

**Report to the Local Government Board on certain means of preventing
excrement nuisances in towns and villages / by J. Netten Radcliffe.**

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REPORT
TO THE
LOCAL GOVERNMENT BOARD
ON CERTAIN
MEANS OF PREVENTING EXCREMENT NUISANCES
IN
TOWNS AND VILLAGES.
BY
MR. J. NETTEN RADCLIFFE,
MEDICAL INSPECTOR.

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Founded 1876

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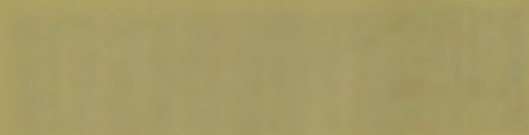
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REPORT TO THE LOCAL GOVERNMENT BOARD ON
CERTAIN MEANS OF PREVENTING EXCREMENT
NUISANCES IN TOWNS AND VILLAGES ; BY
MR. J. NETTEN RADCLIFFE, ONE OF THE
BOARD'S MEDICAL INSPECTORS.

JOHN SIMON,
Medical Department, 1875.

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REPORT OF THE LOCAL GOVERNMENT BOARD BY MR.
J. H. B. HADFIELD ON CERTAIN MEANS OF PRE-
VENTING EXCESSIVE MISCELLANEOUS IN TOWNS AND

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LOCAL GOVERNMENT BOARD

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REPORT to the Local Government Board by Mr. J. Netten Radcliffe on certain Means of pre- venting Excrement Nuisances in Towns and Villages.

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PRELIMINARY.

In 1869, Dr. Buchanan and I, as inspectors in the Medical Department of the Privy Council, made an inquiry concerning the systems then in use in various northern towns for dealing with excrement. The considerations which prompted that inquiry were thus stated in the introduction to the report in which we gave the results* :—

*Privy Council
Inquiry of 1869.*

“The propagation of certain epidemic diseases, especially cholera, enteric fever, and diarrhœa, among communities, as the result of excremental pollution of air and water, is one of the best established facts of sanitary medicine. It is a fact which has been admitted for over a century, and still various inquiries of this department (themselves affording repeated evidence of its truth and importance) are showing that it remains without practical recognition by a large proportion of the health authorities of the kingdom. It must be allowed

* On the Systems in use in various Northern Towns for dealing with Excrement.—
Twelfth Report of the Medical Officer of the Privy Council, 1869.

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Radeliffe.

that this inaction has been mainly due to the ignorance, or the parsimony, or the carelessness of the bodies to which sanitary matters have been entrusted, but the whole extent of the inaction cannot thus be explained. Certain authorities have, indeed, been glad to have, as a handy excuse for delaying to take any step whatever towards amendment, the want of agreement throughout the world as to the means of amendment. But there are other authorities which have fully recognized the importance of efficient and safe excrement removal, which have made themselves acquainted with the defects of their own arrangements, and which have seriously inquired as to means of improvement; and yet even these authorities have, after all, been as little satisfied with any proposed alternative as with their own acknowledgedly bad system. No one who knows what many of these latter bodies have done in other ways of sanitary improvement, especially in the matter of water supply, can imagine that inaction in their case is without some reasonable cause. For the health of their communities has justifiably not been the only care with such authorities. There are other considerations which they have held in view; and the chief of these, in a sanitary aspect, is that the disposal of the excrement shall be done without detriment to other people; while in an economical point of view the question has pressed how there shall be restored to the earth for the sustenance of vegetation the elements which have been taken from the earth by vegetation for the sustenance of animals. The attainment of such objects has affected materially the ability and the disposition of authorities to deal with the primary sanitary aspects of excrement disposal.

"The department, in its investigations as to the local prevalence of disease, has been constantly brought face to face with this state of matters. Its inspectors, when they found places wanting in proper arrangements for excrement-disposal, have of course insisted on the mischief arising from this source, and on the need for improvement. But, especially where the local authority has itself been conscious of defects in its arrangements, and has already entertained schemes of amendment, yet without practical result, advice in general terms has been felt to be somewhat vague and unpractical. Evidently it would be helpful to the action of the local authorities in such circumstances to know what plans are being carried out in various other towns of the kingdom, and to have materials before them for judging how far any of such plans might prove applicable to their own wants, at all events for immediate purposes, and until better agreement should be attained as to the constructive arrangements that constitute perfection in regard of excrement-disposal."

With this object in view we examined and reported upon the arrangements for excrement-disposal in various northern towns; and in addition to describing such of them in detail as we thought it might be useful for other places to know, we endeavoured to determine, from the results of the investigation, certain general principles of action in the abatement of excrement nuisances which might serve as a guide to local authorities.

Scope of present inquiry.

The present inquiry (1874), carried out under the Local Government Board, included also a further investigation of the dry-earth system, which had been dealt with and reported upon by Dr. Buchanan* independently in the first inquiry. The inquiry was directed to ascertain the additional experience which had been gained in the working of the various systems of excrement-disposal described in the previous reports, and generally such new experience as might have been obtained on the subject during the five years which had elapsed since the first inquiry; and for this latter purpose it was extended over a wider area. The subject of nuisance from "slops," which is in some sort complementary to that of excrement nuisance, was, moreover, included in the present inquiry.

* On the Dry-Earth System of dealing with Excrement.—Twelfth Report of Medical Officer of Privy Council, 1869.

In pursuit of this inquiry the following places were visited :—

- | | |
|------------------------------------|--------------------------------|
| 1. Aldbury. | *25. Manchester. |
| *2. Birmingham. | *26. Nottingham. |
| 3. Birkenhead. | 27. Oldham. |
| 4. Bradford. | 28. Paisley. |
| 5. Bristol. | *29. Rochdale. |
| *6. Broadmoor. | *30. Salford. |
| 7. Butleigh. | 31. Skinningrove (Yorkshire). |
| 8. Cockermouth. | *32. Saltaire. |
| 9. Dalmuir. | 33. Shenfield, Essex. |
| *10. Dorchester. | 34. Shildon (Bishop Auckland). |
| 11. Eastwick. | 35. Sunderland. |
| *12. Edinburgh. | 36. Scarborough. |
| 13. Exeter. | 37. Slough. |
| 14. Gaddesden (Little). | 38. Tring. |
| *15. Glasgow and vicinity. | 39. Upleatham. |
| 16. Gloucester. | 40. Wakefield. |
| *17. Hull. | 41. Wandsworth. |
| *18. Halifax. | 42. Warrington. |
| *19. Halton. | 43. Westbury-on-Trym. |
| 20. Hereford. | 44. Whittingham. |
| *21. Leeds and adjoining district. | 45. Walsall. |
| 22. Lands End district. | 48. Worksop. |
| *23. Lancaster. | *49. Wimbledon Camp. |
| *24. Liverpool. | |

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In the following report I do not propose to give in detail the results of inspection in each place, but to describe only such of the several inspections as appear to me most instructive in their bearing upon the subject of the report.

A.—SUMMARY REPORT.

I.—GENERAL OBSERVATIONS.

Reviewing the general results of the inquiry it is desirable to state, first, that while it has disclosed a very assuring advance, during the past five years, in measures adopted in numerous places for the abatement of excrement nuisance and some important modifications of detail in the measures adopted, the conclusions of the previous inquiry remain substantially unaffected. I may be permitted also to remark, that in the course of this inquiry frequent and most gratifying testimony was given of the usefulness of the previous inquiry as helpful of the action of local authorities, for which purpose it had been originally designed.

This inquiry, as the previous inquiry, was restricted to measures of abating excrement nuisance other than water-sewerage, except in so far as it seemed advisable to include particular adaptations of this mode of excrement-disposal to the wants of those sections of a community which are most dependent upon public arrangements and public supervision. The inquiry, in fact, began at the point where it had been assumed,

* The 17 places marked with an asterisk in the above list had been visited in the first inquiry, as also had been two places, not now revisited, Preston and Stamford.

for whatever reasons, that the applicability of water-sewerage to the needs of a community, in respect to excrement-disposal ended; and it designedly included within its range only so much of the question of water-sewerage as was necessary to elucidate certain presumed difficulties of application to particular sections of the poorer classes. It was simple matter of observation that, previous to the first inquiry, water-sewerage which to that time had been the only system of abating excrement nuisance generally advocated in this country, had been regarded as inapplicable to the wants of numerous places where neither ignorance, nor parsimony, nor indifference to sanitary responsibilities could be justly assumed of the local authorities; and that, excepting only such measures as were described in the report of Dr. Buchanan and myself, in these and many other places, sanitary work to this particular end had come to a dead lock. The unquestionable and preponderating advantages of a system of water-sewerage in regard to decency, convenience, and wholesomeness, as compared with other systems of excrement disposal then commonly in use, had naturally so influenced the judgment of most persons concerned in promoting sanitary work, as to cause them to desire its general introduction. It was not until the institution of the system of medical inspections as to local prevalences of disease, established by the Privy Council, came into operation, that it began to be understood how partially water sewerage had been carried into operation in the kingdom since the enactment of the Public Health Act, 1848, and how grave a state of things had persisted in many places, and become aggravated in others, from lack of some alternative methods of abating excrement nuisance. I do not propose to discuss here the various circumstances under which this had come to pass. It is sufficient for my present purpose to state that they commonly depended either upon local peculiarities which precluded the adoption of water-sewerage, except, perhaps, under conditions of combination of authorities too remote to be contemplated as a practical matter; or upon local habits of thought and practice which gave little hope of speedy change, and which must be recognised as elements of judgment in making recommendations for the sanitary amelioration of a place if any hope were to be entertained of these having effect. It had become clearly obvious, in fact, at the time of the first inquiry, that the exclusive recommendation of one particular method of excrement-disposal could no longer have place, if the inspections referred to were to be productive of good, the dead lock in which sanitary authorities were very generally found loosened, and sanitary work throughout the kingdom quickened. This broader view of the question, moreover, appeared to be more consistent with the intentions of the Legislature as indicated in the various Sanitary Acts. For these Acts permit one or other or all of several different ways of depositing excrement, under the general condition that nuisance is to be avoided in the arrangements adopted.

While these considerations had arisen out of the medical inspections instituted by the Privy Council, and had in effect determined the inquiry which was carried out by Dr. Buchanan and myself under the instructions of their Lordships, the local authorities of several northern towns had given serious attention to the same subject as a matter of local administration. Although rejecting a general system of water-sewerage, they had regarded with increasing anxiety the persistence or growth of excrement nuisance within their districts, and, as shown in our report, had cast about to seek its abatement in several ways, other than water sewerage, having at the same time regard to the utilization of the excrement. The wisdom of this course of action, viewed from a medical stand point and gauged by a large dimi-

nution of excrement nuisance in the places where it had been most successfully carried out, was made abundantly clear in the first inquiry, and has been amply confirmed in the present inquiry. The necessity of such a course must, indeed, be accepted if any general progress is to be made in dealing with excrement nuisance throughout the kingdom. Upon this question the experience of the Medical Department, based upon the minute study of local prevalences of disease, is in complete accord with the not less important results of local experience in overcoming practical difficulties connected with excrement nuisance. It was inferred from the first kind of experience, and it is the obvious deduction from the latter kind of experience that the requirements of each place as to excrement-disposal should be judged not from any general preconception of what is the best mode of such disposal, but from a careful consideration of the various modes at command which would best meet those requirements and the habits of the people. Without seeking to suggest a limit to human invention and ingenuity, I may say that nothing in the course of this inquiry has given even an inkling of support to a rather prevalent notion that some perfect scheme of excrement-disposal, applicable to all sorts of places irrespectively, may be looked for, and action properly deferred until such scheme be forthcoming. The more closely the facts are looked into relating to the different conditions under which various populations live, the more surely I am persuaded will the conclusion be arrived at that no reasonable ground exists for anticipating the fulfilment of such hope within any period of time which would justify a local authority delaying action on account of it.

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II.—SYSTEMS OF EXCREMENT-DISPOSAL OBSERVED.

(a.) *General Considerations.*

In one only of the places visited in the course of the inquiry did a uniform system of excrement-disposal exist. Bristol has a general system of water-sewerage, and this was the only town having such a system, properly so-called, which came within the scope of the inquiry. In the other places waterclosets existed as a part of the system of excrement-disposal, in some places many in number, in some few.

Systems of excrement-disposal observed, 1874.

Water-closets existed in conjunction with a plan for the daily removal of excremental matters from localities where closets could not be fixed, and with a plan of public dry-ash closets in Edinburgh; with midden-closets in Birkenhead, Bradford, Eastwick, Hull, Liverpool, Worksop, &c.; with midden and pail closets in Birmingham, Halifax, Leeds, Manchester, Nottingham, Rochdale, Salford, Sunderland, Scarborough, Wakefield, &c.; with midden-closets and earth-closets in Lancaster, &c., and with midden, pail, and charcoal-closets in Glasgow. In a few rural districts only did waterclosets wholly disappear; and certain hamlets and villages were observed in which the midden-closet (Upleatham mines) or the midden-closet and earth-closet (Skiningrove, Shildon, &c.), or the midden-closet and pail-closet (villages near Cockermouth) alone existed.

This conjunction of different plans in various towns represents mainly, in the present state of things, a transitional condition from the common middenstead privy with its great accumulation of filth and abominable offensiveness, to a better system. In almost every place the watercloset has become, from the sentiment of cleanliness attending its use and the privacy which attaches to it as commonly adapted to buildings, the favourite method of the educated and wealthy; and amid much discussion of the subject, I have seen no indications of this prepossession in its favour undergoing any great change. It will be more difficult for those classes to unlearn the use of the watercloset and

Principles of excrement-disposal.

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adopt any of the plans yet offered in substitution for it, than to unlearn the use of the midden-closet for which it was substituted. In some of the places visited, in Edinburgh and Glasgow, for example, the tendency is to make a watercloset system general, and existing supplementary scavenging of excrement, by pail-closets or improved midden-closets, must be regarded as provisional pending the solution of difficulties in the structural arrangements of houses and in the disposal of sewage; although as yet no limit can be indicated when these provisional arrangements may end. In Hull an improved midden system is the complement of water-sewerage; and in Rochdale and Manchester a pail-system is rapidly becoming so. This combination of two or more methods of excrement-disposal in the same place is commonly the result of deliberate efforts to abate a grave nuisance consistently with the believed special wants of a population. In those places where plans complementary to a watercloset system have been most successfully introduced (*e.g.*, Edinburgh, Hull, Rochdale, Manchester, Nottingham), success has been obtained from certain well-defined principles of action which appear to me to be essential to successful work of the same kind elsewhere.

*Frequency of
removal.*

Foremost amongst these, and regulating all that follows, is the *frequency of removal of deposited excrement*. The arrangements to this end must of necessity govern all other arrangements, and it is requisite that they should be first determined by a local authority. The peculiar advantage of the watercloset is that with properly arranged and rightly constructed drains and sewers, and duly supplied with water, it admits of excremental matter being removed without offensiveness beyond the precincts of a house and from amidst a community immediately after it has been deposited.* Dr. Buchanan and I, in discussing the period during which excrement should be permitted to remain in the vicinity of dwellings, expressed ourselves, in 1869, in the following words, which I reiterate now:—

“In the present imperfect state of our knowledge of the conditions under which faecal diseases spread, we do not feel ourselves entitled to say at what time, after being passed, dejections are or may (under various external circumstances) become dangerous to health. We cannot say this either in regard of healthy excrement, or of that passed from persons affected with disease, specific or other; but we think it may probably be taken as sufficiently true for practical purposes that there is little chance of mischief from the storage of excrement *for a day*, even though along with healthy excrement that of persons affected, for example, by enteric fever should, without proper disinfection, chance occasionally to be included. We propose, then, to regard *complete removal of all excrement within a day* as practically constituting safety in the case where excrement is unmixed, or is only mixed with ashes.”

In Edinburgh only has such a frequent removal as is here suggested been successfully carried out by scavenging arrangements, and it appears to have been very generally thought, I hold most mistakenly, that the peculiar circumstances which originally led there to the adoption of this

* The fundamental principles of house drainage and sewerage are set forth in the “*Suggestions as to the preparation of Plans as to Main Sewerage and Drainage and as to Water Supply*,” prepared by Mr. Robert Rawlinson, C.B., C.E., Chief Inspector of the Engineer's Department, and published under the authority of the Board. Particular applications of these principles, essential to the inoffensive removal of excremental matters by the watercloset, consist (a) of the introduction in the course of the drain, after it has passed outside the walls of the building, of a contrivance, forming ordinarily a trap, open to the air, for the purpose of cutting off direct communication between the sewer or other termination of the drain and the portion of the drain and its connections within the house; and (b) of abundant provision for the ventilation of soil-pipe, drain, and sewer.

arrangement remove it from consideration elsewhere. Leeds is now engaged experimentally in a plan of daily scavenging of its worst district. In this town the conditions are very similar to those which are found in many English towns. The mode of scavenging adopted here may probably provoke objection, but the enormous advantage to the district by the systematic daily removal of all excremental filth cannot be gainsaid, and it will be a deplorable result if from any matter of remediable detail, or for financial reasons, this important experiment should prove abortive. In not a few towns (as for instance Cardiff) all dry house refuse is removed daily, and I am unable to believe that what has been found practicable with this comparatively harmless stuff should not be practicable of excremental matters.

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The frequency of the scavenging governs the size of the receptacles for excrement. Hence the primary consideration for a local authority in respect to the abatement of excrement nuisance is the arrangement of the "night-soil scavenging," so-called. In Hull, and Rochdale, and Manchester, and Nottingham, and the towns which are systematically using a pail system, scavenging at weekly intervals has been adopted as the most practicable general arrangement, and the middensteads of Hull and the pails of the pail-closet towns have a capacity regulated by this frequency of removal. That is to say, they are designed to hold a week's excrement of a household and no more.

The want of clear recognition of the principle that systematic frequent scavenging is the initial consideration in improved methods of excrement-disposal other than water-sewerage has led to much fruitless work in attempts to improve the midden system. *The measure of the capacity of the receptacle should be the frequency of scavenging.* With even a weekly scavenging it is obvious that the receptacle, if no larger than is required to contain the excrement in the intervals of removal, will almost of necessity be free from the evils which attach to the structure of the old middenstead privy. There is no necessity for a privy pit, as commonly understood, and all the evils of soakage of excrement into the soil and saturation of walls in addition to accumulation are at once done away with, while the structural requirements to prevent offensiveness are rendered of the greatest simplicity; and better still, it becomes at once possible to substitute a handy moveable receptacle with all its advantages for a fixed one.

Capacity of
receptacle.

(b.) *Particular Modes of Excrement-disposal observed and the Results of Observation thereon.*

The several modes of excrement-disposal observed in the course of the inquiry may be classified as follows:

1. *The Midden System.*
2. *The Pail System.*
3. *The Water System.*
4. *The Earth System.*
5. *The Charcoal System.*

On each of these systems, with the exception of the charcoal system, and with certain limitations as to the watercloset system, Dr. Buchanan and I reported in 1869, and we then endeavoured to set forth the principles which should govern their use. These principles remain wholly unaffected by the results of the present inquiry, and only such change is necessary in the phraseology that we then used in stating them, as is requisite to include sundry modifications of detail.

THE MIDDEN SYSTEM.

The different arrangements observed in operation on this system were as follows :

1. MIDDEN-CLOSETS WITH FIXED RECEPTACLES :—

- a. *Of old type, old parts of almost all towns.*
- b. *With middensteads of large size, and permitting much accumulation, but compulsorily supplied with some means for keeping the contents dry (covers, drains, or both), and for preventing soakage into the earth. Leeds, Birmingham, Nottingham, Bradford.*
- c. *The same (though generally with smaller middensteads) with the addition of special construction aiming at the effectual covering of excrement by ashes—*
By sloping bottom (Nottingham, Salford).
By hinged seats or steps (Manchester, Salford, Saltaire).
By grid and shoot (Bradford).
By shoot (Glasgow).
- d. *The same arrangement, but with the middenstead reduced to a mere space under the seat (Hull).*

2. MIDDEN-CLOSETS WITH MOVEABLE RECEPTACLES.

A tub used as middenstead and placed beneath the privy seat (Nottingham).

1. Midden-Closets with fixed Receptacles.

Starting from the old-fashioned pattern of midden-closet as the standard of all that is utterly wrong, the experience of both inquiries shows that midden-closets may be improved, and that if the following conditions be observed they may be regarded as tolerable :—

1. As to *position*.—It should not be permissible for a midden-closet to be placed under rooms or workshops, or with its walls in juxtaposition with those of a house. Whatever stone, brick, or cement be used in building the middenstead (privy-pit) it must be assumed (regard being given to the conditions under which the work of construction is commonly executed) that some amount of oozing will occasionally, if not habitually, take place. Again, a midden should not be permitted in any place from which its contents cannot be removed without taking them through houses. Dr. Trench's code of regulations under which middens are tolerated in Liverpool expresses these principles in detail.*

2. As to *materials*.—The materials of which the middenstead is con-

*Midden-closets
with fixed re-
ceptacles.*

Position.

Materials.

* This code (see p. 69), provides against—

- " 1. Midden privies inside houses.
- " 2. Midden privies emptied through houses.
- " 3. Midden privies situated beneath rooms.
- " 4. Tunnel middens of every description.
- " 5. Combined open middens supplying many tenements and placed near to inhabited rooms.
- " 6. Midden privies of private houses clustered together in a blind court.
- " 7. Midden privies of private houses in close confined yards or situated beneath windows, or abutting on walls of houses, or within two feet of the lower windows, or of the door of the house.
- " 8. Midden privies of courts.
- " 9. Midden privies abutting on, or opening directly into, streets and thoroughfares, and emptied before the doors and windows of houses.
- " 10. Midden privies of front houses when emptied through a court.
- " 11. Midden privies beneath the footpath of the street, and emptied through a grid on the footpath.
- " 12. Midden privies of many houses, when collected together as a kind of amphitheatre, as is seen in particular groups of streets."

structed should be to the greatest possible extent non-porous, that liquid may be prevented soaking into as well as through them.

3. As to *roofing*.—It is of material importance that a middenstead should be roofed over, for all water helps decomposition, besides increasing the difficulty of removing the contents.

4. As to *ventilation*.—When the middenstead is roofed ventilation should be insisted upon. Whether this should be effected by shaft or otherwise will depend upon the position of the privy to the house or to neighbouring houses. In Manchester special ventilation of the middenstead by shaft is ordered on account of the habitual contiguity of the privy to the house, and in the conversion of midden-closets into pail-closets now going on in that city, it is still held advisable to retain the ventilating shaft for the place containing the pails. The closet, as distinguished from the middenstead, should also be freely ventilated. It has been particularly observed during the recent inquiry that differences of offensiveness in midden-closets were greatly dependent upon the free access of air both to the middenstead and the closet.

5. As to *drainage*.—Drainage of the middenstead is fatal to any possible defence of a midden system at all. If urine with the liquid and partially dissolved fæces be conveyed out of the middenstead into sewers, there can be no sufficient reason either commercial or sanitary for not sending all excrement together along sewers. Drainage is fallacious as the means of continuously draining off the liquid contents of a middenstead, and thus promoting dryness of contents, as was observed everywhere in wetness of open middensteads presumed to be drained; and dryness can be secured in other and more effectual ways. Drainage proves, moreover, a source of hidden mischief by permitting liquid and partially dissolved excrement to trickle into the drain, carrying along with it fine ashes, the mingled excrement and ashes not unfrequently almost wholly blocking up the drain. In illustration of this state of things, the result of explorations made in Manchester into the state of drains communicating with middensteads, and given in the report on that city, may be referred to (p. 43).

6. As to *size and shape*.—It is most desirable that the area from which foulness might sink into the soil should be as far as possible within sight, not sunk beneath the surface; and then it should be as small as can be contrived. In this view, as adapted to a single family, the new Hull middenstead may be indicated as the most satisfactory which has come under observation; as adapted to several families, the new Glasgow middenstead.

The *Hull middenstead*, which is designed to serve for a week for one family, consists solely of the space under the closet seat, and its floor, commencing above the ground level (on the level of the closet floor), is formed by a flag which slopes downwards to the back wall at the ground level there.

The *Glasgow middenstead* is proportionately of smaller size than the Hull middenstead, and is formed by the space beneath the closet seat and about equal space in rear. The floor is slightly sunk beneath the level of the ground, and in this respect the construction is objectionable, and should be changed to the Hull pattern. This middenstead is arranged to contain two days' accumulation of excrement and house-refuse of the families using it.

Since largeness of size means infrequency of emptying, the middensteads can scarcely be too small, and by far the most satisfactory constructions which have come under observation, for the particular requirements they were designed to meet, are the new Hull and Glasgow middensteads.

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Disposition of
contents.

In some instances the *middenstead bottom* has been rounded, as in plans approved at Nottingham and elsewhere, with the object of the ashes becoming better mixed with the excrement in the middenstead. Experience of this arrangement proves that the end sought is not obtained by it. Regard being had to the nature of ordinary building materials, as meeting the condition of imperviousness, a flat surface of stone or slate appears to answer best.

7. *Disposition of contents.*—The *covering up* of the excrement with ashes and dry house refuse, or by ashes alone, should be considered as essential in any scheme for the retention of middensteads. Numerous plans of so-called improved middensteads have come under observation principally designed to secure this end, but the arrangements of the Hull and the Glasgow middensteads have alone in practice appeared to ensure any reasonable degree of success. In the Hull middenstead the ashes and other dry house refuse are simply cast through the closet seat upon the excrement; in the Glasgow middenstead they are thrown into it behind the closet seat, but are directed upon the excrement by an inclined plane. In both instances the small capacity of the receptacle is an element of success. Other schemes, intended to diminish the offensiveness of *large* middensteads, as observed in Manchester, Salford, Nottingham, and elsewhere, have uniformly failed.

The indiscriminate casting of ashes and house refuse upon the excrement diminishes the value of the latter as manure, and many plans exist for covering the excrement with fine ash only, the cinders being separated for reburning. The greater number of these plans are designed somewhat after the fashion of the Bradford plan, and in practice, so far as they have come under observation, have proved quite futile. In the Bradford plan the sifting of the ashes is effected by a riddle so placed in rear of the closet, that the fine ash as a rule fall clear of the excrement. In the dry-ash closets of Manchester and of Morrell's patent it has been shown that it is quite possible to devise and ensure the use of sifters so as to secure the covering up of the excrement. It may be possible to adapt the same means to the common middenstead, but no examples of such adaptation have come under observation.

Access.

8. As to *access*.—Removal of the contents of the midden through the house has already been condemned. The scavengers' access to the privy, where the cleansing is done by the public servants, should invariably be direct from without; and if the middenstead be not simply the space beneath the seat, the opening for removal of the contents should be under his sole control.

Closets.

9. As to *construction of closet*.—The lower parts of the wall and floor should be of impervious material, and the floor should slope somewhat towards the door. In this way a broom and pail of water will well clean out any casual impurity. The closet, as already stated, should be ventilated as thoroughly as practicable.

Holding in view the conditions seen in actual practice, and combining them so as to give what appears to be the least objectionable forms of midden-closet with fixed receptacles, the following results are obtained :—

- (a.) A closet, removed from the house, roofed and floored with sloping flags, the upright of the seat and the seat itself moveable; the space under the seat, constituting the middenstead, made of non-porous material, with its floor at the level of the ground, sloping backwards, and undrained. If the quantity of ashes applied to the excrement with this construction do not suffice to keep the contents solid, there cannot be any presumption in

favour of a midden-closet at all. The roof of the closet serves to keep rain out of the middenstead, and as much ventilation as procurable is given. The type of this simple, inexpensive, and least harmful midden-closet is found at Hull. The upright of the closet-seat, however, in the Hull plan, has the defect of being porous.

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- (b.) The same construction as to roof, floor, and absence of drainage, but with the closet seat fixed, and the space beneath it extended sufficiently back to admit of the ashes and house refuse being thrown upon the excrement, directed by an inclined plane, from the rear. The type of this equally simple privy is found at Glasgow.

Having arrived at these particular modifications of the midden-closet, as being those from which the worst defects of the system are found absent, it must be observed, that *the one great condition under which such closets are alone permissible, is the frequent removal of their contents.* It is unnecessary to dwell upon a sanitary truth so certain as that excrement, if it is to be stored at all in the vicinity of houses, along with no better guard than ashes, should be stored for the shortest possible space of time. In Glasgow the contents are presumably removed every two days; in Hull once a week; and the capacity of the middensteads is calculated in each case to contain only the filth and refuse which accumulates in the intervals of the scavengers' visits. The plan of weekly scavenging of night-soil is at present held alone feasible as a general practice in those towns which have adopted systematic measures for abating midden nuisance; but special arrangements are commonly made for scavenging at more frequent intervals particular houses, such as lodging houses, or districts where greater frequency is obviously called for. The important principle in fact is steadily becoming recognized, that where it has not been found practicable as yet to bring the intervals of scavenging for a whole place within those limits which considerations of health render desirable, a different rule should be applied to the least wholesome localities of the place, by scavenging these more frequently—thus regulating the scavenging by the greater or less degrees of filthiness or liability to filthiness of particular localities.

2. Midden-Closets with moveable Receptacles.

The Nottingham pail-closet is, in reality, a closet with moveable middenstead. It constitutes the link between the pail-closet system and the midden system, and while finding a place in both systems is most usefully considered here. The Nottingham pail-closet, in fact, combines the advantages of the pail-closet with the simplicity of the midden-closet. The substitution of the pail for the middenstead at once obviates the various structural difficulties which beset the building of a middenstead so as to prevent its unwholesomeness, and permits that effectual removal of the contents and cleansing of the receptacle which attach to the pail system.

Midden-Closets
with moveable
receptacles.

The closet is of the same simple construction as the Hull midden-closet, but the floor on which the receptacle stands is flat. The seat is hinged and the front moveable. The pail used beneath the seat is formed, as the pail used at Rochdale, of half a disused paraffin cask, and has an outside diameter of about 1 ft. 7½ in., and height of 1 ft. 3½ in. One pail only is used, all the ashes and dry refuse going into it. The used pail, covered by a metal lid, is removed weekly or at shorter intervals according to the necessity of the case, and a clean pail is substituted for it. An ordinary open waggon serves for the purpose of

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removal and change, a tarpaulin being thrown over the pails. The used pail is carried to the dépôt, emptied, washed, and then charged with a small quantity of a deodorant and antiseptic (freshly prepared carbolate of lime) for re-use.

The plan followed in certain parts of Edinburgh, in which the excrement, ashes, and dry house refuse are deposited in moveable receptacles of various forms in the houses, and then carried daily to the street for removal by the scavengers, might be considered a variety of the midden system and included in the category under consideration. But this plan, as the result of a peculiar local necessity, is unconnected with any structural arrangement for privacy, and although it may be regarded as belonging to this system, it is, perhaps, more accurately classed apart.

PAIL SYSTEM.

Pail system.

The pail system was observed in the following forms :—

- (a.) *Pails used without preparation* (Glasgow).
- (b.) *Pails supplied with a deodorant and antiseptic* (Rochdale, Birmingham, Nottingham, Leeds).
- (c.) *Pails lined on the Goux system* (Halifax).
- (d.) *Pails in which ashes and house refuse as well as excrement are deposited* (Edinburgh, Nottingham).
- (e.) *Pails into which fine coal ashes are screened above the excrement* (Manchester, Salford, Cockermouth).

Pail.

1. As to the *pail*.—Two pails are used for each closet in the pail system as fullest developed, one for the reception of the excrement, the other for ashes and house refuse.

For excrement.

The *excrement pail* in ordinary use is either a wooden pail, such as that adopted in Rochdale, Nottingham, and Halifax, or a metal pail, such as that used in Manchester, Leeds, and Glasgow. In the more recent adoptions of the pail system the metal pail appears to be most approved, but the long experience of Rochdale is in favour of the wooden pail for domestic use. A metal pail is used in that town for factories only, and it is said to be more apt to get out of order, and to have a tendency to corrode at the bottom. Wooden bottoms, are, in fact, being substituted for the metal bottoms here, when these pails need repairing.

Angular wooden boxes, which were at one time used in Leeds, are found objectionable, from the difficulty of cleansing them. The Rochdale excrement pail has a capacity of 10 gallons;* and it is undesirable, on account of handiness as well as on account of capacity, that pails of larger size should be used.

For ashes.

The *ash-pail* in Rochdale is a wooden pail of somewhat larger capacity than the excrement pail. In Manchester it is a rectangular box of handy dimensions. Elsewhere other forms of pail or tub are used. In Glasgow, an ash-pit is attached to the closet. A fixed ash-pit necessarily leads to much of the evil peculiar to the middenstead, for the contents of chamber utensils are liable to be thrown into it. This evil is not found to arise to any considerable extent with moveable ash receptacles. The nature of the receptacle acts as a check upon the practice, and the frequent removal of the contents enables a supervision to be maintained over it which operates very beneficially in preventing wilful carelessness or misuse.

* The Rochdale pail, if filled, will hold 100 lbs. of excrement and urine as usually passed at stool; the average weight of the contents of a pail, after one week's ordinary use by a household, is 41 lbs.

2. As to the *closet*.—The arrangement and structure of the closet is very much the same as that which has been described as the best form of midden-closet, the floor being in this case made level for the reception of the pails, both pails in the most satisfactory form of closet being included under the same roof. It would be difficult to suggest any great improvement upon the patterns adopted in Rochdale, Manchester, and Halifax. The compactness of the arrangement, and the facility with which the pail-closet can be adapted to the varied requirements of old towns in the reconstruction of midden-closets is most instructively shown in the plans given of adaptations in Halifax.

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3. As to *preparation of the excrement-pail*.—Thorough cleansing of the pail before use, and after each removal of contents, is necessary to the satisfactory working of the system; and dosing the cleansed pail before being placed in the closet with a deodorant and antiseptic (crude chloralum, as at Rochdale, or carbolate of lime, as at Nottingham) appears to act beneficially in retarding decomposition of the excrement and abating smell. The practice in Glasgow of simply tilting the contents of the pail into the scavengers' carts and returning the pail to the closet without scraping or brushing out the interior is bad, and the uncleansed pails are foul themselves, and augment foulness of the new contents by accelerating change in the excrement. Much importance is not to be attached to the lining of the pail, as regards absorbency, in the application of the Goux system to a mixed population; but the contents of the pails thus lined, as observed in Halifax, were less offensive to the eye than the contents of non-lined pails, and as little odorous, while the lining appeared to interpose some obstacle to splashing of the contents when the pail was used, and it afforded a ready and excellent cover to them when broken down either before or during removal.

*Preparation of
excrement pail.*

The form of *lid* for covering the excrement pail during removal is not unimportant, and in this regard the Rochdale form as the result of longer observation and experience may be referred to.

Lid.

The *ash-pail* is simply emptied into the dust-cart, and needs no special preparation. But it is desirable that in those occasional cases where moist matters or slops have found their way into it, that the pails should have the "fur" which then collects on the interior surface scraped off. The dustmen should be provided with scrapers for the purpose, and be instructed to use them.

Ash-pail.

4. As to *working of the pail system*.—The *moveableness* of the pails is their great recommendation. If they were as a rule simply emptied into carts and replaced, the process would be quicker and infinitely less offensive than that of cleansing a middenstead of the old construction. But incomparably better than thus emptying them is the Rochdale, Manchester, Birmingham, and Nottingham plan of removing the tub with its contents, and substituting a fresh one. Nothing indeed can be better in this respect than the arrangements at Rochdale, which have formed the chief pattern upon which other towns adopting the system have acted. The full pail is covered by a tight-fitting lid, and the whole is carried off to the manure dépôt in a properly constructed closed van; a fresh, clean pail, charged with a deodorant, and brought by the van, being placed under the closet seat, in lieu of the pail removed. Thus, without any offence, the excrement is gone. At the same time the contents of the ash-tub are tilted into a special cart, so that all the solid household refuse is removed together. Without approving the removal of excrement through houses, it may be observed, that on this plan it would appear possible that such transit can be made without notable offence.

*Working of pail
system.*

The facility which the pail-system gives for *frequent thorough removal* is enormous. At Rochdale weekly emptying is the rule, but

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many tubs are emptied two or three times a week. Other towns adopting a similar system have followed the same rule. Hitherto this removal has been effected during the ordinary working hours of the day, and the abomination of night scavenging to this extent got rid of. Obviously such frequent scavenging of middensteads could not be carried on at these hours without giving rise to incessant offence. Excrement collected by itself, or in combination only with ashes, ought not to be left in the vicinity of houses for a single unnecessary hour, and the plan of moveable pails permits of removal being effected more frequently than any other system in use in this country except waterclosets. Moreover, antiseptic agents can be very effectually applied under the pail system if special circumstances should cause them to be needed.

In this connexion it is impossible not to be struck with the advantage that a pail-system has in relation to diseased excrement. The facility and thoroughness with which any required chemical disinfection can be done, and the way in which the excrement itself can be wholly got rid of, leaving none of its products behind—nothing soaking into the ground or hanging about midden pits or sewers—obviously suggest most important powers possessed by this system for preventing the spread of excremental diseases.

5. As to *special adaptations of system*.—In Manchester and Salford a dry-ash system of excrement-disposal has been combined with a pail-system. Attached to the closet are arrangements by which ashes can be readily sifted, the fine ash falling by means of a shoot into the excrement tubs and covering the excrement, the cinders dropping into a receptacle whence they can be taken for reburning. The fine ash covering the excrement acts as a deodorant, and facilitates its subsequent manufacture into manure.

6. As to *general results*.—The pail system not only effectually does away with midden-nuisance, but, as carried out in Rochdale and Manchester, it is the only one which, while utilizing profitably all solid domestic refuse, appears to give promise of paying ultimately for the expense of its working.

THE WATER SYSTEM.

Water system.

It is assumed here that the fundamental principles of the watercloset system are known, and so much of this system only has been included in this inquiry as would elucidate difficulties experienced in its application to certain classes of population. These difficulties are of two classes. The first class includes such as were described by Dr. Buchanan and myself in our report of 1869, as existing in London and other large towns, and which represent the difficulties attaching to the system when seen in its complete arrangements with water provided for every closet. The second class include the difficulties experienced in those towns and villages where waterclosets have been adopted, the supply of water to which has to be furnished by hand.

The first class of difficulties were thus summarised in the report of 1869:

“A shoot or fragile pan, professing to be trapped, but with the trap almost certainly choked up, or knocked to pieces by the implement that has been used to get rid of obstruction; supplied, if in good order, with water by trickling from a small tap, but the tap usually either fixed or leaking wastefully all day long; no water in time of frost; almost universally filthy and stinking; and washed out (in a fashion to render the place unusable for hours) only every few days when the sanitary inspector is discovered to be in the neighbourhood.”

The second class of difficulties, disclosed during inquiries into local

prevalences of enteric fever, consist of the insufficient flushing of the closet, and the blocking of the drains with excremental matter.

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Two forms of watercloset have been devised to overcome the first class of difficulties, the *Liverpool Trough Closet*, and the *Tumbler Closet*; and a particular form of "eject," called the "*Bristol Eject*," is in use to obviate the latter class.

The *Liverpool trough closet* was described in the report for 1869, as admirable in arrangement and working. The five years' additional experience of its operation confirms in every respect the opinion then formed of its perfect adaptability to the wants of a poor population. The closets are cleansed daily by the people using them according to a systematic rota; there is no waste of water, no injury from frost, and the whole of their machinery is worked regularly by the public scavenger. In addition to these advantages the wear and tear, owing to efficient original construction, has been remarkably small.

*Liverpool
trough closet.*

The automatic action of the *tumbler closet* was designed to secure the regular flushing of the closet at arranged intervals independently of the persons using it. The conception is excellent, the application in practice has been most unfortunate. Local authorities and private individuals have alike contributed to frustrate the success of the closet, the latter by arrangements preposterously ill-adapted, the former by permitting the regulation of the water supply to be governed by considerations of economy, not always consistent with the sanitary object for which the closet was constructed. The tumbler closet appears to be capable of doing good work if due supervision of its action by the local authority and a proper supply of water can be obtained. An admirable report of the working of this form of closet in Birkenhead, by Mr. Francis Vacher, the medical officer of health, with the lessons to be deduced therefrom, is given elsewhere in this report.

Tumbler closet.

The *Bristol eject* is a capacious and strongly constructed dip trap interposed between the privy "trunk," as the receptacle is termed, and the drain. This trap admits of the ready extraction from it of foreign matters cast into the privy, and from the strength of its construction it is not easily broken by efforts made to free it from obstruction. In this respect it has an important advantage over the waterclosets in ordinary use, but its successful operation among the poorer classes of Bristol depends, not upon this structural adaptation or on an abundant handy water supply, but upon the fact that the Corporation, through its servants, undertakes the responsibility of removing obstructions and seeing to its proper flushing among such sections of the population as are known from experience to be untrustworthy in these matters.

Bristol eject.

THE EARTH SYSTEM.

The previous systems refer solely to the storage and removal, or to the removal alone, of excrement; and such dosing with chemicals or covering up with ashes and dry refuse as the excrement may have been submitted to, has been designed merely to diminish offence from it pending removal. The dry-earth system of excrement-disposal differs materially from the foregoing systems in this, that the earth, if used in sufficient quantity, while acting as an efficient deodorant, at the same time destroys the excrement as such, producing a uniform, inodorous, inoffensive, earthy mass. In this state, judging from the sight and the smell, it might seem as if the removal of the mixed earth and excrement from the vicinity of dwellings could with safety be greatly prolonged and the cost of such removal proportionately economised. In our present state

Earth system.

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of knowledge of this compost and of the precise mode of origin of diseases connected with excrement, such a conclusion would be premature, and for the present at least, the same principles should apply to the removal of the mixed earth and excrement from the vicinity of houses as apply to mixed ashes and excrement or to excrement alone. On the other hand, in respect to storage, the dry-earth system yields advantages of the greatest importance in dealing with excrement in isolated dwellings and scattered communities in rural districts where accumulation is not to be avoided.

As a means of abating excrement nuisance, the dry-earth system is of the utmost value. Not every kind of earth is applicable to the system. Clayey and loamy soils and surface mould are best; chalk is of little use; gravel and sand are worthless. Conditions of its proper application are that the earth, thoroughly dried and not too powdery, shall be applied in detail to each stool in quantities of not less than $1\frac{1}{2}$ lb. This application may be made simply by a scoop, or by any of the various forms of mechanism which have approximated the earth-closet for convenience and cleanliness of use to the watercloset. Preferably the receptacle for the mixed earth and excrement should be moveable. Fixed receptacles should be constructed in accordance with the general principles laid down in regard to middensteads.

Important evidence of the facility with which the dry-earth system may be carried out in practice, and of its efficiency in the abatement of excrement nuisance, is afforded by the numerous instances in which persons accustomed to waterclosets have voluntarily substituted for them this system.

THE CHARCOAL SYSTEM.

The successful introduction of charcoal as a common means of abating excrement nuisance would be a gain of which it is not possible as yet to estimate the proper value. Hitherto the use of this great deodorant for the ordinary needs of a community as to excrement disposal has been precluded by its costliness. By the fabrication of charcoal from seaweed, and (as is stated) from street-sweepings, it would appear probable that charcoal may presently be put in the market at a price admitting of its being largely applied by sanitary authorities and others to sanitary uses. By the further proposition of Mr. Stanford to convert the excrement itself into charcoal, and to utilize it (in addition to other profitable utilizations) in abating nuisance from itself, a further important gain would be obtained in overcoming the difficulties of excrement-disposal, if the proposition should prove successful in practice.

Charcoal, as used for the abatement of excrement-nuisance, requires to be applied in detail after the manner of dry earth, and with similar mechanisms; but a much less quantity of the material is needed for the purpose (one fourth, so stated). It is claimed for the mixed charcoal and excrement that it need not be removed from the receptacle more than once in twelve months; but the same observations apply here as have been made in respect to mixed earth and excrement. The claim is made upon a presumption which has no present substantial foundation; and the use of the system among a community should be governed by the same principles as govern other systems of removing excrement by cartage.

III.—LIQUID HOUSE-REFUSE.—SLOPS.

Slops.

The question of abatement of nuisance from liquid house refuse, in those cases where, as in isolated houses and small hamlets, it is not

found practicable to deal with it under the conditions applicable to sewerage in general, has been considered in the course of this inquiry. Several instructive and largely applicable modes of abating nuisance under these circumstances, all by securing the efficient utilization or inoffensive disposition of the refuse on land, have come under observation, and are detailed in the report.

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IV.—EXCREMENT-DISPOSAL IN RURAL DISTRICTS.

It is desirable that the application of some of the foregoing observations to certain of the requirements of rural districts should be more particularly indicated. Where a community of arrangements is practicable to the local authority there the same principles apply in the general provision of means for excrement-disposal, whatever the size of the place, whether hamlet, or village, or town. But there are numerous scattered communities, and scattered groups of dwellings, and isolated houses and cottages which cannot be brought within any common local scheme of arrangements for excrement-disposal. Also, there are numerous communities which, although living together in a space sufficiently compact for a general scheme, have belonging to them many houses with gardens or other cultivated land for which it is desired, and indeed, requisite to retain the whole of the excremental refuse of the household for manure, and for which the regulations of the local authority should make provision. In all such cases no hard and fast scheme of excrement disposal is practicable or advisable, and general success is probably only to be obtained by the application in detail of several schemes according to the particular requirements of individual houses and groups of houses, and the particular proclivities of their occupiers. My own experience tends wholly to prove that a more assured advance is obtained in the cases here contemplated by making existing and familiar local arrangements for excrement-disposal harmless, than by introducing novel arrangements. From this point of view there is no lack of means at the disposal of local authorities. If the predilection be in favour of the common privy, the Glasgow pattern (p. 26) suggests a means of diminishing its evils. Better still, Mr. Neville-Grenville has shown at Butleigh (p. 30) that it is quite practicable by a transformation of the common privy, of the simplest character, to make it an effectual and inoffensive dry-ash or dry-earth closet; and Dr. C. E. Saunders, has adopted at Tring (p. 34), a modification, hardly less simple for the same purpose. Again, Mr. Fox, at Cocker mouth (p. 57), finds that it is possible to obtain the benefits of a pail system among certain classes of the rural population, irrespective of the local authority undertaking its management; and the Nottingham moveable middenstead suggests an adaptation of the pail system to rural life which must be obvious. Excellent illustrations of the advantage of such a form of middenstead I saw in operation in one instance among the fishing population of Mousehole, near Penzance, and in other instances among the agricultural population of Paul Church Town, also near Penzance. The dry-ash closets, designed by Dr. Francis T. Bond (p. 31), the simple dry-ash arrangement of Mr. Fox, and the still simpler arrangement of Mr. Neville-Grenville, are examples of a mode of excrement-disposal of which the applicability is only now being tested. Again the dry-earth system furnishes another important and extensively applicable means.

Excrement
Disposal in
Rural Districts.

The different modes of excrement-disposal here suggested will very largely meet local needs, and the principles upon which they are founded admit of great variety in application. Ingenuity is not yet exhausted in devising methods for preventing deposited excrement fouling either the soil or the atmosphere, or from being offensive either to the sight or the smell; and local ingenuity should be exercised in planning the means of meeting these requirements for local wants. But no

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amount of ingenuity will obviate the necessity for supervision on the part of the sanitary authority; and any plan will, as a rule, certainly fail if care be not taken, in the first instance, to secure its proper application and to familiarize its use.

Suggestions for abating nuisance from liquid house-refuse in rural districts, the complement of the abatement of excrement nuisance, are given in the report (p. 93).

V.—SUMMARY OF CONCLUSIONS.

The general conclusions which I have to submit as resulting from this inquiry, are the same as those submitted by Dr. Buchanan and myself in 1869, modified only in phraseology to meet certain modifications of details:

1. Excrement may be removed from a town or village and disposed of on more than one principle, and the same principle does not need to be applied in all quarters of the same place.

2. As regards the parts of a town or village inhabited by the poorer classes, a watercloset system may be managed so as to be entirely applicable to the circumstances of the most ignorant and most careless population. Essential conditions of such applicability, however, are that the structural arrangements should be adapted to their purpose, and that the management should be wholly undertaken and efficiently done by the servants of the sanitary authority. Where these conditions are observed as thoroughly as they are observed in parts of Liverpool and Bristol, waterclosets are the best means of removing excremental matters from the poor neighbourhoods of a town.

3. The dry-earth system affords a second way of safely disposing of excrement. It is an essential element in this system also, as applied in poor neighbourhoods, that the entire management of it shall be conducted by the sanitary authority.

4. The charcoal system affords a third way of safely disposing of excrement, subject to the same condition of management by the sanitary authority in its application to poor neighbourhoods as the dry-earth system.

4. The midden system may be modified so as greatly to reduce nuisance and danger from it. The forms of midden-closet have been described which present fewest objections. Satisfactory safety in the use of even these forms of midden-closet cannot be averred with certainty, partly because there is no near prospect of such closets being emptied daily, and partly because the materials of the middenstead would probably be retentive of some excremental matters. But if, under certain circumstances, midden-closets constructed as above should be tolerated, it would be scarcely less than essential, first, that they should, if in a densely populated neighbourhood, be emptied daily, or under other circumstances at least once a week, and secondly, that the arrangements for excrement-removal should be wholly in the hands of efficient persons appointed by the sanitary authority.

5. The pail system presents several advantages for poor town districts. This system involves forms of construction or constructive alterations similar to those required for the toleration of a midden system, and offers peculiar advantages over the latter in regard to facility for frequent removal of excrement and to completeness of such removal, in regard to safety from nuisance, and probably in regard to profit in disposing of excrement as manure. The pails, of defined construction, should be changed daily for fresh ones in all crowded neighbourhoods and when used by several families in common or by numerous individuals, and under no circumstances should they remain unchanged more than one week. It is essential to the proper working of a pail-

system that it should be carried out in towns and villages by the sanitary authority.

6. Those who use the closet may, both under the pail and the midden system, be expected, with due superintendence, to do the cleansing of it so far as merely affects ordinary comfort and decency; but such action as concerns the effectiveness of the closet as a means of excrement-removal must be taken by the sanitary authority itself.

7. If these conclusions be accepted, it follows that there are various methods which will fairly answer the purpose of preventing nuisance and injury to health from the retention of excrement near dwellings.

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B.—DETAILED REPORT.

I.—TOWNS AND VILLAGES VISITED AND REPORTED ON.

(a) *Alphabetically arranged.*

	Page		Page
Birkenhead - - -	73	Lancaster - - -	82
Birmingham - - -	60	Liverpool - - -	68
Bradford - - -	31	Manchester - - -	42
Bristol - - -	71	Nottingham - - -	52
Broadmoor - - -	90	Oldham - - -	67
Butleigh - - -	30	Paisley - - -	68
Cockermouth - - -	57	Rochdale - - -	35
Dalmuir - - -	91	Salford - - -	63
Dorchester - - -	78	Shenfield - - -	94
Eastwick - - -	97	Skinningrove - - -	80
Edinburgh - - -	20	Shildon - - -	81
Gaddesden (Little) - - -	67	Tring - - -	34
Glasgow - - -	24	Wakefield - - -	87
Gloucester - - -	31	Warrington - - -	52
Hull - - -	22	Westbury-on-Trym - - -	72
Halifax - - -	49	Wimbledon Camp - - -	89
Hereford - - -	81	Worksop - - -	78
Leeds - - -	54		

(b.) *Classified with reference to the particular object for which visited; the typical examples being given first in each class:*

	Page		Page
1. <i>As to Excrement Disposal without Closets:</i>		4. <i>As to certain kinds of Water-closets:</i>	
Edinburgh - - -	20	LIVERPOOL - - -	68
2. <i>As to Middenstead and Dry-Ash Closets:</i>		BRISTOL - - -	71
HULL - - -	22	Birkenhead - - -	73
GLASGOW - - -	24	Westbury-on-Trym - - -	72
BUTLEIGH - - -	30	Worksop - - -	78
Bradford - - -	31	5. <i>As to Earth-Closets:</i>	
Gloucester - - -	31	Lancaster - - -	82
Tring - - -	34	Dorchester - - -	78
3. <i>As to Pail Closets:</i>		Skinningrove - - -	80
ROCHDALE - - -	35	Shildon - - -	81
MANCHESTER - - -	42	Hereford - - -	81
HALIFAX - - -	49	Wakefield - - -	87
Nottingham - - -	52	Broadmoor - - -	90
Leeds - - -	54	Wimbledon Camp - - -	89
Cockermouth - - -	57	6. <i>As to Charcoal-Closets:</i>	
Birmingham - - -	60	Dalmuir - - -	91
Warrington - - -	62	Oldham - - -	67
Salford - - -	63	7. <i>As to Slop Nuisance:</i>	
Gaddesden (Little) - - -	67	Shenfield (Essex) - - -	94
Paisley - - -	68	Eastwick - - -	97

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EXCREMENT DISPOSAL BY CARTAGE.

1. *Excrement Disposal without Closet.*

EDINBURGH.—In Edinburgh the cleansing operations of the Corporation are designed to compass a daily removal of all filth. With regard to excrement disposal, this, in 1873, was provided for in 27,294 of the 41,615 houses* in the burgh by waterclosets, and in the remaining 14,319 houses by the scavenger. These latter houses include the tenements* of old Edinburgh, of which the common stair with the numerous apartments or suites of apartments opening upon it, occupied by separate families, may be compared to a blind court with its closeness and darkness exaggerated to the utmost. In these tenements, partly from their structure and partly from the class of people occupying them, it has been found impracticable to introduce waterclosets or other fixed method for disposing of excremental matters; and these matters as well as the dry household refuse of the tenements are systematically removed by the scavengers. The manner in which this is effected is similar to that which is enforced for dry household refuse of all kinds. "Dust carts," so called, traverse the streets of the burgh in regular beats at stated times every morning except Sundays, beginning their rounds at 6 a.m. or 7 a.m. according to the period of the year. The house refuse is removed from the new town during the first hour the carts are on duty, and from the old town during the second hour. Householders are required to take "every offensive matter" to the streets or courts "in pails or buckets, or other proper vessels, before the time of passing of the dust cart for deposit in it, under a penalty of 40s. for neglect of this duty." In the new town the "offensive matter" removed consists of the ashes and ordinary day refuse of a household; in the old town it includes largely excrement also. The vessels containing simple household refuse are, as commonly obtains in the new town, placed on the edge of the footway and are emptied by the scavengers directly into the dust cart; the vessels containing excrement and house refuse, as largely obtains in the old town, are first emptied into the channel by the persons to whom they belong, forming more or less offensive heaps which are shovelled by the scavenger into the dust cart. This difference in practice appears to be necessary in order to secure a proper return of the vessels, in the latter case, to their respective owners, and to prevent confusion of ownership; the police regulations requiring that these vessels be removed within 15 minutes after the dust cart has passed, under a penalty not exceeding 10s. for neglect.

The vessels used for both excrement and house refuse, and which do not appear to receive any other cleansing than the daily emptying, are of necessity kept by their possessors in the passage to their rooms, or in a closet, or even in the living or sleeping room.

The scavengers commence their work an hour before the dust carts commence their rounds to prepare for them, and they continue at work with one hour's interval until 4 p.m. Scavengers with barrows follow the dust carts to remove any scattered refuse which may have been left, and this is deposited in fixed dustbins until the carts next pass. Freshly slaked lime is freely sprinkled wherever filth has been deposited in the streets, courts, and thoroughfares. Twice in the week, on the evenings of Friday and Saturday, a supplementary round is made by the

* The words houses and tenements are here used in the Scottish sense; the house meaning a dwelling of one or more apartments, entered by a separate door from the street, court, lane, or common stair; the tenement, a separate building standing by itself, or divided from others by a wall from basement to roof.

dust carts in certain streets of the old town, beginning at 9 o'clock, and the scavengers accompanying the carts are on duty one hour. Formerly this supplementary scavenging was carried out five evenings in the week, but in consequence of recent great increase in the wages of the carters it has been found advisable to diminish the number of evening cleansings. On Sunday the scavengers are on duty from 6 a.m. to 9 a.m.

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The provision for excrement disposal among the tenement houses in the old town above described, is supplemented by public privies. These are 25 in number, all adapted for several persons, and some forming considerable blocks of building, with numerous seats. The greater number of these are MacFarlane's trough latrines, used without water; some are simple pail closets; and others, also pail closets, are arranged to be worked on the dry-earth system, and are now worked provisionally with dry ashes (see *Plates I. II. III. IV.*). Six blocks of privies have been fitted up on this latter plan, the scavenger of the locality in which they are placed being made responsible for their due working. The mechanism for casting the ashes or earth from the hopper upon the excrement is arranged to be worked only from the scavenger's passage in the privy, and he is expected to visit the privy three or four times daily to put the mechanism in action. This duty, however, did not appear to be well carried out; and it is probable that its efficient execution will not be ensured until one or more persons are specially appointed to attend to it. The contents of all the public privies are removed daily; the value of the excrement in adding to the worth of the general town refuse as a manure being held as a sufficient set off for their somewhat complicated arrangement and working as compared with water latrines.

The quantity of refuse carted to the depôts in 1873 was 56,000 tons, averaging a little over 150 tons daily. At a depôt on the canal, which I visited, the refuse is at once tilted into barges, and these when filled are forthwith sent into the country. At another depôt, which I did not think it necessary to visit, the refuse is stored until required by farmers. The selling price of the refuse at the time of my visit, and after it had been enriched by the refuse from the slaughter-houses and markets (which are cleansed under special regulations) and the contents of the public privies (removed daily) was 2s. 6d. per ton.

When Dr. Buchanan and I visited Edinburgh in 1869, the scavenging of the burgh was done under contract. Now the Corporation has undertaken this work itself with, it is stated, great gain both in the efficiency and economy of the work. A saving of 2,800*l.* was effected upon the cost of scavenging in 1873 as compared with 1871, the work being done better and with a smaller number of horses.

The scavenging staff and plant of the burgh are as follows:—*Staff*: 1 inspector, 1 assistant inspector, 1 general overseer, 7 district overseers, 136 scavengers, 4 depôt men, 3 cartwrights, 1 blacksmith, 2 tin-smiths, 3 shoeing smiths, 2 foremen, 2 stable men, 68 carters. *Horses*, 68. *Plant*: 36 waggons, 40 carts, 10 ordure carts, 18 water carts. Each carter is supplied with a wheelbarrow, shovel, &c., and a weekly supply of brooms. The cost of cleansing and watering the burgh for the year ending Whit-Sunday, 1873, was 21,605*l.*, less 5,493*l.* obtained by the sale of manure = 16,142*l.*

No other plan probably than the plan of scavenging which has been here described, would meet the peculiar difficulties which have to be contended with in the tenements, and amidst the narrow wynds and closes of old Edinburgh and the class of population which inhabits them, and reduce the evils arising from accumulated filth there to the least practicable limits. The more closely the cleansing arrangements and opera-

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tions of Edinburgh are studied on the spot, the more forcibly is the mind impressed with the facility of dealing with common filth by systematic scavenging. The conditions, however, which determine the peculiar filthiness of parts of Edinburgh, and which have given to this filthiness historical notoriety, are happily becoming things of the past. The Corporation has entered upon and is rapidly pushing forward on the only course which will remove from Edinburgh the sanitary disadvantages under which it has so long suffered. Broad new thoroughfares are being opened out through the oldest, densest, and worst quarters of the old town, and those older tenements which have prolonged the filth and unwholesomeness of the middle ages into the 19th century, and had superadded to them the squalidness and misery of our own time, are being pulled down unsparingly. The changes which have already been effected by these clearances in the aspect of many historical wynds and closes of the old town is indescribable; and the new Old Town which is rapidly growing up in place of the old Old Town retains all the wonderful picturesqueness of that town that deserves to be retained, and will eventually add to it, while keeping little or none of its unwholesomeness. In the new tenements which have been erected waterclosets have been introduced, and in subsequent buildings the watercloset system of excrement disposal will be adhered to. But for some time to come the old tenements of the city will have to be dealt with each upon its own merits as respects such disposal, and no uniform system will be practicable.

2. *Excrement Disposal by Midden Closets and Dry-Earth Closets.*

Hull.

HULL.—Hull retains unchanged the peculiar system of excrement disposal described by Dr. Buchanan and myself in 1869. This system, supplemented in the better classes of houses by waterclosets, is now in general use throughout the borough. It rests upon a certain frequency of scavenging, the common privy being so modified in size of receptacle that it will not admit of a greater collection of excrement and dry-house refuse than that which accumulates in the intervals of the scavengers' call, and in structure that rain is excluded and soakage into the ground prevented.

For the purpose of "nightsoil collection" the borough is divided into 48 districts, each containing from 300 to 700 houses, the total number of houses enumerated for the purposes of this collection in 1873 being 30,977. The collection is carried out by the sanitary authority through the agency of contractors. As a rule each district is let out to a separate contractor, and no contractor is allowed to undertake more than two districts. The smaller districts are so arranged that the collection may be carried out by anyone who has the command of a horse and cart, and who can have the assistance of a boy or two. With a view of obviating undue combination among the contractors, and diminishing the evil effects of strikes among the men, the contracts are so timed in the letting that only 8 or 9 can fall vacant together. The contractor, in addition to receiving the material he collects, and which he sells for such profit as he can obtain, is paid by the sanitary authority from 2s. to 3s. yearly for each house in his district.* The sanitary authority provides places of deposit (four in number) where the contractor can store the collected material until disposed of; and he is subject to penalty if he should deposit such material elsewhere without permission of the inspector of nuisances in writing.

* In 1869 this payment was from 1s. to 1s. 6d.

The contractor is required by the terms of his contract to collect and remove, *at least once a week*, all nightsoil, offal, dry and liquid filth, dust, paper, and other refuse of every description from all premises, middensteads, ash pits, dust boxes, cellars, or other places used for such refuse, attached to all houses, shops, warehouses, yards, and other premises within his district, with the exception of trade refuse exceeding in quantity three cubic feet in any one week, and all contents of cess-pools, blood, manure, and filth from slaughter-houses, ashes from furnaces, and refuse from manufacturing processes. The work of collection and removal is to be executed on week days, from the beginning of March to the end of October between the hours of 5 and 8.30 a.m., and from the beginning of November to the end of February, between the hours of 6 and 9.30 a.m., and all carts employed in the work are to be clear of the streets and public thoroughfares, on their way to the depôts, before 9 a.m. within the former period and before 10 a.m. within the latter period. Further the contractor is required to use water-tight and properly covered carts.

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In practice, while the weekly removal of excrement and dry-house refuse from the different houses in the borough is very generally secured, certain irregularities of collection are occasioned by the early hours at which the collection commences. Many families at this hour have not left their beds, and the scavenger is unable to obtain access to their premises. In these cases the families will not disturb themselves to admit the scavenger until their receptacles are full, but in regard to privies these from their construction rarely admit of more than a fortnight's accumulation of excrement and house refuse. The requirement of the contract as to water-tight and covered carts is not carried out, and the contractors are permitted to use the common open cart. It has not been found practicable to insist upon this requirement with numerous small contractors.

Consistently with the design of this plan of scavenging, and as part of the scheme it involved of preventing the accumulation of refuse matters on any premises for longer periods than one week, the common privy has been modified in arrangement, so that the pit will not hold more than a week's collection of excrement and dry house refuse. Its construction is also so altered that wetness of contents is intended to be avoided, and if wetness happens, soakage into the soil prevented.

The arrangement of this privy is shown in Plate V. The space under the seat forms the entire receptacle for all the ashes, refuse, and excrement of the house, and is built of bricks in cement, with a bottom of brick or flag, sloping from the level of the paved floor in front to a little below the ground level at the back, and forming only a very shallow pit. Into this space, through the hole in the privy seat, all dry refuse is thrown. The front of the midden space is formed by the front board of the closet, which is made moveable to give the scavenger access to the pit. There is no drain to it, as rain is excluded and slops are in practice thrown down the drains. The ashes are usually sufficient in quantity to soak up all moisture passing into the pit, and the contents are almost invariably dry, and are removed by a spade without difficulty.

The cost of erecting a privy of this construction is 3*l.*, and when built in a corner against existing walls, 2*l.* 10*s.* Every new house, if it have not a watercloset, is required to have a privy of the construction described; and at the back of every new house there must be a space of the full width of the house, and not less than 8 feet long. Upon this space only the pantry, coal-house, and privy may be placed, the privy being farthest from the house. In this way an open yard space is secured of not less than 60 or 70 square feet (see Plate V.) It is an exception to have a back entrance to this yard, and the contents of the

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privies when removed, must, as a common rule, be carried through the house. Little offence appears to be occasioned by this objectionable arrangement, and such rare complaint as came to my knowledge referred to careless scattering by the scavenger of ashes from the bucket or other vessel in which the contents of the privy were removed to the cart.

An extended examination of privies of the kind here described, and of the manner of cleansing them, confirmed the opinion formed by Dr. Buchanan and myself with regard to them in 1869. They represent an enormous gain upon the old form of privy for which they have been substituted, both as to freedom from, and as to liability to, nuisance. In the greater number of instances inspected the excrement, even in families having young children, was as a rule well covered with ashes, and the freedom from privy smell was remarkable; and this although I had inspected on days fixed for removal of the refuse (the seventh day of accumulation), or, sometimes, in cases specially sought out, when the removal had been delayed for longer periods. The contents of the privy were dry, and their disturbance by the spade of the scavenger during removal gave rise to very little and at times to no offensive odour. In other instances privy stink was considerable, and this appeared to be determined by one or other of the following conditions:—

1. Deterioration, or original imperfect construction of the walls of the privy pit, leading to retention of portions, and perhaps to some soakage, of decomposing filth.

2. Careless casting of slops into the privy pit, facilitating decomposition of the contents and soakage of the woodwork.

3. Want of adaptation of the scavenging to the needs of particular localities and their inhabitants. In the localities occupied by the most impoverished and degraded of the population the privies were overflowing with filth, and most offensive. This arose mainly from the insufficiency of the scavenging. Designed to meet the requirements of a single family only, the Hull privy cannot be used by several families without being productive of nuisance, except on condition of a more frequent removal of its contents than once a week. A daily removal is necessary under these circumstances; and as to orderliness of the privy, in those cases where a single family cannot be made responsible for it, this will not as a rule be secured unless the sanitary authority itself undertakes the duty of maintaining it.

The collection of nightsoil and household refuse is not carried out with the same efficiency in all the collecting districts. From the impracticability of exercising thorough control over the numerous contractors, the regulations for their guidance are not as carefully observed as they might be. Forty-two fines were inflicted in 1873 for gross neglect of duty on the part of the contractors; and the inspector of nuisances in his report for that year observes of some of the contractors, who do not employ suitable men, and whose horses and carts are not good, that they are "a cause of many complaints by the public," and a source of annoyance to the sanitary committee. The medical officer of health for the borough, Mr. J. Fearne Holden, in his report for the same year, expresses the opinion that the "collection of nightsoil can only be efficiently effected by the (Local) Board assuming the entire responsibility without the intervention of contractors."

Glasgow.

GLASGOW.—Three different methods of excrement disposal are in use in Glasgow, besides certain experimental methods. The methods in ordinary use are (1) waterclosets; (2) pail closets; and (3) midden-closets of various descriptions. These several methods are distributed

among the 100,000 houses in the parliamentary burgh in the following numbers: waterclosets, 31,927; pail closets, 4,365; midden closets, blocks of, 1,278.* What proportion of the half million population of the burgh uses each method is not accurately known; but, in evidence before the Rivers Pollution Commission in 1870, Mr. Carrick, the master of works, stated that about half the population used waterclosets. A pail, in a pailcloset, is considered to be necessary for every 10 families; a privy may serve for many more families, as in some of the instances which will presently be referred to. In one of these a privy serves for 59 families. This, however, is not considered adequate accommodation.

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In Glasgow, as in Edinburgh, the tendency in new buildings is to

* PARLIAMENTARY BURGH of GLASGOW, 1872-3.

RETURN showing the Number of Houses, Manufactories, Shops, Warehouses,
Drains, Ashpits, and Waterclosets, &c.

Number of dwelling houses	-	-	-	-	-	101,368
" shops	-	-	-	-	-	8,874
" warehouses and counting-houses	-	-	-	-	-	4,053
" manufactories and workshops	-	-	-	-	-	3,291
" stables	-	-	-	-	-	2,304
" horses	-	-	-	-	-	7,024
" cowhouses	-	-	-	-	-	311
" cows	-	-	-	-	-	1,350
" urinals drained into sewers	-	-	-	-	-	211
" ashpits drained	-	-	-	-	5,288	
" " undrained	-	-	-	-	795	
						6,083
" privies drained	-	-	-	-	935	
" " undrained	-	-	-	-	343	
						1,278
" pans only	-	-	-	-	-	4,365
" common sewers, lineal extent in yards	-	-	-	-	-	140,366
" manufactories discharging organic refuse	-	-	-	-	55	
" " " chemical "	-	-	-	-	54	
						109
" waterclosets in houses of one apartment	-	-	-	-	454	
" " " two apartments	-	-	-	-	5,702	
" " " three " and upwards	-	-	-	-	21,512	
" " " in shops	-	-	-	-	1,709	
" " " " warehouses, counting-houses, &c.	-	-	-	-	2,550	
Total number of waterclosets in the city	-	-	-	-		31,927
Number of sinks in houses of one apartment	-	-	-	-	11,185	
" " " two apartments	-	-	-	-	30,502	
" " " three " and upwards	-	-	-	-	29,604	
Total number of sinks in the city	-	-	-	-		71,291
" fixed basins in dwelling houses	-	-	-	-		3,865
" cisterns for W.C. and domestic supply	-	-	-	-	8,940	
" " " only	-	-	-	-	14,957	
						23,897
" houses supplied with water from mains	-	-	-	-	55,394	
" " " " cisterns	-	-	-	-	31,802	
						87,196
" soil pipes, ventilated	-	-	-	-	17,701	
" " unventilated	-	-	-	-	14,522	
						32,223
" cesspools	-	-	-	-		1,901
" courts, paved	-	-	-	-	6,444	
" " drained	-	-	-	-	8,831	
						15,275
" stairs and passages, ventilated	-	-	-	-		7,876
" dwelling houses, lobbies	-	-	-	-		92,895
				1872	1873.	
Estimated Population within Municipal Boundary				502,990	514,295	

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adopt waterclosets, and these are being more extensively introduced from year to year. The older tenements of Glasgow, as of Edinburgh, from their arrangement and the class of population inhabiting them, do not admit of the introduction of waterclosets. For these buildings and their inhabitants efforts are mainly directed to the improvement of previously established plans. I observed in some of the newer tenements which had been furnished with waterclosets that these were out of order and offensive. This had arisen from inability to make particular families in the common stair responsible for the cleanliness of the waterclosets, owing to the inconvenient position and insufficient number of the latter. In other instances, where each flat had its separate watercloset, and this was kept locked, the families of the flat being held responsible for its orderliness, the waterclosets were kept in excellent order, although imperfectly lighted from the common stair.

When Dr. Buchanan and I visited Glasgow in 1869, middensteads were to be seen attached both to public and private privies, of enormous size, filthy and foetid, uncovered, receiving all urine as well as stools of the neighbourhood, and also ashes. Middensteads of this kind still exist, but probably all are now covered in. Of the 1,278 middensteads in the burgh, 935 are drained. For middensteads of this class there are now being substituted smaller, covered, undrained middensteads, of a capacity calculated to hold two days' accumulation of the filth, ashes, and dry-house refuse of the families using them. This important change, begun before 1869, has since been steadily carried out, and recently has received a further development, which makes the Glasgow midden closet, as newly designed—one detail alone excepted,—a pattern for the construction of the common privy, so long as common privies must be tolerated. The additional improvement consists in so fixing an inclined plane beneath the opening through which the ashes and dry-house refuse are thrown into the middenstead, that these shall fall above and cover the excrement. The exception referred to is that the bottom of the middenstead is sunk beneath the level of the ground, which should not be the case. Mr. Carrick, the master of works, appears to have been the first to have conceived this arrangement, but its successful working out has been due to Mr. Dobson, of the sanitary department. Plates VI. and VII. show the arrangements of this form of privy.* The following description of the plans, including also a description of a plan of pail closet (Plate VIII.) is furnished by the sanitary department:—

DESCRIPTION OF PRIVIES IN THE CENTRAL SANITARY DISTRICT OF GLASGOW.

No. 1 (*Plate VI.*)—Is a combined ash-bin and privy, constructed with 9-inch brick walls, the seat, riser, inclined plane, bottom and roof of 1½-inch Caithness stone. The whole structure covers an area of 56 superficial feet. This gives accommodation to 27 families, two warehouses, and seven shops, and costs 16*l.*

No. 2 (*Plate VII.*)—Is a design of two privies, placed back to back, and divided into four compartments by two partitions of Caithness stone, 2½ inches thick; the external walls are built of 9-inch brickwork in mortar, the seat, riser, inclined planes, and bottom of bin of 2½-inch Caithness stone set on one course of brick footings.

The dotted lines are suggestive of a screen to hide the persons sitting from persons passing. The superficial area on which it stands is 95 feet, and giving accommodation to three distinct localities, having a population of 236.

No. 3 (*Plate VIII.*) is the plan of a privy on the pan system, constructed with 1½-inch Caithness paving stone set in grooves in the pavement of the court,

* Mr. Dobson has also devised an ingenious mechanical arrangement, the details of which are shown on *Plate VIIa.*, having for object the prevention of annoyance, from ashes being cast into the middenstead when in use, to the persons using it. An experimental trial of this arrangement was being made when I visited Glasgow.

and cramped together with $1\frac{3}{8}$ -inch $\times$ $\frac{3}{8}$ -inch wrought iron angle irons, and $2\frac{1}{2}$ $\times$ $\frac{1}{2}$ -inch screwed bolts and nuts jointed neatly with Portland cement. adapted for the accommodation of males, females, and children.

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The seats are made of cast-iron with close-fitting galvanized iron pails underneath. The whole structure covers an area of 65 superficial feet, accommodating 59 families, and cost 16*l*.

The objection to this privy arises chiefly from the foul odour continually emitted from the coating of fæcal matter on pails, which could easily be obviated by substituting a clean, deodorised pail at each removal. [The contents of the pails are merely emptied into the scavengers' cart without other cleansing].

At the time of my inspection there was superabundant evidence in the central district, from overfull middensteads and ash-pits, that the operations of the sanitary department and of the scavenging department were not in proper accord. The scavenging of the middensteads and ash-pits has not kept pace with the work of the sanitary department in reducing their size, and as a consequence of the less capacity of these receptacles, they fill and overflow more rapidly than the scavenging department is prepared to deal with them. This want of accord between the two departments did not seem to me to rest upon any necessity of the case, but to arise chiefly from the vicious principle upon which the scavenging of the middensteads and ash-pits is carried out. Theoretically the central district of the town is scavenged every alternate night, and in practice the nightsoil carts traverse it for this purpose. If the scavenging were carried out systematically from street to street, privy to privy, and ash-pit to ash-pit, the present arrangements would suffice, no doubt, to obviate the nuisance from overflowing middensteads and ash-pits which came under my observation. But actually the scavenging is governed by the fullness or not of the middensteads and ash-pits, and this in a given locality is judged by the largest not the smallest. The same practice holds good in the scavenging at longer intervals of other districts of the city. The mode of payment of the scavengers directly fosters this practice, and holds out a premium for imperfect work in another important way. The scavengers are paid at so much per ton of the filth removed, and it is to their interest to encourage fulness of the receptacles so as to diminish the quantity of ground traversed in collecting the contents.* Another evil of this mode of payment is, as I had occasion to observe, that it affords an inducement to the men to cleanse the receptacles imperfectly, the walls not being scraped and the bottoms carefully swept out.

Plate VIII. gives a drawing of a pail closet in ordinary use for a court or common stair. The pails are galvanized iron cylindrical vessels, calculated each to serve for 10 families during the intervals of the scavengers' rounds. These pails, which receive excrement only, are simply emptied into the scavengers' cart, and are neither scraped nor otherwise cleansed. The whole of those I saw were encrusted with filth, and stank offensively, and Dr. Russell, the medical officer of health, has satisfied himself that the excremental matters received into them when in this state rapidly decompose.

The ash-pits, or more accurately middensteads, attached to these pail-closets also receive a considerable quantity of excremental matters from chamber-pots, which are freely used for defæcation in the tenements, and of which the contents are not uncommonly retained some time in the house.

* "Under the present system the men work by the ton, and could not under the nightly system earn the same amount of wages, as they would require to travel over much more ground before they could collect the same quantity of material."—*Observations of the Inspector of Cleansing in reference to a Memorandum of the Medical Officer of Health on the system of cleansing ash-pits, pans, &c., 17th July 1873.*

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Dr. Russell has made the following suggestions as to the scavenging of middensteads and privy-pans :—

- “ 1st. Every midden receiving human excrement should be emptied daily, the only open question being whether in the winter season, when decomposition takes place more slowly, two or three days might elapse where the size and position of the midden will admit.
- “ 2nd. Every privy-pan should be emptied daily, and in confined localities, during the prevalence of specific diarrhoeal disease, twice daily.
- “ Following these main propositions, and carrying out the principle into details, it may be added :—
- “ 1st. That after emptying a midden, the close, court, street, or other surface smeared with its contents should be carefully washed with the hose before the heat has converted the matter into dust, which, as well as the gases evolved, may be transported by the air.
- “ 2nd. Pains should be taken actually to empty the midden, and to scrape from its sides all adherent dirt.
- “ 3rd. The privy-pans should be not only emptied, but cleaned, so that they may not be replaced having a layer of faecal matter over their sides exposing a large decomposing surface to the air, and ready to act like a ferment on the fresh excrement, rapidly propagating to it the process of decomposition.
- “ 4th. Another matter indirectly coming up for remark in this connexion is the removal from the roofs of privies, and other out-houses, of the organic matter thrown there from higher levels. The prevention and punishment of this offence is desirable, but meanwhile, and especially in hot weather, those decomposing matters ought to be removed.”

Under existing arrangements, Glasgow for the purpose of scavenging is divided into six districts. The scavenging of the privies and ash-pits is carried out between the hours of 11 p.m. and 8 a.m., and the night staff consists of 65 carts and men with 60 emptiers. The quantity of stuff removed by this staff per week to the various depôts, 10 in number, is computed at 2,000 tons, where it commands a sale for manure at 1s. 6d. per ton. The entire cost of the scavenging department for the year 1872-73 was 46,275*l.* 0*s.* 0*d.* with a set-off for sale of manure and other items of 17,493*l.* 0*s.* 0*d.* The sale of manure for the year had produced 17,987*l.* 0*s.* 0*d.*; the receipts for manure, including outstanding sums for the preceding year, were 17,375*l.* The scavenging is done by the Corporation, and here, as in Edinburgh, the statement is made very positively that the Corporation to secure the same degree of efficiency does the work with its own staff and plant at a less cost than it could be done by contract.

Two experimental methods of excrement disposal came under observation in Glasgow, one a modification of the watercloset system (*Hoey's watercloset*); the other a system in which charcoal is used to deodorize the excrement and facilitate its ulterior use. This last-named method I have had to examine elsewhere than in Glasgow, and the illustrations of its operations I observed in this city I have included in the separate description which I have given of the method.

Hoey's watercloset is designed to limit to the smallest amount consistent with efficiency the quantity of water used in flushing the pan, and to prevent the passage of the excrement into the sewers. An ingenious arrangement in the cistern restricts the flush of water to a fifth of a gallon, and the excrement is received into an iron tank beneath the floor of the building. By diminishing the amount of the water with the excrement a manure of commercial value sufficient to cover the cost of this arrangement is believed to be obtained; by keeping the excrement from the sewers the dangers commonly arising from sewer air are supposed to be avoided. The tank when full is emptied by atmospheric pressure into an exhausted wheeled

receptacle. I examined this arrangement as applied to four closets in tenement No. 243, Stirling Road. In each closet on raising the handle there was a mere dribble of water, in quantity quite insufficient to remove freely and fully an ordinary stool, especially with paper, and the closets had to be flushed from time to time with a bucket of slops or of water. Each closet pan, although the closets were locked and under the care of orderly people, was more or less smeared with excrement. The excrement tank is a cesspool, and the protection from it on the house side, supposed to be obtained (if the arrangement be adopted, which was not the case so far I understood at No. 243 Stirling Road) by a disinfecting cistern, which suffers a charge of a disinfectant to pass into the soil pipe with each use of the closet, is simply fallacious. Even more fallacious is the supposition that the tank intercepts the passage of the whole of the excrement into the sewers. The tank has an overflow, and there was no certainty in the instance under observation that the overflow was not in frequent action. The tank, in fact, is a mere catch-pit interposed between the soil pipes and the sewers. The whole arrangement is such as to demand for its reasonable working an amount of supervision rarely possible to obtain; and the advantages claimed for it in saving water and securing a saleable manure appear to me to be gained at the cost of more important considerations.

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Note.—Through the kindness of Dr. A. Fergus, I had an opportunity of examining during my visit to Glasgow several examples of corroded and perforated soil pipes. Dr. Fergus discovered these perforations in soil pipes a few years ago, and his subsequent observations have led him to the conclusion that they are an occasional important source of unsuspected sewer air pollution of the interior of houses, and the pathological consequences thereof. He has found them especially co-existent with enteric fever and diphtheria where complete freedom from chances of sewer air poisoning was believed to exist. The corrosions and perforations were most frequently observed in the upper extremity of the pipe, and, if there were a bend or arch in it, on the upper portion of the bend. The corrosions invariably proceeded from within outwards. Dr. Fergus has the following observations on this subject in a pamphlet he has published on "*The Sewage Question: with special reference to traps and pipes.*" (Glasgow, Porteous, Brothers, 1874):—

"Lead has generally been used as the material for soil pipes, and as we have seen how capable it is of corrosion, it becomes a very important sanitary question to inquire how long a good lead soil pipe will hold out. I have been studying this question for years, and it is now about seven years since I first exhibited decayed pipes in public, yet, I would not wish to dogmatize on the subject, but rather give approximations, and would remark that the time will vary under the various circumstances according to the strength and rapidity of the flow of the sewage, as well as the original thickness of the pipe. But after allowing for this, we must broadly distinguish between soil pipes which are ventilated and those which are not. By the former I mean when the pipe is carried up to the roof of the house and open to the external air; by the latter, I mean when the pipes are closed up. Of these last-mentioned, the duration may be stated to be about 12 years, the extremes of variation being from a minimum of 8 to a maximum of 20 years. In ventilated pipes the duration may be stated to be nearly double, running from 21 to 33 years, the extremes of variation being from 18 to 30 or even more years. The practical sanitary conclusion which it concerns us all to keep in mind is, that any house, no matter how carefully or well built, may become unhealthy from this source, and that when cases of typhoid fever, diphtheria, &c. occur, the pipes should be thoroughly inspected, especially their upper surface, and the whole of the soil pipe uncovered. I must strongly insist on this, as in many cases the plumbers have declared pipes to be all right, which turned out to be very defective when uncovered. For some years back, I have insisted on a careful

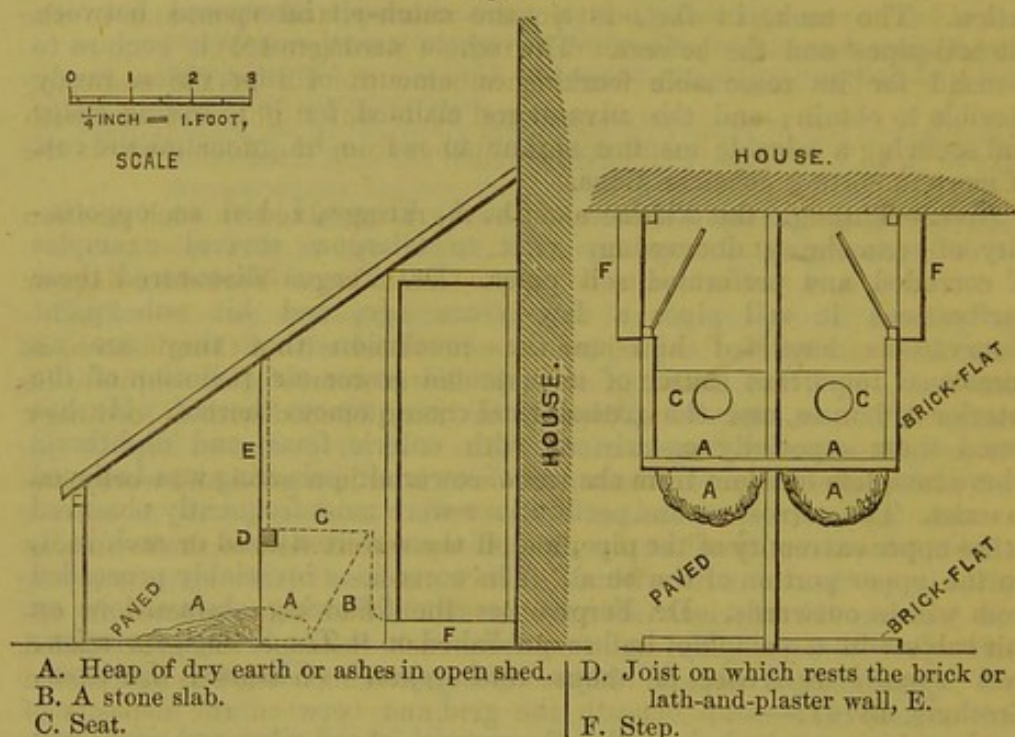
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examination of the soil pipes wherever I have cases of typhoid or diphtheria, and in every case where I could get this carefully carried out, I have detected these perforated pipes, or sewer air getting into the houses in some other way," (p. 21).

BUTLEIGH (*Somerset*).—I had an opportunity of examining at Butleigh an improved privy which Ralph Neville-Grenville, Esq., M.P., is introducing among his cottages. This privy is most instructive as showing by what simple means the abounding nuisance of the common privy, and the indecency connected therewith, which too commonly exists in rural districts may be often got rid of. The change Mr. Neville-Grenville has effected from the old-fashioned privy is shown in the accompanying drawing (Fig. 1.), copied from an article by him on "Cottages" in the *Journal of the Bath and West of England (Agricultural) Society* for 1873.

Fig. 1.



- A. Heap of dry earth or ashes in open shed.
B. A stone slab.
C. Seat.
D. Joist on which rests the brick or lath-and-plaster wall, E.
F. Step.

Below the joist D the privy-pit is open, admitting of the soil being covered from behind; or a shovelful of dry earth or ashes may be thrown upon the soil through the opening in the privy seat.

This change consists in filling up the middenstead to the level of the surface of the ground and paving the filled area, extending the roof of the closet so as to cover this, raising the closet floor a step, and with it the closet seat, and placing a flag sloping backwards beneath the seat so as to diminish the space there and place the excrement in a better position for the treatment now to be described. The roofed space in rear of the closet, the area of the former middenstead, is left open on the side of approach, and is used for the deposit of the ashes, and these failing for a deposit of dry earth. The cinders are separated from the fine ash by a common riddle, the former for re-burning, the latter for covering the excrement, and if the fine ash should be insufficient dry earth is applied: or both fine ash and dry earth are used together. I examined several of the improved privies, and in every instance but one found the excrement fully covered and an absence of all offensive odour; a slight odour in the excepted instance arising from imperfect application of the fine ash. The efficiency of Mr. Neville-Grenville's arrangement equals its

simplicity ; and it was noticeable how more decent privy arrangements had begotten a greater care for the orderliness of the privy and its vicinity. In one instance, the opening to the space behind the closet was closed by a neatly constructed screen of straw.

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BRADFORD, *Yorkshire* (1871, population, 145,830 ; inhabited houses, 29,408).—In 1872 I had to report on the state of middenstead nuisance in Bradford among other sanitary defects of that town. The Corporation has recently approved a form of midden-closet, which, while presenting certain improvements upon the old-fashioned midden-closet, has defects so grave that it is desirable to note them here for the sake of warning. The approved midden-closet is directed to be constructed according to the following instructions :—

Bradford.

“ The foul earth under the old privies and ashpits to be entirely taken out and at once carted away, and the old ashpits to be filled in with concrete.

“ The privies are to be built in the manner and form, and to the dimensions shown in the detail drawing. (*See Plate IX*).

“ The ashpit to be sunk four inches below the sill of the emptying door, and the bottom to be flagged and made watertight, and laid with an inclination of not less than nine inches from the door towards the back or shallow end of the ashpit.

“ Across each ashpit there must be a grating fixed in such position as shown in the detail drawing.

“ Each privy and ashpit to be covered with large *Yorkshire* flags or landings.

“ The upper door of the ashpit to be provided with a thumb latch, as shown in the detail drawing, and the lower door of the ashpit to be provided with a catch-lock, capable of being opened with an ordinary railway carriage key.

“ The whole of the works are to be executed in a good and workman-like manner.”

The grating approved at the time of my recent visit to the town was formed of stout iron wire with a 2-inches mesh.

I visited several blocks of privies which had been erected in accordance with this plan, and found in each instance the grid loaded with a foul mass of ashes and house refuse ; and such ashes as had passed through lay in a heap beneath the grid and between the deposits of excrement, leaving the latter quite exposed. In one instance of a block of four privies, not only was the grid laden, as described above, and the excrement exposed, but the urine and other wet in the middenstead was running from beneath the door for emptying, forming a sluggish stream to the nearest yard-gulley. The offensiveness of this block of privies was not less, if, indeed, it were not greater than that of an old-fashioned open midden-privy.

In fact, the position of the grid is such that, if the ashes be raked above it, the fine ash will not fall upon the excrement ; and the capacity of the middenstead, in accordance with the arrangements for night-soil scavenging, is sufficient to hold several weeks' accumulation of ashes and excrement, while its shallowness makes necessary frequent systematic scavenging if nuisance is to be avoided.

GLoucester.—At Gloucester I had an opportunity of examining two forms of Dry Closet in experimental operation which had been designed by Dr. Francis T. Bond, the medical officer of health for the Gloucestershire Combination of Sanitary Authorities, to meet certain require-

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ments of his district. One of these closets is described by Dr. Bond as the closet with "*external ash distributor*," the other as the closet with "*internal ash distributor*." The following diagrams, to which I attach Dr. Bond's descriptions, illustrate the arrangements of these different forms of closets. Both forms may be fitted with urine separators, but this arrangement is shown only in the diagram of the second form :—

Fig. 2.

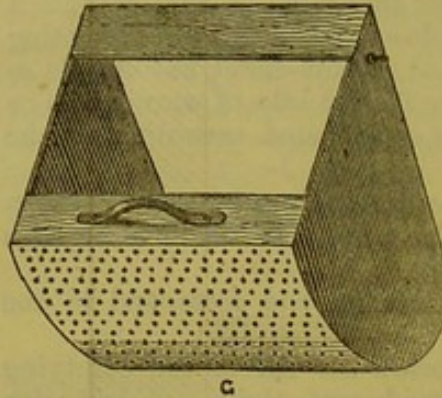
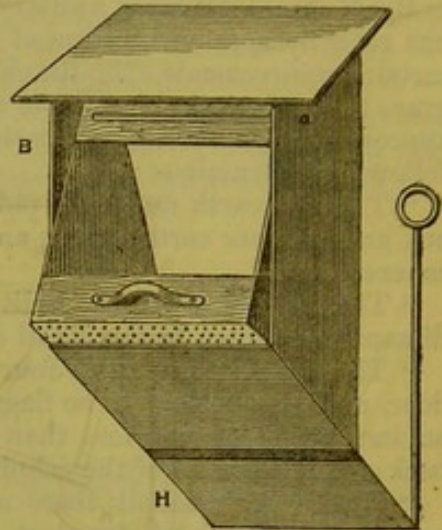


Fig. 3.



Closet with External Distributor. Distributor (Figs. 2 & 3).—G a cradle with sifting bottom suspended in a box *B*, which is attached to the side or back wall of the closet on the outside. At the bottom of the box is a sloping board *H* hinged at one end, on which the ash falls. To the other end of this board is attached a wire, the free end of which rises through the seat of the closet, so that on pulling it up by the handle which is attached to it, a jerking motion is given to the board, which shakes the ashes from it into the receptacle. The cinders are removed from the cradle by merely pulling it forward, when they fall out of it through a shoot which is placed in front of the sifter, into the coal box or other receptacle which may be placed beneath to catch them.

Fig. 4.

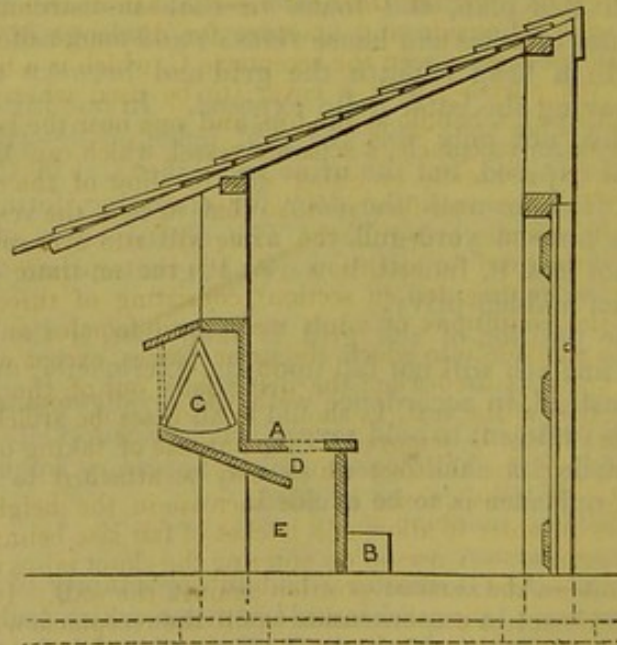


Fig. 4. Section of Closet with External Distributor attached.—A, seat B, step; C, cinder sifter; D, ashes shoot; E, space for moveable receptacle.

Fig. 5.

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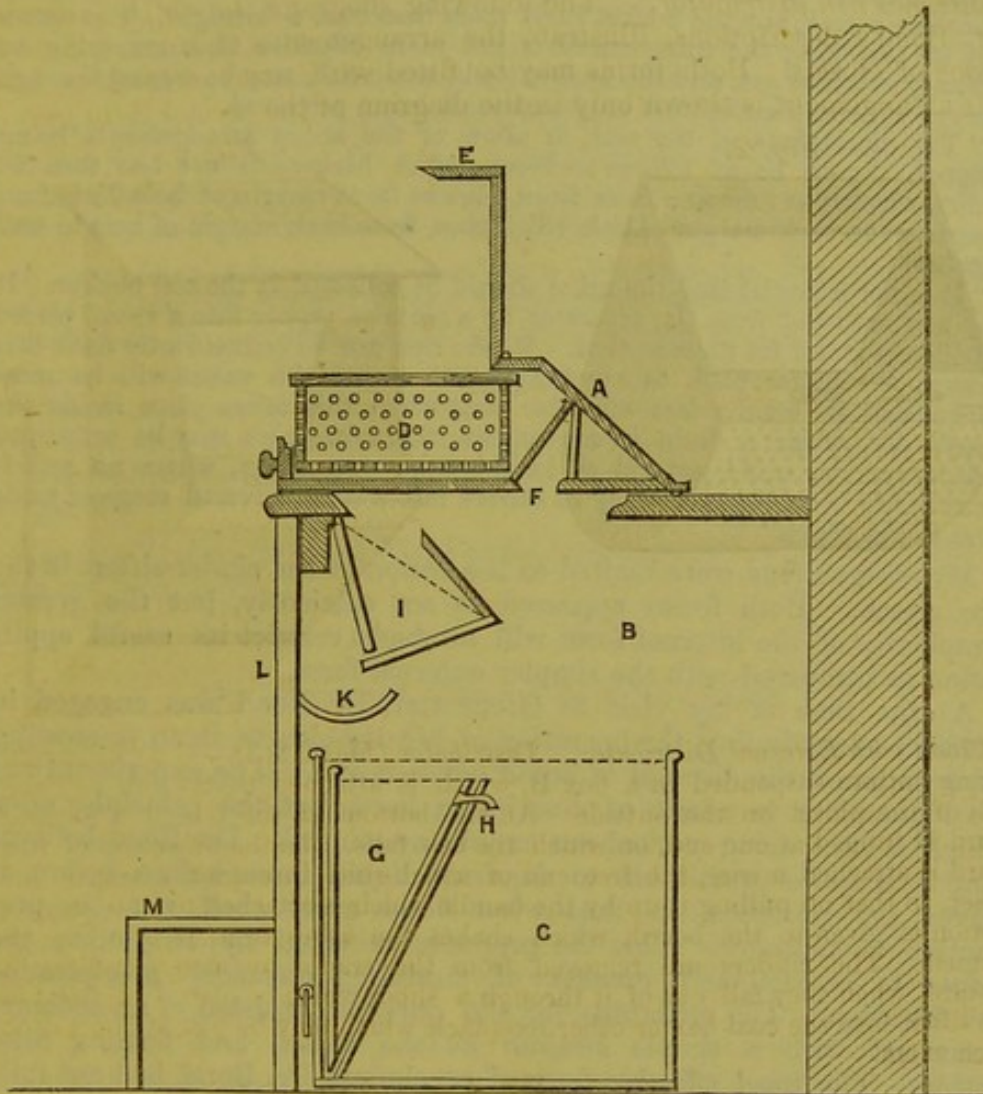


Fig. 5. Closet with Internal Distributor.—“A, ash-distributor with lid, E, open, showing sifter, D, inside and aperture for discharge of ash, F. In B, the space beneath the seat, is seen the receptacle C, which is a bucket specially constructed for the purpose, with a cover (to be used when the bucket is removed for cleansing), a handle at the top, and one near the bottom in front. At G is seen the urine receptacle, a separate vessel, which can be readily lifted out of the bucket by a handle on either side to allow of the contents being poured out. At H is an over-flow vent, so that in case the vessel is allowed to remain until it becomes over-full, the urine will run over into C and thus give indication of the need for attention. At I is the separator (the real shape of which cannot be represented in section), consisting of three elements intended to meet the conditions of adult males and females and children respectively. K is a gutter into which the urine passes, except where a bucket with separating vessel is used when the urine falls out of the separator into the latter. The riser of the seat, L, should in all cases be attached to the seat in such a way that it can be removed for the purpose of taking out the bucket. M is a small support for the feet which may be attached to the riser, and which is required in consequence of the increase in the height of the seat, which is necessary in order to allow of a bucket of fair size being employed.

“Action of Apparatus.—A person on entering the closet raises the distributor A, which then rests in the vertical position against the wall. In so doing he gives sufficient motion to the ashes inside to fill the receptacle which measures the charge. On leaving the seat he replaces the box (as he is requested to do by a notice which is fixed to it) and in so doing discharges the charge of ashes through F into C. The sifter is large enough if filled with ashes, to hold sufficient for 10 or 12 uses of the closet. Hence if properly filled it need

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not, in the case of an ordinary household, be refilled more than every other day. Under similar circumstances the urine receptacle need not be emptied more than once a week, and the bucket itself more than once a fortnight. The operation of emptying the urine vessel is not more offensive than emptying an ordinary chamber pot, and the bucket itself, when full, may be carried through a house without the slightest unpleasantness being perceived.

"The dimensions of the seat, to allow of the above arrangements being adopted, should be as follows:—From before backwards not less than 20 inches, divided as follows; from front edge to front margin of hole $2\frac{1}{2}$ inches, from front to back margin of hole $10\frac{1}{2}$ inches, from back margin of hole to wall 7 inches.

"It is not essential that the urine should be collected in the soil bucket. It may be conducted from the separator by a piece of piping into a vessel placed outside the closet for its reception. Where this can be conveniently done it is perhaps the better plan, as any neglect to empty the vessel will be more evident and its results less offensive than when this takes place inside the closet. Or, where a drain is convenient, the urine pipe may be connected with it, and the urine got rid of in this way. Or, again, where no well is immediately near, the urine may be carried into a small covered cesspool made close to the closet."

My observations were limited to the action of the cinder-sifters in the two closets. Both forms appeared to act efficiently, but the greater complexity of the internal form will no doubt restrict its useful application as compared with the simpler external form.

At the time of my visit to Gloucester, Dr. Bond was engaged in addition to perfecting the operation of his dry-closets, in an interesting experiment on the disposal of liquid house-refuse. The experiment was too incomplete to admit of description here, but the principles upon which it was being worked out may be mentioned. Dr. Bond believes that it is quite practicable to depurate liquid house-refuse before it leaves the premises, so that what flows away shall not be productive of nuisance. This he proposes to effect by subjecting the refuse to a combined process of straining, chemical precipitation and filtration. The apparatus for the purpose consisted of an ordinary waterbutt with a simple strainer at the mouth and floating filter within. The most effective form of precipitate Dr. Bond had not fully determined at the time of my visit; but such results as he showed me of his experimental trials augured well for a successful issue. [Dr. Bond has since informed me that he has made several unessential changes in the "closet with internal distributor;" and that he has determined two available forms of precipitate. One of these which is also a deodoriser, and is believed by Dr. Bond to be a true disinfectant, is termed by him *cupralum*, and is a mixture of cupric dichromate, and aluminic sulphate with terebene.]

Tring.

TRING, Herts (1871, population 4,045; inhabited houses 850).—The urban sanitary authority of Tring has adopted at the suggestion of its medical officer of health, Dr. C. E. Saunders, a modified form of privy, of which a diagram is given in Plate IX^a. The peculiar characteristics of this privy are a shallow pit, and a bin placed at the side of the seat, for containing dry-earth or ashes. The cottagers where this form of privy has been erected are instructed to keep the bin provided with one or other of the materials named, and after each use of the privy, to throw upon the deposited excrement a scoopful of the dry-earth or ashes. I saw several of these privies which had been some little time in use. Where reasonable attention could be secured in covering up the excrement with the earth or ashes, the freedom from nuisance was marked. In view of the necessity for frequent removal of the contents of these closets and of their storage in garden plots, it appeared to me desi-

nable, as a rule, where no proper care from the users can be reckoned upon, to have all ashes and dry household refuse thrown into the pit: to use them, in fact, as middensteads. By this simple plan there would probably be more likelihood of nuisance being avoided among the careless both in the privy and in the subsequent disposal of the contents of the pit.

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[A somewhat similar privy arrangement to the above, and method of use, has been adopted by the rural sanitary authority of St. Neots. In this form of privy, a box or scuttle to contain earth, ashes, or other deodorising material is directed to be placed upon the floor of the privy.

A completer arrangement has been designed by Dr. Baylis the medical officer of health to the West Kent combination of sanitary authorities. He provides, as in the Tring privy, for a bin attached to the seat to contain dry-earth, but a metal pail forms the excrement receptacle, and in rear of the privy he constructs a proper covered dust-bin. Into this dust-bin the contents of the pail can be deposited, along with the ashes and dry house-refuse, when they cannot be at once used for the garden.

The St. Neot's privy and Dr. Baylis' improved privy and dust-bin I have not seen in use.]

3. *Excrement Disposal by Pail-Closets.*

ROCHDALE (1871, population, 64,754; inhabited houses, 13,933). — Six years ago the Rochdale Corporation undertook a twofold experiment in excrement disposal, designed to abate the nuisance from middensteads, and to put their contents to more profitable use. The experiment consisted in the conversion of a certain number of privies into pail-closets, some being managed on the Goux system, others in a simpler manner. The conversion, where accomplished, at once did away with the nuisance from middens by the destruction of the middenstead, and both methods of managing the pail-closets proved equally effective in keeping under control and in diminishing to an extremely insignificant amount, as compared with the common midden, nuisance from excrement. After several months trial the Goux system was set aside, the simpler method of managing the pail-closets adopted, and out of this simpler method has been developed that plan of dealing with the excrement and dry refuse of households known as the "Rochdale system."

Rochdale.

A report of the sanitary committee of the Corporation, under whose supervision the pail-closet experiment had been carried out, and which was published in August 1869, stated, as reported in that year by Dr. Buchanan and myself, that in both systems of management applied to the pail-closet, "the essential condition of the trial, *frequency of removal*, had been secured; that the system of removal had been "thoroughly approved by all who had had experience of it; and that it "had not failed under most varied conditions, having proved equally "efficacious in the highly-rented house with its own closet, in the "lodging-house where great numbers were accommodated, and in the "factory and workshop. In the subsequent manufacture of the dejections and ashes into a saleable manure, the committee concluded that "the Goux system was less advantageous than the use of tubs without "absorbent linings."

When Dr. Buchanan and I visited Rochdale in 1869, 500 middenstead privies had been converted into pail-closets, the other arrangements for the excrement disposal of 45,000 people, occupying 9,000

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houses, consisting of 4,000 middenstead privies and 300 waterclosets. In 1872 the Borough was much enlarged, and within this extended area, at the time of my visit (September 1874), the number of pail-closets amounted to 4,397, of which upwards of 3,200 were within the limits of the Old Borough (3,250, January 1874); the estimated number of middenstead privies to 2,000; the waterclosets remaining about the same in number as in 1869.

The Rochdale system of excrement disposal consists in the systematic removal at weekly, or shorter intervals, of the excrement and dry refuse of households, the collection of the excrement and dry refuse in pails, each separate from the other, the manufacture of the excrement with fine coal ash in a particular manner into manure, and the profitable utilisation of the rest of the dry refuse.

In putting this system into force, the following rules were acted upon by the Corporation, as stated in a report published in December 1873:—

- “ 1. That the privies to all new houses should be on the new system.
- “ 2. That all additional privies to old property should be on the new system, and be accompanied by the alteration from the old system to the new of all existing privies to the same property.
- “ 3. That all old privies being rebuilt should be on the new system.
- “ 4. That the first cost of the ash tub and receptacle for the excreta should be paid by the owner.”

No difficulty was found, it is stated in the report referred to, in carrying out these rules, nor has “ complaint or opposition been made, “ and in no case has the Corporation had to exercise any legal authority “ to enforce them. This feature is, no doubt, owing to the facts that the “ old form of privy and ashpit is more expensive to build than the new “ one; that the privies under the new system are much more cleanly; “ that from the absence of moisture they are more durable; and that “ they need less repairs than those under the old system.”

The progress made in the establishment of the new system from year to year is shown by the following figures:—

ROCHDALE SYSTEM.

Year ending	No. of Privies.	
	Old Borough.	Extended Borough.
1870, March 31 -	527	—
1871, ” -	1,070	—
1872, ” -	1,690	—
1873, ” -	2,309	—
1874, January -	about 3,250	—
” September -	—	4,397

The form of privy (closet) is not prescribed by a formal specification, but a pattern (*Plate X.*) for builders, which may be modified to suit special requirements of space, is placed in the yard of the manure works; and certain structural details are required of which I subjoin a summary.* An approved form of adaptation to new buildings is drawn

* The following is a summary of certain structural details required in pail-closets:—

Floor of privies and ashpits to be flagged with 3-inch flags; lintels to be $4\frac{1}{2} \times 3$

in *Plates XI., XII.* In the pattern it is shown that the excrement pail may be removed either at the back or side of the seat, or at the front; the seat being hinged and its front made moveable as a slide or on hinges to admit of this. The seat itself has a deep metal rim beneath the aperture for directing the urine into the pail. The building must be effectively roofed, and the floor is required to be flagged with Rochdale flags at or above the level of the court or passage; and in the case of reconstruction of middenstead privies, the middenstead must be properly filled to the same level. In certain instances of the pail-closets which came under observation, the space for the ash-tub was needlessly large, and had given occasion to some unsightly littering of dry refuse upon the floor.

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Two kinds of *excrement pail* are in use, one for houses, the other for factories. The former is a wooden pail formed from the half of a disused paraffin cask, with handles attached and with lids (*Plate XIII.*). The latter is a galvanized iron pail, also with handles and lids. The wooden pail has a capacity of 100 lbs., and costs complete for use 4s. 9d. The metal pail, of larger capacity, costs 9s. 6d. The wooden pail is of the same kind as was in use in 1869, and it is still held to be more convenient and economical than a metal pail for the purpose to which it is put. The metal pail deteriorates somewhat rapidly at the bottom, and a wooden bottom is now being substituted for the metal when it needs repair. In 1869 the lid of the pail was single, and it was fixed in place so as to prevent stink being diffused from the contents during removal by an india-rubber packing. A different arrangement is now adopted, two lids being used, an inner and an outer, both resting within a groove inside the pail, the outer lid fixing the inner lid, as shown in *Plate XIV.* These lids being made of metal, I observed in a few instances that they had been battered by use out of form, and consequently did not fit into the groove of the pail as closely as was desirable.

The *ash tub* is usually a tub with handles in the form and dimensions given in *Plate XIII.* I noticed in the course of inspection that it would be well that the scavengers should be provided with the means of scraping, and have instructions to scrape such tubs as from whatever cause might be furred within.

The *removal* of the excrement pail is effected in a covered van, and of the contents of the ash tub in an open cart. Both van and dust cart differ in design from the van and dust cart used in 1869. The van (*Plates XV., XVI.*) is constructed to hold 24 excrement pails arranged in two rows, and placed within it from either side, flaps being raised for the introduction of the pail. The flaps when fastened down rest upon hollow india-rubber beading, which effectually closes the interstices between the lid and the body of the cart. The *dust cart*, which in 1869 was a covered vehicle, is now a simple open cart (*Plate XVII.*).

The arrangements for the removal of, and process of removing the excrement pails and dry house refuse are as follows:—The town is divided into six districts for the purposes of removal, and the dry house refuse is removed at the same time as the excrement, a dust cart accompanying each night-soil van for the purpose. The removal is all

spars $3 \times 1\frac{1}{2}$ and 16 inches, centre to centre; wall plates to be $4\frac{1}{2} \times 3$; roof covered with Welsh slates 20×10 , lap, 3 inches; ceiling of privies, lath and plaster to spars; urine flags to be $1\frac{1}{2}$ inches thick; seats $1\frac{1}{4}$, nosed and fixed on bearers; door frames, $4\frac{1}{2} \times 3$, wrot., rebated, and chamfered; doors, 1 inch, and edges $7 \times 1\frac{1}{4}$, T hinges and secured with latch and catch; each door to have lock and keys; wood gutter 6×4 , with 2 inches down-spout, head, &c.; iron conductors to be fixed under privy-seat.

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effected during the ordinary working hours of the day, the vans commencing their rounds at 7.0 a.m., and ending at 5.30 p.m. Each night-soil van makes five rounds daily. It leaves the yard laden with clean empty pails, each pail containing a quantity of a "disinfectant," and returns carrying the pails containing excrement, for which the empty pails have been substituted. The process of substitution is effected by the scavengers withdrawing from beneath the closet seat the pail containing excrement, covering this up with the lids already described, removing it to the van, an empty pail being left in its place, and on placing the pail in the van sprinkling over the outer lid a little carbolate of lime. The ash tub is then carried to the dust cart and its contents simply tilted into it. Each pail closet is numbered and registered, and the scavengers proceed from closet to closet systematically, according to the portion of their district within the day's beat, reporting at the end of each round the closets from which the pails had been removed, and those, if any, which had been omitted. The greatest number of omissions for any one month in the whole town has been 42, for any one week 14. Each Monday the scavengers' returns are balanced, and a supplementary van with dust cart sent out to rectify omissions. In the case of lodging houses and closets used by several families the excrement pails are removed twice or thrice weekly.

On the return of the vans and dust carts to the yard, the collections of excrement and dry house refuse are immediately dealt with. The contents of the ash tubs are screened by machinery, to separate the fine coal-ash from the cinders and other refuse. The cinders are then set aside for use in the furnaces and for sale, the refuse metal, leather, and rags are sold, and the vegetable refuse burnt. The fine coal-ash is used in the process of manure manufacture. Deposited on the floor of sheds trenches are made in it, and into these trenches the contents of the excrement pails are poured as received. The excrement is then covered with fine ash, and a quantity of sulphuric acid is added to facilitate drying. At intervals of about seven days other excrement is added to the mass, and this process is repeated three times. The mixed mass of excrement and coal-ash is then left undisturbed for a period of 14 days, when it is turned over. After another seven days it is again turned over. Then it is left undisturbed a week, when the process of manufacture is complete, and the mass has become pulverulent and inodorous. The proportion of excrement to fine ash in the finished manure is 80 parts of the former to 35 parts of the latter. The sulphuric acid added is in the proportion of 25 lbs. to 1 ton of the excrement.

After the excrement pails have been emptied, they are arranged upon a stand and effectually cleansed by water delivered under 40 lbs. pressure from a hose; and before being again sent out of the yard there is placed in each tub a quantity of "disinfectant" (a half-pint in the cooler months and one pint in the warmer) made at the works from the following formula:—

Chloride of lime	-	-	-	10 parts.
Crude alum	-	-	-	10 "
Brown sugar	-	-	-	1 "
Water	-	-	-	100, mix.

This antiseptic has been adopted as giving the most satisfactory effects in arresting decomposition, after a trial of sulphate of iron, and other antiseptics. The vans also are sluiced out after each round; once a week they are thoroughly cleansed inside and out; and occasionally the interior is coated with gas-tar.

Of the economical advantages of the Rochdale system actually and as

compared with the midden system, the following tabulated statements, prepared for the Corporation, have been submitted to me. These statements show that while for the period referred to in the first table, the net cost per annum, per 1,000 of population, for the removal and disposal of excrement and dry house refuse on the midden system in the towns named was in one instance (the maximum) 77*l.*, and in another instance (the minimum) 35*l.*, the average for the whole of the towns being 57*l.*, the net cost of the Rochdale system in 1873 was 19*l.* only. I subjoin a detailed account of one week's collection and manufacture on the new system, taken from the explanation already referred to.

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MIDDEN SYSTEM.

TABLE showing the net Cost of removing and disposing of Night Soil, &c., on the Midden System, in the surrounding Towns whose populations are similar, and whose market for the sale of manure is the same as Rochdale.

—	Cost 1872.	Population.	Cost per 1,000 persons per annum.
	£		£
Rochdale - - - -	1,596	22,484	71
Oldham - - - -	6,478	84,000	77
Bolton - - - -	2,966	84,853	35
Manchester - - - -	21,700	360,000	60
Salford (township) - -	4,508	83,280	54
Pendleton (township) -	1,164	26,574	44
Ashton - - - -	1,982	32,800	60

ROCHDALE SYSTEM.

TABLE showing the Cost of the Removal of the Night Soil of the Town of Rochdale, and its Manufacture into a Manure by the Rochdale System.

Year ending	No. of closets.	Collected.		Manure.		Houses.	Mills and Workshops.	No. of Persons using the Privies.	Gross Expenditure.	Manure made.	Net Cost
		Excreta.	Ashes.	Made.	Sold.						
	Tons.	Tons.	Tons.	Tons.	Tons.				£ s. d.	£ s. d.	£ s.
1870, Mar. 31	527	398	611	377	217	1,048	12	5,797	694 17 6	537 19 5	156 18
1871 "	1,070	846	1,521	1,059	699	2,944	31	11,770	1,538 7 11	1,380 14 3	157 13
1872 "	1,690	1,431	2,405	1,556	1,019	3,174	39	19,283	2,392 13 0	2,167 17 3	224 15
1873 "	2,509	1,989	3,413	1,989	412	4,560	69	26,984	3,463 6 11	2,826 16 1	637 10
1874 "	3,980*	3,516	5,196	3,497	1,543	7,287	106	†43,500	5,284 3 7	4,449 11 2	834 12

* Increase 1,471, of which 165 were for new houses.

† Being two-thirds of the borough.

STATEMENTS showing separately the COST of COLLECTION and MANUFACTURE on the ROCHDALE SYSTEM.

Week ending September 24th, 1873.

Number of privies on the new system - - -	- 3,354
Number of dwelling-houses to do. - - -	- 6,213
Number of factories and workshops to do. - - -	- 76
Number of population - - -	- 36,894

The total weight collected from the before-named places was—

Ashes, - - - -	- 96 tons.
Excreta - - - -	- 71 "

Or a total of - - - - 167 tons.

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No. 1.

COST OF A WEEKS' COLLECTION.

	£	s.	d.
3 receptacle washers, at 22/0 per week -	3	6	0
2 labourers to load and unload carts -	2	4	0
16 collectors, including 8 carters, at 22/6 per week -	18	0	0
Keep of 8 horses, including farriery and saddlery, but not rent -	6	16	0
Horse keeper -	1	5	0
3 labourers or wharfmen for storing and loading for sale, each labourer having to store 9 tons odd each per day in addition to loading -	3	6	0
Book keeper and wharfinger -	1	10	0
Office boy -	0	15	0
Town inspector and manager -	2	0	0
Carried forward -	39	2	0

	£	s.	d.	£	s.	d.
Brought forward				39	2	0
The capital and depreciation is as follows:—						
Receptacles value 1,200l., depn. per annum -				240	0	0
Ash tubs value 125l., depn. per annum -				25	0	0
Horses and gear value 700l., depn. per annum -				100	0	0
Vans and carts value 450l., depn. per annum -				64	0	0
Capital in plant 2,475l., interest -				123	15	0
Rent of wharf and stables, rates, taxes, &c. -				150	0	0
				£702	15	0
702l. 15s. per annum is per week -				13	10	3
Total weekly cost of collection equal to 6/3½ per ton -				£52	12	3

No. 2.

MANUFACTURE : A WEEKLY BALANCE SHEET.

Dr.	£	s.	d.
Wages:—			
3 cinder sifters @ 22s. 6d. -	3	7	6
1 manager and engine tender -	1	10	0
2 labourers -	2	4	0
1 boy -	0	7	6
	7	9	0
Materials:—			
Chemicals -	8	0	0
Bags -	1	0	0
Implements and machinery -	1	0	0
	10	0	0
Depreciation:—			
2 per cent. per annum on 4,730l. for plant -	1	17	0
	1	17	0
Capital:—			
5 per cent. per annum on 4,730l. -	4	10	0
	£23	16	0

Cr.	£	s.	d.
By 71 tons of manure @ 1l. per ton -	71	0	0
By 28 tons of cinders for sale @ 1s. 6d. per ton -	2	2	0
By rags, iron, glass, &c.,— say -	0	5	0
	73	7	0
Deduct—			
By cost of manufacture, as on Dr. side -	23	16	0
By commission to agents on sale of manure -	7	2	0
	30	18	0
By net profit on manufacture -	£42	9	0
The cost of collection this week was -	52	12	3
Deduct profit on manufacture -	42	9	0
Making the total cost to the town -	£10	3	3
for the removal of excreta and house refuse of a population of 36,894, being at the rate of 14l. 6s. 8d. per 1,000, per annum.			

The manure made is here put down at its selling price, although its value as now made is much greater than it was formerly, as four tons of night soil are now used to 1 $\frac{3}{4}$ tons of ash.

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The 167 tons of night soil and refuse thus dealt with by the manufactory was disposed of as follows :—

Rochdale.

56	tons of cinders.
8	„ refuse, rags, glass, paper, &c.
32	„ water evaporated.
71	„ manure made.
Total	167

Another statement by way of comparison between the economic working of the midden and pail systems has also been made to me. Taking the whole borough within its enlarged limits, 44,000 of the population are under the pail system and 22,000 under the midden system. The staff and plant required for the scavenging of 4,000 closets under the pail system consist of 11 carters, 11 other men, “guards,” 9 night-soil vans, 10 dust carts, and 11 horses. The staff and plant required for the scavenging of 2,000 closets under the midden system, consist of nine carters, nine emptiers, one foreman, 10 carts, and 9 horses.

When Dr. Buchanan and I studied the working of the Rochdale system, as it was seen in operation in 1869, we formed a high opinion of its advantages as a means of controlling and abating excrement nuisance, particularly as compared with the system for which it was being substituted. In the recent inspection I have again submitted the working of the system, so far as it relates to the question of nuisance, to a detailed examination, particularly in view of certain objections which have been urged against it. These objections referred to asserted offensiveness in the changing of the excrement pails and their being carted through the streets, and to averred danger arising from the collection of unmixed excrement in pails. The construction of the closets, as I have already had to observe, at once removes the evils of the middenstead. The absence of marked excremental odour of separate closets used by single families, in the greater number of the instances examined, after seven days use, was remarkable. In one instance only, that of a block of closets opening beneath a common roof and into a common passage, was the odour striking; but even in this case the odour was only perceptible within the building, and was quite inconsiderable compared with the stink of a neighbouring middenstead. The removal of the excrement pails from beneath the closet seat, the affixing of the lids and carriage to and placing within the night-soil van, were done with great celerity and without a trace of nuisance; and I satisfied myself that in this process, and in the subsequent cartage of the tubs, nuisance could only arise from gross carelessness of the scavengers. The Corporation, in addition to exercising a strict supervision over the process, are desirous to diminish even the semblance of nuisance from the removal of the pails. An experiment is now being tried in one district of the town, containing 993 pail-closets, of collecting the excrement pails apart from the collection of the contents of the ash tubs. By increasing the number of vans in this district, and employing the whole of the men, in the first place, upon the removal of the excrement pails, it is hoped to complete this part of the work before 11 a.m., and perhaps even earlier; the collection of the dry house refuse being left to the after part of the

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day. Should this experiment succeed, the same arrangement will be adopted generally throughout the town. I made particular inquiries of householders as to offensiveness arising from the pail system; but in every instance decisive testimony was given as to its inoffensiveness as compared with the midden system, and an equally decisive opinion expressed against a return to the latter system, whether as regards mode of depositing the excrement or of its removal. In order to leave nothing to the imagination, I sought to obtain permission, after inspecting the work of removing the pails and their cartage in the night-soil vans, to have the contents of a middenstead removed before nightfall. But I was foiled in carrying out this perhaps most needless experiment in stink by the officials of the night-soil department objecting to undertake the task during the daytime, for the very significant reason that it would provoke disturbance in the town. Complaints to the Corporation of offence from pail-closets rarely arise; complaints as to offence from midden closets are the rule, for a midden closet is not cleansed except on request of its owner or of the inspector of nuisances—until, in short, it has become a nuisance in the ordinary sense of the word.

The objection urged against the pail-closet as dangerous to health rested upon the assumption that the collection of the unmixed excrement and its cartage through the town would disseminate enteric fever, and other diseases connected with excremental nuisance. No facts are stated in support of the assumption, and it is sufficient to say that the opportunities of such dissemination from the pail-closet as managed at Rochdale are wholly insignificant as compared with the midden-closet for which it is being substituted. It has been overlooked, moreover, by the objectors that the pail-closet gives particular advantages for effectively limiting the prevalence of the diseases referred to. This is one of the reasons which have influenced the Corporation in adopting it.

It is no part of my business to express an opinion upon the ultimate disposal of the excrement and dry house refuse, but I may observe that every care is taken to avoid nuisance in the manufacture of the manure.

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MANCHESTER (1871; population, 351,189; inhabited houses, 67,204).—When Dr. Buchanan and I visited Manchester in 1869 there were 10,000 waterclosets and 38,000 middensteads in the city; a middenstead being in many instances used in common by several families. Waterclosets were discouraged except in higher class houses; and changes now being made by the Corporation in the construction and regulation of privies other than waterclosets will tend still further to their discouragement. In 1869 the Corporation fully recognising the evils arising from the common privy with open middenstead, had instituted itself and permitted others to institute several experimental methods for obviating the offensiveness and unwholesomeness of this form of excrement disposal. These methods were designed to secure in various ways dryness of the contents of the middenstead; diminution of their offensiveness by covering the deposited excrement with ashes and house refuse, and by restricting the amount of accumulation; dispersion of any noxious gases formed during decomposition of the contents at some safe point; and prevention of leakage or soakage from the middenstead. Roofing and drainage of the middenstead, and occasionally a mechanical device for diverting into the drains urine passed at stool, constituted the principal arrangements for obtaining

dryness. Sifting ashes through a screen so arranged that the fine ash fell upon an inclined plane and was directed beneath the privy seat, or casting the ashes and house refuse in bulk beneath the privy seat, hinged so as to be raised for the purpose, or through an aperture at the level of the privy floor were the means adopted for covering the freshly-deposited excrement, the ashes contributing also by reason of their absorbency to dryness of the middenstead contents. The removal and dispersion of noxious gases formed in the roofed middenstead were sought by a ventilating shaft. Finally the middenstead was restricted in size, and leakage and soakage were provided against by certain peculiarities of construction, or by the substitution of a wood or metal receptacle for the fixed middenstead.

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The Corporation at this time required that the several objects aimed at by the arrangements mentioned above should be provided for in all new middenstead privies or middenstead privies which had to be reconstructed, specifying the main structural requirements. These included, with regard to the middenstead, roofing with slates or flags well pointed, and flooring with Rochdale flags of not less than 3 inches in thickness, bedded in mortar, and laid with proper inclination to a drain outlet; and, with regard to the privy, a construction such as to ensure the ashes being deposited upon the excrement, the seat to this end being hinged and having a hinged "riser." The depth of the middenstead was limited to 5 feet from the sill of the emptying hole (2 feet below the level of the ground); and the door of the emptying hole was to be provided with a lock and key of approved pattern.

Notwithstanding the improvement gained in the construction of the common middenstead privy by these regulations, the new middensteads, as Dr. Buchanan and I observed in our departmental report on the subject, were large enough to hold three or four months' accumulation of excrement and refuse; the scavenging arrangements of the Corporation only contemplated the removal of this accumulation when the pit was ready to overflow; and the drainage was fatal to any possible defence of the midden system at all.

Further experience has convinced the Corporation that the accumulation of filth contemplated by the arrangements approved in 1869, although much less than previous accumulation, was inconsistent with wholesomeness of the atmosphere about dwellings; and that the infrequent scavenging which these arrangements involved was not sufficient to meet the sanitary necessities of the city. An examination, moreover, of the drains and smaller sewers in various parts of the city, made under the direction of the medical officer of health, Mr. John Leigh, disclosed a state of things, from the accumulation in them of solid refuse from middensteads, which is best described in Mr. Leigh's own words. He writes in a report, prepared in February 1874, (p. 21) as follows:—

"Some time ago I caused to be sunk in every township of the city a series of shafts down to the drains and sewers situated respectively in courts, passages, narrow secondary streets, and in the broader primary ones. The greatest accumulations I found in the drains at the backs of houses, in courts, passages, and in narrow streets. Some of the drains in these were quite full of solid matter, others had a few inches of space above the deposit. The sewers in the large streets were as a rule comparatively free, though occasionally a large amount of deposit was found. In all openings made into the drains the extent of deposit was generally the greatest at the highest point, gradually tapering off towards the outfall. Upon examination the deposit was found to consist of

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small coal, ashes, bits of broken pot and fœcal matter, cemented by the latter into a strong mortar, which after being allowed to stand for a short time gave off very offensive gases, which bubbled up through the deposit. The matter had in fact all been derived from the ashpits and privies. The two figures

Fig. 6.

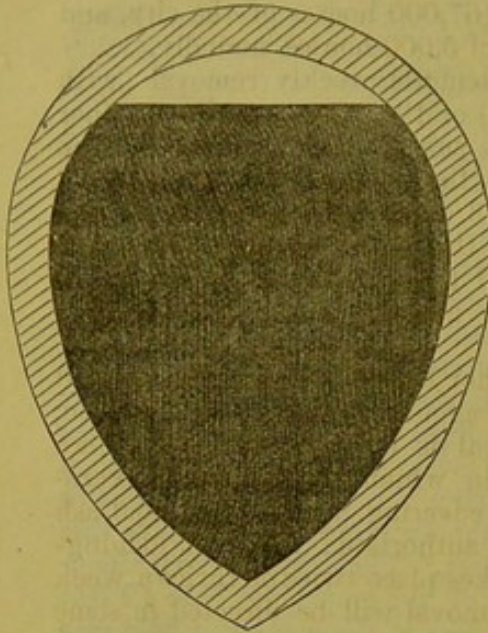
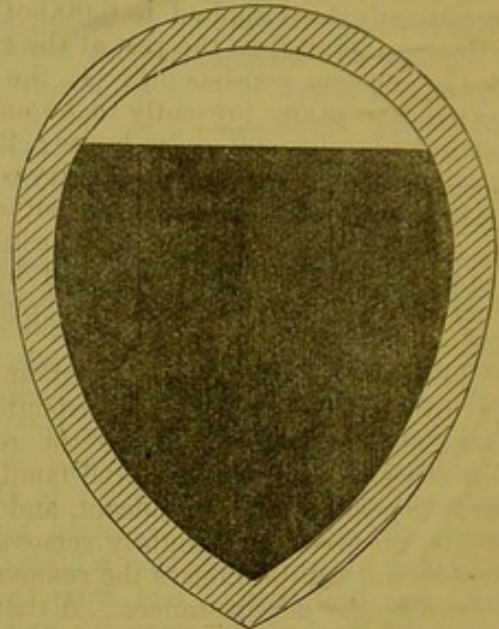
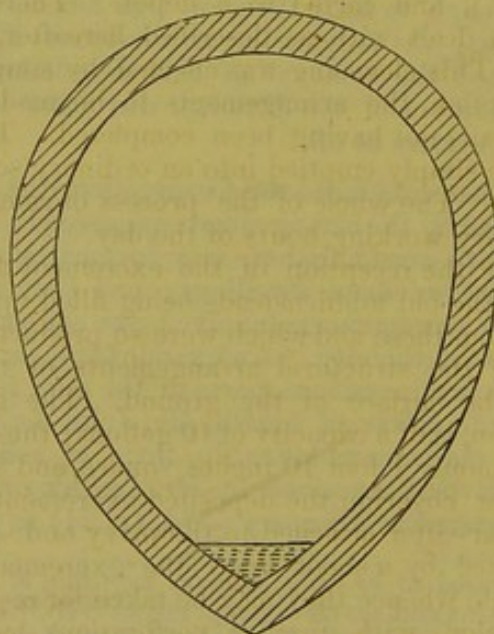


Fig. 7.



(Figs. 6 and 7) represent the sections of a drain in Joddrell Street. It will be seen that the drain is nearly full. The contents were as black as the ink in the diagram, and were excessively offensive. The lowest figure (Fig. 8)

Fig. 8.



represents the section of a drain in a passage behind Collyhurst Road, which had been laid down about eighteen months, and which was not in connexion with any ashpit or privy drain, but drained the adjoining houses. The deposit was about three-fourths of an inch of gray silt or sand. Several drains similarly situated in Chorlton-upon-Medlock were likewise opened with a like result."

In view of the evils left untouched by previous experiments, the Corporation next proceeded to establish a frequent systematic removal

of excremental and other household refuse and to do away with middensteads, substituting for them moveable receptacles. In this way was gradually developed the system of excrement disposal now fully accepted by the Corporation and being put into operation in the city. This system, which involves the reconstruction of all middenstead privies, has already been applied to 6,000 of the 67,000 houses of the city, and is being extended to the rest at the rate of 5,000 houses annually.

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The system consists in: 1, the systematic weekly removal (with certain exceptions presently to be named) of the excremental and other household refuse of every house; 2, the substitution of pails for the reception of the excrement and dry refuse, the excrement being deposited in one pail, the dry refuse in another; 3, the covering up of the deposited excrement with fine coal ash; 4, the ventilation in a particular manner of the space beneath and behind the privy seat, in which the excrement and refuse pails are placed; and 5, the utilization of the excrement and other refuse.

The removal of the excrement and other household refuse is carried out by the Corporation itself through the agency of its own staff of men, carts, and horses. As a rule the removal is effected weekly, but in a few cases of small well-ordered families, in which the amount of excrement deposited is insignificant, and its covering up with fine coal-ash can be ensured, a fortnightly removal is authorised; while in lodging-houses and sub-let houses the removal takes place twice or thrice a week according to circumstances. A daily removal will be directed in some localities, if eventually this should be found advisable. The excrement pail, with its contents, is at each removal taken away entirely, a clean pail being deposited beneath the privy seat in its place. The pail, a lid having first been placed upon it to cover the contents, is carried to a covered van constructed after the Rochdale fashion (see *Rochdale* and *Plates XV. and XVI.*), and carted to a dépôt. There the contents are emptied out, to be dealt with as described hereafter, and the pail cleansed for re-use. This cleansing was effected by simple brushing at the time of my inspection, the arrangements to be made for washing and disinfecting the pails not having been completed. The contents of the dry-refuse pail are simply emptied into an ordinary scavenger's cart, and the pail replaced. The whole of the process of removal is carried on during the customary working hours of the day.

The use of pails for the reception of the excrement and dry household refuse admits of the old middensteads being filled up, of the drains which formerly ran from these and which were so productive of nuisance being removed, and of the structural arrangements of the privy being wholly kept above the surface of the ground. The excrement pail, made of galvanised iron, is of a capacity of 10 gallons; the dry-refuse pail, made of wood, is commonly 1 foot 10 inches square, and 18 inches high.

The arrangement for covering the deposited excrement with fine coal ash, consists of a cinder-sifter attached to the privy and so designed that the fine ash is directed by a shoot upon the excrement, the cinders falling into a receptacle whence they may be taken for re-burning. The sifter is formed of zinc, with circular perforations half an inch in diameter; this construction having been found by experience less liable to deterioration and to blocking up of the perforations.

Ventilation of the space beneath and behind the privy seat is provided for by a flue which is required to be carried 3 feet above the eaves of the house.

The excrement and dry house refuse are dealt with at the dépôt to which they are conveyed in the following manner. The excrement is manufactured into a manure by mixing with it fine coal ash in about equal bulk, and a small proportion of gypsum (1 lb. to 100 lbs. of the

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mingled mass) with the object of fixing ammonia. Subsequently street sweepings and the refuse of slaughter-houses are added. In order to enrich this manure, cottagers are being encouraged to preserve urine, which would otherwise be cast down the drains; the scavengers removing it at the same time as the excrement. The dry house refuse consists chiefly of cinders, broken pots, rags, waste iron, and tin, old boots and shoes, bones, bits of leather, animal and vegetable refuse. The cinders when the arrangements of the Corporation are complete will all ultimately be consumed in the *depôt* furnaces; the broken pots are ground up with lime and sand for mortar; a ready sale is found for tin and scrap-iron with the copperas manufactures, also for old boots and shoes, bits of leather, woollen rags, and certain animal matters with the prussiate of potash manufacturers, in each case at the rate of 10s. per ton. Such refuse as remains unutilized is destroyed by fire.

I add drawings of an elevation and section of the Manchester dry-ash closet (*Plates XVIII., XIX.*); also the detailed specification of the several works required by the Corporation in the reconstruction of privies, together with the illustrative drawings. (*Plates XX.—XXIV.*)

"SPECIFICATION of the several works required in the reconstruction of PRIVIES.

- Foul earth. "The foul earth under the old ashpits and privies must be entirely taken out, and at once carted away from the works.
- Filling in. "The old ashpits must be filled in where required, with suitable dry hard material, small and well rammed in level courses not exceeding 6 inches in thickness.
- Ash-pit floors. "The floor of the ashpit is to be flagged with a Rochdale flag, not less than 3 inches in thickness, properly squared and jointed, bedded in mortar, and laid with an inclination of 1 inch towards the door.
- Privy floors. "The floor of the privy is to be flagged or tiled, and laid with an inclination of half an inch towards the doors, and raised 9 inches from the level of the yards, or 18 inches from the level of the passage.
- Lintels. "The lintels carrying the $4\frac{1}{2}$ inch division walls, between the flues and the privies, must be set flush with the under side of the privy seat.
- Cinder sifter from the yard. "A side cinder sifter must be fixed to each privy, and in all cases where practicable must be fixed so that the ashes can be thrown in from the outside of the privy in the yard, and pass down the shoot directly under the privy seat, as per detail drawing No. 2; but in any case where the receptacle is to be emptied from the front, from under a folding riser and seat, or in other special cases approved of by the health committee, then the cinder sifter must be fixed at the back of each privy seat, as per detail drawings Nos. 3 and 4.
- Cinder sifter inside the privy.
- Refuse frame. "Wherever side cinder sifters are fixed a refuse shoot must be provided, or a door 12 in. by 9 in. (as shown in detail drawing No. 2), and hung to frame $4\frac{1}{2}$ in. by $1\frac{1}{2}$ in. built in, for passing refuse, broken pots, &c.
- Privy seat. "The privy seats to be fixed on bearers, $2\frac{1}{2}$ in. by 2 in., let into the flag riser at the front, and secured to the lintel at the back, the depth of the flag from the privy floor to the underside of the seat to be 17 in.
- Folding seat. "Where there is no yard space, and a privy is shown underneath a room, a folding riser and seat must be provided (as shown on the detail drawing No. 4), firmly braced together by wrought-iron stays, and hinged with strong wrought-iron bands and gudgeons, the gudgeons being either plated and fixed with screws or driven into the lintels which carry the $4\frac{1}{2}$ in. division wall.
- Seat cover. "Each seat is to have a fall cover 1 in. thick, hung with 10 in. bands and gudgeons.
- Privy doors and frames. "The doors to the privies must be 1 in. thick ledged doors, hung to frames $4\frac{1}{2}$ in. by 3 in., with strong wrought-iron bands and gudgeons, and left 3 in. short at the top.
- Ash-pit frame and doors. "The emptying holes of the ashpits shall be 3 ft. 6 in. high by 2 ft. wide inside the door frames, or in special cases (approved by the Health Committee) 19 in. square, and built in with the brickwork, the doors to be cross boarded and finished $1\frac{3}{4}$ in. thick, and hung to frames $4\frac{1}{2}$ in. by 3 in., with strong bands and gudgeons, and secured with a latch approved by the health committee; the door to overhang and to overlap half its thickness, $\frac{3}{4}$ in. on three sides on the inside edge of the frame, and to be left $\frac{1}{2}$ in. short at the bottom.

The bottom of the ashpit is to be 3 inches above the level of the adjoining passage, and sleepers $4\frac{1}{2}$ in. by 3 in., for guiding the receptacles, must be fixed as shown on the detail drawings.

"A galvanised iron receptacle, 15 in. high and 18 in. diameter, together with a wooden receptacle for the cinders, broken pots, &c., 1 ft. 10 in. square by 18 in. high, or in special cases 2 ft. 6 in. long by 18 in. wide and 18 in. high may be procured free of cost, from the Health Committee, at the Town's Yard, 279, Oldham Road, on production of an order for the same.

"A urine guide must be fixed underneath each seat with screws.

"The ashpits must have ventilating flues constructed of brickwork or of earthenware pipes; the size of the flue to be (if square) 9 in. by 9 in., if of circular earthenware pipes 6 in. diameter, and carried when practicable up the side of the wall to 3 ft. above the eaves of the house, and secured to the walls with strong bands and clips.

"The privies and ashpits must be covered with either slated or flagged roofs, well pointed with lime and hair mortar.

"The privies must have two coats of limewash.

"All the woodwork with the exception of the privy seats, must have two coats of good bodied oil paint.

"The yards must each have a trap and grid, placed in such a position that the waste pipe from the slop stone shall discharge itself on to the grid.

"All flagging and other necessary work to be done to the satisfaction of the Committee.

"Cinder sifters, urine guides, &c. may be purchased from the Health Committee, at the Town's Yard, corner of Osborne Street, 279, Oldham Road, Manchester.

"Patterns of locks and keys, bands and gudgeons, grids and traps, cinder-sifters, and refuse shoots may be seen at this Office, and no other patterns will be allowed.

"The whole of the works to be executed to the entire satisfaction of the Officer of Health, and to be certified in writing by him.

"Written notice must be given at this Office three days before the work is commenced, and also when completed.

"Inquiries to be made at the Health Office, York Chambers, King Street."

The drawings show the most ordinary arrangement of the new closet, but in inspecting reconstructed privies I was struck with the readiness with which the different parts of the closet admitted of being adapted to meet peculiarities of available space.

In order to facilitate the reconstruction of privies the Corporation has established works in which the wood fittings of the closets are manufactured on a great scale, and it supplies these as well as all other fittings to builders. The excrement and dry-refuse pails are furnished by the Corporation free of cost.

In the series of inspections I made with reference to the working of this new system, I had occasion first to observe the contrast as to nuisance between the dry-ash closet and the old midden closet. In several streets where the process of reconstruction had been only partially completed it was possible to compare the old and new privy arrangements in contiguous premises. It was the contrast between open, big, uncleanable cavities, containing a greater or less amount of decomposing faecal matter, and emitting a horrible, penetrating odour, and between small receptacles emitting hardly any appreciable smell, even with the nose above the privy seat, and admitting of thorough cleansing. Most significant testimony was given to the benefit of the change by some householders. Many houses in Manchester are built in parallel rows, a back passage running between the rows, and each house having a small yard in the rear in which the privy is placed. Since the reconstruction of the privies "*it has been possible to open the back windows of the houses.*" The change, moreover, has affected

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Manchester.
Receptacles.

Urine guide.
Ventilating flues.

Roofing
Whitewashing.
Painting.

Yard grids.
Flagging.

Cinder sifters,
&c.

Locks, hinges,
&c.

Work to be
satisfactory.

Notices to be
given.

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beneficially the value of cottage property, and tenants are quite willing to give 3*d.* more rent weekly since the reconstruction of the privies for the gain in decency and comfort. Soakage of excremental matter into the soil, and its passage into and accumulation in drains is, of course, obviated by the reconstruction; and the smaller space occupied by the new closet is not an unimportant matter. The removal of the excrement pails is, with the most ordinary care, free from offensiveness, and if commonly conducted as I saw the operation, it may well be executed during the day-time, and the abomination of night scavenging done away with. The use of the cinder sifters has been adopted by householders with a readiness which proves how accurate the Corporation was in depending upon their co-operation in the working of the scheme. The high price of coal during the last two years has contributed to this good result, from the value of the cinders in economising its use. It is found, also, that a class of the population, commonly believed to be unmanageable in regard to any niceties of arrangement for excrement disposal, have rapidly appreciated the advantages of the new closet, and taken to the use of the cinder-sifter. In other words, it has been found that habits of decency and order in the particular matters referred to have been largely developed with the opportunities for such decency and order. Among the lowest class, occupying sub-let houses, and having privies used by several families in common, it will, however, probably be found necessary to adopt some special supervision, and to remove the excrement and dry-house refuse daily.

Mr. Leigh attaches great value to the deodorising effects of the fine ash. Limiting my remarks upon this subject to what I observed in the actual working of the closet, I would say that when the excrement was fairly covered by fine ash and undisturbed there was no marked odour perceptible from it. But the amount of fine ash scattered above the excrement varied very greatly according to the care given by householders, and more especially according to the times at which the ashes were sifted. Great differences were in consequence observed in the quantity of exposed excrement, and some differences in the faecal smell. But where least care had been taken, and also where the pail contained simply the uncovered excrement of several days' accumulation, the faecal odour was inconsiderable.

The success of the new system depends chiefly upon the completeness of the arrangements for the systematic removal of the excrement and other refuse. The scavenging, both of streets and houses in Manchester at the time of my visit was under the control of a Scavenging Committee, while the regulation of privies and ash receptacles was under the charge of the Health Committee. It was a matter of experience that the inability of the Health Committee to exercise direct control over the scavenging of excrement and dry house refuse, interposed a serious difficulty to the efficient exercise of its duties in preventing nuisance from these sources; and the Scavenging Committee had passed a resolution recommending the Corporation to transfer to the Health Committee the charge of the arrangements for the scavenging of "nightsoil" and dry-house refuse. This resolution the Corporation has since approved, and it has now been carried into effect.

Sanguine expectations are entertained that the measures adopted for the utilization of the excrement and other house refuse will ultimately go far to reimburse the Corporation for the costs imposed upon it by the new system. To whatever extent this expectation may be realized, the Corporation by directing the reconstruction of all privies of the old kind upon this new system, manifests confidence in the sufficiency of the

system to meet the sanitary requirements of the city as to abatement of excrement nuisance, and the ultimate disposal of excremental and other dry house refuse.

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Halifax.

HALIFAX (1871, population, 65,510 ; inhabited houses, 13,970).—Few things came under observation during the inquiry conducted by Dr. Buchanan and myself in 1869 more remarkable than the arrangements for excrement disposal in this town. The midden system was that common to the greater number of houses, and was here witnessed in its most repulsive form. The chief object of our visit had been the arrangements existing in the two suburban districts of Akroydon and West Hill Park, built, the former by Colonel Akroyd, M.P., and the latter by Mr. John Crossley, M.P., as models of cottage construction for artisans. The description we then gave still applies, for, with a few exceptions, the cottages in these districts are provided each with midden-closets placed in a small yard in the rear, and constructed to contain several months' accumulation of excrement and dry house-refuse. "At West Hill Park the ashes are thrown into an opening under the seat, so that the excrement is well covered, and the pit is roofed in; but at Akroydon the ashes are thrown in at a separate door, and the middens are wet and fetid, there being no roof to the pit. At both places the privies occupy a considerable part of the small back yard, and have the peculiarity of being sunk two or three steps below the ground level, so that the pit is of course deeper still. This arrangement makes the privies less conspicuous objects from the house windows, and when the pit is roofed flowers are occasionally grown on the top of it. But this sinking of the privy helps the contamination of the ground by the excrement, makes the pit more difficult of drainage, and is nowise to be commended."

In the town newly built privies were observed, constructed according to a regulation which required each house to have its own privy, but in which the privies were placed in blocks above a common middenstead, the privy seats being hinged so that the ashes could be thrown upon the deposited excrement. We observed of this arrangement at the time, that "it introduced the evil of the public closet without the only justification of such closets, the lessening of the area of filthiness."

The Corporation exacted a charge of from 1s. 4d. to 2s. per cubic yard for removing the contents of middensteads. "Halifax," indeed, as we remarked at the conclusion of our report on that town, "well illustrates the dependence of constructive arrangements upon the public regulations of the town. A charge for such emptying of a privy (even though levied according to quantity) amounts in effect to a tax upon frequent removal of excrement. Pits come to be constructed of the largest available size, and their contents are retained in the hope of making a more profitable bargain with some farmer."

Since 1869 the *Goux Patent Absorbent Closet System* has been introduced into the town, and it is estimated that about one-third of the midden-closets have been reconstructed on this system. The total number of closets in the town on the Goux system on the 19th May 1874 was 2,573. Dr. Buchanan and I had seen this system at work in Salford in 1869, and as there managed, as I have stated in my report on that town, we observed no sanitary advantage which was not to be obtained from a simple pail system. A detailed examination of the working of the system in Halifax showed, as a rule, a less degree of offensiveness to the eye than is commonly observed in the simple pail system.

The Goux system is a pail system of which the peculiarity consists in

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a certain preparation of the pails and in a particular mode of manufacture of the excrement into manure, and utilization of the dry house-refuse generally. I am here concerned with so much of the system only as relates to the abatement of excrement nuisance in the vicinity of dwellings. The pail used preferably in the Goux system is of wood, of oval form, and measures 24×19 inches and 16 inches deep. It is prepared for use by being lined at the sides and bottom three or four inches thick with various refuse matters used as absorbents. These matters may be (to quote from a trade circular) "chaff, chopped or broken straw, damaged or refuse hay, coarse grasses, moor grass, dry street sweepings, dry horse dung and litter, sweepings of markets, hay and straw lofts, refuse wool and hair, wool, shoddy, varic or seaweed, charcoal dust, dry peat, dry ferns, spent dye woods, coal ashes, &c., any, or all of these, or their equivalents, to be mixed in such proportions as may be most convenient, together with a small per-centage of sulphate of iron or sulphate of lime." At Halifax the materials used for lining the tubs are the waste arising from the manufacture of worsted, cotton and flax, and old manure which has become dry and fallen to powder. To these materials a little sulphate of lime is added. The pails are lined with the assistance of a mould as shown in Figs. 9 and 10.

Fig. 9.

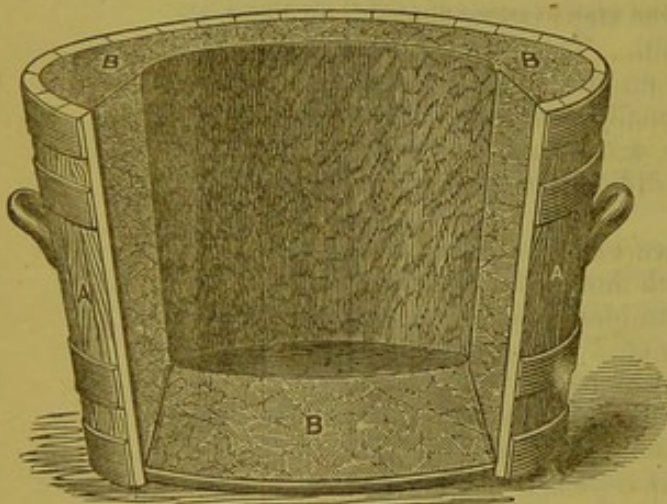


Fig. 10.



Fig. 9 shows in section an oval pail or receptacle, the bottom of which is supplied with absorbent matter at B.

Fig. 10 represents a mould (D) of a diameter less by six inches than that of the receptacle, so that the workman may raise it by the handle (E) and place it in an upright position on the absorbent bed (B), previously laid at the bottom of the receptacle.

The space (BB) which exists round the mould is filled with the same matter as that placed at the bottom.

The lining of the pail is designed to absorb the urine and other liquid which may pass into the pail, and so tend to keep the excrement drier and delay its decomposition; but absorption appeared to me to be very trivial in pails used by women and children. Widely different degrees of sloppiness existed obviously dependent upon differences in the families using the pails; but the extent of sloppiness noticed in Salford, in 1869, was rarely observed in Halifax, greater care being apparently taken in the latter town to avoid the emptying of chamber utensils into the pails. Probably the more regular locking of the doors of the closets which is practised in Halifax contributes not a little to the exclusion of the contents of chamber utensils from the pails, less trouble being experienced in casting them into the yard drain. At

any rate the aspect of the lined pails in use in Halifax generally was less offensive to the eye than of the simple pail, and the casting down of a portion of the lining, as I noticed in several instances, sufficed effectually to hide the offence and to diminish odour from the pail.

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The sanitary advantages gained from the introduction of a pail system such as Goux's as compared with the midden system, in Halifax, cannot well be over-rated. The specification for the reconstruction of privies on the Goux system, which is subjoined, necessarily provides for the filling up of middensteads; and the suppression of those receptacles is an initial requisite of sound privy administration in Halifax.

Specification of Works shown on Plates XXV and XXVI. — "The outside walls to be 9-inch and the inside 4½-inch brickwork, set in lime, mortared, neatly pointed at the joints on the inside, and flush-pointed on the outside. Fill up and flag the ash-place [middenstead] with 2-inch flags, so that the same will be level with court or passage. The privy-floor to be 6 inches higher than the ash-place and the adjoining passage. Provide and fix 1½ inch white wood riser and seat with 4½ inch by 3 inch lintel, to back wall. Provide ¾-inch ledged door, which must be hung with bands and crooks to 4½-inch by 1½-inch frame, and secured with strong iron latch and lock with a key for each tenant. The door to the ash-place to be similar but cut in two, and each half to be hung with one pair of bands and crooks. Paint the whole of the woodwork with two coats of good oil-paint, and twice lime wash the inside of both privy and ash-pit. N.B.—The privy and ash-pit must be constructed so as to allow of the effectual removal of the refuse by the system now adopted."

The facility with which a pail-closet, such as the Goux closet, may be adopted to the requirements of old towns, is admirably shown in *Plates XXVII. and XXVIII.*, prepared for me by Mr. J. R. Smith, the Sanitary Inspector of the Borough, and showing various adaptations designed by him and carried out in Halifax. I append his description of the plans given in the plates.

The Goux system in Halifax is worked by the company through the agency of its own servants. The company supplies the pails, and it receives from the Corporation for each pail-closet a royalty of 5s., and payment at the rate of 7s. per annum to the end of the present year (1874), the payment to be increased to 12s. if the contract be continued beyond the year. For change of the pails the company has five night-soil vans, constructed on the Rochdale pattern, with the exception of the india-rubber packing for the flaps. Each of these vans is attended by two men. It has also five carts, with eight men attached to them, for the removal of the ashes and dry house refuse. The pails are changed weekly, the exposed part of the lining of the removed pail being broken down and cast over the excrement before the pail is taken from the closet to be placed in the van. Some needless carelessness occurs in lining the pails, in their removal and cleansing, as well as in the cleansing of the night-soil vans, from want of special supervision of the working of the system by officers of the Corporation. I noticed in the course of my inspection pails imperfectly lined, and some not lined at all; pails which had overflowed from neglect to remove them at the proper time; littering of ash-place in the removal of the ashes; some splashing in van and leakage from van into street; and unsatisfactory arrangements for cleansing the vans at the wharf whence the pails are despatched to the manure works. These defects, insignificant as compared with the advantages which those parts of the town derive from the system where it has been introduced, but exciting prejudice against it, entirely arise from the want of such special supervision as the Corporation should exercise over it.

I examined two boat-loads of the filled pails. There was no perceptible odour from them under a hot sun, and I should not have had

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any suspicion of their contents either from sight or smell, had I not previously known what they were. I visited the manure works of the company at Salterhebble. The manure was then being sold, I was informed, at 8s. a ton, for re-sale.

Description of Plans, Plates XXVII. and XXVIII.

"No. 1 is a block plan drawn to a scale of 24 feet = 1 inch, limiting the maximum to 12 houses in one block on the back-to-back principle of construction, and arranged for the tub or pail system of collection.

"No. 2. Arrangement selected by the Improvement and Sanitary Committees of the Halifax Corporation for recommendation, to meet the requirements of houses erected on the above-named principle, with reciprocal service, *i.e.*, upon examining plans it will be found that the night-soil tubs are withdrawn from under the closet seats at the back of the closets alternately with the ash tub designed for the accommodation of the corresponding closet on the contrary side.

"No. 3. Alternative arrangement to meet the above requirements and those of separate properties abutting on each other, without reciprocal service.

"No. 4. Alternative arrangement to meet the above requirements with reciprocal service designed for better ventilation and the prevention of offensiveness, the receptacles not being inclosed, but simply roofed over, admitting a more free circulation of fresh air than in arrangement No. 2.

"No. 5. Six closets erected for Mr. Saml. Whitehead in Whitehead's Court, Hanson Lane.

"No. 6. Six closets erected for the executors of the late John Abbott, Esquire, in Abbott's Yard, Back Clarence Street.

"No. 7. Four closets, Lilly Street, Claremount.

"No. 8. Eight closets erected for the accommodation of 24 houses belonging to Mr. J. H. Leyland in Queen Street, Cross Field, on a site originally occupied by three privies, and an open ash-pit or midden.

"J. R. SMITH,

"Sanitary Inspector."

Nottingham.

NOTTINGHAM (1871, population, 86,621 ; inhabited houses, 17,911).—In Nottingham a modification of the pail system is being gradually carried out in the Old Town of peculiar interest. When Dr. Buchanan and I made inquiry as to the arrangements for excrement disposal in the borough in 1869, the use of waterclosets for the poorer classes of the population had, as a result of certain attempts to introduce them made several years before, come to be regarded as impracticable, and the efforts of the Corporation were directed to improving the construction of midden-closets and to the introduction of pail-closets under certain circumstances. A plan of midden-closet had been designed, and had received the approval of the sanitary committee of the Corporation, for securing imperviousness of the middenstead, dryness of its contents, and the proper covering of the deposited excrement with ashes and dry house-refuse, the middenstead being made of a capacity sufficient for four months' accumulation. Several privies had been constructed according to this plan at the time of our visit, but although less offensive than the common middenstead privy, they were open to grave objections. In places where space did not exist for the erection of midden-closets, pail-closets had been introduced. The pails were simple rectangular wooden boxes, receiving excrement only, and they were dealt with, either by tilting the contents into carts or by removal of the pail and the substitution for it of a clean one, daily or at intervals of two or three days, according to circumstances of use. The clean pails had a small quantity of fine coal ash or dry earth placed at the bottom before being put beneath the closet seat.

At my recent visit to Nottingham I found that comparatively few

additions had been made to the number of improved midden-closets existing at the time of the previous visit, and that the chief change made by the Corporation in the arrangements for excrement disposal had been in a certain systematic development of the pail system.

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I examined several of the improved midden-closets, including some I had visited in 1869. Although in the better constructed there was some gain of decency in appearance, all were offensive and contained accumulations of filth altogether inconsistent with the wholesomeness of the surrounding premises. In the best the excrement was largely uncovered, and in the worst, notwithstanding a presumed emptying of the middenstead at intervals of three months, the ashes and dry house refuse had become piled up above the level of the opening into the middenstead beneath the seat, converting the space beneath the seat into a trough containing a large amount of decomposing excrement.

The number of pail-closets in use, all within the Old Town, was 2,510, serving for the use of 4,516 houses. This form of closet is now regularly adopted in the Old Town when a new privy has to be erected, or an old privy to be reconstructed. The arrangements of the closet differ from those I have had to describe in other towns, in that separate receptacles are not provided for the excrement and for the ashes and dry house refuse. A single pail answers for both purposes, but householders are instructed to comply with the following notice:—

DRY CLOSETS.

“ The substitution of these closets for the ordinary privy and ashpit will, if properly carried out, be a means of preventing offensive smells, which are dangerous to health. In order to accomplish this, the tenants are requested as far as possible to observe the following rules:—

“ 1st. The fine ashes from fireplaces should be put into the closet tubs, the cinders and unconsumed coal should be first taken out and used for fuel.

“ 2nd. All other refuse capable of being consumed, such as waste paper, straw, vegetable refuse, pieces of stick, and other like matters should be burnt.

“ 3rd. Chamber slops must on no account be put into the closet tubs, but should be emptied into the sewer grate.*

“ Any complaints of want of attention, or otherwise, should be forwarded to me at the municipal offices.

“ WM. RICHARDS,

“ Chief Sanitary Inspector.”

In practice I found (and I believe that this is consistent with the general experience of the sanitary officials) that the bulk of the ashes and dry house refuse was thrown into the pail above the excrement, and that, in fact, each pail was a *moveable middenstead*. The structural arrangements of the closet are as simple as in the Hull system, and by substituting a pail for the space beneath the seat, as middenstead, even such slight offensiveness as attaches to the Hull system is avoided, and the facility of dealing with the collected stuff greatly increased. The freedom from offensiveness of the different pails in use examined was notable.

The pail used in Nottingham is made from half of a disused paraffine cask as at Rochdale, and a simple metal lid is placed upon it when it is removed after use. The town is divided into six districts for the change of the pails, and in every instance the used pail is removed to the town-yard for the emptying of its contents and for cleansing, a clean pail being substituted for it at the time of removal. No pail is permitted to remain longer in use than a week, and pails in use by several families

* It has been suggested that the chamber-urine should be thrown into the pail, and the house-slops down the grate.

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are removed at shorter intervals, and in some cases daily. The scavengers arrange their visits upon a rough approximation to the time required for a pail to become half full. The removal is effected by open waggons, a tarpaulin being thrown over the pails; and the process of changing and removing the pails is completed before 10 in the morning in summer, but in the winter it is carried on throughout the day. At the town-yard, which adjoins the canal, the contents of the pails are emptied directly into a barge; the pails are then washed out with a jet of water, and each has placed in it previously to being again put to use, a portion of deodorant powder made from mixing carbolic acid with fresh-slaked lime. The tubs are coated within and without from time to time with fresh coal tar.

Notwithstanding the increase in the number of pail-closets during the last five years, and the attempts to improve the construction of the midden-closet, the common middenstead-privy is still the predominant form of excrement disposal in the borough. The trial is now being made in a few instances of privies constructed so that the ashes are thrown upon the deposited excrement through or beneath the seat, and some restriction is being placed upon the size of middensteads, so that the area of each middenstead shall not exceed five feet square. Abundant illustration of the insufficiency of the first of these arrangements to abate middenstead nuisance, unless combined with smallness of receptacle and frequency of cleansing, will be found in other parts of this report; and the proposed degree of limitation of the size of the middenstead, while, perhaps, diminishing some existing nuisance, will leave the essential evil of the middenstead system—improper accumulation of filth in the vicinity of dwellings—untouched.

Nottingham readily gets rid of its midden-closet and pail-closet refuse. Both are as a rule in regular demand for farms in the vicinity of the borough, and along the line of canal. At the wharf the midden-closet refuse sells at 2s. a ton, and the pail-closet refuse at 3s., exclusive of carriage. When deposited in the barges the refuse from the slaughter-houses and markets, and some stable manure are added, also urine collected from the public urinals. A store of street sweepings is kept in the yard to obviate any sloppiness of the contents of the barges. In 1873 the total refuse removed from the town (exclusive of street sweepings) was 32,619 tons, of which 31,926 tons consisted of nightsoil and ashes. The total cost of this removal was 8,269*l.* and the receipts for the sale of manure (including charge for carriage) amounted to 3,956*l.*

Leeds.

LEEDS (1871, population, 259,212; inhabited houses, 55,827).—I had occasion early in 1871 to describe the condition of the borough of Leeds, at the close of 1870, with regard to its arrangements for excrement disposal. At that time there were in the borough 30,335 privies communicating with 13,500 middensteads (or "privy-sumps"), 6,348 waterclosets, of which several were tumbler-closets, 277 pail-closets, and 4,500 dry ashpits. The pail-closets were the remains of a system begun in 1863 with the hope of manufacturing profitable manure from the excrement, but which had not been approved by the Corporation.

I then wrote* of the middenstead system in Leeds as follows:—"The common privy with middenstead is, in fact, still the ordinary provision for excrement disposal of the great mass of the population, as

* Report on the sanitary state of Leeds, with particular reference to Diarrhœa and Fever, 1871.

“ well of the town as of the borough outside the town. Although long recognised as the filthiest and most unwholesome mode of excrement disposal, it is not only retained in Leeds, but it is perpetuated by the building laws of the Corporation in its most objectionable form. . . . The greater numbers of the privies and middensteads in Leeds were built at a time when either there was no public provision for their being cleansed, and the householders were dependent for this process upon the convenience or necessities of farmers, or when such public provision as existed was without any systematic regulation or supervision. As a consequence it was necessary that middensteads should be constructed of so great a capacity as to contain many months’ accumulation of filth. These receptacles, dug several feet into the ground, are, as a rule, lined and built in with walls of highly porous brick, and the bottom is either paved with brick or flags, or, as is not uncommonly (perhaps more generally) the case, it is formed by the natural soil. Some are gulfs so vast that an individual falling accidentally into them, if aid be not at hand, may readily lose life.”

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The scavenging of middensteads within the town of Leeds and the suburbs of Holbeck, Hunslet, and part of New Wortley, was, in 1871, carried out by servants of the Corporation, under its direct control. In the rest of the borough this scavenging was effected by owners and occupiers at their own cost, subject to the supervision of an inspector of nuisances for each township. Here the scavenging was regulated solely by the fulness of the middensteads and the convenience of the owners and tenants; and nuisance in respect to the receptacles was interpreted as overfulness, and the additional abomination apt to arise therefrom.

Of the cleansing of the middensteads within the district scavenged by servants of the Corporation I had to say:—

“ The work is not performed systematically street by street, in definite order, throughout the sub-districts. It is regulated—(a) by notices received from householders requiring the cleansing of their middensteads; (b), by information received from the inspectors of nuisances; and (c), by the observation of the inspectors and foremen of scavengers and their men. The inspectors and foremen arrange the day’s work of the carts, in accordance with the information received from the different sources mentioned; and if this be not sufficient to occupy the whole staff, the spare carts and men are sent to the *worst-known* places, irrespective of notices. The scavengers work during the night, and, on an average, 120 middensteads and ashpits are cleansed nightly. The number of middensteads and ashpits within the scavenging districts is 11,500; and if these were scavenged systematically, at the rate compassed by the present staff, they would be emptied about four times in the year. This would be the best result that could follow from the present regulations of the staff. But, practically, the result must fall far short of this; for the greater part of the scavenging is made conditional upon the convenience of householders, and the amount of provision they possess for the storage of refuse. The existing arrangements, indeed, are sufficient to prevent larger collections of refuse than the receptacles provided for it will contain; but they entirely fail to effect so great a reduction of the excremental filth and other refuse, commonly stored in the vicinity of dwelling-houses, as is needed to affect in any sensible degree their noxious influence upon the health of the inhabitants.”

Subsequent to the publication of this report the Corporation again instituted an experimental trial of a pail system of excrement

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removal within a limited district; and since May 1 of the present year (1874) it has caused certain important modifications to be made in the cleansing of middensteads within the area scavenged by its own servants. In other respects the state of Leeds as to its middenstead-privies remains as I described it in 1871, and, except in the limited district referred to, no change has been made in the construction of middensteads.

The *pail system* has been introduced into a district (the East Ward), which contained 1,506 privies and 699 middensteads for the use of a population of 15,000. From the time of introduction to February last, 690 of the middensteads had been filled up, and 1,484 of the privies converted into pail-closets. I have had an opportunity of inspecting parts of this district twice during the course of the alterations. The middenstead privies in the district were among the very worst and most offensive in the borough, and the change effected by their removal and the substitution for them of pail closets is remarkable. The absence from the East Ward of the penetrating midden stink which is so characteristic of Leeds, even in well-to-do parts, is especially noteworthy. The *pail system*, as first adopted, consisted in the removal of the pails from the closets weekly, and the substitution of clean pails for them. Each pail before being used had been cleansed in the Corporation yard, and a quantity of carbolate of lime placed in it. When removed from the closet a lid was placed over it, and it was carried away in a closed van. As managed complaints quickly arose of sloppiness in the closets, and scattering of contents in the passage of the pails to the vans and through the streets, and much nuisance therefrom. Eventually this arrangement was given up and under the advice of Dr. Goldie, the present medical officer of health, another mode of working the *pail system* has been adopted.

The causes which, so far as I can gather, appear to have led to this failure of the *pail system*, as carried into operation at the outset, have been as follows:—first, there was a want of due proportion between the number of pails and the number of families using them, or between the frequency of removal of the pails and the rate at which they filled. The pails adopted were of the capacity used in Rochdale for a single family during one week. In Leeds a pail would frequently serve for the use of several families, and, as a consequence, its contents not rarely overflowed or were liable to be spilled in part during removal. To avoid this evil the pail closets should have been increased in number, or the removal of the pails should have taken place more frequently.

The *pail system*, as now worked in the East Ward, Leeds, comprises a *daily* emptying of the pails, without changing them, and the use of fine coal-ash to cover the deposited excrement. The use of the fine coal-ash is simply an instruction to householders, and is at present carried out very irregularly. Many houses in the East Ward have ash-pits before the fire-range, into which the fine ash is raked and the cinders separated for re-burning. These ash-pits are only emptied at intervals, usually of a week, and then only in these cases is the fine ash cast into the excrement pails. In an examination of many pails which I made, it was the exception to find ashes above the excrement. The contents of the pails when removed are merely tilted into the nightsoil cart, and the pail is then scraped, sprinkled with carbolate of lime, and replaced. The stink from this process is much less than the description would imply, and incomparably less than the stench from emptying a common middenstead.

The nightsoil scavenging is conducted between the hours of 11 p.m. and 6 a.m., and I made an inspection both of the mode of

emptying the excrement pails and of the ordinary mode of emptying middensteads. Anything more offensive than the process of emptying an ordinary middenstead, particularly when it is sloppy and shut in beneath houses, I cannot conceive. The process is necessarily limited to the night hours; but that the necessity for it should exist in a borough like that of Leeds, I can only explain on the supposition of the absolute ignorance of its nature on the part of those who are responsible for its continuance.

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The present mode of working a pail system in Leeds, had been too short a time in operation at the period of my inspection to admit of a definite conclusion being formed as to its particular merits, except with regard to the *daily* cleansing. The enormous advantage gained by this frequent removal of filth, as compared with the old midden-system, is incontestable. Under this system the ashes and dry-house refuse are collected by a separate set of men and carts during the day.

At the suggestion of the superintendent of the sanitary department, Mr. Newhouse, since the 1st May last arrangements have been made for systematically cleansing middensteads and ash-pits by street-row. With some increase of the scavenging staff, this, it is believed, may be effected throughout the district scavenged by the Corporation every six weeks.

The four years' work of the Corporation in regard to excrement disposal since my inspection in 1870, may be summed up as follows:—*One sixteenth* (16,000) of the population of the borough or thereabouts, has a pail-system with its great advantages. Not more than six weeks' filth will probably now be permitted to accumulate among *twelve-sixteenths* (192,000), the manner of accumulation remaining unchanged. The state of the remaining *three-sixteenths* (48,000) as to its filth receptacles and the storage therein is unaltered.

Forty-three tumbler-closets are now in use in Leeds. No addition has been made to this number during the last three years. This form of closet is, in fact, now discountenanced, as wasteful of water and difficult to keep in order. In 1870 I found that the regulation of the water supplied to these closets, the control of which is under the Waterworks Committee, was not conducted on any definite principle, and that the supply was in several instances quite insufficient for the proper working of the closets. This cause of defective action of tumbler-closets still continues. Further experience has shown, moreover, that the pivot of the tumbler is apt to get out of order, and experiments with pivots formed of various materials have not succeeded in remedying this defect. Finally, much difficulty has arisen from ashes and other rubbish thrown into the trough of the closet.

I subjoin a drawing of a tumbler-closet. (Plate XXIX.)

COCKERMOUTH.—In the district of the Cockermouth union rural sanitary authority, I had the opportunity of witnessing the beginning of an interesting and important experiment in excrement disposal which is being carried out by the authority. On the advice of their medical officer of health, Mr. John Makinson Fox, it is seeking to familiarise the rural population with the use of a pail closet, independently of any arrangements for cleansing and dealing with the contents of the pails by the sanitary authority. Part of the scheme is to secure the covering of freshly-deposited excrement with fine coal-ashes, with a view of obviating nuisance from it and of better fitting it for subsequent use as

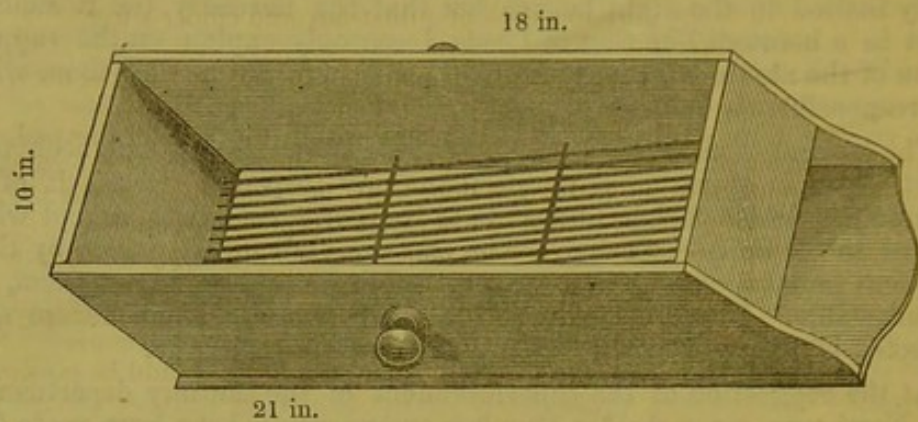
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manure. To these ends Mr. Fox has invented a cheap and handy cinder-sifter (Fig. 11), which may be used above the aperture of the

Fig. 11.



closet seat. This sifter, to meet local habit, is also designed for a "trug," the Cumberland term for a dust-box, an article of furniture found in every house.

In furtherance of this experiment and otherwise to provide for improved privies and the abatement of privy nuisance, the sanitary authority (having previously been invested with certain urban powers) has included the following regulations in its byelaws, made under 21 & 22 Vict. c. 98. s. 34, and sanctioned by the Local Government Board on the 9th July in the present year (1874):—

"1. The person constructing any privy and ash-pit in connexion with any new buildings shall construct such privy and ash-pit at a distance of not less than ten feet from any part of any house.

"2. The person constructing any ash-pit or midden privy shall cause the floor and sides of such ash-pit or privy to be cemented or constructed of non-porous materials so as to prevent infiltration into the soil.

"3. The person erecting any privy, may, in lieu of any ash-pit and midden privy constructed as above, provide pails according to the following arrangements:—

Every such privy must be constructed with hinges at the back of the seat, that the seat may be raised for the use of the cinder sifter and removal of the pail.

Every house must be provided with a dust box and cinder sifter for the daily covering of the nightsoil with dry ashes from the fire or with dry earth.

"4. The person constructing any privy or ash-pit shall cause it to be placed in a convenient situation, to be constructed with proper materials and of such a size as shall provide adequate accommodation for the premises.

"5. He shall cause the same to be provided with an opening as near to the top as practicable, communicating directly with the external air, or to be otherwise furnished with sufficient means of ventilation.

"6. He shall cause such ash-pit to be roofed in, and to be provided with a side door one yard square."

The sanitary authority has also issued the following special notice with respect to the use of the dust-box and cinder-sifter:—

"COCKERMOUTH UNION RURAL SANITARY AUTHORITY.

"*Dust-box and cinder-sifter for disinfection of nightsoil.*

"Every privy must now be kept, according to the statute so as not to be a nuisance and injurious to health.

" A privy is a nuisance where the nightsoil is allowed to accumulate, or where it is not covered, disinfected, or removed, every day.

" A pail for the reception of the nightsoil is better than the old pit privy.

" The dust-box and cinder-sifter is intended to accomplish the purpose of disinfection with the least possible trouble and expense.

" This box combines the purposes both of a dust-box and cinder-sifter.

" It is to be used every day.

" Each day the ashes and cinders are to be placed in the box on the wire floor.

" The box is then to be taken to the privy, and shaken over the pail.

" The projecting end of the floor is to be placed within the sides of the pail, and after shaking the box, the ashes only will fall upon the contents of the pail.

" The cinders remaining upon the iron floor, may be taken back to the fire or removed to the coal-place, or placed in a separate receptacle for cinders.

" *If the cinders and other house refuse are placed in the pail, they will deprive the whole of its contents of any value.*

" The pail when full, will either be removed by the township, and an empty one left in its place ; or the contents may be used in the garden as manure.

" In every case, where there is a difficulty of removal, notice should be given to the inspector.

" It is important that the ashes should be thus used every day. The habit then becomes easy.

" *By this means an infectious and offensive smell will be destroyed, sickness prevented, coal will be economised, and a valuable manure will accumulate for the ultimate benefit of ratepayers.*

" JOHN MAKINSON FOX.

" Medical Officer of Health to the Authority.

" JOHN MUSGRAVE,

" Clerk to the Authority."

In addition to the foregoing instructions, the inspectors of nuisances are directed to report as nuisances privies in which no attempt is made to keep the excrement covered with ashes or dry earth.

Previous to the constitution of the sanitary authority, pail closets had been introduced into various parts of its district by private enterprise, and the efforts to bring them into more general use have thus been facilitated. The total number of pail closets in the district at the time of my inspection was 360, and of these 163 had been constructed at the suggestion of the sanitary authority.

In the several instances I examined in which pail closets had been substituted for the old middenstead privy, the cottagers had not failed to appreciate the greater orderliness and slight offensiveness of the former, as compared with the latter. They recognised the advantages of getting rid of the abiding stink of the old privy, and of having under control any stink which might come from the new privy, if they would take the trouble to sift their ashes over the pail. An incidental inducement to take this trouble was confessed by some, it may be noted, in the high price of coal, which made the recovery of the cinders from the ashes a matter of some consideration. Where cottagers have gardens, little difficulty appears to be experienced in managing pail closets, as it is possible to store the contents of the pails, harmlessly, it is believed, until they can be used as manure, for which purpose they are held in high esteem. In the comparatively few instances where cottages have not gardens, if pail-closets be adopted, it will be necessary to make arrangements for the removal of their contents with neighbouring farmers or possessors of gardens. Each case of construction or reconstruction of a privy on the pail system is, however, being dealt with on its own merits, the object being kept in view, in carrying out the change, to endeavour to effect it mainly through the agency of the

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people themselves. Proprietors of cottages who have adopted pail closets in connexion with them, have in some instances undertaken the removal of their contents. One instance was mentioned to me of 50 cottages having pail closets, attached to a manufactory, of which the proprietor removed the contents of the pails at intervals to a farm he possessed.

If, as seems not improbable, the success of the experiment undertaken by the Cockermouth union rural sanitary authority should in certain cases, be interfered with by obstacles in the disposal of the contents of the pails the sanitary authority proposes to overcome these obstacles by some supplementary action.

Birmingham.

BIRMINGHAM (1871, population 343,787 ; inhabited houses, 68,532).—When Dr. Buchanan and I visited Birmingham in 1869, the Corporation had no detailed information of the arrangements for excrement disposal in the borough. Except in better-class houses, midden-privies were in common use, but neither the number nor the structural disposition of the latter was known, and their construction was not subjected to any systematic rule. No byelaws existed regulating the erection of privies or ashpits in new houses, and although plans of new buildings and their appurtenances had to be approved by the borough surveyor, he interfered with the privy arrangement only so far as to require the provision of a drain from the privy pit. For the rest, a builder might as a rule build privies on any plan that suited him uncontrolled by the authorities. There appeared to us, therefore, as we observed in our report of this visit, “No prospect of rapid improvement on the filthy state of things that exists throughout the poorer parts of the town.”

In 1871, the Corporation appointed a Committee of Inquiry on the best mode of disposing of the sewage of the borough. This committee, presided over by Mr. Alderman Avery, devoted three months to the inquiry, and prepared a detailed report of remarkable interest, which has been published as an independent work.* In the summary account of the results of the inquiry which precedes the report, the Committee state that :—

“The extent of the midden system is now for the first time ascertained. There are in Birmingham 3,884 premises containing 7,065 waterclosets, accommodating about 20,000 persons ; and 70,000 houses connected with 19,551 privies and middens, accommodating about 325,000 persons. Of these middens or ashpits, nearly 14,000 are drained into the sewers. The middens cover an area of 16,170 square yards, or about $13\frac{1}{2}$ acres ; and practically all of them, containing faecal water, and solid and liquid refuses are open to the air. Some of them are situated beneath houses or workshops, and large numbers are built against the walls of houses, which are thus permeated with the filthy liquid making through the walls. The consequence is that the sewers are constantly fouled by the drainage from the middens, and that the surface wells gradually become the receptacles of sewage matter, with which the earth surrounding the middens is absolutely saturated.” (p. xi.)

The Committee recommended in regard to the midden-stead system, and as part of a plan of excluding almost all excremental matters and trade refuse from the sewers :—

* Borough of Birmingham.—Report of the Sewage Inquiry Committee, 1871. Simpkin, Marshall, & Co.

- (a.) "The gradual abolition of middens, and substitution of a new privy system, based upon the principle of exclusion from the sewers, and weekly collection of all excrementitious matters solid and liquid." (b) "An experimental trial of the Rochdale and Manchester systems on a sufficiently large scale, and under the strictest supervision, and ultimately an extension to the whole town of that system which shall be found to be the most efficient." (c) "The imposition of a rate on occupiers in respect to water-closets connected with the sewers on a scale to be sanctioned by the Council."

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The "Manchester system" referred to above is not the system described in this report, and now adopted in Manchester, but the system of improved dry privies described in the report of Dr. Buchanan and myself in 1869, and which has since been given up for the pail-system now in process of being introduced generally throughout that city.

In May 1873 an experimental trial of a pail-system, founded upon the Rochdale system, was begun in Birmingham, and at the time of my recent visit 2,700 pail-closets had been constructed in the borough. No compulsory power is exercised by the Corporation in the introduction of these closets, but byelaws are in preparation for their regulation. The Corporation has directed their introduction in new houses where no objection is offered by the owner, and has encouraged their substitution for midden-privies when these have required reconstruction. But it is optional with the owner whether he adopts the pail-closet, the midden-closet, the ordinary watercloset, or a form of trough-closet which has been erected in a few instances. So rapidly, however, is the pail-closet gaining favour with property holders that the present limited means which the Corporation possesses of carrying out the experiment is taxed to the uttermost. This has arisen mainly from want of yard space in which to deal with the collected matters, and pending this difficulty being overcome it has been found necessary to discourage the alteration of midden-closets into pail-closets.

The pails are changed weekly, the clean pail having a portion of anti-septic in it prepared after the Rochdale plan. The arrangements of the Corporation, indeed, generally as to the collection of the excrement pails and dry house refuse, and subsequent manufacture of the excrement into manure and utilization of the refuse follow the Rochdale system as closely as their provisional nature admits. The manure made from the mixed excrement and fine coal-ash sells at 5*l.* per boat-load of from 24 to 25 tons, and has even commanded a price of 7*s.* a ton. Of the sanitary advantages of the system, as marked by its freedom from nuisance in comparison with the middenstead system, there can be no question; and it is beginning to be perceived that the net cost of the working of the pail-closet may be much less than that of the midden-closet, as has been shown at Rochdale. A prospective advantage of the extension of pail-closets in the borough, mentioned to me, was the probable utilization in the manufacture of manure, of a vast and accumulating deposit ("tip") of middenstead refuse which exists 10 miles from the town. The excrement pail used in Birmingham differs, especially in the arrangement of the lid, from the pail commonly used in Rochdale. It is of galvanized iron, and is of the dimensions and form shown in *Plate XXX*.

During the inspection I made of many of the pail-closets erected in Birmingham, I noted the same freedom from offensiveness which I remarked in the inspection of similar closets elsewhere. But in Birmingham, for the first and, indeed the only, time during the recent

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inquiry, a complaint was made to me of greater offensiveness from pail-closets than from midden-closets. This happened in No. 2 Court, Ward Street, in which an excellently constructed block of pail-closets had been erected. There was certainly more odour within the closets than I had before experienced; but I satisfied myself that this arose from insufficiency of through ventilation of the closet. A neighbouring block of pail-closets (No. 4 Court, Ward Street) constructed in the same style, but much more freely ventilated, was free from the odour which existed in No. 2 Court. I shall elsewhere have to refer to defective through ventilation as favouring a certain degree of offensiveness in earth-closets otherwise fairly managed.

In addition to the introduction of pail-closets, an important change is being made in the cleansing of middensteads, and which is to be regarded as the first step to their systematic scavenging irrespective of notice from householders. The borough has been divided for the purpose of night-soil scavenging into six districts and 36 sub-districts, and arrangements are now made that the applications for the cleansing of middensteads from each sub-district received during the day shall be dealt with during the night following.

The applications to the night-soil department for the cleansing of middensteads and ash-pits in 1873 amounted to 26,518, of which 5,826 were received from the inspectors of nuisances. Altogether 27,644 were cleansed in the course of that year, and 163,142 loads of stuff removed. The cost of this cleansing was 24,000*l.* less 3,500*l.* received for the sale of part of the removed material. It is estimated that the cost of working the pail system in the borough, including interest on capital account and depreciation, would not exceed the cost of the present night-soil scavenging by more than 2,000*l.*, while the receipts from the sale of manufactured manure and rough ashes would probably realise 18,000*l.* This estimate does not, however, appear to include the cost of the manufacture of the excrement into manure.

I examined one of the trough-closets referred to in a previous paragraph. The closet in question is in No. 8 Court, Hospital Street. Four closets here, used by 12 families, communicate with a common trough which is designed to be flushed by slops and the rainfall falling in the court. The bottom of the trough was covered with a thick layer of excrement and paper, and the sides were lined with excrement. The stink from the closets was most offensive, and a considerable up-draught through the seats appeared to come from the sewer.

Warrington.

WARRINGTON (1874, population 32,144, inhabited houses 6,044).—The Corporation of Warrington has adopted a pail system of excrement disposal, and is now steadily carrying it out in the borough in new houses, where waterclosets are not adopted, and in the reconstruction of old privies. At the time of my visit to Warrington, in October last, 1,157 pail-closets had to that time been constructed and were in use. Generally the Rochdale system is followed in regulating the pail-closets, but with certain noticeable modifications. The excrement pails are of wood, as at Rochdale, but made, as well as the ash-tubs, on the Corporation premises. The arrangement of the lid is, however, different: first, a piece of canvas is placed over the mouth of the tub, and this is held in place by a circular wooden lid. Then the mouth is closed by an outer metal lid with flange. The pails, after being emptied and washed, have the interiors brushed with a brush made for the purpose, and saturated with a disinfectant, of which also a ladleful, measuring a gill in quantity,

is placed at the bottom of each pail before it is again used. This disinfectant is made from the following formula :

Sulphate of iron	-	-	4 lbs.
Sulphate of zinc	-	-	1 lb.
Chlorate of potash	-	-	2½ lbs.
Hydrochloric acid	-	-	2 lbs.

Water to 40 gallons. Mix.

In the construction of the closets, preference is given to a pent-house, beneath which to place the ash-tub.

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SALFORD.—The borough of Salford has not yet emerged from the experimental stage as to excrement disposal, in which it was found by Dr. Buchanan and myself, when we visited it in 1869. At that time, here as in Manchester, the Corporation was seeking some way of permanently abating the nuisance arising from the many middenstead privies in the borough, then with certain exceptions presently to be mentioned, numbering 21,642, and serving, together with 1,500 waterclosets, for 25,555 houses; now, with similar exceptions, numbering 26,184, and with no greater quantity of waterclosets, serving for 29,423 houses. The byelaws of the Corporation required that every dwelling house should have at least one watercloset or privy, and that "every privy should be placed outside the dwelling house, and should have an opening to the external air, near the top thereof of at least 12 square inches, and the receptacle for the soil should be separated from the wall of the dwelling house by a space of at least 3 feet, and should have a drain therefrom, to, or to some drain communicating with, the sewer in the adjoining street or court, and should be so constructed as to prevent nuisance." By a resolution of the health committee of the Corporation, the building sub-committee had been instructed to require that all ash-pits (middensteads) to new buildings should be made of a *minimum* size of 3 feet by 4 feet 6 inches; and in respect to old constructions, the Corporation by virtue of powers possessed under the Salford Borough Improvement Act could require alteration to the same type to be made.

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While the privies of new houses were generally being constructed according to the byelaws and the resolution of the health committee, two experimental methods of excrement disposal had been put in operation by the Corporation, chiefly in parts of the borough where privy nuisance was greatest, and involving reconstruction of existing privies. One of these methods was an improved form of middenstead-privy, a "dry privy," so called; the other was a pail-privy, managed upon a particular plan, and designated, after the inventor, *Goux's Patent Absorbent Closet System*.

The dry privy consisted of a water-tight receptacle beneath the seat, into which was intended to be thrown, through an aperture, beneath a step ("the tread"), attached to the "riser" of the seat, the ashes and dry-house refuse, so as to cover the excrement. The seat was hinged, so that it could be thrown back, and the floor made movable, to admit of the receptacle being cleansed. A ventilating flue was carried from the upper part of the receptacle several feet above the roof of the privy. About 200 privies of this pattern had been constructed at the time of our visit. We inspected several, and as we then reported, "except where a closet was locked, and its use restricted to a single family, or at the most two or three families, we found them in a most unsatisfactory state." In the cases where privies of this kind were used by several families, we found the aperture beneath "the

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tread" more or less choked, the floor littered with filth, the litter extending about the doorway, and the excrement largely uncovered. They were, in fact, almost as offensive as the privies for which they had been substituted, and were not less filthy in their surroundings. The result of this experiment has not been such as to induce the Corporation to approve of the multiplication of these privies. Several of those constructed at the time when Dr. Buchanan and I visited Salford remain. I re-inspected a few, and their state confirmed the opinion formed upon them in 1869.

Of Goux's Patent Absorbent Closet System, as seen in operation in Salford by Dr. Buchanan and myself, we reported as follows:—

"We inspected many pail-closets used by single families, and others used by several families, or by the inmates of a common lodging-house. In every instance where a pail had been in use over two or three days, the capacity of absorption of the liquid dejections, claimed by the patentee for the absorbent material, had been exceeded; and whenever a pail had been four or five days or a week in use it was filled to the extent of two-thirds or more of its cavity with liquid dejections, in which the solid excrement was floating. The contents, in fact, differed nowise in aspect, except in the cases where a portion of the dyewood lining had broken down and fallen into the liquid, from what we should have expected if a simple unprepared pail had been used. It was suggested that a part of the sloppiness of the pails probably depended upon the fact of chamber pots having been emptied into them; but although the regulations for their use permit this to be done, we did not always find on inquiry that even this source of wetness had been in operation."

The subsequent experience of the system has not induced the Corporation to continue it, partly because it did not appear to yield any sanitary advantages over a simple pail system, partly from a distrust of the economic results to be obtained from it in the manufacture of manure. This manufacture, it is proper to add, was carried out as a matter of private enterprise, and not by the Corporation; and the method differed in some details from that proposed by M. Goux. The manufacture did not prove a commercial success, and with its cessation the use of the Goux system also ceased.

I have given a description of this system in my account of Halifax, in which town it has been put in operation somewhat extensively. Here results were observed, during the recent inspection, more favourable to the working of the system than had been witnessed in Salford in 1869, and more in accordance with the statements of the projecter.

The privies which had been re-constructed in Salford for the Goux system, about 2,000 in number, are now used as simple pail-closets, the pails being changed weekly, or as often as required. The van used for their removal is constructed after the Rochdale pattern. The contents of the pails are mixed with middenstead and other refuse which can be used for manure, except a portion that is put at the command of a company, The Universal Charcoal and Sewage Company Limited, which, by permission of the Corporation, is carrying on certain experiments in manure manufacture in the municipal scavenging dépôt, or "Town yard."

The Salford Corporation, dissatisfied with the results of the experiments as to excrement disposal which it had already instituted, is still carrying out, or permitting to be carried out, other experiments. These experiments, however, do not appear to be undertaken upon a definite plan, or with any clear conception of the principles which should govern

the removal of filth from the midst of a community. They seem rather to be the expression of irregular impulses, and from the mere multiplication of methods, their tendency is more to complicate than to simplify the difficulties besetting the subject. Meanwhile middenstead-privies of the old, offensive type still enormously preponderate, and even are increasing in number. For the middenstead-privies commonly constructed under the byelaws, differ too little in actual harmfulness from the privies of the old type to be dissociated from them.

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In addition to the pail-closets and dry-privies already referred to, I observed, during the recent inspection: (1) A so-called modified midden-closet, of which, although it was roofed and built with some care, it is sufficient to say that it was specially constructed to hold from three to six months' excremental and dry-house refuse of the families using it, and thus limit the necessity for cleansing to those periods. This form of midden-closet, in fact, exhibited an actual adoption of the evil which it should be a principal object of the Corporation to remove, namely, the evil of large accumulation of filth in the vicinity of dwelling houses.* (2) The Manchester plan of dry-ash closet, in a few instances. (3) Another form of dry-ash closet (Morrell's). (4) A so-called "self-acting watercloset."

The closet, known as *Morrell's Patent Ash-Screening Closet*, now the property of a particular company (*the Sanitary and Economic Manure Company, Limited*), has been recently adopted, by direction of the sanitary committee of the Pendleton district of the borough, in upwards of 300 houses. This closet was one of the earliest invented of the dry-ash closets, and examples of it were seen by Dr. Buchanan and myself in operation in Manchester in 1869, but not under conditions which would admit of our forming a judgment as to its general applicability to a civil population. The dry-ash closet now adopted in Manchester is formed essentially upon the same principles as Mr. Morrell's closet. His closet differs from the Manchester closet in the mechanism for distributing the fine-ash over the excrement, and in the absence of means of ventilating the space behind and beneath the seat; but the objects it is designed to answer are the same. I give Mr. Morrell's own description of the arrangements of his closet, taken from a paper read by him before the National Health Society.

"The system which I advocate," he says, "provides for the perfect separation of the *ashdust* from the *cinders* by means of a screen or sieve of galvanised woven wire placed at the rear or side of the ordinary closet into which house ashes may fall by being simply thrown, as now, through a hole in the wall. Attached to this screen are parts which form a hopper for receiving the ashes. This screen and hopper, forming one, are connected by a simple lever arrangement to the seat of the closet, or by a foot treadle in front of the seat in such a manner that, when the closet is used, an agitating motion is given to the screener by which the cinders are made to fall down the incline, the ash dust dropping through into the hopper below, and thence into a small receiver from

Description of
Morrell's Com-
bined cinder-
sifter and ash-
closet.

* The following note attached to the detail drawing of this modified privy, issued by the Corporation, sufficiently describes the structure:—

"The ashpit to be made with the bottom 1 ft. 2 in. below the level of the passage, and with a fall of 6 in. from under the seat. A well-hole under the ashpit, to be built with bend pipe as shown, and properly connected with sewer. The ashpit to be roofed in and well ventilated. The floors of the ashpits to be 3 in. Rochdale flags, laid on concrete. The privy seat to be hinged to turn back, so as to allow ashes to be thrown over the soil. Openings to be made on the yard side 2 ft. by 2 ft., for the ashes to be thrown into the ashpit. A door, 3 ft. 6 in. by 2 ft., to be placed on the passage side for the purpose of emptying the ashpit. The whole to be finished to the entire satisfaction of the medical officer of health" [who, however, it is proper to add, disapproves wholly of the structure].

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Material which
may be added.

Receptacle for
soil.

Space occupied.

Application for
access from in-
terior of house.

which it is meted out in the exact quantity required over the recent dejection, when the seat is vacated. Thus the ash dust is by this simple, self-acting contrivance separated from the cinders, and on each use of the closet is made to serve as a sanitary agent by arresting the decomposition of the faecal refuse, the cinders being thrown simultaneously on to the coal heap, or on to the floor, or into a box for re-consumption at the house fire.

"House sweepings, dried earth, or any other dry material may be thrown in with the ashes, as the screener rejects all the portions unsuited for use in the closet.

"The receptacle for the soil may be a moveable vessel or a fixed water-tight trough. In general practice my impression is that a fixed trough made of a small capacity, corresponding, say with the size of the seat in length and breadth, and of about 1 foot to 2 feet deep, and emptied at one end, will prove the most serviceable and efficient. The application of this arrangement to existing structures is best accomplished by filling up the cess or ash midden to the level of the surface with (in case the small vault is used) the exception of the space it will occupy below the seat.

"The total space, then, occupied will be an addition to the privy proper, but only by as much as is taken up by the screener, which will usually be found to be much less than that occupied by the old ash-midden. For new erections the total space absolutely necessary need not exceed 6ft. by 2 ft. 6 in., but these dimensions can be extended if larger premises are preferred.

"If it is desired to apply the system so that the closet can be entered from the inside of the house, the screening portion of the apparatus can be placed as a projection from the external wall, and be accessible for charging with ashes from the outside. In this case the privacy of the closet proper is preserved, and all the advantage of the internal earth-closet secured, whilst the cinders are thrown for collection outside and the vault emptied, or the soil-pan removed from the outside."

I inspected several of these closets in operation in Pendleton. They presented all the cardinal advantages in the diminution of privy nuisance which I had occasion to observe in the Manchester dry-ash closet. The stink and the porous middenstead were got rid of; the accumulation of filth was brought within a small compass; and nuisance from the freshly-deposited excrement was obviated by the fine ash cast upon it. The closets had been too little time in use to enable me to form an opinion on the comparative merits of Mr. Morrell's arrangement and the Manchester arrangement for screening the ashes.

The "self-acting watercloset" which has been referred to is a form of closet designed and patented by the borough surveyor, Mr. Alfred M. Fowler. It is now being somewhat largely adopted in the town of Salford. This closet is arranged to be flushed by slop and waste water without the use of town's water. The closet is formed by fixing a trapped pan at such a level that the waste water from the sink, the slops from the house, and the rain water from the roof are carried by a covered drain into the trapped pan. A very similar arrangement exists in some of the Bristol privies, and it appeared to me that the conditions for the successful working of Mr. Fowler's closet would be found to be the same as for the Bristol privy, namely, frequent systematic inspection; the sanitary authority being prepared to cleanse, and undertaking the cleansing of the privies where necessary; and a plentiful and readily accessible supply of water.

I give drawings (Plate XXXI.) showing a section of Morrell's closet as applied in McCleary St. Pendleton (Salford), also a section of the privies for which Morrell's closet has been substituted.

The Universal Charcoal and Sewage Company, Limited, to which reference has been made as carrying out certain operations in the Salford Town Yard, has patented a process for manufacturing charcoal from *street sweepings*. It proposes, while fully utilizing a form of refuse often most difficult to be got rid of at a loss by local authorities, to

provide a charcoal fitted for all sanitary and some other large purposes to which charcoal can be applied, at a cost considerably less than the ordinary charcoals of commerce. The charcoal mixed with nightsoil is said to form a valuable manure, and manure is being manufactured in this way by the Company in the Salford "Town yard." I shall have to refer to the operations of this Company again, when I describe the charcoal process of excrement disposal.

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OLDHAM (1871, population, 82,629 ; inhabited houses, 16,739).—The Corporation of Oldham has adopted a pail system throughout the municipal borough. When Dr. Beard inspected the borough in 1872 the then existing arrangements for excrement-disposal consisted of 1,300 water-closets, 1,800 pail-closets, and 6,200 midden-closets of the old offensive type. Now, less than 50 midden-closets remain in the borough, and for the remainder pail-closets have been substituted. At the time of my visit to Oldham, the Corporation had entered into an agreement with the Carbon Fertilizer Company, Limited, by which the Company on payment by the Corporation of 3s. per closet, exclusive of closets attached to mills and workshops (the scavenging of which is conceded to the Company free of charge), undertook the collection of the pails and the disposal of their contents. The Company, I was given to understand, proposes to use charcoal in detail for the different closets, as also in dealing with the collected excrement in bulk for commercial purposes (see section on *Charcoal System*). My visit happened at a time when the arrangements under this agreement had not come into full operation, and before an opinion could be formed of the hygienic value of the system. I refrain, therefore, from describing the working of the pail-closets at Oldham, excepting so far as to state that the Company were collecting the pails, systematically, at weekly intervals.

Oldham.

GADDESSEN (LITTLE), Herts.—Here certain cottages, built in couples, on the estate of Earl Brownlow, have had erected for their use improved privies after the following design. A short distance in rear of each couple of cottages, a block of outhouses has been built, constructed of concrete, and containing for each cottage a garden-tool and coal house, a pigsty, and a privy. The privy is fitted, beneath the seat, with a rectangular iron receptacle on wheels. This receptacle can be readily withdrawn through a door at the side of the privy, and one end of it is made moveable on a horizontal axis, the easier to discharge the contents. But this moveable end admits of leakage of fluid, and to obviate the nuisance from this source as well as to facilitate the thorough cleansing of the flagged space beneath the privy seat, the floor of this space is provided with a drain. In one instance where leakage was considerable, this drain did not appear to be acting, and a very noisome puddle had collected beneath the receptacle. When the receptacle is full, it is drawn out, and its contents, covered with vegetable refuse or earth, stored where convenient, or at once used, in the garden plot attached to each cottage.

Gaddesden
(Little).

The conception of this plan of excrement disposal is good, but it fails in certain details. The moveable end of the receptacle is objectionable as leading to nuisance, and the drain beneath the privy seat, while serving the purpose of cleansing the space there, is to be condemned as an outlet for urine and fluid fæces. No sufficient care seemed to be taken to cover the deposited excrement with ashes and dry house refuse, needless stink thus arising ; the collected material, moreover, being in

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a state not well fitted for deposit in the garden. The cottages obtain their water supply from waterworks, and there is apparently no danger to this supply even from a careless use of excrement in cultivating the garden.

Paisley.

PAISLEY.—(*Colquhoun's Closets.*)—At Paisley, in certain manufactories, a peculiar kind of closet, invented by a Mr. John Colquhoun, has been for some time in use. This closet aims at dryness of the contents and continuous removal of any effluvium which may arise from them. The receptacle consists of a moveable pan, with aperture at the bottom communicating with a drain. The bottom of the pan is packed with furnace ashes, gravel, or coarse peat through which the urine is presumed to filter into the drain, and thence flow to a tank arranged for its reception. The solid excrement remaining in the receptacle should, by reason of its dryness prove little offensive, and any odour which might arise from it ought to pass away through a flue carried from the space beneath the closet seat and about the receptacle to a convenient chimney, kitchen or furnace, as the case may be. I examined the operation of these closets in the Anchor Thread works (Messrs. Clark & Co.), where several have been in use two years and a half. Personal examination showed sloppy receptacles, indicating obstruction of the filtering material; and the stink from these receptacles proved that the effluvium shafts exercised little or no effect at the time, although the furnace flue to which they were attached must have been in free action. Information given to me by one of the members of the firm, and by the overseer responsible for the supervision of the closets was to the effect, that at the best there was more smell from the closets than was desirable, and that waterclosets would be substituted for them but for a difficulty in disposing of the sewage. The firm were about to adopt experimentally a charcoal closet in one part of the works, and a new part of the manufactory had been fitted with water-closets.

EXCREMENT DISPOSAL BY WATER-CARRIAGE.

Excrement Disposal as to certain kinds of Water-Closets.

Liverpool.

LIVERPOOL.—Since Dr. Buchanan and I visited Liverpool in 1869, no change has been made in the measures adopted by the Corporation with respect to excrement disposal which we then described. It is simply necessary for me to reproduce our report of that date, intercalating certain figures where alterations of number have taken place during the past five years; and further to state that the recent inspection has fully confirmed the opinion expressed in 1869 on the efficiency of the trough watercloset.

“This town has particular interest as showing very remarkable recent improvements in the matters with which this inquiry deals. The midden-closet, which was formerly the only sort of privy for the poorer parts of Liverpool, was constructed on the worst possible plan; and in some courts whole rows of houses had their foundations tunnelled by long excrement receptacles. Some progress in lessening the disgusting nuisances from these arrangements was reported to the department by one of us (Dr. Buchanan), in 1864. Besides improved supervision and monthly removal of midden contents, 2,639 privies in particular houses and in some few courts had, in the 11 previous years, been converted

into waterclosets. But it is since 1864, under the greater powers conferred by the Local Sanitary Amendment Act of that year, that chief progress has been made. There are indeed parts of Liverpool reported at the earlier inspection which cannot now be recognised for the close and foetid places which they then were. Courts of crowded houses have been demolished, and free ventilation between streets and rows of houses has been obtained. Without these improvements much of the very great amendment that is now seen in the arrangements for filth removal would not have been possible.

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"In advising measures for improving the excrement removal arrangements hitherto existing in the town, the medical officer of health, Dr. Trench, has consistently kept in view two principles: the one, to deal only with such midden privies as were, for one reason or another, nuisances, or injurious to health; and the other, to remedy such nuisance or injury in a definite way, by the conversion of these privies into waterclosets of a sort approved by the Corporation. He was met at the outset by difficulties arising from the poverty of owners of property, but the Corporation overcame these difficulties by making contributions from the public funds in cases where the conversion of privies was ordered by the health officer.

"In applying his first principle, Dr. Trench had to lay down, as generally as possible, conditions under which an existing midden privy was to be regarded as a nuisance. The following are such conditions, and they constitute so valuable a code for the general guidance of authorities under like circumstances, that we reproduce them from Dr. Trench's notes of evidence given before the Rivers Pollution Commission. It will be seen that Dr. Trench regards position of a midden privy as being much more important than its construction, in determining whether or not it may be allowed to remain. [The construction and position of new privies are otherwise regulated.]

"The Act of 1854 provides that, 'when it shall have been certified by the medical officer of health that any privy or cesspool was in a condition, state, or situation injurious, dangerous, or prejudicial to the health of any inhabitants of the borough,' the owner thereof may be required within a reasonable time 'effectually to abate and remedy the same to the satisfaction of the Council.' In giving practical effect to the above powers of the law, it became necessary at once and *in limine* to define the nature of the required remedy, and also, as far as possible, the conditions which would justify the certificate of the medical officer. In November 1863, and on subsequent occasions, he laid down certain rules by which he would be directed in the exercise of his certificates. He proposed to certify against,—

- " 1stly. Midden-privies inside houses.
- " 2ndly. Midden-privies emptied through houses.
- " 3rdly. Midden-privies situated beneath rooms.
- " 4thly. Tunnel middens of every description.
- " 5thly. Combined open middens supplying many tenements and placed near to inhabited rooms.
- " 6thly. Midden-privies of private houses clustered together in a *cul-de-sac*.
- " 7thly. Midden-privies of private houses in close confined yards or situated beneath windows, or abutting on the walls of houses, or within two feet of the lower windows, or of the door of the house.
- " 8thly. Midden-privies of courts.

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" 9thly. Midden-privies abutting on or opening directly into streets and thoroughfares, and emptied before the doors and windows of houses.

" 10thly. Midden-privies of front houses when emptied through a court.

" 11thly. Midden-privies beneath the footpath of the street and emptied through a grid on the footpath.

" 12thly. Midden-privies of many houses, when collected together as a kind of amphitheatre, as is seen in particular groups of streets.

" The council, in order to secure uniformity of action, and likewise to prevent future mistakes in the application of remedial measures, directed the town clerk to notify to the several owners against whom proceedings should be taken, 'That it appears to the said council of the said borough that the only effectual remedy for such privies and cesspools is by converting the same into waterclosets.'

" Since Dr. Trench has been medical officer, and mostly since 1866, he has ordered and obtained the conversion of 14,393 privies into waterclosets, and there are now (1869) in Liverpool 20,000 privies attached to ashpits, and 31,150 waterclosets, 2,150 of which are tank or trough closets. The extent to which contributory payments have been made by the Corporation has been 40,000*l.*, expended in this manner: 3*l.* 10*s.* has been given for every siphon watercloset ordered to be erected, 5*l.* 10*s.* for a single trough watercloset, and 7*l.* 10*s.* for a double trough watercloset. These closets are constructed on a pattern ordered by the Corporation, and approved as to details by the borough surveyor." [1874. During the four years 1870-73, the number of privies converted into waterclosets was 756, of which 3 were "trough-closets," the rest "siphon-closets." The number of middensteads now in Liverpool is 15,249, the number of privies attached to them about 20,000. The number of "troughs" for trough-closets is 3,304, serving for about 6,000 closets, and the number of waterclosets other than trough-closets 43,395 (1872). The population of Liverpool in 1871 was 493,405, the number of houses, 78,403.]

" The midden privy (which, where retained, has its old pit construction, all the tunnel middens being done away with), and the ordinary siphon watercloset of the single house, require no special description. But there is particular interest in the arrangement and working of the trough closets, which are in use by numerous families in the sort of neighbourhoods where in other towns ordinary waterclosets are commonly a failure and a nuisance. Drawings of these trough closets will be found accompanying this report (*Plates XXXII. and XXXIII.*) and they describe the construction better than can be done in words. It remains to say that the position chosen for these new closets has been carefully determined by the circumstances of each place where they have been erected, and that peculiar facilities for their being well placed have been obtained by the time of their erection concurring with that of other improvements. The closets that are common to several families are cleansed in rotation by the people using them, and a register is kept of the order in which this should be done. Inspectors visiting the closets every two or three days see that this duty is performed, and are themselves held responsible for any shortcoming. By a little patience and firmness the inspector succeeds in obtaining the necessary cleansing, even among the most intractable classes, with very little assistance from the law. He will, if necessary, wait and see a closet cleaned out by the proper person. Last year only a dozen or so of people were summoned for neglect in this

respect, and three of the offenders had to be sent to prison. It will be seen from the drawing that in connexion with these closets there is an opening of access to the trough and water supply. This opening is for the scavenger, and the people using the closets have no concern with it. The scavengers are employed by the Corporation, and every day they visit each of the trough closets, unlock the iron door of access, discharge the contents of the trough, flush it out with hose and water, sweep it thoroughly clean and leave it charged with fresh water for the next 24 hours' use. Frost has done no harm to these trough closets, nor yet to the ordinary siphon closet with its service box.

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"The ashes and other refuse of such houses and courts as have common closets on the trough principle are now put out on the street and carted away daily by the public scavengers. The throwing of ashes about the courts or into the privies is an offence, and under the efficient inspection that is given is becoming of rare occurrence; but where midden privies exist ashes and refuse are of course thrown into the midden-pit.

"There can be no question of the admirable efficiency of the working of the arrangements above described in semi-public privies, nor of the recognition by the people of the superiority of the new to the old arrangements. Nor can there be any question that these results are due even more to the management of the whole business by the public authority than to the excellence of the constructive arrangements themselves. And not only is complete freedom from nuisance obtained where formerly filth and stink were universal, but Dr. Trench states that in 1868, when an epidemic of enteric fever was prevailing in and about Liverpool 'the only localities that seemed exempt from it were 'the places occupied by the poor in which we had removed all the 'privies and made trough waterclosets.'"

BRISTOL (1871, population 182,552, inhabited houses 27,536).—The provision for excrement disposal in the poorer class of houses in Bristol is of peculiar interest. A privy has long been in use there which is, in fact, a watercloset flushed by hand. The privy in its present state appears to have grown out of some pre-existing usage of which the history has not been very definitely recorded; but the rules by which the construction of the privy are now regulated date from 1865. This privy is held by the medical officer of health for the borough, Dr. David Davies, to meet very efficiently the needs of the poorer classes of the population as to excrement disposal. It appeared to me desirable, therefore, in view of the adverse experience of this department to waterclosets flushed by hand, and to the numerous instances in which inquiry had been made by the department concerning mischief to health arising from such arrangement, to investigate the conditions under which this mode of excrement disposal worked successfully in Bristol. To this end Dr. Davies and the different inspectors of the city gave me ready assistance, and with their help I was enabled to contrast the working of the system in Bristol with its working in the neighbouring village of Westbury-on-Trym, which has recently come under the charge of Dr. Davies as medical officer of health for the newly formed sanitary district in which it stands, but which had not at the time of my visit been placed under detailed sanitary supervision.

Bristol.

The privy is required to be constructed according to the following rules:—

"The Bristol Local Board of Health will not consider any privy sufficient unless it be constructed in the following manner:—

"The trunk of the privy to be of brick work set in cement, and

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rendered on the four inside faces with cement not less than one inch in thickness.

"The eject to be of freestone not larger than 18 inches long by 9 inches wide, and 12 inches deep, having the tongue standing at least 3 inches in the water.

"The drain to be of 9-inch stone-ware pipes properly laid and jointed, and with a fall of not less than 1 inch in 5 feet.

"The privy to be ventilated by means of an opening of not less than 9 inches square, communicating with the external air, and if the privy be situate in a dwelling-house and communication with the external air cannot be otherwise readily obtained, an air-tight trunk or shaft of not less than 9 inches square is to be provided and fixed.

"All the works to be executed as the Board's surveyor shall direct, and to his satisfaction."

A drawing of the arrangement of the privy is given in Plate XXXIV, and it will be observed that the "eject" forms a somewhat capacious dip-trap. The "eject" is now also constructed of stone-ware, and "ejects" of this material are permitted to be used in place of the freestone "eject." The advantages claimed for this kind of privy are its little liability to get out of order from careless use or from violence, and the facility with which foreign matters that may have been cast into it can be removed without damaging the structure.

I examined a considerable number of these privies in the poorer parts of the city, and among the population most liable to misuse them, and found with few exceptions the "ejects" free from accumulated matters and the "trunks" clean and without offence. On the other hand, I examined several privies in Westbury-on-Trym of similar construction, and found some of these blocked and the trunks filled almost to the brim with excrement, and others foul within and most offensive. In fact I found the privies here in the state in which I had been accustomed to find other forms of waterclosets elsewhere in which flushing by hand had been depended upon as a means of cleansing them. The difference in the state of the privies in Westbury-on-Trym and in Bristol indicated corresponding differences in supervision, management, and water supply.

In Westbury-on-Trym, to the time of my visit, the local authority had exercised no systematic supervision or control over the management of the privies, and such supervision and control has only now become possible since the sanitary organization formed under the Public Health Act, 1872; the water supply is scanty, and more or less labour is involved in carriage of the quantity of water to the privy needed for the purpose of flushing it; while the incidental help which might be derived from slop water is not uncommonly diverted from the privy by a drain with gully conveniently placed close to the cottage door. The excuse proffered for the state of the privy seen in worst condition was that "the husband came home too tired from his work at night to 'undertake fetching pails of water with which to flush it.'"

In Bristol, as contrasted with this state of things, the Corporation maintains a constant systematic supervision over the privies, and by its servants undertakes the management and cleansing (even to lime washing the closets) of those situated in the worst districts, while the water supply is abundant and close at hand. Three conditions, indeed, are found necessary to the successful working of the Bristol privy, namely:—

1. Frequent systematic inspection.
2. The sanitary authority being prepared to cleanse, and undertaking the cleansing of the privies where necessary.
3. A plentiful and readily accessible supply of water.

Under these conditions the Bristol privy works well in Bristol, but in judging of its applicability elsewhere another highly important consideration should not be overlooked. The poorer population of Bristol which most needs, and indeed absolutely requires the active interference of the Corporation in its sanitary management, is for the most part housed in small houses which rarely contain more than two families. This gives great facility in dealing with individual houses and families, as regards excrement disposal, general sanitary management, and the control of infectious disease. The problem, in fact, of excrement disposal in Bristol is very different from that which presents itself in Liverpool and Glasgow. The number of families having access to a privy in Bristol obviously exercised a considerable influence upon the state in which it was found as to freedom or not from filth.

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Bristol has four inspectors of nuisances to each of whom is attached two men. I accompanied one inspector on part of a round to observe the process of cleansing the privies which it was necessary the Corporation's servants should see to. The men were armed with a species of two-pronged iron rake used for the purpose of clearing blocked ejects, and they carried with them freshly slaked lime to sprinkle the "trunks" with. I observed that while a single bucketful of water sufficed to flush some "ejects," others required several bucketfuls. This inspection and cleansing is carried out at weekly or shorter intervals, according as the known necessity of the case requires. I should add that where the arrangement can be made, the rain-water pipes and yard drains are made to communicate with the ejects so as to secure the flushing action of rainfall and of the house slops.

BIRKENHEAD.—I visited Birkenhead for the purpose of ascertaining the results of experience there in the working of *tumbler water-closets*. Mr. Francis Vacher, the Medical Officer of Health, courteously undertook to prepare a special report on the subject, which I here subjoin. This report is as thorough as suggestive, and it renders unnecessary any observations on my part.

Birkenhead.

Report on the experience of Birkenhead as to the working of the Tumbler Watercloset System, by Francis Vacher, Medical Officer of Health for the District.

"The tumbler watercloset, which is merely a trough closet flushed automatically by means of a water box which capsizes at regular intervals, was introduced into Birkenhead in October 1864, and since that date 40 have been constructed. In many instances they have replaced offensive middens or privies, in some they were designed with the houses they serve, and in two cases they were erected simply to flush the drains from ordinary hopper waterclosets. To a Mr. Matthews, the owner of a small cottage property in the humbler part of the town, the credit is due of having built the first tumbler closet, the idea having been suggested to him by the town surveyor, who was familiar with the system in use at Leeds. As this is one of the best, if not the best, closet of the kind in Birkenhead, I will briefly describe it. The trough is of brick built in cement and cemented over, round-bottomed with a slight fall, and made to retain 4 inches of water by means of a bar. Beyond the bar is a siphon trap protected by a grid. The trough receives from two seats each in a separate locked closet, and the tumbler is in a locked compartment adjoining. The length of the trough from mouth of tip to trough bar is 8 feet. The tumbler is of cast iron, the

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trunnions being cast in a piece with the box. The measurements are supplied to me as below:—

Length of tumbler at top	-	-	3 ft.
Do. do at bottom	-	-	1 ft. 10 in.
Width do	-	-	1 ft. 7 $\frac{3}{8}$ in.
Depth do	-	-	1 ft. $\frac{3}{4}$ in.

Trunnions are 6 $\frac{1}{4}$ in. from top, and 1 ft. 1 $\frac{3}{4}$ in. from back.

"The tumbler is set in a stout wooden frame built into brickwork, the trunnions riding in cast-iron grooves capped with cast iron. The water supply is direct by a $\frac{1}{2}$ -inch pipe fitted with a tap. The tumbler has never been out of order, and the owner only once had it out, and then for the purpose of removing an india-rubber bed that had been fixed to the back part of the frame, and which was not found to be an improvement. Mr. Matthews' double closet accommodates four cottages, the number of adults and children inhabiting which is now 24. Since it has been in use a man has always been paid to cleanse and take care of it.

"Nearly all the tumblers in the town are similar to this. I am told that at least half were cast from the same pattern. The dimensions of four or five that I took were a trifle less than the measurements given above. In some I noticed the trunnions had been riveted on, and a few were furnished with brass bushes. While, however, nearly all the tumblers put up in Birkenhead are alike in pattern and size, there is no sort of uniformity in the troughs they flush. Of the three next constructed (December 1864), one measures 13 feet, receives from four seats, and accommodates nine houses, lodging together 37 persons; the second measures 29 feet, receives from eight seats, and accommodates 14 houses, lodging 49 persons; and the third measures 130 feet, receives from 10 seats, and accommodates 10 houses, now lodging 68 persons. The 13-foot and 29-foot troughs are of brick cemented over, each very shallow at one end and deep at the other, and not rounded off, the bottoms forming two inclined planes. These troughs do not retain water, and there is nothing to prevent articles mischievously or carelessly consigned to them choking the 9-inch pipes they deliver into. It is therefore not surprising that during the last three years the condition of each of these tumbler closets has six times formed the subject of a nuisance removal notice. The 130-foot range referred to is a far more objectionable structure. It is not a trough at all, but a series of round-bottomed brick receptacles (neatly built but not cemented over), connected by means of 9-inch glazed earthenware pipes. On May 12th when I visited this row of closets they had just been cleansed, and the man who had been employed for the purpose drew my attention to a bucket of "foreign bodies" he had removed, among which were several large bits of broken crockery, a brick, a piece of cotton cloth, a scrubbing brush, a quart bottle, and an 8-oz. phial corked and labelled, containing medicine.

"Of the 10 tumblers erected in 1865, four deserve special notice. Two, already alluded to, are remarkable as having never served any further purpose than flushing the drains of eight ordinary waterclosets. One, placed at the end of a row of 12 hut closets in a common yard behind a back street (inasmuch as the tumbler and closets are accessible to anyone), is much misused, and the trough, though a fairly well-made one, frequently becomes obstructed. One designed to carry away the soil delivered through 15 seats, sends each charge of water along a line of 15 brick receptacles, connected by 9-inch pipes, pipes and receptacles measuring 185 feet. The population (taken this May) of the 15 houses thus accommodated was 110 all told. Out of the remaining six of the tumblers put up in 1865, only three tip into properly made water-

retaining cemented troughs; the other three, which serve respectively three, five, and five houses, tipping into three, five, and five receptacles, the three connected with 9-inch, and the five each with 12-inch pipes.

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"There appear to have been eight tumbler closets constructed in 1866. Three of these were in connexion with property now in ruins, and about to be cleared away by a railway company; two are fairly made trough closets now in use (the trough of one, however, being twice bent at a right angle); one consists of six receptacles connected by and flowing into 9-inch pipes, one of five receptacles connected by and flowing into 6-inch pipes, and one consists of three large cesspits connected by and flowing into 12-inch pipes.

"This last I am desirous of drawing particular attention to. The extraordinary amount of work its projectors designed that one tumbler should achieve is hardly credible. It was to flush beneath 32 seats, accommodating 37 houses; the distance from mouth of tip to the end seat being 119 feet, and the population of the houses served (taken this May when some few were empty) being 191 adults and children. How one tumbler has accomplished such a task may be imagined. On seven separate occasions since June 1871, the owners of the range have been served with a nuisance removal notice in respect of its condition; the number of times it has been cleansed without the interference of the sanitary authority I of course have no means of telling.

"Of the tumbler closets put up in 1867, four have well-built cement-lined troughs, one measuring 73 feet, one 10 feet, and two 13 feet each. The latter pair are, however, not without defects; their tumblers being awkwardly placed, the oil holes in the trunnion caps almost inaccessible, and each of the troughs being L shaped. The only other tumbler range built in this year is unique in design. It consists of an arched brick sewer 60 feet long, into which six seats deliver by means of six roughly made man-holes, and is flushed by two tumblers.

"I find no record of any tumbler constructions in 1869, and only one pair of tumblers credited to 1869. One tumbler closet probably opened about this time, after being many times obstructed, and giving much trouble was last year converted into an ordinary trough closet. The 1869 pair are now in good working order; but when I exposed them a few weeks back (they had been carefully sealed up under two flagstones, as I take it, to prevent anyone tampering with them), they were tilted and fixed, and the closets in a disgustingly foul state.

"I am not able to give with any certainty of being correct the dates of erection of the remaining nine tumbler closet ranges in the township. One has been put up within the last few months, the others all appear to have been two or three years in use. Five are carefully made troughs varying in length from 7½ to 68 feet; three are pipe-joined brick receptacles measuring severally 93, 93, and 51 feet, and one consists of two short troughs united by 9-inch pipes.

"As regards the water supply of these 40 tumbler closets, 16 only were constructed in connexion with cisterns (the three now in ruins being among those thus favoured), the remainder from first to last deriving their supply direct from the mains. Two are served by 1-inch pipes, seven or eight by ¾ or ⅝ inches, and the rest by ½-inch pipes. I mention this as it is a particular that should not be omitted in a statement of this kind; but practically the size of the supply-pipe is not very important, as I found by experiment a ½-inch supply from the main will deliver 18 gallons in from four to seven minutes. Whether the supply is direct or by cistern is of course of paramount importance, as in the former case the tumblers are necessarily idle when the water is "off," in Birkenhead two days a week.

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"I have said that nearly all our tumblers are similar in size and pattern, with one exception (that in the girls' yard of the Industrial Schools, which measures 27 inches at the top by 16 inches at the bottom, 10 inches deep, and 13 inches across, and which falls at eight gallons); they are all nominally 21-gallon tumblers, but out of nine whose capacities I tested, only two required 21-gallon charges to capsize them, one capsizing at 20 gallons, three at 18 gallons, one at 17 gallons, and two at 15 gallons.

"Some, when I inspected them, were tipping every 20 minutes, some about hourly, and some apparently only every five or six hours, or less frequently. There is evidently no rule whether a tumbler is found capsizing three times an hour or three times a day, the frequency as often as not simply depending on the person who has last adjusted the tap serving it. When this kindly office has just been performed by a neighbouring house tenant, the tumbler is discovered to be working briskly, when by a waterman the reverse of briskly. For instance, on my directing attention to the mere trickling supplied to one tumbler, I was told by an occupant of the house behind which it was situated that "a man was at it the other day, and he thought it went too fast," and on my telling another house tenant what supply I considered the tumbler on his premises should have, I was answered, "The waterman comes round and he puts the tap slow."

"One tumbler I noticed very inadequately supplied with water had the $\frac{5}{8}$ lead pipe delivering into it neatly flattened, so that it could do no more than dribble. Of course I cannot say the waterman did this, but it had without doubt been done designedly; yet the tenant in whose yard the tumbler receptacle stands assures me it was not done by him, and I am quite certain it was not the work of any servant of the sanitary authority.

"The tumblers in connexion with schools (except those at the Industrial Schools) are not kept working night and day, but merely during school hours, or as occasional flushing boxes. Thus the master at St. John's schools informed me the tumbler was only used at dinner time, and then made to fall three or four times; he attended to this himself to prevent waste, he naïvely added, as there was a meter against him. The man who had charge of the tumbler at Our Lady Schools was, however, even more niggardly in the matter of water; he flushed with two tumblerfuls every evening, and this was all the water he used except on Saturdays, when he thoroughly cleansed tumbler and trough. The master of St. Lawrence's Schools told me he "flushed once a day, or less frequently," but here the rain water helps the master occasionally, the spouting from the roof of this building being directed on to the tumbler.

"As regards the situations of our tumblers, these are not all well chosen. Some are underground and difficult of access; some so close to inhabited rooms that they must prove a source of annoyance, and one is uncomfortably near a seat. Then some instead of being set to face their troughs are at right angles to them, the result being that the force with which each charge of water is thrown is lost.

"Most of the tumblers are very properly housed in locked receptacles, but the locks on some are broken or out of order. Even a good padlock, however, will not always prevent an officious waterman from meddling. Thus, on my asking one of the tenants in Back Myrtle Street if she would obtain for me the tumbler door key, I was brought a poker for wrenching out the staple, at the same time being told, "This is what the waterman uses."

"In a period of nearly 10 years we have only put up 40 tumblers, and

only 12 since 1867. Of the 36 now in use, seven but serve as occasional flushing boxes, two merely assist in cleansing ordinary watercloset drains, and five (that in the park and those in the Industrial Schools and market vaults) are in places where closets of any kind could readily be kept in order. Thus an answer to the important question whether or not tumbler closets are adapted to the wants of the poor must rest, so far as the experience of Birkenhead goes, upon the evidence furnished by no more than 22 such closets. As these all, with a single exception, not unfrequently get out of gear, or become obstructed and cause nuisances, I cannot resist the conclusion that tumbler closets are not suitable at all events for the class of tenants for whom they have been provided in Birkenhead. The foregoing facts not only show the very limited extent of the tumbler experiment in this town, but also the still more limited success it has met with.

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"Of course it may be said that the people referred to are peculiarly dirty in their habits. I do not think so; they are ordinary cottage property occupants, skilled and unskilled working men and their families, who pay rents averaging from 4s. to 8s. 6d. per week. But even if they were uncleanly above their fellows in other towns, do not the advocates of the tumbler-closet system contend that it is specially fitted for those who cannot be got to keep clean any form of pan watercloset? With more truth it may be urged that our tumbler ranges have never received the care and attention which is necessary to maintain them in thorough order; but if tumblers are to make the same demands on the time of the township's sanitary labourers as common trough closets it is difficult to understand wherein lies their special advantage.

"No doubt the failure (I am constrained to call it a failure) of the tumbler-closet system here is chiefly due to our ranges having been for the most part ill-planned, too long, and required to serve too many persons. The 22 now in use in connexion with cottage property have an aggregate length of 1,192 feet, receive from 152 seats, and accommodate 191 houses inhabited by 946 persons; thus the mean length per range is 54 feet; the average number of seats each range receives from, 6.9; the average number of houses served per range being 8.6, and the average number of persons 43. The folly of building ranges such as the following, it cannot be necessary to insist upon.

—	Length of Trough or Pipes.	No. of Seats.	No. of Houses accommodated.	No. of Persons accommodated.	
				Adults.	Children.
Oliver Place -	130 feet	10	10	30	38
Eldon Place -	185 "	15	15	57	53
Orderly Place -	119 "	32	37	86	105

"Of the 22 ranges only 6 are in my opinion fairly well constructed, and but one of these is supplied with a cistern.

"As regards the practice in some of our day schools of flushing their closets with a few tumblerfuls at noon, or after school hours, I have nothing to say against this as I have seen troughs thus kept very clean, especially those that get a brushing once a week; but such closets have no pretensions to be classed as genuine tumbler closets.

"The tumbler-closet system appears to me to be so perfect in theory, that I regret I am unable to give a more satisfactory report of my experience of it, and I am still in hopes other towns may be more successful with it than Birkenhead has been.

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"That the removal of excremental matter from districts occupied wholly by the working classes may yet be efficiently accomplished by means of tumbler closets I cannot doubt, provided only the closets be properly constructed and placed under careful supervision.

"In conclusion I take the liberty of submitting the following suggestions regarding the structure and management of tumbler closets :—

"I. *The tumbler*, of iron, cast in one piece, and to hold a charge of not less than 18 gallons, should be swung in a strong wooden frame set in brickwork, the trunnion caps being furnished with oil holes and pegs, the whole being in a locked compartment accessible only to the sanitary authority's accredited servant.

"II. *The channel* to be flushed should be a brickwork, cement-lined, open, straight trough, round bottomed, with slight incline, and made to retain water, at least 1 inch, at its shallow end. It should terminate in a syphon-trap protected by a grid, and should not measure more than 25 feet, or receive from more than 5 seats.

"III. *The seats* should be of wood, not painted, each in a separate locked compartment, each exclusively for the use of the occupiers of one house, and accessible only to the occupiers of one house and the sanitary authority's accredited servant.

"IV. *The water supply* should be by cistern, the capacity of each cistern not being less than 1,000 gallons (except in districts where the mains are always charged), and the service pipe should be fitted with a ferrule of a size to enable it to deliver not less than 18 gallons every 40 minutes.

"V. *Inspection* should be undertaken by the sanitary authority, and should be systematic, thorough, and frequent; every tumbler, channel, seat, and cistern in a district being examined by a servant of the sanitary authority at least once a week."

Worksop.

WORKSOP (1871, population 10,409; inhabited houses 2,074).—I had reason to believe that I could study with advantage in operation at Worksop waterclosets flushed by hand with slops and waste water, and I visited that town for the purpose. I found, however, that the total number of waterclosets in the town did not exceed 90, and of these from 18 to 20 only were without cisterns. Other provision for excrement disposal consisted of the common midden closet. The surveyor and inspector of nuisances entertained a strong objection to the waterclosets without proper water supply, from the liability to blocking of the drains connected with them. I inspected 11 of these closets with the following results: in five the pans were very filthy; in five others the pans were more or less smeared with excrement; and in one only was the pan in a proper state of cleanliness.

THE DRY-EARTH SYSTEM.

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The dry-earth system of excrement-disposal, designed and perfected by the Rev. Henry Moule, M.A., vicar of Fordington, Dorset, is best described in the words of Dr. Buchanan, given in his report of an official inquiry concerning the subject made in 1869. He writes as follows:—

"The dry-earth system consists in the application, with the greatest procurable detail, of dry earth to fresh human excrement, and in the subsequent removal and use of the mixture for agricultural purposes. In so far as detailed application is not made, or as the earth is not dry, or the excrement

not fresh, or the mixture otherwise dealt with, the dry-earth system is departed from.

"If about a pound and a half of suitable earth, carefully dried, be thrown over a dejection, all smell from it is forthwith removed, and if the same quantity be mixed with half a pint of urine the latter is absorbed. The mixture of earth with stool and urine is not only inoffensive when fresh, but remains so after keeping for two or three months, or longer.

"The process which goes on in the mixture is obviously one of disintegration and of some combination between the earth and the organic matter, as is evidenced by the disappearance of stools and even of paper among the other constituents of the compost. But the absence of fœtor from the mixture of earth with stool or urine, even with prolonged keeping, shows that decomposition in the ordinary sense does not take place.

"The Rev. H. Moule, to whose observations the practical use of these facts is due, regards the process which takes place in the mixture as consisting in a change of the organic substances of excrement into the state in which organic matter naturally exists in fertile soil, in such a way that the animal refuse becomes proximately available for the support of the plant, without undergoing ultimate reduction into simple salts and gases.

"In order that the described result shall be efficiently brought about, the quantity and quality of the earth have to be considered. With any quantity materially less than a pound and a half to the average dejection, (unless some artificial means, not generally applicable, of mixing are had recourse to,) a tendency to wetness remains, and more or less fœtor results. If much more earth is used the proportionate agricultural value of the product is lessened. The quality of earth, as affecting its power of producing an inoffensive compost with excrement, is of at least equal importance with its quantity. Sand and gravel have almost no power in this respect. Chalk has very little. Clay stands very high in rank. Properly dried it falls readily into a convenient powder which has great power of absorption and of preventing offensive change. High in rank also is surface earth, that which is loamy being preferable to any of peaty character. One of the best of all earths is the brick earth of the drift. Earths which already contain some quantity of organic matter are very suitable. Some one of these better sorts of earth may be readily procured in most parts of England.

"The mixture of excrement and earth appears to become more intimate after a little time has elapsed; for whereas the mixture when fresh will, if exposed to heat or wet, enter into ordinary decomposition and become fœtid, it may (if a proper proportion of good earth have been used), after remaining a month or so (during which time it gives off no offensive gases), be exposed to wet and to any moderate degree of heat without the production of any smell.

"I have next to mention a circumstance, of the truth of which I have complete evidence, both from the statements of those who have used the system and also from my own observation, but which was at first unexpected and surprising to me. It is that the mixture of excrement with earth, after being kept awhile and then dried, has again the power which the original earth possessed of absorbing and making inoffensive any stools and urine to which it is applied. This power is so marked that it has repeatedly been alleged to me that the earth (especially if clay) acts better a second time than the first, and I can answer from my own observation that earth used three and four times over, with drying at the proper stages, will render excrement quite inoffensive. The limits of this power do not appear to have been reached, but for experiment's sake the earth has been employed a dozen and more times over, when it must have come to have more than half its bulk of excrement, with the same result on the dejections as at first."

When Dr. Buchanan made his inquiry in 1869, certain debatable and some doubtful questions occupied much of his attention. So far as the present inquiry is concerned, but one of these questions needs consideration, namely, the extent of applicability of the system to communities.

Of the value of dry-earth as a means of abating excrement-nuisance no question, I presume, now exists; and its application in detail to

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this purpose has been facilitated to the utmost by the ingenious mechanical arrangements devised and patented by Mr. Moule and Mr. Girdlestone (the engineer of Moule's Earth-Closet Company). These arrangements, which provide for proper charges of dry-earth being thrown upon the deposited excrement, admit of ready adoption of the system in houses, schools, and other institutions.

Since Dr. Buchanan's inquiry the system, in its integrity, has been adopted in many mansions and on numerous estates, as well as in not a few public and private institutions. The wider experience of its use under these circumstances does not differ in result from that which has been already recorded by Dr. Buchanan, and it would serve no useful purpose to enter into a detailed examination here of the different instances which came under observation during this inquiry. So far as my observation went, wherever the system had been intelligently applied and carried out, and due supervision over its working had been maintained, there its success in the abatement of nuisance from and the disposal of excrement had been assured. Where the system had been adopted without due regard to the amount and kind of labour at disposal and the amount of supervision which could be secured, there it had failed, as any other system would have failed, under like circumstances. Other important sources of failure, so-called, cannot rightly be accredited to the system. The chief of these were imperfect preparation of the earth, and mixing with it, or substituting for it, dry coal ash. In several places I found that the so-called dry-earth system was a dry-ash system, and that the defects arising from the little else than mechanical action of dry coal-ash as a deodoriser were wrongfully spoken of as belonging to the dry-earth system.

The most interesting applications of the system which I observed during the inquiry were among certain mining and colliery villages in Yorkshire and Durham, and at the Industrious Aid Society's cottages and farm at Hereford.

At Skiningrove, a village on the sea coast, at the foot of the Cleveland Hills, and adjoining the Lofthouse iron-ore mines, I saw 66 earth-closets in operation. The mines are the property of Messrs. Pease, of Darlington, and the earth-closets had been introduced at the suggestion of Mr. France, the manager. The closets, of which the mechanism had been constructed by Moule's Earth-Closet Company, were in excellent order, and the earth supplied to them, a clayey soil obtained from the foundation of buildings, had been carefully dried in a proper kiln erected for the purpose. A few of the closets had lever-seats, in others the earth was cast from the hopper upon the excrement by a handle acting upon a simply arranged "chucker." A man was detailed to prepare the earth and keep the hoppers supplied; and an arrangement had been made with neighbouring farmers to remove the contents of the closets once in every three weeks. No difficulty had been experienced in making this arrangement; indeed, the farmers, it was told me, very gladly undertook the task for the value of the manure, and further, they had engaged to supply earth for the use of the closets when that obtained from new buildings failed. An inspection of the closets showed that the users had not habituated themselves to putting the mechanism in action after use, and that in consequence in some, although the hoppers were full of earth, the excrement was uncovered. This, however, appeared to have arisen rather from an oversight in the management than from any indisposition on the part of the cottagers to use the closets properly. It had been too readily assumed that the population for whom the closets were designed would take to their use without some instructional supervision. The advantages of the closet, as com-

pared with the old-fashioned midden-closet were, however, so obvious, even in the state that I saw them, that Mr. France was about to introduce 200 in a new mining village then in process of being built on the hills above Skiningrove.

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At the Adelaide collieries, Shildon (Bishop Auckland), also the property of Messrs. Pease, a row of cottages lately erected has been furnished with earth-closets. These closets, placed in the yards in rear of the cottages, are furnished with apparatus similar to that adopted at Skiningrove, as described in the foregoing section, and also prepared by Moule's Earth-Closet Company. The proprietors undertake the charge of supplying the closets with earth and removing their contents, the hoppers being filled weekly and the closets cleansed every three weeks, the contents being used upon a farm adjoining the colliery. The earth, a surface soil, is not specially dried, but simply placed for a time, and occasionally turned over, in a shed attached to a gas-house. The occupants of the cottages belong to the better class of colliers, the whole of their surroundings being characterised by comfort and orderliness. In almost every instance the closet was found to be in proper use, and the excrement covered with earth. A few had a little wet in them, but of these one or two only had any offensiveness, and in two, the contents of the hopper having become exhausted by an oversight of the filler, the excrement had been covered in one case by sand, in the other by ashes. The several cottagers to whom I spoke on the subject were, with one exception, enthusiastic in their preference for the earth-closet as compared with the old midden-closet, and more than one spoke of its greater decency, and of the influence of this upon the habits of growing children. In this respect, the instances I have just mentioned of the covering up of the excrement with ashes and sand when the earth failed, are instructive. One woman, however, expressed a decided preference for the old privy stink as compared with the new privy (earth-closet) stink. More specifically she complained that, unless she kept the closet door constantly open, there was at times a most disagreeable odour in the closet. The closet was one of the wet ones, and her complaint directed attention to the fact that no sufficient provision had been made for the ventilation of the closets.

The Hereford Society for Aiding the Industrious has 11 model cottages and a model farm on the outskirts of the city. The dry-earth system is in use here not only for the inhabitants of the cottages, but also for the piggeries and the fowl-pens; and the farm (9 acres) and plots of garden attached to each cottage (one-sixth of an acre) are wholly cultivated with the manure from the dry-earth closets, pig-styes, and fowl-pens. Some slight amount of sub-irrigation from house slops in the garden plots may be put out of consideration as aiding cultivation, from the limited extent to which the liquid is distributed in the irrigating drains. Each cottage has its arrangement for drying earth, but the rule of collection and preparation would appear to be to gather earth (a fine surface soil) in dry weather, and store for use, without artificial drying, sifting the fine earth from the coarse before charging the closet hoppers. The receptacles of the closets are built of brick, and cemented within. They measure 2 feet 6 inches by 4 feet, and 3 feet 6 inches in depth. The contents are removed twice or thrice yearly by the cottagers, according to the fulness of receptacle, or to garden requirements, as the case may be. I noticed here, as also at Halton, that several receptacles had within them a large number of small flies. Frequent insufficient covering of the excrement, from the use of the closet by children, might have something to do with this phenomenon.

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The dry-earth is passed three times through the closets which serve for this purpose to form manure for the farm; but in the piggeries and fowl-pens the dry-earth is used once only. Each cottage has its pigstye and large fowl-pen, and on the farm a great range of pigstyes and fowl-pens has been built, with mushroom- and rhubarb-forcing cellars beneath, of admirable construction and design. A layer of dry-earth, of from two to three inches in thickness, is spread at the bottom of each fowl house; this is raked over every morning, the upper surface being removed, and the earth is replaced as often as necessary. The floor of the outer portion of the pigstye is laid with a slight fall to a depression or gutter. Into this depression the urine flows, and the filth is swept several times a day, all being covered up with dry-earth. The cottagers are encouraged to follow the same practice with their pigs and fowls.

The earth-closets I examined were well managed, and the dry-earth appeared to be equally effectual in obviating nuisance from the excremental matters of pigs and fowls as of human beings.

I may note here that Mr. James, of Halton, pointed out to me a very useful application of the dry-earth system to cats. It would appear that cats take readily to an open box or other receptacle charged with dry-earth, and that this affords an excellent means of obviating the nuisance they are apt to create.

The statements made to me by Mr. Walters, the manager of the farm, of the great agricultural value of the earth-closet manure, accorded with statements I had already heard to the same effect from the Rev. Mr. Moule, Mr. James, of Halton, and Capt. Armytage, of the West Riding prison. Mr. Walters had a ready sale for the earth-closet manure, in small quantities, for garden purposes, at the rate of 6s. per cwt., and sales to the extent of between two and three tons had been effected at this price during the preceding 12 months. What part the earth-closet manure and the mode of cultivation respectively played in the agricultural successes Mr. Walters described to me, I am unable to judge, but it was impossible not to be struck by the detailed care given by him to his different farming and garden operations.

With the exception of the Corporation of Edinburgh, which has recently introduced public earth-closets into that city, as described in a previous section (p. 21), the Corporation of Lancaster is still, as at the time of Dr. Buchanan's inquiry, the sole sanitary authority (so far as transpired during this inquiry), which has adopted the dry-earth system; and in this case the adoption is only partial. When Dr. Buchanan visited Lancaster, 90 earth latrines, serving for 200 privies and 450 houses, were under the control of the Corporation. The number of earth latrines is now 120, including the latrines serving for a large school, and the houses thus provided for number about 500. The dry-earth system, although continued within these limits by the Corporation, is not now being extended. For new houses waterclosets are adopted. The latrines are mainly old middensteads roofed in. The dry earth is stored up in one part and replenished from time to time. Once a day a servant of the Corporation visits the latrine and shovels over the excrement and urine deposited since his last visit a sufficient quantity of dry earth. The quantity of dry earth used weekly for the latrines amounts to 22 loads, each load weighing from 23 to 24 cwt. The earth is obtained from the foundations of new buildings, and about 18 months' stock is in store. Street sweepings are occasionally substituted for or used with it. At the time of my recent visit, street sweepings were alone in use, on account of the apparatus for drying earth being temporarily out of order. The contents are removed every six or seven weeks, and carted to the

Corporation yard, where they are mixed up with blood offal from the shambles and street sweepings, and stacked in an open shed until required by the farmers. It was reported in 1869 that subsequent processes of preparation were adopted of a kind that formed no part of the dry-earth system proper; but in 1869 these processes were at least carried out at such a distance from the town as not to create a nuisance. Now, in the Corporation yard, they are effected in close and very improper proximity to houses. At the time of my visit a great pile of the manure, giving off a pungent offensive odour, was awaiting sale. In 1869 the manure sold for from 7s. 6d. to 10s. the ton. The selling price is now 3s. a ton, and this fact, as well as the consideration that the time will probably come before long when earth must be bought for the latrines, instead of as now being simply obtained for the cost of carting, has no doubt largely influenced the judgment of the Corporation in ceasing to extend the dry-earth system. The sanitary gain from the latrines, measured by diminution of excrement nuisance and as compared with the old middenstead, is very considerable.

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The dry-earth system, as practised at Lancaster, was introduced into that city, with the approval of the Corporation, by a gentleman since deceased; the Corporation subsequently adopting and extending very slightly, the system as first put into operation. The dry-earth system here is not a fair representation of that system as originally designed and intended to be carried out; and the history of its introduction and the method of management do not furnish such information as is to be desired for sanitary authorities regarding the adaptability of the system to the needs of a community in relation to excrement disposal. It may be taken that the system fully meets the requirements in this respect of certain kinds of institutions and of certain communities living on estates, or in connexion with mines or manufactories, under private management. But the question of adaptation of the system to a mixed community, for which the local authority must devise and carry out provisions for its sanitary welfare, has yet to be solved practically. It must not be too hastily assumed that the very fact of no local authority having adopted, of its own motion, the dry-earth system during the several years it has been before the public, is decisive against its adaptability to public requirements as to excrement disposal. The truth is, that only now does such a local sanitary organisation exist as would admit of its application in those villages and towns where presumably the system is best fitted for operation. Before the Public Health Act, 1872, the sanitary organisation of rural districts and of many small towns was too incomplete to give any reasonable hope of the efficient working of a system, whether the dry-earth or any other, which required careful and systematic supervision and management. Since the passing of that Act, an organisation fitted to these ends has either been established, or is in progress of establishment, in every part of the kingdom. It is, perhaps, even more necessary now than when Dr. Buchanan reported, that sanitary authorities, in examining the sanitary requirements of their districts, should have under their consideration the dry-earth system among other systems of dealing with excrement nuisances.

I have already mentioned the great value assigned to the earth-closet manure by certain gentlemen who are well acquainted with its practical use. This opinion, held also when Dr. Buchanan made his inquiry, has undergone no change, but has been confirmed by the five years additional experience since that inquiry took place. On the other hand Drs. Gilbert and Voelcker, studying the question chemically, have shown that the earth-closet manure after it has been charged twice, or even

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thrice, with excrement is no richer than good garden mould.* Mr. Walters, as I have stated, gets 6*l.* a ton for the manure retailed in small quantities, and I may add, that he believes this sum fairly represents the value of the material. Dr. Voelcker estimates the value of the compost after it has been charged five times with excrement at 7*s.* 6*d.* per ton. I cannot pretend to reconcile the differences; I merely state the facts. But it may be observed that the chemical estimate of the value of earth-closet manure, does not disprove the sanitary value of the dry-earth system, but, so far as it may be the true index of value, only tends to shew that its economical adaptation must be limited to cottages and small towns, where the cost of providing and drying the earth and distribution of the manure will be of the smallest. On this question, the Committee on the Treatment and Utilization of Sewage appointed by the British Association for the Advancement of Science has said, as to houses and villages (again looking at the value as a matter to be estimated by chemical analysis), that the dry-earth system "might be even" economical where the earth for preparation and absorption and the land "for utilization, are in close proximity."†

Without desiring to under-rate the commercial aspects of the question, it appears to me that it is the economical aspect in the sense of obtaining an unquestioned good at the least cost which has place here. If the value of a method of excrement-disposal is to be estimated by its profitability as a pecuniary investment, rather than by its hygienic success, all measures at present in use in this country would have to be condemned. From the former stand-point the best, perhaps, that can yet

* I give the following analysis, one of several showing similar results, by Dr. Voelcker:—

COMPOSITION of EARTH and of three Samples of EARTH-CLOSET MANURE produced at WEST RIDING PRISON, WAKEFIELD, in dry state (dried at 212° Fah.).

	No. 1. Earth for use in Closets.	No. 2. Earth once used in Closets.	No. 3. Earth twice used in Closets.	No. 4. Earth thrice used in Closets.
Organic matter and water of combination - - - }	9.88	9.79	11.53	12.22
Oxide of iron and alumina - - -	12.95	16.15	14.11	12.48
Phosphoric acid - - - -	.18	.25	.44	.51
Carbonate of lime - - - -	2.21	2.25	2.13	2.14
Magnesia - - - - -	1.44	} 2.63 {	.77	.90
Alkalies and loss in analysis - -	1.35		.72	.74
Insoluble siliceous matter (clay and sand) - - - }	71.99	68.93	70.30	71.01
Containing nitrogen - - - -	100.00 .31	100.00 .37	100.00 .42	100.00 .51
Equal to ammonia - - - -	.37	.45	.51	.62

"On the Composition and Agricultural Value of Earth-closet Manure."
"Journal of the Royal Agricultural Society," No. 15, p. 185 (1872).

† Report, 1872, p. 188. Drs. Gilbert and Voelcker were both members of this Committee.

be said of the completest of these is, that it is the least costly. From the sanitary stand-point it is unfortunate, although quite explicable, that the promoters of the dry-earth system should have rested its advantages so largely upon its presumed results for agricultural purposes. Their experience must, however, be taken as showing that there are certain conditions of use of earth-closet manure which justify their encomiums of it as a manure; and there is no sufficient reason to believe that a multiplication of like experience would lead to different results. But adopting the chemical estimate of the value of earth-closet manure, it still leaves the question in this not particularly unfavourable position, namely, that the dry-earth system is perhaps the only method of excrement-disposal at present practised in this kingdom, which wholly or almost wholly would probably cover the cost of working, if it were judiciously put in operation within suitable districts.

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Thus regarded, Dr. Buchanan's estimate of the conditions and cost of application of the system to a community of 1,000 persons is as instructive now as when written, and I reproduce it with a few modifications and with the omission of that portion which relates to the estimated value of the manure.

"I now find myself in a position to state, with some approach to accuracy, the way in which the earth system may be worked, as well as its approximate cost and produce. I need not here consider the case of public institutions or of very small villages, as the instances quoted sufficiently illustrate the operation of the system there. But for my present purpose I begin with the case of a village population of 1,000 persons already provided with the ordinary arrangement of outside privies and cesspools. People making use of closets as receptacles for all stools and urine from every inhabitant, may be taken to use them on an average three times a day each,* and to require for each use $1\frac{1}{2}$ lb. of dry earth. This gives 4,500 lbs., or two tons, as the daily quantity of earth required for the population. The amount that would accumulate in the closet pits, and which would need to be removed about four times a year, would be larger than this by the bulk of the stools and of such portion of urine as did not evaporate; but without reckoning increase on this score, the quantity of manure produced may be reckoned at the same quantity of two tons a week.

"I assume that, after owners of property have paid the original cost of providing earth-closets according to the scheme of the local authority, all supply and maintenance of them should be the function of that authority. The cost to owners would vary (1) according to the adaptability of the existing arrangements, and (2) according to the character of the earth arrangements to be required. The latter may either consist, as at Lancaster, in a single daily application of earth to the closets, or much preferably, as at Halton, in an arrangement for the mechanical delivery of earth after each use of the closet. In this latter case an average outlay for structural alterations and machinery of some 3*l.* or 4*l.* might be required in respect of each closet.

Expenses in
village.

"The expenses which, for the efficient management of the earth-closets of such a population, would have to be borne by the local authority, consist first in an original expenditure of some 250*l.*, and in a continuous weekly expenditure of about 4*l.* 15*s.*, as follows:—

Agricultural
value

Capital:—

	£	s.	d.
Drying sheds and furnace	-	150	0 0
Cart and horse	-	50	0 0
Other outlay	-	50	0 0
Two men's wages, at 16 <i>s.</i>	-	1	12 0
One boy's wages	-	0	10 0
Horse keep	-	0	18 0
Firing (at 1 <i>s.</i> 6 <i>d.</i> for each ton of earth)	-	1	1 0
Purchase of earth (at 1 <i>s.</i> a load)	-	0	14 0

* "Closets used in the ordinary way, for stools and part of urine only, would not be so often visited. Less than two visits daily by the average person would be estimated for such use."

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The two men and boy could perfectly well manage the collection of earth, its drying and distribution, and the removal of the product, not only for our village of 1,000 inhabitants, but for a place, if lying compactly, of a hundred or two more.

"The annual cost to the authorities then would be ($52 \times 4l. 15s.$) 247*l.*, and with the addition of 13*l.* as interest on capital, 260*l.* The removal of ashes might very well come within this amount, for if the labour of collecting were somewhat increased, there would be a saving in fuel by the gain of the cinders, and also a gain (to which little importance, however, attaches) of dry dust that might, in some circumstances, be used with the earth to the closets.

"The quantity of manure got from the earth-closets of the village would each year amount to 730 tons, or, from the consideration before advanced, more. The cost of production of this will have been 7*s.* a ton. . . .

"This then is the way in which it appears that the earth system may best be worked in the village or small town. But it is susceptible of some modifications. For instance, if it be desired to irrigate partially with the refuse of the inhabitants, a part of the urine may be allowed to flow into sewers, or it may be wished to use some of the liquid refuse direct on cottage gardens; and, of course, in such cases less manure (at less cost) will be got from earth closets. And there appears no reason why an earth system should not be used in certain parts of a town, and a watercloset system in other parts. Especially when one remembers what a delicate machine the watercloset is, the use of the earth system may prove to be particularly useful for the poorer parts.

"The extension of this scheme beyond the village of 1,000 people to larger towns appears to be essentially a question of multiplication, with these differences: on the one hand, an organization on a large scale can commonly be had more cheaply than one on a small scale, and in this way and by its compactness the town has the advantage over the village; on the other hand, labour is dearer in towns, and towns often have their closets so arranged that it is difficult without much cost to adapt them to the earth system, and thus the village has advantage over the town. Further, in towns, which must necessarily be supplied with sewers for the purpose of drying the soil, and for removing rainfall and house slops, the question arises whether it may not be more advantageous to throw all foul matters together into these sewers. I do not propose to discuss the relative merits of a watercloset system and of an earth-closet system; this must depend upon a variety of considerations proper to each particular place. In a locality where sewage can be cheaply delivered upon suitably situated land, where the amount of sewage dilution is such as fits it for the particular crops that are marketable, where the irrigable land is of such extent and quality as effectually to remove the manurial constituents of sewage, and to allow of the effluent water passing off in sufficient purity; in short where sewage irrigation can be effected with profit to the people and safety to the health of themselves and their neighbours, I should anticipate a preference for a system of water carriage for the excrement of the place. But for populations where these conditions may not be attainable, or where experience may show greater profit realizable from solid manure, I should suppose that the earth system would find advocates in preference to the water system; and it is impossible to ignore the fact that many large English towns do not regard the watercloset system as suited to all their particular wants, nor irrigation as being a remedy certainly suitable to their particular sewerage difficulties. I refer, of course, to towns which, although possessed of a system of sewers, nevertheless retain their excrement in middens or cesspools, deliberately avoiding waterclosets as not affording them the certainty of advantage which they need to have before they enter upon expensive new constructions. By the authorities of such towns the earth system will especially deserve consideration as promising them the means of making harmless their retained excrement by a system readily, perhaps, adaptable to their present privy construction, and not involving in its introduction a new kind of difficulty."

The present inquiry has led me to conclusions as to the hygienic

advantages of the dry-earth system similar to those arrived at by Dr. Buchanan in 1869, and I adopt mainly his words in stating them.

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(1.) The earth-closet, intelligently managed, furnishes a means of disposing of excrement without nuisance, and apparently without detriment to health.

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(2.) In communities, the earth-closet system requires to be managed by the authority of the place, and in limited communities it will probably pay at least the expenses of its management.

(3.) In the poorer class of houses, where supervision of any closet arrangements is indispensable, the adoption of the earth system offers especial advantages.

(4.) The earth system of excrement removal does not supersede the necessity for an independent means of removing slops, rain water, and soil water.

(6.) As compared with the watercloset, the earth-closet has these advantages:—It is cheaper in original cost; it requires less repair; it is not injured by frost; it is not damaged by improper substances being thrown down it, and it very greatly reduces the quantity of water required by each household.

Note.—In the course of the present inquiry, an instance came to my knowledge of disease occurring in a place where earth closets were used, namely, certain states of ill health and an outbreak of enteric fever in the West Riding gaol, Wakefield, which the medical officer, Dr. Wood, believed to have been connected to some extent with the use of earth-closets there.

The *West Riding Prison*, Wakefield, has for eight years had numerous earth-closets in operation within it. The provision for the excrement-disposal of the prisoners confined there consists now of earth-closets and waterclosets in equal proportions, the number of each form of closet being about 800. The arrangements for drying the earth, preparing it for the closets, and for subsequently storing the contents of the used closets, are the most complete I have seen in any institution. The dry earth, before being distributed to the closets, is sifted through a sieve having a $\frac{1}{4}$ -inch mesh. Formerly, closets with lever-action seats were used, but now the simpler arrangement of a scoop for covering the deposited excrement with the dried earth is in use throughout the prison. On the male side the prisoners are instructed not to pass their urine into the closets, but to use for the purpose a separate vessel. This urine was not, at the time of my visit, mixed with the compost removed from the closets, but was sold for scouring to blanket manufacturers. The average duration of the confinement of a prisoner in this prison is 53 days; the maximum duration two years.

In November, 1870, enteric fever appeared in the prison. From a detailed report on the subject, which has been courteously forwarded to me by Dr. Wood, the medical officer, it appears that this malady had been so long unknown in the cells that it was almost a "new disease" within them. Seven cases of the disease took place in November, two in December, five in January, 1871, and three in February, after which month there were no further cases. Eighteen cases occurred altogether, of which 13 happened in the male division of the old prison buildings (the E. prison), four in three of the four wings of the new prison buildings,

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wholly devoted to males; (two in B. wing; one in C. wing; and one in A. wing); and one case occurred in December, in the reception cells. The origin of the outbreak was obscure, but it was believed to be connected with the prison itself, all the prisoners first attacked having been several months in confinement. The first case of enteric fever had occurred on the 21st October in the new buildings, the person attacked having entered the prison on the 21st March. The four next cases occurred in rapid succession (one on the 22d November, two on the 24th, and one on the 26th) in the old buildings among prisoners who had been in the prison 2, 4, 7, and 10 months respectively.* The outbreak took place at a time when there had been considerable deterioration of the prisoners' health in certain parts of the prison, believed to have arisen partly from deficiencies in the dietary then in force, partly from defects in the ventilation of certain parts of the prison, and partly from the mode of managing the earth-closets. The contents of the earth-closets at this period were removed from the cells only once a week, and it is stated to me that before the expiration of this time the cell was very commonly pervaded by a faint, unpleasant odour, coming from the mixed earth and excrement, and which no care in covering the excrement with abundant earth entirely obviated. It was believed that the enteric fever, and especially its localisation, was connected with the presence in a notable degree of the several conditions of unwholesomeness mentioned; and that in the older buildings of the prison (the E. prison where 13 of the 18 cases of fever occurred) the state of the water supply, obtained from a surface-well within the precincts, might have contributed to the localisation.

A sub-committee of the magistrates investigated the different conditions of unwholesomeness referred to, and in April 1871, as the results of its deliberations, the water supplied to the E prison (and which had been shewn by chemical analysis to be impure) was discontinued, and a supply from a purer source introduced; necessary changes in ventilation and warming of the unwholesome cells were carried out; the effects of the sparser dietary of the early period of imprisonment were more closely watched; and the following changes were directed to be made in the regulation of the earth-closets:—

19th April, 1871.—“That the pans in the earth-closets be emptied and

* The dates of admission into the prison and into the hospital of the several cases of enteric fever were as follows:

Order of Cases of Enteric Fever.	Dates of Admission.		Order of Cases of Enteric Fever.	Dates of Admission.	
	Prison.	Hospital.		Prison.	Hospital.
1	March 11/70.	Nov. 21/70.	9	Aug. 10/70.	Dec. 11/70.
2	Sept. 17 „	„ 22 „	10	Dec. 16 „	„ 19 „
3	Aug. 24 „	„ 24 „	11	Nov. 23 „	Jan. 12/71.
4	Jan. 6 „	„ 24 „	12	Nov. 26 „	„ 12 „
5	April 4 „	„ 26 „	13	Aug. 10 „	„ 12 „
6	May 24/69	„ 27 „	14	Jan. 2/71.	„ 18 „
7	Oct. 3/70.	„ 28 „	15	Jan. 13 „	„ 22 „
8	June 27 „	Dec. 2 „	16	April 20 „	Feb. 8 „

In addition, two prisoners from Coldbath Fields prison were admitted into hospital Feb. 15th and Feb. 17th respectively, both with enteric fever; the dates of admission of these prisoners into the West Riding prison are not stated.

"cleaned at least three times a week. That the earth be not used more than once in the closets in the cells. That a scoop be supplied to each cell to be used by prisoners in case of any defective or insufficient action in the machinery of the closets. That earth after being used in closets, be not dried in the present drying house, situate in the A. courtyard of the prison, and which they recommend be used for drying clean earth only. That printed instructions for the use of the closets be placed in each cell, and the neglect of them treated as a breach of prison rules, and that the closets be frequently inspected by officers of the prison as to their observance."

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The enteric fever had ceased before these various changes were made, the last case having been admitted into hospital on the 17th February. Since the alterations the general health of the prisoners has improved; there has been no occurrence of enteric fever, and the working of the dry-earth system appears to give rise to no greater offensiveness in the cells than the watercloset system. During an inspection I made the number of instances of carelessness in the use of the earth-closets and of waterclosets which came under observation was about the same, but the offence seemed to me more obvious from the watercloset than the earth-closet.

This account of the presumed connexion of the outbreak of enteric fever described, with, among other conditions, defective working of the dry-earth system, I have given from the reports of Dr. Wood, written at the time. The progress of the outbreak and the circumstances under which it occurred, do not suggest to me other than an incidental connexion of the unwholesome conditions referred to with the enteric fever. Information is wanting as to the prevalence, at the time of the outbreak, of enteric fever in the town of Wakefield, and especially among houses in the immediate vicinity of the prison, situated above the stratum of ground from which the polluted well derived its water. When I inspected Wakefield in 1869, under instructions from the Privy Council, the people living in those houses deposited their excrement, as the people living there now still deposit it, in old privy-pits sunk into this stratum. Dr. Wood took objection to the management of the earth-closets, at the time of the outbreak, rather than to the dry-earth system. Of the present management of the closets in the prison, he remarks in a letter addressed to me on the subject: "As regards the earth-closets, with the supervision we now have, I can urge no objection to them professionally."

When Dr. Buchanan made his inquiry in 1869 as to the dry-earth system he gave consideration to the great prevalence of diarrhoea in the camp at Wimbledon, during the meeting of volunteers in the exceptionally hot summer of 1868, and which was held by some to have arisen from the use of earth-closets in the camp. It was shown by Dr. Buchanan that this prevalence was not local, but was part of a general prevalence, common to the camp and the whole of the metropolis, and that therefore the assumed connexion with the use of earth-closets could not be sustained. I visited the camp during the present inquiry, and the following table, prepared from figures courteously furnished to me by Staff-surgeon Owen, the principal medical officer, and showing the amount of diarrhoea at each of the Wimbledon meetings from 1868 to 1874, is of interest. The use of earth-closets in the camp has been continued from year to year, and when I inspected them on the eleventh day of the present year's meeting (1874), the working of the closets in

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the volunteer encampments, under the charge of Moule's Earth-closet Company, was admirable * :—

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Force.	Wimbledon Camp.													
	1868.		1869.		1870.		1871.		1872.		1873.		1874.	
	Strength.	Diarrhoea.	Strength.	Diarrhoea.	Strength.	Diarrhoea.	Strength.	Diarrhoea.	Strength.	Diarrhoea.	Strength.	Diarrhoea.	Strength.	Diarrhoea.
Army	548	41	670	0	655	3	400	2	633	1	607	1	643	1
Volunteers	1,172	173	1,071	33	1,177	21	1,206	7	1,477	10	1,265	7	1,654	1
Police	232	45	265	8	248	3	256	3	265	3	248	0	248	1
Camp Followers	207	50	419	18	75	3	441	4	262	7	577	1	464	—
Totals	2,159	309	2,425	59	2,155	30	2,303	16	2,637	21	2,697	9	3,009	3

III.—THE CHARCOAL SYSTEM.

Charcoal System.

The use of charcoal for deodorising, and subsequently disposing of excrement, came under observation during the inquiry in connexion with the operations of two commercial companies. One of these companies is the *Universal Charcoal and Sewage Company, Limited*, and the other the *Carbon Fertilizer Company, Limited*.

The Universal Charcoal and Sewage Company has works at Salford, in the Town's Yard, where it manufactures a charcoal from street sweepings. This charcoal, applicable to the various sanitary purposes to which charcoal can be put, is not used in detail in the deodorisation of privies in Salford; but I had an opportunity of judging of its deodorising effects on excrement in the manufacture of manure from mixed excrement and charcoal which is carried on at the works of the Company. The deodorization is complete, but as the operations of the Company do not include the abatement of excrement nuisance in privies, although it contemplates the charcoal, from its peculiar cheapness, being put to this use, and seeks a market for this purpose, any further description of the Company's objects and work do not enter into my inquiry.

The Carbon Fertilizer Company also manufactures a cheap charcoal from seaweed, but in addition it uses this in a defined way for the abatement of excrement nuisance, and for the utilization of the excre-

* The dry-earth system had been adopted throughout the *Broadmoor Criminal Lunatic Asylum*, shortly before Dr. Buchanan's inquiry, in consequence of continued prevalence among the inmates of a peculiar form of "fever" so-called, supposed at first to have been dependent partly on defective sewerage arrangements, and partly on a water supply containing much vegetable organic matter. At the time of Dr. Buchanan's visit, the probability of defective sewerage having any part in the prevalence was believed to have been entirely set aside, and as his report shows, the nature and origin of the disease remained in obscurity. I am now able to state that, subsequently to Dr. Buchanan's inquiry, further doubts arising as to the sewerage of the asylum, and the "fever" persisting, a more searching examination was made, and defects so extensive discovered, that it was found necessary to reconstruct a considerable portion of the drains. With this reconstruction the recurrence of the "fever" ceased, and no cases have been recorded since 1870.

ment on a particular system. This system includes the charring of the excrement, after its first treatment with seaweed charcoal, so that the excrement itself may be made available in removing nuisance from excrement, and profitable as well in this way as from the chemical products distilled from it in the process of charring, or it may be converted into a valuable manure, or may be used in both these ways as proves best. The charcoal derived from the mixed charcoal and excrement is called by Mr. Edwd. C. C. Stanford, F.C.S., the inventor of the process, *Cycle*, or *X charcoal*. It increases in weight at each reburning by the amount obtained from the excrement; and it retains all the potash and phosphates of the excrement. From the volatilized products which pass off during the charring, and which include an inflammable gas of considerable illuminating powers, are condensed ammoniacal liquor and tar; and from the ammoniacal liquor sulphate of ammonia and acetate of potash are obtained. The cycle charcoal, although wanting nitrogen, has a high estimated value as manure, and when charged with the ammonia distilled from it during charring forms a manure of double the estimated value in its former state, and designated by the Company "nitro-carbon manure."

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My observations were necessarily limited to the action of the seaweed charcoal as used for deodorizing excrement. The proportions of water, carbon, and ash in this charcoal as compared with wood and bone charcoal are thus given by Mr. Stanford:—

		Wood.		Sea-weed.		Bone.
Water	-	6.2	-	2.6	-	3.0
Carbon	-	92.0	-	63.0	-	9.2
Ash	-	1.8	-	34.0	-	87.8

Mr. Stanford observes on these results that seaweed charcoal resembles more the charcoal from bone than from wood, but that it differs from bone charcoal in containing more carbon and carbonates of calcium and magnesium, and less phosphates of these bases. It is noteworthy that in Mr. Stanford's experiments no difference was observed in the action of wood charcoal and bone charcoal upon organic matter, notwithstanding the great difference in the proportion of carbon in them.

I examined the action of the seaweed charcoal as applied to excrement under the following conditions:—

1. *Works of the Company at Dalmuir*:—(a) A closet attached to the office, used regularly by six or seven adult men, of which the receptacle had not been emptied for $2\frac{1}{2}$ years. This receptacle received the whole of the excrement and the greater portion of the urine, during business hours, of the persons referred to. The seat of the closet has a lever action, and on each use an ingeniously designed "chucker," fed from a hopper, scatters a suitable proportion of charcoal over the deposited excrement. A urinal is also placed in the closet, of which the basin is filled with charcoal, and which communicates with the closet receptacle. The receptacle was opened for my inspection. All excrement was completely covered, and the contents were dry and odourless. The contents were freely turned over with a spade at my desire, but no odour was given off during the process. (b) Twelve months' accumulation in a large shed of mixed charcoal and excrement of about equal bulks, from closets in various manufactories and houses on the Clyde and in Glasgow. This great mass was quite odourless, and a section cut into it showed excrement retaining its form and unchanged paper, but without a trace of smell.

(c) Another accumulation of mixed charcoal and excrement, which had been brought into the works a week before. This accumulation had a slight ammoniacal odour.

2. *Messrs. J. and G. Thomson's Ship Yard, Clyde Bank.* A privy of 36 seats, opening into a common vault, and used by 2,500 workers. The vault constitutes a chamber, entered by folding doors on the level of the ground, the closets forming a storey above, approached by stairs. The rule appears to be not to empty the contents of the vault until they approach the ceiling. At the time of my visit the vault was being cleared, and half the contents had been removed, leaving a section of the undisturbed half extending from floor to ceiling. Notwithstanding this newly exposed surface of the still great mass, there was no offensive odour, except in one or two spots where from careless use of closet, or an empty hopper, a portion of uncovered fresh excrement lay. The mechanism of the closets was similar to that already described.

3. *Smallpox Hospital, Glasgow.*—Here the charcoal is used with pail-closets, and for the close-stools in the wards. In the closets a box with scoop is placed on the seat, and the nurse is held responsible for covering the excrement deposited. Where this was properly done, the deodorization was complete. The use of the charcoal in the close-stool was said to be to some extent objectionable, from the difficulty of cleansing the vessels after its use, and from the amount of slop arising from this process which had to be cast into the closet-pail. The contents of the pails are deposited in a shed within the hospital inclosure, and removed at intervals of three weeks to Dalmuir. The deposit in the shed at the time of my visit was odourless, but moist when turned over. The hospital contained 100 patients, and 26 cwts. of charcoal were supplied to it twice a week. This was abundant for the requirements of this number of patients, but when the number had exceeded 200, some little difficulty had been experienced in obtaining a sufficient supply of charcoal.

4. *Bowling-Green Terrace, Glasgow, Stair, No. 4.*—The closets in this and adjoining stairs in the terrace have been built to communicate by shafts (a filthy arrangement) with a common receptacle in the basement. They were designed for dry-ash closets, and the closets of one stair have been converted into charcoal closets. Although the mechanism of one closet was broken, and the closets were dirty, there was no excremental smell from the shafts. But the inhabitants of the stairs complained of occasional smell when the receptacle had been long unemptied. The receptacle of the ash closets on an adjoining stair, it must be stated, was also almost free from smell, other than that of the ashes and dry-house refuse.

5. *The Quay, Glasgow.*—Two large public closets, one a Macfarlane's trough, without water, cleansed every alternate day; the other managed with charcoal, and containing a great accumulation in its pit. The former closet stunk unbearably, the latter had only such stink as came from excrement deposited since the last distribution of charcoal by the man in charge, this being effected several times daily. The former in fact was a public nuisance, the latter an unnoticeable convenience.

The quantity of charcoal needed for the efficient deodorization of excrement is stated to be by weight one-fourth that of dry earth; and upon this estimate the supplies of the Company to the various closets to which they furnish charcoal have been calculated. Mr. Stanford, taking the total excremental matters to be removed per

head from a household annually to be 8 cwts. (of which $\frac{3}{4}$ cwt. would be solid excrement), estimates that the quantity of charcoal required for the deodorization and utilization of a family of 10 persons would be about 4 tons yearly, and that the amount of material to be removed, making allowance for drying of the mixed excrement and charcoal, would be between five and six tons in weight. The Company contemplates the cleansing of the closet at long intervals, say once a year.

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Charcoal System.

The examination of the charcoal closets in Glasgow and the vicinity, proves, as was to be anticipated, that charcoal properly applied acts as a most effective deodorizer of excrement, and that this action, in receptacles kept dry, persists for an indefinite period. The assumption, however, that the mixed excrement and charcoal may, therefore, be safely stored for many months in the vicinity of or within the precincts of dwellings, appears to me to be at least premature. We know too little yet of the modes in which excrement acts in the production of disease to justify such assumption; and we are not less ignorant of the action of charcoal upon the disease-producing qualities of excrement. Mr. Stanford's researches on the mode of action of charcoal on organic matter, suggests extreme caution in our conclusions on this subject. He believes, from his experiments, that the charcoal acts not as an oxidising agent, but simply as a drier.* The possible changes in a mixed mass of excrement and charcoal which may occur under various conditions of moisture and temperature are as yet wholly unknown.

But apart from these considerations there is the simpler question of the success which would probably be obtained among a mixed population in the ordinary use of charcoal as a privy deodoriser. The experience of Glasgow, even to the present time, shows, that there is no such surety of action to be obtained in this respect as Mr. Stanford and his Company contemplates, and that notwithstanding the great advantages accompanying the use of charcoal in deodorising excrement, the frequency of its removal from houses should be governed by other and wider considerations.

At the time of my visit to Glasgow, the Company had entered into a contract with the Corporation of Oldham to apply its process to the disposal of excrement in that borough. The preliminary arrangements for carrying out this contract had not been completed when this inquiry came to an end.

SLOP NUISANCE.

The abatement of nuisance from slops, including under that term the whole liquid refuse of a household, is part of the wider question of the disposal of sewage. The same principles apply in dealing with slops as with sewage, the two subjects merging the one into the other. Certain typical methods of slop disposal, here described, came under observation during this inquiry.

Slop Nuisance.

* "On the Action of Charcoal on Organic Nitrogen," *Journal of the Chemical Society*, January 1873.

1. In certain new cottages at Halton (Bucks), on the estate of Sir Anthony de Rothschild, the slops are conducted by a drain to a small water-tight receptacle in the garden, whence it is proposed that they shall be ladled from time to time for garden purposes. These cottages are provided with earth-closets, and each cottage has attached to it 40 poles of garden ground. It is calculated that the manure from the earth-closets and the slops may be all utilized in gardening this plot.

2. Another method of disposal is followed at the cottages of the Industrious Aid Society, Hereford. Here sub-irrigation is used to get rid of the slops. Each cottage has a garden-plot of a sixth of an acre, and in this plot sub-irrigation drains are laid for the slops, with small catch-pits at intervals. The slops, however, except when in large quantities, as the contents of a washing tub, penetrate but a very short distance into the drains. The porous loamy soil readily absorbs the liquid and no nuisance arises. Earth closets are attached to these cottages, as already described in the section on the Dry-Earth System.

3. A third method of disposing of liquid house refuse combines the two former methods, developing the first described into a system. This has been devised by the Rev. Henry Moule, M.A., vicar of Fordington, Dorsetshire. Mr. Moule, whose name is commonly associated solely with the dry-earth system of excrement disposal, has by no means limited his attention to that system alone. The dry-earth system, indeed, is perhaps most correctly described as a part of a more general scheme, which Mr. Moule is engaged in maturing for dealing with the whole refuse of a household. As part of this scheme I witnessed in a small plot of garden attached to his house the successful disposal and utilization of the whole of the liquid refuse of the household. This refuse flows to a catch-pit in the garden, which has an overflow into a sub-irrigation drain. The garden is cultivated by alternate cropping, the only manure applied to it being the fresh slops, which are ladled from the catch-pit and distributed to the garden daily. Luxuriant successive crops of garden vegetables are obtained in this manner, and Mr. Moule is of opinion, as the result of his experiments, that the liquid refuse of a family of from 17 to 20 persons can be thus profitably used on five or six perches of ground, as many as three or four crops being grown yearly. The following illustration of Mr. Moule's procedure may be given: On two perches of ground from which potatoes had been removed, drills were run, and after these had been saturated for two days with slops, brocoli was successfully transplanted to them in blazing sunshine. Then between the drills holes were made to the depth of 10 inches and prepared for subsequent transplantation of cabbages by filling them again and again with slops. Meanwhile on both sides of each row of holes a row of autumn carrots was sown.

So far as this inquiry was concerned the method described appeared to be a very feasible way of obviating nuisance from slops where garden ground and intelligent labour were available for its adoption.

4. A fourth method of disposal of slops, in which the difficulty of sub-irrigation by gravitation from the ordinary flow is overcome, has been invented by Mr. Rogers Field, C.E. Mr. Field is the owner of two cottages, at Shenfield, near Brentwood. When these cottages came into his possession they had much adjacent nuisance from their privies, and from the accumulation of slops in contiguous ditches. Mr. Field converted the privy pits into smaller watertight receptacles, with the object of their being used as earth-closets, but he failed, from inability to exercise frequent supervision, to induce the cottagers to use the earth. He succeeded, however, in preventing soakage

of excremental matters from the privy-pit into the ground and in diminishing considerably their accumulation, and the nuisance therefrom. For some time he was puzzled in what manner to get rid of the slop nuisance, the irregularity and smallness of the flow foiling him in an attempt to direct it a sufficient distance along subsoil drains for any useful purpose and for the complete avoidance of nuisance. At length he devised a plan of accumulating the slops in a tank and discharging them at intervals rapidly by means of a siphon. The kind of tank first designed, and of which a pair have been in action at the cottages in question over six years, is shown in the accompanying drawing (Fig. 12). When this tank is full, a little additional slop thrown down

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Fig. 12.

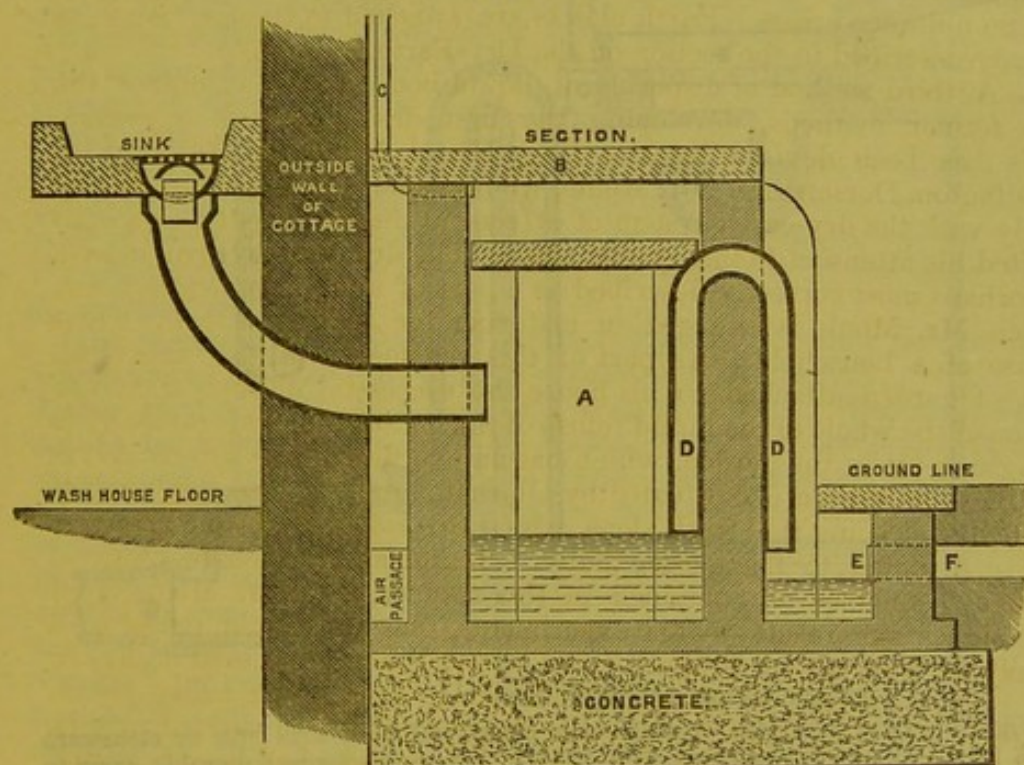


Fig. 12, A, a tank of about 33 gallons capacity, covered with moveable stone cover B, and provided with a ventilating pipe (C), which is carried up the outside of the cottage. The outlet from this tank consists of a siphon pipe (D), so arranged that when the liquid in the tank rises above the top of the siphon, it becomes charged, and empties the tank very rapidly. As soon as the sewage is lowered to the level of the bottom of the siphon (which is a short distance above the bottom of the tank, so as to leave a space for the deposit to be cleared out periodically), the siphon is thrown out of action, and allows the tank gradually to fill again with sewage. The siphon discharges through a small well (E) into a drain (F) leading to the sub-irrigation drains, which latter consist of common 2-in. agricultural drain-pipes laid about 12-in. below the surface of the cottage gardens.

the sink starts the siphon in action, and the contents are emptied with sufficient rapidity and force to carry them a considerable distance along the drains attached to the tank.

The action of this tank, as far as the abatement of slop nuisance is concerned, has been complete, and except an occasional cleansing at somewhat long intervals, and an examination of the drains with which it is connected in order to obviate any stoppage, its operation has involved no trouble. But sundry defects in the action and arrangement of the tank were brought to light by experience. The point of entrance of the sink drain was undesirable, the slops backing up in the drain as the tank filled, and the water from the bell-trap of the sink being

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occasionally emptied by the suction action of the siphon. It was objectionable also that urine from the bed-chamber and in chamber slops could not be poured into the tank except from the sink. Again, the quantity of water required to start the siphon when the tank became full was too large, and it happened that smaller quantities thrown down the sink at this time would simply cause an overflow through the siphon, the slops dribbling away until their level in the tank fell to the level of the siphon's bend. These defects have been remedied by Mr. Field, and the flush-tank as now designed and fabricated in iron

Fig. 13.

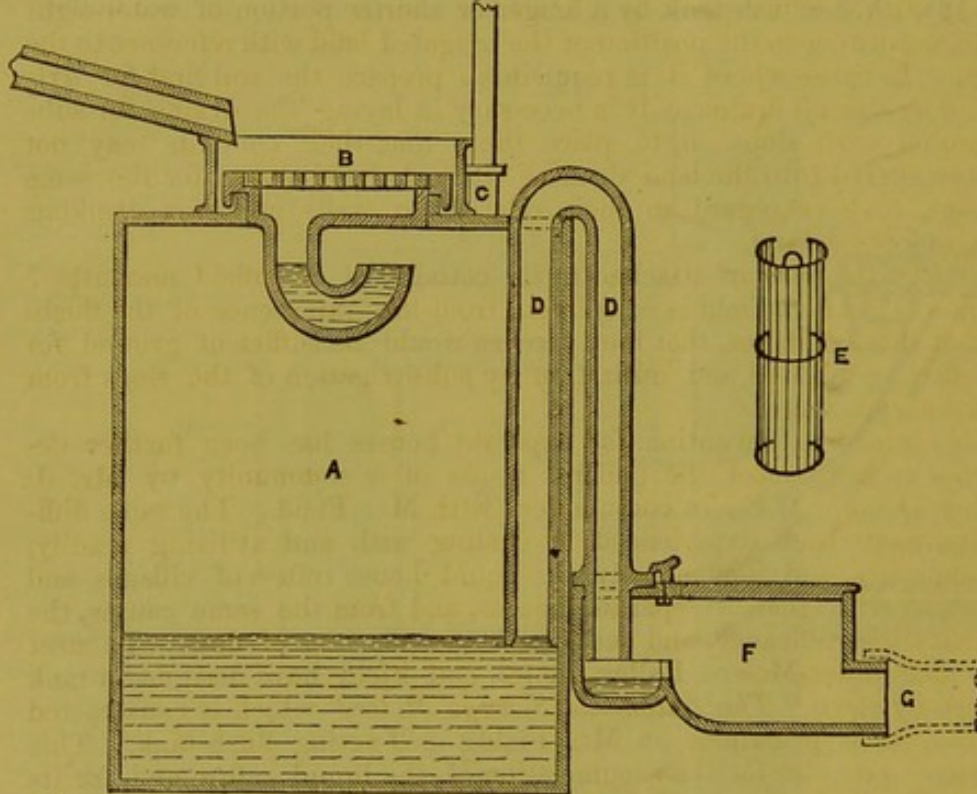


Fig. 13. This apparatus consists of a cylindrical watertight iron or stoneware tank (A). This tank has a trapped inlet (B), which also forms a movable cover to give access to the inside of the tank, and a socket (C) for a ventilating pipe. The outlet consists of a siphon (D), so arranged that no discharge takes place till the tank is completely filled with liquid, when the siphon is brought into action and the contents are immediately discharged. The inner end of the siphon is protected by a wire strainer (E), and the outer end enters a discharging trough (F), which is made to turn round so that its mouth may be directed as required to connect the tank with the line of outlet pipes (G). This trough has a cover which can be removed to give access for cleaning.

or stoneware, appears to be perfect in action. A drawing of this tank is given in Fig. 13.

It will be observed in this figure that the sink drain opens outside the tank above a trapped inlet; and that the long limb of the siphon terminates in a small trough. This trough is so arranged that any trickle of slops along the siphon quickly closes the outlet; and continuation of the trickle after this closure, from air contained in the siphon being carried along with the liquid, exhausts the siphon sufficiently to cause it to be brought into action by the preponderating atmospheric pressure upon the surface of the liquid in the tank. By this ingenious arrangement a much less quantity of liquid thrown down the sink will start this siphon in action than in the tank first designed, and abortive flow from the tank is obviated.

The flush-tank is made of different sizes, varying in capacity from 16 to 30 gallons, exclusive of space for deposit. When in continuous use

the interior should be cleansed and the deposit (a useful manure) removed every month.

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Slop Nuisance.

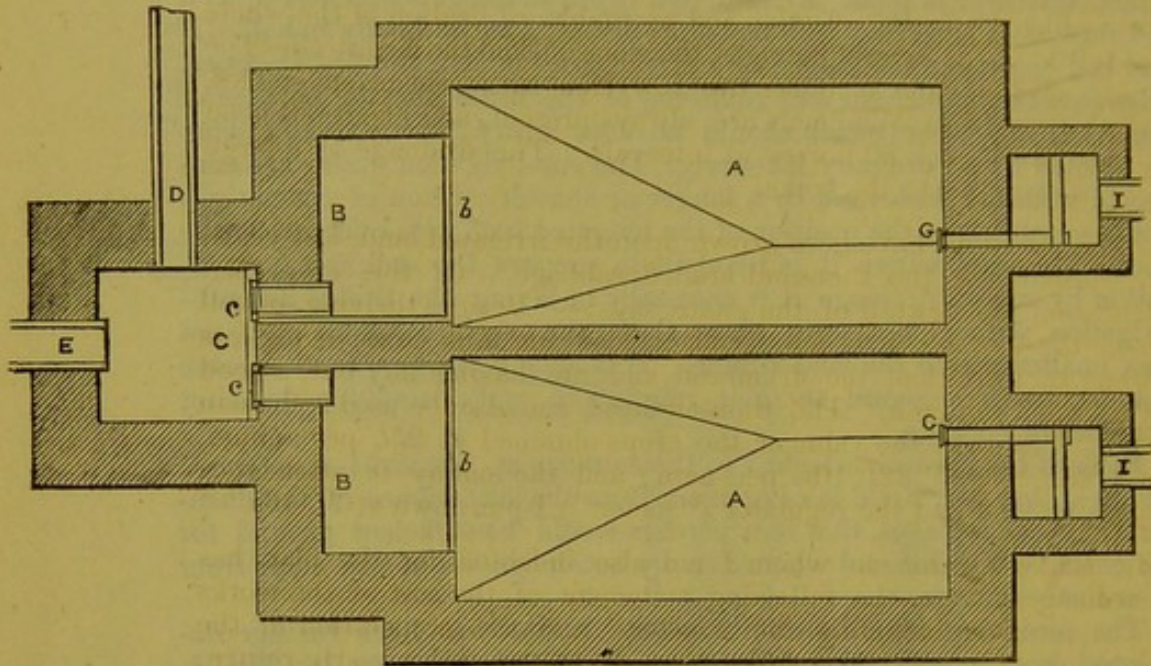
I subjoin a plan of the cottages at Shenfield and the arrangements of their drains. (*Plate XXXV.*) The sub-irrigation drains, formed of 2-inch agricultural pipes, are laid, at a depth of about 12 inches, upon a bed formed of larger agricultural pipes divided longitudinally in half. If this bed be properly arranged by a skilful workman in the first instance, subsequent examinations and replacing of the drain for the purpose of removing stoppages (which should be done every twelve months) may be effected by an ordinary labourer. The sub-irrigation drains are connected with the flush-tank by a longer or shorter portion of water-tight drain, according to the position of the irrigated land with reference to the house. In cases where it is requisite to prepare the soil first for irrigation by subsoil drainage it is necessary in laying the drains for sub-irrigation with slops so to place them that their contents may not pass unaltered into the land drains. It is also necessary, for the same reasons, to give regard to their relation to wells used for drinking purposes or cooking.

Each of the gardens attached to the cottages at Shenfield measures 7 perches; but Mr. Field is of opinion, from the experience of the flush-tank at these cottages, that four perches would be sufficient ground for the effective disposal and utilization by sub-irrigation of the slops from an ordinary cottage.

The foregoing invention for separate houses has been further developed so as to meet the general wants of a community by Mr. J. Bailey Denton, C.E., in conjunction with Mr. Field. The same difficulties have been experienced in dealing with and utilizing readily, economically, and inoffensively, the liquid house refuse of villages and towns, as with that of separate houses, and from the same causes, the ordinary insignificance, and occasional irregularities of flow. To meet these difficulties Messrs. Bailey Denton and Field have designed a tank termed by them "*The Automatic Sewage Meter*," which is constructed on the same principles as Mr. Field's self-acting flush-tank. This "meter" provides for the accumulation of the liquid refuse and for its automatic discharge, at definite intervals, in quantities admitting of distribution over land by gravitation, for purposes of irrigation. A meter of this kind has been in use about three years in the hamlet of Eastwick, near Leatherhead, in Surrey, and its operation, particularly as part of the sanitary arrangements of the village, may there be studied very usefully.

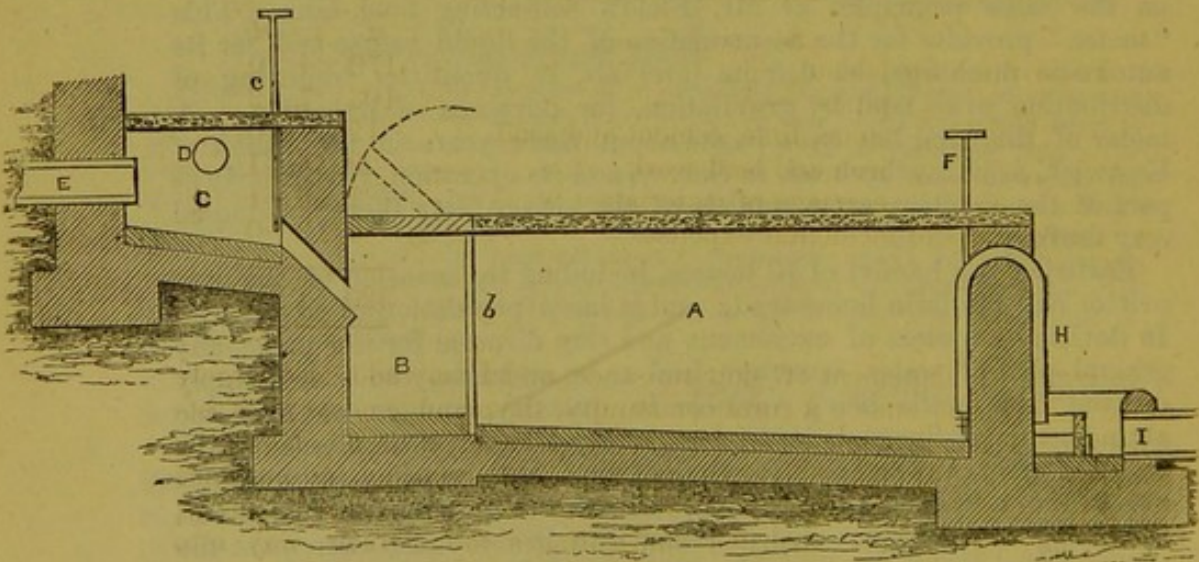
Eastwick is a hamlet of 13 houses, including the mansion of the proprietor and the farm homestead; and it has a population of about 145. In devising a system of excrement and slop disposal for the place, any general plan of water sewerage had to be set aside, the water supply derived from wells being variable in quantity, and at no time too abundant for ordinary domestic use, irrespective of waterclosets. The common privy was retained for the cottages, but the privy-pit was converted into a water-tight receptacle beneath the floor of the closet, and the cottagers were instructed to throw into it above the excrement the refuse ashes, and to remove the contents of the pit monthly for use in their gardens. Four waterclosets exist and five earth closets for the use of the mansion and its precincts; and one watercloset and three earth-closets for the use of the farm homestead. To provide for the liquid house refuse of the hamlet, and for the drainage of the farm buildings, the scheme of sewerage was carried out by Mr. Bailey Denton which is shown in the accompanying plan (*Plate XXXVI.*), and which has an outlet in a meter tank, of which the plan and section are given in the following figures (Figs. 14 and 15).

Fig. 14.



THE AUTOMATIC SEWAGE METER-TANK (PLAN).

Fig. 15.



THE AUTOMATIC SEWAGE METER-TANK (SECTION).

Figs. 14 and 15, A, the meter-tank ; B, the straining chamber ; b, the strainer ; C, sluice-chamber, with sluices, c, governing communications with straining chambers ; D, overflow ; E, sewer ; F, sluice for draining off sediment through the pipe G ; H, siphon ; I, delivering pipe.

The tank is in two compartments, to admit of cleansing without entire disuse. It has a capacity of 500 gallons, and it fills and discharges in ordinary dry weather three times in two days. The several discharges are directed successively on different portions of a plot of ground prepared for the purpose, and which measuring 3 roods 3 perches serves ordinarily for the effective and profitable utilization of the whole liquid refuse of the several cottages, the mansion, and the farmstead. The drainage of the latter includes the flow from cattle sheds and stables, in which from 15 to 20 animals are always present, and about 30 head of horned cattle, and 30 horses at intervals. The drainage of a large piggery also passes to the tanks.

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Luxuriant crops have been grown upon the irrigated land, last year's crop consisting of the thousand-headed cabbage. Of this crop, Mr. Hutchinson, the steward of the estate, says:—"Besides thriving so well upon the sewage, it is an excellent food for milk cows, being less strong in taste than the drumhead and not having any but a good effect upon the milk. The thousandhead can also be used as human food. I estimate the value of the crops obtained at 25*l.* per annum, or at the rate of 32*l.* 10*s.* per acre; and the outlay in attendance upon the land and the regulator ("meter") I put down at 7*l.* 16*s.*"

Mr. Bailey Denton, to whom I am also indebted for the plan, has courteously sent me the following statement of the cost of the works above described, including the "meter" and the preparation of the land, and he remarks upon this statement that:—"the yearly return, after deducting the cost of attendance upon the sewaged land and regulator cannot be less than 17*l.* per annum, so that already a return of about 5 per cent., on the outlay is gained, while there is every prospect of increasing that return as the quantity of sewage dealt with becomes greater and its treatment becomes better understood."

Eastwick Sewerage.

	£	s.	d.
To payment for labour - - -	179	4	0
" " pipes - - -	103	7	2
" " stone, lime, cement and sand -	12	14	0
" " iron and lead work -	20	5	1
" " carriage of materials -	1	9	1
Travelling and incidental expenses -	3	12	0
	<u>320</u>	<u>11</u>	<u>4</u>

In regard to abatement of slop nuisance, and I may add also largely of farm nuisance, among a rural community, the arrangements at Eastwick are the most complete and satisfactory I have yet seen. Notwithstanding the contiguity of the irrigated land to the mansion, no nuisance is experienced from it, whereas previous to the present arrangements, when the slops of the mansion and cottages found their way into neighbouring ditches and decomposed there, considerable nuisance had existed. With some structural alterations in the privies (the principles of which are stated in their proper place in this report) and such needed supervision as will now be obtained from the Sanitary Authority appointed under the Public Health Act, 1872, the arrangements at Eastwick may be regarded as a pattern to be followed by villages and small towns similarly circumstanced.

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From what has already been said it may be inferred that the "Automatic Sewage Meter" admits of wide application in removing the difficulties which often beset the disposal of the sewage of communities larger than Eastwick. It simplifies the whole question of dealing with the sewage of small towns, villages, isolated institutions, and mansions, while securing the most efficient application of the sewage to land, both for purification and utilization, with the least expenditure of labour.

5. In my observations under the head of Gloucester, I have referred to certain experiments of Dr. Francis T. Bond, on the depuration of slops by a combined process of straining, chemical precipitation, and filtration. These experiments should be had in mind as at least giving promise of successful dealing with slop-nuisance under conditions to which the simpler methods already described might not be applicable.

The various methods of slop-disposal which have been described meet the greater number of the conditions under which slop-nuisance is apt to occur. With the exception of Dr. Bond's method, all dispose of the slops by distributing them to the soil either upon or beneath the surface, or in both ways, intermittently—in other words, by intermittent irrigation.

J. NETTEN RADCLIFFE.

31st December 1874.

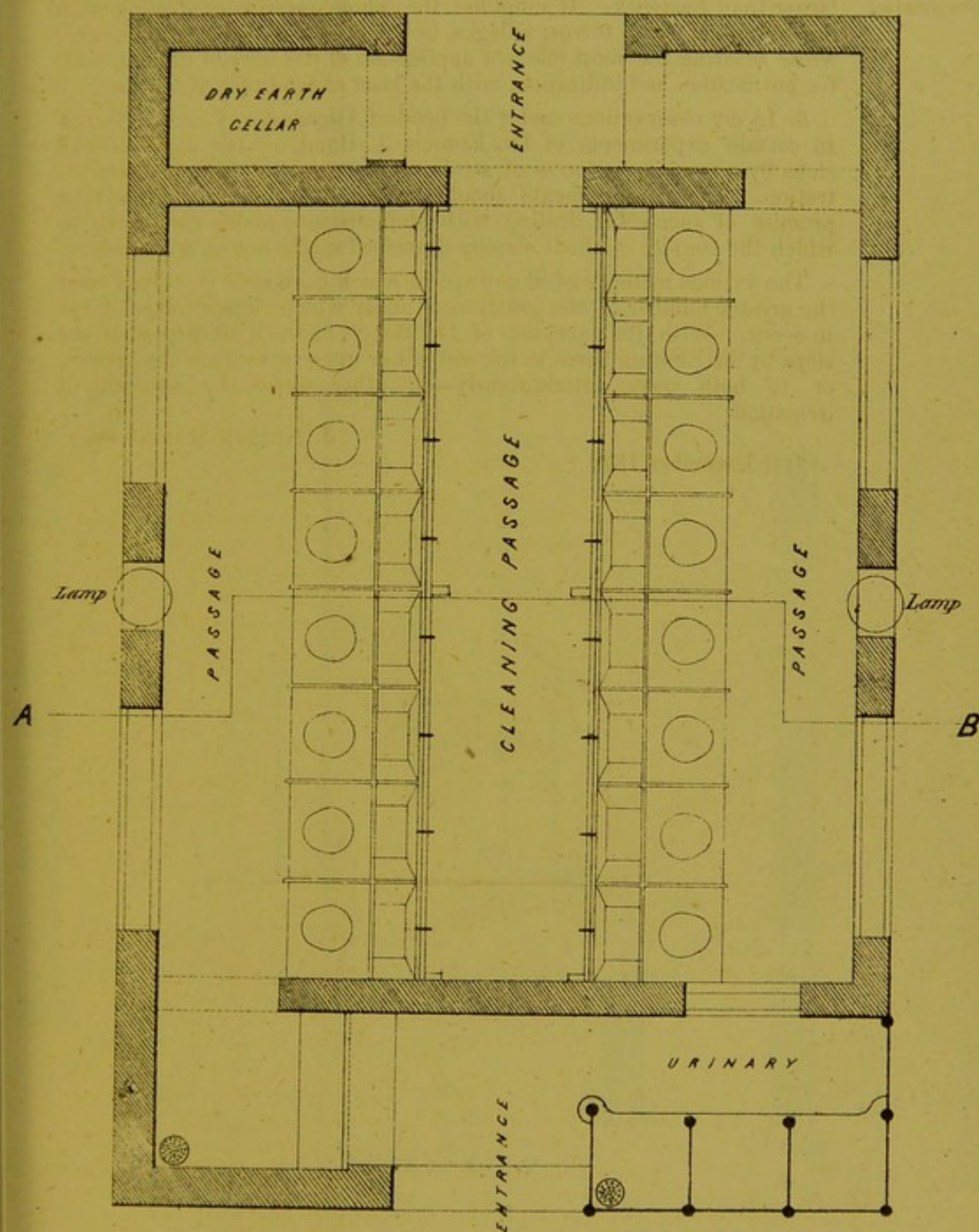


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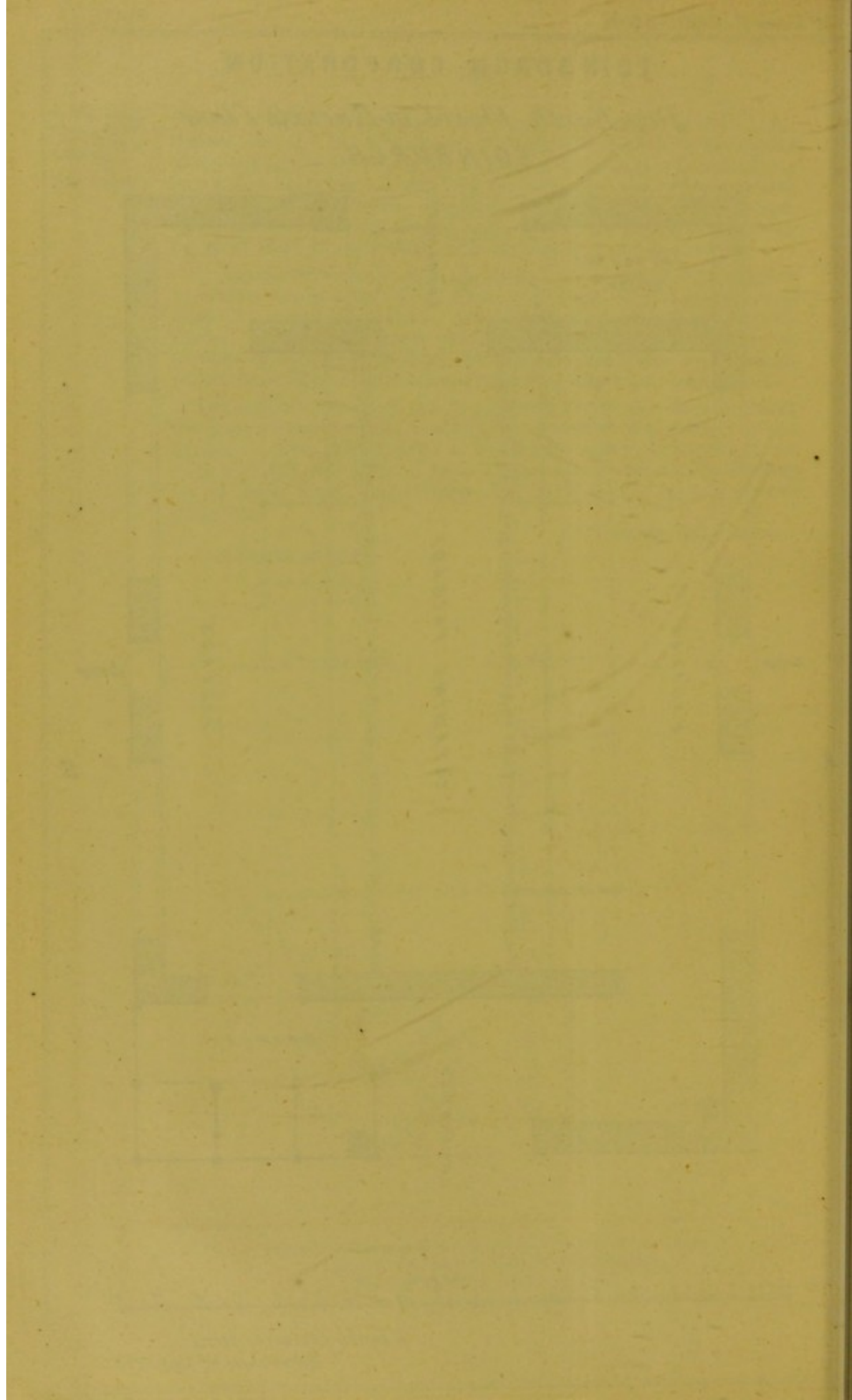
EDINBURGH CORPORATION.

N^o 1*Dry Earth Closet in Burnet's Close.*
EDINBURGH.

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SCALE

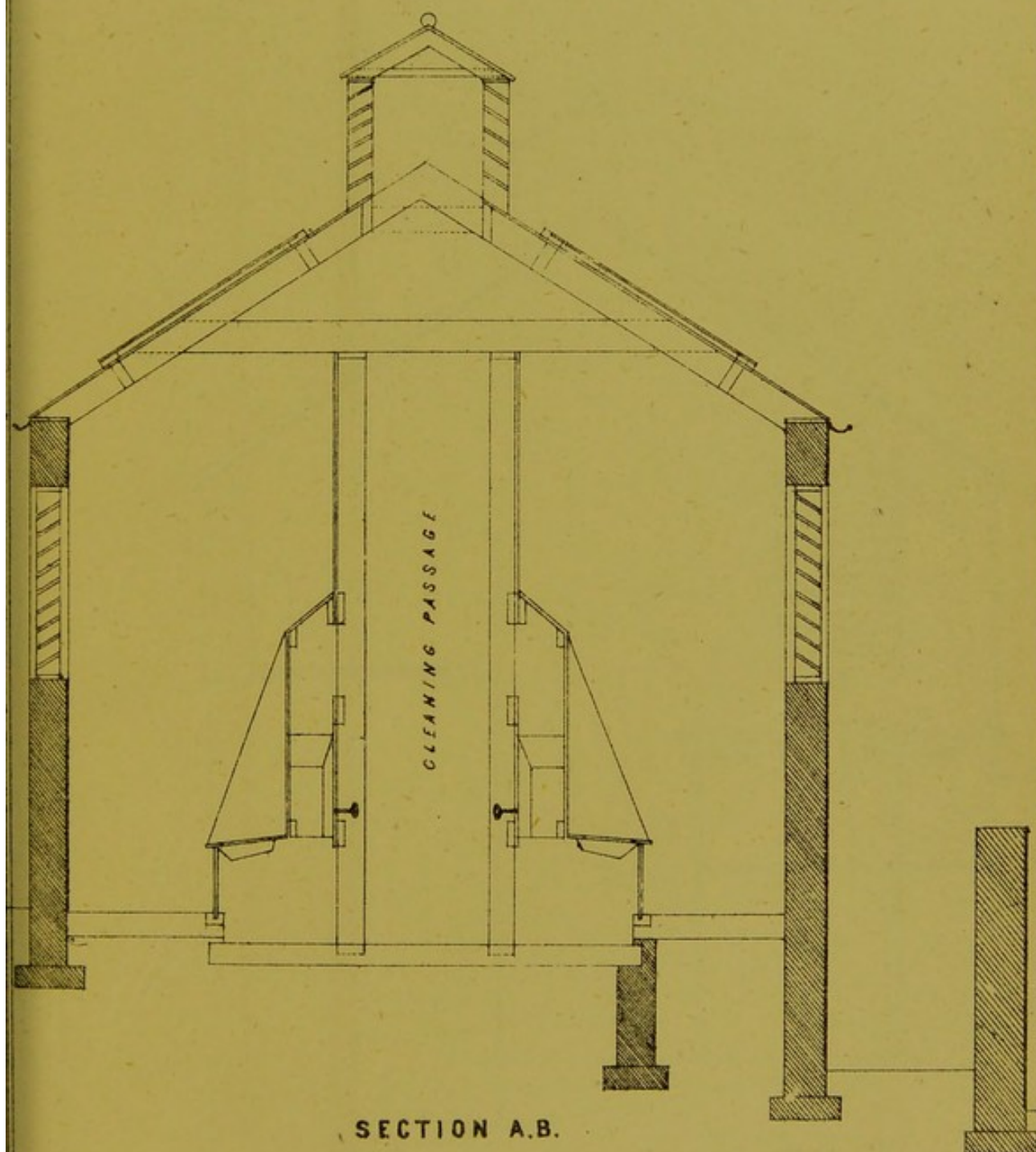
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Edinburgh, 8th Sept 1874.



EDINBURGH CORPORATION.

N^o 2.

Dry Earth Closet in Burnet's Close,
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SECTION A.B.

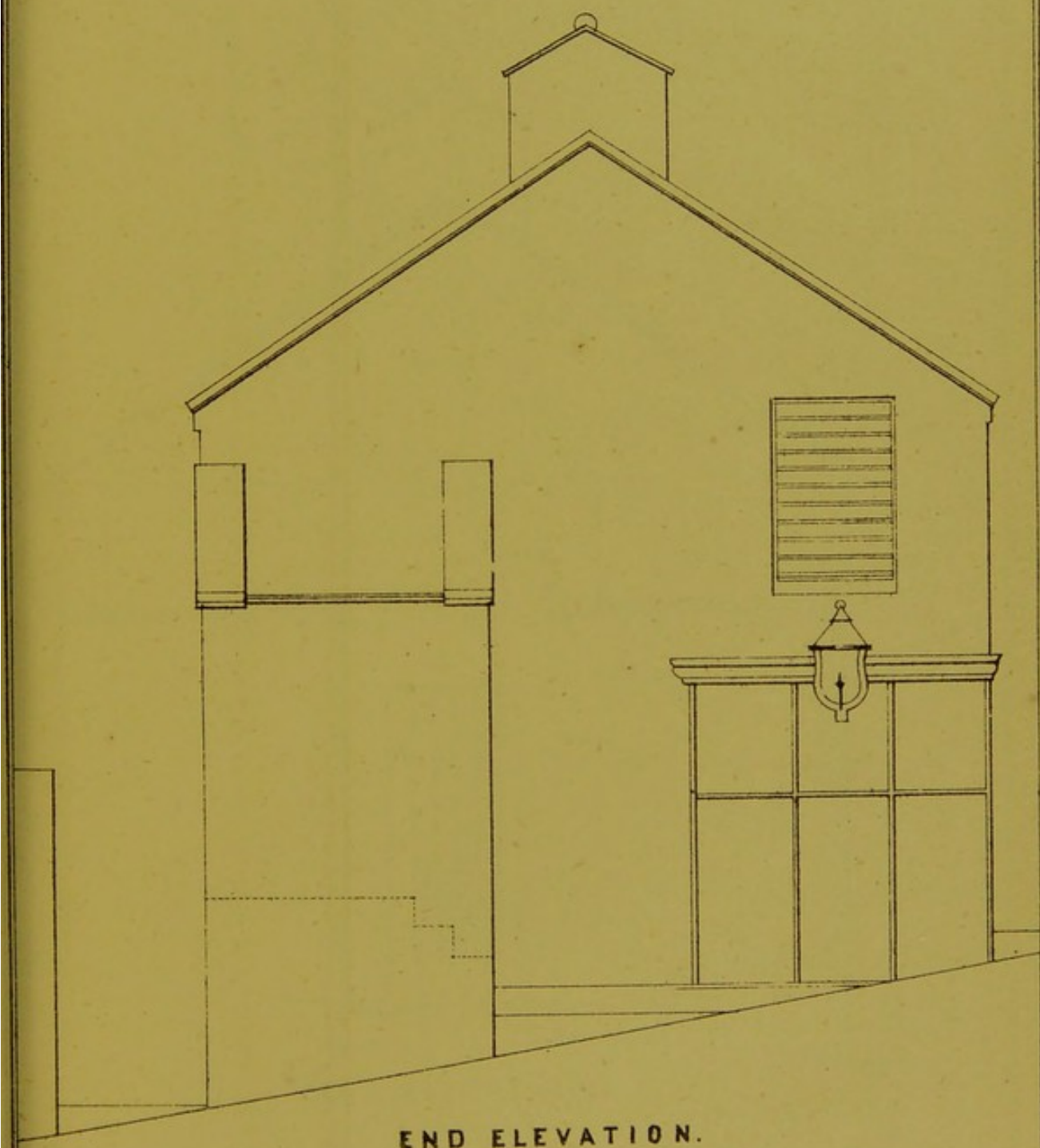
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EDINBURGH CORPORATION.

N^o 3

Dry Earth Closet in Burnett's Close,
EDINBURGH.



END ELEVATION.



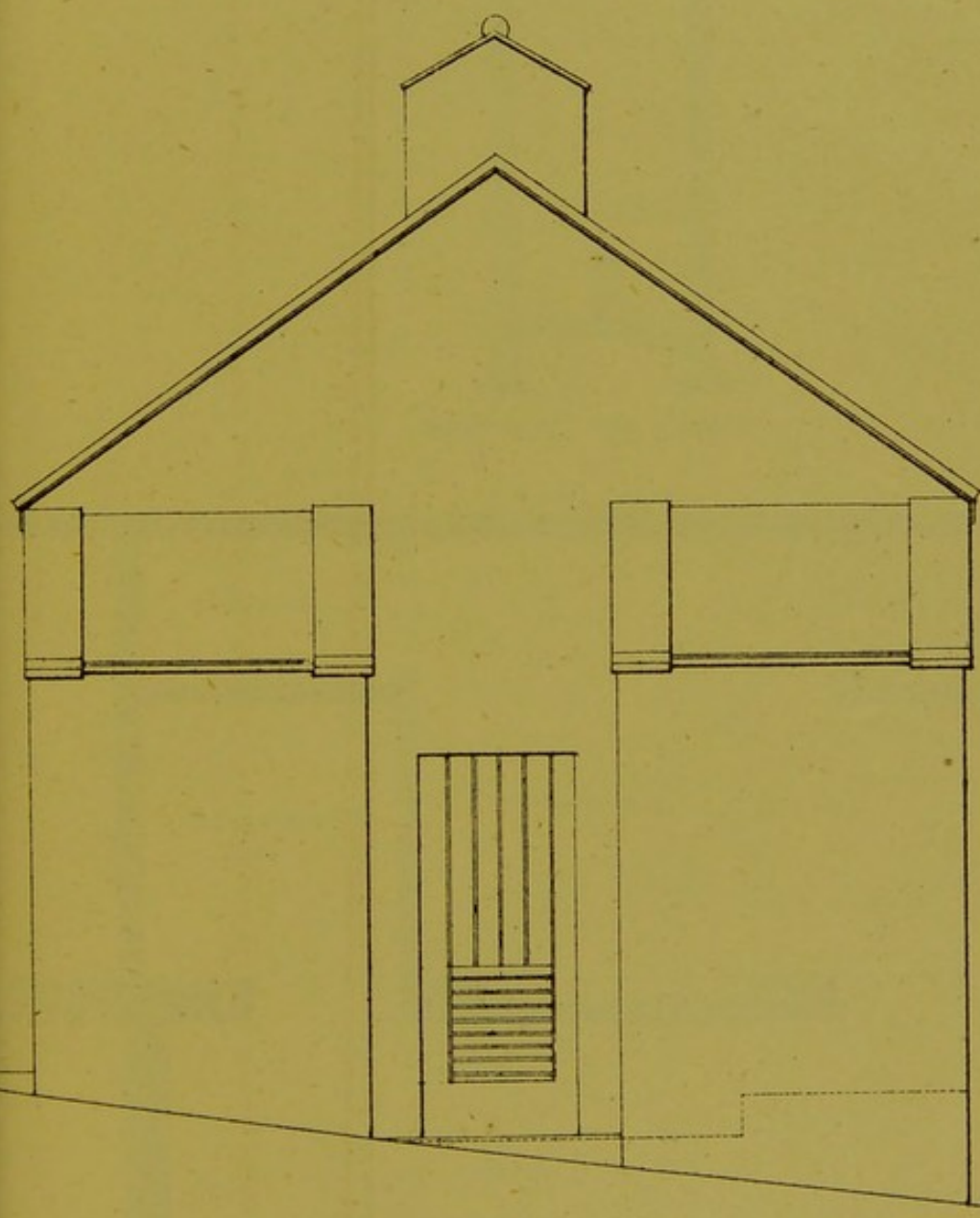
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Dangerfield Lith. London.

EDINBURGH CORPORATION.

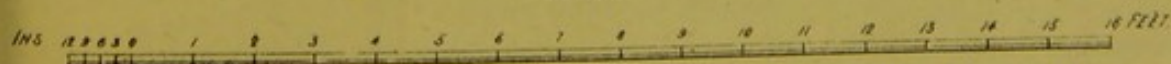
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Dry Earth Closet in Burnet's Close,
EDINBURGH.



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SCALE



BURGH ENGINEER'S OFFICE,
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THE UNIVERSITY OF CHICAGO

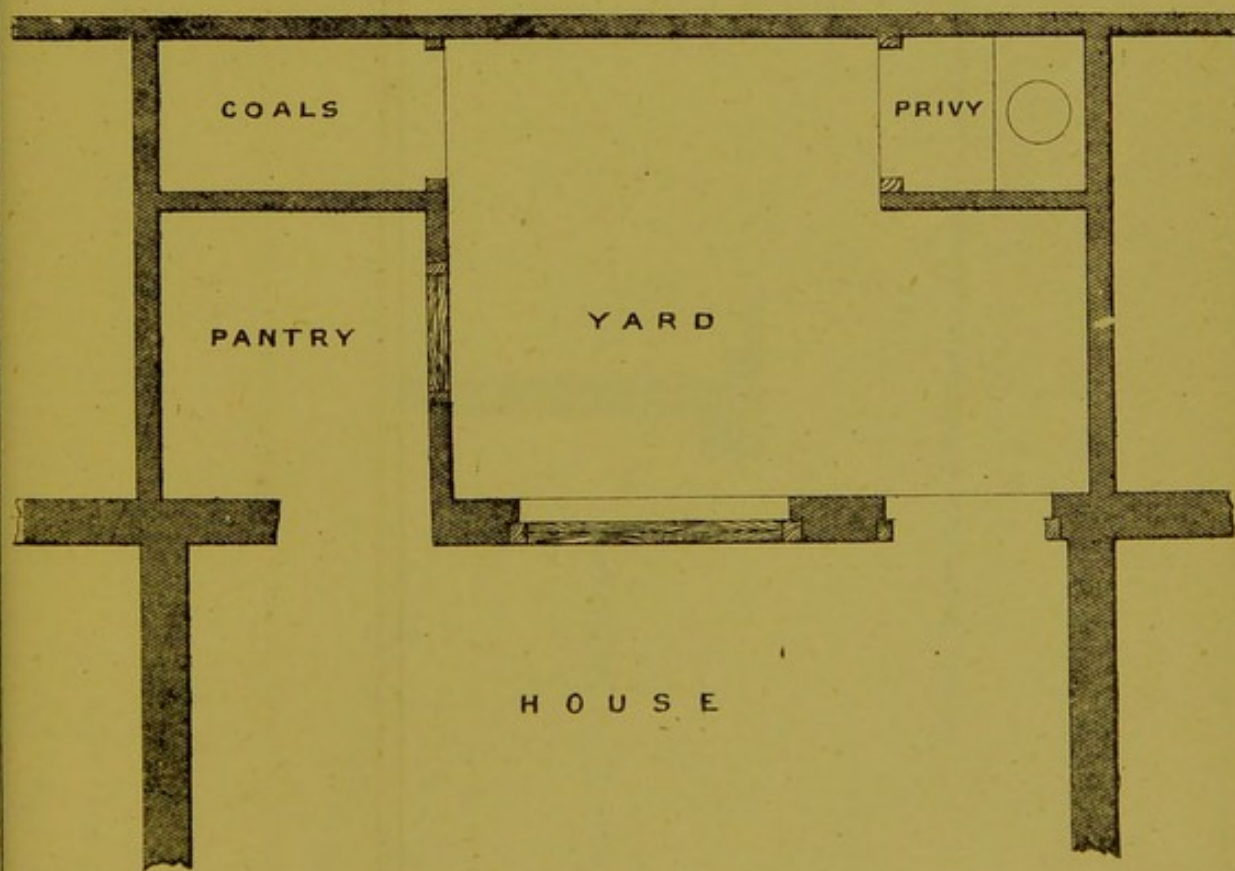
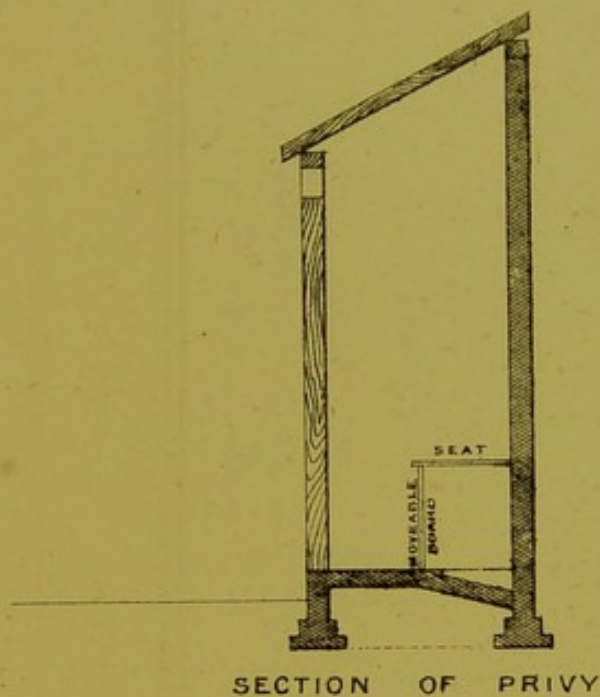
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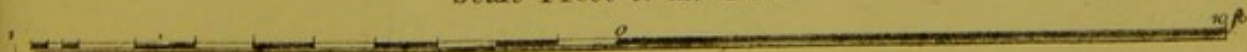
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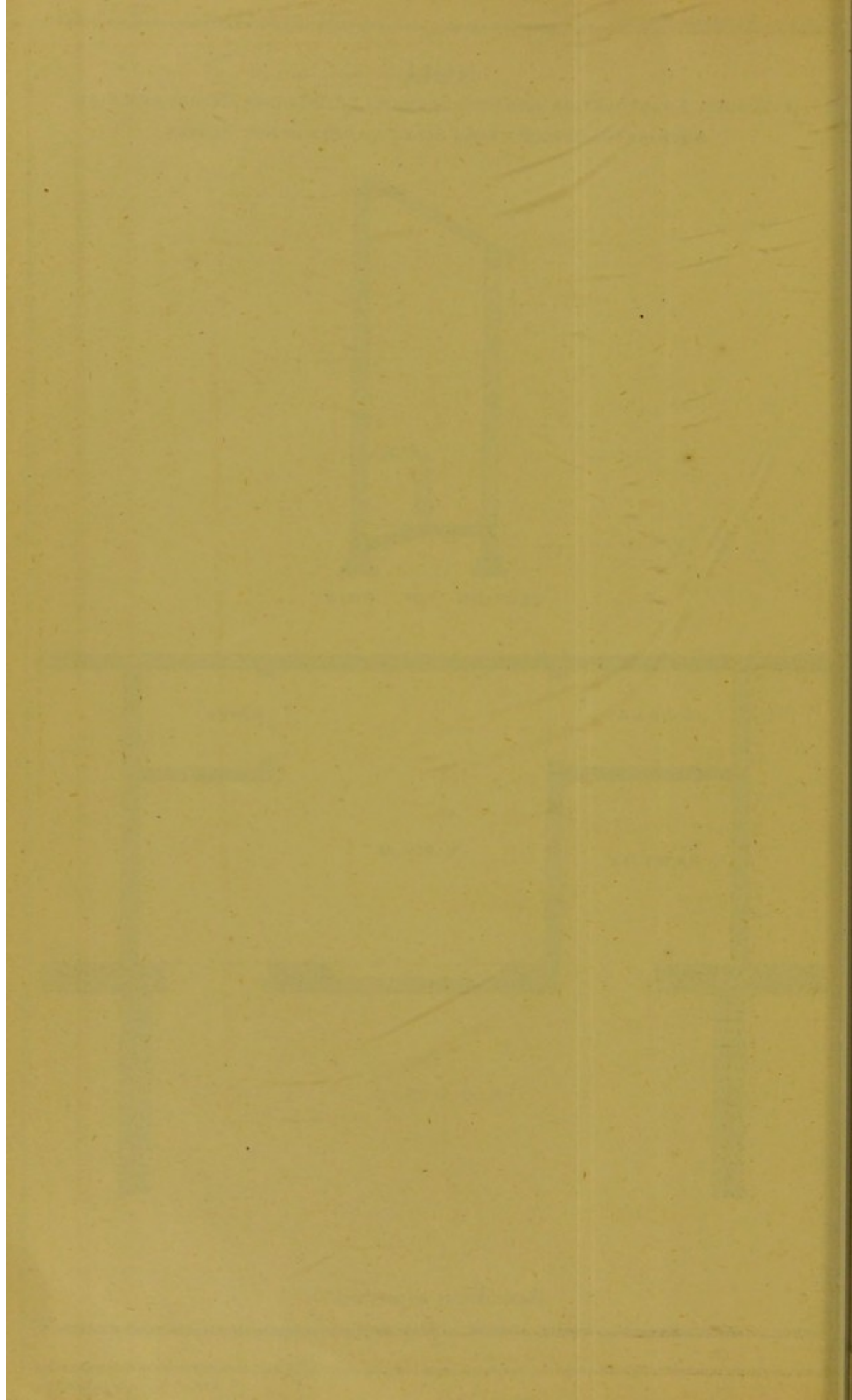
HULL.

APPROVED CONSTRUCTION AND ARRANGEMENT OF ORDINARY PRIVIES WITH PLAN
SHOWING THE SMALLEST YARD SPACE ALLOWED IN NEW HOUSES.



Scale 4 Feet to an Inch.

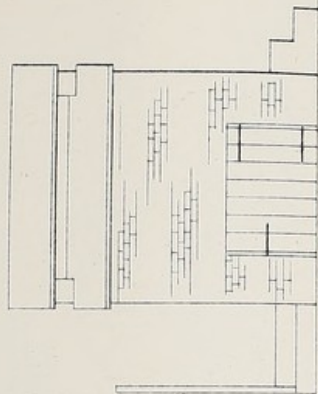
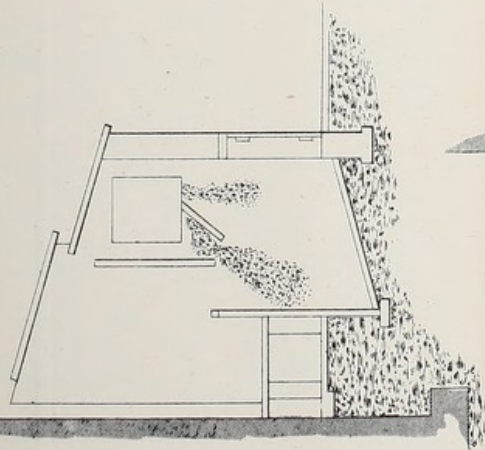




PLAN OF PRIVY
AT N° 24 WILSON ST

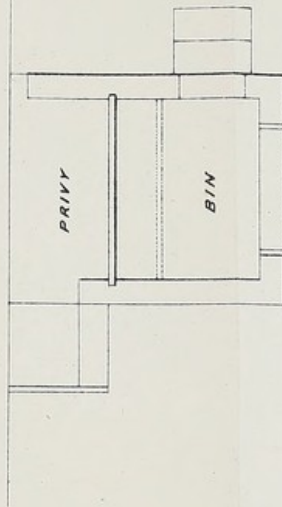
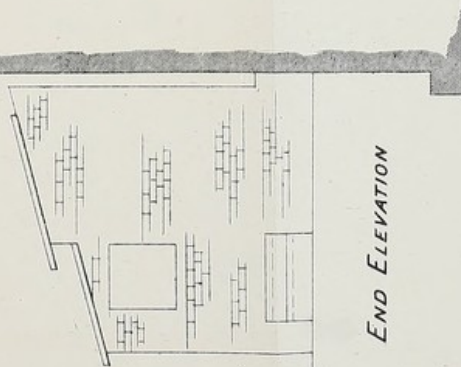
CLASCOW CORPORATION.

PLATE VI
N° 1



SECTION

ELEVATION



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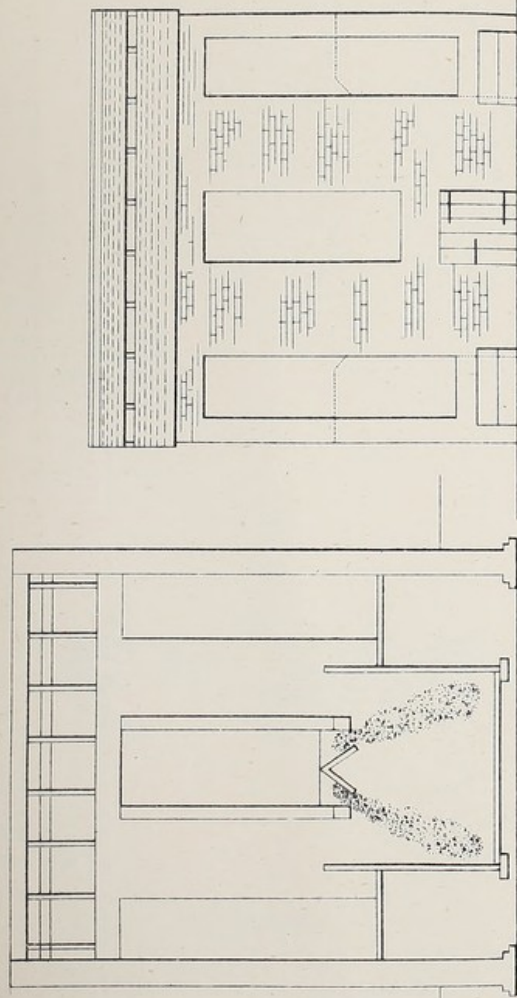
PLAN



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N° 1 Montrose Street,
CLASCOW.

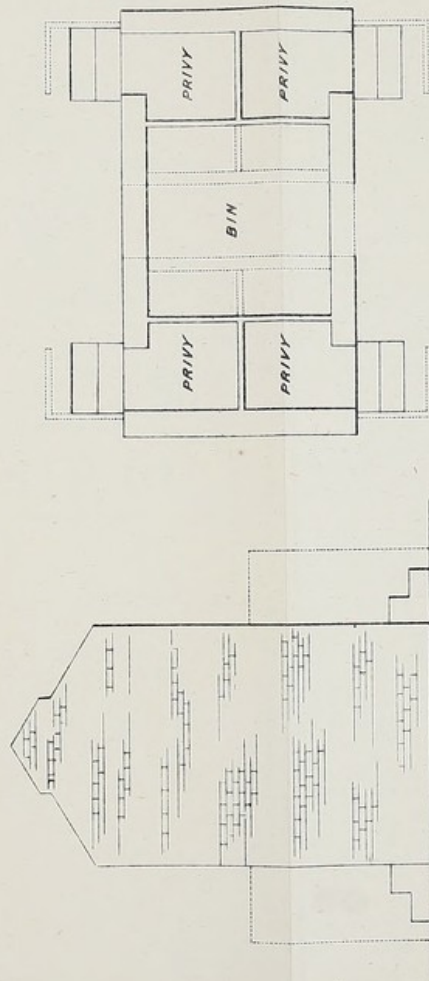


GLASGOW CORPORATION.



SECTION

ELEVATION



END ELEVATION

PLAN



SANITARY CHAMBERS.
N^o 1 Montrose Street.
GLASGOW.

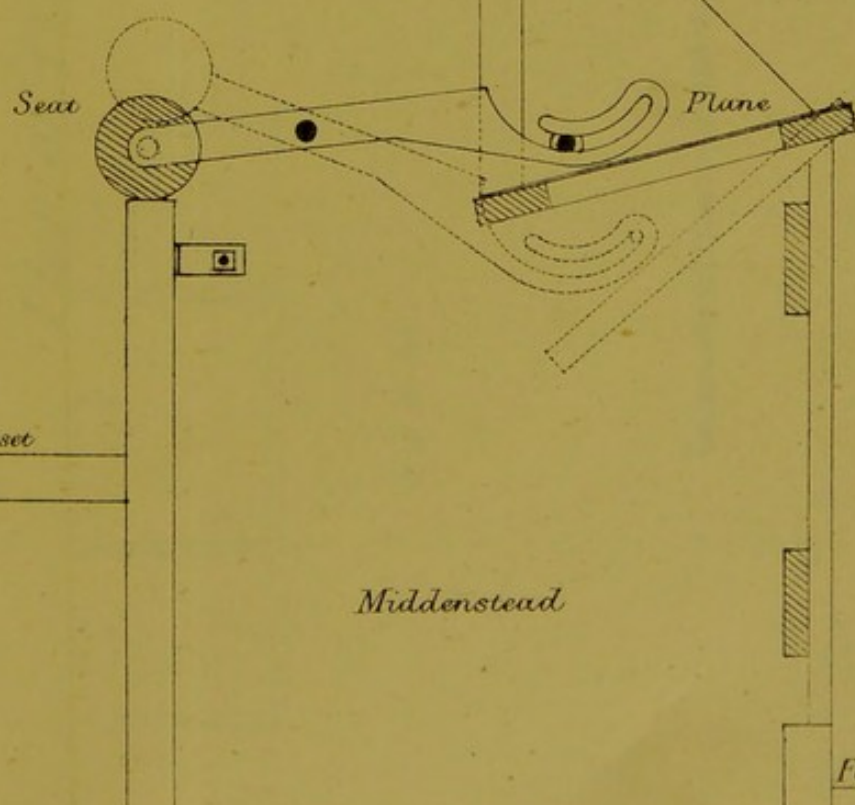


GLASGOW CORPORATION

New Midden Closet

Design for the seat, when in use, acting upon the plane, & closing the opening through which the ashes & house-refuse are thrown into the middenstead.

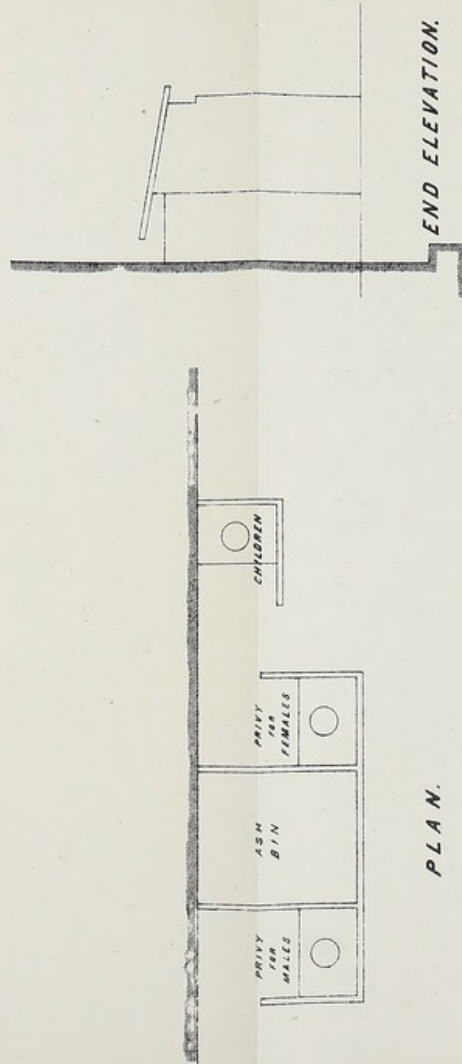
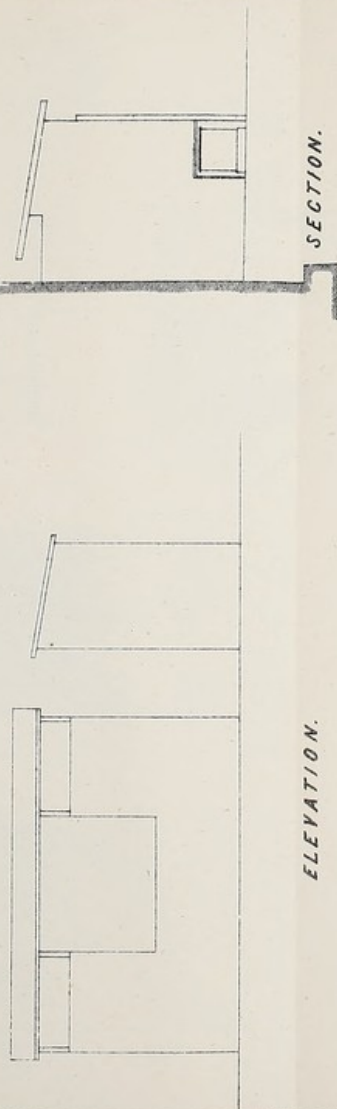
SCALE ONE INCH = ONE FOOT.



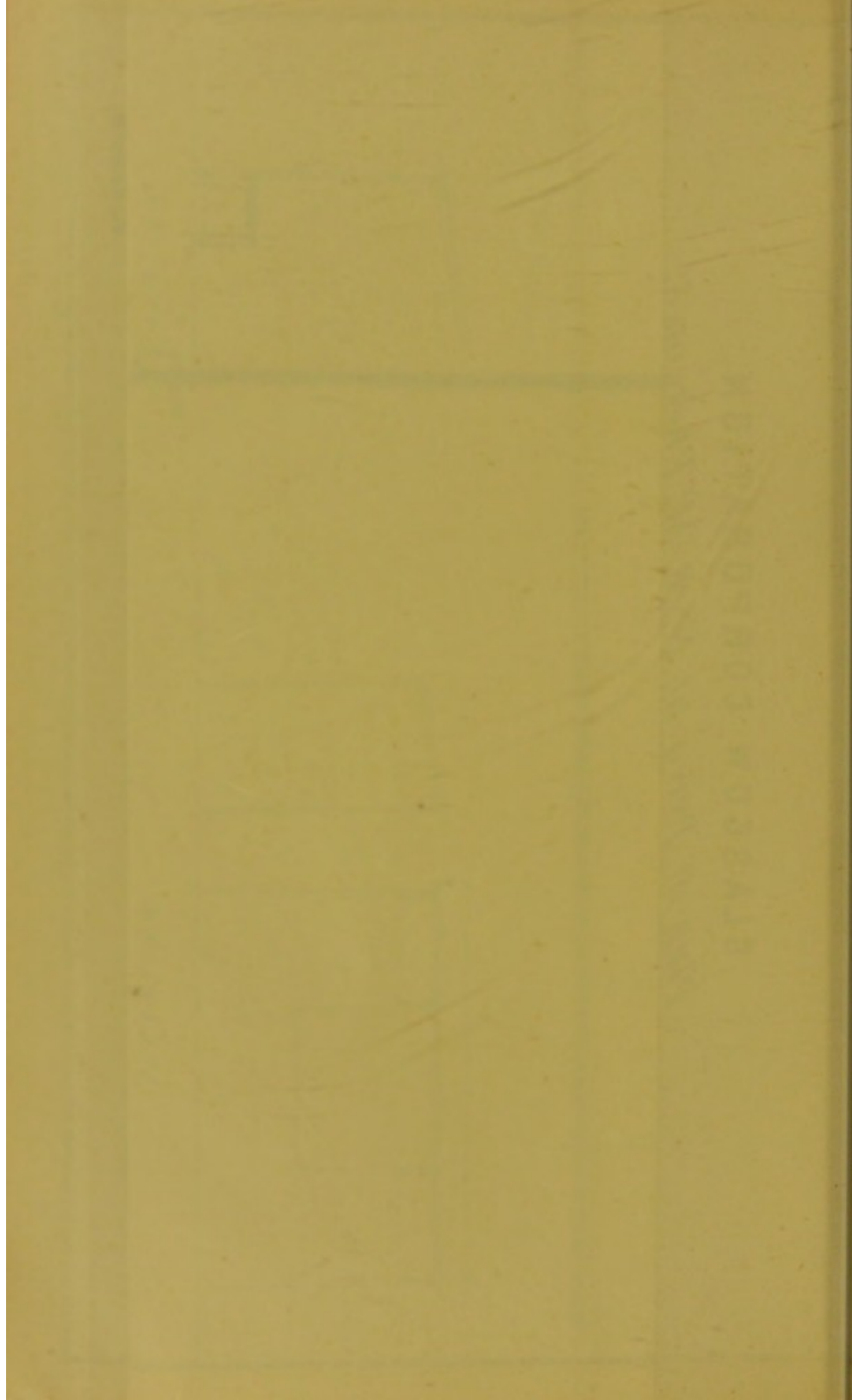
SANITARY CHAMBERS.
N^o 1, Montrose Street.
GLASGOW.

GLASSBORO CORPORATION

GLASGOW CORPORATION.
Plan of Privy at N° 8 M^cPherson Stⁿ

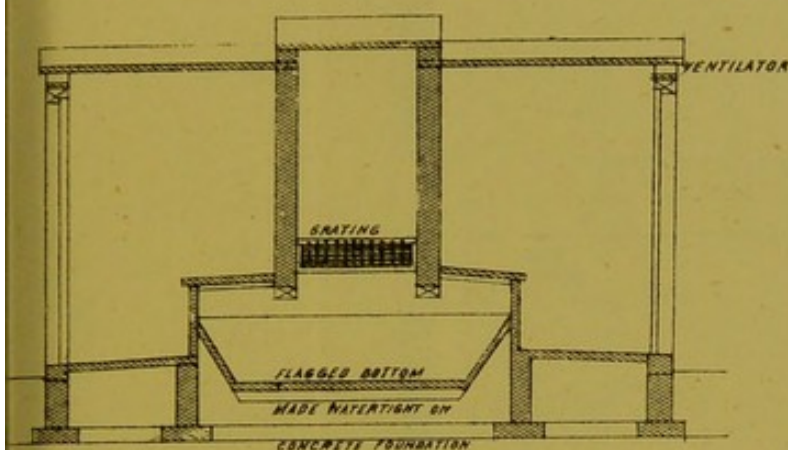


SANITARY CHAMBERS.
N° 1, Montrose Street,
GLASGOW.

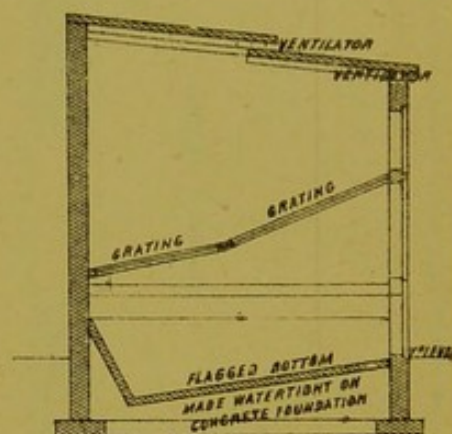


BRADFORD CORPORATION.

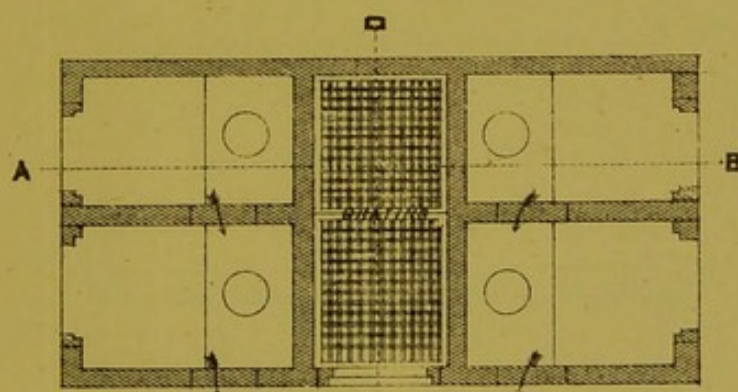
Approved plan of Privies and Ashpit.



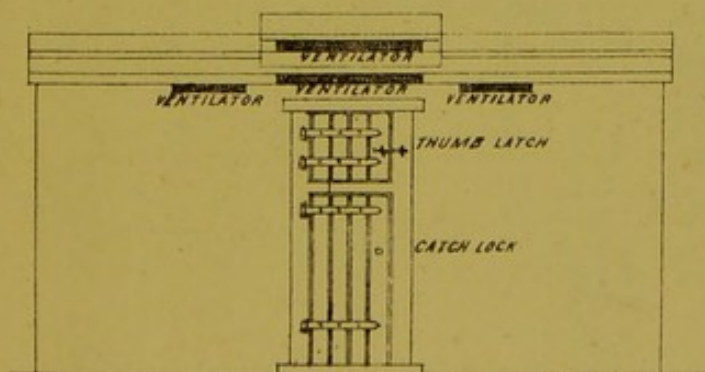
SECTION ON LINE A.B.



SECTION ON LINE C.D.

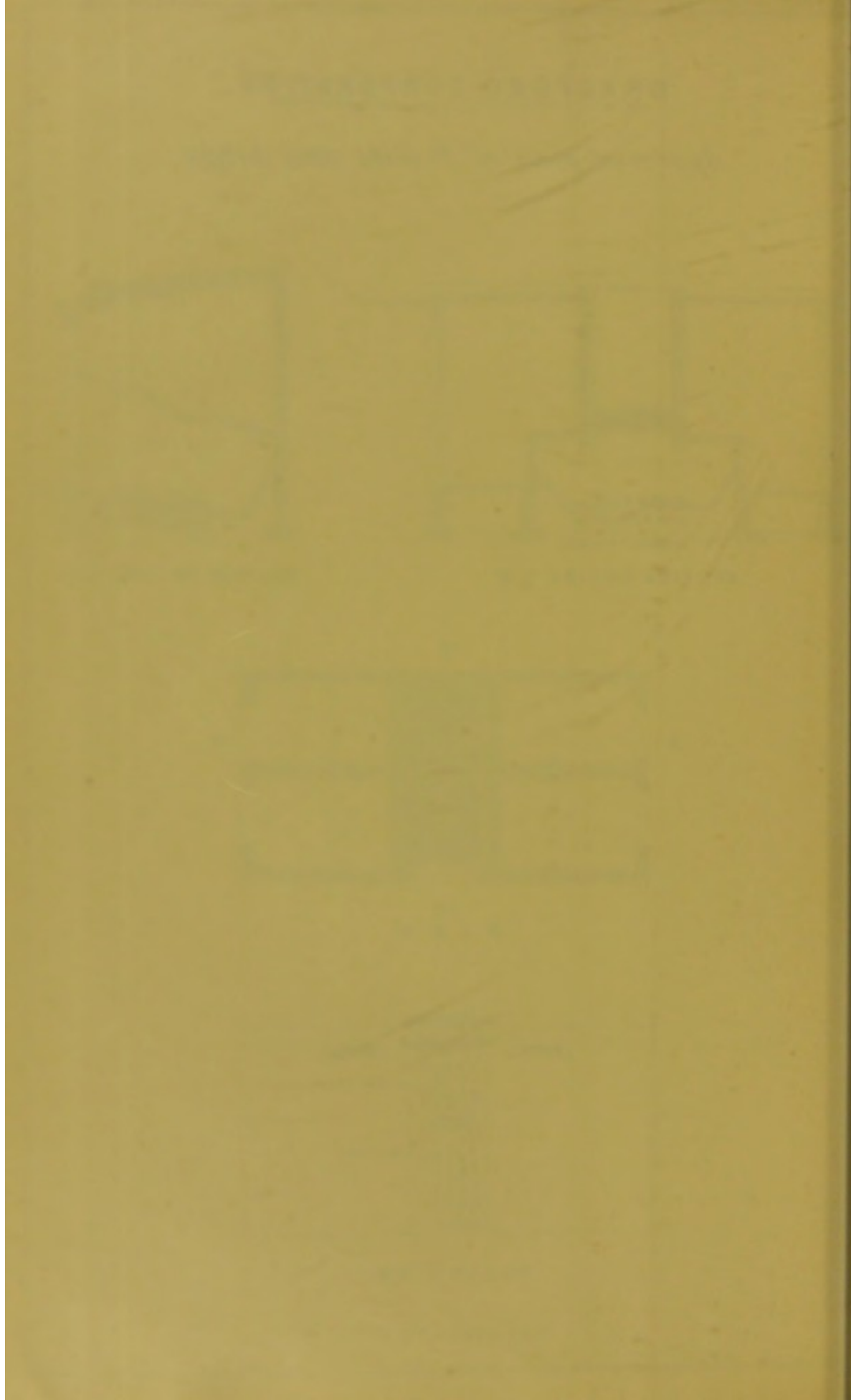


P L A N

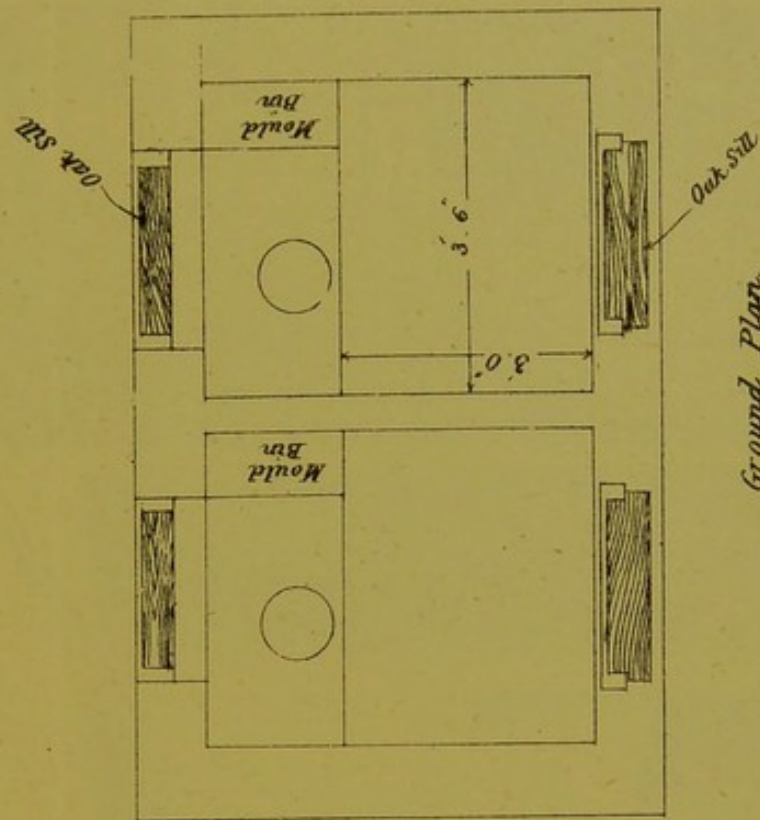
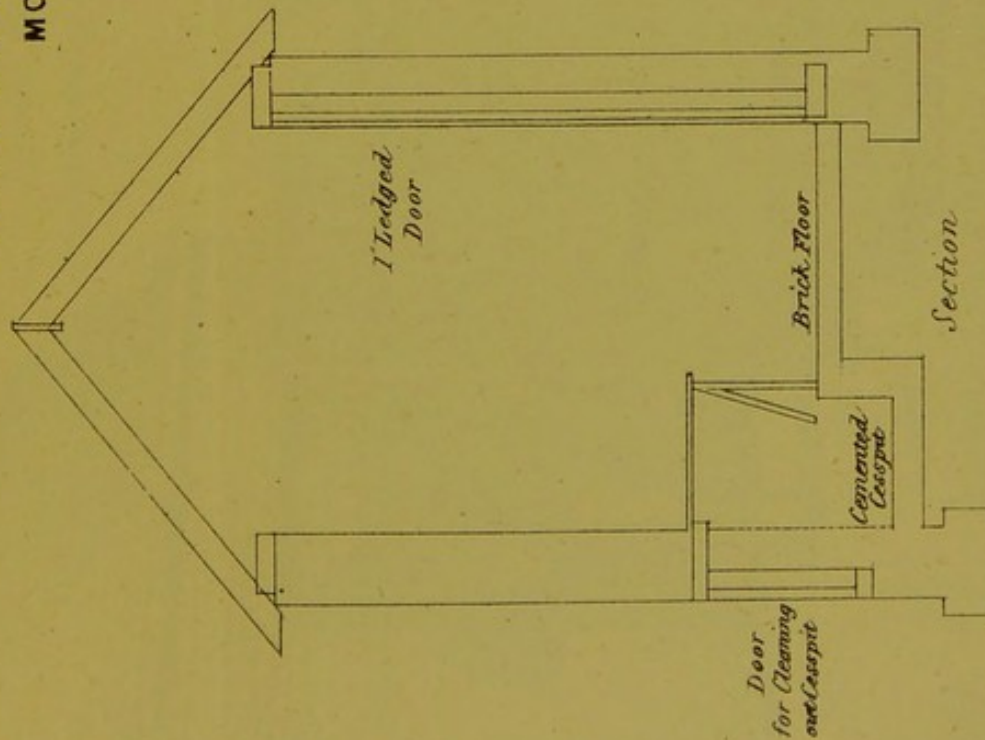


ELEVATION.

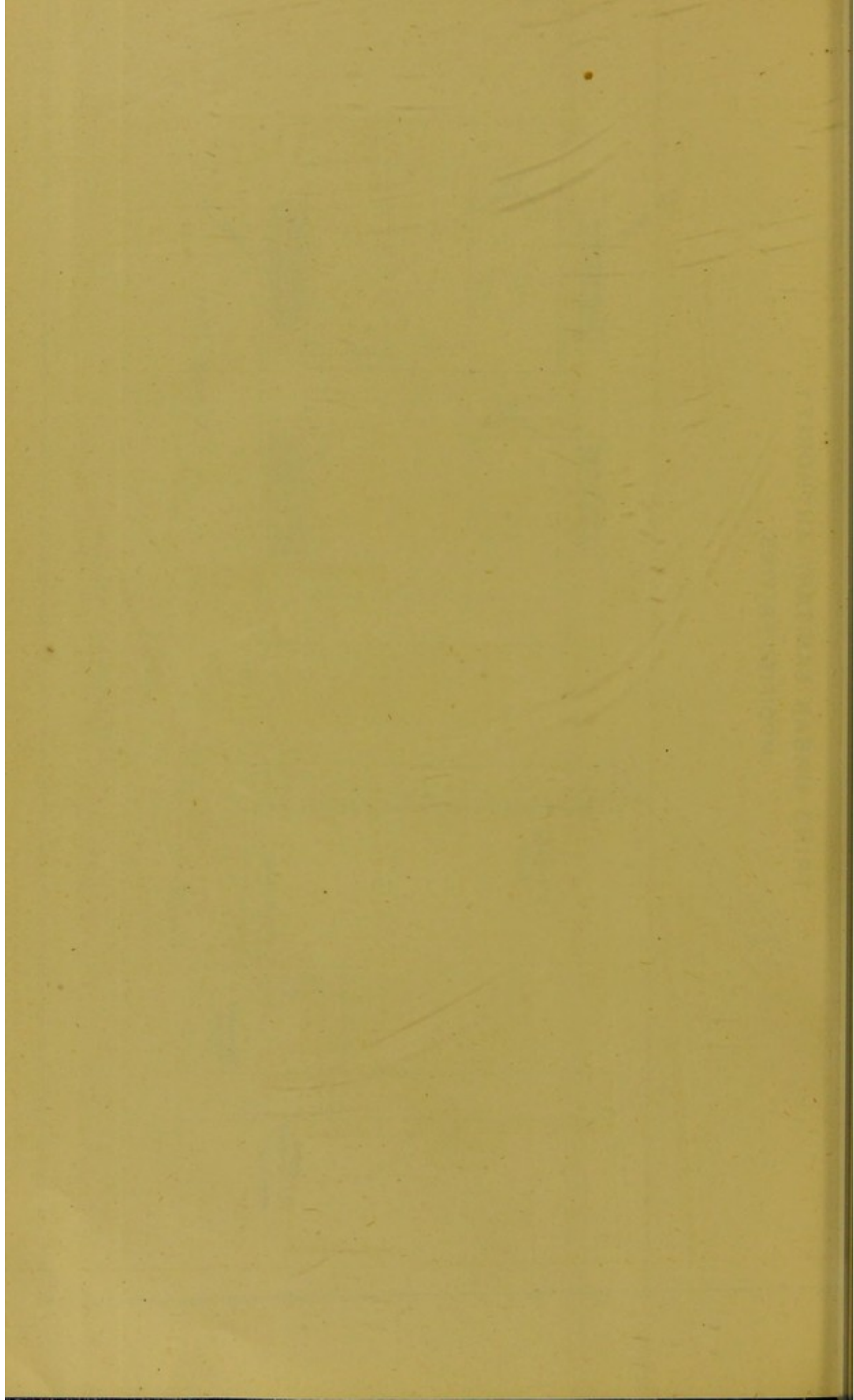
SCALE, 1 INCH = 5 1/2 FEET.

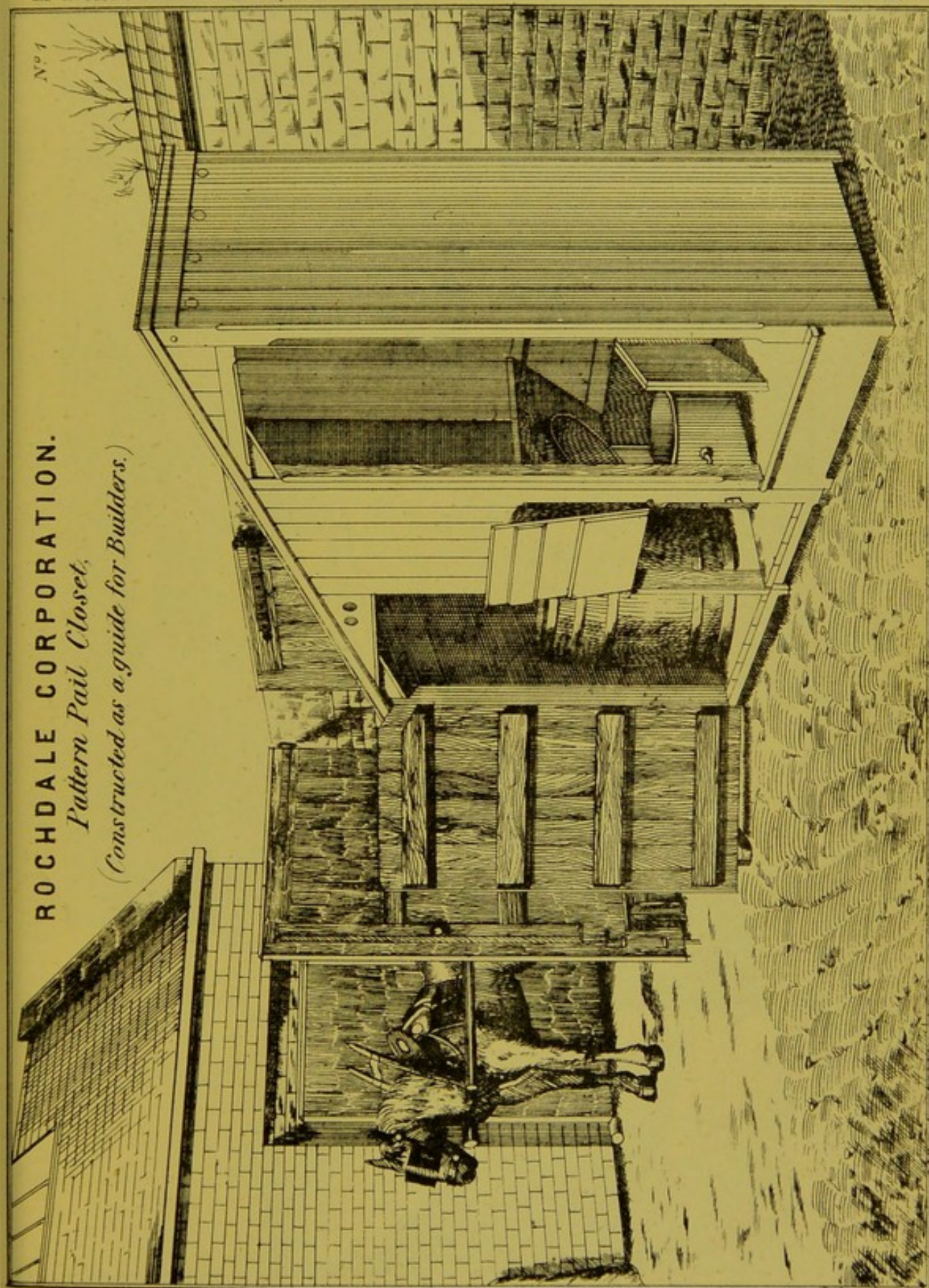


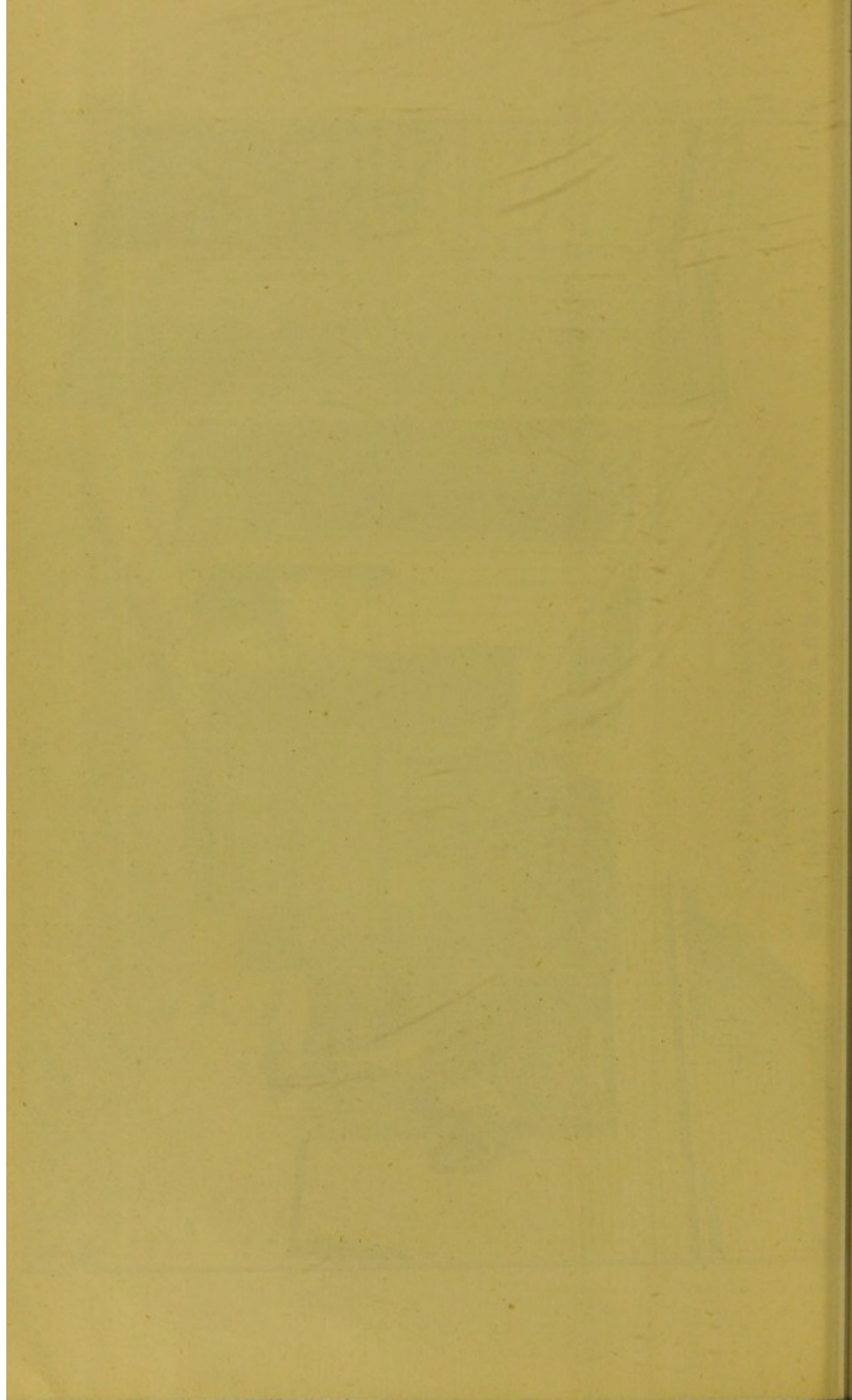
TRING URBAN SANITARY AUTHORITY.
MODIFIED PRIVIES.



SCALE 2 FEET TO $\frac{3}{4}$ INCH





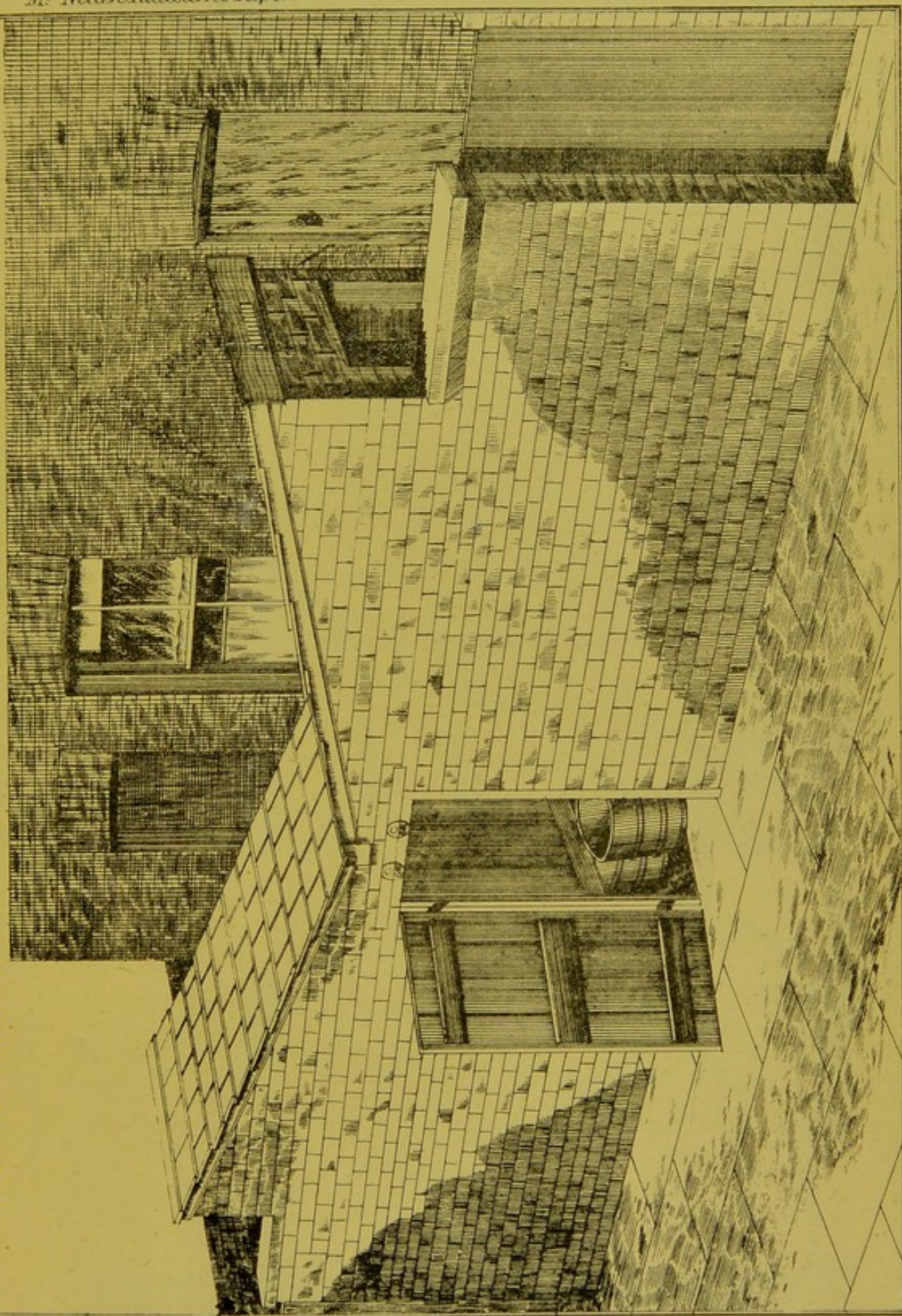


ROCHDALE CORPORATION. *Pail Closets as Erected on New Property.*

No. 2.

M^r Netten Radcliffe's Report

PLATE XI.

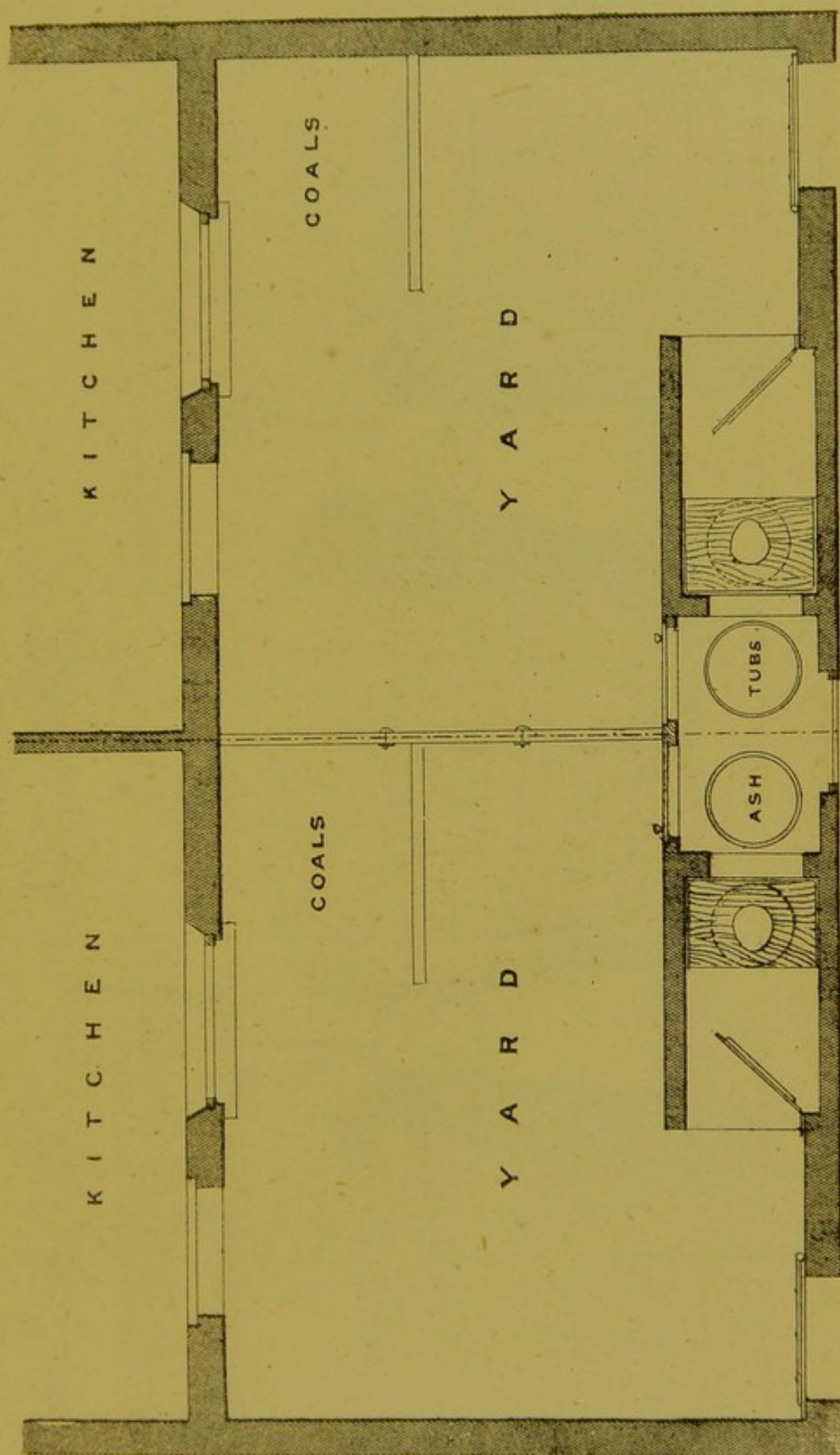


Dangerfield Lith. London

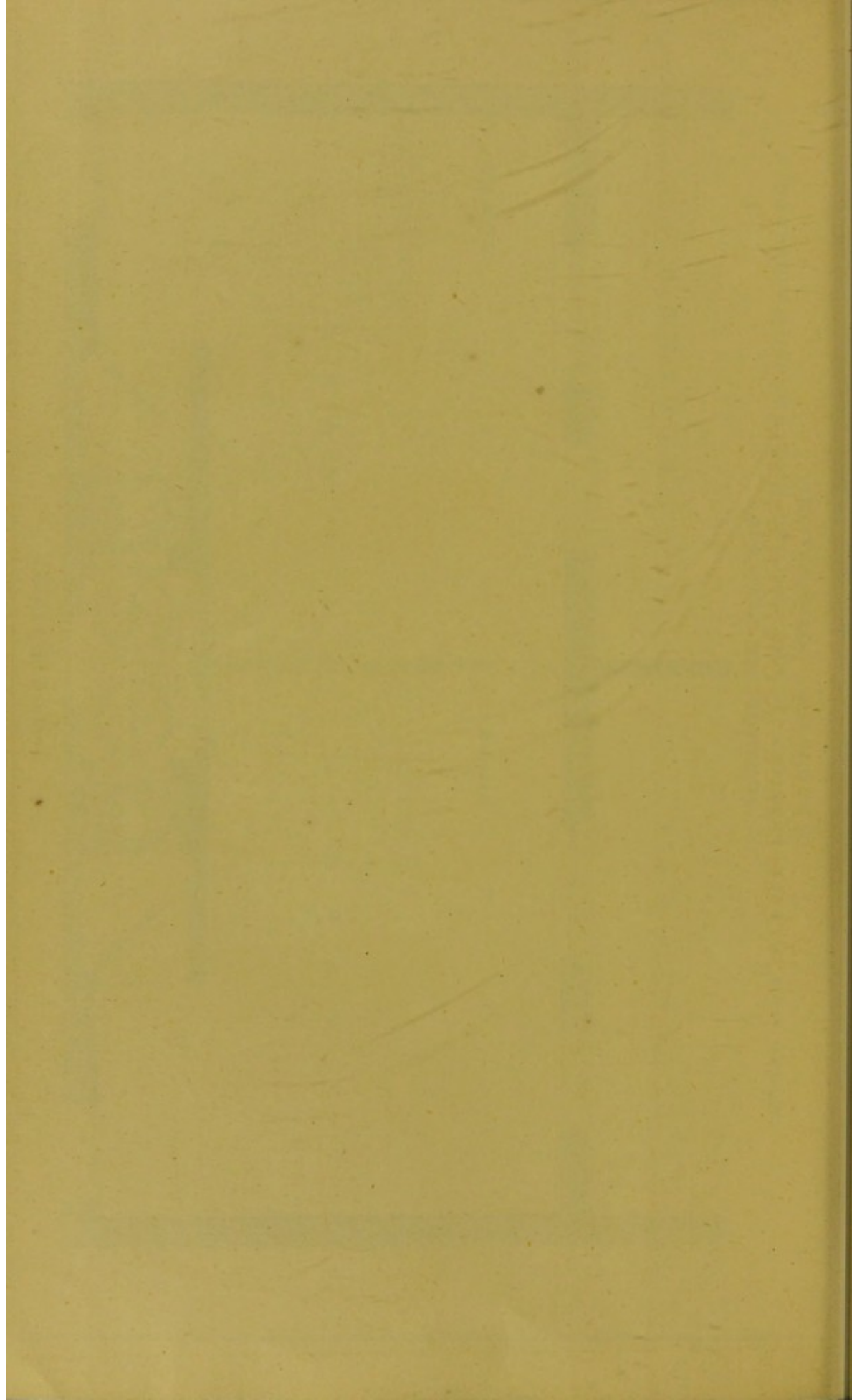


No 3.

(3) ROCHDALE CORPORATION.
GROUND PLAN OF BACK PREMISES OF TWO DWELLING HOUSES SHOWING ARRANGEMENT
OF PRIVIES AND ASHPLACE.

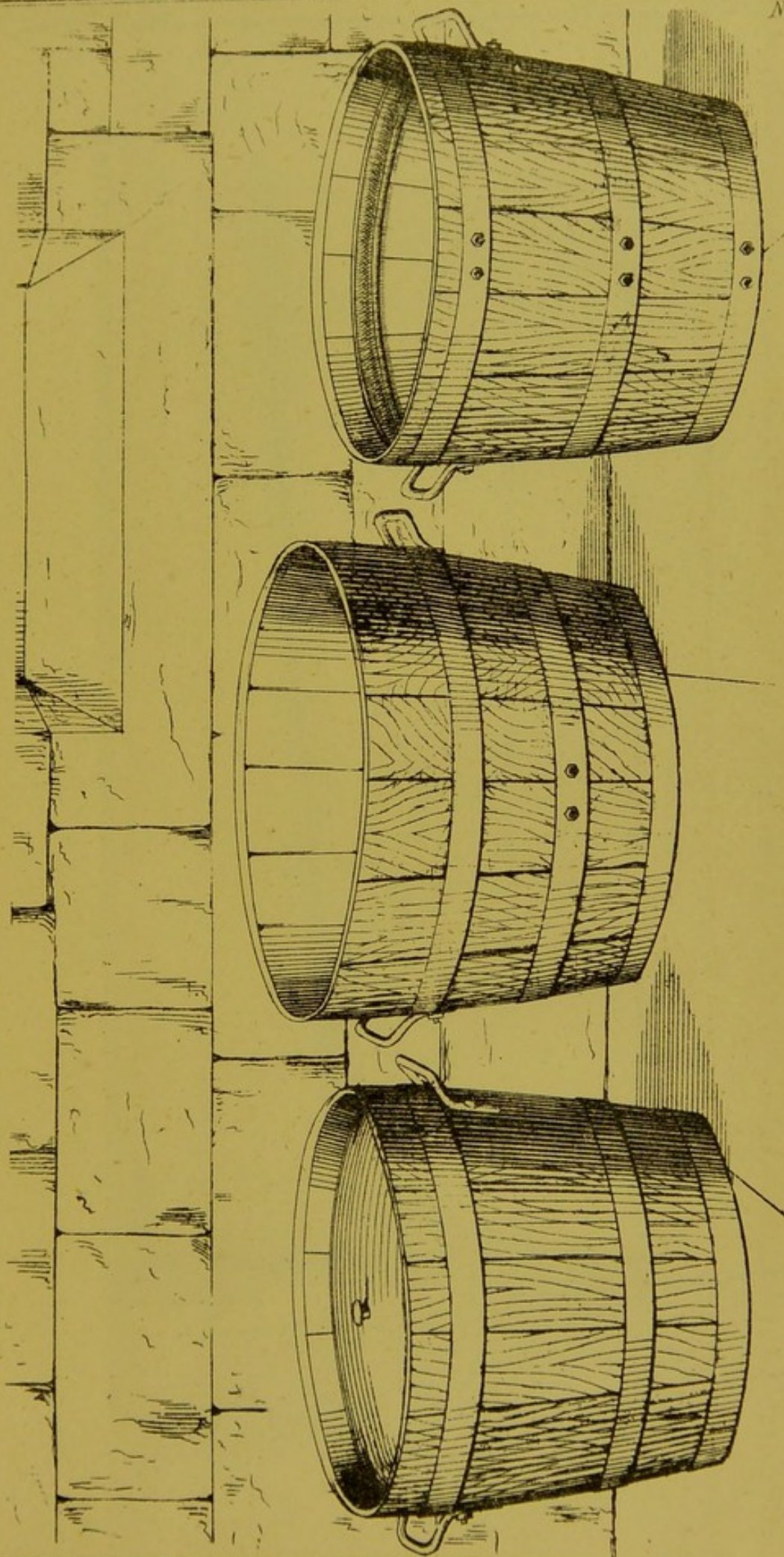


Scale 4 Ft. = 1 Inch.



No 1

ROCHDALE CORPORATION.

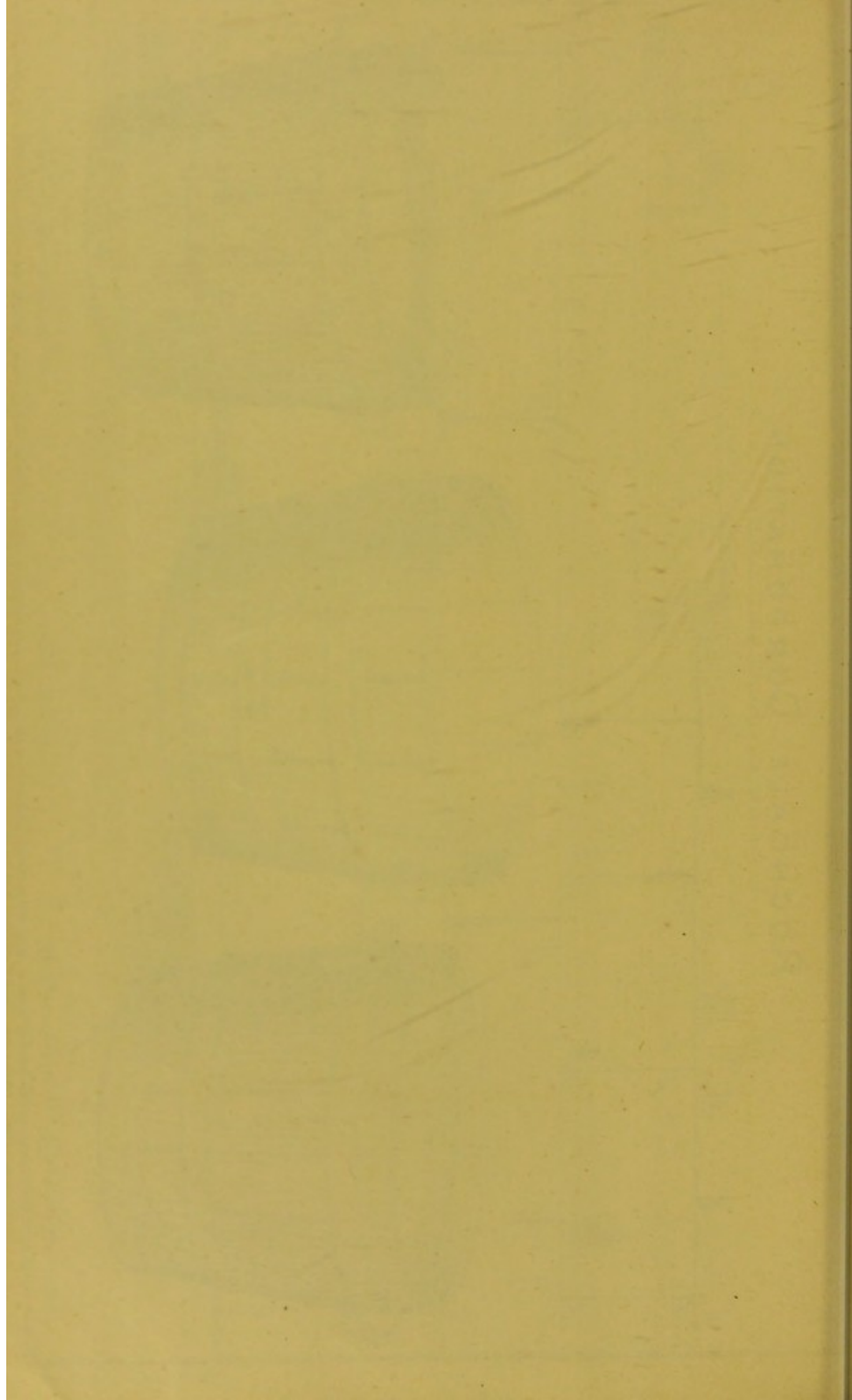


Excrement Pail with lid on, ft 1, to return to Works.

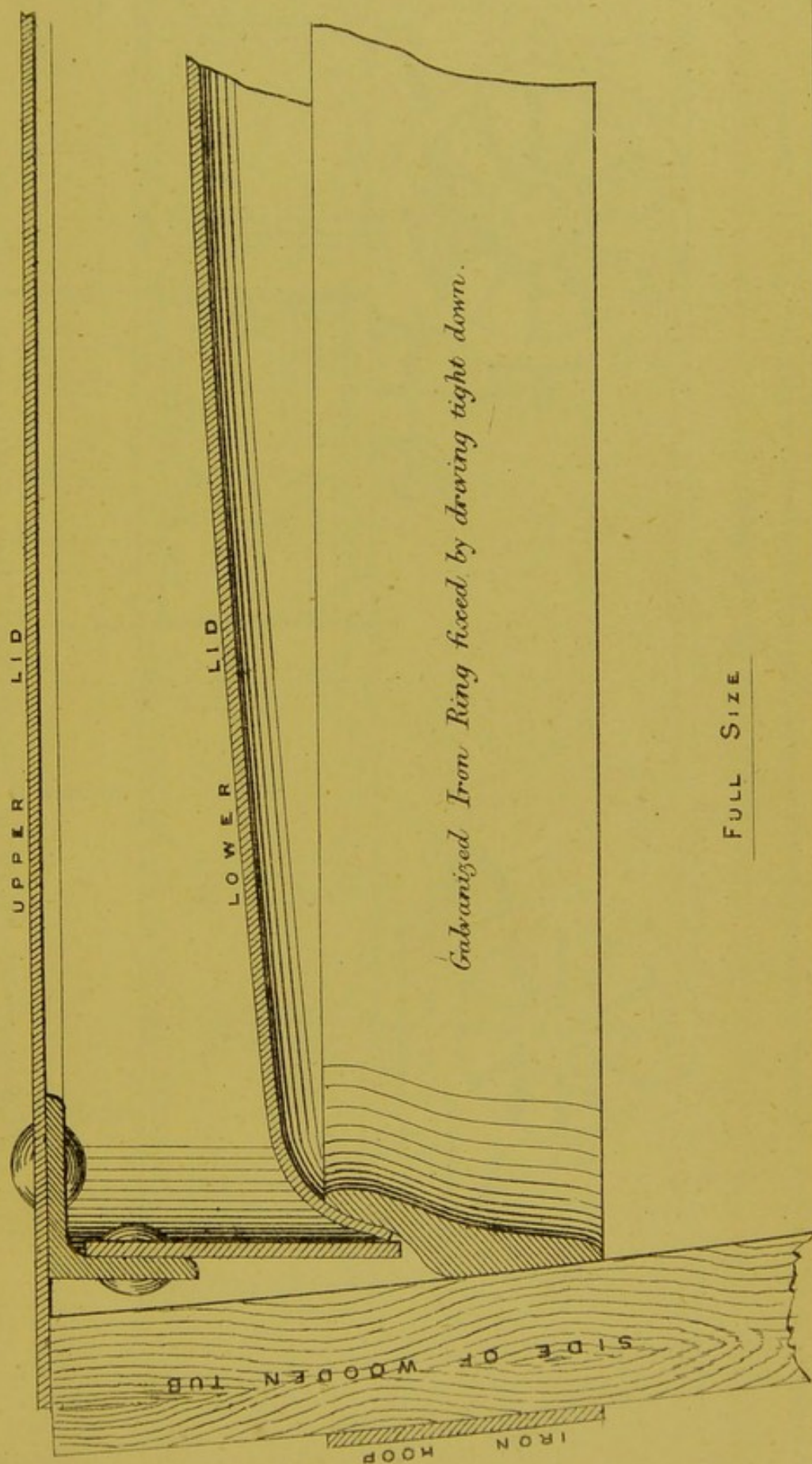
Ash Tub (Empty)

Excrement Pail empty ready for use.

Excrement Pail; Diameter, mouth 19½ in., bottom 16½ in.; Height 15½ in. Ash Tub; Diameter, mouth 23½ in., bottom 20½ in.; Height 15½ in.



ROCHDALE CORPORATION SECTION THROUGH SIDE OF EXCREMENT PAIL.

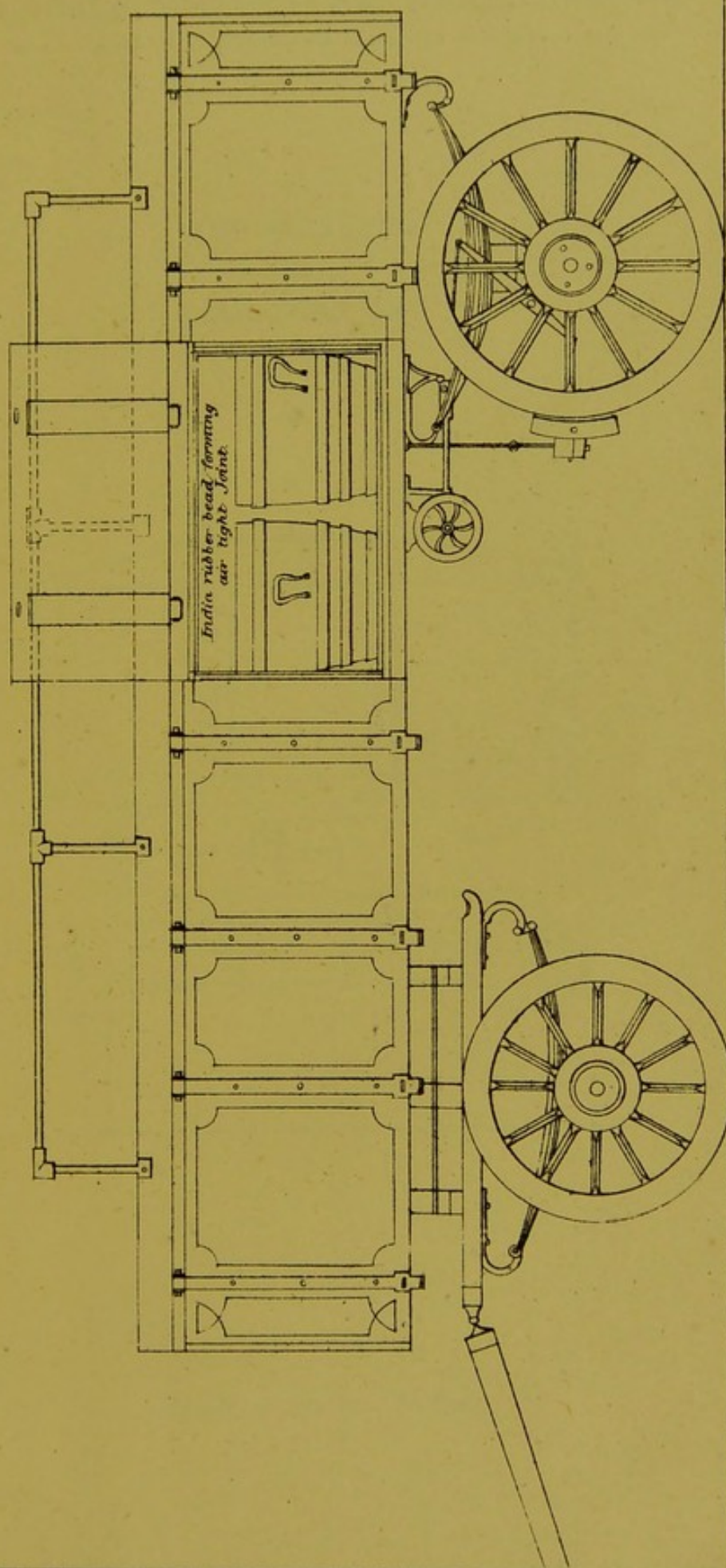


FULL SIZE

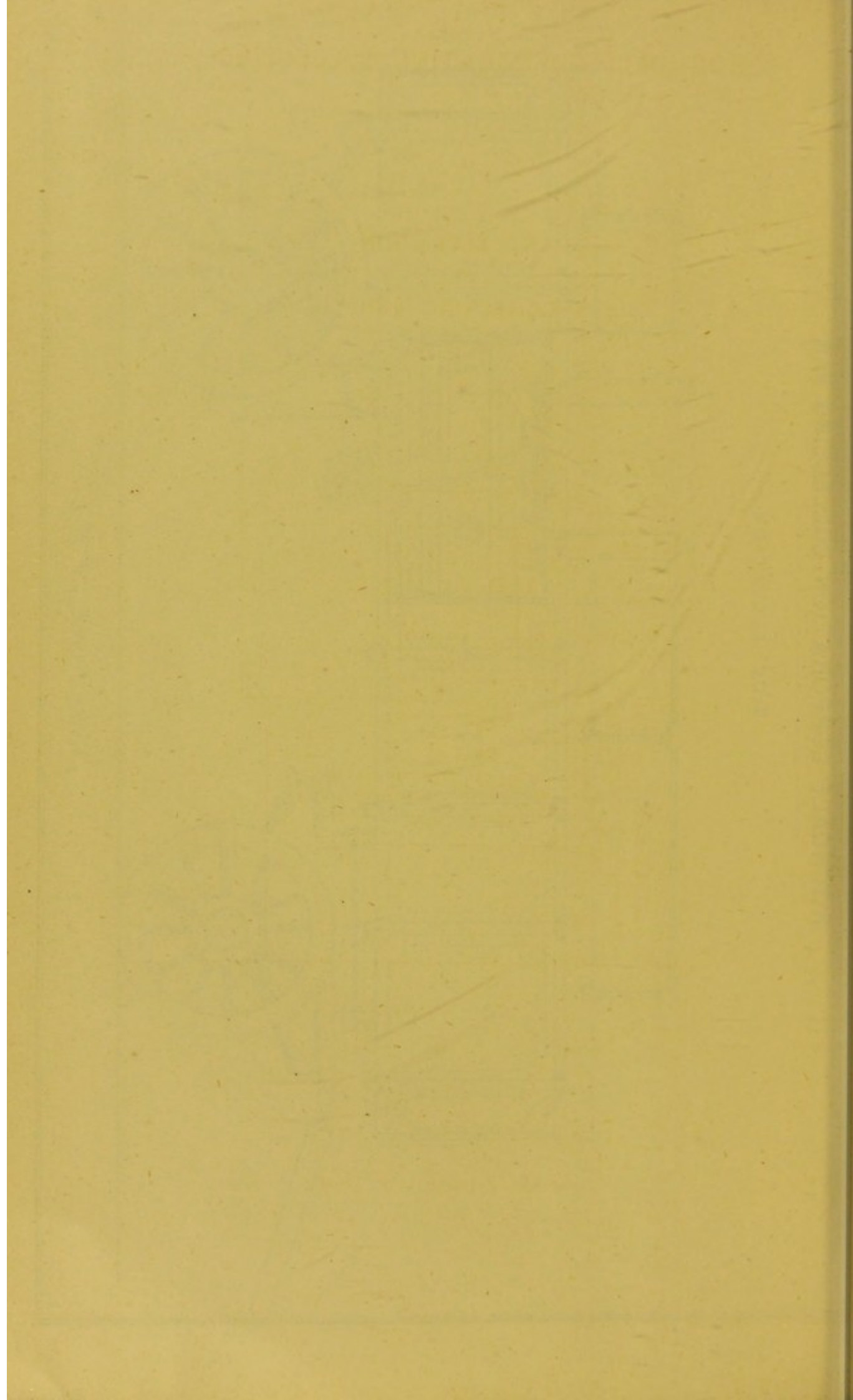


ROCHDALE CORPORATION. COLLECTING VAN

SIDE ELEVATION.

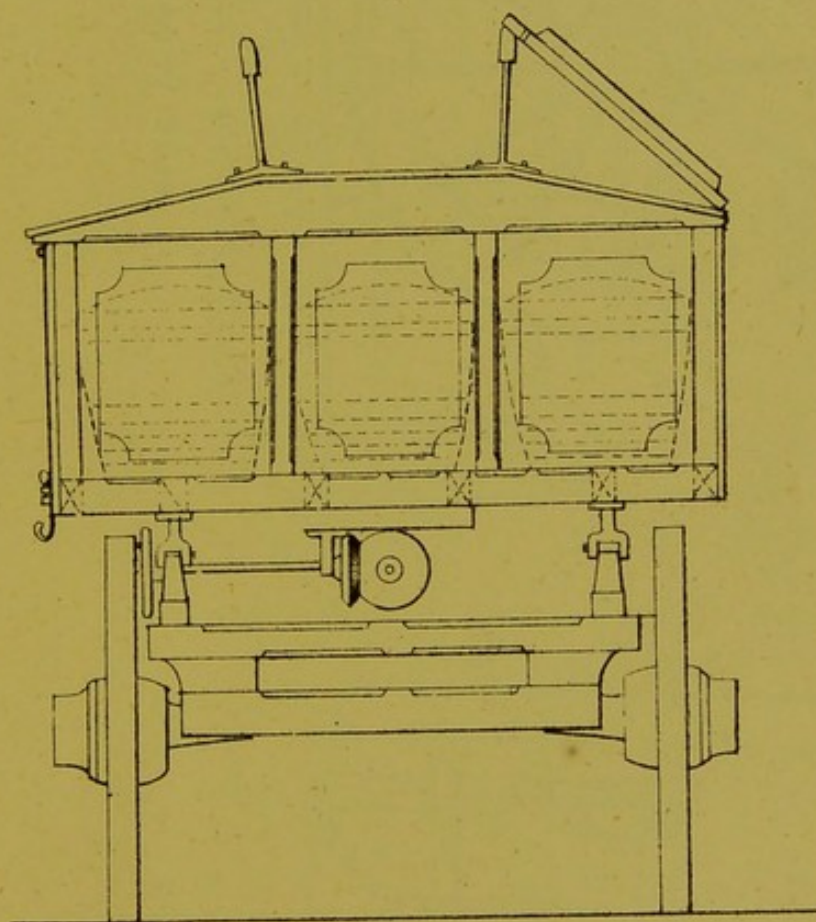


Scale 1 inch = 4 feet.

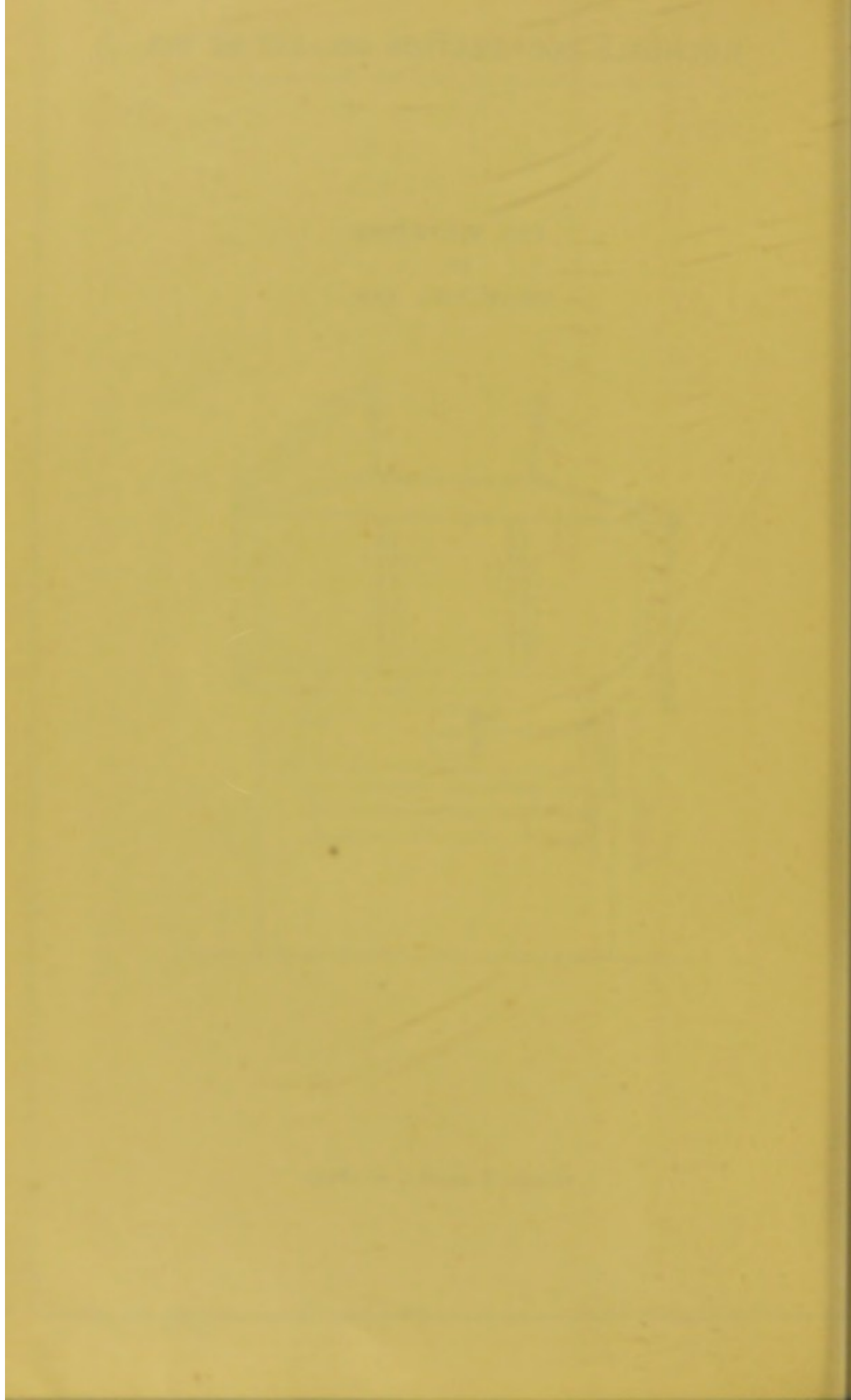


ROCHDALE CORPORATION. COLLECTING VAN

END ELEVATION
OF
COLLECTING VAN.

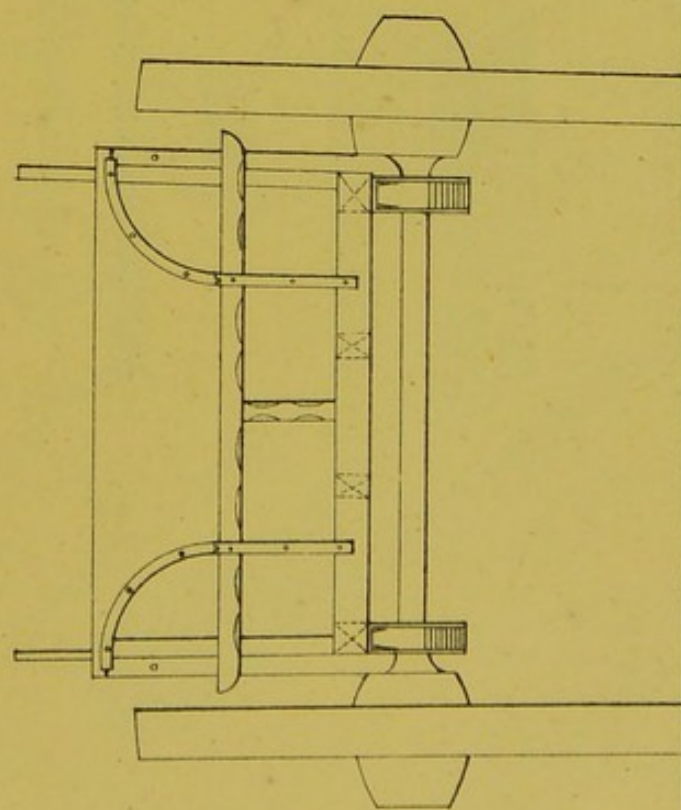


Scale, 1 inch - 4 feet.

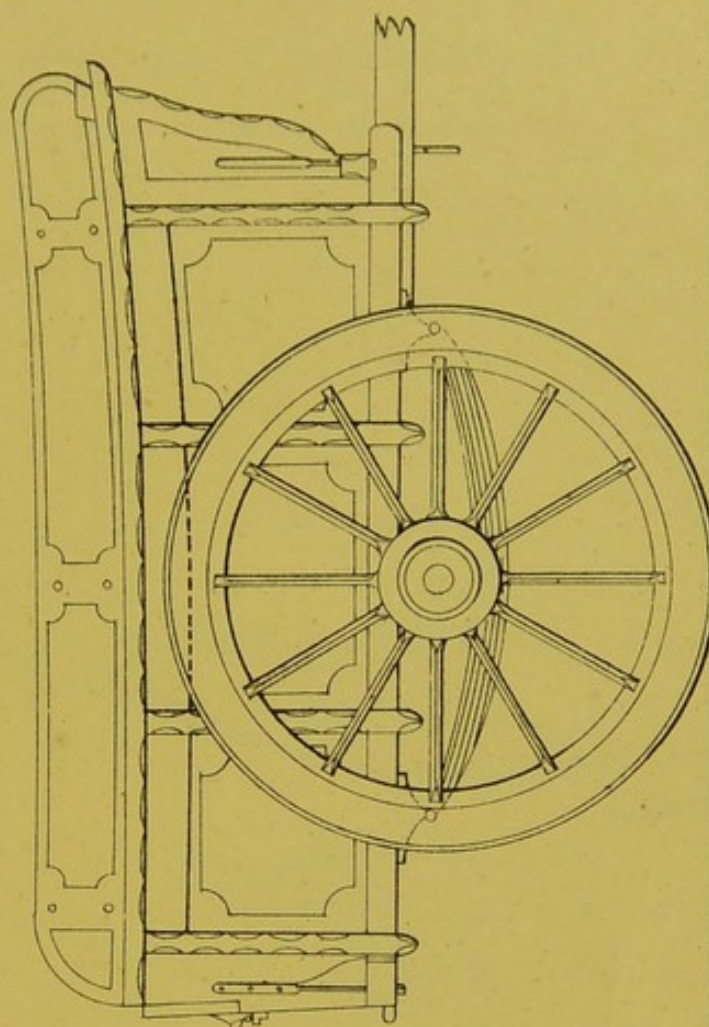


ROCHDALE CORPORATION. DUST CART.

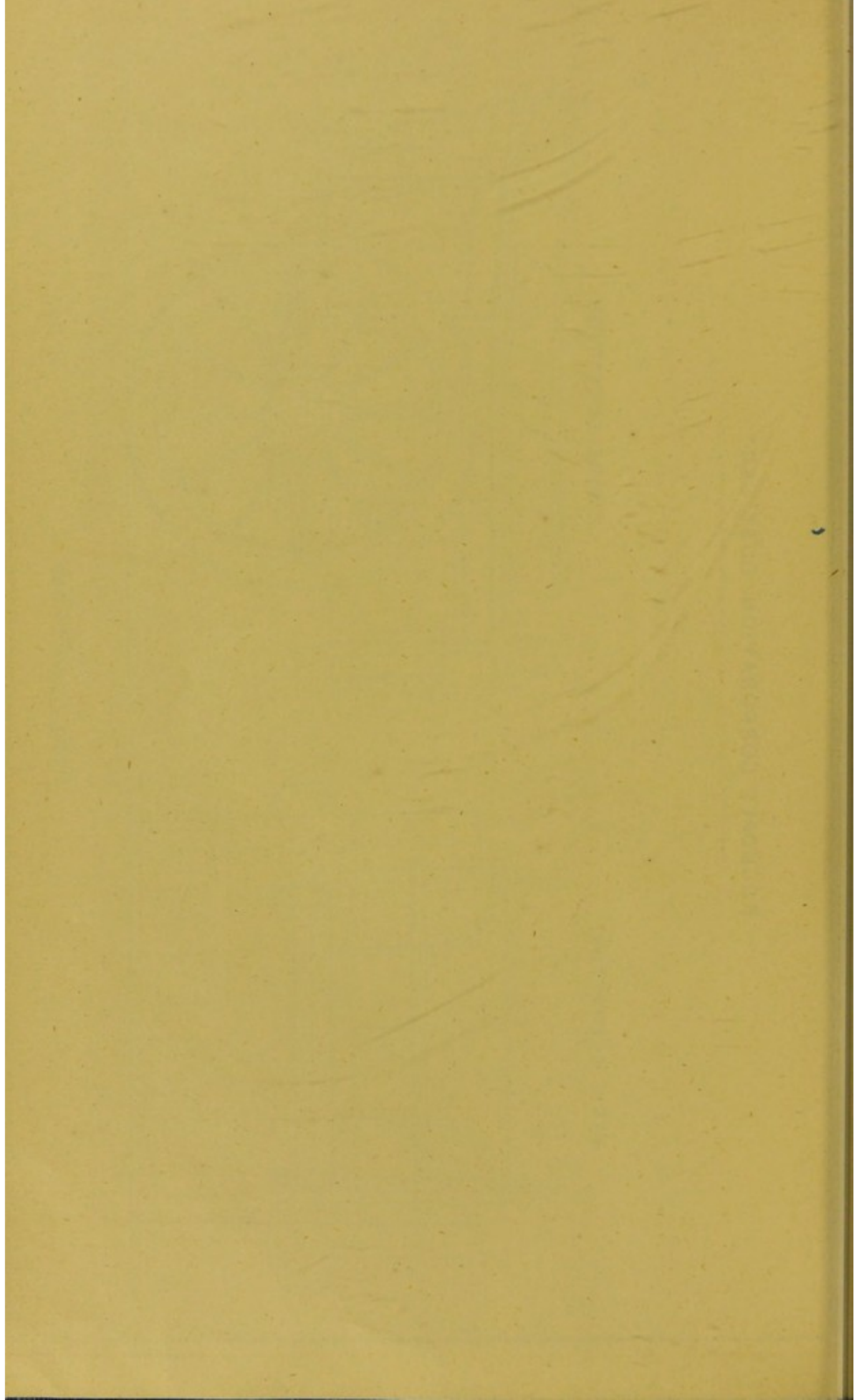
BACK ELEVATION.



SIDE ELEVATION.

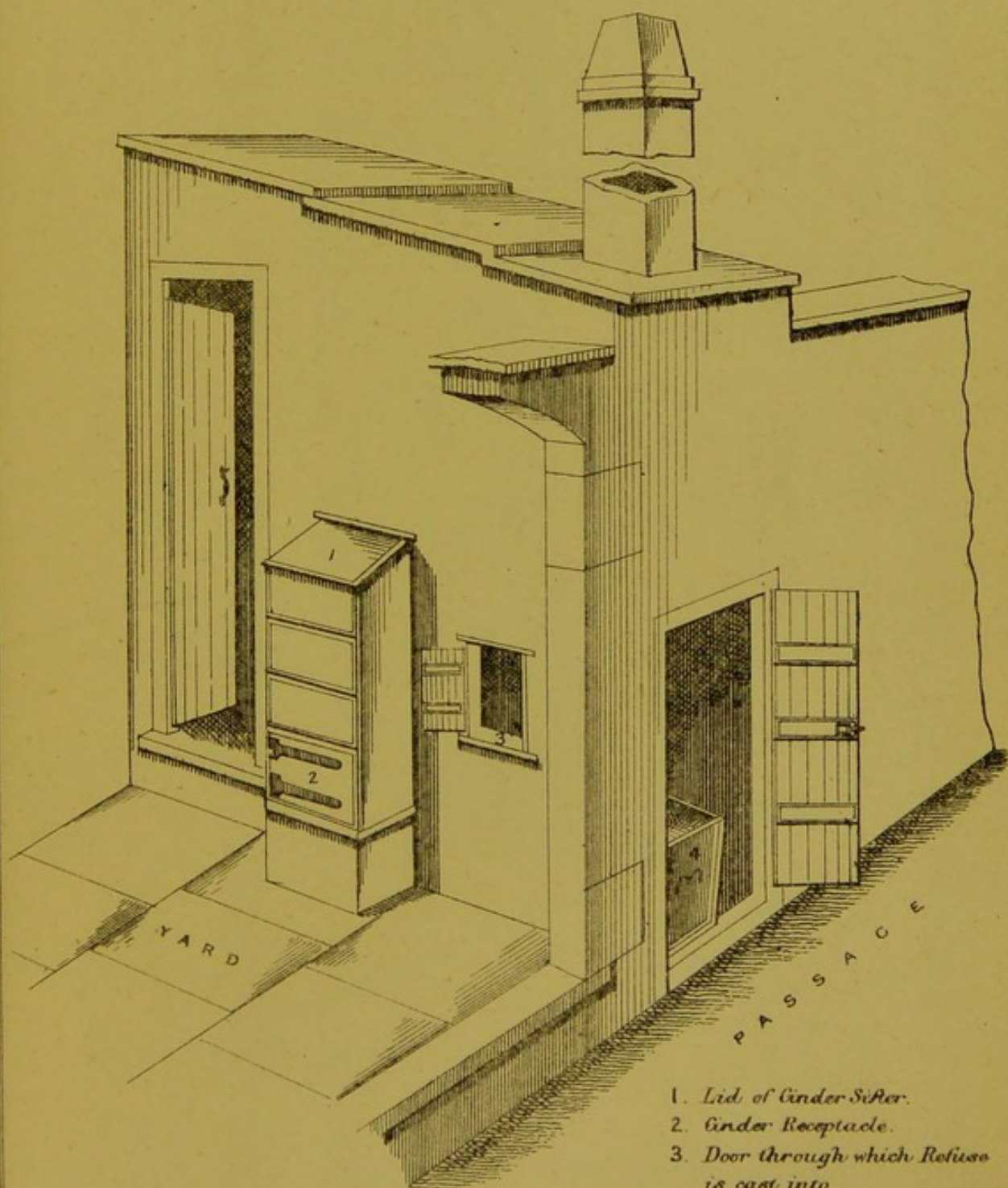


Scale, 1 inch = 4 feet.

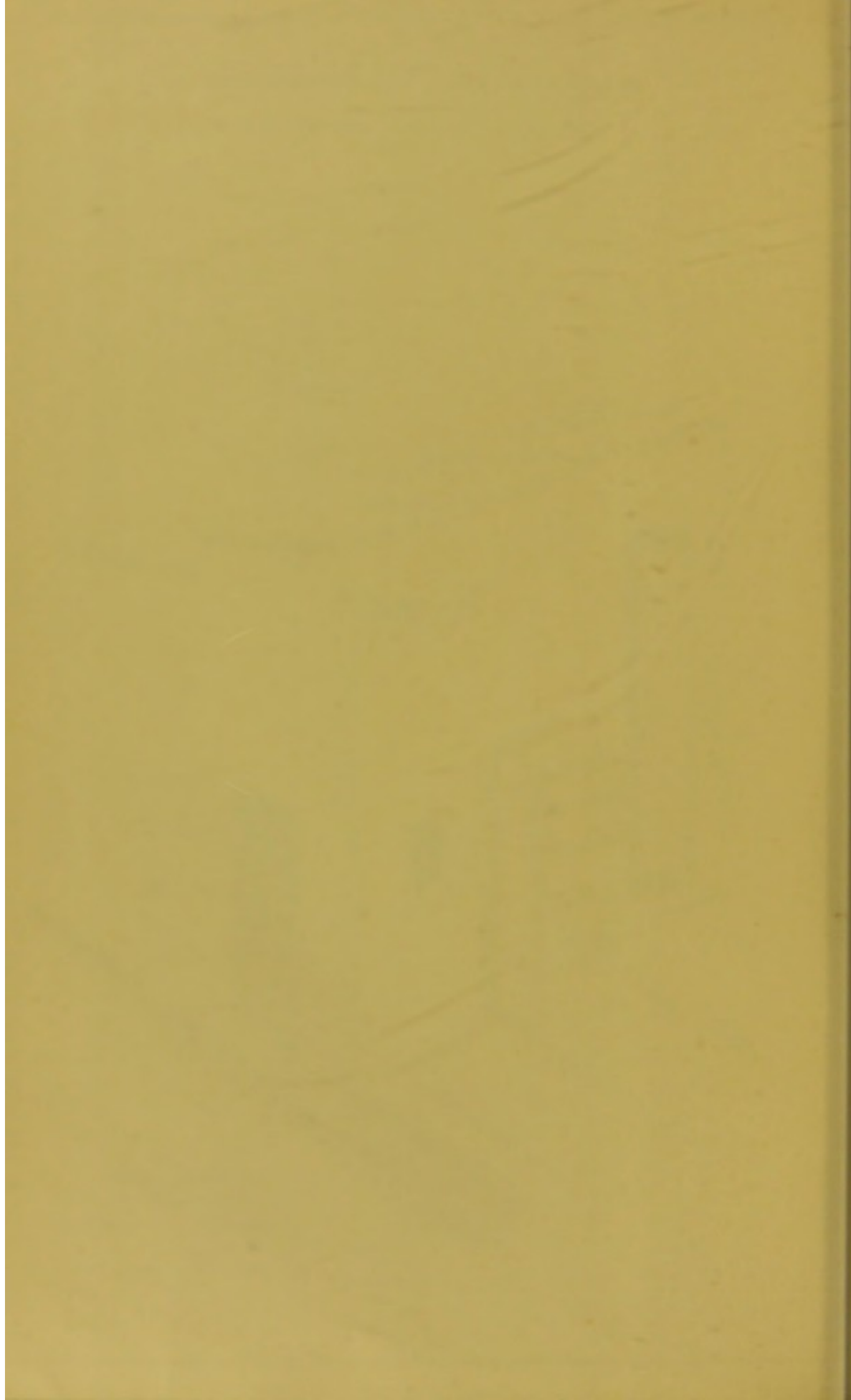


MANCHESTER CORPORATION.

DRY ASH CLOSET. ELEVATION.



1. Lid of Cinder Sifter.
2. Cinder Receptacle.
3. Door through which Refuse is cast into
4. Pail for dry House Refuse.

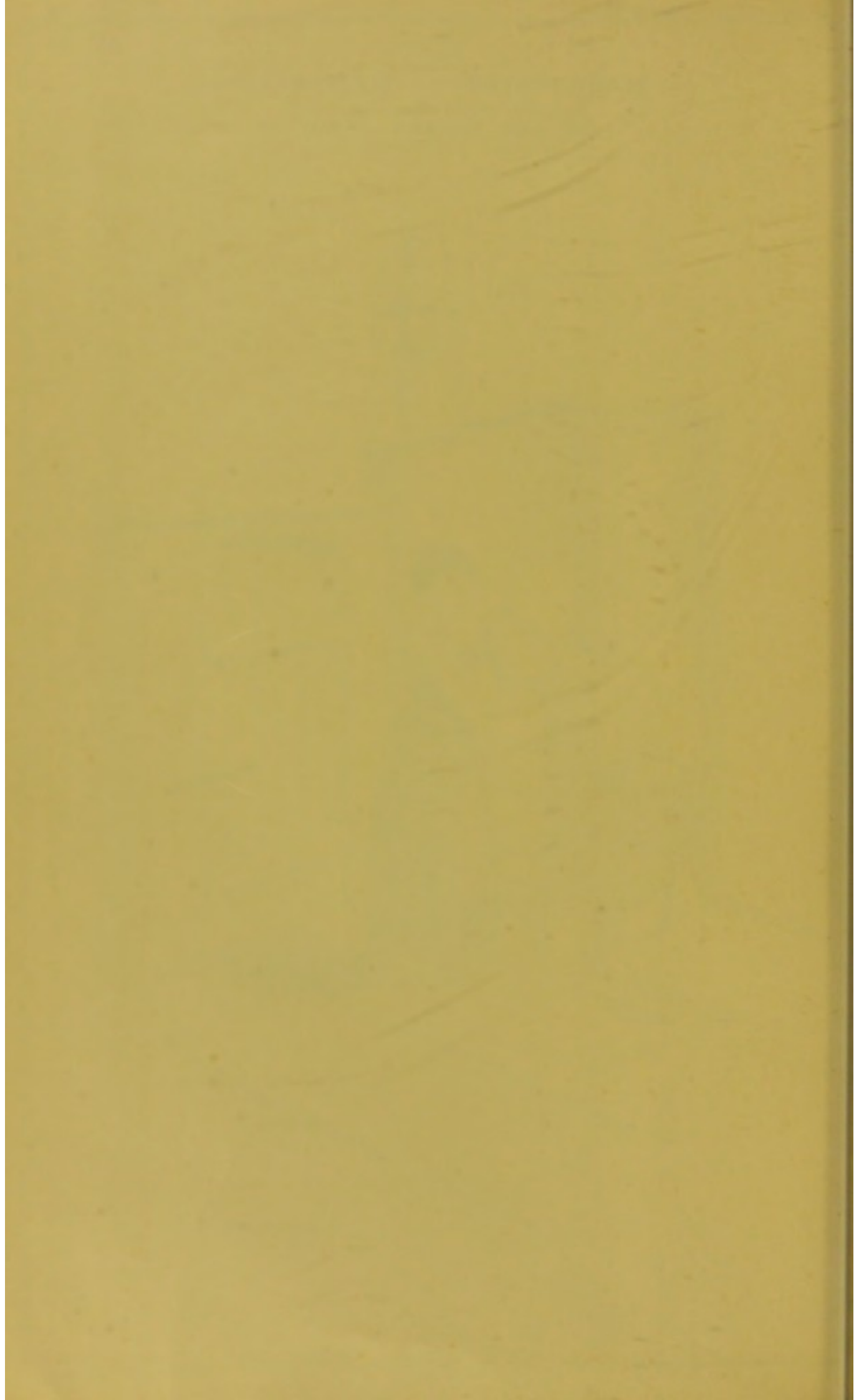


MANCHESTER CORPORATION.

DRY ASH CLOSET - SECTION.



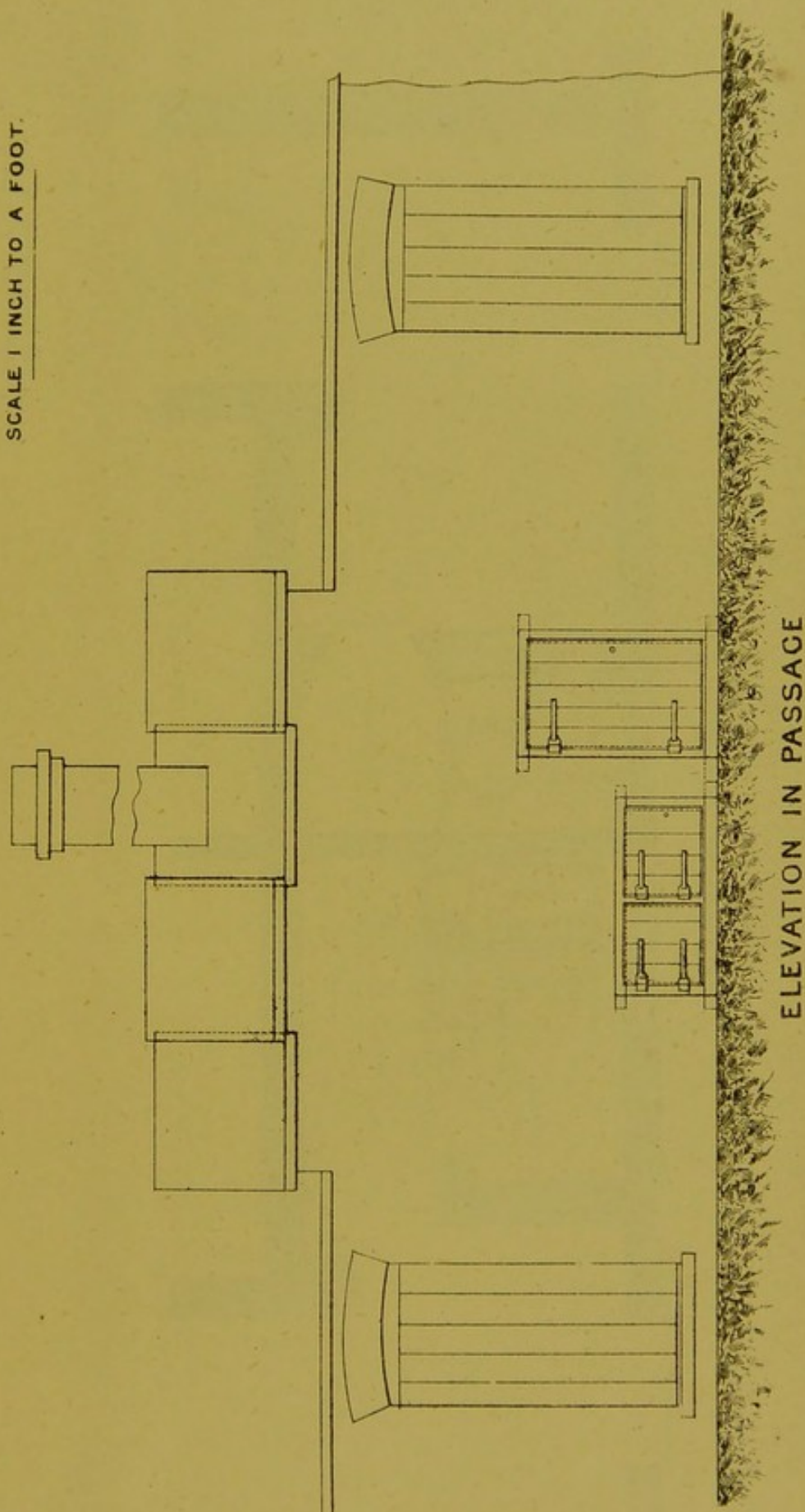
1. Excrement Pail.



CITY OF MANCHESTER

DETAIL DRAWING ATTACHED TO SPECIFICATION OF PRIVIES.

SCALE 1 INCH TO A FOOT.

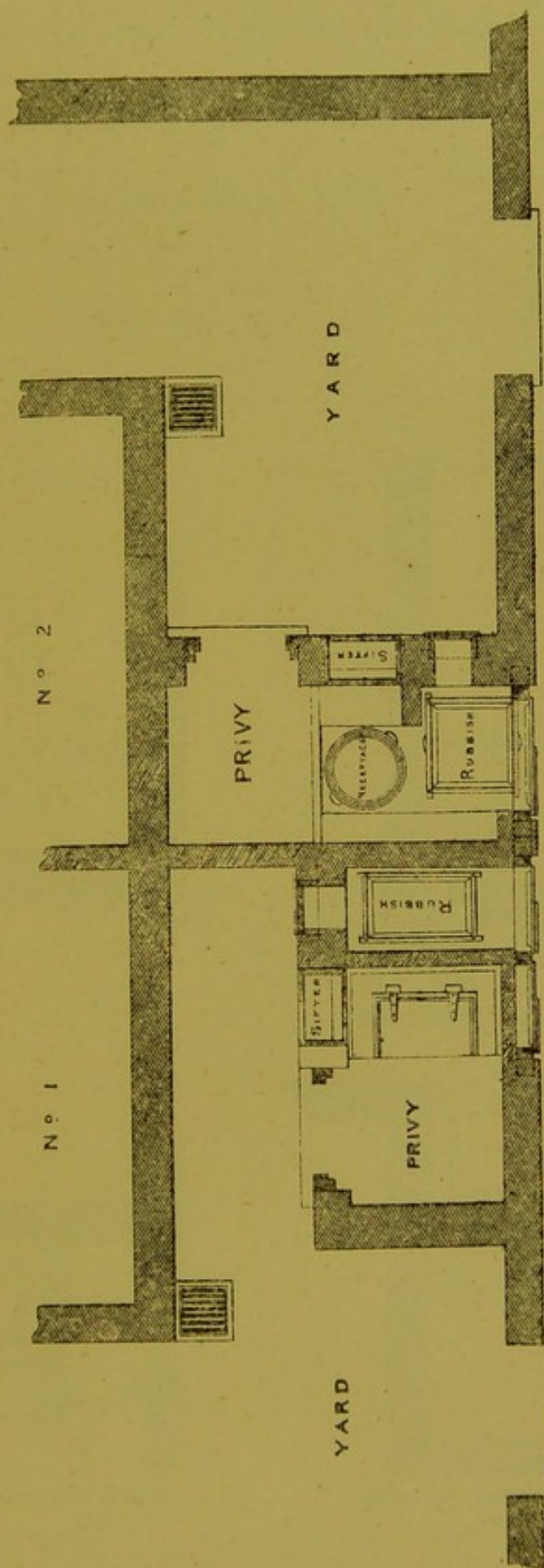




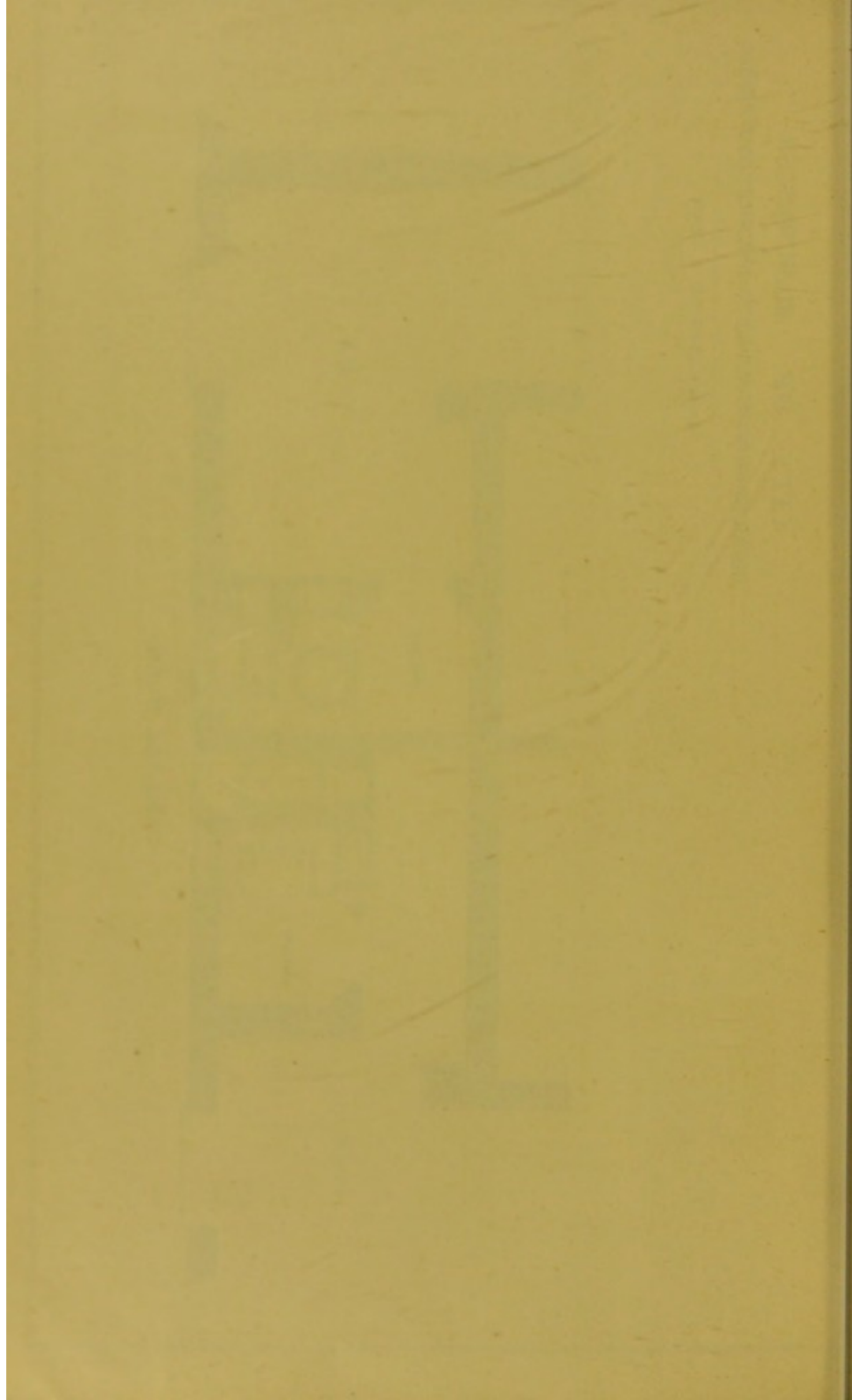
CITY OF MANCHESTER

DETAIL DRAWING ATTACHED TO SPECIFICATION OF PRIVIES.

SCALE 1 INCH TO A FOOT.



GENERAL PLAN

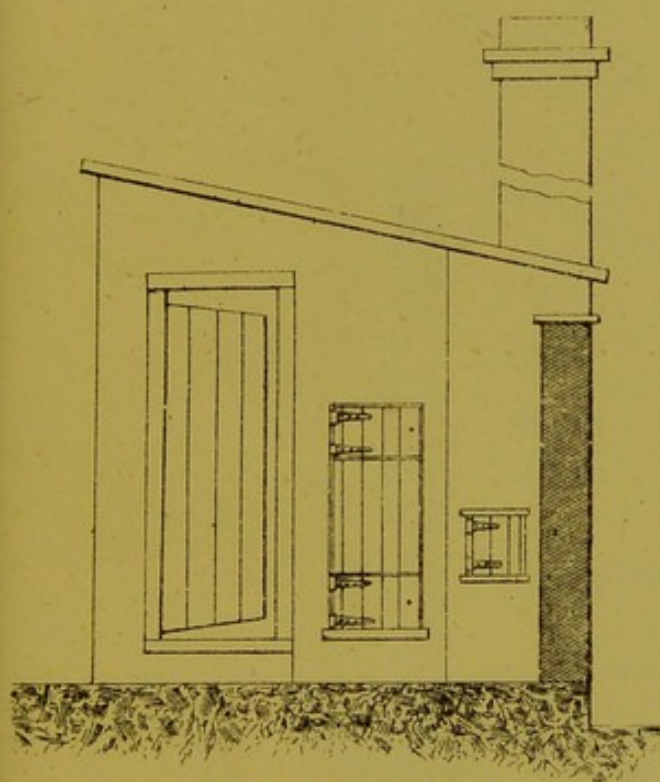


CITY OF MANCHESTER.

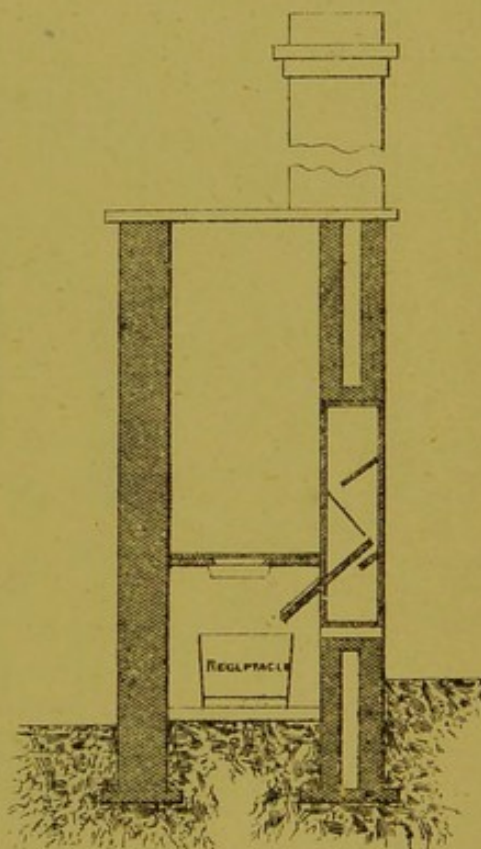
DETAIL DRAWING ATTACHED TO SPECIFICATION OF PRIVIES.

SCALE 1 INCH TO A FOOT.

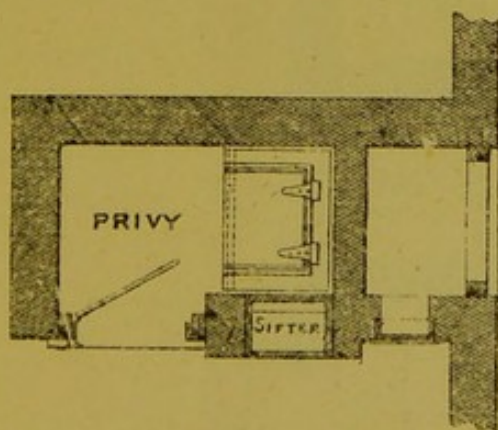
DETAILS OF N^o 2



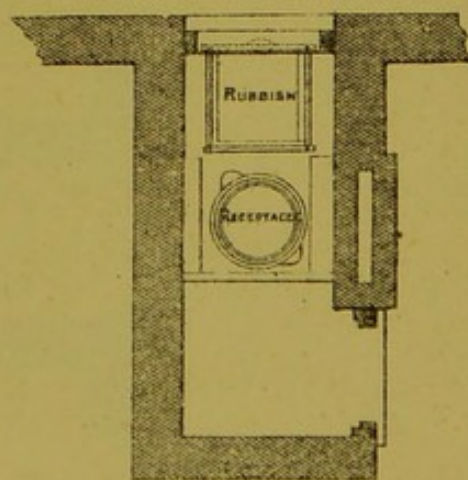
ELEVATION IN YARD



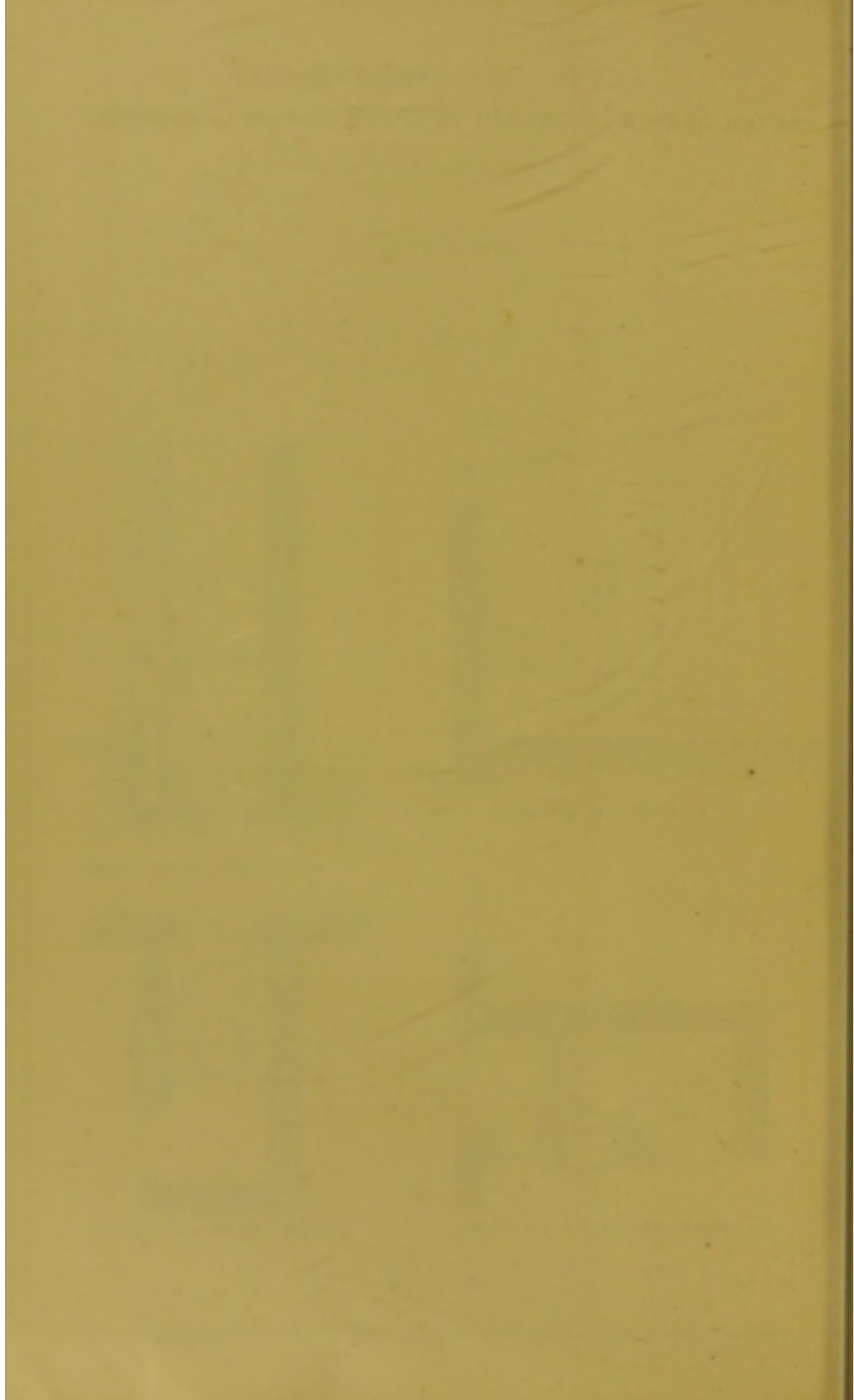
SECTIONAL ELEVATION



PLAN ABOVE PRIVY SEAT



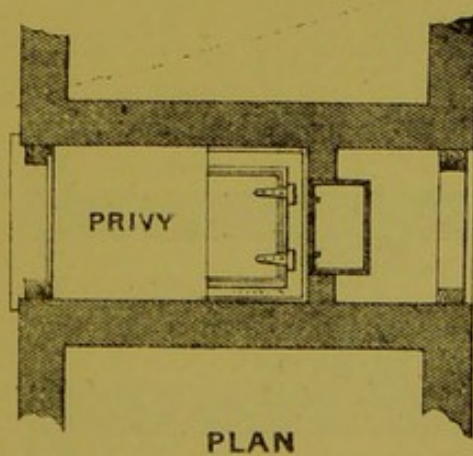
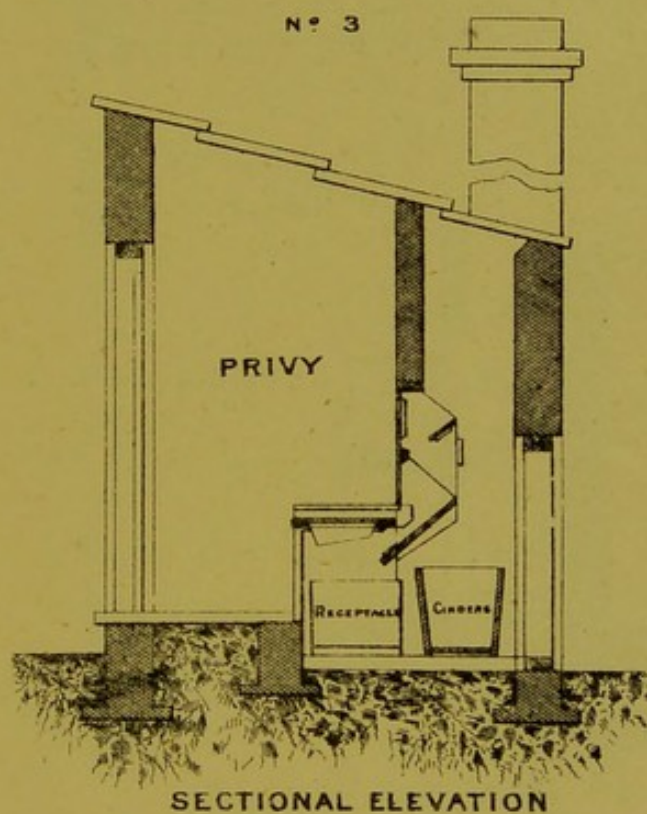
PLAN OF PRIVY FLOOR

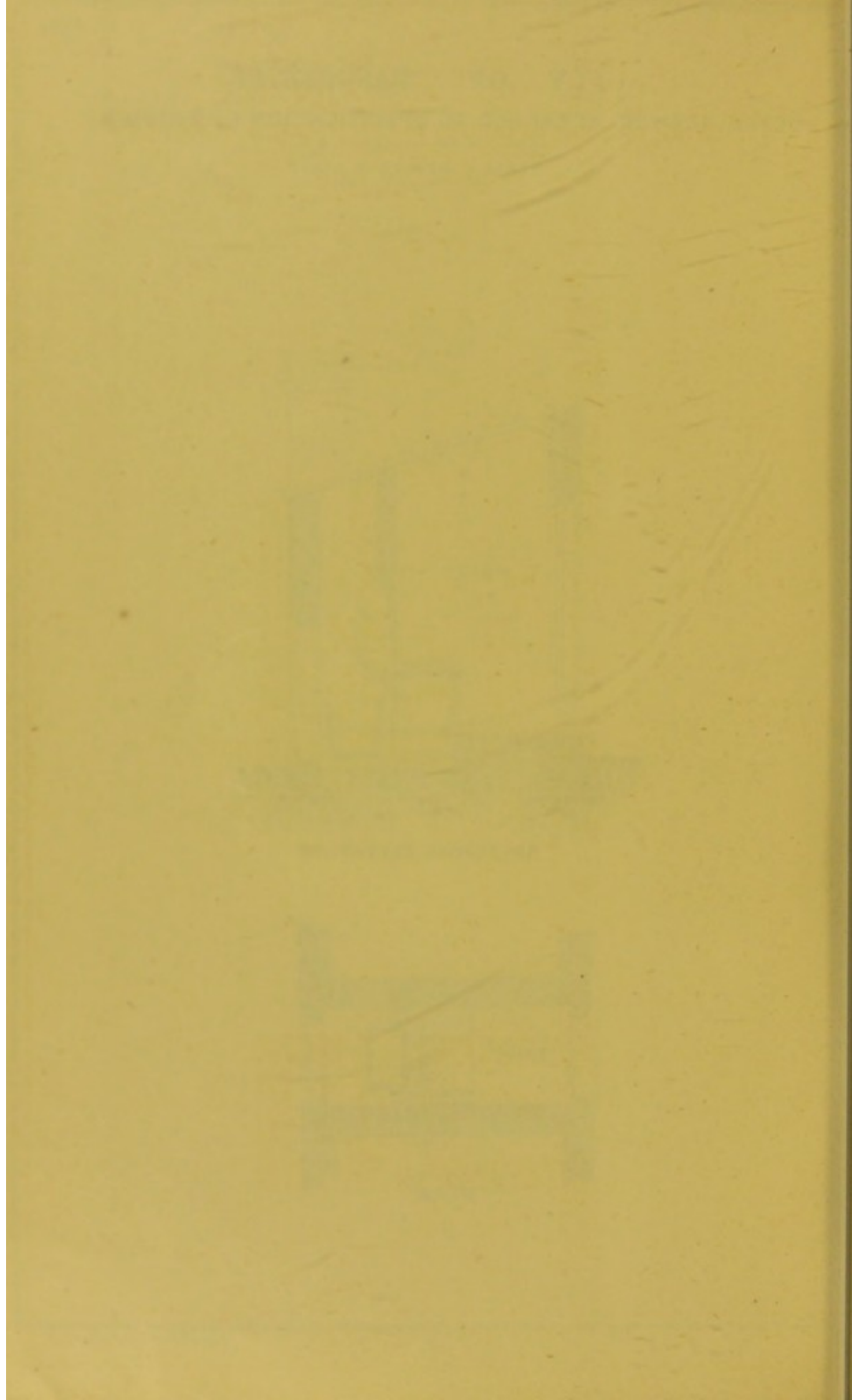


CITY OF MANCHESTER.

DETAIL DRAWING ATTACHED TO SPECIFICATION OF PRIVIES.

SCALE 1 INCH TO A FOOT.

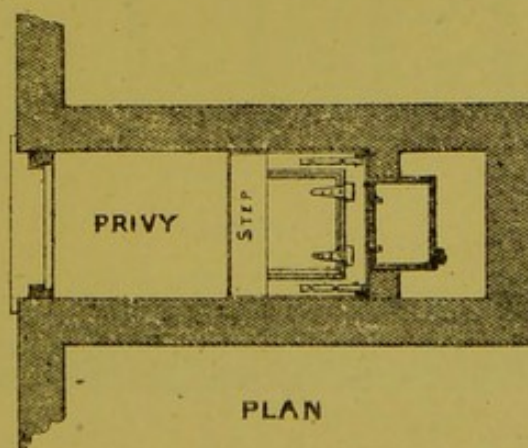
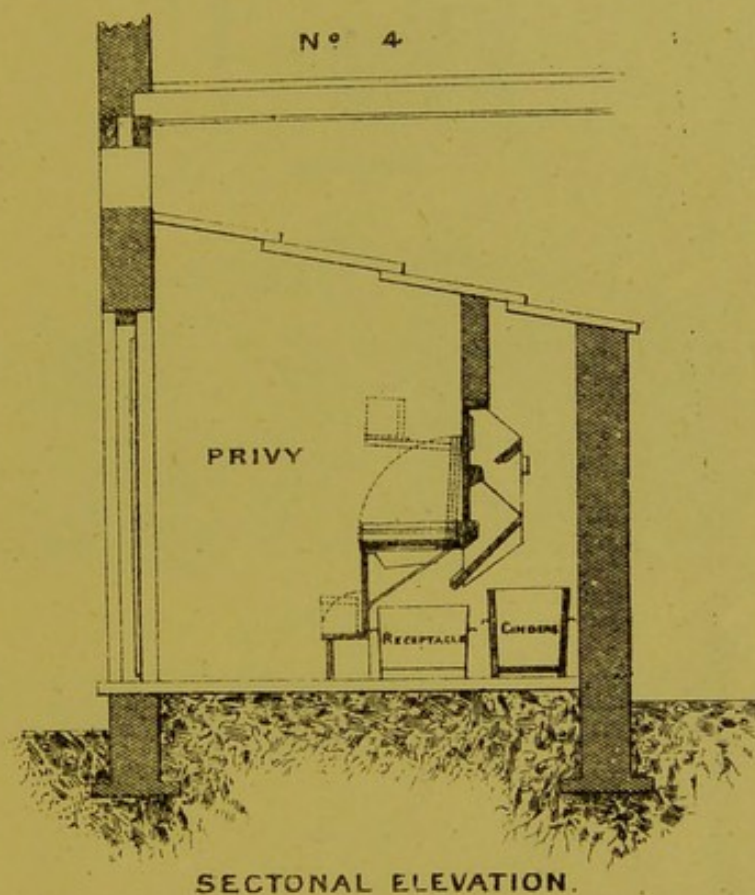


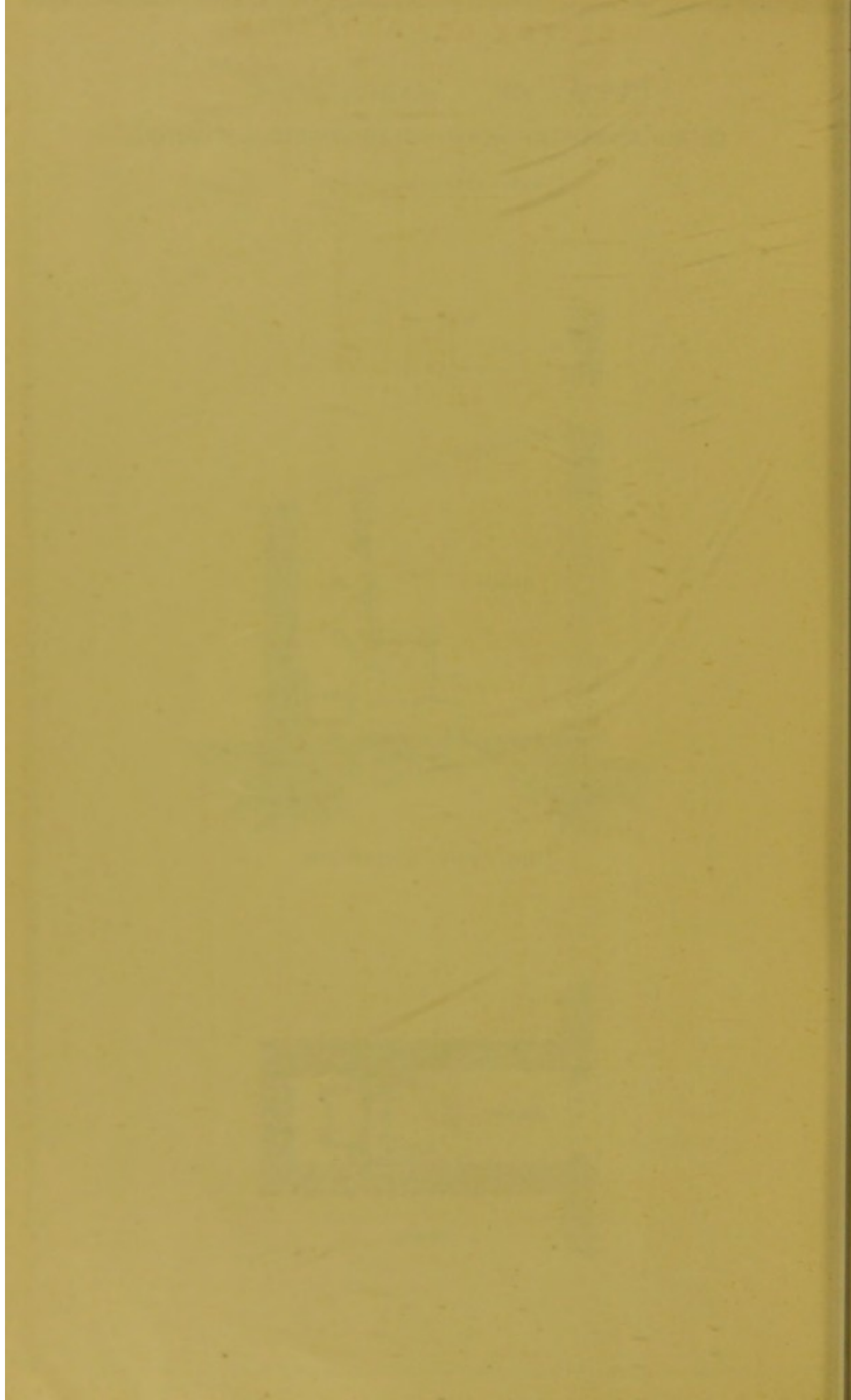


CITY OF MANCHESTER.

DETAIL DRAWING ATTACHED TO SPECIFICATION OF PRIVIES.

SCALE 1 INCH TO A FOOT.

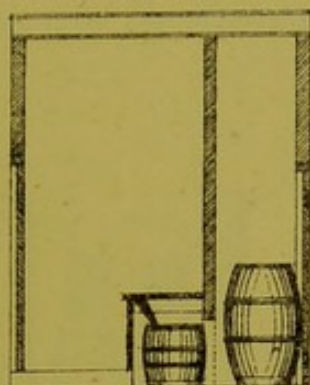




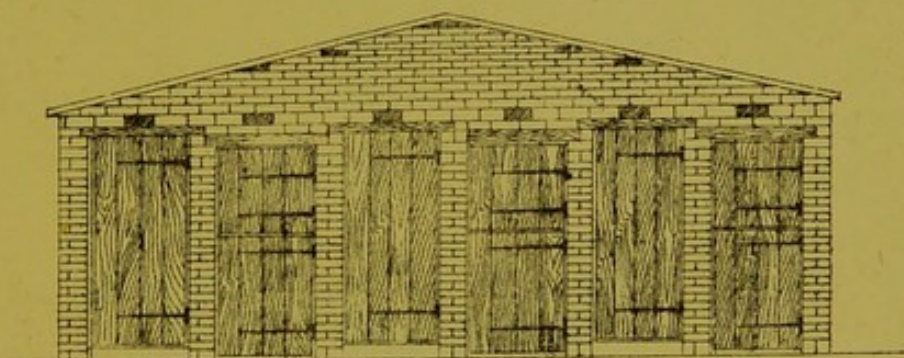
HALIFAX CORPORATION.

N^o 1.

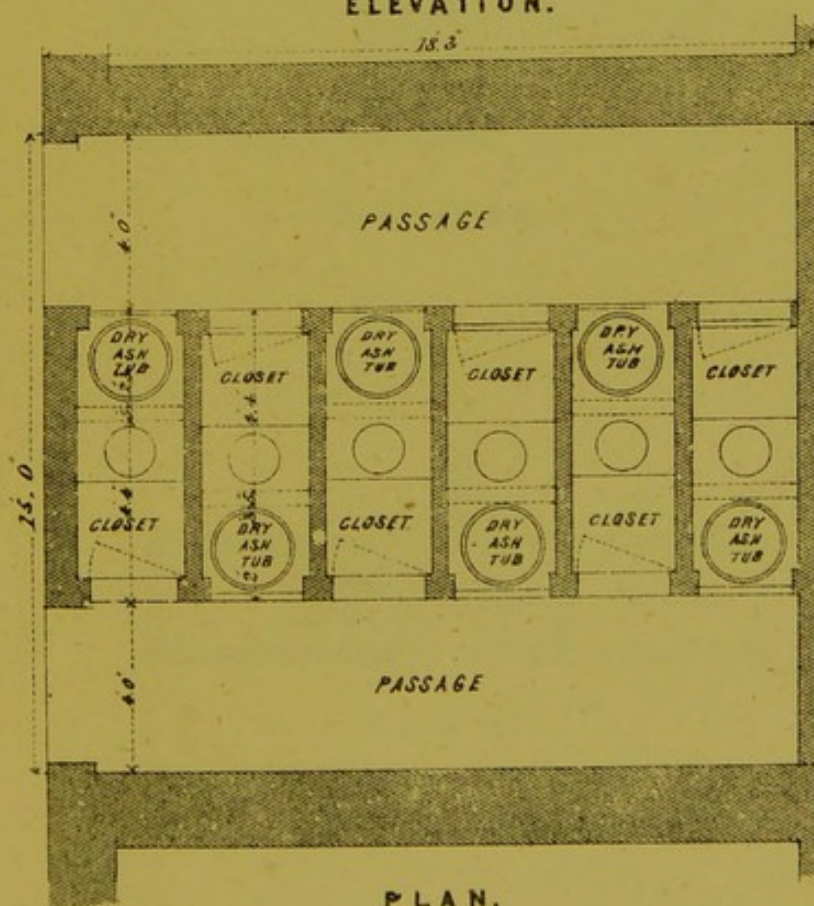
*Plan of Gow's Closets accompanying specification of Works—
N^o 1. Suitable for existing back to back Houses.*



SECTION.



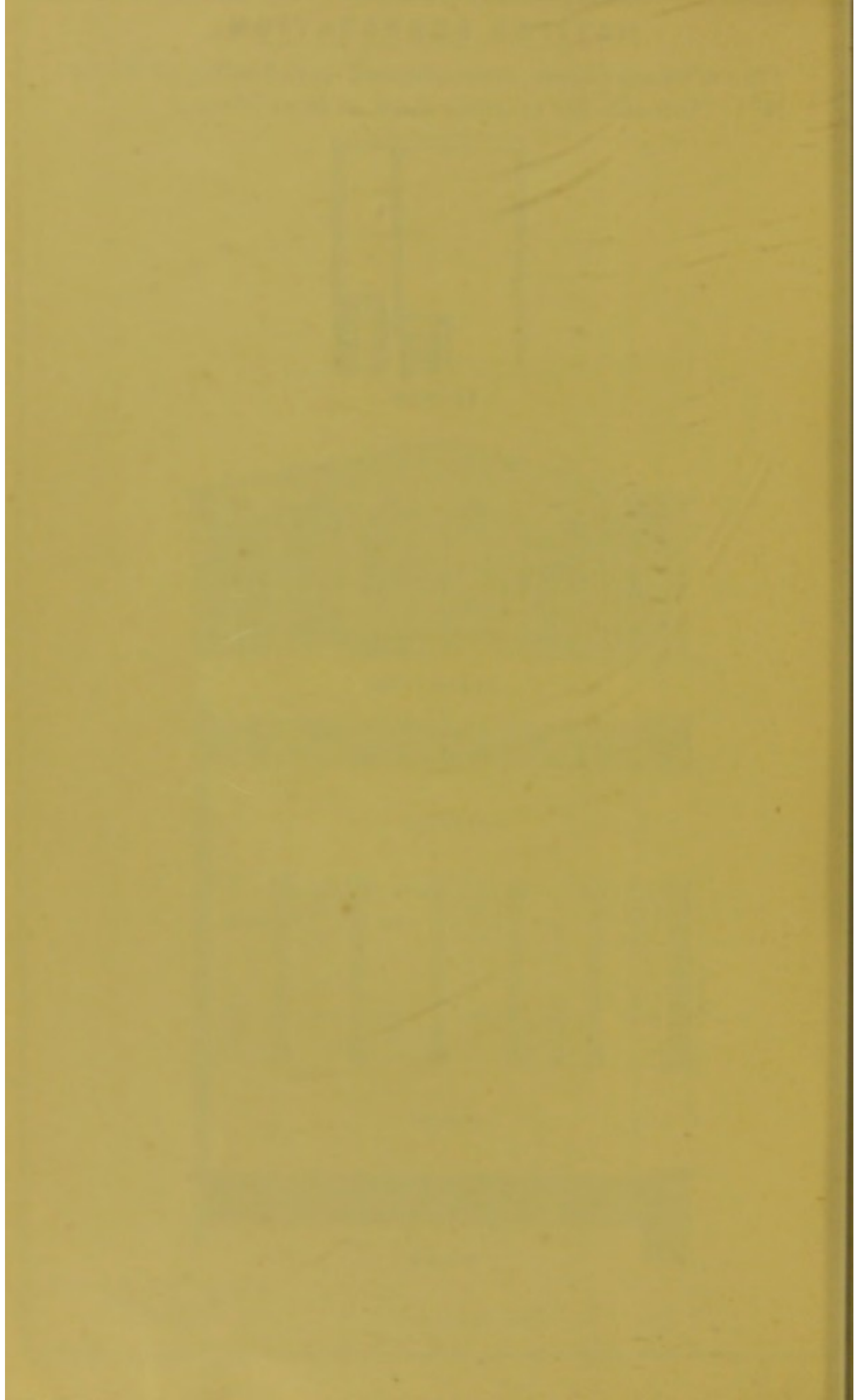
ELEVATION.



PLAN.

SCALE, 1 INCH EQUAL TO 6 FEET.

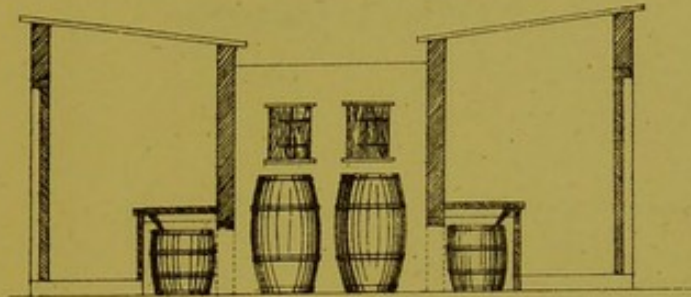
BURROUGHS ENGINEER'S OFFICE
TOWN HALL, HALIFAX.
JUNE, 30th 1871.



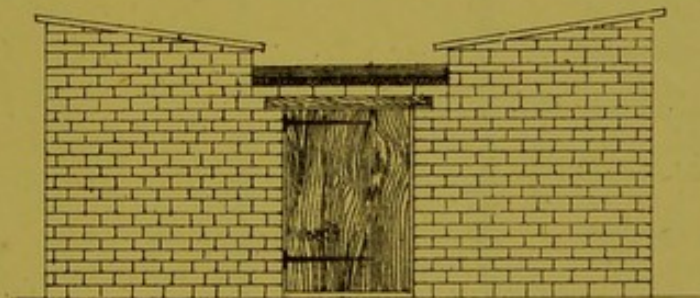
HALIFAX CORPORATION.

Plan of Goux's Closets accompanying specification of works.

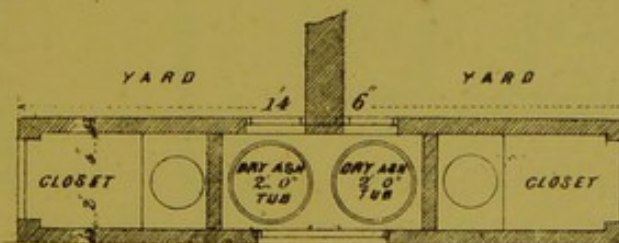
N^o 2, Suitable for separate Dwellings with Yards.



SECTION



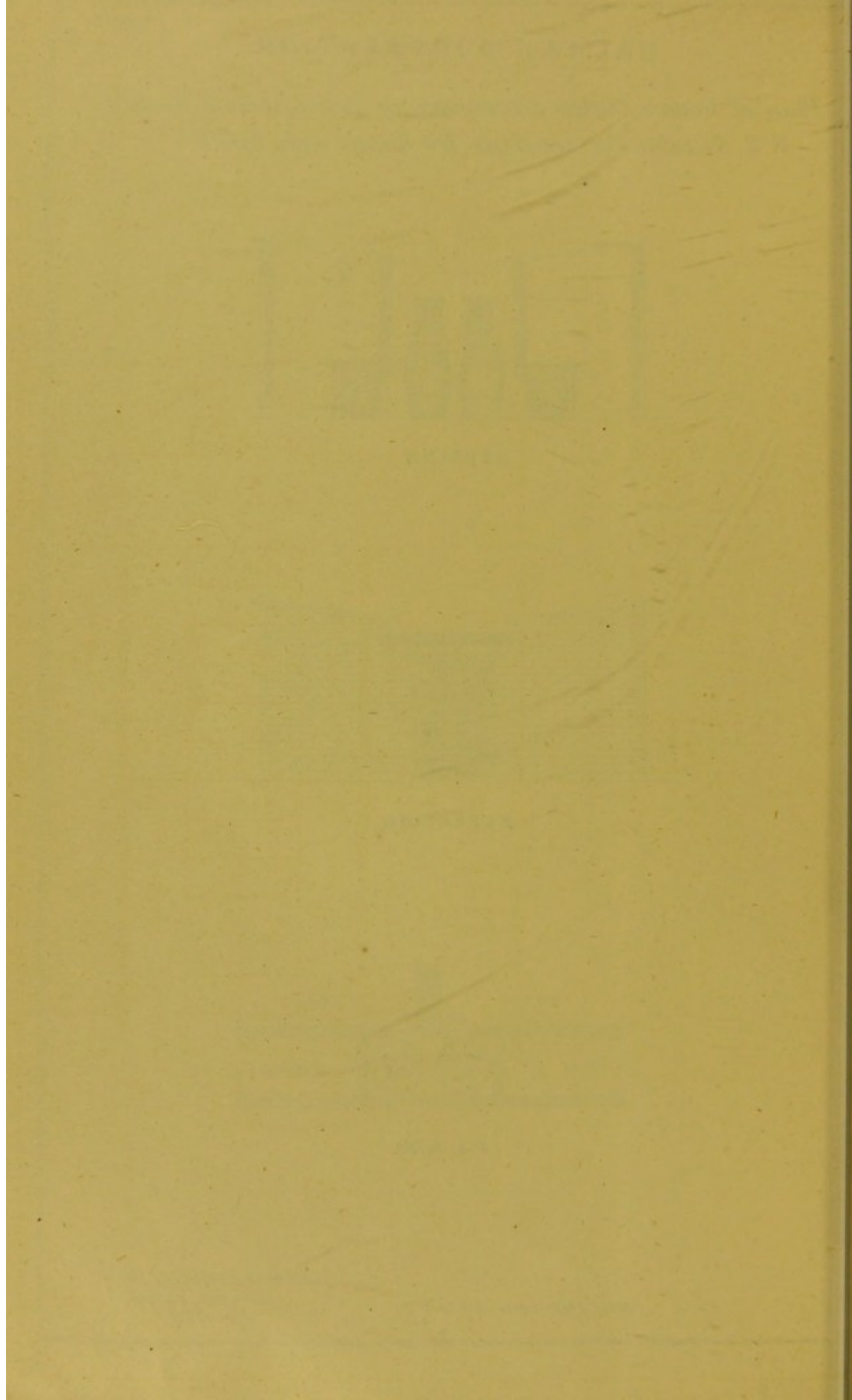
ELEVATION.



PLAN.

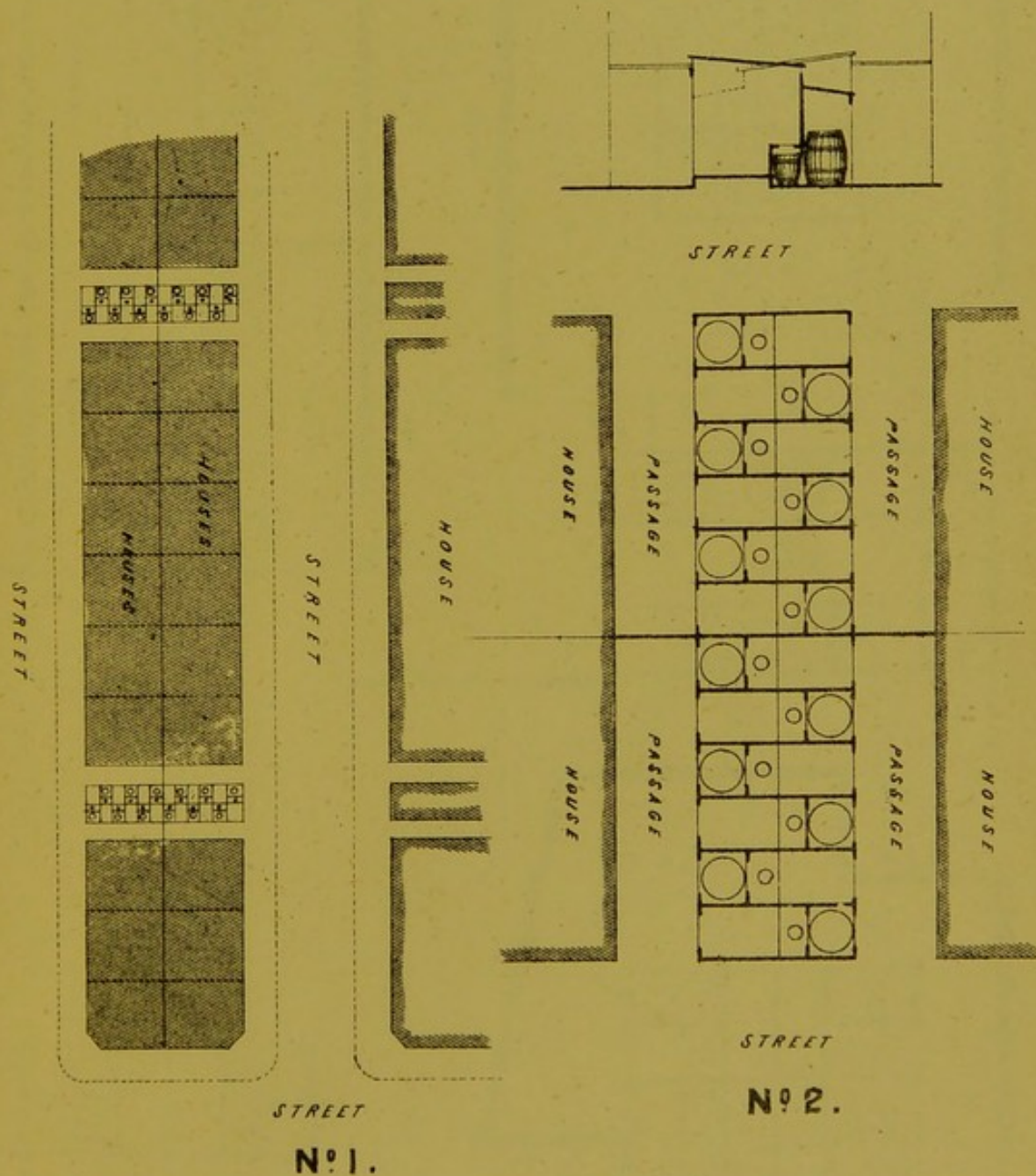
SCALE 1 INCH EQUAL TO 6 FEET.

BOROUGH ENGINEER'S OFFICE,
TOWN HALL, HALIFAX,
JUNE 30th 1871.



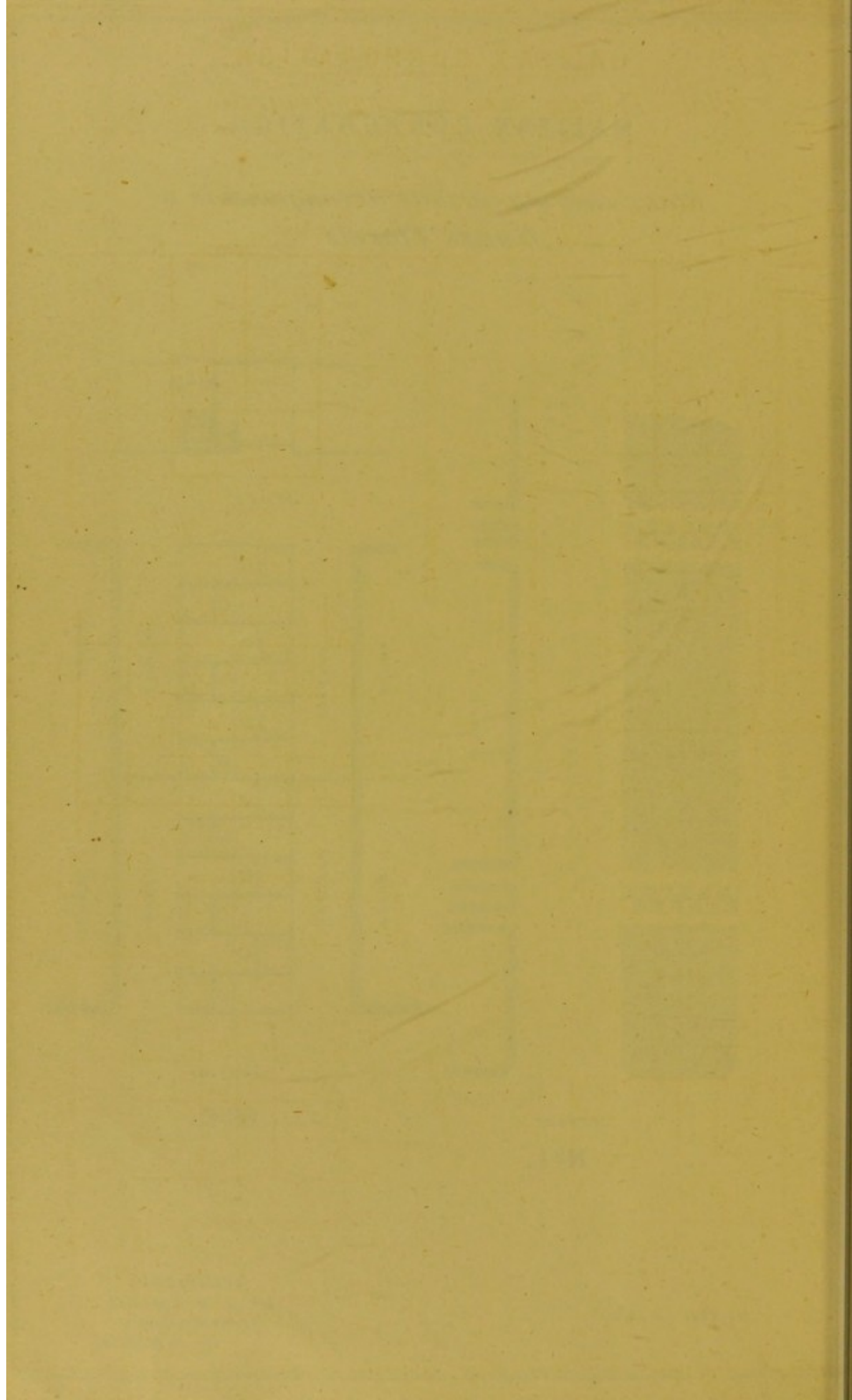
HALIFAX CORPORATION.

*Plans shewing various arrangements of
Goux's Closets.*



24 Feet = 1 Inch.

DESIGNED BY
M^r J. R. SMITH,
SANITARY INSPECTOR,
FOR THE BOROUGH.



N^o 4.

HALIFAX CORPORATION.

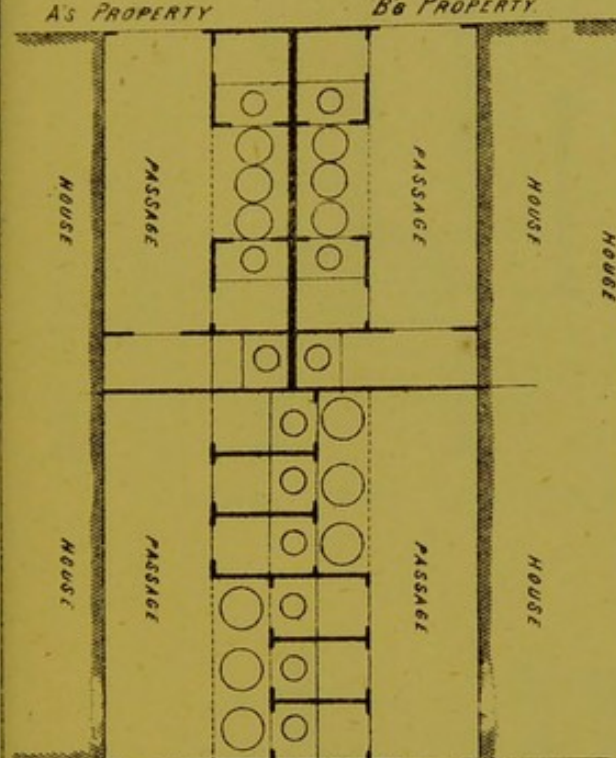
*Plan shewing various arrangements of
Goux's Closets.*

N^o 3.

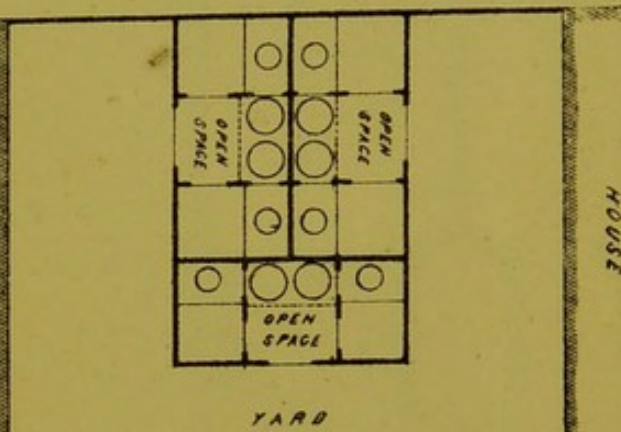
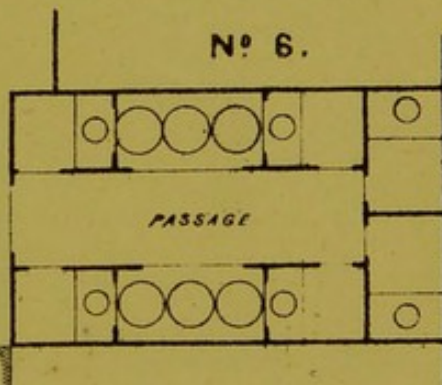
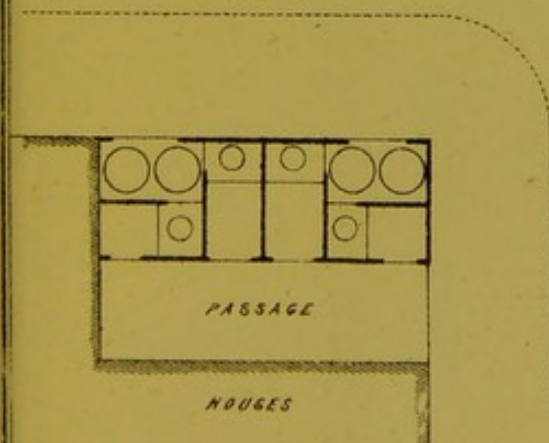
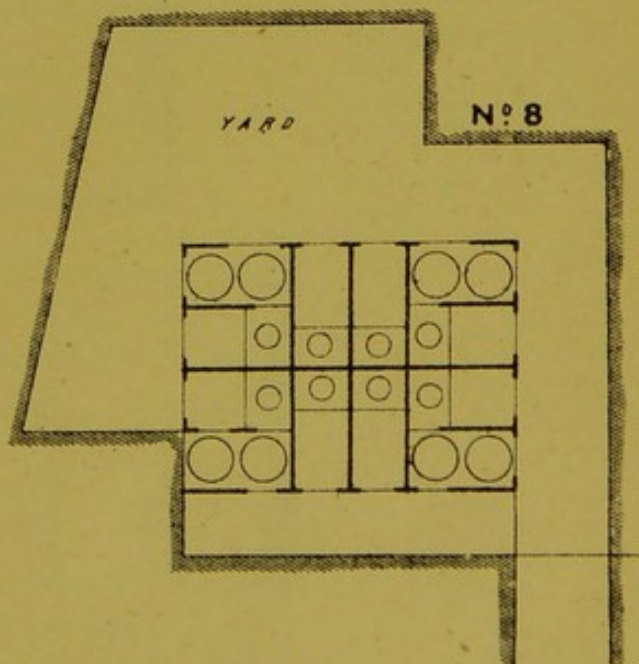
STREET

A's PROPERTY

B's PROPERTY

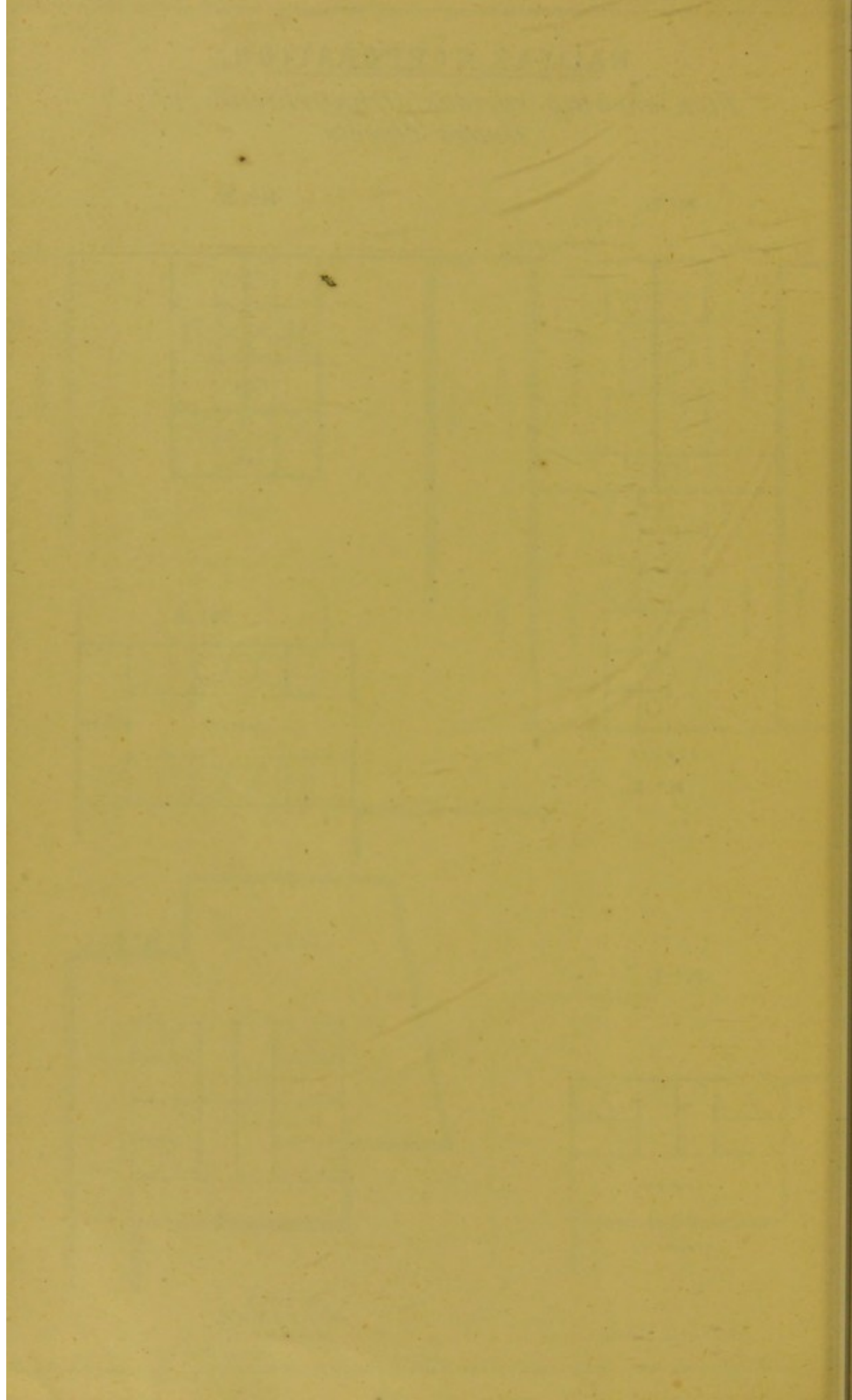


STREET

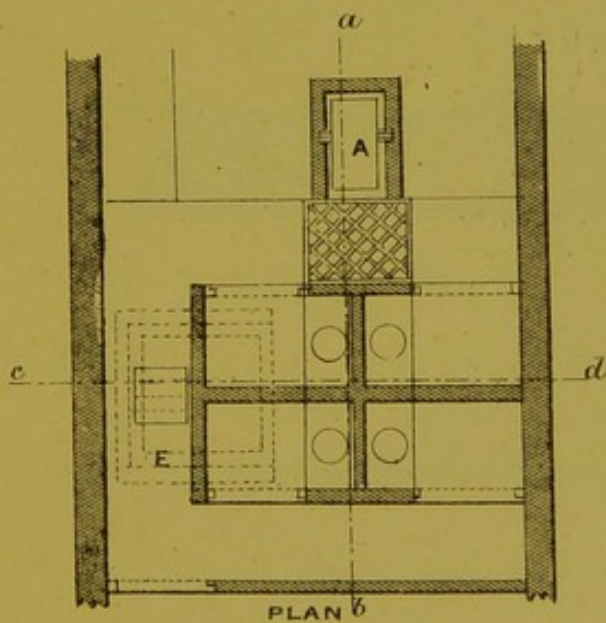
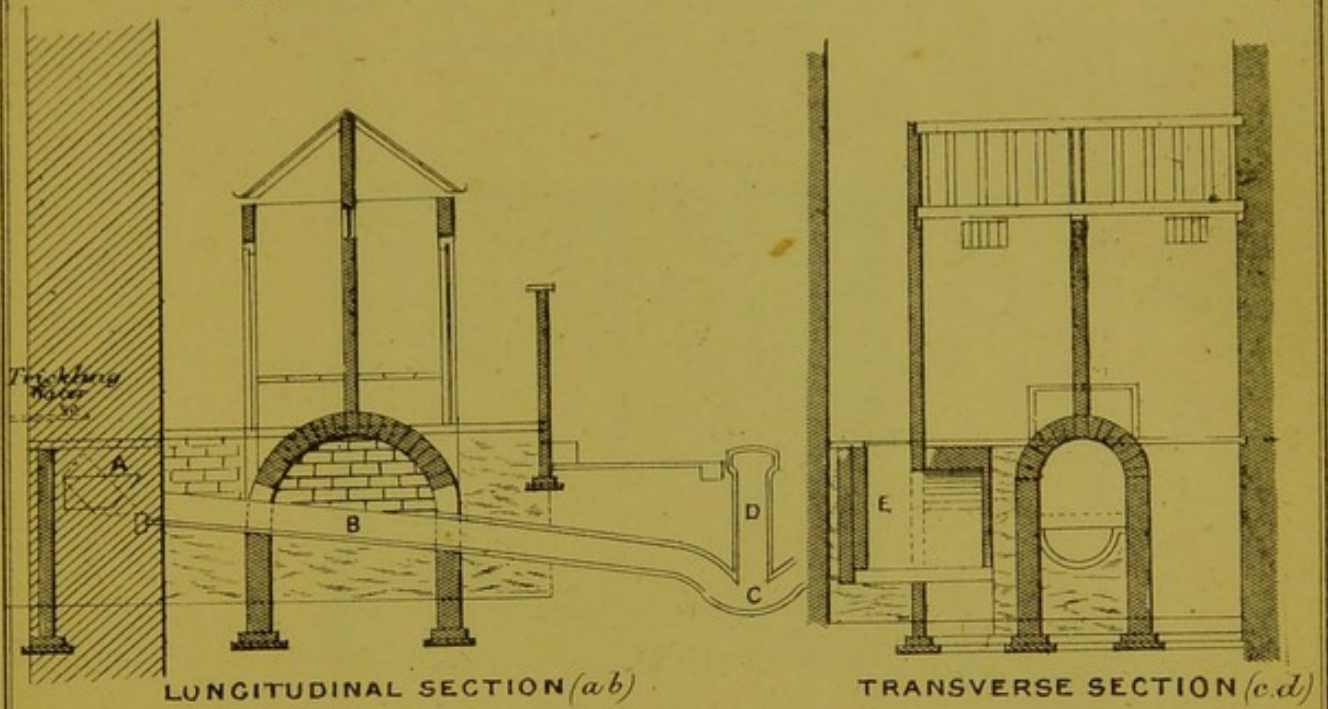
N^o 4.N^o 5.N^o 6.N^o 7.N^o 8.

24 Feet = 1 Inch.

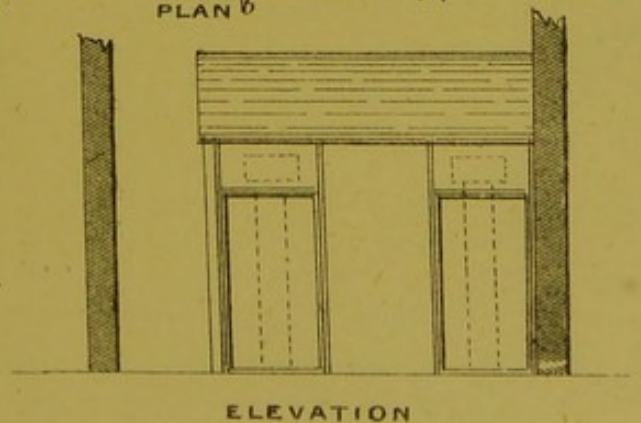
DESIGNED BY
M^r J. R. SMITH,
SANITARY INSPECTOR
FOR THE BOROUGH.



LEEDS CORPORATION. TUMBLER WATER CLOSETS, HENRY STREET LEEDS.

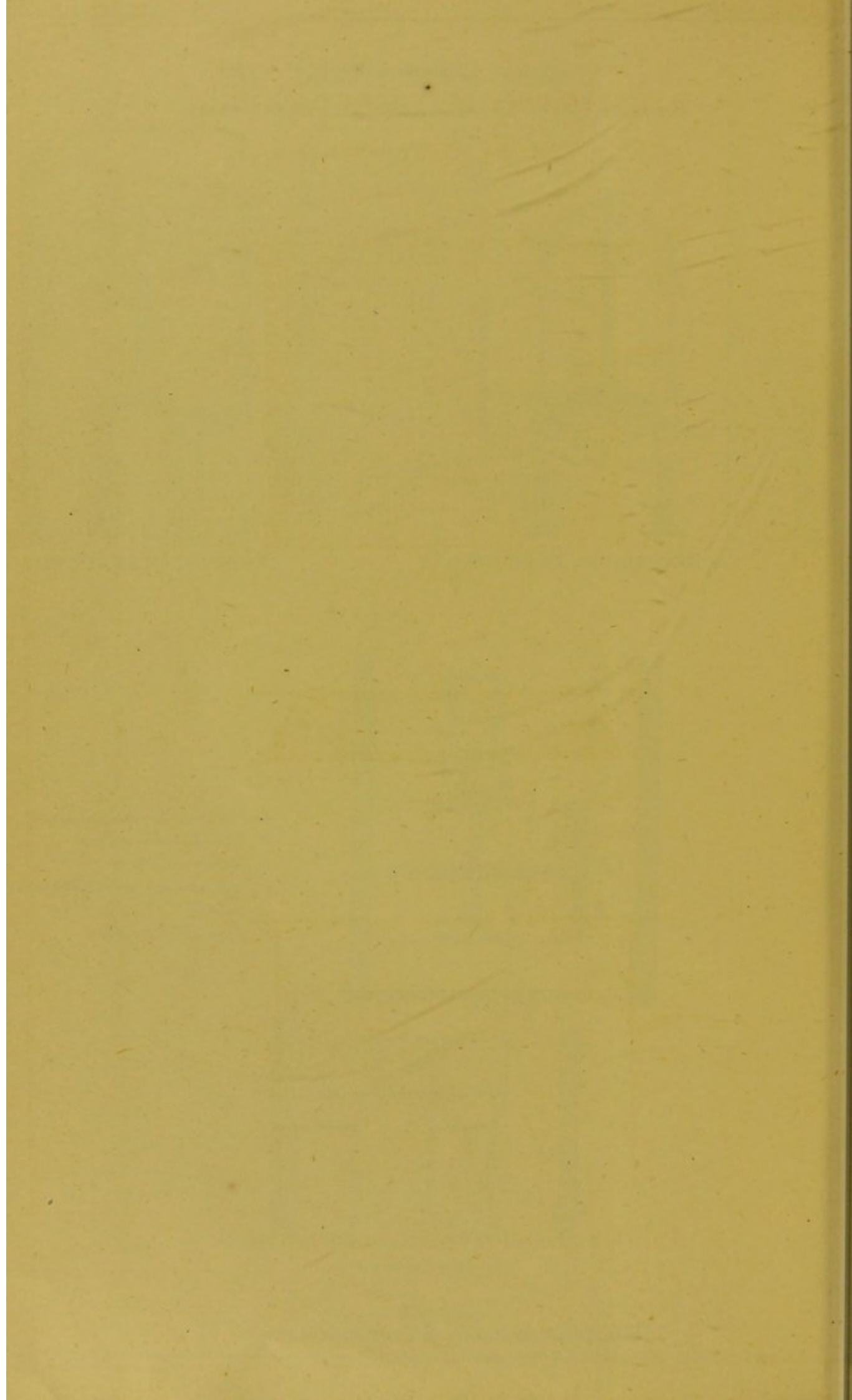


- A Tumbler to flush trough.
- B Trough below 4 Seats shown on Plan.
- C Siphon trap with (D) cleansing shaft.
- D Sunk dry ashpit.



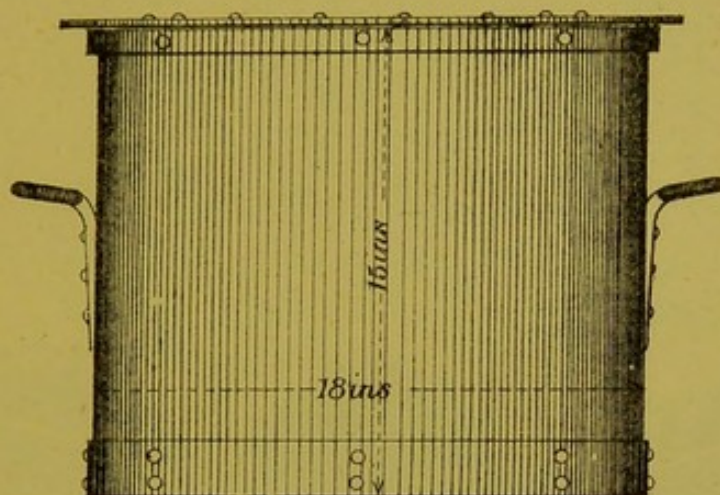
Scale 8 Feet to 1 Inch.

A horizontal scale bar with markings for 0, 5, 10, 15, and 20 feet.



BIRMINGHAM CORPORATION.

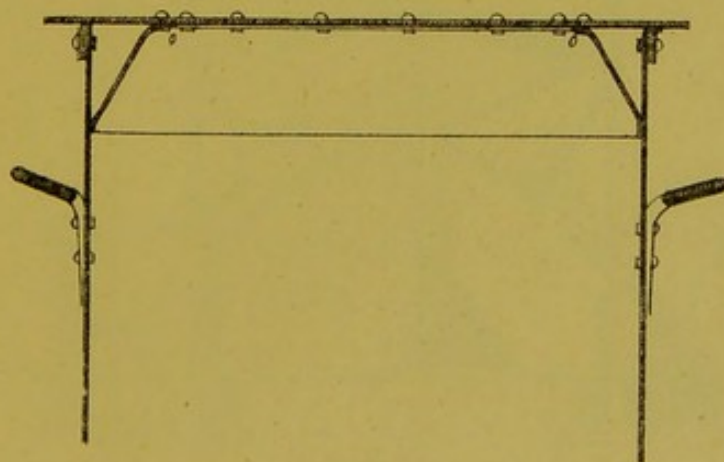
EXCREMENT PAIL.



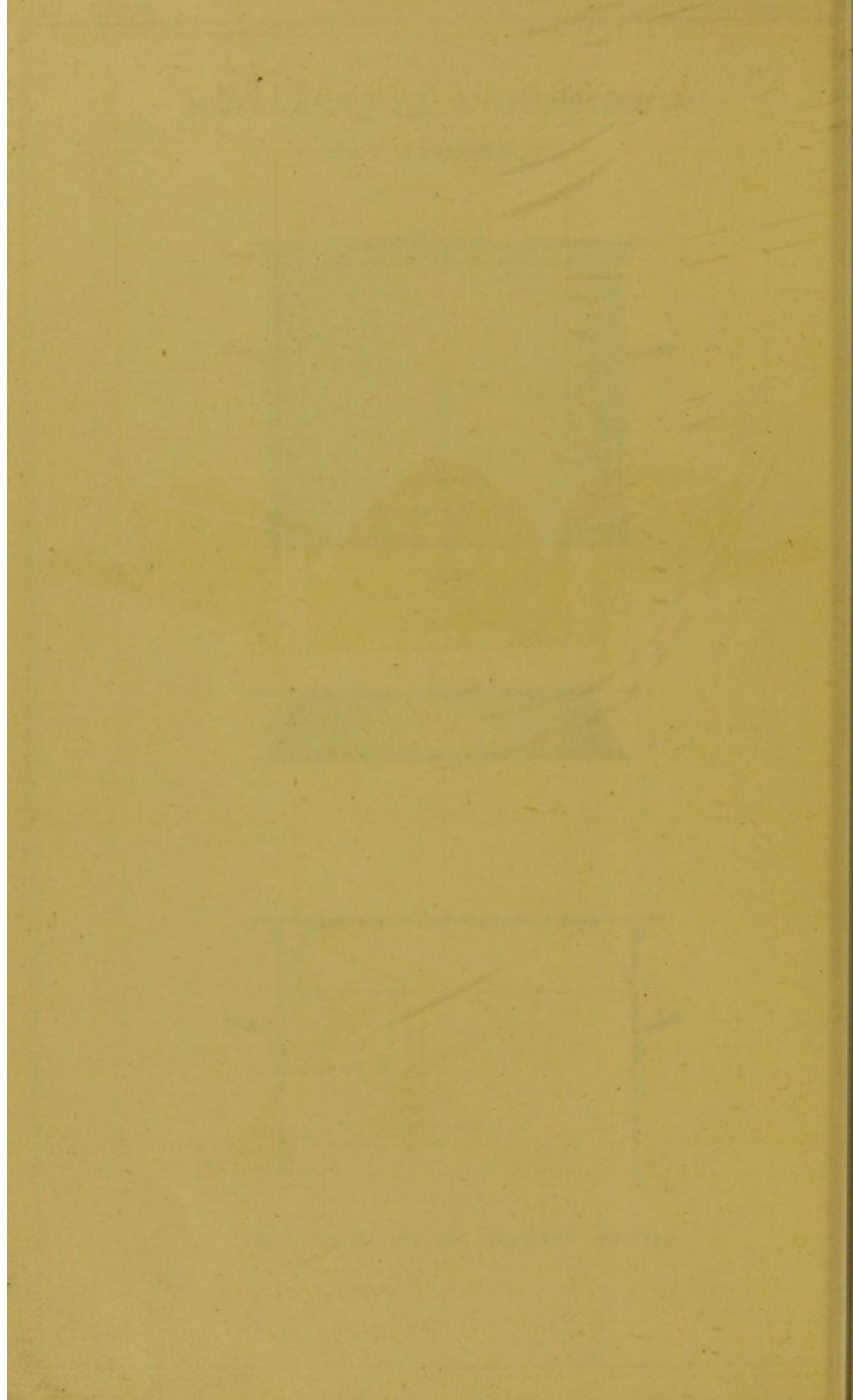
PAIL.



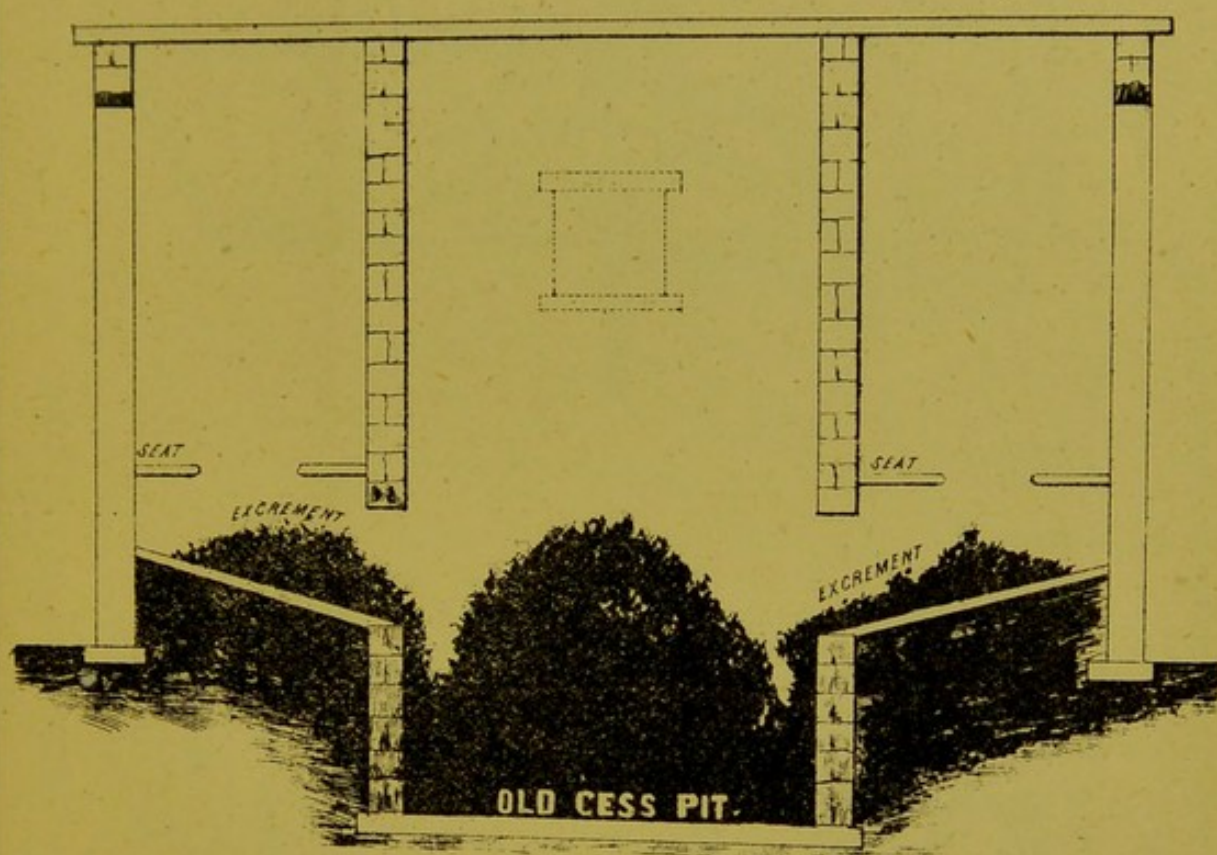
LID.



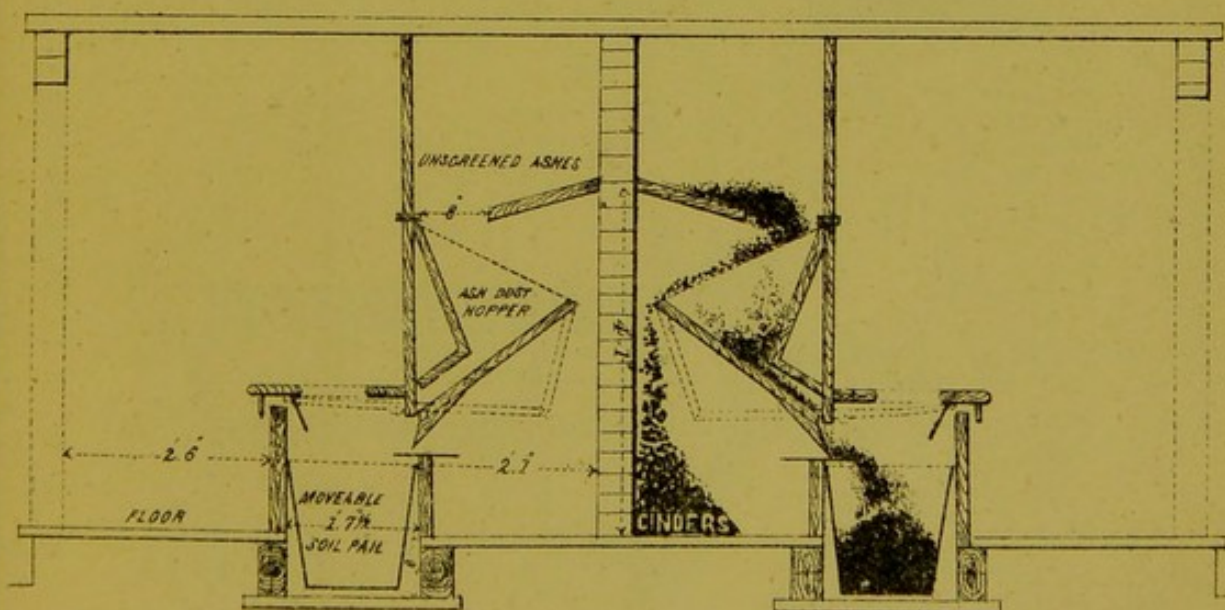
SECTION SHEWING THE LID IN POSITION.



SALFORD CORPORATION.



*Section of old Closets,
M^c Cleary S^t PENDLETON.*

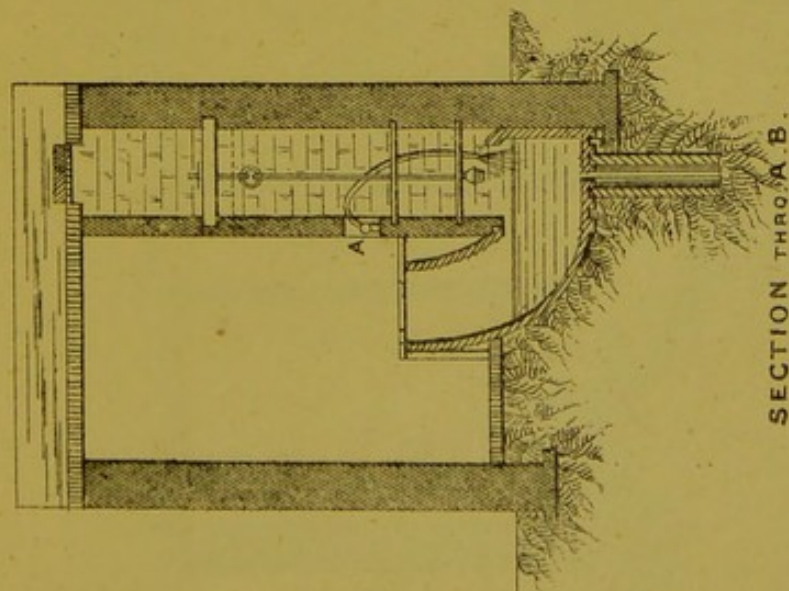


*Section of Improved Closets,
with moveable Soil Pan, Morell's arrangement.
M^c Cleary S^t PENDLETON.*

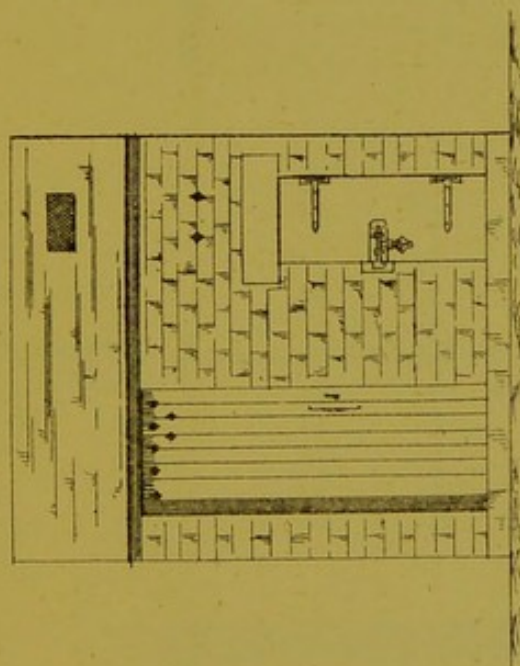
NOTARIAL PUBLIC

LIVERPOOL CORPORATION TROUGH WATER CLOSET.

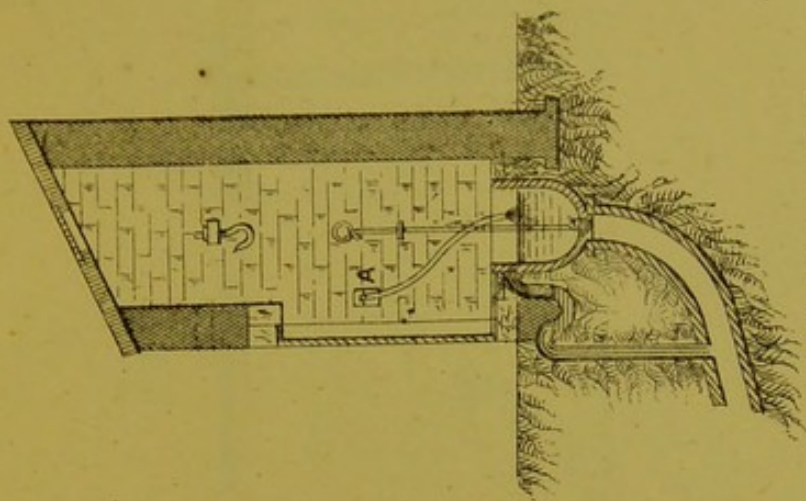
N^o 1.



SECTION THRO' A. B.

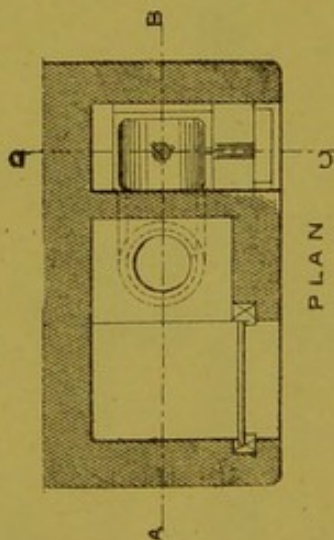


ELEVATION



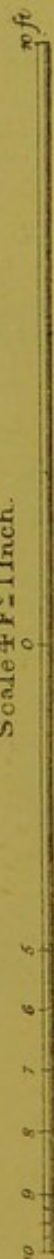
SECTION THRO C. D.

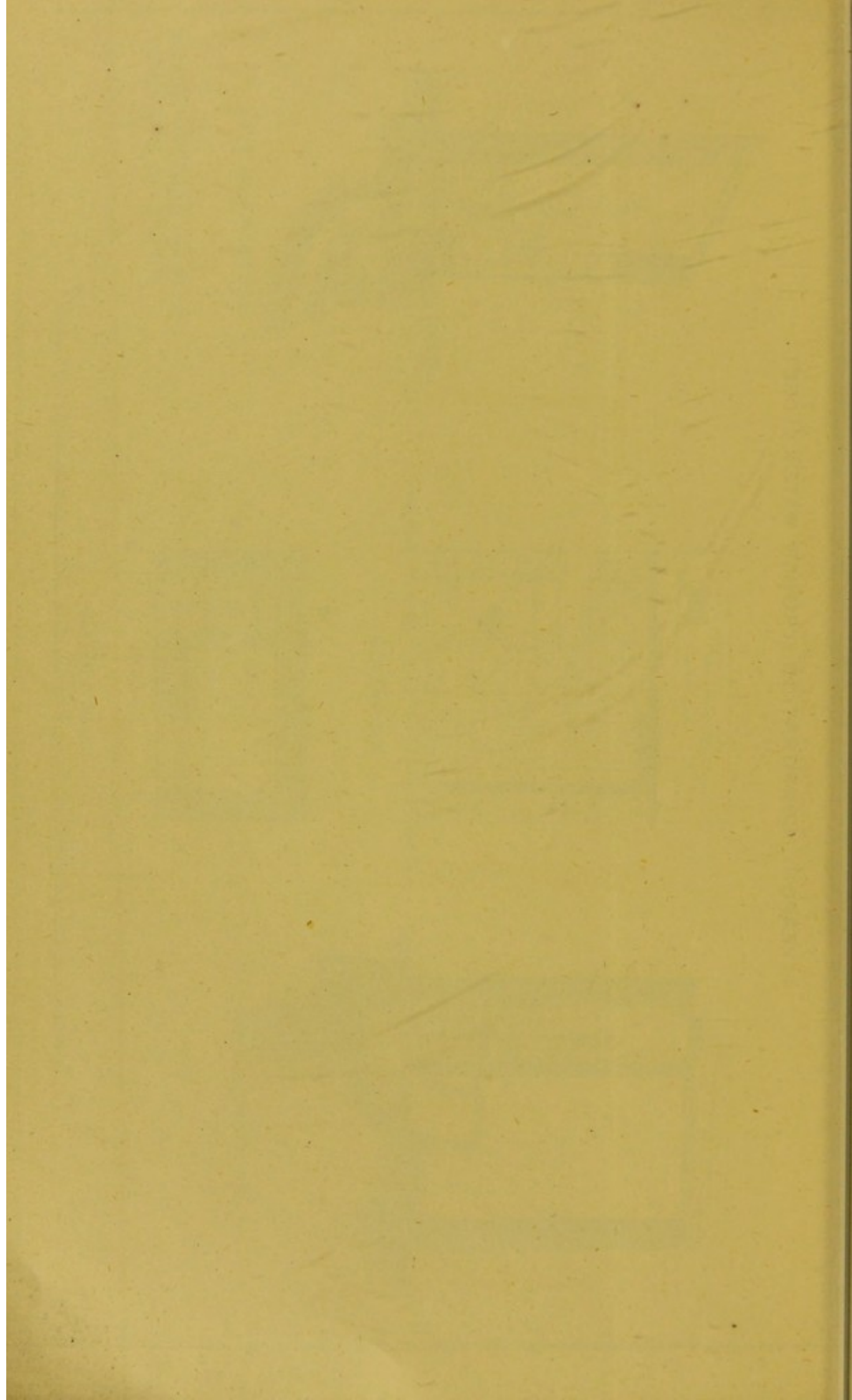
A Water Supply from Hydrant
with Hose inside Chamber.



PLAN

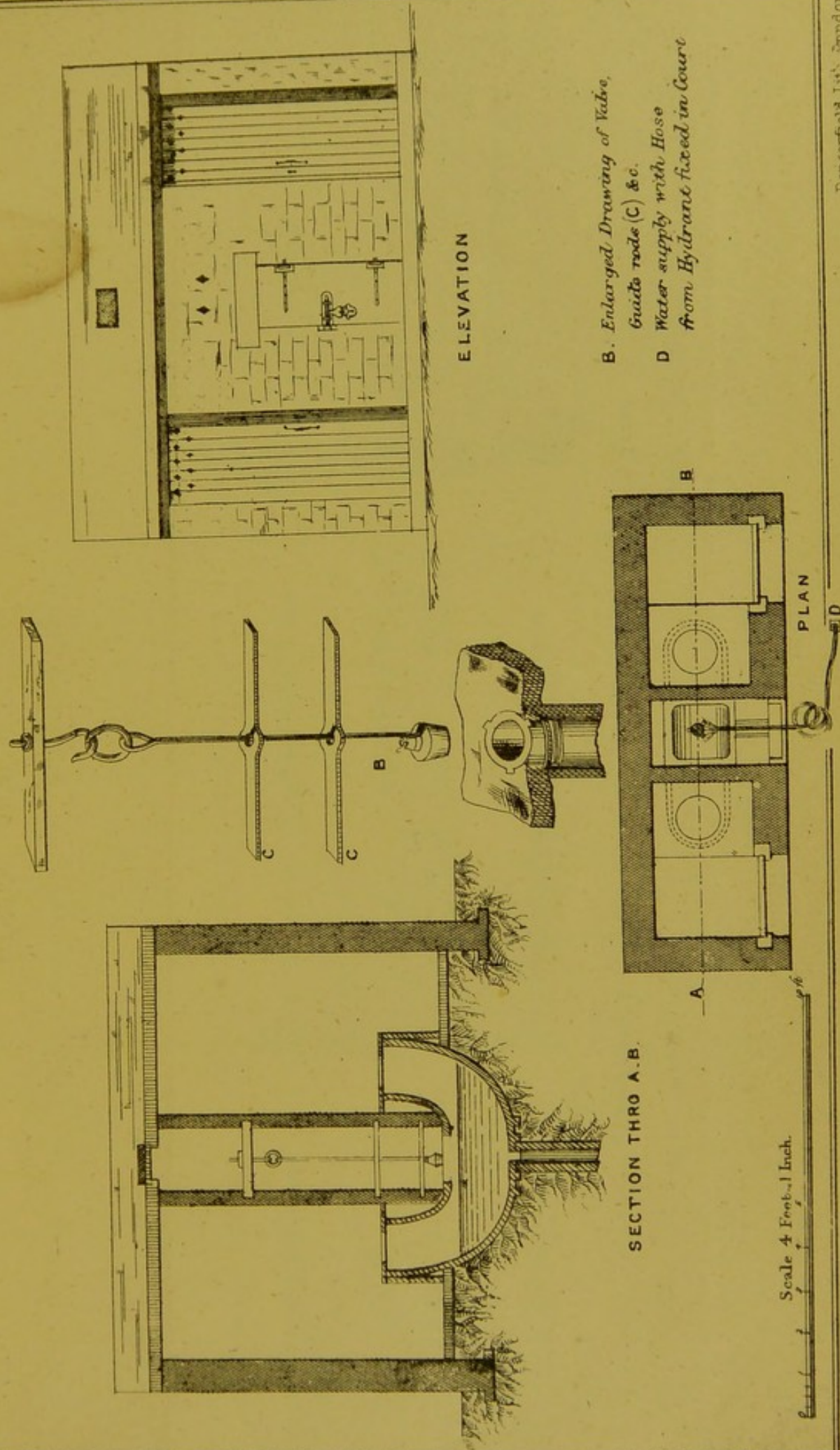
Scale 4 Feet 1 Inch.





N^o 2.

LIVERPOOL CORPORATION. DOUBLE TROUGH WATER CLOSET.

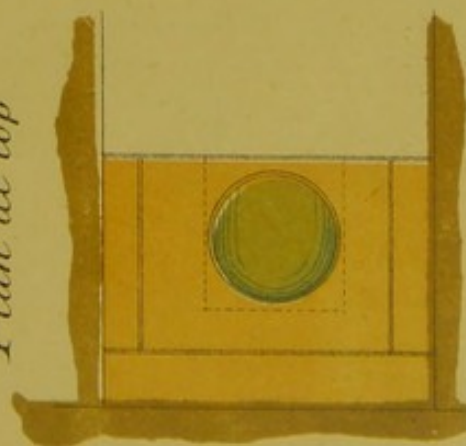


Scale 4 Feet = 1 Inch.

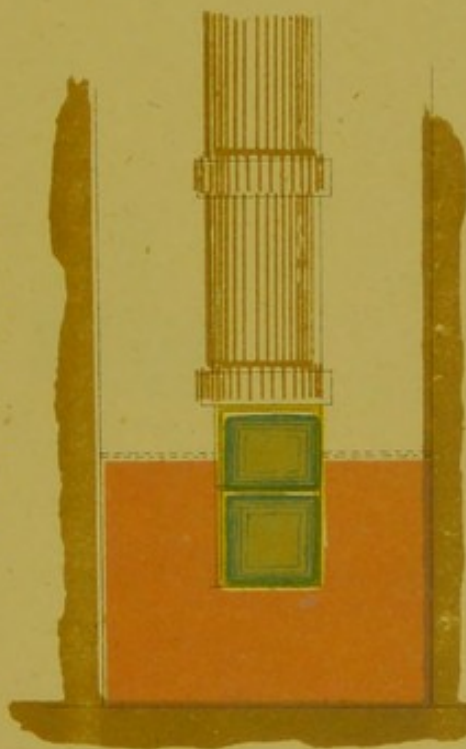


BRISTOL CORPORATION.
DRAWING OF COMMON PRIVY.

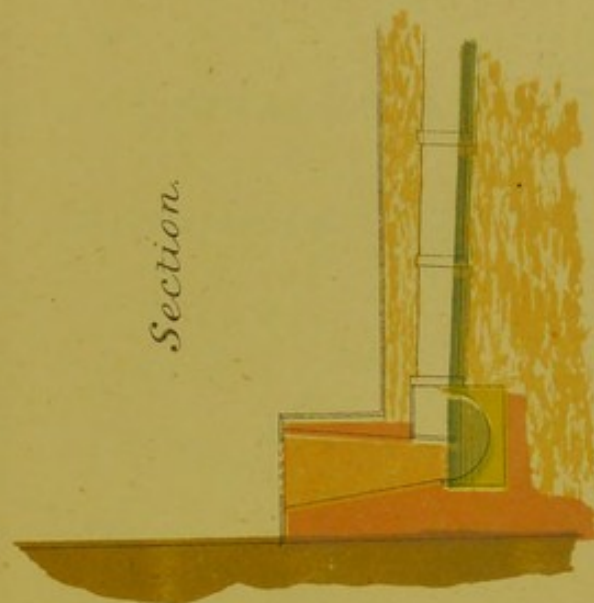
Plan at top



Plan at bottom



Section.



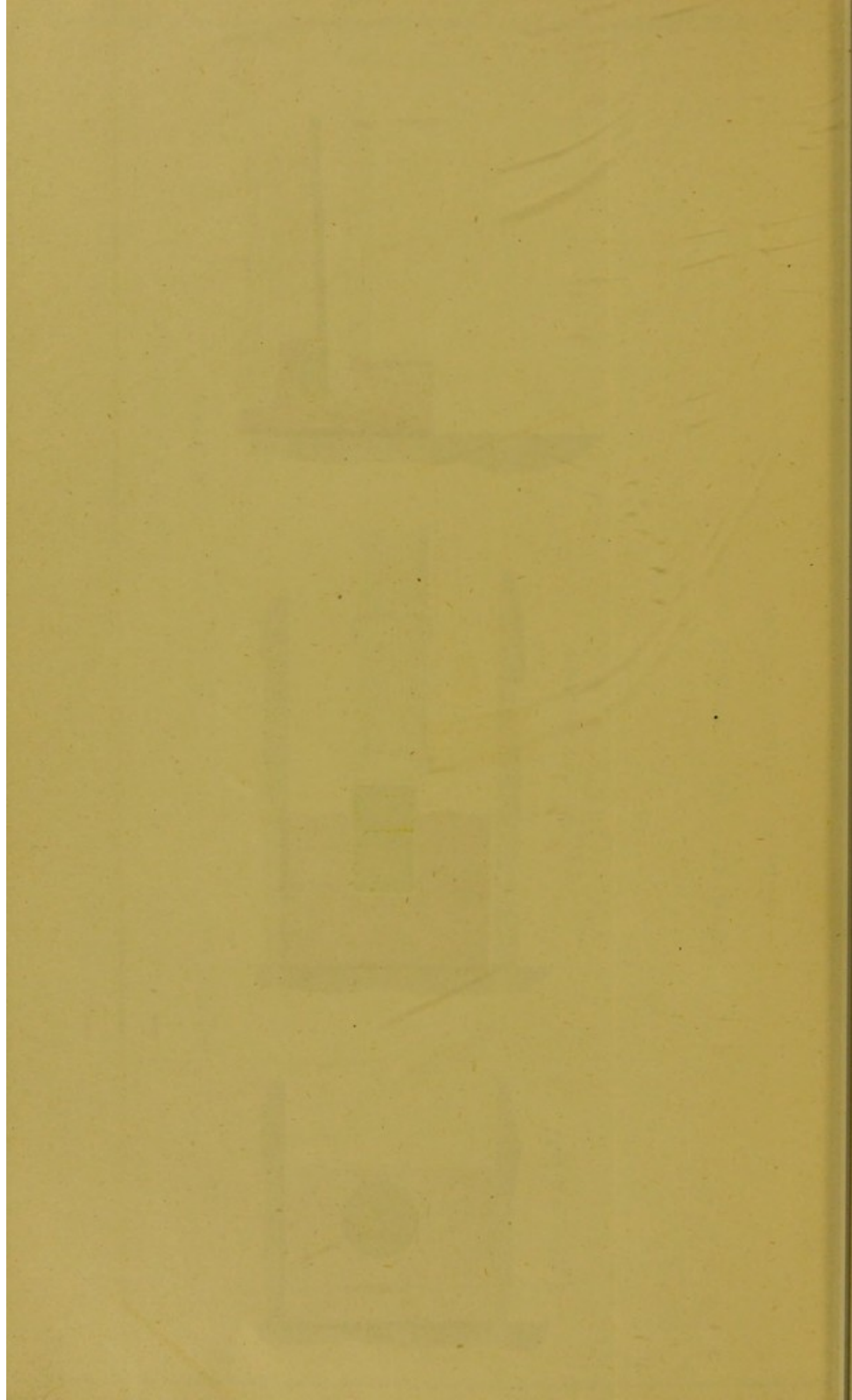
REFERENCE.

- brickwork.
- freestone.
- woodwork.

SCALES.

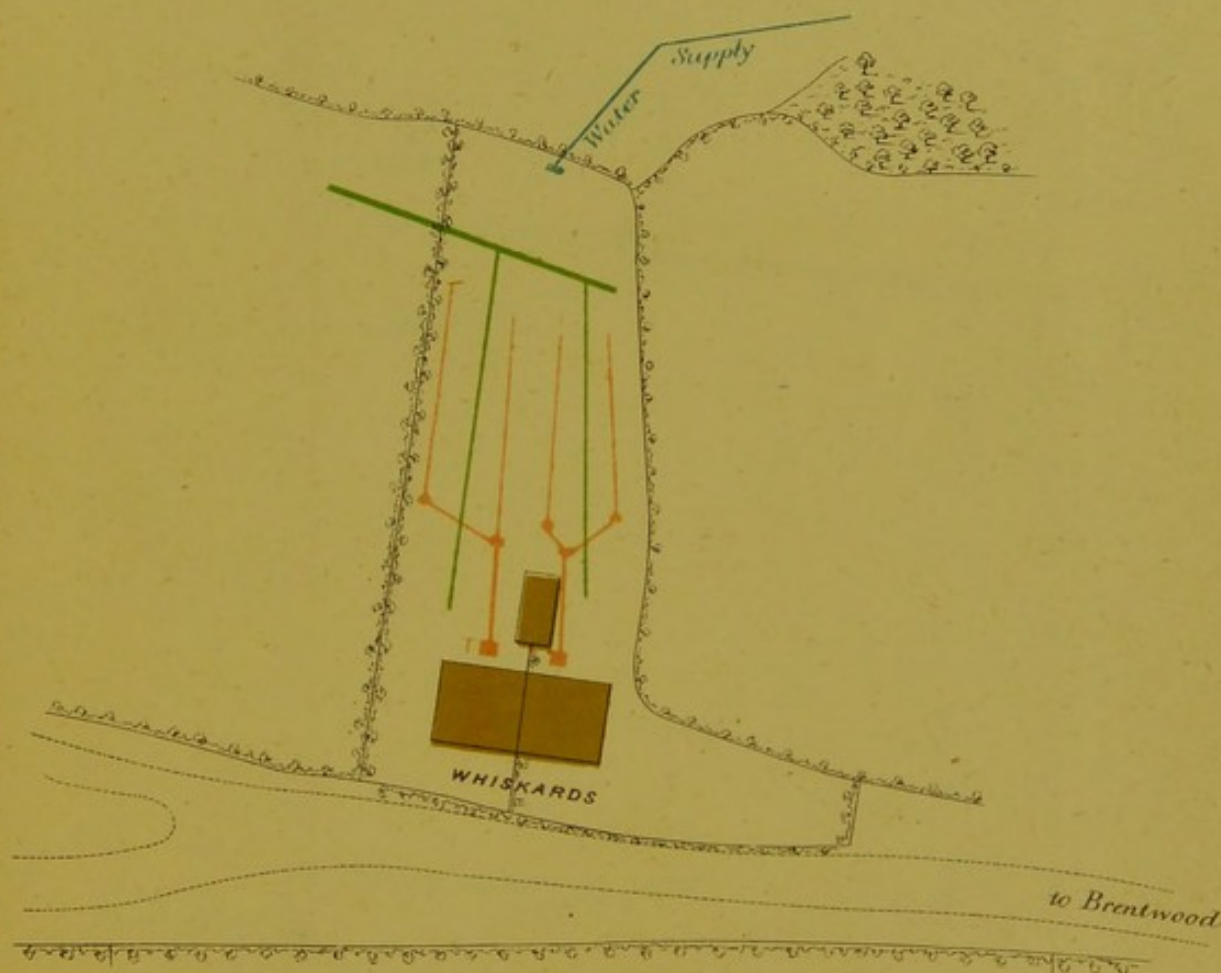
Plans 1/2 Inch to a Foot.

Section 1/4



Fields Patent Siphon Tank.

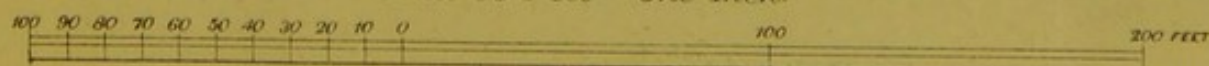
PLAN OF COTTAGES & GARDENS AT SHENFIELD, ESSEX.



REFERENCE

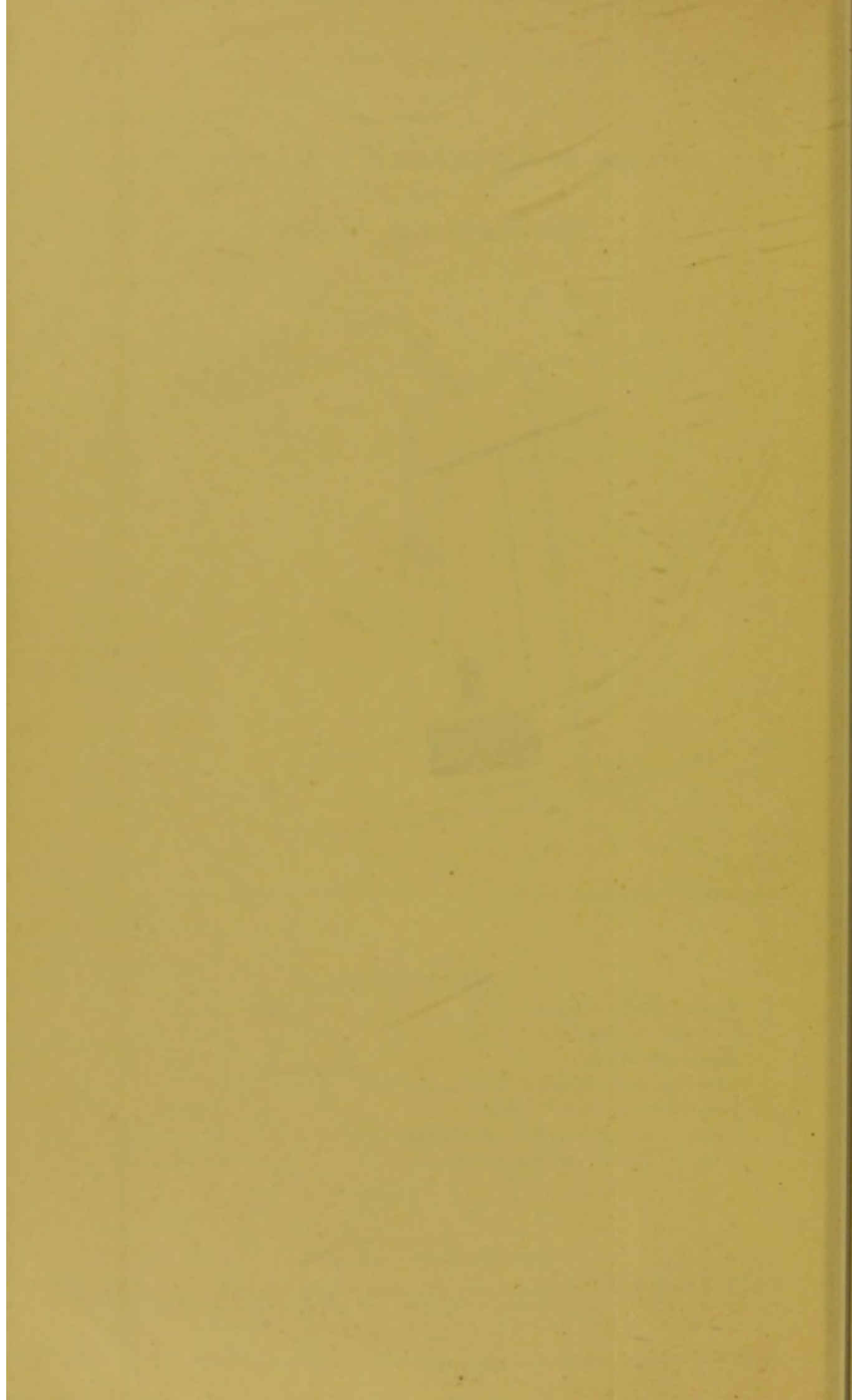
<i>Siphon Tanks shewn</i>	<i>thus</i>		
<i>Watertight Drains</i>	"		
<i>Inspection Wells</i>	"		
<i>Subirrigation Drains (1 Ft deep)</i>	"		
<i>Land Drains (4 Ft deep)</i>	"		
<i>Total Area of Land & Buildings</i>	0	1	9
<i>Area of Land irrigated about</i>	0	0	14

Scale 66 Feet - One Inch.

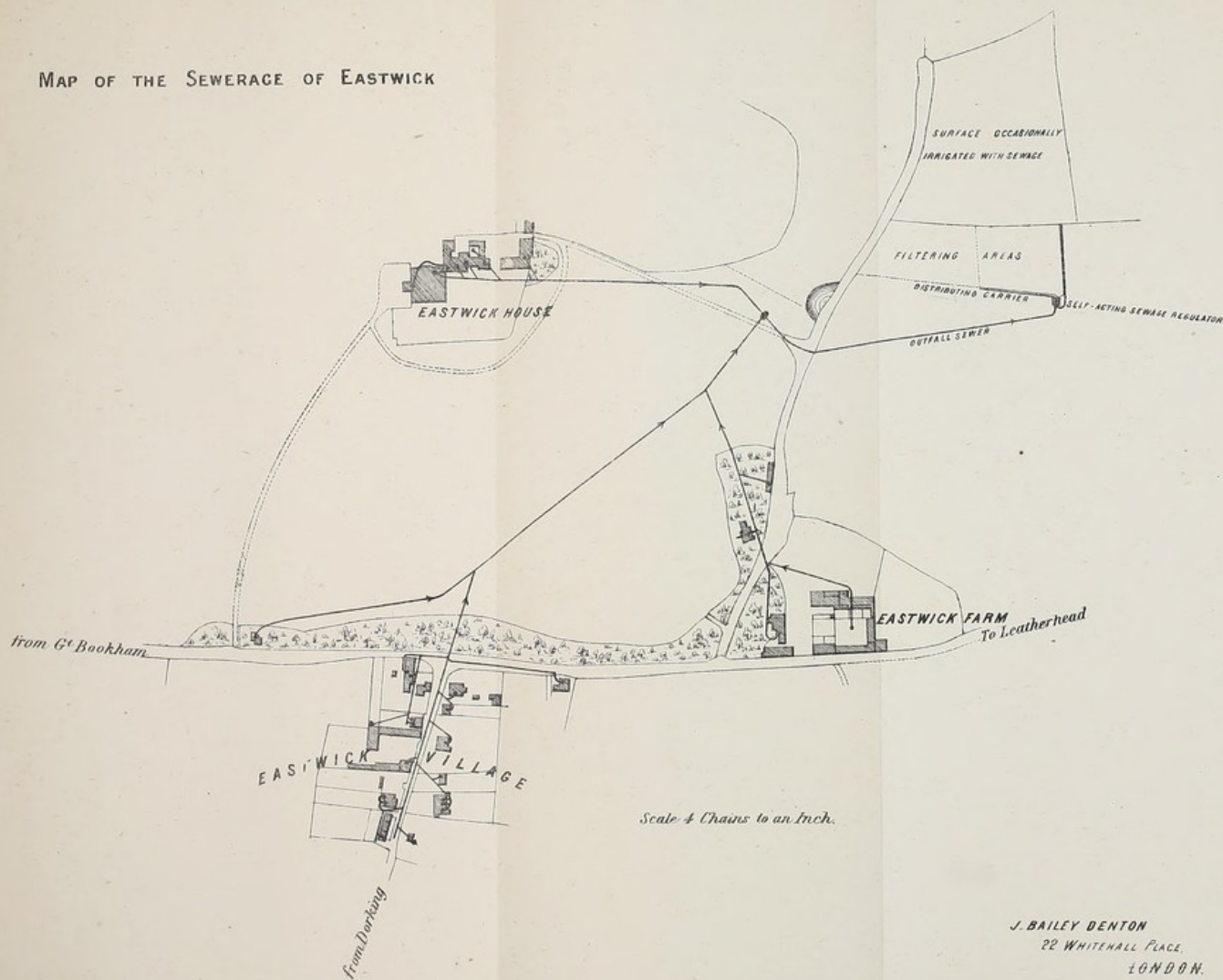


5 Cannon Row,
Westminster.
Sept^r 1873.

Deverfield Lith. London



MAP OF THE SEWERAGE OF EASTWICK









✓

