satisfied with such an arrangement, he should advise the contrary course, and leave it to the Sanitary Authority to accept the responsibility of inaction. As different landlords may be responsible one after the other for the overcrowding of a room or house, or for the letting of an underground room as a separate dwelling, it is provided by the 36th section of the Sanitary Act, that where two convictions have been obtained under

Different action in different cases.

No action in certain cases.

Closing, if two convictions.

such circumstances within three months, "it shall be lawful for any two justices to direct the closing of such premises for such time as they may deem necessary, and in the case of cellars occupied as aforesaid, to empower the nuisance authority to permanently close the same in such manner as they may deem fit at their own cost."

Lighting and warming.

After the impurities introduced into the air by persons living in it, come those produced by the combustion of substances for the purposes of lighting and warming, but over this the medical officer, as such, has no special control, and the same may be said of the smoke from factories about which there are special Acts which, however, it is no longer his duty to see carried out. We have already considered the methods to be practised for the riddance and disposal of house refuse, and in the following chapter we shall treat of special trade nuisances.

Ventilation.

We have now to consider briefly the methods to be used for ensuring as far as possible the purity of the air in apartments by the simplest possible means. This can only be done effectually by providing a sufficient and continual change of air. In apartments in which persons live there should be always a large quantity of air entering at one place and escaping at another without a draught. Ventilation has been described as natural and

Natural and artificial.

artificial. Natural ventilation includes all the methods by which air is renewed without resorting to any apparatus which forces it in particular directions. Natural ventilation depends in the first place upon the property of

Diffusion of gases.

diffusion of gases, by which, for instance, the excess of carbonic acid which may be present in the air of a room would be gradually distributed to all parts of the room, even supposing there to be no currents of air in it: (but the organic matters which are suspended in the air

No effect on suspended organic matters.

are not acted upon by virtue of the law of the diffusion of gases). In the next place it depends upon movements produced in the air by variations in the density

Variations in density.

of the air itself, and in all successful methods of ventilation such movements are regulated and taken advantage of. These movements are ordinarily caused in rooms by means of a fire or lamp which heating and therefore expanding the air causes it to rise and escape at certain openings,

while denser air comes in through others to take its place. Thirdly, it depends upon movements produced in large bodies of air outside of houses by the same cause operating on a large scale; these are known as "winds," and they act in two ways—directly (if the chance is given them) by forcing the air before them and taking its place, and indirectly by aspiration. A wind passing over the top of a chimney (even supposing there to be no fire in the grate below), causes a diminution of pressure in it, and the result is an upward movement of air from the room with which the chimney communicates. Winds are very powerful agents of ventilation, and in the summer it is only necessary to open the windows, because the slightest amount of air, almost imperceptible as a wind, suffices completely to change the air of a house. Winds have also been utilised for the ventilation of large buildings by means of a cowl turning always towards the wind and communicating with a tube that descends underneath the house into a warmed chamber from which the air passes to the various parts of the house. This is known as Sylvester's plan, and by it the holds of ships are frequently ventilated.

Winds,

Double action of.

Power of winds.

As to the methods of ventilation by which the movements of air caused by variations in its density are utilised, the first and most obvious is to take advantage of the fact that the impure warmed air of a room rises to the top, and to make openings for it to go out by. Such openings, whether there be a fire in the room or not will have precisely the contrary effect unless sufficiently large openings are made lower down in the room, and at least equally exposed, by which denser air can enter. It is perfectly impossible that this can be done either in large or small rooms unless the air is artificially warmed before being allowed to enter the room, and so it becomes a matter of practical necessity in ninety-nine cases out of a hundred to introduce air into rooms at the upper part, and either to provide special openings for its exit, or to allow it to get out by the chimney, and this latter plan is generally sufficient. Air may be most conveniently introduced into rooms by openings over the lintel of the door, and if these be so constructed that the cold air passes upwards to the ceiling no draught will be felt.

Exit openings.

Entrance openings.

In fact draughty rooms are only made inhabitable by providing a special means of entrance for air from outside. A ventilator of common use and of great efficiency for this purpose is known as Sherringham's valve. It is fixed in a hole in the wall at any convenient situation, but preferably high up in the room and opposite to the fireplace. On the outside—that is, either in the open air or in the hall or staircase from which it is proposed to supply the room with air,—the aperture is covered by a piece of wire gauze or of perforated zinc to keep dust, soot, &c. out as far as possible. On the inside is a heavy flap which falls forwards by its own weight into the room for a certain distance so that the opening left by it looks upwards towards the ceiling. This flap is balanced by means of a weight hung on a string which passes over a pulley—the weight serving as the handle and keeping the flap in any desired position. By means of one of these ventilators a very large amount of air is continually introduced into a room (especially if there be a fire in it) quite imperceptibly. An excellent plan for introducing outer air into staircases or sleeping rooms is, to have a block of wood made to fit under the lower sash of the window so as to raise it a little; air then enters between the sashes and is directed upwards; no draught is felt. Staircase windows may be screwed in this position in winter.

Sherringham's valve.

Simple plan.

Circular glass ventilators are occasionally useful especially over entrance doors, but louvre ventilators with metal frames are liable to get out of order, especially in large towns.

Among ventilators intended to provide for the exit of heated air from the top of rooms may be mentioned especially Arnott's valve, which consists essentially of a light flap balanced in an aperture made into the chimney flue high up in the room, and so arranged that any pressure of air from the inside of the room will open it without allowing of an escape of smoke into the room. The disadvantages of this ventilator are, that it is apt, especially if a little out of order, to make a clicking noise, and that a certain amount of soot generally gets through it into the room. Another is that such provision for the escape of vitiated air is not necessary in rooms with a fireplace, especially if a sufficient amount of pure air is being continually introduced. A very simple

Arnott's valve.

Not to be recommended.

and most excellent ventilator for rooms which project from houses and have no other rooms above them, or for water closets in similar situations, is McKinnell's, which has been already described. (See page 233.)

McKinnell's.

Chimneys act not only in winter but also in summer as extraction shafts if only sufficient means be provided for the entrance of fresh air into the room. A chimney, indeed, may be considered to be a kind of inverted syphon, the fact being that air will come into a room at the lowest place possible. If there be no aperture in the walls of the room for this purpose as much will come in by chinks round the door, at the joints of the window, &c. as can, and the rest will come down the chimney—one of the most frequent causes of smoky chimneys. In fact in large chimneys there is frequently an up-current and a down-current, the latter being produced in the way here indicated; but if a sufficiently large opening be made into the room to allow dense air of the lower *strata* to come in, a continual current will be established up the chimney, and there will be no chance of any air coming down it. The efficiency of chimneys as ventilators is increased by narrowing their two ends so as to produce a more rapid entrance and exit of the air, and the upper end is equally well narrowed by placing a chimney pot inside the top of the chimney instead of outside it, while the unsightliness of the latter proceeding is avoided. Stoves of various sorts may be used to ventilate apartments, the external air introduced into the room being warmed by contact with them, and the same plan is carried out in Galton's fire-places. A single fire may be made to ventilate a whole house if pipes are made connecting the various rooms in the house with the ash-pit below this fire. By this means a fire (say the one in the hall), may be made to extract air from all the rooms in the house, and it is only necessary in that case to provide openings by which external air can enter these rooms. It is not our purpose to discuss these plans here, as we have only to do with the simplest methods employed for ventilating rooms. We may mention however, that the first great essential is that the products of combustion shall pass directly from the apartment and not have any chance of being brought into it again. Sloping

Chimneys.

Smoky chimneys.

Narrowed apertures.

Stoves and fire-places.

Windows.

windows, that is windows which slope when they open, are an excellent contrivance where they can be conveniently placed, and double windows are especially advantageous for hospital wards. When air is to be introduced by means of them, the outer one should be opened at the bottom and the inner one at the top.

Large buildings.

Large buildings, if at all, are usually ventilated by some artificial method, but it is not often that the numerous lights in them are utilised for the purpose of producing an outward current of air, and of removing much of the vitiated air of such places when overcrowded. The sunlights now in vogue do this to a considerable extent. Outside the tube which carries off a certain proportion of the products of combustion is a large tube opening into the room round the lights, in which an upward current is caused by the heated air in the inner tube, and thus a large quantity of air is drawn out of the room ; a few large buildings, as theatres, are now ventilated by the chandeliers which light them, by means of small tubes which connect the different parts of the building with the extraction tube just mentioned, by which air is thus drawn from all parts. It is only necessary to provide a means by which slightly warmed air can enter at the lower part of a building—the pit of a theatre for example : it can be warmed by contact with coils of hot-water pipes.

Sunlight ventilators.

For descriptions of the apparatus used in the various plans for the artificial ventilation of Public Buildings, &c., and also of the arrangements of hot water pipes for warming and ventilating, we must refer the reader to special treatises ; for while such matters only come very occasionally under the notice of the Medical Officer of Health, they could not be usefully described except at considerable length.

Torrens's Act.

If the Medical Officer of Health is of opinion that any premises " are in a condition or state dangerous to health so as to be unfit for human habitation," he is to report (in writing) on the matter to the Sanitary Authority, who will refer the matter to the Engineer or Surveyor, and get his suggestions, whether they concern the improvement or the demolition of the premises, enforced by means of the Artizans' and Labourers' Dwellings Act (1868), if that Act applies to the place in which the premises are situated.

CHAPTER VII.

INSPECTION OF TRADES, ETC.

Slaughter-houses. — The places for slaughtering cattle, sheep, and pigs for human food are of two sorts: they are either public *abattoirs* or private slaughter-houses. I cannot quote a higher authority than Tardieu to show the advantages of public over private slaughter-houses. He says (*Dictionnaire d'Hygiène Publique et de la Médecine Légale, art.* '*Abattoir*')—

Advantages of public abattoirs.

"We must point out that the establishment of communal and public *abattoirs* is of capital importance as regards the butcher's trade and the exercise of supervision over the kind as well as the quality of the meat. Beasts intended for food are taken directly to the *abattoirs*, where a special inspection, entrusted to competent men, is carried out. It is forbidden to slaughter in these public establishments animals suffering or supposed to be suffering from contagious diseases, and especially from malignant pustule or entozoic disease. Animals suffering from other diseases cannot be slaughtered without the consent of the inspectors of the slaughter-house; nor, in case of doubt, without the previous advice of a veterinary surgeon. Animals which happen to die in the *abattoirs* are treated in the same way. Lastly, the meat (whether of oxen, sheep, or pigs) must be inspected after the animals are slaughtered, and seized whenever it is found to be spoiled, tainted, or unfit for food."

Paving, &c.

Slaughter-houses, whether public or private, must fulfil certain conditions. The pavement must be impervious, made of York paving-stone or hard bricks set in cement, or of asphalt, and laid on four or five inches of concrete;

and the drains should be constructed of glazed stoneware pipes.

The freest possible ventilation should be provided. The walls should be frequently lime-whited. A sufficient supply of water is, of course, absolutely necessary; but the old plan of providing an enormous supply was faulty for several reasons; and the modern one to be seen at work at the public *abattoirs* in Paris, as recommended by Bouchardat—that of allowing a comparatively small supply of water, and insisting on the place being kept clean by the continuous removal of all offal, blood, and other refuse—is by far the best. By it much less is wasted; and the cleanliness of slaughter-houses conducted in this way will compare favourably with those in which the careful removal of putrescible matters is avoided by flooding the place with water.

Water supply.

It need hardly be added, however, that where this plan is carried out it must be under constant authoritative supervision, and that, where this cannot be had, the plan of insisting on the use of a very large quantity of water is the safest one; and so in all private slaughter-houses one of the first necessities is the presence of a sufficient supply of water; and the tap should, as a rule, project from the wall over the highest point of the floor.

Blood.

The blood should not be allowed to run into the drains, or it will stop them up; and a special receptacle should be provided in every slaughter-house to receive it. In large slaughter-houses, where many animals are killed, this is always done on account of the value of the blood; but in small ones it is sometimes allowed to run into the drains.

Dogs.

Occasionally, butchers are in the habit of tying up dogs in the slaughter-house at night. This should never be allowed, as it is a practice which is not only filthy, but dangerous, on account of the facilities afforded by it for the spread of entozoic disease.

Licenses.

Private slaughter-houses have in London to be licensed annually by the magistrates; and the local authorities may, if they choose, and do occasionally, upon the advice of their medical officer, who makes an inspection of all the slaughter-houses once a year, oppose either the renewal of

old licenses or the granting of new ones. But there are considerable difficulties in the way of refusing licenses to the proprietors of slaughter-houses which have been licensed for a number of years, but which, from their proximity to dwellings, cannot but be a nuisance, however well they are kept.

Private slaughter-houses.

Although it is admitted on all hands that a great improvement has taken place in the condition of the private slaughter-houses in London since the introduction of inspection by the Sanitary Inspectors and by the Medical Officers of Health, yet it cannot be denied that there are a large number of private slaughter-houses in London and other towns which are a nuisance to the persons living in the neighbouring houses, even if they are well kept; and plenty more that are so because they are kept badly. In many instances these slaughter-houses are placed in small back yards, with houses built all round, the only access to them being through the house of the butcher; so that the animals have to be driven across the pavement and through the shop, and often down steps into the yard.

Bad positions.

Disadvantages.

The impossibility of any inspection whatever of the condition of the animals slaughtered in private slaughter-houses is obvious. Perhaps, however, the strongest argument that can be used against them, and that can be urged in favour of their discontinuance, which it is to be hoped will be in great measure effected next year, when the Act of 1834 will come into force, is, that very few butchers in the best parts of London slaughter at all. They apply annually for their licenses, so that they may not lapse; for this would diminish the value of the premises; and also that they may be able, if they choose, to slaughter occasionally; but they do not find it necessary, or even expedient, to have the animals driven up to London and to slaughter them on their own premises.

Private S. H. not necessary.

Whether on the ground of public health or on that of economy, there can be no question of the superiority of public *abattoirs* over private slaughter-houses—a superiority acknowledged and acted upon in Paris as long ago as 1810.

Cowsheds are (if the milk is sold) subject to the same

conditions as to licensing (in the Metropolis) as private slaughter-houses. They are visited frequently by the sanitary inspectors, and once a year by the medical officer as well.

Paving channels, &c.

The paving requires to be impervious, and laid on concrete, as in the case of slaughter-houses. The channels must be well laid, so that the water runs freely off them, and does not accumulate in pools. They are best made of York paving or asphalt; and if made of brick, require to be frequently set to rights, as they become uneven. The mangers should be lined with cement.

Ventilation.

Cowsheds must be well ventilated. It is well to insist on having a louvred window in each stall; and, if there be a loft overhead, the floor should be taken off over the heads of the animals for about three feet all along, and the tiles of the roof should not be pointed. It is much better, however, not to have lofts over cowsheds at all. The cubic space allotted to each cow should be about 1000 cubic feet, at least 800.

Water supply.

The water supply is a most important consideration in connection with cowsheds. So many epidemics of enteric fever have now been traced to wells or tanks containing polluted water, in dairies and cowsheds, that it becomes a matter of necessity to insist, in all cases, that the water supply to a cowshed or dairy be unexceptionable. Underground tanks should not be allowed, and wells only when there is no doubt as to the purity of the water they contain. It is, however, very difficult to prevent the use of wells, unless it can be clearly proved that they actually do, on a particular day, contain water which is then unfit to drink. There are plenty of wells in London and other large towns of which this cannot be said.

Wells.

Mangers.

It is a good plan to have the mangers so constructed that they incline in the opposite direction to the channels, so that water thrown into the manger at the upper end may run down it, and, when above a certain level, overflow so as to run into the upper part of the channel and then down along it into the drain. Thus, every time that the cows are watered, the channels will be washed. The grain-pit as well as the dung-pit must be properly drained. The

manure and other refuse matters from slaughter-houses and cowsheds should be removed very frequently, every other day, or, if there be a large quantity, daily. The same is to be said about the manure from stables; and sanitary authorities have power, under the Sanitary Act, to insist that it shall be frequently removed from such places. Manure, &c.

Piggeries should be got rid of, if possible, whenever they are near to houses; they are almost invariably a nuisance, and ought not to be tolerated in populous districts. Neither pigs nor any other animals ought to be kept except in properly paved and drained sheds, or they will necessarily be a nuisance to the neighbourhood, and a notice should always be served on anyone offending in this way, and followed up, if necessary, by a summons to appear before a magistrate, sufficient evidence being brought forward to prove the existence of the nuisance. Animals kept so as to be a nuisance.

Bakehouses require to be inspected frequently, and at irregular intervals. It is obviously necessary that they, and all the troughs, tables, &c., used in them, should be kept scrupulously clean; and to this end it is provided by the 26th & 27th Vict., cap. 40, as follows:—

"The inside walls and ceiling or top of every bakehouse situate in any city, town, or place containing, according to the last census, a population of more than five thousand persons, and the passages and staircase leading thereto, shall either be painted with oil or be lime-washed, or partly painted and partly lime-washed; where painted with oil there shall be three coats of paint, and the painting shall be renewed at least once in seven years, and shall be washed with hot water and soap once at least in every six months; where lime-washed the lime-washing shall be renewed once at least in every six months. Cleanliness.

"Every bakehouse, wherever situate, shall be kept in a cleanly state, and shall be provided with proper means for effectual ventilation, and be free from effluvia arising from any drain, privy, or other nuisance.

"If the occupier of any bakehouse fails to keep the same in conformity with this Section, he shall be deemed to be guilty of an offence against this Act, and to be subject in respect of such offence to a penalty not exceeding five pounds.

Penalties for infringement.

"The Court having jurisdiction under this Act may, in addition to or instead of inflicting any penalty in respect of an offence under this Section, make an order directing that, within a certain time, to be named in such order, certain means are to be adopted by the occupier for the purpose of bringing his bakehouse into conformity with this Section. The Court may, upon application, enlarge any time appointed for the adoption of the means directed by the order, but any non-compliance with the order of the Court shall, after the expiration of the time as originally limited, or enlarged by subsequent order, be deemed to be a continuing offence, and to be punishable by a penalty not exceeding one pound for every day that such non-compliance continues."

And that the officer of health or sanitary inspector, or any other person appointed by the local authorities, may enter any bakehouse at all times during the hours of baking; and that any person obstructing him, or refusing admission, shall, for each offence, incur a penalty not exceeding 20*l*.

Dangerous or noxious trades may be divided, for public health purposes, into four classes:—

Fires or explosions.

1. Those which are especially liable to fires or explosions, as petroleum works or stores, gas works, and the like. About the propriety of insisting that such works should be as far as possible from the centre of the population, there can be no question, apart from the fact that they frequently cause a nuisance to the neighbourhood around; and this is especially the case with the manufactures attached to gas works. It must be remembered also that the leaking of gasometers, by which escape of the foul water contained in them into the subsoil is allowed, has frequently been the means of polluting the wells of a whole neighbourhood.

Poisons.

2. Trades in which poisonous matters are given out into the air. Gas works must be again included under this head, because the possibility of accidents causing considerable escape must always be taken into account; the great advantage of the oxide of iron process for the purification of gas over the lime processes (wet and dry) from a sanitary point of view are, it is believed, acknowledged on

all hands, and its employment should be insisted on: lime-kilns, which give out enormous volumes of carbonic acid, both from the limestone burnt and from the fuel employed, and which have been the cause of suffocating persons living in the immediate neighbourhood; and especially smelting works, from which sulphurous acid, arsenious acid, &c., are liable to be allowed to escape into the air; soda-works, where we have hydrochloric acid as a refuse product and the like, are liable to become a nuisance, especially as Dr. Angus Smith says that chlorine, hydrochloric acid, &c. are carried in the air for long distances. They are placed in France in the first class of noxious trades. In them, every precaution that can be devised should be taken to prevent the escape of the poisonous materials. The processes should be conducted in closed vessels where practicable. Vapours, such as that of hydrochloric acid, should be absorbed by water, being made to pass through high chimneys, in which water is continually trickling, or by some other suitable method.

Precautions.

3. Trades in which the danger to health arises chiefly to the operatives from the fine dust floating continually in the air of the premises. Such are those of marble workers and polishers of various sorts, especially those who use emery, as steel polishers. In these trades the great danger is from phthisis; but it is seldom that they cause much nuisance to the neighbourhood, except in the case of manufactures of artificial manures, in which the manure made by ground-up coprolites and bones, frequently mixed with a certain amount of putrid organic matter, and treated with concentrated sulphuric acid, gives off, when dry, a very fine dust, which is particularly irritating, and which, if blown out of the premises, may cause a considerable nuisance to the neighbourhood. The smoke from factory chimneys may perhaps be mentioned here: smoke consuming furnaces should be used.

Dust

4. Lastly, we have trades where the nuisance consists in the necessary production of foul organic vapours; and these are very numerous. Places where horses are slaughtered, and their carcases turned to the various uses to which they are assigned, must be mentioned first, necessi-

Organic effluvia.

tating, as they do, the works of the bone boiler, the soap maker, &c. Then those of the albumen makers, gut cleaners and preparers, and a quantity of other offensive trades. Varnish makers may also be added, for the fumes emitted by the boiling resins are very offensive.

Should be burnt.

In all such cases the best plan is to insist that the vapours from the boilers (which should be provided with covers that can be easily lifted up and let down) be conducted into a flue which passes into the furnace of the boiler itself, so that they are effectually burnt. And this can be done in almost all cases.

No accumulation of offensive matters, as rags at marine-store dealers' warehouses, &c., should be allowed to remain any longer than is absolutely necessary for the purposes of the trade.

It is only when a manufacturer is found to be neglecting the precautions which are considered necessary to prevent his processes becoming a nuisance that he can be interfered with, and compelled to remove his business to some other place.

The inspection of articles of food exposed for sale is a matter that must be left to common sense, guided by a little practical experience. Entozoic diseases are sufficiently described in medical treatises.

DEATHS registered in the District of *during the* 13 *Weeks ending March* 29*th*, 1873.

CAUSES OF DEATH.	Ages at Death.							Sub-Districts & Population.						Sexes.		
	Under 1.	1 and under 5.	5 and under 20.	20 and under 40.	40 and under 60.	60 and under 80.	80 and above.	A—18,700.	B.—13,020.	C.—58,038.	Workhouse—268.	Hospital —216. Residents.	Hospital —216. Strangers.	Males, 38,456.	Females, 51,302.	Total, 89,758.
CLASS I. ZYMOTIC DISEASES.																
ORDER 1.—Miasmatic Diseases.	9	8	6	10	5	2	..	2	3	25	..	5	5	21	19	40
1. Small Pox	..	..	..	1	..	..	..	..	..	1	..	..	..	..	1	1
2. Measles	2	3	1	..	..	..	..	..	..	6	..	..	..	4	2	6
3. Scarlet Fever (Scarlatina)	1	1	1	1	..	..	..	..	..	4	..	..	..	2	2	4
4. Diphtheria	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5. Quinsy	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6. Croup	1	2	1	..	..	..	..	..	..	4	..	..	..	3	1	4
7. Whooping Cough	..	1	..	..	..	..	..	..	1	..	..	..	..	..	1	1
8. Typhus	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Enteric (Typhoid) Fever	..	1	2	6	1	..	..	..	..	5	..	2	3	4	6	10
Simple Continued Fever	..	..	..	..	1	..	..	..	..	1	..	..	..	1	..	1
9. Erysipelas	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10. Puerperal Fever (Metria)	..	..	..	1	..	..	..	..	..	..	..	1	..	..	1	1
11. Pyæmia	..	..	..	1	2	1	..	..	..	..	..	2	2	3	1	4
12. Carbuncle	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13. Influenza	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14. Dysentery		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15. Diarrhœa	5	..	..	..	..	1	..	2	1	3	..	..	..	4	2	6
16. Simple Cholera	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17. Ague	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18. Remittent Fever	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19. Rheumatism	..	..	1	..	1	..	..	..	1	1	..	..	..	..	2	2
ORDER 2.—Enthetic	1	..	..	..	1	1	..	..	..	1	..	1	1	3	..	3
1. Syphilis	1	..	..	..	..	..	..	..	..	1	..	..	..	1	..	1
2. Stricture of Urethra	..	..	..	..	1	1	..	..	..	..	..	1	1	2	..	2
ORDER 3.—Dietetic	4	..	..	2	..	..	..	..	1	4	1	..	..	5	1	6
1. Privation	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2. Want of Breast Milk	3	..	..	..	..	..	..	..	1	2	..	..	..	2	1	3
3. Purpura and Scurvy	1	..	..	..	..	..	..	..	..	1	..	..	..	1	..	1
4. Alcoholism { *a.* Del. Tremens	..	..	..	2	..	..	..	..	..	1	1	..	..	2	..	2
4. Alcoholism { *b.* Intemperance	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
ORDER 4.—Parasitic.	2	..	..	..	..	..	..	..	..	2	..	..	..	..	2	2
1. Thrush	2	..	..	..	..	..	..	..	..	2	..	..	..	..	2	2
2. Worms, &c.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
CLASS II. CONSTITUTIONAL DISEASES																
ORDER 1.—Diathetic	1	..	..	3	10	5	..	3	2	7	..	1	6	8	11	19
1. Gout	..	..	..	..	1	..	..	1	..	..	..	..	..	1	..	1
2. Dropsy	1	..	..	..	1	2	..	..	..	3	..	..	1	2	2	4
3. Cancer	..	..	..	3	8	3	..	2	2	4	..	1	5	5	9	14
4. Cancrum Oris (Noma)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5. Mortification	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

CAUSES OF DEATH.	Ages at Death.							Sub-Districts & Population.						Sexes.		
	Under 1.	1 and under 5.	5 and under 20.	20 and under 40.	40 and under 60.	60 and under 80.	80 and above.	A.—18,700.	B.—13,020.	C.—58,038.	Workhouse—268.	Hospital —216. Residents.	Hospital —216. Strangers.	Males, 38,456.	Females, 51,302.	Total, 89,758.
ORDER 2.—Tubercular	4	4	11	23	14	3	..	1	6	36	1	4	11	34	25	59
1. Scrofula	..	..	1	..	..	..	..	..	..	1	..	..	..	1	..	1
2. Tabes Mesenterica	2	..	..	..	..	..	..	..	..	2	..	..	..	2	..	2
3. Phthisis	1	2	9	23	14	3	..	1	6	29	1	4	11	30	22	52
4. Hydrocephalus	1	2	1	..	..	..	..	..	..	4	..	..	..	1	3	4
CLASS III. LOCAL DISEASES.																
ORDER 1.—Nervous System	10	8	4	2	15	19	2	11	8	33	2	4	2	34	26	60
1. Cephalitis	..	..	..	1	..	..	..	..	..	1	..	..	..	..	1	1
2. Apoplexy	..	..	..	..	9	12	1	4	4	9	..	4	1	11	11	22
3. Paralysis	..	..	..	..	4	4	1	3	1	5	..	..	..	4	5	9
4. Insanity	2	..	..	..	..	2	..	..	..	2	2	..	..	1	3	4
5. Cholera	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6. Epilepsy	..	..	2	1	..	..	..	..	..	3	..	..	..	2	1	3
7. Convulsions	8	6	1	..	..	..	..	3	2	10	..	..	..	12	3	15
8. *Brain Disease, &c.*	..	2	1	..	2	1	..	1	1	3	..	..	1	4	2	6
ORDER 2.—Organs of Circulation.	..	..	1	7	8	15	1	3	4	19	..	1	5	17	15	32
1. Pericarditis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2. Aneurism	..	..	..	2	..	1	..	..	1	..	..	..	2	3	..	3
3. *Heart Disease, &c.*	..	..	1	5	8	14	1	3	3	19	..	1	3	14	15	29
ORDER 3.—Respiratory Organs.	14	16	1	11	25	37	5	25	4	67	7	3	3	55	54	109
1. Laryngitis	2	..	..	..	..	..	..	..	..	2	..	..	..	1	1	2
2. Bronchitis	10	13	..	4	14	30	3	18	3	45	6	1	1	38	36	74
3. Pleurisy	..	..	..	..	..	1	..	..	..	1	..	..	..	..	1	1
4. Pneumonia	1	3	..	5	2	..	..	2	..	6	..	2	1	6	5	11
5. Asthma	..	..	..	..	2	3	2	1	..	5	1	..	..	5	2	7
6. *Lung Disease, &c.*	1	..	1	2	7	3	..	4	1	8	..	..	1	5	9	14
ORDER 4.—Digestive Organs	4	2	..	5	9	6	..	2	3	17	..	1	3	12	14	26
1. Gastritis	..	..	..	..	..	1	..	..	..	1	..	..	..	..	1	1
2. Enteritis	1	1	..	..	..	..	..	..	..	2	..	..	..	..	2	2
3. Peritonitis	..	1	..	2	..	1	..	..	1	1	..	..	2	2	2	4
4. Ascites	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5. Ulceration of Intestines	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6. Hernia	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7. Ileus and Intussusception	1	..	..	1	1	2	..	1	..	3	..	..	1	3	2	5
8. Stricture of Intestine	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9. Fistula	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10. *Stomach Disease, &c.*	1	..	..	..	..	1	..	..	..	2	..	..	..	1	1	2
11. *Pancreas Disease, &c.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12. Hepatitis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13. Jaundice	1	..	..	1	1	..	..	..	..	2	..	1	..	2	1	3
14. *Liver Disease, &c.*	..	..	..	1	7	..	..	1	2	5	..	..	..	3	5	8
15. *Spleen Disease, &c.*	..	..	..	..	..	1	..	..	..	1	..	..	..	1	..	1
ORDER 5.—Urinary Organs	..	..	2	1	6	6	..	3	2	7	..	2	1	10	5	15
1. Nephria	..	..	2	..	3	1	..	..	..	4	..	1	1	4	2	6
2. Diabetes	..	..	..	1	1	2	..	1	..	3	..	..	..	2	2	4
3. *Kidney Disease, &c.*	..	..	..	..	2	2	..	1	2	..	..	1	..	3	1	4
4. Disease of Bladder	..	..	..	..	..	1	..	1	..	..	..	..	..	1	..	1
5. Calculus (Stone)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

BIRTHS registered during 13 weeks.—(A.) M. 43, F. 46; (B.) M. 29, F. 28; (C.) M. 219, F. 202; Total, 567.

CAUSES OF DEATH.	Ages at Death.							Sub-Districts & Population.						Sexes.		
	Under 1.	1 and under 5.	5 and under 20.	20 and under 40.	40 and under 60.	60 and under 80.	80 and above.	A.—18,700.	B.—13,020.	C.—58,038.	Workhouse—268.	Hospital —216. Residents.	Hospital —216. Strangers.	Males, 38,456.	Females, 51,302.	Total, 89,758.
ORDER 6.—Generative Organs .	..	..	..	..	2	..	..	1	..	..	..	..	1	..	2	2
1. Ovarian Dropsy	..	..	..	..	2	..	..	1	..	..	..	..	1	..	2	2
2. *Uterine Disease, &c.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
ORDER 7.—Organs of Locomotion.	1	..	..	..	1	..	..	..	..	1	..	..	1	2	..	2
1. Arthritis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2. *Joint Disease, &c.*	1	..	..	..	1	..	..	..	..	1	..	..	1	2	..	2
ORDER 8.—Skin, &c. . .	2	..	..	..	1	..	..	..	..	2	..	..	1	1	2	3
1. Phlegmon	1	..	..	..	1	..	..	..	..	1	..	..	1	1	1	2
2. Ulcer	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3. *Skin Disease, &c.*	1	..	..	..	..	..	..	..	..	1	..	..	..	..	1	1
CLASS IV. DEVELOPMENTAL DISEASES																
ORDER 1.—Diseases of Children .	10	2	..	..	..	..	..	1	1	9	..	1	..	8	4	12
1. Premature Birth	4	..	..	..	..	..	..	..	1	2	..	1	..	2	2	4
2. Cyanosis	2	..	..	..	..	..	..	..	..	2	..	..	..	1	1	2
3. Spina Bifida	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4. Other Malformations . . .	1	..	..	..	..	..	..	..	..	1	..	..	..	..	1	1
5. Teething	3	2	..	..	..	..	..	1	..	4	..	..	..	5	..	5
ORDER 2.—Diseases of Adults .	..	..	..	1	..	..	..	..	1	..	..	..	..	..	1	1
1. Paramenia	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2. Child-birth (*see* Metria) . .	..	..	..	1	..	..	..	..	1	..	..	..	..	..	1	1
ORDER 3.—Diseases of Aged. .	..	..	..	..	..	10	9	3	3	9	4	..	..	6	13	19
1. Old Age	..	..	..	..	..	10	9	3	3	9	4	..	..	6	13	19
ORDER 4.—Diseases of Nutrition.	11	1	..	..	..	..	..	1	..	10	1	..	..	7	5	12
1. Atrophy and Debility . . .	11	1	..	..	..	..	..	1	..	10	1	..	..	7	5	12
CLASS V. VIOLENT DEATHS, &c.																
ORDER 1.—Accident or Negligence.	4	3	..	6	3	5	..	1	1	10	..	4	5	13	8	21
1. Fractures and Contusions .	..	..	..	3	2	3	..	..	..	4	..	3	1	7	1	8
2. Wounds, Gunshot, Cut, Stab	..	..	..	..	..	1	..	1	..	..	..	..	..	..	1	1
3. Burns and Scalds	..	3	..	..	..	..	..	..	..	..	..	..	3	..	3	3
4. Poison	..	..	..	..	1	..	..	..	..	..	..	1	..	..	1	1
5. Drowning	..	..	..	1	..	..	..	..	..	1	..	..	..	1	..	1
6. Suffocation	4	..	..	1	..	..	..	..	1	4	..	..	..	3	2	5
7. Other Injuries	..	..	..	1	..	1	..	..	..	1	..	..	1	2	..	2
ORDER 2.—Homicide . .	1	..	..	..	..	..	..	..	..	1	..	..	..	1	..	1
1. Murder and Manslaughter .	1	..	..	..	..	..	..	..	..	1	..	..	..	1	..	1
ORDER 3.—Suicide.																
1. Cut, Stab, Shot	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2. Poison	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3. Drowning	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4. Hanging	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5. Otherwise	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sudden Deaths (Cause unascertained)	..	..	..	1	..	1	..	1	..	1	..	..	..	2	..	2
Causes not specified or ill-defined	5	..	..	..	..	1	..	3	1	1	..	..	1	2	4	6
TOTAL . . .	83	44	25	72	100	111	17	61	40	262	16	27	46	241	211	452

DEATHS registered during corresponding weeks of fourteen years (average) 544·7.

PART III

CHAPTER I.

WATER.

Solids present in Water—Gases present in Water—Hardness—Chlorides in Drinking Water—Nitrates in Drinking Water—Metals in Drinking Water—Organic Matter in Water—Ammonia—Process of Analysis.

CONSIDERED as a chemical substance, every description of drinking water—including even the very foulest varieties that are actually drunk—is a substance in a high degree of purity. Drinking water does not contain so much foreign matter (i.e., matter that is not water) as amounts to 0·1 per cent.; and, with the exception of water, it is rare for the chemist to meet with chemical compounds that do not contain the one-thousandth (or 0·1 per cent.) of foreign matter. The foreign material contained in drinking water consists of solids and gases dissolved in it. The solids may be exhibited on evaporating by help of the lamp a few drops to dryness on a platinum spatula, or on a strip of platinum foil, when they are left behind as a residue. The amount of the solids contained in a given quantity of water is ascertained by measuring (or weighing) a given quantity of water, then evaporating it to complete dryness, and weighing the residue. The operation is conveniently carried out as follows:—A measuring flask, holding 70 cubic centimeters when filled up to the mark, is filled with the water to be examined. A platinum dish is carefully cleaned, washed, dried, and weighed. Into the dish is poured the water. The dish is then placed in *the water bath*, and maintained at a temperature of 100°C, until the 70 cubic centimeters of water have evaporated to dryness. It is then removed from the bath, wiped externally, and weighed. The difference between the weight of the empty dish and the weight of the dish containing the residue, is the

weight of the residue yielded by 70 cubic centimeters of water. *Each milligramme of residue* counts for one grain of 'total solid residue' in a gallon of water. This will be understood when the reflection is made that a gallon of water weighs 70,000 grains, and that 70 cubic centimeters of water weigh 70,000 milligrammes.

If an accurate measure for 70 cubic centimeters of water be not at hand, a 100 cubic centimeter measure may be employed; and in that case the result in milligrammes must be multiplied by 0·7, in order to arrive at the number of grains of 'total solids' contained by a gallon of the water. Conducted in the manner just described, the taking of the 'total solids' may be accomplished in less than two hours. If the operator have a good Oertling's balance and weights, and if he be capable of working neatly, the small quantity of water above-named will be sufficiently large to admit of accuracy within one grain per gallon. If, however, the balance or weights be not of the most accurate description, or the operator be not skilful, he had better take ten times as much water as the quantity just named, and in that case, in the calculation, a centigramme will stand for a grain per gallon.

The following table will serve to indicate the amount of total solids in well-known varieties of drinking water.

	Grains of Solids in a Gallon.
London, Thames Companies	18·5
London, New River	17·6
London, Kent Company	26·5
Manchester Water Supply	4·7
Glasgow, Loch Katrine	2·3
Bala Lake	3·2
Guildford, New Supply	19·7
Scarborough Reservoir	28·7
The Rhine at Basel	11·8
The Spee at Berlin	8·0
Distilled Water	0·1

The solid residue is, as a rule, made up chiefly of mineral matter. In the London water and the Guildford water, it is mainly carbonate of lime. There is no reason for believing that if these waters contained less carbonate of lime they would be any better adapted for drinking; possibly

even the presence of the carbonate of lime may be advantageous, as affording an available supply of lime to the animal economy. Be this so or not, it is an incontestable fact that the natural water charged with lime is usually less contaminated with organic matter than those waters which contain very little mineral matter. Thus the water of the Kent Company and the new supply to Guildford, in Surrey, are almost as free from organic nitrogenous matter as the most carefully distilled water; whilst the water from Bala Lake, and even that from Loch Katrine belongs to the less pure (organically speaking) varieties of drinking water.

The present state of our knowledge does not warrant the raising of any objection to a water intended for domestic use on the score of its containing 30, or perhaps even 40, grains of solid residue per gallon. We are not even justified in according any preference to a water on the score of its containing exceptionally little solid residue; indeed, as has been said, exceptionally small solid residues are the rather indicative of a certain degree of organic impurity.

When, however, the mineral matter much oversteps these bounds, it becomes objectionable in itself. The water of the sea, in which there is from 3 to 4 per cent. of mineral matter, becomes, from that cause alone, an impossibility regarded as a drinking-water. Long, indeed, before the sea-water level of solid contents is reached, water passes out of the category of drinking-water.

Very high solid residues in river-water are indicative of tidal influence, or of the contamination brought about by the operations of industry, as in the instance of some of our northern rivers with factories on their banks, or of sewage contamination. The spring or well with an extraordinarily high solid residue may be a mineral water, or it may be actual sewage, or that somewhat diluted sewage which is known as surface-water. Examples in point are now given:

	Grains of Solids in a Gallon.
Sea Water	2408·0
Water from the River Thames at London Bridge at different states of the tide . .	(1) 186·0, (2) 269·0
Discharge from a chemical factory into the River Irwell, in Lancashire (Nov. 1865)	6811·0

	Grains of Solids in a Gallon.
Stream falling into the Irwell, and conveying refuse of coal-pit and factory (Nov. 1865) . . .	532·0
Specimen of London Sewage (Jan. 1872) . .	82·0
Water from Pump in Goodge Street, London (Oct. 1868)	104·0
Water from Pump in Oxford Market, London (Oct. 1868)	117·0
Sewage-contaminated Water from a Well at Windsor .	60·0

The foregoing waters, I need hardly add, are not drinking-water.

Gases present in Water.—In addition to the solids contained by different waters, gases are always present. The water of the Thames has been found to contain from 52·7 cubic centimeters to 71·25 cubic centimeters of gases per litre. Of this the greater portion consists of carbonic acid, the rest being nitrogen and oxygen in varying proportions. An attempt has been made to utilise these variations as indices to the state of purity of the water, and the maxim has been suggested that unless the oxygen bear a certain ratio to the nitrogen, the water is *insufficiently aërated*. It was found that, whereas at Kingston (i.e., considerably above London) the river contains oxygen and nitrogen in the ratio of 1 : 2, the ratio of oxygen to nitrogen in the river at Greenwich is 1 : 60. This extraordinary falling off of the oxygen is brought about by the action of the metropolis on the river, and in particular by the oxidation of the ammonia resulting from the decomposition of some 80 or 90 tons of urea which the metropolis pours out daily. I am not, however, of opinion that much light can be thrown on the condition of a given specimen of water by an examination of the gases evolved by it. Good water, no less than bad, is liable to have the dissolved nitrogen gas in immense preponderance over the oxygen. It is notorious that some of the deep spring waters show this peculiarity (the case of the Buxton-water may be instanced). Moreover, the taking of the amount of gases evolved by water is not the easiest piece of manipulation, and we have much better and much more available criteria of the quality of drinking-water.

With the further remark that the gases in the Thames water amount when weighed to about 10 grains per gallon, and that the gaseous contents of a soft water are at least equal

in amount to the solids, we will return to the consideration of the solids.

Hardness.—It is rarely, if ever, that the medical officer will be required to make a complete mineral analysis of the 'solid residue' left by a water. Provided that the solids do not much exceed 20 or 30 grains per gallon, it is not of importance whether the proportion of lime to magnesia be great or small, or what may be the exact ratio between the lime and alkalis. These points may have interest to the geologist, and sometimes to the manufacturer; but for the sanitarian they have none. The only question which arises in connection with these constituents is the hardness or softness of water; that is to say, whether it easily forms a lather with soap or not.

If a water contain a very small proportion of solids it must necessarily be a soft water, and if, on the other hand, there be more than 16 grains of solids to the gallon the water is almost invariably hard. Hardness is occasioned by the formation of insoluble lime or magnesian compounds with the fatty acids of soap, and is specially measured by the soap test invented by Dr. Clarke. A dilute solution of soap in weak alcohol is prepared. This solution is diluted until one measure (say one cubic centimeter) of this soap solution corresponds to one grain of lime. The soap solution is then gradually added to a given measure of the sample of water. After each addition of soap solution, the water is shaken up and the measure of soap solution noted. When the point is reached at which the water begins to form a lather the addition of the soap is stopped; and from the amount of soap which has been added the soap-destroying power of the water is calculable. It is customary to express this soap-destroying power in terms of carbonate of lime. So many degrees of hardness, so many grains of carbonate of lime per gallon.

When carbonate of lime is held in solution by carbonic acid it is deposited on boiling the water. Hence by boiling a water is often softened, and hence the terms 'temporary' and 'permanent' hardness. The temporary hardness expresses the number of grains per gallon of carbonate of lime deposited on boiling. The permanent hardness is the number of grains of carbonate of lime which boiling will not precipitate. Total hardness is the sum of the temporary and permanent hardness.

Not alone carbonate of lime, but sulphate of lime and likewise a variety of other salts act on soap, causing hardness; but whatever be the source of the hardness, custom enjoins that it should be expressed in terms of carbonate of lime per gallon.

The importance of taking the degree of hardness has been greatly overrated, and the medical officer of health can hardly ever be required to determine it.

Chlorides in Drinking Water.—It is customary for an analysis intended for sanitary purposes to include a determination of the amount of chlorine in the specimen of water. Urine and sewage (and consequently sewage-contaminated water) contain chlorides; whilst, on the other hand, uncontaminated water is very often, but by no means invariably, almost devoid of chlorides. Thus, it happens, that the presence of more than a trace of chlorine in water affords reason for suspecting sewage-contamination. It should, however, not be forgotten that proximity to the sea, and also the geological formation of the district may be sources of chlorides; and care should be taken not to attribute chlorine to sewage-contamination when it is due to other causes. The maxim may, however, be laid down that no specimen of water that is devoid of chlorine can possibly be affected by sewage-contamination. The amount of chlorine in water is determined by a very simple and satisfactory volumetric method, depending on the fact that chromate of silver, which is red in colour and very conspicuous, is not formed so long as any soluble chlorides are in the water, but is produced by excess of nitrate of silver so soon as the chlorides are transformed into chloride of silver. The details of the operation are as follows:—A standard solution of nitrate of silver is made by dissolving 4·79 grammes of dry nitrate of silver in one litre of distilled water. Each cubic centimeter of this solution contains as much nitrate of silver as corresponds to one milligramme of chlorine. It is essential that the nitrate of silver used for this purpose be neutral, inasmuch as chromate of silver is soluble in acids. The standard solution just described is used thus. In 70 cubic centimeters of water, about 30 milligrammes of yellow chromate of potash are dissolved. The standard solution is then dropped carefully into the 70 cubic centimeters of water until the red coloration just begins to be permanent. During the addition

of the standard solution the water must be constantly stirred up. Every cubic centimeter of silver solution employed represents one grain of chlorine per gallon of water.

In order to attain a high degree of accuracy, it is sometimes desirable to take 140 cubic centimeters of water and evaporate it down to one-half before adding the chromate of potash and silver solution. Should the water to be tested be acid, it must be carefully neutralised with pure carbonate of soda before being tested for chlorides. The necessity of having the neutral chromate of potash free from chlorides, and also the carbonate of soda in a state of freedom from chlorides, need hardly be insisted upon. Nor need I do more than hint at the wisdom of making a blank assay with pure distilled water before trusting to the results given on examination of suspected waters.

The following is a tabular statement of the amount of chlorine in different waters :

	Grains of Chloride per Gallon.
Bala Lake	0·706
New Water Supply to Guildford (Surrey)	0·94
Tunbridge Wells	3·7
Thames at Kew	0·847
Thames' Companies in London	1·2
Rhine at Basel	0·10
London, Pump in Portland Place	2·2
London, Pump in Goodge Street	12·4
London, Pump in Oxford Market	33·2
Well in Windsor	6·9
Weak Sewage	9·9

Nitrates in Drinking-water.—Much stress used to be laid on the presence and proportion of nitrates in drinking-water; but the progress of investigation has completely discredited the nitrates as criteria of unwholesomeness. It is quite true that in the course of nature the nitrogenous matter of sewage is to a great extent converted into nitrates, and that, therefore, when a given specimen of water contains nitrates, it *may possibly* owe those nitrates to the discharge of sewage into it. But, on the other hand, if a specimen of water be devoid of nitrates, the consequence by no means follows that sewage has never been poured into it; for aquatic vegetation destroys nitrates, and absence of nitrates may be due to a rife aquatic

vegetation as well as to absence of sewage. Curiously enough, also, very fresh sewage is said to be free from nitrates. The circumstance, however, which is most fatal to the employment of the test of the quantity of nitrates as a test of the impurity of drinking-water is, that the very purest natural water (i.e., that of deep springs) is highly charged with nitrates. If, then, a specimen of water be rich in nitrates, it may be either very pure or very much contaminated; and if a specimen of water be poor in nitrates, it may likewise be either pure or foul. I would, therefore, advise the medical officer to avoid making determinations of nitrates in drinking-water.

The following are a few examples in illustration of the amount of nitrates actually existing in various waters:

	Nitrogen existing as Nitrates and Nitrites.	Grains per Gallon.
I.	Guildford (Surrey) New Supply (very pure) by Wanklyn in 1872	0·27
II.	Water from West of England (very pure) by Wanklyn & Smith in 1868	0·45
III.	Water supplied by the Kent Water Company to London (very pure) by Frankland & Armstrong . .	0·28
IV.	Thames Water, as delivered by Water Companies in London (Frankland & Armstrong) . .	0·24
V.	Water supplied to Glasgow from Loch Katrine (Frankland & Armstrong)	0·02

These examples show most strikingly the danger of drawing any conclusion against the goodness of a drinking-water from the circumstance of its being comparatively rich in nitrates. In the three first examples the water is of extraordinary purity (organically speaking), and yet the nitrates are high. Example IV. is the case of water of fair quality, and the nitrates are high. Example V. is the celebrated Glasgow water, which contains more organic matter than average London water. It is, however, strikingly devoid of nitrates.

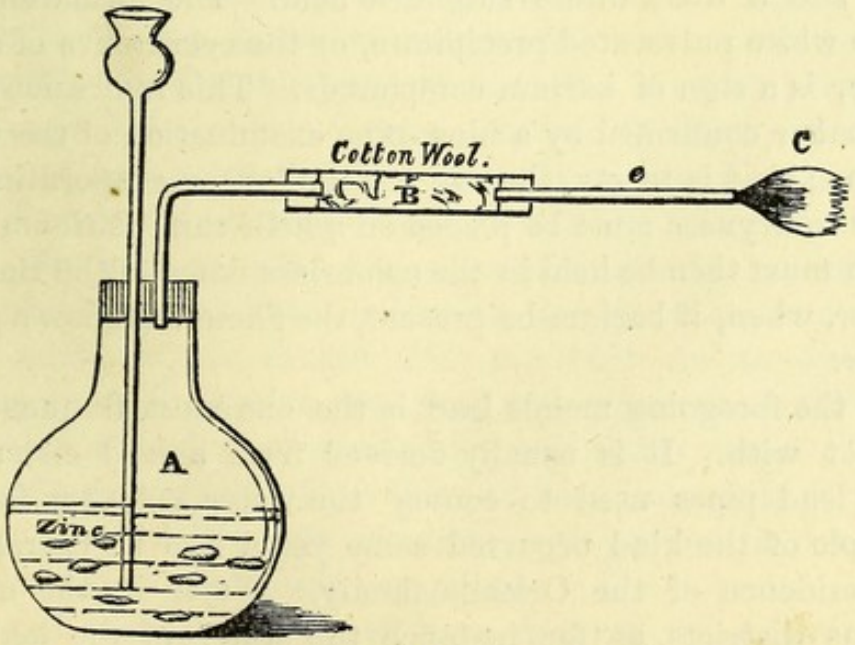
Metals in Drinking-Water.—A high degree of freedom from metallic impurity is demanded of all water which is to be employed for domestic purposes. The metals especially to be avoided are lead, copper, zinc, arsenic and barium. In order to test for lead and copper the water should be evaporated down to one-twentieth of its volume, then rendered slightly acid with a few drops of hydrochloric acid, and then mixed with a

little strong solution of sulphuretted hydrogen in distilled water. Thus treated it ought to remain colourless. The production of a brownish colouration or precipitate indicates the presence of one or other of the metals in question. This testing is most conveniently managed in a white porcelain dish, which admits of very accurate recognition of any trace of colouration. Should the water under examination become brownish on concentration, as is sometimes the case, especially in the instance of peaty water, the evaporation must be carried down to dryness, and the residue must be very gently ignited with free exposure to the air. The residue is afterwards to be treated with a few drops of hydrochloric acid, diluted slightly, and then tested with sulphuretted hydrogen water.

It is preferable to perform this ignition in a thin porcelain and not in a platinum dish, inasmuch as there is just the possibility of a faint trace of platinum passing into solution and giving a colouration with sulphuretted hydrogen.

In order to test for zinc, the water should be evaporated down to one-hundredth of its volume, mixed with a little solution of potash, filtered, and the filtrate mixed with sulphuretted hydrogen water. A white precipitate in the alkaline solution is indicative of zinc.

To test for arsenic.—Zinc (free from arsenic) is placed in



the flask A, and is covered with pure water. Then sulphuric acid, previously diluted with twice its volume of water is

poured through the funnel. Hydrogen gas will then begin to be generated, and will traverse the drying tube B. After the hydrogen has escaped for a sufficient length of time to displace all the air in the apparatus a light may be applied to the small orifice in the tube at C. If a piece of cold white porcelain (e. g. the surface of an evaporating basin) be held in the flame at C, a brown spot 'the well-known arsenical crust' will appear, unless the zinc and sulphuric acid be quite devoid of arsenic. In order, still more delicately to test for traces of arsenic the flame of the lamp may be applied externally to the tube at the spot marked E. The presence of arsenic in that case shows itself by the production of an arsenical ring inside the tube, and situated between E and C.

Having got the apparatus into working order, and having made sure that it contains no trace of arsenic, in the manner just described, the operator may proceed to test the water. This he does by simply pouring the water (previously evaporated to one-hundredth of its original volume) through the acid funnel, and continuing the generation of hydrogen gas. If arsenic be present the gas will on burning, or being heated, as was described, yield the well-known arsenical spots on porcelain, or on the interior of the tube in the form of a ring.

To test for Barium.—Evaporate to about one-quarter, and then add a little dilute sulphuric acid. The formation of a dense white pulverated precipitate, or the occurrence of a turbidity, is a sign of barium compounds. This indication must be further confirmed by a blow-pipe examination of the water residue; that is to say, the dry residue left on evaporating the water to dryness must be placed on a little thin platinum wire, which must then be held in the colourless flame of the Bunsen-burner, when, if barium be present, the flame will show a green colour.

Of the foregoing metals lead is the one most frequently to be met with. It is usually derived from a lead cistern or from lead pipes used to convey the water. A very famous example of the kind occurred some years ago at Claremont, the residence of the Orleans family. Water in the metalliferous districts, as for instance the water of the lakes in Cumberland and Westmoreland, is to be suspected of lead and copper, and ought to be most rigorously tested before being

used for the supply of towns. The presence of more than a trace of Iron in a water is against its employment for domestic purposes. A drinking water ought not to blacken to more than a very slight extent when it is evaporated to one-tenth of its volume rendered alkaline with ammonia, and tested with two or three drops of sulphuret of ammonium.

Organic Matter in Water.—The main object with which the sanitarian undertakes the examination of drinking water is to make out whether or not it is dangerously contaminated with organic matter: whether or not it contains animal excreta which have not undergone complete destruction. The possibility of dealing with this branch of the subject by chemical methods is quite modern, inasmuch as, a few years ago, there were no chemical tests of sufficient delicacy for employment with this object in view. The difficulty depends upon the excessive minuteness of the difference in composition between a clean and an unclean water.

Let us trace the progress of contamination in a well known case. The instance of the metropolis may be taken. In London the urine of the population, mixed with about 30 gallons of water per individual, constitutes the sewage. In addition to the urine, there are, it is true, the fæces, and also a quantity of soap and other varieties of refuse. Confining, however, our attention to the urine (which is the more important constituent) we may arrive at numerical results which will be sufficiently true for the present purpose. A man passes on an average three pounds of urine in the 24 hours. Since 30 gallons of water weigh 300 pounds, it follows that average London sewage must contain not more than one per cent. of urine. In average urine the organic solids do not exceed three per cent., therefore, in London sewage the urinous organic solids do not exceed 0·03 per cent. on an average. Examinations of London sewage of late years show that the strength is indeed very considerably below this mark. Three parts of urinous organic solids in ten thousand parts of sewage is, therefore, the maximum proportion in London. This amounts to 21 grains per gallon.

Now, if the water of a well have received one-twentieth of its volume of sewage, it would be a very foul well; and yet in such a well there would be but one grain of urinous or-

ganic solids per gallon. One per cent. of sewage in a well is undesirable, and this is only 0·2 grain of these solids per gallon.

Directing attention more particularly to the nature of these urinous solids, we recognise that at least four-fifths of the organic matter in urine is urea, and that this, for the most part, undergoes fermentation into carbonate of ammonia when the urine is diluted so as to become sewage. My own examination of specimens of sewage show abundance of carbonate of ammonia (which is fermented urea) but little or no actual urea; and I am informed that other observers have arrived at a like result. Clean rivers and deep springs are devoid, or all but devoid, of ammonia: therefore when we find carbonate of ammonia occurring in a water, we may regard it as the representation of so much urea.

Owing to the excessive minuteness of the quantities which distinguish between a bad and a good water, it is convenient to adopt a different scale of measurement for them. Instead of dealing with them as with the 'total solids' in water, which we have measured by the number of grains per gallon (or parts in 70,000), there is convenience in adopting a much finer scale, and these quantities are conveniently measured by 'milligrammes per litre' (which is parts in a million). My experience has led me to attach great importance to the adoption of an appropriate standard of measurement.

When average urine is thoroughly decomposed, so that all its urea is completely transformed into carbonate of ammonia, it yields according to my own experiments, 0·90 per cent. of free ammonia and 0·05 per cent. of 'albuminoid ammonia' (the term 'albuminoid ammonia' will be explained presently). Assuming that London sewage, as aforesaid, contains a day's urine (or 3 pounds of urine) in 30 gallons or 300 pounds of water, it follows that 1,000,000 parts of London sewage contains 90 parts of free ammonia.

Now, on 18th June, 1867, I found that the Thames water at London Bridge, where it is highly contaminated (having received the Fleet Ditch sewer) contained 1·02 parts of free ammonia per million parts of water. Let us ask what proportion of sewage is thereby indicated. The answer is, about one volume of sewage in 90 of water.

There is no reason for supposing that traces of carbonate of ammonia in drinking-water are in themselves injurious, and the only reason for attaching importance to carbonate of ammonia (or free ammonia) in water is that its presence is indicative of recent sewage, and consequently of those poisons which sometimes occur in sewage. The importance of the free ammonia is of the same kind as the importance of the chlorine in drinking-water, but the evidence of sewage contamination afforded by abundance of ammonia is far more cogent than that afforded by abundant chlorides. The striking character of this ammonia-test for sewage may be judged of by the example just cited, viz., that of the river Thames, which, by sewage contamination, is made to contain 50 times as much ammonia as it would otherwise have done. A very extended examination of natural water, from a great variety of sources, has established the important fact that, unless fouled with recent sewage, it is devoid of ammonia to an extraordinary degree. Thus, the water supply to London, Manchester, Edinburgh, Chester, and Glasgow contains less than 0·03 parts of free ammonia *per million* parts of water.

By the ammonia-test there is no difficulty in recognising one part of recent sewage in 2,000 parts of drinking-water. As has been said, the other nitrogenous matters in urine are present in much smaller amounts. They are, however, much more permanent than urea, and survive not only the transformation of urea into carbonate of ammonia, but even the oxidation of the carbonate of ammonia into nitrates. It is such matters as these, and also permanent organic matters in the fæces, which are really to be dreaded in drinking-water. For them Science is now in possession of a test of extraordinary delicacy, consisting of oxidation by strongly alkaline permanganate of potash, and estimation of the amount of ammonia which is thereby generated. With these remarks we now pass on to the description of the ammonia-process of water-analysis, which has for its object to determine whether water is clean (organically speaking) or whether it is foul.

The Ammonia Process.—For the performance of water-analysis by the ammonia process, the following are required :—

(1). The Nessler reagent.
(2). Dilute Standard Solution of Ammonia.
(3). Solution of Potash and Permanganate of Potash.
(4). Carbonate of Soda.
(5). Distilled Water.
(6). Retort.
(7). Liebig's Condenser.
(8). Lamp and Retort holder.
(9). Glasses for Nessler Test.
(10). Half Litre Flask.
(11). Graduated Burette.
(12). Pipette for Nessler Test.

The Nessler reagent is a saturated solution of periodide of mercury in iodide of potassium rendered very strongly alkaline by means of much potash or soda. Boil 35 grammes of iodide of potassium and 13 grammes of corrosive sublimate in about half a litre of water, in which they will dissolve completely. That having been accomplished add to the solution a cold saturated solution of corrosive sublimate until the precipitate of periodide of mercury just begins to be incapable of redissolving in the liquid. Then add 160 grammes of caustic potash (or 120 grammes of caustic soda) dissolved in about 200 cubic centimeters of water, and dilute the whole liquid with water up to one litre.

Having in this manner made a litre of Nessler reagent, add about 20 cubic centimeters of saturated solution of corrosive sublimate in order to impart sensitiveness to the reagent; allow it to stand in a stoppered bottle until the precipitate has subsided. It is then ready for use.

When a small quantity of the reagent is added to a solution containing a trace of ammonia, a yellow or brown colouration is produced, and the quantity of ammonia is judged of by the depth of colour. Before trusting a given specimen of Nessler reagent it should be tested with a little weak ammonia, in order to make sure that it is *delicate*. If by any accident it should refuse to yield the colouration, the addition of a little more solution of corrosive sublimate will usually be found to render it active and delicate.

(2.) The dilute standard solution of ammonia is thus prepared. In one litre of water 3·15 grammes of chloride of ammonium (commercial sal ammoniac will do very well) is

dissolved. This gives a solution containing one miligramme of ammonia in one cubic centimeter of water. This is the most convenient strength to keep. For use, however, in water analysis it requires dilution with ninety-nine volumes of pure distilled water, which is conveniently effected by measuring out with an accurate five-cubic-centimeter pipette, and then filling up in the half litre flask with distilled water. In this manner is obtained a *standard solution of ammonia containing* 0·01 *milligramme of ammonia in one cubic centimeter of water.*

(3.) The solution of potash is made by dissolving eight grammes of permanganate of potash, and two hundred grammes of solid caustic potash in a litre of water. The solution is boiled for some time to free it from all traces of ammonia, and organic nitrogenous matter; for this purpose some 200 cubic centimeters may be evaporated off, and replaced by means of pure water. The quantity of this solution required for each analysis is 50 cubic centimeters; so that each analysis consumes 10 grammes of potash, and 0·4 grammes of permanganate of potash.

(4.) A saturated solution of carbonate of soda may be made by boiling an excess of the common carbonate in water. About 10 cubic centimeters of the cold saturated solution is the right quantity to use in a water analysis. Instead of solution, the dry solid carbonate which has just been ignited may be used. About a gramme is the proper quantity. The object of using carbonate of soda is in order that the free ammonia in water may be easily expelled on distillation.

(5.) *Distilled Water.*—This is required for the making-up of the various standards of ammonia, as will by and by be explained. It must be very free from ammonia. In 100 cubic centimeters there ought not to be 0·005 milligrammes of ammonia. By distilling any common drinking water it may be easily obtained in a satisfactory state of purity if the first portions of distillate be rejected before the collection be commenced. The distillation ought not to be pushed too far. For the execution of a water analysis not more than a half litre of distilled water is used up; wherefore, as will doubtless be suggested by some of our readers, the same retort and Liebig's condenser, which is required for the execution of the analysis, may be first conveniently utilised in the prepara-

tion of a little distilled water. It is unsafe to trust any distilled water without testing it; and this is specially true of that which is sold.

(6.) *Retorts.*—The capacity of the retort required is about a litre. They should be stoppered, and in London cost from two to three shillings.

(7.) *The Liebig's Condenser.*—This is provided by the various dealers in chemical apparatus, and may cost from ten shillings to thirty shillings, depending upon the material.

(8.) *Lamp and Retort Holder.*—A good-sized Bunsen's lamp with a piece of india-rubber tubing to connect it with the gas pipe, is required. It is also of importance to have a firm and convenient retort-stand. An iron upright with an iron clip, lined with cork is that which I am in the habit of using.

(9.) *Glasses for Nessler-test.*—These are cylinders of white glass with a mark at 50 cubic centimeters. About half-a-dozen of these are needed.

(10.) *A half litre flask* to measure out the water; (11) a *graduated burette*, marked into cubic centimeters, for measuring the dilute standard; and (12) a *Pipette for Nessler test*, consisting of a simple glass tube, which is capable of delivering two cubic centimeters of the Nessler test, will require no particular mention. They are all to be bought of the dealers in chemical apparatus.

The operation is performed in the following manner.

The retort having been washed out first with a little strong acid (either hydrochloric or sulphuric acid) is then washed out with good tap water until the few drops which drain out do not taste acid. It is then mounted in its holder and properly connected with the Liebig's Condenser, either by means of an india-rubber tube or else just packed into the condenser by means of a little writing paper. Half a litre of the sample of water is then measured in the half litre flask and poured into the retort. Then the 10 cubic centimeters of solution of carbonate of soda, or else the one gramme of freshly ignited carbonate of soda, is put into the retort. The Bunsen lamp is then lighted, and its flame applied externally, directly to the naked retort. The retort must be thrust right down into the flame, which, however, must not play upon the surface higher than the level of liquid inside. In a few

minutes the contents of the retort will begin to boil. Distil off 50 cubic centimeters, and *Nesslerise* it. Then distil off 150 cubic centimeters, and throw them away. Having done so, and thereby reduced the volume of the contents of the retort to 300 cubic centimeters, pour into the retort, by means of a wide funnel, 50 cubic centimeters of the above described 'solution of potash and permanganate of potash.' At this stage of the process it may be requisite to shake the retort gently in order to avoid bumping. This is especially the case in the analysis of very bad water. With a little practice and a little presence of mind the operator will, however, overcome difficulties of this description. The distillation being again continued, 50 cubic centimeters must be collected and Nesslerised. Then a second 50 cubic centimeters distilled off and Nesslerised; and then a third 50 cubic centimeters distilled off and Nesslerised: and then the ammonia process of water analysis is accomplished.

Nesslerising, which has been often mentioned in the above passage, is the operation of finding the strength of a dilute solution of ammonia by help of the Nessler test—a test discovered by a chemist named Nessler. The preparation of the Nessler reagent has been already described in detail. Let it be required to tell how much ammonia is present in 50 cubic centimeters of distillate contained in one of the 50 cubic centimeters cylinders of colourless glass which has been referred to. For this purpose, 2 cubic centimeters of Nessler reagent must be mixed with the 50 cubic centimeters of distillate. This is best done by aid of the appropriate 2 cubic centimeter pipette already mentioned. With the pipette 2 cubic centimeters of the reagent are withdrawn from the bottle in which the Nessler reagent is kept, and transferred to the cylinder containing the 50 cubic centimeters of distillate. The pipette also serves as a convenient stirrer to stir up after adding the reagent. This having been done, wait a minute or two. If the liquid assumes a rich deep brown it contains much ammonia; and if, indeed, it yields a brownish precipitate, then it contains very much ammonia: but if it remain quite colourless it is free from all trace of ammonia (i.e. it does not contain so much as ·005 milligramme). If the colour is not deep, but only slightly yellow, there is a little ammonia

there. The amount is found by comparison with an artificial and known solution of ammonia. This is managed by taking another clean colourless glass cylinder, and pouring distilled water and a certain known measure of the 'dilute standard ammonia' above described, and then adding two cubic centimeters of Nessler reagent and noting the depth of colouration thereby produced. If the depth of colouration in this artificial solution be just equal to that in the distillate the task is done; inasmuch as the quantity of ammonia employed to make the artificial solution must in that case be equal to that in the distillate.

Should the artificially-prepared solution of ammonia produce a deeper colouration than the distillate which is compared with it, then, as will be obvious, another artificial solution of less strength must be prepared and treated with the Nessler reagent; in short, the colouration given on addition of Nessler reagent to the distillate is to be imitated by means of distilled water, standard solution of ammonia and Nessler test and the quantity of ammonia required for the imitation is the quantity actually contained by the portion of distillate.

In the course of a water analysis it will be perceived that ammonia is to be looked for at two stages; firstly, on distilling off with carbonate of soda; and, secondly, on distilling off with alkaline permanganate. The first portion of ammonia is the 'free ammonia.' The second portions of ammonia are the 'albuminoid ammonia.'

As will have been seen, the recommendation was given to Nesslerise the first 50 cubic centimeters of distillate containing 'free ammonia,' and then to throw away the next 150 cubic centimeters of distillate containing free ammonia. Formerly it was the custom of my colleagues and myself to Nesslerise all four lots of free ammonia; but that was a useless expenditure of labour, inasmuch as the first 50 cubic centimeters *invariably* contains *three quarters* of the total quantity. The rule is *to Nesslerise the first 50 cubic centimeters of distillate, and then to add one-third to the ammonia found.* For instance, suppose the first 50 cubic centimeters contain 0·02 milligramme of ammonia, then the total free ammonia is 0·027 milligramme per half litre, and of course double that amount in one litre.

In the instance of the albuminoid ammonia, it is necessary to Nesslerise each successive fraction (i.e. 50 cubic centimeters) of distillate, and to add the amounts together in order to arrive at the total 'albuminoid ammonia.' Before leaving this part of the subject a caution must be given: viz., that before trusting to the purity of the materials used in the analysis, and before trusting to the completeness of the arrangements for the experiments, it is prudent to make either an analysis of a water of known quality, or else a blank assay on recently distilled and pure water.

Inasmuch as half a litre of water is employed for a determination of the amount of free and albuminoid ammonia, the result must be multiplied by two in order to arrive at the yields per litre, or per million parts. The following example of the manner in which notes are kept of these analyses in my laboratory may possibly be useful.

Half a litre of sample of water taken for analysis :—

Free Ammonia	·01 milligrame.
Albuminoid Ammonia. . . .	·035
	·015
	·000
	·05

Therefore in one litre—Free Ammonia = ·02.
Albuminoid Ammonia = ·10.

The following examples will serve in illustration.

Date.		Parts in a million Milligrammes per Litre.	
		Free Ammonia.	Albuminoid Ammonia.
1867.			
July	West Middlesex Company—Thames .	·01	·07
Do.	Do. do. . .	·01	·06
Do.	Do. do. . .	·01	·06
Do.	Do. do. . .	·01	·06
1868.			
July 29	Do. do. . .	·01	·09
1872.			
Oct. 3	Do. do. . .	·01	·07
Dec. 3	Do. do. . .	·00	·10
1873.			
Jan. 2	Do. do. . .	·00	·08

Date		Parts in a million Milligrammes per Litre.	
		Free Ammonia	Albuminoid Ammonia
1867.			
July	Grand Junction Company—Thames .	·01	·08
Do.	Do. do. . .	·01	·07
Do.	Do. do. . .	·01	·07
Do.	Do. do. . .	·01	·07
1872.			
Oct. 8	Do. do. . .	·00	·07
Dec. 5	Do. do. . .	·00	·16
1867.			
July	Chelsea Company—Thames . .	·01	·07
Do.	Do. do. . . .	·01	·10
1872.			
Oct. 5	Do. do. . . .	·00	·06
Dec. 2	Do. do. . . .	·02	·13
1867.			
July 6	Southwark & Vauxhall Co.—Thames .	·03	·16
July 18	Do. do. .	·02	·12
July 18	Do. do. .	·01	·15
1872.			
Feb. 7	Do. do. .	·01	·12
Do.	Do. do. .	·01	·09
Do.	Do. do. .	·01	·12
Oct. 2	Do. do. .	·06	·12
Oct. 12	Do. do. .	·06	·13
Do.	Do. do. .	·06	·12
Dec. 2	Do. do. .	·00	·18
1867.			
July 19	Lambeth Company—Thames . .	·02	·14
July 20	Do. do. . . .	·02	·15
1872.			
Feb. 7	Do. do. . . .	·01	·14
Oct. 9	Do. do. . . .	·01	·10
Dec. 2	Do. do. . . .	·01	·16
1867.			
July 21	Water from the New River . .	·02	·08
July 12	Do. do. . .	·01	·05
July 20	Do. do. . .	·02	·05
Aug. 21	Do. do. . .	·00	·06
1868.			
Jan. 25	Do. do. . .	·02	·09
Aug. 1	Do. do. . .	·00	·08
1872.			
Oct. 2	Do. do. . .	·02	·08
Nov. 21	Do. do. . .	·01	·06
1867.			
June 18	East London Company—River Lea .	·03	·09
1872.			
Oct. 10	Do. do. do. .	·01	·04
Dec. 4.	Do. do. do. .	·01	·18

Date		Parts in a million Milligrammes per Litre.	
		Free Ammonia	Albuminoid Ammonia
1872.			
Feb. 7	Kent Company . . .	·01	·02
Nov. 20	Do. do. . . .	·01	·02
1867.			
Aug. 19	MANCHESTER WATER-SUPPLY . .	·01	·06
Do.	Do. do. . .	·01	·07
Do.	Do. do. . .	·01	·07
1871.	CHESTER WATER-SUPPLY . .	·01	·07
1867.	EDINBURGH WATER-SUPPLY		
Sept. 25	Swanston	·03	·10
Do.	Crawley	·01	·08
Do.	Colinton	·14	·08
Do.	Comiston	·00	·03
Sept. 18	University tap	·00	·07
1867.			
Oct. 3	GLASGOW WATER (from Loch Katrine).	·00	·08
1871.	SCARBOROUGH WATER-SUPPLY		
Dec.	From the Pumping Station . .	·01	·06
1872.	NEW WATER-SUPPLY TO GUILDFORD (SURREY)		
Feb. 6	consisting of deep spring water .	·00	·01
1867.	WATER FROM COLD HARBOUR, DORKING	·01	·00
1867.	CATERHAM-WATER after the application of Clark's softening process . .	·04	·00
1868.	FIVE SPRINGS IN THE WEST OF ENGLAND		
July 23	No. 1 (containing 26 grs. of solids per gal.)	·00	·01
Do.	No. 2, with 23 grains . . .	·01	·04
Do.	No. 3, with 20 grains . . .	·00	·01
Do.	No. 4, with 52 grains . . .	·00	·01
Do.	No. 5, with 20 grains . . .	·01	·03

Three of the Thames Companies which supply London with water, supply water which does not yield more than 0·06 or 0·07 milligrammes of albuminoid ammonia per litre. This they do in summer time, and ordinarily when the river is not flooded. Occasionally, however, in winter and in flood-times the water supplied by these Companies is not so pure; owing, no doubt, to the capacity of the filtering beds being overtaxed.

Two of the Thames Companies, viz. the Southwark and Vauxhall and the Lambeth Companies, supply impure water at all seasons; and instead of ·06 or ·07 milligrammes per litre, supply water yielding on an average about ·14 milligrammes of albuminoid ammonia per litre. These Companies have had defective filters, and indeed have been supplying London with water which is only slightly cleaner than the unfiltered Thames water drawn from the river at Hampton Court. Ordinarily the water of the New River Company which is supplied to London does not give more than ·06 or ·07 milligrammes of albuminoid ammonia per litre. The water which is brought to Manchester, from the high ground at Woodhead, showed a similar result when it was examined. The same thing has been noted relative to the waters of Edinburgh, Chester, Scarborough, and Derby.

These remarkable results have led to the assignment of the limits '·06 or ·07 milligrammes of albuminoid ammonia per litre' as the limits which distinguish clean from unclean water. No town ought to be served with water which oversteps these limits.

In conclusion I will give some examples of analysis of waters which are not fit to drink.

Date.		Parts in a million · Milligrammes per Litre.	
		Free Ammonia.	Albuminoid Ammonia.
1872. Feb.	An 'Effluent Water' from sewage.	16·20	0·90
	Waters from the Thames at London Bridge, taken at different states of the tide		
1867. June	High tide	1·02	0·59
	Do.	1·02	0·56
	Do.	1·02	0·50
	At two hours flood (after filtration through paper) . . .	1·76	0·35
1867. June	Great St. Helen's Pump, London .	3·75	0·18
	Pump in Bishopsgate Street, London	7·50	0·26
	Pump in Drapers' Hall, London, .	3·75	0·18
1867.	Pump in Edinburgh . . .	0·21	0·29
1873.	Well Water in Windsor (containing 60·2 grs. of solids and 6·9 grs. of chlorides per gallon) . .	1·20	0·08
1873.	Well Water from Eton (containing 48·5 grs. of solids and 5·6 grs. of chlorides per gallon) . .	·00	0·84

CHAPTER II.

AIR.

In order to a right understanding of the subject, it will not be useless to begin with a general survey of the chemical composition of the atmosphere.

The atmosphere consists mainly of the two gases, nitrogen and oxygen, which are not combined with one another, but only mixed together. The relative proportions of these gases are 79·02 volumes of nitrogen, and 20·98 volumes of oxygen. This ratio is maintained all the world over, whether we go to the top of the mountain, or to the surface of the sea, or down into the valley. Hardly is it altered by the greatest activity of our busiest and most populous towns, notwithstanding that every animal that breathes, and every fire that burns, is using up the oxygen of the air. In the air of the streets of Manchester and of the streets of London, there is all but as high a proportion of oxygen as in the air off the hill-tops in Scotland. Vide the following table, compiled from Dr. Angus Smith's admirable book on "Air and Rain":—

SOURCE OF THE AIR.

	Oxygen. Percentage by volume (in dried air)
Tops of Hills (Scotland)	20·98
North East Sea-shore and open heath (Scotland)	20·999
Suburb of Manchester in wet weather	20·98
Do. do.	20·96
From Marburg (Germany), analysis by Bunsen	20·92
Mean of a great number of specimens of Air from Paris (analysis by Regnault)	20·96
Average composition of the Air in open parts of London (by Dr. Angus Smith)	20·95
Average composition of Air in the worst parts of London Streets (by Dr. Angus Smith)	20·857

Even in such places as the tunnel of the Metropolitan railway and in close rooms the fall in the oxygen is of a very trifling description, as may be judged of from the following analysis made by Dr. Angus Smith :—

Date.	Place.	Oxygen. Percentage by volume (in dried air).
1869.	METROPOLITAN RAILWAY.	
Nov. 12	Tunnel between Gower Street and King's Cross Stations: specimen taken at the open window, first-class carriage, 10 A.M. . .	20·60
Do.	Do. 7.30 P.M.	20·79
Do.	Tunnel, Praed Street: specimen taken at the open window, second class carriage, 10.30 A.M.	20·71
Nov. 15	Specimen taken during journey between Gower Street and King's Cross, first-class carriage, windows open, 10.15 A.M. . . .	20·66
Do.	Do. 3 P.M.	20·70
Do.	Do. 11 P.M.	20·74
	Average	20·70
	Air taken from a sitting-room which felt close, but not excessively so	20·89
	From small room with petroleum lamp . . .	20·84
	Do. after six hours	20·83
	About backs of houses and closets . . .	20·70
	Pit of theatre, 11.30 P.M.	20·74
	Gallery of theatre, 10.30 P.M.	20·63

From which it is abundantly evident that a lowering of oxygen to the extent of only 0·3 per cent. is all that takes place in many badly ventilated places. Now, in itself, this lowering of the oxygen is far too trifling to be of influence on the animal economy. In mines a far greater depression of the oxygen is observed than in the worst ventilated rooms. The worst instance of air in a mine cited by Dr. Angus Smith, is that in which the oxygen fell to 18·27. Even, however, in this extreme case it is not improbable that the deficiency in oxygen is in itself of no biological importance.

Turning to history, it may possibly not be uninteresting to make the observation that the captives in the Black Hole in Calcutta did not perish (or even suffer) for lack of oxygen.

From the foregoing it will be abundantly plain that the

Medical Officer of Health need not trouble himself with measurements of oxygen in air, but that he must look to other criteria.

Next after oxygen in abundance in the atmosphere, comes aqueous vapour. This forms, on an average about one per cent. of the volume of the atmosphere, and is by far its most variable constituent. It will not, however, occupy our attention.

Leaving the nitrogen, oxygen, and water, which make up the great mass of the atmosphere, we now pass on to those constituents which exist in the air in minute proportions, but which determine the differences between different atmospheres, and form the subject of air-analyses for sanitary purposes.

Next in abundance after aqueous vapour comes the carbonic acid, which forms 0·037 volume in 100· volumes of air. In point of quantity, the carbonic acid of the atmosphere may be likened to the solid residue in water; and, curiously enough, the proportion by volume of carbonic acid in the atmosphere is very nearly that of the weight of the solid residue to the weight of the London water which yields it. Thus 100,000 volumes of air contain 37 volumes of carbonic acid, and 100,000 parts (by weight) of Thames' water, as supplied to London, contain 30 parts (by weight) of dissolved solids. This parallel may serve to give an idea of the scale on which atmospheric impurity actually occurs in nature. The following table (compiled from Dr. Angus Smith's book) shows the range of variation actually to be met with in the open air.

	Volume of Carbonic Acid in 100 vols. of Air.
Lake of Geneva (by Saussure) years 1826 to 1829 (mean)	·0439
Chambeisy (by Saussure) years 1826 to 1829 (mean)	·0460
Munich (by Pettenkofer) mean	·050
Suburbs of Manchester (by Angus Smith) year 1864 (mean)	·0369
Open parts of London (by Angus Smith) mean	·0301
Surface of the Thames (by Angus Smith) mean	·0343
In the Streets of London :—	
Cheapside	·0352
Do.	·0337
Outside the Exchange	·0398
Newgate Street	·0413
Oxford Street	·0344

	Volume of Carbonic Acid in 100 vols. of Air.
Lower Thames Street	·0428
Small Alley, Smithfield	·0337
Small Court, Lambeth	·0382
New Cut	·0413
Top of Monument	·0398

Showing that the air of London streets is hardly appreciably richer in carbonic acid than the air of the country.

Even in close rooms the rise in the carbonic acid is very slight, *vide* the following :—

	Volume of Carbonic Acid in 100 vols. of Air.
Close Places in London :—	
Chancery Court, shut	0·193
Do. do.	·203
Do. open	·0507
Do. do.	·045
Strand Theatre, gallery, 10 P.M.	·101
Surrey Theatre, boxes, 10.3 P.M.	·111
Do. do. 12 P.M.	·218
Olympic, 11.30 P.M.	·0817
Do. 11.55 P.M.	·1014
Victoria Theatre,	·126
Pavillion, 10.11 P.M., Whitechapel	·152
City of London Theatre, pit, 11.15 P.M.	·252
Standard Theatre, pit, 11 P.M.	·320
Metropolitan Railway	·078
Do.	·338

It is hardly necessary to call attention to the fact that in the worst of all these instances, the carbonic acid has not risen to a dangerous height. It is indeed not improbable that the mere rise in the carbonic acid from 0·037 to 0·338 vol., is in itself of no consequence whatever; and it is certain that the feeling of closeness is not due to this rise. We are in great darkness as to the real cause of foulness of atmosphere. Certainly the action of animals on a confined atmosphere fouls that atmosphere; apparently too the burning of lamps and candles contributes to do so—but the fouling is not in virtue of the abstraction of oxygen and generation of carbonic acid, but is due to something else, which is not yet understood.

There is some reason for thinking that animals actually poison the atmosphere which they breathe, and that lamps and candles throw off traces of carbonic oxide, or acetyline, or other actively poisonous substance. Be this, however, as it may, certain it is that the discharge of carbonic acid is the concomitant of fouling of the air. It is highly probable that the chemist might produce an atmosphere which shall be quite salubrious, and yet richer in carbonic acid and poorer in oxygen than the air of the Standard Theatre or of the Metropolitan tunnel; but in nature and in daily life we do not meet with such air, and we may take slight elevations of the proportion of carbonic acid as very trustworthy signs of defilement of the atmosphere.

As has been said, normal air contains 0·037 per cent. (by volume) of carbonic acid. According to Pettenkofer, when the proportion of carbonic acid exceeds 0·100 per cent. (by volume) the air is too much defiled; and if such a state of things be found in a dwelling-room, it is high time to improve the ventilation.

Methods of measuring the Carbonic Acid in the Atmosphere.— Carbonic acid is absorbed by caustic alkalis, forming carbonates, and accordingly when air containing carbonic acid is treated with alkali the air is deprived of its carbonic acid. This fact is made use of by the chemist in the analysis of gases. If a gas containing carbonic acid be measured, then submitted to the action of alkali and finally measured after the alkali has absorbed the carbonic acid, the volume of the carbonic acid may be found by the difference between the two measurements. This method of procedure is in common use among chemists who devote themselves to gas-analysis, and is valid when the proportion of carbonic acid is considerable. In the case of examinations of the atmosphere, it is, however, an invalid procedure; because, the error of observation is larger than the quantity to be measured. This may be readily understood when it is considered that the limit of accuracy in the measurement of gas is 0·0002 of the total volume. If then 100·00 volumes of air be indifferently represented as 100·00 or as 100·02, and if this error be made twice over (there are the two readings), there must be an experimental error of 0·04

per cent. which we have seen a little exeeeds the normal volume of carbonic acid in the air. Although the futility of this method of determining the carbonic acid is palpable enough when once pointed out, there is, nevertheless, in chemical literature a rather recent example of such a determination of the carbonic acid in the air on the Alps by a very well-known chemist.

Accurate measurements of the carbonic acid are to be made by taking advantage of the formation of the insoluble carbonate of lime or baryta when lime-water or baryta-water is exposed to the air. De Saussure exposed 34 litres of air to the action of lime or baryta, and actually weighed the insoluble carbonate which was produced. Dalton, and after him Pettenkofer, have slightly modified this proceeding. Instead of weighing the carbonate, they measure the strength of the lime-water or baryta-water; then they allow the absorption of carbonic acid to take place, and thereby a certain proportion of the alkali is neutralised, and finally they determine the alkalinity of the partly exhausted lime or baryta-water. The difference in the two strengths becomes thus the measure of the carbonic acid in the air under examination.

In his excellent book, to which I have so often referred, Dr. Angus Smith calls attention to the possibility of effecting simplifications in this process. Instead of adopting the plan of weighing the carbonate of lime or carbonate of baryta, and instead of adopting the differential titration just sketched out, Dr. Angus Smith proposes to go by *the depth of turbidity*. The plan which he adopts is to ascertain the volume of air requisite to produce a given degree of turbidity in a certain volume of lime or baryta-water. The smaller the volume of air required to produce the effect, the richer the air in carbonic acid. I am inclined to believe that a somewhat different modification will be found to be more convenient in practice, and propose the following method:—

A solution of carbonate of soda in water is first made as follows:—4·74 grammes of gently ignited carbonate of soda are dissolved in one litre of water, giving a solution of such a strength that one cubic centimeter contains exactly one cubic centimeter of carbonic acid (=1·97 milligrammes of

$C O_2$). A large quantity of baryta-water (strength about 0·1 per cent.) is prepared.

If now 100 cubic centimeters of clear baryta-water be treated with one cubic centimeter of the standard solution of carbonate of soda just described, a certain degree of turbidity is produced. If two cubic centimeters of the solution be taken, another degree of turbidity is produced, and so on. If then a bottle capable of holding 2,000 cubic centimeters of air, together with 100 cubic centimeters of baryta-water, be filled with the sample of air to be tested, there will be a certain depth of turbidity produced on shaking up.

Having got the air to exhaust itself on 100 cubic centimeters of baryta-water, the degree is to be found by comparison with another 100 cubic centimeters of baryta-water in which a like turbidity has been induced by means of the standard solution of carbonate. Every cubic centimeter of soda-solution counts for a cubic centimeter of carbonic acid in two litres of the air. A consumption of one cubic centimeter will correspond to 0·05 volumes of carbonic acid per cent. Good air should accordingly not take more than one cubic centimeter of the soda solution, air which takes two cubic centimeters being already bad.

In order practically to execute this determination of carbonic acid, the following apparatus is required:—Several bottles capable of holding 2,210 cubic centimeters and well stoppered. (Failing bottles of exactly the right capacity, Winchester quart bottles will answer.) A small pair of bellows. Several colourless glass cylinders, marked at 100 cubic centimeters capacity. The Nesslerising cylinders will answer for this purpose.

A graduated pipette or burette to deliver tenths of a cubic centimeter of solution. The standard solution of carbonate of soda, and the baryta-water, which may be of moderate strength.

The testing is managed thus:—Winchester quart bottles having been washed clean, are rinsed with distilled water and allowed to drain a little. They are then closed with their stoppers, and are ready for use. The operator, having provided himself with two or three of these bottles and a small

pair of bellows, enters the room the air of which is to be tested. The stopper is then removed from one of the bottles, and some air of the room blown through with the bellows, and then the stopper is replaced and the bottle carried away to be tested.

The testing is done by pouring into the bottle 100 cubic centimeters of clear baryta-water, shaking up for two or three minutes, and then pouring out into a cylinder of colourless glass and observing the depth of turbidity in various lights and against various backgrounds. The turbidity is to be exactly imitated by means of the standard solution of carbonate of soda. In order to imitate the turbidity produced by a Winchester quart full of good air, only one cubic centimeter of this solution of carbonate of soda is required.

If two cubic centimeters, or more than two, are required, the air is bad, and the ventilation is defective. In place of the first cubic centimeter of solution of carbonate of soda, the carbonic acid naturally present in a Winchester quart of good average air may be used, and a little practice and intelligence will suggest the necessary precautions.

In addition to carbonic acid, air contains ammonia and organic nitrogenous matter in minute quantity; and bad air has been shown to contain more of these than good air. Dr. Angus Smith's book may be referred to for further particulars relating to them. At present, however, I should recommend the medical officer to confine his attention to the carbonic acid.

CHAPTER III.

MILK, BUTTER, AND CHEESE.

MILK is a solution of milk-sugar, caseine, and certain mineral salts in water. It contains also, fat, partly in solution, but mainly in the form of globules. The fat has been said to be coated with some kind of membrane, being, at any rate, protected to a great extent, from the action of ether.

For the purposes of this book, we shall confine ourselves to cows' milk, which is the only kind of milk which has any commercial importance in this country.

The first point to be brought out, is the great constancy of the composition of the milk of well-fed cows. According to the observations of Müller and Eisenstück, which were carried out for the Agricultural Society of Sweden, the milk of a herd of cows (fifteen cows of different breeds) contained on average 12·8 per cent. of solids, and never once, during an entire year, contained less than 11·5 per cent. of solids. The highest percentage of solids observed on any day throughout the year was 14·08. My own observations are completely in accord with the Swedish results; and it may be accepted as a well-established fact, that cows' milk does not contain *less than* 11·5 *per cent. of solids*, and seldom less than 12 per cent. of solids. The average composition of cows' milk, I take to be 12·5 parts of solids, and 87·5 parts of water. According to an analysis of my own, good country milk contains:—

Water	87·55
Fat	3·07
Caseine	4·04
Milk-Sugar	4·63
Ash	0·71
	100·00

By dint of stall-feeding, healthy cows may be made to give richer milk, and in a specimen of such milk I found, solids, 14·07 parts, and water, 85·93 parts.

Water	85·93
Fat	4·00
Caseine	5·02
Milk-Sugar	4·31
Ash	0·74
	100·00

The analysis of milk may be conveniently made in the following manner:—five grammes of milk (well stirred up, so as to get a fair proportion of cream) is weighed out and evaporated to dryness in a small and shallow platinum dish, heated in an appropriate water bath. From numerous experiments I find that there is no difficulty in taking the solid residue in milk with great accuracy. The heating at 212° Fah. must be maintained for three hours; and, that having been done, the residue will be found to be quite constant. I give four determinations of the residue in the same sample of milk, in order to show the degree of constancy which is easily attainable in work of this description.

	Grammes of Milk.		Grammes of Solids.		Percentage of Solids.
Analysis I.	4·969	gave	0·616	or	12·40
Do. II.	5·0105	do.	0·6255	or	12·48
Do. III.	5·007	do.	0·623	or	12·44
Do. IV.	5·0145	do.	0·626	or	12·48

I do not approve of the plan of mixing milk with sand (or with oxide of copper as a certain gentleman once proposed), in order to obtain the solid residue. According to my experience, such admixtures are not required; and certainly they are sources of error and uncertainty. It is, however, desirable that the analyst should be warned against operating on too large a quantity of milk.

In order to obtain the mineral matter in milk (the ash as it is termed), the solid residue is carefully ignited and weighed. The results are, as given above, and very constant. For the fat, a solid residue is exhausted with boiling ether, having been first just moistened with alcohol. The filtered ethereal

solution of the fat is then evaporated in the water-bath and weighed.

For the milk-sugar, a solid residue from which the fat has been extracted, and which has been moistened with alcohol, is boiled with water, and the resulting solution filtered, and the filtrate evaporated to dryness in the water-bath and weighed.

It must, however, not be forgotten that the common salt contained in milk will dissolve in the water, and that either it must be allowed for, or else the milk-sugar must be burnt, and the weight of the salt subtracted from the total weight of sugar-salt. Having, as above described, obtained the percentage of water (which is the difference between 100 and the percentage of solids), also the percentage of fat, milk-sugar, and ash, the percentage of caseine may be found by difference. A direct determination of caseine may also be made as follows:—a known weight of milk (and for this purpose some twenty or thirty grammes of milk may be taken) is rendered slightly acid with hydrochloric acid, filtered, and the precipitated caseine washed very thoroughly with water. It is next washed with alcohol, and then washed with ether, in order to dissolve out the fat. A caution should here be given, relative to the washing with ether. The caseine must be got off the filter, and actually boiled with the ether, otherwise the removal of the fat will not be complete. It will be observed that so long as the caseine contains fat it will stick to the filter-paper, but that when the fat is removed, the caseine may very readily leave the filter-paper. As will, however, be perceived, the direct determination of caseine is not a very easy operation. Although precipitated by means of an acid, which might be expected to retain the phosphate of lime in solution, nevertheless, experiment shows that the caseine is accompanied by the phosphate of lime, and that a burning of the caseine is necessary, in order that the weight of this phosphate of lime may be ascertained and subtracted.

Another method of determining the percentage of caseine is by means of 'the ammonia process,' or else by means of an elementary nitrogen-determination.

Milk is diluted with 99 times its weight (or volume) of water, and the dilute milk is then distilled with alkaline solution of permanganate of potash, whereby every one part

of caseine yields 0·065 parts of ammonia, which is determined by the Nessler test (vide chapter on water analysis).

The percentage of ammonia obtained by this process for milk is 0·26. It is convenient to operate on 50 to 100 milligrammes of milk by this process. (This is 5 to 10 cubic centimeters of diluted milk.)

Adulterations and Sophistications of Milk.—There are two forms of wrong-doing in the milk trade, viz., the skimming of milk, either wholly or partially, and the diluting of milk with water. From an examination of more than a thousand samples of London milk, I conclude that not 10 per cent. of the milk sold in the metropolis is genuine; that is to say, neither skimmed nor watered. This was especially and strikingly manifested in the course of an investigation of the milk supplied to workhouses and hospitals. The method of detecting fraud of this description is based upon a determination of the total solids and also of the fat. Possibly I cannot do better than reproduce part of a paper published by me a short time ago, wherein this subject is fully discussed.

If we consider the changes in composition which the addition of water to milk will produce, it will be apparent that it must diminish the proportion of solids in the milk, whilst the effect of skimming is to diminish the proportion of fat, and to leave the proportion of 'solids not fat' unaltered, or indeed, strictly speaking, to make a very trifling increase in the proportion of the 'solids not fat.'

Treating the question quite rigidly, which I believe is the proper way of dealing with it, we arrive at the following:—

Problem I.—Given the percentage of 'solids not fat' ($=a$), in a specimen of sophisticated milk (i.e., milk either watered or skimmed, or both),—required the number of grammes of genuine milk which was employed to form 100 grammes of it.

Answer.—Multiply the percentage of 'solids not fat' by 100 and divide by 9·3. Or—

$$\frac{100}{9{\cdot}3}a.$$

Problem II.—Given the percentage of 'solids not fat' ($=a$), also the percentage of fat ($=b$) in a specimen of sophisticated milk,—required the number of grammes of fat which have

been removed by skimming from the genuine milk which was employed to form 100 grammes of it.

Answer.— $\frac{3{\cdot}2}{9{\cdot}3}a-b.$

In translating fat into cream, the rule is that a removal of 0·2 gramme of fat equals a removal of 1·0 gramme of cream. This rule is directly founded on experiment. I do not, however, claim a high degree of accuracy for the measurement of the cream.

Finally, a slight refinement may be noticed. If a specimen of sophisticated milk have been produced by both skimming and watering, it will be obvious, on consideration, that the extraneous water employed in manufacturing 100 grammes of it is equal to the difference between 100 and the quantity of genuine milk employed to make 100 grammes of sophisticated milk, together with a quantity of water equal to the fat removed by skimming.

$$\text{Extraneous water} = 100-\frac{100}{9{\cdot}3}a+\frac{3{\cdot}2}{9{\cdot}3}a-b.$$

$$=100-\frac{100+3{\cdot}2}{9{\cdot}3}a-b.$$

An investigation of the different milks supplied to the different London Unions (which was made by me for the Government, at Mr. Rowsell's instance, last year, and which is published in Mr. Rowsell's 'Report on the System of Supply of Provisions for the Workhouses of the Metropolis') will furnish an illustration of this method of interpreting the results of milk-analysis.

In column 1 is given the designation of the sample, viz., the name of the Union which furnished it, and the number of the sample.

In column 2 is given the number of grammes of 'solids not fat' contained by 100 grammes of the sample.

In column 3, the fat.

In column 4, the number of grammes of genuine milk which was employed in making the 100 grammes of sample (calculated).

In column 5, the number of grammes of fat removed by skimming from 100 grammes of sample (calculated).

In column 6, the number of grammes of cream which had been skimmed off 100 grammes of sample (calculated).

In column 7 is given the number of grammes of extra water which had been put into 100 grammes of sample (calculated).

In 100 Grammes of Sample of Milk.			Calculated.			
	Grms. of Solids not Fat. a.	Grms. Fat. b.	Grms. of Genuine Milk. $\frac{100}{9{\cdot}3}a$.	Grms. of Fat Removed. $\frac{3{\cdot}2}{9{\cdot}3}a-b$.	Grms. of Cream Removed	Grms. of Extra Water. $\frac{100}{100-9{\cdot}3}\frac{3{\cdot}2}{a}+\frac{3{\cdot}2}{9{\cdot}3}a-b$.
Bethnal Green (St. Matthew) I.	9·04	1·22	97·2	1·89	9·45	4·7
,, ,, II.	4·38	2·08	47·1	−0·57	−2·85	52·3
Camberwell (St. Giles) ... I.	8·37	1·14	90·0	1·74	8·70	11·7
,, ,, ... II.	8·94	0·96	96·1	2·12	10·60	6·0
Chelsea (St. Luke) ... ... I.	9·36	2·24	100·6	0·98	4·90	−0·4
,, ,, ... II.	7·48	2·86	80·4	−0·28	−1·40	19·3
Fulham Union ... ... I.	9·09	1·52	97·8	1·61	8·05	3·8
,, ... II.	9·30	1·80	100·0	1·40	7·00	1·4
St. George's Union ... ... I.	9·52	2·44	102·6	0·84	4·20	−1·8
,, ... II.	9·08	2·82	97·6	0·31	1·55	2·7
St. George-in-the-East ... I.	6·55	2·32	70·5	−0·06	−0·30	29·5
,, ... II.	5·92	1·30	63·7	0·74	3·70	37·0
St. Giles-in-the-Fields & St. George, Bloomsbury I.	9·13	1·50	98·2	1·65	8·25	3·4
II.	7·17	1·96	77·1	0·51	2·55	23·4
Greenwich Union ... ... I.	6·60	2·32	71·0	−0·05	−0·25	29·0
,, ... II.	6·38	1·98	68·6	0·21	1·05	31·6
Hackney Union ... ... I.	9·09	3·50	97·8	−0·47	−2·35	1·7
,, ... II.	7·40	2·54	79·6	0·00	0·00	20·4
Hampstead (St. John) ... I.	8·44	1·50	90·7	1·40	7·00	10·7
,, ,, ... II.	7·74	3·00	83·3	−0·34	−1·70	16·4
Holborn Union ... ... I.	8·27	1·84	89·0	1·01	5·05	12·0
,, ... II.	7·64	2·40	82·1	0·23	1·15	18·1
Islington (St. Mary) ... I.	7·70	0·92	82·8	1·73	8·65	18·9
,, ,, ... II.	7·06	1·45	75·9	0·98	4·90	25·1
Kensington (St. Mary Abbott) ... ... I.	8·04	0·60	86·0	2·17	10·85	16·2
... ... II.	6·08	1·26	65·4	0·83	4·15	35·4
Lambeth (St. Mary) ... I.	6·54	1·56	70·4	0·69	3·45	30·3
,, ,, ... II.	7·08	1·22	76·1	1·22	6·10	25·1
Lewisham Union ... ... I.	6·42	0·96	58·3	0·90	4·50	42·6
,, ... II.	5·95	1·30	64·0	0·75	3·75	36·7
London (City of) Union... I.	8·84	2·82	95·1	0·22	1·10	5·1
,, ,, ... II.	6·26	1·10	67·3	1·05	5·25	34·0
St. Marylebone ... ... I.	7·84	1·14	84·3	1·56	7·80	17·3
,, ... II.	9·44	3·06	101·5	0·19	0·95	−1·3
Mile-End Old Town ... I.	9·55	1·96	102·7	1·32	6·60	−1·4
,, ... II.	8·70	1·80	93·6	1·19	5·95	7·6
St. Olave's Union ... ... I.	7·17	1·86	77·1	0·61	3·05	23·5
,, ... II.	7·70	1·86	82·8	0·79	3·95	18·0

In 100 Grammes of Sample of Milk.			Calculated.			
	Grms. of Solids not Fat. a.	Grms. Fat. b.	Grms. of Genuine Milk. $\frac{100}{9{\cdot}3}a$.	Grms. of Fat Removed. $\frac{3{\cdot}2a-b}{9{\cdot}3}$.	Grms. of Cream Removed.	Grms. of Extra Water. $100-\frac{100}{9{\cdot}3}a+\frac{3{\cdot}2}{9{\cdot}3}a-b$.
Paddington ... ... I.	7·22	1·44	77·7	1·04	5·20	23·3
„ ... ... II.	6·06	2·16	65·2	−0·07	−0·35	34·7
St. Pancras ... ... I.	7·22	1·12	77·7	1·37	6·85	23·7
„ ... ... II.	4·94	1·64	53·1	0·09	0·45	47·0
Poplar Union ... ... I.	7·40	0·76	79·6	1·79	8·95	22·2
„ ... ... II.	5·96	0·90	64·1	1·06	5·30	37·0
St. Saviour's Union... ... I.	6·65	2·10	71·5	0·19	0·95	28·7
„ ... ... II.	6·30	1·90	67·7	0·27	1·35	32·6
Shoreditch (St. Leonard) I.	9·99	1·48	107·4	1·96	9·80	−5·4
„ „ II.	9·44	2·36	101·5	0·89	4·45	−0·6
Stepney ... ... I.	4·98	0·78	53·6	0·93	4·65	47·3
„ ... ... II.	5·09	0·58	54·7	1·17	5·85	46·5
Strand Union ... ... I.	9·56	1·64	102·8	1·65	8·25	−1·2
„ ... ... II.	9·16	2·46	98·5	0·69	3·45	2·2
Wandsworth and Clapham Union ... I.	8·78	1·50	94·5	1·52	7·60	7·0
Wandsworth and Clapham Union ... II.	8·66	2·86	93·1	0·12	0·60	7·0
Whitechapel Union ... I.	5·62	0·68	60·4	0·25	1·25	39·8
„ ... II.	6·06	1·90	65·2	0·19	0·95	35·0

Inasmuch as I have submitted the analyses of these workhouse milks to severe and elaborate treatment, it is right that some particulars should be recorded concerning the manner in which they were conducted. The ash of each milk was determined, and in no instance was it excessive in amount, showing that no mineral had been used to adulterate the milk. For organic adulteration I made no elaborate analysis; but no indication of such adulteration presented itself in the course of the examination; furthermore, I should add that I have never yet met with a case of adulteration of milk with organic substances, and believe it to be of very rare occurrence.

The solid residue dry at 100° C. was taken with great—and I believe unprecedented—accuracy. I have made a study of the taking of milk-residues, and set down the average experimental error in the solid residue as not more than 0·02 per cent. The solid residues were taken twice over, and the

mean of the two closely-agreeing determinations was employed in the construction of the table.

The fats were taken with great care, but they do not pretend to so high a degree of accuracy as the total solids. It is hardly necessary to add that the numbers (designated as a) in the column headed 'Grammes of Solids not Fat' were obtained by subtracting the quantity of fat ($=b$) from the quantity of total solids dry at 100° C.

The calculation of the quantities of genuine milk employed in making 100 grammes of the samples is based on the assumption, which I believe to be warranted, that milk is tolerably uniform in strength, consisting of 9·3 parts 'solids not fat,' 3·2 parts of fat, and 87·5 parts of water. This is the composition of country-fed milk. There is, however, an exceptionally rich milk given by highly stall-fed cows in town. This milk contains 10·0 parts of 'solids not fat,' 4·0 parts of fat, and 86·0 per cent. of water; but it is comparatively rare.

If, in any instances in the above table, this rich stall-fed town milk have been employed instead of average country milk, then the real amount of watering and skimming in those instances is a little higher than the table exhibits. In the table there are seven examples of more than 100 grammes of genuine milk being used in making 100 grammes of the sample. Of these one appears to be an example of this town-fed milk, the rest not being sufficiently above 100 to call for such a supposition. The example to which I refer is the Shoreditch milk, which on the first occasion yielded 9·99 per cent. of 'solids not fat,' which is a very close approximation to the 'solids not fat' in 100 parts of town-fed milk.

When a exceeds 100 a minus-quantity will correspond to it in column 7, unless the slight correction for fat obliterate the minus-quantity of water. On calculating for town-fed instead of for country-fed milk, the minus-quantities in column 7 will disappear in every instance. The calculation for town-fed milk instead of for country-fed milk, as in the table, is simple, viz., substitute $10a$ for

$$\frac{100}{9{\cdot}3}a\text{; substitute } 0{\cdot}4\ a \text{ for } \frac{3{\cdot}2}{9{\cdot}3}a$$

The occurrence of minus-quantities in the column headed 'Fat Removed' requires a word of explanation. These minus-

quantities have a real and substantial meaning. They are the quantities of fat which have been the reverse of removed,—that is to say, which have been added to the milk. Whenever one of these minus-quantities occurs in the 'Fat Removed' column, one of three things has happened:—either the minus-quantity is within the limits of experimental error, as is the case with three of them (viz., −0·06, −0·05, and −0·07), or the milk was town milk, or the milk had through imperfect mixing received an undue share of the cream. There are only four cases of the kind in the table, viz., −0·57, −0·28, −0·47, and −0·34.—*Chemical News*, 18th Oct., 1872.

It used to be the fashion to attempt to distinguish between genuine milk and watered milk by the specific gravity. Milk has a specific gravity of 1·029; but rich milk is lighter, and if specific gravity alone were depended upon it might be mistaken for watered milk. There is a still further source of uncertainty in the circumstance that by skimming the specific gravity is raised, whilst by watering it is lowered, and that therefore, by alternately skimming and watering the original specific gravity may be restored. The notion that such cases may be dealt with by supplementing the determination of specific gravity by a reading of the amount of cream is illusory, inasmuch as there is a more perfect rising of cream from watered than unwatered milk. I believe one of the soundest pieces of advice which can be given to those who are engaged in the testing of milk is to abandon the use of the lactometer.

Besides skimming and watering there appears to be very little adulteration in the milk-trade.

I have specially sought for mineral adulteration (such as chalk and salt) in more than a hundred instances, and in every case had positive proof that *no* mineral adulteration had been practised. Nothing is easier that to ascertain whether or not milk has been adulterated in this manner. All that has to be done is to take the ash, and if this be not excessive then there can be no mineral adulteration.

I have never met with a case of organic adulteration of milk, and do not believe that they are common. When anything of the sort is suspected it is to be dealt with by making a complete analysis of the sample in the manner described above.

Butter.—This is the fat of milk which, as need hardly be

said, is extracted either from cream or from milk by a mechanical process. Mr. Way has found in ordinary butter—in its ordinary condition, as actually employed—

Fat	82·70
Caseine	2·45
Water and a little Salt	14·85
	100·00

I have found in good fresh butter—

	A.	B.
Fat	82·7	82·1
Salt	1·1	1·8
Water and trace of organic matter	16·2	16·1
	100·0	100·0

A was a sample of Devonshire fresh butter; B was a sample of Normandy butter. There ought to be 82 to 83 per cent. of real butter-fat in genuine butter.

Butter is a very dear and valuable article, costing from one to two shillings per pound. Manifestly, therefore, there is a temptation to make a partial substitution of water or salt and water for butter-fat. In a variety of butter which is in the market under the name of Bosch, I found—

Fat	69·4
Salt	3·3
Water and trace of organic matter	27·3
	100·0

In another sort of butter known as Hamboro' re-packs I found—

Fat	62·8
Salt	7·5
Water, &c.	29·7
	100·0

In an investigation of the butters supplied to the workhouses of the metropolis, which I was instructed by Mr. Rowsell to make for the Government, I found abundant examples of this description of practice.

The examination of butter is carried ou thus:—A quantity —one or two grammes—is weighed out into a shallow platinum

dish and dried in the water-bath at 100° C., until it ceases to lose in weight. The loss in weight is the water contained in the sample of butter. The dry residue may next be burnt over the lamp, and the residual ash (which is salt) weighed. Another portion of butter (say five grammes) should be weighed out, partially dried at 100° C, and then treated with ether; the ethereal solution of the fat filtered, and the filtrate carefully evaporated to dryness in the water-bath and weighed. This gives the percentage of fat. If, now, the percentage of water, ash (or salt) and fat be added together, and the sum be subtracted from 100, the difference is the percentage of '*organic matter not fat*' in the butter. This, in unsophisticated butter, is always very small. Even in bad butters it is rarely high—and, indeed, among a great number of bad butters I did not find a single instance of high '*solids not fat.*' Should a case in point be encountered by the Public Analyst he will do well to test for starch, by means of solution of iodine; for one of the alleged frauds in the butter trade is said to be the putting mashed potatoes into the butter. Gelatine, also, is alleged. This will, of course, be recognised as a nitrogenous substance, and by gelatinising with water, and by the formation of the well-known precipitate with infusion of gallnuts. Granting, then, that the sample of butter contain not too much water—not too much ash—not too much '*organic matter not fat*'—is it necessarily genuine butter? No, it may be partly butter-fat and partly extraneous fat. Butter-fat is *not* one chemical compound but a mixture of compounds. It contains a number of the ethers of glycerine, including some of the commonest and most widely diffused descriptions of fat. It contains stearin (stearate of glycerine $C_3H_5O_3(C_{18}H_{35}O)_3$. It contains olein and palmitin which are likewise well-known ethers of glycerine. In addition to these there are a variety of other fats in butter, such as, for instance, butyrate of glycerine.

Although, doubtless, if a chemist were to take the trouble to investigate butter with that especial object he could hardly fail to come upon good tests to distinguish between a genuine butter-fat and a spurious one, there is at present no known method of doing so.

Butter, as is well-known, fuses at high temperatures a little

higher than the average atmospheric temperature in this country. A sample of fat, purporting to be butter, must not be too hard to melt, otherwise some such fat as tallow may be suspected; neither must it be too easily melted. Genuine butter is moreover dissolved by 28 parts of boiling alcohol, of a specific gravity of 0·82.

Butter is apt to become rancid,—a change consisting in the decomposition of traces of its fats into fatty acid and glycerine. Rancidity may be, to some extent, abated by the employment of a little alkali; and by the short application of a high temperature to the butter. During the siege of Paris, the practice of heating butter and other fats for the purpose of sweetening them is said to have been largely in vogue.

CHEESE.

This substance consists of caseine and fat in variable proportions; also of water (and by no means little of it) and of mineral matter, mainly phosphate of lime. There is very great diversity in the composition of different cheeses, as the following analyses by Payen show:—

	Percentages.			
	Water.	Fat.	Nitrogen.	Ash.
Cheshire Cheese . .	30·4	25·4	5·6	4·8
Brie	54·0	24·1	2·4	5·6
Neufchâtel . . .	61·9	18·7	2·3	4·2
Marolles . . .	40·1	28·7	3·7	6·0
Roquefort . . .	26·6	32·3	5·1	4·4
Holland	41·4	25·1	4·1	6·2
Gruyeres . . .	32·0	28·4	5·4	4·8
Parmesano . . .	30·3	21·7	5·5	7·1

As is well known, cheese is coloured with annatto, which is a vegetable colouring matter. In Accum's book, a curious instance is related of alleged poisoning with oxide of lead, which was said to have been used to adulterate the vermilion which was said to have been employed to adulterate the annatto used to colour a Gloucester cheese. The instance is rather doubtful. It may be noted, in passing, that cheese-rind is to be looked upon with suspicion. I have nothing to add concerning the actual adulteration of cheese

CHAPTER IV.

FLOUR AND BREAD.

FINE wheaten flour contains—

Water	16·5
Ash	0·74
Fat	1·2
Sugar, Gum, and Dextrin	3·3
Albuminous matters (Gluten, &c.)	12·0
Starch	66·3
	100·0[1]

The water is determined by weighing out some flour in a platinum dish, and exposing it to a temperature of 130° C., until it ceases to lose in weight. In a sample of fine flour (price 2½ pence per lb.) I found 16·5 per cent. of water. In a sample of 'seconds' flour (price 2¼ pence per lb.) I found 15·7 per cent. of water. In other samples of flour, drying, however, at a lower temperature, viz., 110° C. and 115·6, I have obtained 14·0 per cent. and 14·4 per cent. of water.

The Ash, which is a most important datum in the chemical examination of flour, is obtained by igniting a weighed quantity of the flour in a platinum crucible, and subsequently weighing the residue, which persistently refuses to burn away. About one gramme of flour is a convenient quantity to take for a determination of ash. At first, at the commencement of the ignition, the flour burns rapidly, but soon forms a hard coke, which burns slowly. On continuing the application of a red heat, with free access of air, and stirring with a platinum wire, the coke will burn completely away and leave an ash which seems to shrink up almost to nothing, and which is very

[1] I quote an analysis made recently in my own laboratory, and giving results in accordance with standard authorities.

constant in amount. In three different samples of fine flour I found respectively 0·73, 0·75, and 0·74 per cent. of ash. In a specimen of 'seconds' flour I found 0·82 per cent. of ash.

The chemical composition of the ash of flour is mainly phosphate of potash, phosphate of magnesia, and phosphate of lime. Of these three the first mentioned forms considerably more than half of the entire ash, and next in abundance comes the phosphate of magnesia.

If it be required to find out whether or not plaster of Paris has been used to adulterate a sample of flour, a determination of ash may be resorted to. With the object of testing the working of this method I adulterated a sample of flour with about 6 per cent. of plaster of Paris, and then determined the ash. The result was striking and satisfactory. The only caution to be given is not to mistake the coke yielded by flour in common with most organic nitrogenous substances, for the ash. Re-ignition will diminish the coke, but not a genuine ash. If, therefore, a sample of fine wheaten flour yield sensibly more than 0·7 or 0·8 per cent. of residue, which does not burn away on repeated ignition, there must be something wrong with the flour. Every case of replacement of flour by a mineral material cheaper than flour would be most satisfactorily dealt with by the incineration test. We have next to consider an adulteration to which much attention has been directed, viz., the adulteration of flour and bread with alum. In order to understand the nature of this peculiar case, it is necessary to remark that neither miller nor baker puts alum into flour or bread on account of the difference in cost between alum and flour. Flour or bread to which enough alum had been added to render the replacement of flour by alum financially successful would be absolutely unsaleable. What the miller or baker really does is to mix a very minute proportion of alum with the flour in order to improve the quality of the bread; in order to enable inferior flour to make fairly good bread. This practice is at least fifty years old. According to Accum, whose book on 'Culinary Poisons' was published in 1822, the proportion of alum employed is about one or two parts of alum in a thousand parts of flour. This is apparent from the following quotations:—'From three to four ounces to a sack

of flour, weighing 240 pounds,' and 'Five bushels of flour' (i.e., 240 pounds) 'eight ounces of alum, four pounds of salt, half a gallon of yeast, mixed with about three gallons of water.'

Inasmuch as crystals of alum contain nearly half their weight of water, and inasmuch as a pound of flour makes more than a pound of bread (by reason of the higher percentage of water in bread than in flour) the actual proportion of dry alum in bread must be considerably lower than one part in a thousand pounds of bread. The question may, therefore, be very fairly raised whether the use of alum in bread-making be really detrimental to health. Is it injurious to take from two to four grains of sulphate of alumina daily?

Whatever the answer may be which is returned to this question, it is, in the meantime, necessary that the public analyst should be placed in a position to say decisively whether or not a given specimen of flour or bread be aluminised.

This is possible, but by no means easy; and here I would record my opinion, that in this country at any rate, chemists have often failed to find alum when present in bread, and succeeded in finding it when originally absent.

Alum is missed partly owing to the minuteness of the quantity which is present. Alum is found in its absence when the phosphate of magnesia and phosphate of lime of bread-ash, or when the alumina or silica in the reagents, are mistaken for alumina originally existing in the bread.

The first point to be regarded in testing flour for alum is to operate on a sufficient quantity of the material. One gramme is far too little. 100 grammes is the right quantity. This is to be incinerated in a platinum dish, and the resulting ash treated with 0·5 cubic cents of oil of vitriol (or one gramme of oil of vitriol). The acid mass is heated till fumes of sulphuric acid escape, and then let cool, diluted with water, and filtered. To the filtrate one and a-half grammes of pure solid potash are added; when this has dissolved, the liquid is filtered, and the filtrate mixed with about one and a-half grammes of chloride of ammonium and boiled. The formation of a white gelatinous precipitate indicates alumina.

The pure potash may be potash prepared by solution in alcohol. Instead of caustic potash, caustic soda prepared by

dissolving a little metallic sodium in water (which must be done with care) may be used.

The operator ought to make a blank testing of the reagents before trusting to them. The aluminous precipitate obtained in the manner described is phosphate of alumina. The remark need hardly be made that the same course is to be followed whether flour or bread is to be tested for alum; only double the quantity of bread (viz., 200 grammes) should be employed.

Copper in Flour and Bread.—The detection of this metal is very easy and very delicate. A quantity of the flour or bread is incinerated, and the ash boiled with a few drops of strong sulphuric acid and then diluted with water. Into the solution, which is contained in a platinum crucible, a piece of iron or zinc is placed; whereupon the copper (if there be any) will be deposited on the surface of the platinum crucible. The test is very delicate, and one part of sulphate of copper may be readily detected in ten thousand of bread.

The Fat in flour is yellow in colour and solid at ordinary temperatures, but fusing to a clear bright oil when heated somewhat. It is totally soluble in alcohol of 95 per cent.; soluble also, as a matter of course, in ether. As given above, there is 1·2 per cent. of fat in fine wheaten flour. According to some analyses quoted in Watts's Dictionary of Chemistry, oats and maize contain much more fat than wheat, viz., some 6 per cent.; whilst rice is very poor in fat, viz., 0·1 or 0·2 per cent. The fact of this deficiency in rice may possibly be available as an analytical distinction.

Sugar, Gum, and Dextrin.—When flour is stirred up with cold water, it undergoes a considerable alteration in appearance. The major part of the albuminous constituents (viz., the gluten) does not dissolve in the water, but absorbs water, becoming gluey; whilst a small proportion of the albuminous matter, viz.; the vegetable albumen, enters into complete solution. The starch does not dissolve, but is mechanically separable from the gluten. The sugar, gum, and dextrin, and also the phosphate of potash, dissolve. In a cold water extract of flour there is accordingly—

	Grammes.
Sugar, Gum, and Dextrin	3·33
Vegetable Albumen	0·92
Phosphate of Potash	0·44
	4·69

The numbers are the numbers of grammes of the respective matters yielded by one hundred grammes of fine flour in an experiment recently made in my laboratory.

The analytical characters presented by the cold water extract of flour are that it coagulates on boiling (owing to the presence of the vegetable albumen), and that it reduces oxide of copper to sub-oxide, owing to the presence of the sugar and dextrin. Evaporated down to dryness, it leaves an organic residue, which burns with the well-known burnt-bread smell and leaves an ash. The determination of the amount of sugar, gum, and dextrin in flour is of considerable importance, inasmuch as unsoundness in flour is marked by an increase in the proportion of these matters. This determination may be made very simply as follows:—

100 grammes of flour is well stirred up with water, and diluted with water (being also thoroughly mixed), until it occupies exactly 500 cubic centimeters. It is then thrown upon a filter, and 50 cubic centimeters of the filtrate are taken and evaporated down to dryness in the water bath. This 50 cubic centimeters will, of course, contain one-tenth of the total quantity which the 100 grammes of flour yields. The weight of the residue, dry at 100° C., should not exceed 0·469 grammes, whereof 0·092 grammes are vegetable albumen and 0·044 grammes are ash.

The Albuminous matters in flour consist of a number of distinct chemical substances. First, there is vegetable albumen, which, as already mentioned, dissolves in cold water, and is therefore found in the cold water extract. This substance is very like animal albumen (possibly being identical with it). Its cold-watery solution coagulates on being warmed. Boiled with alkaline solution of permanganate of potash, it yields ammonia; and indeed the readiest way of ascertaining how much of it is present in the aqueous solution is by distilling with alkaline permanganate, and estimating the ammonia which is produced. Ten times the weight of the ammonia is the weight of the albumen which yields it. According to my experiments, flour contains about one per cent. of vegetable albumen.

The other albuminous matters in flour, which are insoluble in water, are much more abundant, and are known as gluten.

A rough and ready estimation of the gluten in a sample of flour is effected by an almost mechanical process. A considerable quantity of flour (500 grammes or a pound) is worked well in contact with water, when the gluten coheres in the form of a tenacious mass, whilst the starch is pulverulent, and may be washed away. In this way a mass of gluten is obtained. It is washed, dried, and weighed. This process cannot have very high pretensions to accuracy. Operating on average flour, from 9 to 12 per cent. of gluten is obtainable. Gluten is not a single substance. When treated with weak alcohol, part of it is dissolved and part remains insoluble. (Absolute alcohol, or even alcohol of 95 per cent., hardly dissolves a trace.) The substance insoluble in weak alcohol has received the name of vegetable fibrin. The substances soluble in the alcohol are mucin, or vegetable casein, and glutin, which is also termed gliadin, or vegetable gelatin.

In place of making the determination of gluten in flour by the process described, there are great advantages in making determinations of the nitrogen and using them as measures of the albuminous substances. The percentage of nitrogen in flour appears to be about 2·0, and is, no doubt, subject to considerable variation. I am, however, inclined to recommend determinations of albuminoid ammonia, that is, determinations of the amount of ammonia generated by the action of boiling solution of alkaline permanganate. These are very easy to make, and especially so in laboratories where the ammonia-process of water analysis is in use. The method is the following. Into a retort containing half a litre of water (either distilled water, or fair tap water), 50 cubic centimeters of the alkaline permanganate solution, described under water analysis (*vide* p. 317), are introduced. 100 cubic centimeters of water is then distilled off and thrown away. Then 20 milligrammes of the sample of flour are put into the retort and the distillation continued, the distillates being Nesslerised (*vide* water analysis, p. 319). From 20 milligrammes of flour 0·24 milligrammes of ammonia are obtainable (i.e., from 100 part of flour 1·2 parts of ammonia). Either the 20 milligrammes of flour may be weighed on a bit of platinum foil and introduced bodily into the retort along with the foil; or

else a solution may be made containing in one cubic centimeter of solution one milligramme of flour. Of such a solution, 10 or 20 cubic centimeters may be conveniently employed for an experiment. This process bids fair to be the readiest and best method of determining the albuminoid material in different samples of flour.

A determination of 'albuminoid ammonia,' as just described, may be employed to recognise the adulteration of wheaten flour with rice, which is very much poorer than wheat in nitrogenous matter. Rice is said to contain between 7 and 8 per cent. of albuminous matter, whereas wheat contains 12.

Starch.—By far the larger proportion of the solid part of wheaten flour consists of starch (*vide* the tabular analysis, p. 346), and indeed flour may be described as a variety of starch, which, in comparison with many other natural starches, is highly charged with albuminous substances. The composition of starch is expressed by the formula $C_6 H_{10} O_5$, probably, however, the formula ought to be reduplicated several times inasmuch as starch presents all the signs of high complexity. As will be seen, it is a *non-nitrogenous* substance, and a member, moreover, of the so-called carbo-hydrates or substances, whose ultimate composition is carbon plus exactly the elements of water in the right proportion to yield water. The original state in which starch occurs is in the form of granules, which are of different shapes and sizes, according to the origin of the starch. In its original condition starch is insoluble in ether, alcohol, and water. But if the granules be broken, or if they be distended by hot water, then it enters into solution to some extent. By means of hot water it passes into a well-known form, viz., starch paste. A well-known test of extraordinary delicacy is afforded by iodine. This strikes a deep blue colour with starch, for which it is constantly employed as a test. Reciprocally starch paste is used by the chemist as a test for iodine. In working the test it should, however, be borne in mind that only *free* iodine (not any iodine-compound) gives this blue colour, and that the blue colour itself (delicate test though it be) is not the colour of any stable compound of starch with iodine, but of one of the weakest of chemical compounds. By many persons it is maintained that the iodide of starch is not a chemical compound at all, but only a mechanical mixture. Almost every

substance which is capable of acting chemically on iodine will, therefore, destroy the blue colour of the iodide of starch. Sulphuretted hydrogen, sulphurous acid, and alkalis, all of them remove the colour, inasmuch as they re-act chemically on iodine and water together. Even by simple boiling water the colour may be discharged—the iodine being in that case volatilized along with the vapour of water.

One of the most convenient modes of applying the iodine-test consists in having the iodine dissolved in aqueous solution of iodide of potassium; and here be it remarked that iodide of potassium, although it combines with free iodine, does not decompose iodide of starch—which is a very exceptional and noteworthy circumstance, tending to disprove the notion that iodide of starch is absolutely a mechanical and not a chemical compound. When starch is heated to 160°C. it is converted into an isomeric modification called dextrine, from its extraordinary power of turning polarised light to the right. It differs from starch very widely. It does not blue iodine. It is soluble in cold water. It reduces black oxide of copper to red suboxide. It is, so to speak, starch on its way towards sugar. Not alone by heat, but in many other manners is starch converted into dextrine. Boiling with dilute acids effects the transformation—even dilute acetic acid does so. Strangely, however, concentrated acetic acid brings about no such change, and digestion with acetic anhydride actually forms an acetate of starch, from which veritable starch—capable of blueing iodine—may be regenerated by means of alkalis. By means of ferments of various descriptions starch is transformed into dextrine; and especially easily by the nitrogenous matters of flour when these pass into the fermentative condition, or are passing into decay. We have already directed attention to the importance of ascertaining whether flour contains its starch intact or whether the starch has passed into dextrine and sugar. This, as has been said, is ascertained by making an experiment on the cold aqueous extract of flour which, if the flour be sound, will contain only little in solution; but, if the flour be damaged, will be rich.

As has been mentioned, starch-granules are of different shapes and sizes, according to their origin. Wheaten-starch differs from potato-starch, and from rice-starch in the size

and shape of the granules, and so the aid of the microscope may be called in to distinguish between these different starches, and consequently to detect adulterations of this description. Wheat-starch is intermediate in size between potato-starch and rice-starch. Wheat-starch, moreover, is lenticular in shape. The granules of wheat-starch are 0·36 millimeter (or ·0015 inch) in diameter. *Vide* figs.

Bread.—Little need be said, in this place, of the operation of bread-making. Although physically very different from flour, bread is chemically not very much different. Flour is mainly starch—starch granules. So is bread. According to an analysis made by Vogel (*vide* Watts's *Dictionary of Chemistry*, Article, Bread) the solids in a wheaten loaf consists of 53·5 per cent. of unaltered starch; 18·0 altered starch; 20·7 gluten mixed with starch; and 3·6 of sugar.

In bread-making flour is first mixed with a certain quantity of water, and afterwards in the baking of the loaf some, but by no means all, of the additional water is driven off. In comparison with flour bread is, therefore, rich in water. According to Odling, the mean percentage of water in bread is 43·4;—the extremes in twenty-five specimens of loaves being 38·6 and 46·7 per cent. of water.

In making bread salt is added to the flour; accordingly the mineral matter in bread is higher than in flour. Odling found it to be 1·3 on an average. The mean percentage of nitrogen was found to be 1·26 by the same authority.

There are two ways in which the carbonic acid is generated which imparts to bread its peculiarly porous condition. By fermenting some of the sugar of the flour and thereby forming alcohol and carbonic acid. By charging the dough with carbonic acid dissolved in water under pressure; in this case the sugar of bread is economised and not allowed to degenerate into carbonic acid and alcohol. A modification of the latter process at one time in use consisted in using bicarbonate of soda and dydrochloric acid, which evolved carbonic acid and produced chloride of sodium at the same time, thus salting the bread. A rather formidable objection has been raised to this method of procedure, viz., that the commercial hydrochloric acid is liable to be contaminated with arsenic, and consequently to render the bread arsenical. Should a case of this sort come before the public analyst he will, of course, deal with it as with an ordinary case of arsenical poisoning.

CHAPTER V.

BEER AND WINE.

BEER contains alcohol, together with extract of malt and hops, and, of course, water. There is, likewise, a little carbonic acid, a little mineral matter, and a very little acetic acid.

According to recent analyses made in my laboratory, Bass's bottled bitter ale contains in 100 cubic centimeters

5·3 grms. of Alcohol.
5·52 grms. of Organic Residue.
0·36 grms. of Ash.

A sample of draught ale, costing twopence a pint in London, contained in 100 cubic centimeters

4·7 grms. of Alcohol.
5·8 grms. of Organic Residue.
0·32 grms. of Ash.

In a sample of London porter, I found in 100 cubic centimeters

3·3 grms. of Alcohol.
4·45 grms. of Organic Residue.
0·30 grms. of Ash.

The following table, which I quote from Watts's *Dictionary*, will also serve to indicate what may be expected in different varieties of beer :—

	Percentage.	
	Alcohol.	Malt Extract.
London Ale for Export	6 to 8	7 to 5
London Ale, ordinary	4 „ 5	5 „ 4
London Porter, for Export	5 „ 6	7 „ 6
London Porter, ordinary	3 „ 4	5 „ 4
Brussels Lambik	4·5 „ 6	5·5 „ 3·5
Brussels Faro	2·5 „ 4	5 „ 3
Bière forte de Strasbourg	4 „ 4·5	4 „ 3·5
Bière blanche de Paris	3·5 „ 4	8 „ 5
Bavarian Beer	3 „ 4·5	6·5 „ 4
White beer of Berlin	1·8 „ 2	6·2 „ 5·7

In examining a specimen of beer, said to be adulterated, the first point to be made out is whether it is strong enough for the price at which it is sold. If it does really contain as much alcohol and malt-extract (i.e., organic extract) as it ought to do, that fact is very strongly against its being sophisticated. The amount of alcohol in beer is determined as follows. A hundred cubic centimeters of the beer are introduced into a small retort, which is connected with a Liebig's Condenser. A third of the liquid is then distilled over. The distillate then contains all the alcohol which was originally present in the beer. The distillate is to be diluted with water till it weighs exactly 50 grammes, and its specific gravity taken at 15·6°C (or 60° Fahrenheit). From the specific gravity the amount of alcohol is to be found by help of the annexed table.

Percentage by Weight.	Specific Gravity.	Percentage by Weight.	Specific Gravity.
0·5	·9991	11	·9828
1	·9981	12	·9815
2	·9965	13	·9802
3	·9947	14	·9789
4	·9930	15	·9778
5	·9914	16	·9766
6	·9898	17	·9753
7	·9884	18	·9741
8	·9869	19	·9728
9	·9855	20	·9716
10	·9841		

The table gives the number of grammes of absolute alcohol

contained in 100 grammes of the distillate. Inasmuch as the weight of the distillate was only 50 grammes, there will be only half the number of grammes in it that there is in 100 grammes. The strength of the distillate must, therefore, be halved in order to arrive at the strength of the original beer. The following example will serve in illustration.

100 cubic centimeters of London porter yielded 50 grammes of distillate, the specific gravity of which, at 15·6° C, was found to be ·9892. Therefore, the strength of the distillate (*vide* the table) is 6·6. Therefore, the strength of the beer is 3·3.

The specific gravity is best taken by means of the specific gravity bottle, which is first weighed empty, and afterwards weighed full of water and full of the weak spirit under investigation. The weight of the weak spirit divided by the weight of an equal volume of water is the specific gravity of the spirit.

The Malt Extract in beer is determined very simply as follows:—

Into a small platinum dish of known weight 5 cubic centimeters of beer are measured, and then evaporated to dryness in the water bath. The dish, with its contents, is then weighed, and the weight of the dish subtracted from the weight of the whole. In this manner the total solid residue yielded by 5 cubic centimeters of beer is found. This, multiplied by 20, is the weight of solid residue yielded by 100 cubic centimeters of beer. The solid residue is afterwards ignited in order to find the ash.

In order to give an idea of the constancy of the results (and also to illustrate the method), I will cite five experiments made on the same sample of London porter:—

Five cubic centimeters of porter were evaporated to dryness in the water bath and weighed.

	Weight of Dry Residue.	Residue from 100 c. c.
Exp. I.	0·238 grms.	4·76 grms.
Exp. II.	0·240 „	4·80 „
Exp. III.	0·236 „	4·72 „
Exp. IV.	0·239 „	4·78 „
Exp. V.	0·235 „	4·70 „
		5) 23·76
		4·75

The mean residue yielded by 100 cubic centimeters of porter was, therefore, 4·75 grammes.

The ash was found to be ·015 gramme from 5 cubic centimeters. Therefore 0·30 gramme from 100 cubic centimeters of porter.

The organic extract yielded by 100 cubic centimeters of porter was, therefore, 4·45 grammes.

The organic extractive matter yielded by beer consists of dextrine, sugar, lupuline, from the hop, and also of residual gluten in a more or less altered condition. The inorganic matter, the ash, consists in great part of phosphates. Adulteration of beer by means of salt will be at once detected by means of a determination of the ash. Under such conditions, the ash would be found to be excessive.

Among the organic adulterations, two are especially to be named, viz., picric acid and cocculus indicus. Picric acid may be detected by its power of colouring wool. If white wool be boiled with beer adulterated with picric acid, it will be stained yellow, the stain being permanent when the wool is washed.

The detection of picrotoxin, the active principle of cocculus indicus, is not very easy. The following method is given by Herapath :—

Mix the beer with acetate of lead in excess ; filter and transmit sulphuretted hydrogen through the filtrate. Filter again, concentrate the filtrate ; treat it with animal charcoal, which has the property of absorbing the picrotoxin. The animal charcoal is subsequently washed, dried at 100° C., and boiled with alcohol, which dissolves out the picrotoxin. From the solution in alcohol it may be got in tufts of crystals.

In addition to picric acid and picrotoxin, strychnine has been talked of as an adulterant of beer.

Wine is the fermented juice of the grape, and is, as a rule, stronger than beer. The different varieties of wine differ also very widely in alcoholic strength, as may be seen from the following determinations made many years ago by Christison :—

	Percentage of Absolute Alcohol.
Port Wine	16·20
Sherry (old)	15·37
„ (weak)	13·98
„ (strong)	16·17
Claret (first quality)	8·99
„	7·72
Rüdesheimer (first)	8·40
„ (inferior)	6·90

There are also in wines different kinds of ethers, some being volatile, and others fixed. Aldehydes also appear to occur sometimes, and no doubt the particular kind of ether or aldehyde exercises much influence in determining the exact quality and value of the wine. The proportion, however, of ether or aldehyde in wines is very small, being about one part in one thousand of wine.

Just as beer contains malt-extract, so wine contains grape-extract, consisting partly of grape sugar. A certain proportion of mineral matter likewise occurs in wine, which, on being evaporated to dryness, and having the residue subjected to ignition, leaves an ash containing carbonate of potash, arising from the decomposition of the cream of tartar. Small quantities of free acid are also to be looked for in wines.

Although much labour has been expended by chemists on the examination of wines, still the chemical recognition of the differences between the different sorts of wines is very imperfect and unsatisfactory; and almost equally unsatisfactory is the chemical testing for some of the commonest sophistications which are avowedly practised.

The alcohol found in a sample of wine may be either produced by the fermentation of the grape juice, or it may have been (in part) added to the wine. Both as a matter of taste, and physiologically, wine to which no spirit has been added differs from wine to which spirit has been added; and yet no chemical examination has hitherto distinguished between the two cases. Most probably some trace of powerful empyreumatic material communicates the peculiarity to distilled spirit, but chemical analysis has not as yet availed to disclose the presence of such substances. One thing, however, can be told: if the percentage of alcohol exceeds a certain figure (about 14), then the wine must have been fortified with spirit,

since fermentation is brought to a standstill by the presence of that amount of alcohol. Some degree of probability, too, is attached to a judgment founded on a comparison of the percentage of alcohol in the sample, and the average strength of the particular sort of wine. Thus, if in claret we should find as much alcohol as might fairly be present in genuine sherry, we should be warranted in pronouncing the claret to have been fortified with spirit. A few examples of analysis of different wines quoted from Dr. Dupré's paper (*vide* Journal of the Chemical Society, vol. v. p. 493, *et seq.*) may possibly be interesting.

Light claret, 1865, price 15*s*. per dozen.

	Percentage by Weight.
Alcohol	9·05
Total dry residue, including mineral matter	2·17
Sugar	0·047
Alcohol obtainable from the ethers	0·048
Free fixed Acid, expressed as Tartaric Acid	0·338
Free Volatile Acid, expressed as Acetic Acid	0·222

Rhine wine, Rauenthaler, 1864, 18*s*. per dozen.

	Percentage by Weight.
Alcohol	7·44
Total dry residue, including mineral matter	2·207
Sugar	traces
Total Alcohol present in the ethers	0·043
Free Fixed Acid, expressed as Tartaric Acid	0·674
Free Volatile Acid, expressed as Acetic Acid	0·118

Rauenthaler, 1862, 54*s*. per dozen.

	Percentage by Weight.
Alcohol	8·83
Total dry residue, including mineral matter	1·867
Sugar	0·062
Total Alcohol present in the ethers	0·046
Free fixed Acid, expressed as Tartaric Acid	0·445
Free Volatile Acid, expressed as Acetic Acid	0·178

Port wine, 1864.

	Percentage by Weight.
Alcohol	18·56
Total dry residue, including mineral matter	7·30
Sugar	4·90
Total Alcohol in ethers	0·043
Free fixed Acid as Tartaric Acid	0·307
Free Volatile Acid as Acetic Acid	0·084

The percentage of mineral matter (i.e. of ash) in wine appears to be very much as in beer, viz., about 0·3.

The description of the analysis of beer is applicable to the analysis of wine. There is one special kind of impurity which will occasionally come before the public analyst and medical officer of health, and which is of considerable importance. Lead is sometimes present in wine. This sometimes arises from carelessness in bottling; the shot which is employed in cleaning the bottles having been left in them. The presence of lead in wine is ascertained by evaporating a considerable quantity of wine to dryness, igniting the residue in a thin porcelain dish, treating the ash with a little hydrochloric acid, and then adding sulphuretted hydrogen water to the solution. Blackening, or darkening, indicates the presence of lead.

Cider is likewise liable to be contaminated with lead, and those whose duties call them into the apple-growing counties will, doubtless, be required to test that liquor for the metal in question.

CHAPTER VI.

TEA.

In making a chemical examination of tea, one of the points which first attracts the attention of the chemist is the high proportion of ash which tea leaves contain. The following determinations have been made recently in my own laboratory—

	Percentage of Ash.
Specimen of common tea	5·63
Civil Service Tea	5·56
Horniman's Tea	5·99
Mandarin's Tea (eight shillings per pound)	5·3
Orange Pekoe (five shillings per pound)	5·84
" "	6·06
Green Tea (four shillings and sixpence per pound)	5·86
Average	5·75

From a paper of Zöller's, in *Liebig's Annalen*, May 1871, it appears that a fine specimen of tea received direct from the growers, yielded 5·63 per cent. of ash. This agrees with the above; and we may, accordingly, set down the average ash in normal tea as 5·7 per cent. The hygrometric moisture in tea was also determined by Zöller as 4·95 per cent.

The tea met with in commerce is not unfrequently adulterated with mineral matter, such as sand and even metallic iron in a state of powder. These adulterations may at once be detected by making a determination of ash in the sample. A sample which was recently examined in my laboratory yielded 14·5 per cent. of ash, of which about 9 consisted of lumps of sand. Tea burns pretty readily, and there is, consequently, no difficulty in taking the ash. About one gramme of tea leaves will be found to be a convenient quantity to burn for the ash. It is unnecessary to moisten the ash with nitric acid, inasmuch as the combustion is complete without it.

The composition of the ash is remarkable. According to the analysis by Zöller, it contains—

	Percentage of Ash.
Potash	39·22
Soda	0·65
Magnesia	6·47
Lime	4·24
Oxide of Iron	4·38
Protoxide of Manganese	1·03
Phosphoric Acid	14·55
Sulphuric Acid	trace
Chlorine	0·81
Silica	4·35
Carbonic Acid	24·30
	100·00

The high percentage of potash and phosphoric acid will not fail to be noticed. This prevails in the ash of fine tea, that is to say of young tea leaves. As the tea leaves grow older on the tea plant their mineral constituents undergo an alteration—the potash and phosphoric acid diminish whilst the lime and silica increase.

By an examination of the ash a judgment may, therefore, be formed as to whether the tea be of fine or of inferior quality. Much potash and much phosphoric acid with little lime and silica denotes excellent tea; and the contrary denotes inferior tea.

Commercial tea is sometimes accused of having been used once and then dried, and sold as genuine tea. This fraud may be investigated through the ash of the tea leaves, which will be found deficient in potash in that case.

The percentage of ash in spent tea leaves (dry at 100° C) was found by Zöller to be 3·06, being, as will be observed, less than in normal tea. The composition of the ash was—

Potash	7·34
Soda	0·69
Magnesia	11·45
Lime	10·76
Oxide of Iron	9·53
Protoxide of Manganese	1·97
Chlorine	trace
Phosphoric Acid	25·41
Sulphuric Acid	trace
Silica	7·57
Carbonic Acid	25·28
	100·00

Low potash and high lime in the ash left by tea are very suspicious signs. But we are not by any means confined to an examination of the ash in investigating a case of suspected sophistication of a sample of tea. An examination of the infusion in boiling water gives valuable information. Zöller found that 100 parts (by weight) of tea gave 36·26 parts of dry solid extract soluble in water. The extraction, moreover, was believed by him to have been incomplete, and was made thus: Three litres of boiling distilled water were poured on 100 grammes of tea leaves, and afterwards poured off them. A second three litres of water was used in the same manner, and the resulting six litres of infusion evaporated to dryness, and its residue dried at 100° C and weighed. Tea leaves, therefore, yield to water more than one third of their weight. It will accordingly be easily appreciated that a determination of the amount of extract is an admirable test whether or not a specimen of tea be genuine tea or spent tea.

The percentage of nitrogen in tea leaves is extraordinary. Zöller found it to be 5·38—which is more than twice as much as in wheaten flour. The nitrogen exists partly in the form of thein, but mainly as an albuminous substance which, according to Peligot, resembles casein, and which must amount to 13·7 per cent. of the tea leaves.

Thein is extracted thus: Tea leaves are dried at 100° C, then poundered finely, and then covered with sulphuric acid slightly diluted with water, and placed in the water-bath for some time. The whole mass is next to be diluted with a little water and mixed with excess of oxide of lead, which forms sulphate of lead with the sulphuric acid. The mass is then extracted with alcohol of 86 per cent., and the alcoholic extract deposits first any traces of theobromine that may be present, and afterwards a part of the thein.

The alcoholic extract having been evaporated to dryness the remainder of the thein is extracted with ether. The yield of thein obtained by Zöller was 4·94 per cent. Any colour which the thein may have is removable by means of animal charcoal.

Inasmuch as thein is the characteristic principle of tea, a little description of it is called for. Its formula is, $C_8 H_{10} N_4 O_2 + H_2 O$. It has slightly basic properties, and

forms salts which, although very well defined, are frequently decomposed by water. This is the case with the hydrochlorate and the sulphate.

Thein from the tea plant, and caffein from coffee are one and the same chemical substance. They are beautifully crystalline, forming silk-like crystals which fuse at 178° centigrade and sublime like benzoic acid. The crystals contain 8·4 per cent. of water, which is partly lost at 100° C, but not entirely until 150° C. They have a slightly bitter taste. Cold water and cold alcohol dissolve them to a considerable extent, and hot water dissolves them still more readily.

Hydrochlorate of thein (which is got either by the action of gaseous hydrochloric acid on thein, or else with the strongest hydrochloric acid, dilution with water or alcohol being avoided) combines with bichloride of platinum, with chloride of gold, and also with corrosive sublimate, forming double salts. There is likewise a double compound of nitrate of thein and nitrate of silver.

On being boiled with strong solution of potash thein gives methylamine : and with boiling permanganate of potash it yields some ammonia. With boiling nitric acid it yields a yellow liquid which assumes a purple colour on being mixed with ammonia. This latter reaction calls to mind uric acid, which, as is well known, yields purple murexide under like conditions.

Thein appears to exist in the tea plant, not in the free state but as a tannate of thein. In coffee it appears to be combined with another acid, viz., chlorogenic acid.

CHAPTER VII.

SUGAR.

Brown sugar and loaf sugar, whether it be derived from the sugar-cane or from beet-root, are one and the same chemical substance. This substance has received the name cane-sugar, and the formula $C_{12} H_{22} O_{11}$. It is in many respects most remarkable, being the heaviest organic compound which is devoid of iodine and metals and contains only the organic elements. Its specific gravity is 1·606. Its solubility in water is extraordinary. At common temperatures 100 parts of water dissolve 300 parts of sugar; whereas 100 parts of water dissolve only some thirteen parts of common salt. In boiling water the solubility of sugar is much greater even than in cold water and is described in the books as being indefinite. The specific gravity of an aqueous solution of sugar is very high, and it is probable that no organic solution containing an equal percentage of organic matter has so high a specific gravity as a solution of cane-sugar.

In weak alcohol sugar dissolves freely; in absolute alcohol, not at all in the cold, and very sparingly at the boiling point of alcohol. In ether it is insoluble.

The aqueous solution is thick and syrupy. Moreover, it acts powerfully on polarised light, rotating it to the right. It crystallises very finely under suitable conditions and when in the form of large crystals is known as sugar candy.

Under the influence of dilute acids it is very easily altered: its action on polarised light being inverted and its power of crystallising destroyed. Albuminous substances also bring about this change with great rapidity; and this circumstance constitutes the difficulty of the sugar-factories wherein this transformation of cane-sugar into uncrystallisable sugar has to be most diligently guarded against.

An aqueous solution of pure cane-sugar does not, in the slightest degree, reduce oxide of copper even when boiled for *a minute* or *two* with it in the presence of caustic potash. If, however, any uncrystallisable sugar be present; if, for instance, the solution of cane-sugar have been boiled for only a few seconds with a little hydrochloric acid, then the reduction of oxide of copper to red suboxide of copper is instantaneous at the boiling point of water.

The ordinary loaf-sugar of commerce is, according to observations recently made in my own laboratory, an exceedingly pure substance.

In the first place it is singularly devoid of mineral matter. From a number of experiments it would appear that the ash left on incinerating it does not exceed 0·01 per cent. of the sugar.

It is also singularly free from nitrogenous matter. I once burnt up a considerable quantity with oxide of copper and proved the entire absence of nitrogen gas in the products of combustion; and recently I have submitted it to the action of boiling permanganate of potash in presence of much caustic potash and proved the non-production of ammonia.

It is also devoid of uncrystallisable sugar, as may be proved by adding to its aqueous solution a few drops of solution of sulphate of copper, then an excess of caustic potash (which will yield a splendid blue-purple solution), and finally boiling for a minute, when there will be no formation of yellow or red suboxide of copper.

Brown sugar is not by any means so pure as loaf-sugar. It contains a certain proportion of mineral matter derived from the plant, and in different samples of brown sugar I have found 0·49, 0·61, and 0·57 per cent. of ash respectively. From this it would appear that the ash in raw-sugar is pretty constant. The detection of actual adulteration of sugar by mineral matter such as sand is therefore very simple. All that is required is to take the ash; and any real case of adulteration of this description will be manifested by the finding of a far higher percentage of ash than could be due to the mineral contents of the juices of the sugar-cane or beet-root.

Much has been written respecting the sugar-insect, which is sometimes found in raw-sugar, but never in refined.

Whether the presence of this insect in a sample of sugar be of more importance than the presence of mites in cheese, I will not undertake to determine. It will, however, be obvious that in a specimen of sugar which is almost devoid of nitrogenous matter, this creature cannot flourish, and the possibilities of the presence of these insects may be judged of through a determination of nitrogen (or still better of albuminoid ammonia) in the sugar. From 100 parts of moist sugar I have obtained not more than 0·2 part of albuminoid ammonia. Microscopical examination should likewise be had recourse to where there is reason for suspecting the presence of these insects. Moist sugar is contaminated with uncrystallisable sugar, as may be very readily proved by adding to its solution some sulphate of copper and caustic potash, and boiling for a few seconds, when there will be a very abundant reduction of the copper solution. The difference between loaf-sugar and brown sugar is in this respect very striking.

CHAPTER VIII.

DISINFECTION.

THERE are two distinct kinds of infection, viz., the propagation of specific disease which reproduces itself, and the engendering of disease and unhealthiness by uncleanliness and filth.

The communication of small-pox by contact with a patient suffering from small-pox, or by contact with his clothes and surroundings, affords a characteristic example of the one kind of infection. The other kind is exemplified by the falling into low fever, or even into a simply weak state of health which is induced by living amidst filth.

Against specific infection we are almost limited to two disinfectants; against common infection we have many and various disinfectants which have their appropriate uses.

Given a bundle of clothes from a small-pox patient, there is only one safe and practicable course to be taken, that is to burn it. We might, it is true, destroy it with corrosive chemicals, but that would only be a more difficult and more costly way of destroying it, and unless we pushed the action of the chemicals so far as to destroy the fibre of the fabric we could have no security.

The belief that dilute chlorine or dilute carbolic acid is of any avail in destroying specific infection is founded on the misconception that the action of dilute chemicals differs *only in degree* from the action of the same chemicals in a state of concentration. A very striking illustration of the action of the same chemical in a dilute and in a concentrated state is afforded by sulphuric acid, which when dilute transforms cane-sugar into grape-sugar susceptible of fermentation, and when concentrated turns it into a mass of black carbon. It is

no doubt true that pure chlorine, aided by sunlight or heat, will destroy the infecting material of small-pox; but there is no real reason for believing that a touch of bleaching powder introduced into the wash tub will aid in disinfecting small-pox linen. If a good washing with soap and hot water be not effectual, there is little hope that any kind of washing, which does not destroy the fibre, will render such linen safe.

In fire, which is quick, and *weathering*, which is slow, we have the two great natural disinfectants; and against specific infection we have no others which are generally practicable.

All clothes which are tainted with specific infecting matter, such as the matter from small-pox, scarlet fever, &c., ought to be burnt. When plague breaks out in a crowded part of a town, there is much to be said in favour of burning down the houses where it has been rife. Failing so extreme a measure (which, however, we would most seriously commend to the attention of the authorities of a plague-stricken town), they should be, for a while, dismantled and freely exposed to the rain and to the wind. There is no just reason for trusting to any fumigation with chlorine, sulphurous acid, or carbolic acid in any such case.

With regard to the action of fire, it consists in the destruction of the infecting material, which, whether it be a germ or an organic poison, must in common with all complex organic substances be destroyed by a high temperature especially in presence of an excess of oxygen.

In place of burning clothes and bedding, there is a custom of baking them: and the practice is defended on the ground that the small-pox poison is destroyed by a heat approaching to the boiling point of water. Granting, however, that the subjection of the poison to such a temperature will destroy it, there is always room for very reasonable doubt whether a mass of bedding, for instance, is raised throughout its entire substance to the required temperature, and in the present state of our knowledge on the subject we should discourage the substitution of baking for burning outright.

The action of weathering is very complex. A very important element in it is dilution, with air or water. There is no chemical poison which does not lose its efficacy when it is extremely dilute: and the same holds good of germs, which

require to be sufficiently numerous in order to be fertile. Free exposure to atmospheric changes also induces slow oxidation and disintegration.

There is, perhaps, no other subject which has been so overlaid with absurdities as disinfection, and in this chapter an important part of our task is to point out how that which is commonly believed to be effective cannot possibly be so.

By chemical means the attempt is often made to disinfect the atmosphere of a room. Occasionally even an attempt has been made to disinfect the open air of the country; we remember such an attempt on the part of the Cattle Plague Commissioners in the time of the panic occasioned by the cattle plague, when cloths dipped in carbolic acid were tied to the horns of cattle which were turned loose in the fields to disinfect the air of the country.

Now, when it is recollected how vast is the atmosphere which covers a field, and that on the stillest of days it is being constantly renewed, it must be obvious that to alter its composition in any but an infinitesimal degree is a quixotic undertaking. It would be easier to alter the composition of the sea which surrounds our coasts than of the air which covers the country. A very striking illustration of our impotence in this direction is afforded by the researches of Dr. Angus Smith and others, which have shown that the air of London streets does not contain 0·10 per cent. of carbonic acid, and rarely 0·05 per cent. And yet every animal and every fire in London is engaged in the generation of carbonic acid, and the normal proportion of carbonic acid in the atmosphere is 0·038 per cent. If we cannot, even in confined streets, raise the carbonic acid from 0·04 to 0·10 per cent., what chance can there be that we can rid the atmosphere of the country of anything which happens to be in it, or even sensibly diminish it?

Paradoxical as it may seem, we are, however, able to defile the air, but not to purify it. Over our manufacturing towns there floats an atmosphere which is not compatible with vegetation, and which is not well adapted to the requirements of animal life. We are able to defile the air, because plants and animals are sensitive to infinitesimal change in the atmosphere, because an inconceivably minute dose of certain atmo-

spheric poisons has effect on living things. This brings us to the case of the atmosphere of a room, which it is often proposed to disinfect. The difficulty in dealing with the air of a room depends on the fact that an infinitesimal quantity of corrosive chemical introduced into it renders it unfit to breathe. Before anything like a tenth of the chlorine, or sulphurous acid, or carbolic acid, which could possibly purify it, has passed into the atmosphere of a room, the atmosphere will have become unfit to breathe; and if, in purifying the air, we render it unfit to breathe, what object do we gain in purifying it? Let any of our readers take up any of the popular prescriptions for purifying the air of a sick room.—"Take so much bleaching powder and so much acid and put them in a saucer under the bed,"—and let him calculate the percentage of chlorine which will enter into the air of an ordinary bedroom and he will be astonished at the smallness of the fraction. In one of the official documents relative to disinfection with sulphurous acid, there occurs a very significant passage to the effect that if it be possible to abide in the room for a few minutes, the disinfection is not satisfactory. Clearly in such a case the disinfection cannot be for the sake of the atmosphere (which has to be sent up the chimney or out of the window) but for the sake of the walls and the furniture.[1]

If the atmosphere of a room be foul there is only one practicable method of dealing with it, and that is to send it out and get in a fresh supply of air. We can defile, but we cannot purify the air, and our efforts must be directed towards proper ventilation and towards avoidance of defilement.

This brings us to the consideration of the true scope and subject of artificial disinfectants. They are of use mainly in arresting putrefaction and hindering defilement of the atmosphere.

The most important disinfectants are those whose action consists in preventing putrefaction; the antiseptics as they are termed. This is a very large class comprising common salt,

[1] And most clumsy, costly, and ineffectual such a disinfectant must be. All fumigation with chlorine and sulphurous acid are founded on a delusion, and ought to give place to more rational procedure.

a great variety of metallic salts, carbolic acid, most acids, charcoal, and a great variety of substances.

In selecting a disinfectant we have not so much to choose a powerful antiseptic, as a sufficiently powerful antiseptic which is otherwise unobjectionable. For general use, the property of being very poisonous is an absolute bar to the employment of certain antiseptics. Arsenious acid is most powerfully antiseptic (and it is tolerably cheap), but its poisonous properties completely forbid its use as a general disinfectant and antiseptic. For a like reason corrosive sublimate and carbolic acid (though powerfully antiseptic) are not adapted for general use. One of the most powerful antiseptics and deodorisers is copperas (proto-sulphate of iron) which has the further merit of being very cheap (£7 per ton), and of being not frightfully poisonous. It is specially adapted for use in water-closets and urinals; but its property of staining, giving spots of basic persalt and oxide of iron, is an unpleasant quality and will prevent its coming into general use. Alum and the material which has of late come before the public under the name of chloralum is an excellent antiseptic and deodoriser and does not labour under the objection which applies to proto-sulphate of iron; it does not give rise to brown spots.

There are two ways in which a disinfectant acts on a mass of putrescent matter—e. g.—putrid urine or fœces. It may stop the putrefaction in virtue of its preservative or antiseptic properties, or it may absorb the products of putrefaction, and it may do both.

In carbolic acid we have an example of a substance which arrests decomposition but is absolutely powerless to absorb or to decompose the offensive products of decomposition. In proto-sulphate of iron we have a substance which both stops decomposition and absorbs the odoriferous alkaloids and sulphuretted hydrogen to which the vile smell of putrescent matter is due. In soluble permanganates (Condy's fluid) we have chemicals which destroy sulphuretted hydrogen; but have little antiseptic power.

The main causes of bad smells in our streets and houses are alkaloids,—stinking ammonias. In order to get rid of these smells, even vinegar is of service: the common device

of keeping fish steeped in vinegar owes it efficiency to the circumstance that the stink from fish consists of an alkaloid which is neutralised by the vinegar.

The main nitrogenous excretion from the population of a town is the urine, which in its fresh condition has very little smell, but in its putrid, or fermented state, is exceedingly offensive. According to our experience the cheapest method of dealing with it is by means of a mixture containing chloride of calcium, which is a waste product in various industrial processes. The conversion of urea into carbonate of ammonia appears to take place with extraordinary rapidity in the sewers. The postponement of this fermentation until the contents of the sewers have mingled with the water of the river into which they are discharged is one of the tasks which will have to be accomplished if our towns are to be devoid of bad smell: and this appears to be practicable by the employment of some such material as the waste chlorides of commerce.

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