Bye-laws and regulations with reference to house drainage, adopted by the Uppingham Sanitary Authority and allowed by the Local Government Board, with explanations and suggestions / by Rogers Field.

BYE-LAWS AND REGULATIONS

WITH REFERENCE TO

HOUSE DRAINAGE,

ADOPTED BY THE UPPINGHAM SANITARY AUTHORITY AND ALLOWED BY THE LOCAL GOVERNMENT BOARD.

WITH

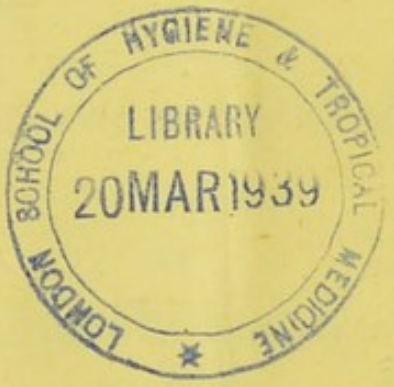
EXPLANATIONS AND SUGGESTIONS.

BY

ROGERS FIELD,
M. INST., C.E.

LONDON:
E. & F. N. SPON, 46, CHARING CROSS.
NEW YORK:
446, BROOME STREET.
1877.

Price One Shilling.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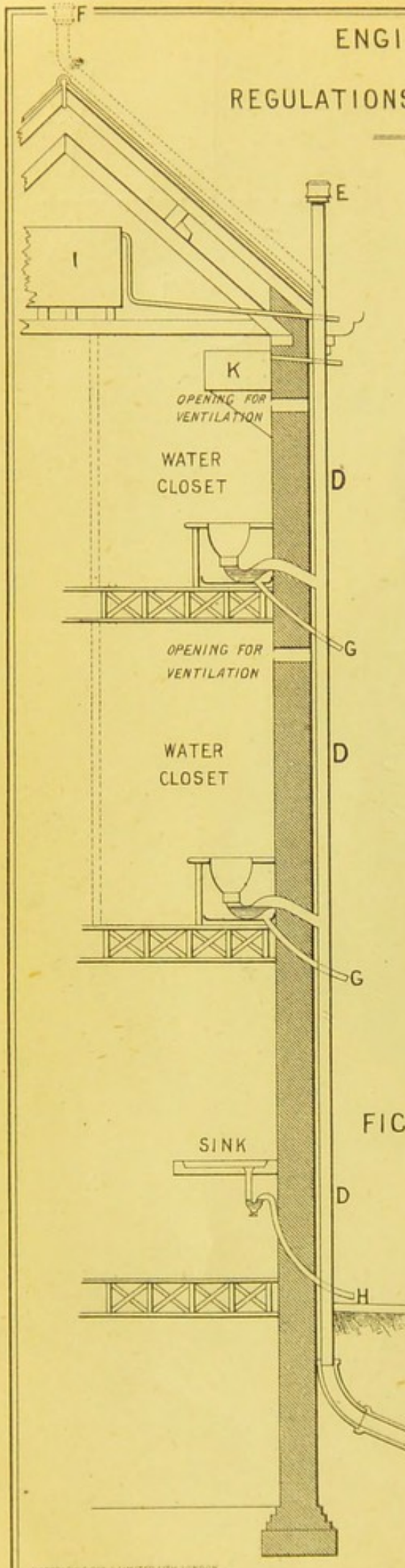
ENGINEER'S SKETCH

EXPLANATORY OF

REGULATIONS FOR HOUSE DRAINAGE



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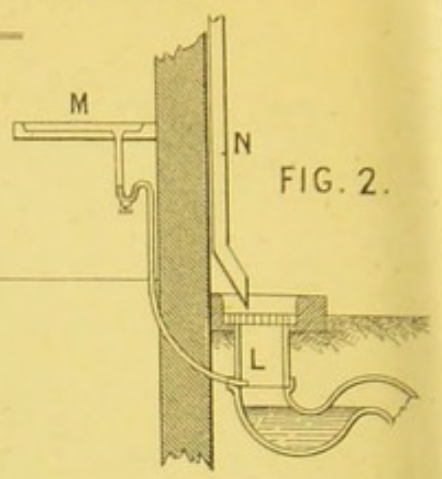

FIG. 2.

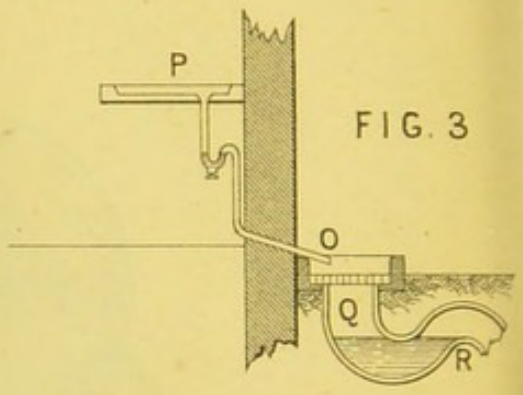

FIG. 3

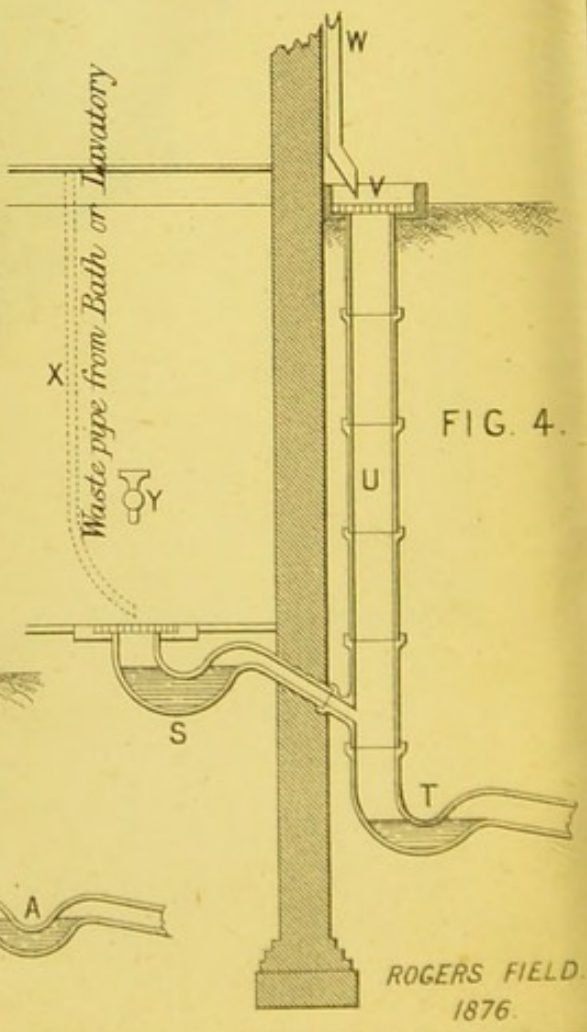

FIG. 4.

ROGERS FIELD.
1876.

WATERLOW & SONS LIMITED LITH. LONDON.

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INTRODUCTION.

I HAVE been induced to publish the following Bye-laws, Regulations, and Suggestions with reference to house drainage at the request of several persons on whose judgment I rely. They were prepared for the Uppingham Rural Sanitary Authority, who have kindly given permission for their publication in the present form. The Bye-laws and Regulations are allowed by the Local Government Board; such portions of them only are here reproduced as relate to the drainage arrangements of houses. The "Engineer's Explanations and Suggestions" that follow were prepared by me and appended to the copy of the Bye-laws, printed and circulated amongst the ratepayers by the Rural Sanitary Authority.

The following passages from my "Report on Uppingham Sewerage and Private Drainage" (dated 6th January, 1876) will explain the principles on which the Regulations and Suggestions are based.

Objects of house drainage.

"The two chief objects of a perfect system of house drainage should be—

(1.) The immediate and complete removal from the house of all foul and effete matter directly it is produced.

(2.) The prevention of any back current of foul air into the house through the pipes or drains which are used for removing the foul matter.

First Object, immediate removal of foul matter.

"The first object—immediate removal of foul matter—can commonly be best attained by the water-closet system when carried out in its integrity, though in certain cases a system of earth or other dry closets may be preferable. Cesspools do not fulfil this condition of immediate removal. They serve for the retention of excremental and other matters, and they are inadmissible where complete removal can be effected. Where this is not possible and cesspools must be had recourse to, they must be most carefully designed, and must on no account be placed in the immediate neighbourhood of any dwelling.

Cesspools do not fulfil this condition.

Many kinds of water-closets and traps retain foul matter in the house, and are in reality small cesspools.

"Many kinds of water-closet apparatus and of so-called "traps" have a tendency to retain foul matter in the house, and therefore in reality partake more or less of the nature of small cesspools. These again should be discarded. This is especially the case with the ordinary "pan-closet" arrangement of water-closet, as I can testify from actual experience,* having frequently had them taken to pieces and the traps cut open, when I have invariably found them more or less foul. This description

* I may add that each year's experience strengthens this conviction, and I would now (April, 1877) speak even more strongly about the inherent and irremediable nastiness of the "pan-closet" and D trap.

of closet is largely in use at the houses examined; and, although a well-kept pan-closet cannot be condemned as necessarily injurious to health, it should always be looked upon with suspicion and be avoided as much as possible. The so-called "D traps" are specially objectionable. This question of internal fittings is of much greater importance in a sanitary point of view than would at first sight appear, as nuisances are frequently attributed to the ingress of "sewer gas" which have nothing whatever to do with the sewers, but arise from foul air generated in the house drains and internal fittings.

SECOND OBJECT, prevention of back current of foul air into house.

"The second object of perfect drainage—the prevention of a back current of foul air into the house—is of the utmost possible moment, as, unless it is attained, the drainage may do harm rather than good. Indeed it is not too much to say that if proper means are taken to secure this object no foul air can enter houses from the public sewers; while, if these precautions are neglected, no degree of care given to the public sewers will prevent risk of sewer air entering houses.

Water-traps quite insufficient.

"The usual means relied upon to prevent a back current of foul air are "water-traps," but these of themselves are quite insufficient. Some traps, such as the common bell trap in universal use, have their efficiency destroyed by simply removing one of their parts, and all traps have their efficiency destroyed if the trapping water is removed either

by evaporation or by undue pressure or suction in the drain. Even, however, if the traps are in perfect order, it has been shown that foul gases will under certain conditions *pass through the trapping water*, being absorbed on one side and given off on the other. A striking instance of the actual occurrence of this passage of sewer gas through a water-trap was met with in the course of the present investigation, and the matter has such an important bearing on the present question that it will be well to give the particulars here instead of in the Appendix. On my examination of the Sanatorium I found that there was a bad smell in two lavatories attached to water-closets situated one above the other. Further investigation showed that this smell did not proceed from the water-closets, but from the lavatory basins, where a decided current of very foul air was coming into the chamber from the unplugged outlet of the basins, and it was found that each basin was connected directly with a pipe which discharged into a partially closed gully outside the house covered with snow, and this again into a cesspool. On opening the gully it was ascertained that the outlet was properly trapped, and that there was no apparent escape of foul gas, but that the water in the gully (though clear) had a very bad smell. In order to test whether this arose from any passage

Foul gases will pass through the trapping water.

Instance of this at the Sanatorium.

of foul gas through the trap, clean water was poured into the gully, and this removed the smell. The gully was then examined again after a few hours, and it was found that the water had assumed a very decided smell. The experiment was repeated with the same result, and it appeared that the longer the water was left after it was changed the fouler it got. Moreover, on closing the gully again after the water had become foul, the foul current of air returned in the lavatory. There could be no question, therefore, but that the smell arose from the passage of foul air from the cesspool *through the water-trap*. . . . .

Other means must be adopted, viz.

"It is manifest from the preceding that other means must be sought for than mere water-traps to prevent the back current of foul air into the house, and these are found in a proper system of *disconnection* and *ventilation*.

Disconnection or a break with free communication to open air.

"By *disconnection of house drains* is meant breaking the direct communication between the sewer and the house in such a way as to allow a free communication with the open air at the break, or, in other words, as Mr. Rawlinson has well expressed it in his Suggestions for Drainage, "House drains should not pass direct from sewers to the inside of houses, but all drains should end at an outside wall." The simplest type of disconnection is to let the drain from the sewer end in a water-

trap outside the house, and then have a piece of *open* drain between this trap and the house. The trap shuts off the direct current of sewer gas, and the opening allows any gas that gradually passes through the water of the trap to escape into the open air, instead of being carried on through a continuous closed channel into the house. Of course it is not often practicable to adopt such a simple arrangement as this, but all true disconnection will be found on examination to reduce itself in principle to the above.

No true disconnection at Sanatorium.

"Referring again to the instance already quoted at the Sanatorium, it is evident from what has just been stated that there was no efficient disconnection, as the gully was virtually closed. Moreover, it will be seen from the further details in the Appendix, that the waste-pipes from the lavatories were carried vertically down to within two inches of the water surface, so that even if the gully had been fully open to the air there would not have been a sufficient break between the gully and the waste-pipe for perfect disconnection. This was shown to be actually the case, as when the stone slab covering the gully was removed the smell in the lavatory was not absolutely removed, though greatly diminished. The above is an excellent instance both of the uselessness of mere water-traps to prevent the back current of foul air from sewers into the house, and the care that must be taken in the

details of construction to ensure perfect disconnection.

"*Ventilation of House Drains* does not appear at first sight to require explanation, but its object is frequently misunderstood. It is often assumed that all that is necessary is to obviate undue pressure of foul gases in the drains, whereas this, though important, is by no means the chief object to be aimed at. No ventilation should be considered efficient unless a thorough dilution of the foul gases with pure air is thereby effected. For this purpose a *current* of pure air must be produced in the drains, which can only be effected by having at least two openings of ample size. The small pipes therefore frequently employed for ventilation, such as the 1-inch pipes in some of the houses examined, are practically useless.

Ventilation often misunderstood.

Two openings are required.

"I need hardly say that if it is necessary to apply disconnection and efficient ventilation in the case of houses draining into sewers, it is still more imperative to do so in the case of houses draining into cesspools. Sewers are for the purpose of removing the foul matters which produce the foul gases. Cesspools are for the purpose of retaining them, and the gases must therefore necessarily be more offensive in the latter case than in the former.

Disconnection imperative in case of cesspools.

"The principle of disconnection has long been applied to the waste-pipes of sinks, baths, overflows, &c., but till recently it has been the usual practice

Disconnection often confined to sinks, but really applicable to soil-pipes also.

to consider the principle as inapplicable to the soil-pipes from water-closets. This is, however, quite a mistake, as with suitable arrangements soil-pipes as well as waste-pipes can either be absolutely disconnected, or ventilated in such a manner as to be virtually disconnected. It would be out of place here to discuss the details; suffice it to say, that the essential point is, that the soil-pipe should be open to the air at its lower end, as well as at its upper end. If this is done, and a water-trap placed on the sewer side of the lower opening, a *current of pure air* will be created through the soil-pipes. By this arrangement any foul vapours derived from a sewer or cesspool become greatly diluted with pure air in the pipes before they enter the house; whereas without this provision the vapours of the sewer or cesspool enter the soil-pipe in a concentrated state, and have the greatest opportunity of doing mischief if they chance to escape from the soil-pipe into the house.

By proper arrangements a current of pure air instead of foul air can be created in soil-pipes

"The same principle of disconnection should always be applied to drains passing under houses when such passage is unavoidable, and the drains always be open or amply ventilated *at each end* outside where they intersect the house."

Disconnection should always be applied to drains passing under houses.

The main principles laid down in the preceding extracts, are, so far as I am aware, universally admitted by authorities on sanitary subjects. With reference, however, to one or two of the details,

there is some difference of opinion, and it may therefore be desirable to say a few words. I will take the points in the order in which they arise in the extracts from my Report.

First, as regards the passage of foul gases through the water of traps *when there is no pressure*. Some sanitary engineers have hitherto been disposed to consider that this is rather a theoretical than a practical danger, and that if proper means are taken to secure water-traps from pressure they practically afford a bar against the passage of sewer gases. This is undoubtedly not the case, as since the striking instance at the Uppingham Sanatorium (recorded in the above extract), I have had opportunities of observing several other instances of foul gases passing through the trapping water by being absorbed on one side, and given off on the other, and am convinced that this is of frequent occurrence. The passage is, however, gradual, so that if the surface of the water in the trap is freely exposed to the air, the foul gases given off from the water surface are immediately so diluted and dispersed as to be imperceptible. If, on the other hand, the water-trap is in a closed pipe or drain, the foul gases which pass through the trapping water will accumulate on the house side of the trap in sufficient volume to demand attention.

Next, as regards the air disconnection of soil-pipes, some authorities consider that this is unadvisable, and that it is better to have the soil-pipes

in direct connection with the sewers, so that they may act as ventilators to the sewers. To show the fallacy of this view, I cannot do better than quote the experience of Dr. Buchanan, Assistant Medical Officer to the Local Government Board, in his recent official Report on the epidemic of enteric fever at Croydon. Speaking of the direct connection of soil-pipes and sewers he says:

"The air of the sewers is as it were 'laid on' to houses; it is arranged that every house drain and every house soil-pipe shall contain, up to the very wall of the house and up to the very trap of the water-closet, the common air of the Croydon sewers, not simply charged with impurities it may receive from the particular house, but charged also with any dangerous quality that it may have brought from other houses; for hardly anywhere in Croydon can there be found an arrangement for severing the sewer air from the air of the house drain; so that wherever drain air has entered the house, no matter by how inconspicuous a defect, and no matter whether it has given rise to stink or not, it has been the air of the common sewer."

In lieu of this direct connection Dr. Buchanan advocates separation between the air of the public sewers and the house drains, and recommends for this purpose an arrangement almost identical with that shown in Fig. 1 of Engineer's sketch accompanying my explanation of the Bye-laws (see p. 22). Concerning this he says:

"The arrangement here shown isolates each set of house drains into a wholly distinct system. . . . . Even if there should be a little smell from the opening" [corresponding to that marked C on Engineer's sketch] "it can only be derived from

matters that have passed into the drain from the house, and cannot have any fever infection with it, unless there be fever in the house itself. But in effect (I speak from experience of the arrangement under its most difficult conditions) there is seldom any smell whatever from this opening [C], for when the drains are in good order it habitually acts as an inlet for air that goes up the ventilating pipe" [D on Engineer's sketch] "by the side of the house; if the drains are not in good order there may be smell from this lower opening, and *such smell should be welcomed as an indication (otherwise wanting till ill health occurs) of something about the drains requiring amendment.*" . . .

"It ought to be no objection to this arrangement that the house-drain ventilators" [D on Engineer's sketch] "can no longer serve for the ventilation of public sewers. It is not the business of householders to ventilate public sewers, that is the affair of the authority to whom those sewers are vested. In Croydon the direct connection between public sewers and the pipes that run up the sides of houses is not only dangerous to the houses, but in relation to public sewer ventilation the arrangement is little more than a sham."

The italics in the above quotation are my own, and are introduced to call attention to what appears to me to be a remark of the greatest possible weight.

ROGERS FIELD.

5, Cannon Row, Westminster,
April, 1877.

EXTRACTS FROM THE BYE-LAWS

OF THE

UPPINGHAM SANITARY AUTHORITY.

NOTE.—The Bye-laws from which these extracts are taken were adopted by the Uppingham Rural Sanitary Authority on the 27th day of July, 1876, and allowed by the Local Government Board on the 9th day of August, 1876.

CAP. V.

"WITH RESPECT TO THE DRAINAGE OF NEW BUILDINGS, TO WATER-CLOSETS, PRIVIES, ASHPITS, AND CESSPOOLS IN CONNECTION WITH SUCH BUILDINGS AND TO THE CLOSING OF SUCH BUILDINGS, OR PARTS OF BUILDINGS, WHEN UNFIT FOR HUMAN HABITATION, AND TO PROHIBITION OF THEIR USE FOR SUCH HABITATION."

Drainage of new buildings.

1.—Every person erecting a new building shall cause such building to be drained in the most effectual manner which may be practicable, and he shall adopt a suitable mode of drainage in accordance with the Regulations for House Drainage hereunto appended, and shall use only sound, suitable, and substantial materials in the construction of such drainage.

REGULATIONS FOR HOUSE DRAINAGE.

Referred to in the foregoing Bye-law.

Laying down of drains.

§ 1.—Every drain from a house or building shall be laid down in a straight line with proper falls and true gradients, and shall be of glazed stoneware or iron pipes, carefully jointed and made water-tight. No right-angled junction shall be allowed, except in the case of a drain discharging into a vertical shaft, and the works shall be executed in a substantial and workmanlike manner, and shall be inspected by the Surveyor to the Sanitary Authority before being covered up.

Precautions in case of passing under dwelling-houses.

§ 2.—No drain should be constructed so as to pass under a dwelling-house, except in particular cases when absolutely necessary. In such cases the following precautions shall be adopted. The portion of the drain which passes under the house shall be constructed either of glazed stoneware pipes, bedded and covered in concrete, or of cast-iron pipes, and such portion shall be ventilated at each end by a suitable pipe or opening according to the provisions in § 4.

Flushing where necessary.

§ 3.—Every drain shall be arranged so as to be kept at all times free from deposit; and if in any case this cannot be effected without flushing, it shall be necessary to provide special flushing arrangements, so as to effectually remove all foul matter from the house drains to the public sewers.

Ventilation of drains.

§ 4.—Every drain shall be ventilated by one or more suitable pipes or openings, and no pipe or opening shall be used for ventilation, unless the same be carried upwards without angles or horizontal lengths and with tight joints. The size of such pipes or openings shall be fully equal to that of the drain-pipe ventilated, except in particular cases where the Sanitary Authority shall give permission for the use of a smaller size, which shall, however, be under no circumstances less than four

inches bore. Rain-water pipes shall not be used as ventilators except in particular cases, where their upper extremities are at a distance from any windows, openings, or projecting eaves, so that there is no danger of the escape of foul air into the interior of the house from such pipes.

Traps.

§ 5.—A properly constructed trap shall be placed on the line of drain between the house and the public sewer, with a suitable ventilating pipe or opening to the drain on the house side of such trap. (See § 4.)

Protection by gratings.

§ 6.—All inlets to the drains or openings for ventilation shall be efficiently protected by gratings or otherwise, to prevent the introduction of improper substances. All inlets shall be properly trapped, except where left open for ventilation of the drains. In the case of inlets or openings used for ventilation or disconnection (see § 11), every such grating or protection should be so arranged as to have a free air space of at least twelve square inches in the case of four-inch pipes, and of twenty-five square inches in that of six-inch pipes and of gullies.

Subsoil drains.

§ 7.—Wherever dampness of site exists, it shall be necessary to lay subsoil or land drains, and no such subsoil or land drain shall pass directly to any drain or sewer, but shall have a suitable break or disconnection. (See § 11.)

Water-closets and sinks to be trapped.

§ 8.—Every water-closet and slop-sink shall be efficiently trapped by a suitable trap, not being of the kind known as the D trap. The soil-pipes from all water-closets and waste-pipes from slop-sinks for urine shall be continued above the eaves of the house for ventilation, and there terminate with the ends thereof open to the air; and if such ends be at or near any window of the house, it shall be necessary to further continue such pipes to the ridge of the roof. Every such continuation shall be of the full size of such soil or waste pipes.

Rain-water pipes

§ 9.—Except in the particular cases provided for in § 4, where a rain-water pipe may be used as a ventilator, no rain-water pipe shall pass directly to any drain or sewer, but shall

be disconnected therefrom by delivering into an open channel or over an open gully with a suitable trap, or in some other way, so as to have its discharging end open to the air.

And overflow pipes not to pass directly into any sewer.

§ 10.—No overflow or waste pipe from any cistern or rain-water tank, or from any sink other than a slop-sink for urine (see § 8), or from any bath or lavatory, or safe of a bath, or of a water-closet, or of a lavatory, shall pass directly to any drain, soil-pipe, or trap of a water-closet; but every such pipe shall be disconnected therefrom, by either itself passing through the wall to the outside of the house and discharging with an end open to the air, or by delivering into a pipe which so passes and discharges. All overflow or waste pipes shall be properly trapped, except in particular cases when their ends discharge in such a position that the passage of foul air to the interior of the house through such pipes from drains, disconnecting traps, ventilators, or rain-water pipes is rendered impossible.

Gullies.

§ 11.—There shall be no gully inside a house in cellars or basements or otherwise, unless absolutely necessary. Where such gully cannot be avoided, it shall be properly trapped, and the outlet pipes shall not pass directly to any drain or sewer, but shall be disconnected therefrom by passing through the wall to the outside of the house, and there delivering with an end open to the air over a suitable trap. Subsoil or land drains shall also have a similar break or disconnection between them and the drain or sewer.

Rain-water from roofs.

2.—Every person erecting a new building shall cause all rain-water to be so drained or conveyed from the roof of any building as to prevent its dripping on to the ground and causing dampness in the walls.

Construction of water-closets.

3.—Every person who shall construct a water-closet or earth-closet in a new building, shall construct such water-closet or earth-closet in such a

position that one of its sides at the least shall be an external wall, and no part of such water-closet or earth-closet shall be situated immediately beneath any habitable room.

Privies.

5.—Every person constructing a privy in connection with any new building, shall construct such privy in a suitable situation wholly detached from a dwelling-house, of adequate dimensions, and with sound, suitable, and substantial materials. He shall furnish such water-closet or privy with a sufficient opening as near to the top as practicable, communicating directly with the external air.

Cesspools.

5.—No person shall construct a cesspool in connection with any new building in any case, except when unavoidable.

In that case the person constructing such cesspool shall construct the same in a suitable situation, and with sound, suitable, and substantial materials.

He shall cause such cesspool, in every case, to be made water-tight, to be arched or covered over, and a pipe or shaft for ventilation, to be carried up from it or from the drain communicating with it from the water-closet.

Ashpits.

6.—Every person constructing an ashpit in connection with any new building, shall construct such ashpit in a suitable situation, with sound, suitable,

and substantial materials, and of a size not larger than necessary to contain the ashes and dry refuse likely to accumulate between the times appointed for the removal of such ashes and refuse, or if no times be appointed during a period not exceeding in any case two weeks.

CAP. VI.

"As to Giving of Notices, as to the Deposit of Plans and Sections by Persons intending to Lay out New Streets or Construct New Buildings, as to Inspection by the Sanitary Authority, and as to the power of the Sanitary Authority to Remove, Alter, or Pull Down any Work begun or done in contravention of such Bye-laws."

New buildings. Notice to be given with plans, &c.

2.—Every person who shall intend to erect any new building, shall give notice to the Sanitary Authority of such intention, by writing, delivered to them at their Board Room, or at the Office of their Surveyor, and shall at the same time leave, or cause to be left, at such Board Room or Office detail plans and sections of every floor of such intended new building, drawn to a scale of not less than one inch to every eight feet, showing the position, form, and dimensions of the several parts of such building, and of the water-closet, privy,

cesspool, ashpit, well, and all other appurtenances, and together with such plans and sections he shall leave, or cause to be left, at the Office of the Sanitary Authority, or of their Surveyor, a description of the materials of which the building is proposed to be constructed, of the intended mode of drainage, and means of water supply.

He shall at the same time leave, or cause to be left, at such Board Room or Office a block plan, drawn to a scale of not less than one inch to every thirty-two feet, showing the position of the buildings and appurtenances of the properties immediately adjoining, the width and level of the street, the level of the lowest floor of the intended building, and of the yard or ground belonging thereto.

He shall show on such plan the proposed lines of house drainage, and their size, depth, and inclination.

Surveyor to inspect work. Builder to give him two days' notice before commencement of any work.

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

which may have been required by the Surveyor to be done in amendment of any irregularity, and before such works shall be covered up.

Duties of Surveyor in case of non-compliance with bye-laws.

4.—If in doing any work, or erecting any building, anything is done contrary to the bye-laws, or anything required by the bye-laws is omitted to be done, or if the Surveyor on surveying or inspecting any building or work finds that the same is so far advanced that he cannot ascertain whether anything has been done contrary to any bye-law, or whether anything required by the bye-laws has been omitted to be done, the Sanitary Inspector shall within six hours after such survey or inspection, give to the builder or person engaged in erecting such building, or in doing such work, notice in writing, requiring such builder or person within forty-eight hours from the date of such notice, to cause anything done contrary to the bye-laws to be amended, or to do anything required to be done by the bye-laws, but which has been omitted to be done, or to cause so much of any building or work as prevents such Surveyor from ascertaining whether anything has been done, or omitted to be done, as aforesaid, to be to a sufficient extent cut into, laid open, or pulled down, and such builder or other person shall forthwith comply with the notice so given, unless he can show that he has duly observed the requirements of the bye-laws.

EXPLANATIONS AND SUGGESTIONS

AS TO

FOREGOING BYE-LAWS AND REGULATIONS FOR HOUSE DRAINAGE.

NOTE.—These were appended to the copy of the Bye-Laws printed and circulated amongst the Ratepayers by the Rural Sanitary Authority.

Plans and sections to be deposited.

It will be seen by Cap. VI., Bye-law 2, that before proceeding to carry out works of drainage, plans and sections of the proposed work, drawn to scale, must be deposited; and the sanction of the Sanitary Authority obtained for such works.

Regulations to be followed.

It is also required by Cap. V., Bye-law 1, that the drainage works shall be done in accordance with "Regulations" set forth, § 1 to § 11.

The accompanying sketch has been prepared with a view to facilitate carrying out these Regulations.

General arrangement of drainage.

Fig. 1 is a general view of the arrangements for house drainage carried out in accordance with the Regulations.

Drains to be outside house.

The drain is shown outside the house, and this is the proper course to adopt (see Regulation § 2). Stoneware pipes with Stanford's patent joint, manufactured by Doulton and Co., will be found effective and economical for making the drains water-tight

(see Regulation § 1). It will be advantageous to construct small access chambers at every change of gradient or direction.

Fall of drains.

In order to keep the drains free from deposit (see Regulation § 3) they should not be larger than 6-inch—4-inch is generally to be preferred—and they should have a good fall, say 1 in 40 (3 inches in 10 feet) or more if obtainable. If from insufficient fall or other causes, the drains cannot be kept clear of deposit without flushing, special flushing arrangements must be provided (see Regulation § 3). Where water is plentiful, a discharge direct from a large cistern provided for the purpose may be obtained. Where water is limited, the drains may be flushed by introducing small paddles in grooves formed at the access or junction chambers, and suddenly releasing the pent-up water; or where the flow of sewage is small, a tumbler flushing box or "Field's self-acting flush tank" may be used.

Flushing.

"Disconnection" from sewer.

A is a siphon trap (so called) placed on the line of drain between the house and the public sewer; B is a vertical pipe rising from an upright junction on the drain, and is situated betweeen the house and the siphon trap A. It is covered by an open grating, C, which affords the means for ventilation required by Regulation § 5. The trap A should not be larger than 6-inch (4-inch is in most cases preferable), and the drain directly above the trap should have a rapid fall, as shown, to keep the trap

clear. It will be seen that by this arrangement a complete severance or *disconnection* is effected between the sewer and the house, as the trap A shuts off the direct current of sewer air, and the vertical pipe B (through the grating C) supplies the soil-pipe D with a continuous current of fresh air. Thus should any sewer air find its way through the trap A, it either escapes at C, or, as is generally the case, becomes mixed with a large volume of fresh air, and is carried up the soil-pipe D to escape at E.

NOTE.—There are some advantages in having a man-hole or "disconnecting chamber," instead of the pipe B, to give means for inspecting the siphon trap, but this is more expensive.

Water-closets. Ventilation.

The water-closets are shown against an external wall (see Cap. V., Bye-law 3), and permanent ventilation is afforded by openings to the outer air as near the top as possible (see Cap. V., Bye-law 4), and say not less than 12 square inches in area. The soil-pipe D, placed on the outside of the house, is continued *full size* up above the eaves for ventilation, and terminates with an open end at E (see Regulation § 8). The end E is protected by a cowl, which may also be made to assist the upward current in the soil-pipe. Horizontal lengths or flat bends in this pipe must be avoided, as they impede the passage of the air (see Regulation § 4). The dotted line to F shows the continuation of the soil-

pipe to the ridge of the roof, which is required if the end E is too near any window (see Regulation § 8).

The water-closet apparatus shown is the common hopper with S trap, not D trap (see Regulation § 8); and if sufficient flush of water is provided, this closet apparatus is satisfactory and inexpensive. Pan closets with iron "containers" are objectionable, as they collect foul matter and require to be taken down and cleaned periodically.

Separate cisterns.

NOTE.—Small waste-preventing cisterns will be found advantageous, as if they are provided with a large pipe to the closet basin ($1\frac{1}{4}$ or $1\frac{1}{2}$ inch) they will give a good flush, and will at the same time prevent waste of water. The use of the waste-preventing cisterns will often render unnecessary the provision of a separate cistern for the water-closets.

"Safes."

The waste-pipe of the "safe" or tray under the water-closet is shown at G, and is disconnected by passing through an exterior wall and terminating with an open end (see Regulation § 10).

Sinks.

The waste-pipe of the sink is provided with a trap beneath the sink (see Regulation § 6), and is disconnected from the drain by passing through the outside wall and discharging with an open end at H into a suitable channel leading to the grating at C (see Regulation § 10).

Overflows of cisterns.

The overflow-pipe of the cistern for general water supply, I, is disconnected by delivering through the

wall with an open end into the rain-water gutter (see Regulation § 10). If there is a standing waste, it is advisable to carry the waste-pipe down to discharge over a gully. A separate cistern, K, is provided for the water-closets, and its overflow passes through the outer wall. If waste-preventing cisterns are used, as mentioned above, their overflows pass through the wall in the same manner.

Modifications of sink disconnection.

Figs. 2 and 3 show enlarged views of modifications of the sink disconnection mentioned above.

Fig. 2 shows a disconnection where the pipe L from the sink M is admitted below the grating over an ordinary trapped gully. This arrangement is suitable where from its situation the overflow from a sink over a channel or grating might be objectionable. A rain-water pipe, N, is shown discharging over the same gully.

Fig. 3 shows a similar arrangement to Fig. 2, where the pipe O from the sink P discharges over the grating Q of the trapped gully R. The gullies should be of a similar form to that shown on sketch, so as to be self-cleansing. "Dip traps" should not be used, except where it is desired to retain sediment; a 4-inch outlet is generally best.

Gullies in basement.

Fig. No. 4 shows the method of disconnecting gullies in cellars or basements (see Regulation § 10). These should never be adopted unless necessary, but where unavoidable they must be trapped and disconnected by such means as shown. S is the

trap in cellar floor discharging by a pipe into and above the trapped gully T outside the house. This outside gully is surmounted by the pipe U reaching to the surface of the ground, where it is covered by a suitable grating, V. A rain-water-pipe or waste-pipe, W, is shown discharging over the grating V, which serves the purpose of keeping the trap of the gully T replenished with water. The inner trap S also needs special provision for replenishing, for which purpose a waste-pipe should be made to discharge over it as shown at X, or a water tap, Y, should be arranged so that the drippings fall into it.

Works to be done to the satisfaction of the Surveyor.

It is required by Cap. VI., Bye-laws 3 and 4, that all work must be done to the satisfaction of the Surveyor to the Authority; and if such work is not considered satisfactory, that it shall be taken up and replaced by work to his satisfaction.

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