**The plumber and sanitary houses : A practical treatise on the principles of internal plumbing work, or the best means for effectually excluding noxious gases from our houses / By S. Stevens Hellyer.**

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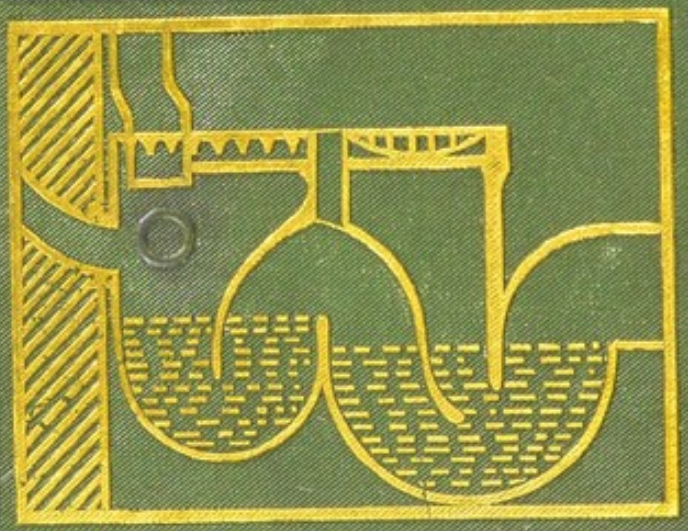

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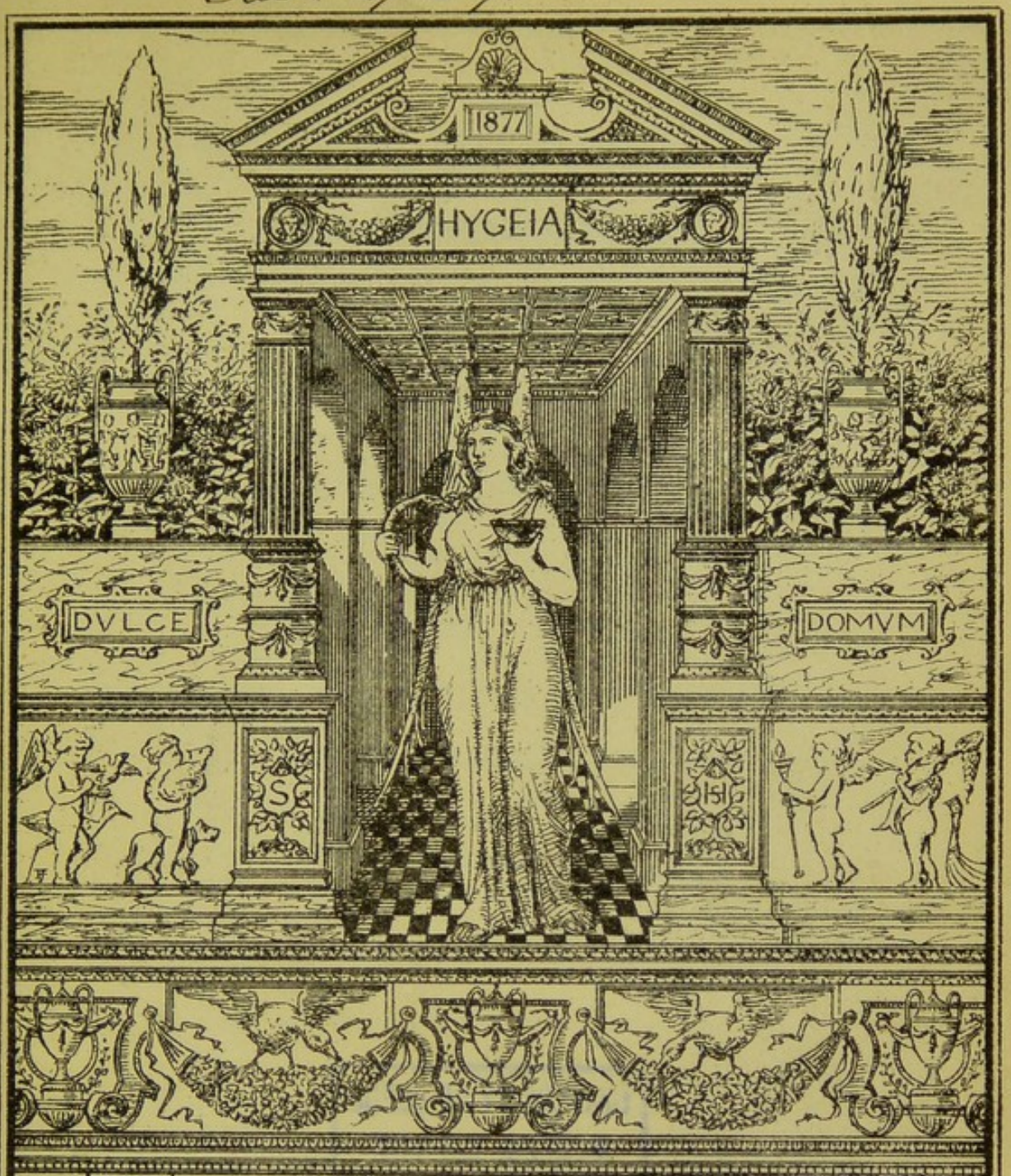



# THE PLVMBER & SANITARY HOVSES.

A Practical treatise on the Principles of Internal Plumbing Work or the Best means for effectually excluding Noxious Gases from our Houses.

By

L. Stevens Hellyer

LONDON
T.B. BATSFORD 52 HIGH HOLBORN

L.J.

C.F. Kell. Photo Litho, London E.C.

# DEDICATION.

To the

DESIGNERS AND BUILDERS OF HOUSES,

HEAD-WORKERS AND HAND-WORKERS,

THIS LITTLE WORK

IS,

WITH ALL DUE RESPECT,

Inscribed,

BY THEIR OBEDIENT SERVANT,

S. STEVENS HELLYER.

# CONTENTS.

# ILLUSTRATIONS.



# DIAGRAMS.

# PREFACE.

THERE are a "thousand gates to death!" Few are wider, or open more readily, than those in our own homes, when unlocked by noxious gases or bad air from drains, &c.

How many deaths have been caused by a polluted water-tank, a brick cesspool, a foul drain, a diseased water-closet trap, a bottled-up soil-pipe, a sink "*bell*"-trap? Is not the very name ominous, and ought it not rather to be called a "death-bell-trap?" At any rate, it sets the death-bell ringing occasionally.

All England was alarmed some time ago when it heard one of these gates to death rattling upon its hinges, and threatening at every moment to fly open—under the influence of one of the evils enumerated above—for a royal prince to pass through. Another puff of bad air, and who knows how wide the gate would have opened?

"Shut this gate," is the gratuitous advice given to passengers as they ride along on our

railways, and look out upon the broad acres. But both the *hard* seated and the *comfortably* seated observers of this advice alike ride on, careless of the notice, for they cannot touch the gates, even with their longest fingers, and the gate that is open for any stray beast to go through must be open still.

But the gates of which I speak can be reached, and shut too, by every house-maker, if he will but take the trouble and precaution. To aid him in this most *wholesome* work, and to help him to put a padlock upon such gates, is the aim of the writer in this little treatise.

In every house a water-closet may be considered a necessity, and a slop-sink a convenience. By English people lavatories and baths, fitted up with hot and cold services, would, I suppose, be considered a luxury. Well, so is a bed, but few John Bulls would care to sleep without one, if they could at all manage to buy it. And where cleanliness is valued, and the funds are at all elastic, a bath should be provided in every house. Of course it is not necessary to have hot water laid on to it, but in case of illness it

is a good provision, and the comfort of it in the winter is worth one or two decorated ceilings.

But this treatise is not to show the comforts and conveniences of such sanitary fittings as have just been referred to, but to prove that it is possible to have all these things, without the smallest fear of making them *inlets* for foul air or noxious gases, and, in fact, that if the principles laid down in the following pages are strictly adhered to, there will be *no* foul air in any of the soil, waste, or drain pipes to escape into our houses, for a constant stream of fresh air will always be passing through the whole of the pipes.

Under the old system these sanitary conveniences generally *advertised themselves*, especially in hotels and places of that kind, and all that one had to do in such buildings was to follow the scent, like a hound after a fox, by the dictates of an organ which is very useful, but which one does not care to abuse in such a way, for, to say the least, it is an offensive way of following up a thing.

It is then from no desire to "ventilate" the

writer's thoughts, or to "*air*" his ideas in print, but to give the public the benefit of his experience—an experience gained by a thorough examination of the working of the *old way* of doing these things, and by many practical and costly experiments on the *new way*, as laid down by the following principles, that the author has written this treatise.

It may be worth while to say that these principles have been thoroughly tested, and that the internal plumbing work in some of the most important houses in the kingdom has been carried out upon these principles with a complete success.

For any imperfections in this little work, the writer's apology is that his pen is quite new, and his ink is unused to travel in such a channel. But go ye forthe, ye lyttle booke, and do ye work of *ventilation*, if not in the minds of the people, at least in the pipes and drains of their houses.

21, *Newcastle Street, Strand,*
*London.*

# THE PLUMBER & SANITARY HOUSES.

## CHAPTER I.

### TRAPS.

Traps doorways to drains.

IT is impossible to exaggerate the importance of having efficient traps to the various sanitary fittings inside our houses; for what are they but *doorways* to the drains and sewers? The *dip* of the trap may be considered as the door, and if by such doors we cannot shut off these lower regions, they become worse than useless, and leave the house exposed to the deadly attacks of foul air or noxious gases from these drains and sewers.

Traps legion.

I am not about to discuss the merits or demerits of each individual trap now in use, for their name is legion, nor to consider at any length the material of which traps should be made, but

Material.

I must remark that the material should be of such a kind as can be easily and *securely* jointed to the waste-pipe, with which it should be *perfectly united*, for any defect here—*i.e.*, in the jointing of

the trap to the waste—would allow any bad air in the waste to escape through it into the house. And if the waste-pipe is not trapped at the foot, or if it does not discharge with an open end, then any noxious gases in the drain can travel up the waste-pipe, through the defective jointing, into the house.

Lead. Further, as lead is the best material for wastes (as I hope to show under the head of "Soil-pipes," Chapter II., page 29), so it is also the best material for traps for all fittings *inside* our houses, not only because of its special fitness for soundly jointing to waste and soil pipes of lead, but also on account of its smoothness, non-corrosiveness, and durability.

Stone-ware. In yards, areas, and *out-door* positions, where the trap is connected directly with the drain-pipe, and where it does not so much matter if a small defect occurs in the jointing, as it is in the open air, there is nothing better than stoneware syphon-traps. And as the drain-pipe is of the same material, the connection with the trap can be better made. Moreover, these traps are clean, smooth, non-corrosive, and very durable, but care should always be taken that these traps are made with a proper water-dip; as a general rule, they are *insufficiently dipped to be of any value as a trap.*

Cast-iron. Such corrosive material as *cast-iron* should

never be used for trapping off places where urine and such like corrosive matters are likely to pass through them.

Traps independent of the fitting.

All traps fixed inside a house should be *separate* and *independent* of the fitting, be that what it may, which is to be fixed upon them, and be made *fixtures* in a very complete way with the soil or waste pipe to which they are to be attached.

And then, when the "fitting" gets out of order, whether water-closet, urinal, slop-sink, or whatever the fitting may be, it can be removed for repairs without interfering with the trap or exposing the house to the drain.

But when the trap forms a part of the fitting, and is in "one piece" with it, it cannot be removed for repairs without exposing the waste, and through the waste the drain, to the house; leaving it in fact in free and open communication with the soil or waste pipe in which the fitting was fixed. And, if there is no trap at the foot of the soil-pipe or waste-pipe, any bad air can pass freely up from the drain into the house.

Connection of the trap with the waste very important.

But there is another and stronger reason why the trap should be independent of the fitting. The *junction* of the "fitting" with the *trap* is *un*important, as this jointing is on the *trapped side* of the waste and drain; but the junction of the *trap* with the *waste* is of the utmost importance, as *that*

is on the *untrapped* side of the waste or drain, and any defect here would at once allow any bad air or noxious gases in the waste or drain to escape through this defective jointing into the house. When any sanitary "fitting" and traps are all in *one piece*, and the material of which it is made is earthenware, or cast-iron, how is it possible to make a perfect and *durable* connection with a soil or waste pipe which is of another material? The ordinary way of making such connections is by a *cement joint*, made of putty, or white or red lead, or almost anything, but such a joint is always *breakable*. A rough cleansing of the apparatus, a shaking of the floor, or a little sinking of the building, and the connection is broken, and the house left exposed to the air of the soil or waste pipe, without any protection as far as the trap is concerned. But if the connection does not get broken in this way, the cement in time dries up, and leaves the joint unsound, and the evil is that this joint may remain unsound for some time before it is discovered; for it is not like a water-leak in a pipe, it is only an air-escape; and you cannot find it out, either, as they find out gas leakages; you know there is an unpleasant smell, but you cannot trace it with a light, but only in the way a dog turns up a rabbit—by the nose.

No sanitary fitting

No sanitary fitting *inside* a house should be

without a trap. This trap should be as *close to the "fitting"* as possible, to prevent any length of waste-pipe from being untrapped on the house side of the pipe, as it is sure, sooner or later, to get corroded, and become (more or less) offensive. Whatever unpleasant smell of air there may be in a pipe may as well be made to blow away through the air-pipe outside the house, and this can always be done by keeping the trap close to the "fitting," and ventilating the waste.

inside a house without a trap.

There may be nothing terribly injurious in leaving an *ordinary* waste-pipe, say a lavatory-waste, entirely untrapped, provided the *discharging end* is *open* to the *air* at the foot, and that the pipe is not directly over a drain. And there is nothing terribly injurious, I suppose, in going into a room filled with stale smoke from a dozen cigars and old pipes a few hours after the smokers have left the room, and yet who would care to live or sleep in such a room?

Nothing *terribly* injurious from a waste with an open end, though untrapped at the foot.

The kind of trap must, to some extent, depend upon circumstances. When a trap is likely to remain in disuse for some months together, as in country mansions, it ought to have a greater *dip*, and contain more water, to allow for evaporation, than a trap in daily use.

The kind of trap to use.

The most important thing in a trap is its self-cleansing powers—*i.e.*, that every part of the inside

Self-cleansing.

of a trap shall be washed by its own action in the passage of the water through it.

Free from corners.

It is also important that every trap should be free from all corners, or places where any foul matter can accumulate and generate noxious gases.

Water-dip.

Any trap which in its action is self-cleansing, and which is *sufficiently water-dipped* to prevent syphoning out, and back draughts from coming through, may be used with safety, provided it is of a smooth and non-corrosive nature.

Substance of lead traps.

When the trap is made of lead it should be equal in substance to lead weighing 7 lbs. or 8 lbs. to the superficial foot, according to circumstances; in no case should it be less than equal to 6-lb. lead; and where any quantity of hot water is likely to pass through, it should not be less than 8-lb. lead.

Cap-screws in traps.

Traps with a cleansing "cap and screw" attached (see Figs. 8 and 9) are always very convenient when fixed to lavatories and sinks, &c. &c., or at the *foot of soil-pipes*; but to water-closets, and places of that kind, they are of no value, for the hand can always get down to the trap through the apparatus. When a trap has a "cap and screw" attached to it, care should be taken to see that this cleansing screw-cap is *below* the water-dip, and on the *house-side of the trap—i.e.*, it should be under the level of the water in the trap. Where

this cannot be done, through insufficiency of room or any other cause, then the cap and screw should be fixed on the *inlet*-side of the trap, and never on the outlet or drain side, except when the trap itself is *outside the house.* The screw-cap will need to be taken off occasionally, to cleanse the trap, but, unfortunately, you cannot depend upon everybody, and though it may be screwed up all right at one time, it may not be at another; then, if this screw-cap is on the *drain*-side of the trap, any air in the drain will work its way through this imperfect connection into the house. This may go on for some time before it is discovered where the foul air is coming from. But when the screw-cap is *under* the water, it is not only below any air in the pipe, but it is in a place that would show at once if it were not perfectly sound. And when it is on the inlet or *house side* of the trap, if it is not quite tight, it does not so much matter, because it is on the trapped side of the waste and drain.

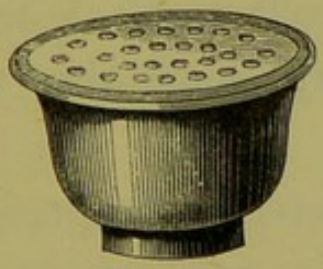


FIG. 1.

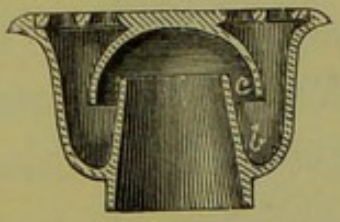


FIG. 2. SECTION.

*Bell-trap.*—The "bell-trap" is one of the oldest traps now in use. It is generally employed

Bell-trap worse than useless.

for trapping off waste-pipes to sinks, and surface drainage, but it is *worse than useless.* The small pipe, Fig. 2, which stands about half-way up in the body of the trap, and which forms the dip, obstructs the free passage of the water through the trap, and makes the lower part, *b*, a receptacle for dirt, which ought to pass into the waste-pipe without any obstruction.

Then, again, there is no room for any body of water to pass through this trap: a glance at the Section, *c*, Fig. 2, will show this. This sluggishness in emptying might have done very well in an age when time was of little value, and the people treated years as we do days. But it will not do now for servants to wait half an hour for a sink to empty itself through a bell-trap. And they take care not to do this, for they soon remedy this evil by pulling or knocking off the "bell-grate." But the remedy, most assuredly, then becomes worse than the disease, for by removing the grate they have virtually destroyed the trap, and exposed the drain to the house, and the cold nasty air from the drain soon makes its way into the warmer atmosphere of the house.

Water-dip too shallow.

Apart from all this a bell-trap is imperfect, for the water-dip, as a rule, is only about three-eighths of an inch—perhaps, in some cases, it may be a little more—therefore the slightest back draft or "puff" of air in the drain or waste soon enters

the house, or the water in the trap soon evaporates, and leaves it uncharged.

*Antill's Patent Trap.*—Fig. 3. This is a great improvement upon the bell-trap, and by the arrangement of its water-dip it remains as much trapped with the grating off as on. But it is far from what a water-trap should be: the water-dip is insufficient to shut out any strong current of air in the waste-pipe, and from the peculiarity of its construction it is not self-cleansing; any sediment getting into the compartment A, Fig. 3, is almost sure to remain there, and the compartment B cannot be got at to be cleaned out, and the covering over this compartment makes a lodgment for grease and dirt; also there is no free passage for water to pass through the trap quickly. The partitions are soldered with copper-bit, and the lead is too thin to last long.

Antill's patent trap.

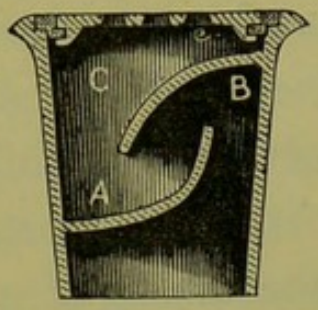



FIG. 3. SECTION.

*D-trap.*—This old-fashioned trap, Fig. 4, is a great favourite among plumbers, and is in very general use. It is difficult to understand why plumbers should like this trap, especially for water-closet uses, except it is that having so much to do with them—as undertakers with dead

D-trap favourite with plumbers. Inside of an old trap disgusting.

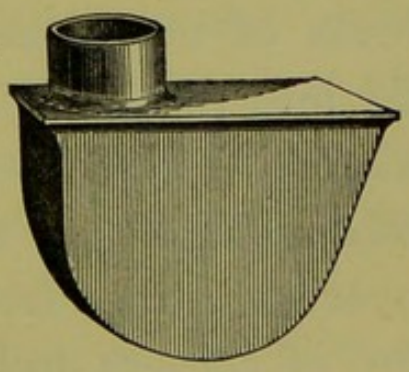


FIG. 4.

bodies—they think little or nothing at all about the thing. If anybody (but a plumber) could see the *inside* of this trap after it has been in use under a water-closet, say for half a dozen years, he would be disgusted with the sight, and would certainly prohibit its use in any house of his own. And yet most plumbers, though they have seen the inside of a hundred traps, go on fixing them as a matter of course, and would, if they could, rise out of their very graves to fix yet another.

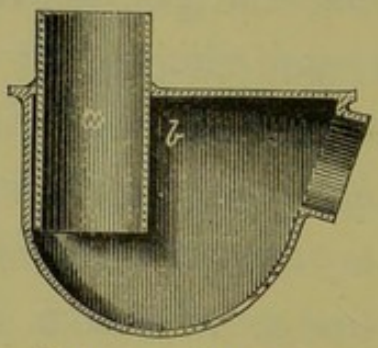



FIG. 5. SECTION.

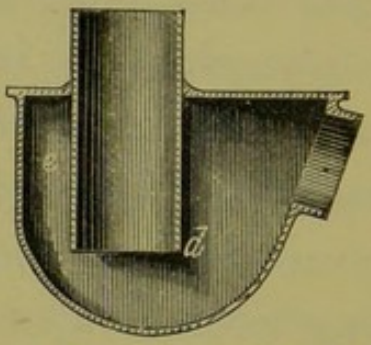



FIG. 6. SECTION.*

The dip a collector for filth, and the impossibility of cleaning it.

The dip-pipe, *a* (see Section, Fig. 5), goes down more than half-way into the body of the trap, and is made to dip into the water from half an inch to an inch and a half, according to the ideas of the maker. This dip-pipe, entering so far into the trap, forms a sort of collector for all kinds of filth upon its *outer side*, where it is *impossible* to get at it to clean it away. Moreover this trap, from its peculiar construction, is full of corners and places for filth to accumulate

* This is a section of a D-trap which was made by a plumber from the country, between thirty and forty years of age.

in, without any chance of its ever being washed out, for with the utmost desire to cleanse such a trap, it is impossible to get at the part *b*, Fig. 5; and round on the *outer side* of the dip-pipe (next the top part of the trap) and the space between the dip-pipe and band of the trap, *e*, Fig. 6, with any kind of brush or cleansing instrument, so that whatever collects about the inside of a trap of this kind must remain to corrode and make it foul.

Dip fixed too far away from the "band," or fixed not far enough down into the trap, or too far.

There is also much ignorance displayed by some plumbers in fixing the *dip-pipe* in this trap, which often gives rise to another evil: Instead of fixing it close to the "band" of the trap, as shown in Section, Fig. 5, they fix it an inch or so away, as shown by Section, *e*, Fig. 6, and thus diminish the passage-way, *d*, to the outlet, and at the same time giving more room for filth to aggregate round the pipe between the dip and the band, *e*. Then, again, the dip-pipe is either not fixed far enough down into the trap, or it is fixed too far down. When the dip is not low enough, it gets insufficiently water-trapped, and allows any air in the waste or soil-pipe to blow through it into the house; but when the dip-pipe is too far down in the trap, it obstructs the free passage of the discharge, and stops up the trap.

Made by apprentices or anybody.

But these evils of the dip-pipe do not, of course, occur when the trap is made by a skilled plumber; but unfortunately everybody, not ex-

cepting the apprentices, is set to work making up D-traps, when there is nothing else to do, and so the trap may be right or wrong, as it happens. The best place for all such D-traps is the melting-pot when it is seven times heated.

Cast-lead trap self-cleansing, made in two shapes and various sizes.

*Patent Cast-lead Trap.*—The most self-cleansing lead trap now in use is the patent cast-lead trap, as Figs. 7, 8, and 9: there are no soldered

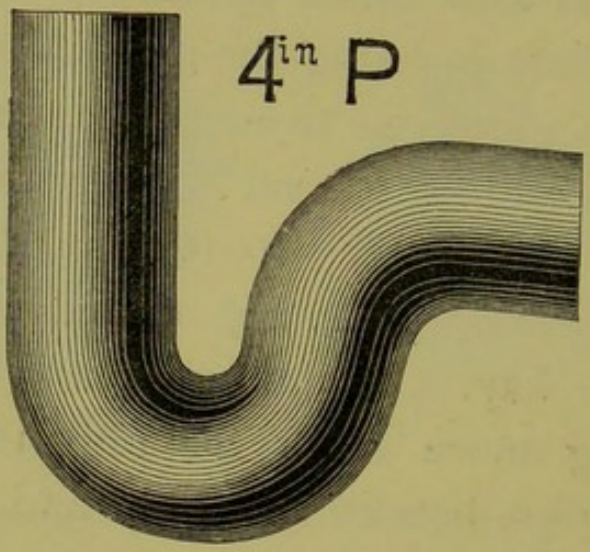



FIG. 7.

seams or corners about them for anything to adhere to, as will be seen by a glance at the illustrations.

This trap is made in two shapes, to fit horizontal and vertical wastes from it; and in sizes from 4 in. to 1½ in., as the clear diameter of the water-way through the trap.

Made of soft lead.

These traps are made of the softest and purest lead, and are as smooth inside and out as pipe

made by hydraulic pressure. The substance of the lead is regulated, but the strength is equal to milled lead 7 lbs. and 8 lbs. to the superficial foot. It consists simply of a round pipe cast into the shape somewhat of a reaper's hook in the one case, as Figs. 7 and 9; and in the other somewhat of the letter S, as Fig. 8. Figs. 7 and 9 are known in the trade by "P" or "Half S," and Fig. 8 by "S." Strength.

A cap and screw are attached to the smaller size traps, as shewn in Sections, Figs. 8 and 9, for cleaning-out purposes, and for unstopping the Cap and screw for cleansing purposes.

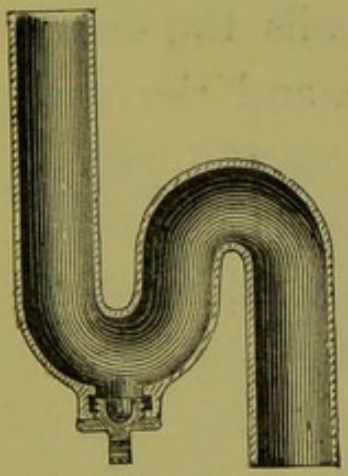


FIG. 8. SECTION.

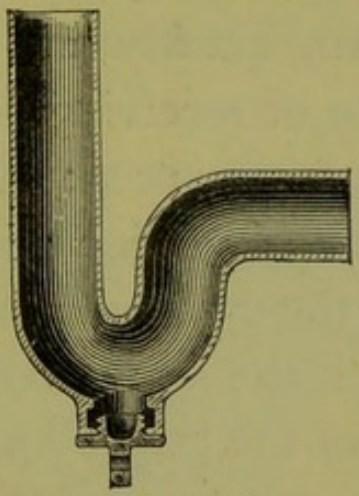


FIG. 9. SECTION.

waste-pipes on which they are fixed when necessary. The 4-in. trap, Fig. 7, can always have a cap and screw soldered to it when fixed in places where the hand cannot be put into the inlet, or dip-part, of the trap; but this can always be done when they are fixed under a water-closet or slop-sink, and also when there is a $4\frac{1}{2}$-in. rim and grate

over the inlet, as to a scullery-sink, &c., and then, of course, a cap and screw is not needed.

Syphoning action. Traps liable to be unsyphoned unless well ventilated.

On usage every part of the inside of this trap is scoured out by friction, and being a round-pipe trap there are no corners where anything can accumulate or become foul. The only objection to this trap is its syphoning power, which, at the same time, is one of its merits, for it is this suction power of the discharge passing through it which keeps it clean. Acting on the principle of the syphon, it is liable when a large body of water is thrown suddenly into it—as from a slop-pail—to be syphoned out, *i.e.*, untrapped. A pail of water thrown quickly into the trap fills the discharging orifice or receiving waste-pipe, and the suction at once commences; and if the waste-pipe is a long length of vertical piping, without proper ventilation, the syphoning action will continue until it has pulled the water out below the dip—the water-lock of the trap—when it immediately gets air and stops the syphoning. And then, unless there is some water behind (from the "fitting") to drain into the trap, to recharge it, it will allow the air in the waste-pipe to escape through the trap into the house. But this defect is easily remedied. A ventilating-pipe fixed on the outgo of the trap, or on the branch waste near the trap, will at once break the syphoning action of the discharge, and free the trap from too great

a suction power of the passage through the waste-pipe.

Size of traps to use for various fittings.

The patent cast-lead trap is especially adapted for lavatories, sinks, baths, water-closets, &c. &c. But the size of the trap is of importance, and for water-closets, slop-sinks, baths, *tip-up* lavatories, and scullery-sinks, it should be not less than 4-in. traps, but the smaller size, 3 in., 2 in., and 1½ in., may be used for plug wash-hand basins, draw-off sinks, and other fittings, according to circumstances.

Mansion water-closet trap.

*"Mansion" Water-closet Trap or "V-Dip" Trap.*—This trap, Fig. 10 (also see Section, Fig. 11),

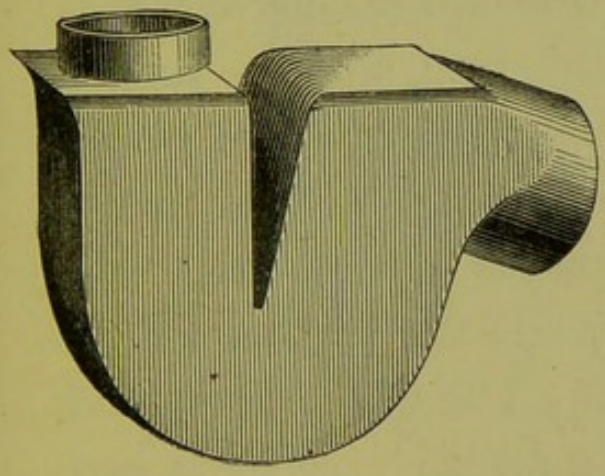


FIG. 10.

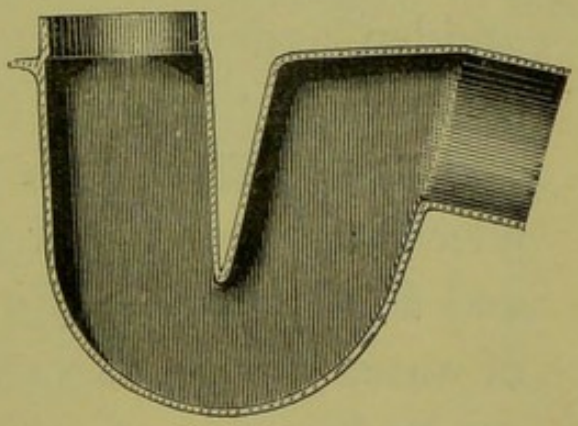


FIG. 11. SECTION.

is almost the same in principle as the patent cast-lead trap. It differs from it in this, that whilst the patent cast-lead trap is a *round-pipe* trap, this is a *square-pipe* trap, with a *round outgo*. And the former is made by machinery, without solder, and the latter by hand, with soldered angles.

Can be made by any skilled plumber.

This trap, in any size, can be made by any skilled plumber, with lead of any substance to suit the purpose for which it may be required. But the weight of the lead should never be less than 6 lbs., and 7-lb. or 8-lb. lead should be used for water-closet traps, and never less than 8-lb. for hot-water wastes.

Specially adapted to prevent syphoning.

This V-dip trap is specially adapted to prevent a too great syphoning action in the passage of the discharges through the waste-pipes or soil-pipes, and to allow for evaporation, when unused for months together, as is often the case in country mansions.

Specially fitted for valve closets, &c.

It is specially constructed for *valve* water-closets and slop-sinks, where the discharge is sudden and direct into the trap, and in such a volume as at once to fill the orifice of the outgo, and to commence a syphoning action unless checked; and also for places where the traps and fittings remain idle for months, without a drop of water passing into them. The water-dip should not be less than $1\frac{3}{8}$ in., and for such places as just referred to the *dip* should be $1\frac{1}{2}$ in.—this is equal to a 4-in. dip in a round-pipe trap 4 in. diameter.

Self-cleansing.

Like the patent cast-lead trap, it is free from all places where any foul matter can accumulate, and in its action it is self-cleansing—every part of the inside being washed by the passage of the water through it.

Little known. Expense against its extensive use.

This trap is little known, though many hundreds have been fixed in most important houses with entire success. The expense is against its extensive use—it is nearly three times as costly as the "patent cast-lead trap," but where cost is no object, and the pipes are insufficiently ventilated, it is a valuable trap to use. Where there is a great syphoning action upon the traps, caused by long lengths of vertical soil or waste pipe, and where evaporation has to be considered, it is the most efficient trap that can be fixed. (See "Trap-ventilation," Chapter VIII., page 64.)

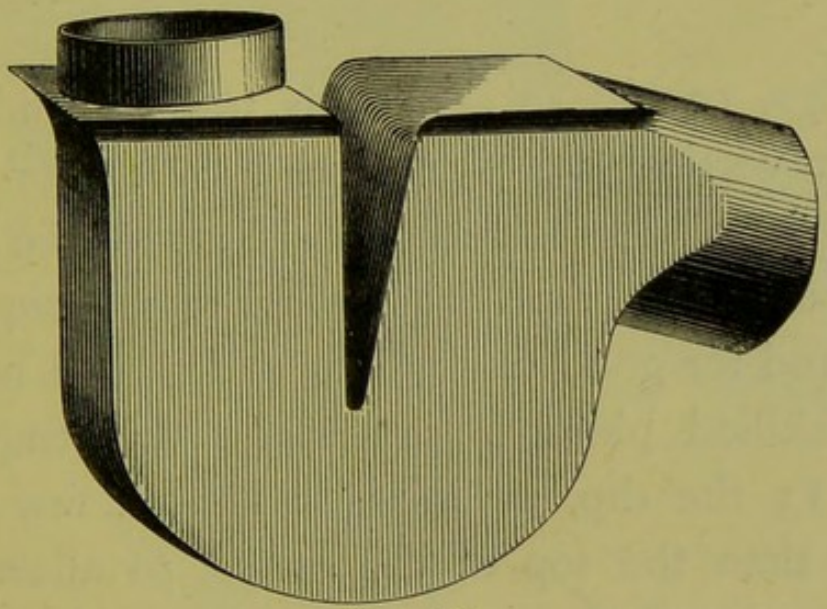


FIG. 12.



Soil-pipe trap in lead.

*Soil-pipe Trap.*—This soil-pipe water-trap, Fig. 12, is similar in principle to the "mansion," or "V-dip" trap. It is specially constructed for fixing at foot of soil-pipes, and connecting the same with drains. There are two sizes—one for

4-in. and 4½-in. soil-pipes, and the other for 5-in. and 6-in. soil-pipes; but of course they can be made in any size, as required by circumstances.

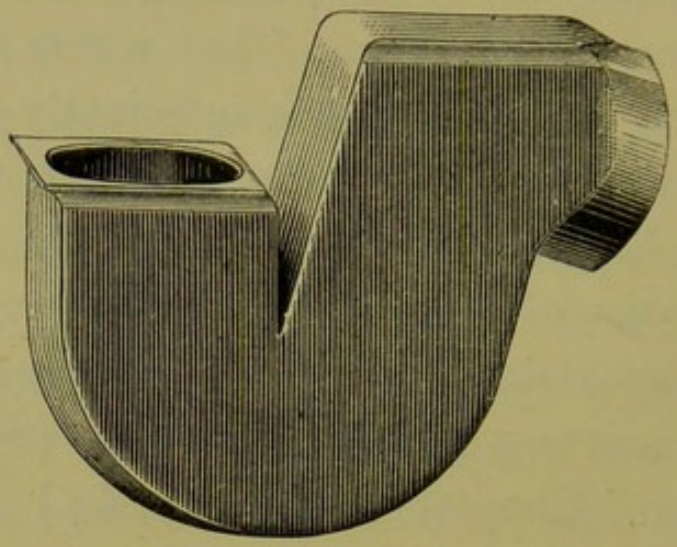


FIG. 13.

Description.

Figs. 12 and 13 show this trap in lead—Fig. 12 for vertical soil-pipe, and Fig. 13 for "horizontal." The substance should always be strong, and never less than lead 7 lbs. to the superficial foot, and for good work 8-lb. lead should be used. Any skilled plumber can make this trap. In Fig. 13 the dip, or inlet, is kept a few inches lower than the top of the outgo, to allow for a horizontal soil-pipe to come into it without much increasing the depth of the trap (see Fig. 14, showing this trap fixed). The cheeks and band are of the same width at every part of the trap, except at the outlet, and so arranged as to give a water-dip of 1½ in. The outgo of the trap is rounded to fit the drain-pipe, and also to give a

clear course for the waste-discharges, to prevent any lodgment of foul matter when passing through the trap. The outlet of the trap can be lengthened to suit any position by soldering a piece of soil-pipe to the outgo.

Lead soil-pipe trap fixed inside and outside a house.

Fig. 14 shows a section of this lead soil-pipe trap, fixed immediately *outside* the external wall of the house, with all its connections. These soil-pipe traps should never be fixed *inside* a house if

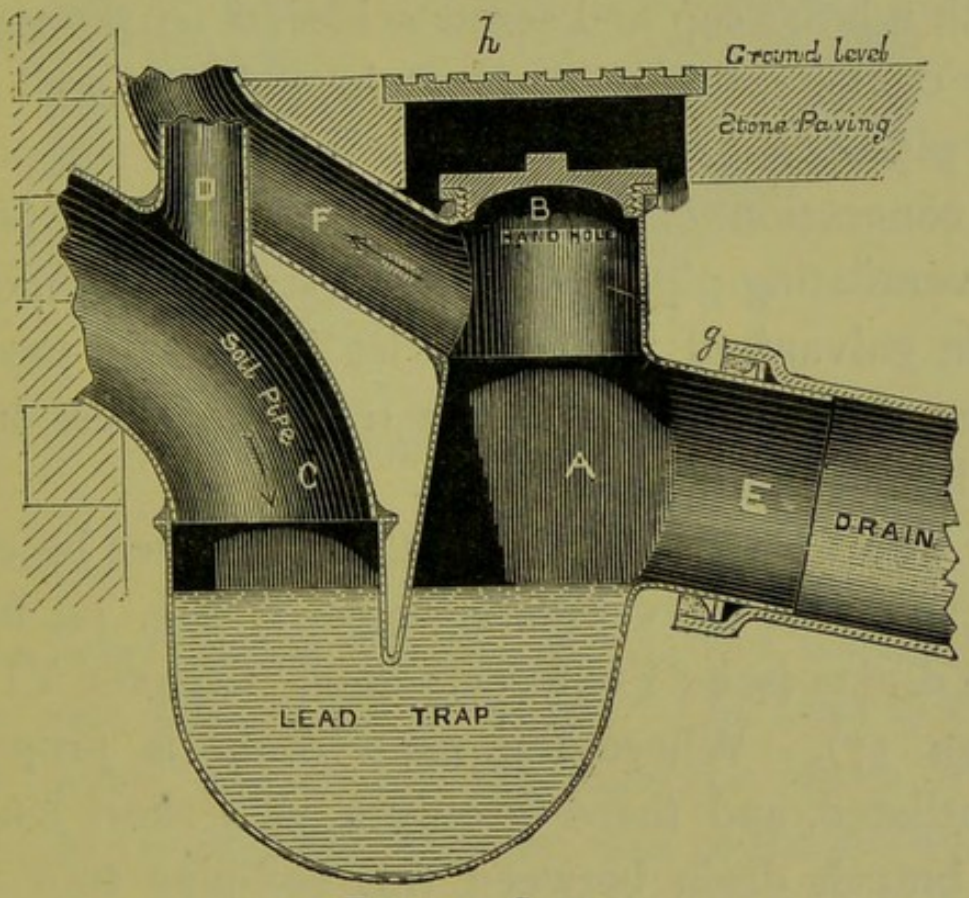



FIG. 14. SECTION.

there is any possible means of fixing them *outside*. When they are fixed inside the house, the outgo should be taken through the wall of the house, and connected with the drain-pipe outside, so that if the connection becomes defective, the drain-air

can escape into the open air; and also, when the screw-cap, B, Fig. 14, is removed for the inspection of the trap, or drain, or for cleaning out same, the drain will be exposed to the external air, instead of inside the house.

A, Fig. 14, shows a section of this trap with its water-dip of 1½ in.; B, the hand-hole, with a cap and screw over it—this is a *short* piece of 4½-in. lead pipe soldered on the top of the trap, with a brass cap and screw soldered on the top of it; C, the soil-pipe coming through the wall; D, air-pipe, or "foot-ventilation" to the soil-pipe; E, connection of the outgo with the drain-pipe; F, ventilating-pipe to drain and trap; *h*, a moveable galvanised iron cover let into stone paving over the screw-cap to the trap, for access to it without disturbing anything.

Air-pipes separate. Ventilating branch drains.

The air-pipe, D, Fig. 14, must never be connected with the ventilating-pipe, F, Fig. 14, from the drains (see "Foot-ventilation," Chapter VIII., page 57). Where the main drain is properly ventilated, and there is only a very short length of branch drain between this soil-pipe trap and the main drain, it is not necessary to have a ventilating-pipe, as shown at F, Fig. 14. But where the branch drain is a long length of piping, then it is important to have this ventilating-pipe, so that every part of the drain shall be properly ventilated.

Soil-pipe trap in cane-coloured ware. Connections with trap.

Fig. 15 shows a pottery-ware trap,* which the writer specially designed for fixing at the foot of soil-pipes. It is more suitable than lead for this purpose, and being fixed *outside* the house, the jointing is not of the same importance as connec-

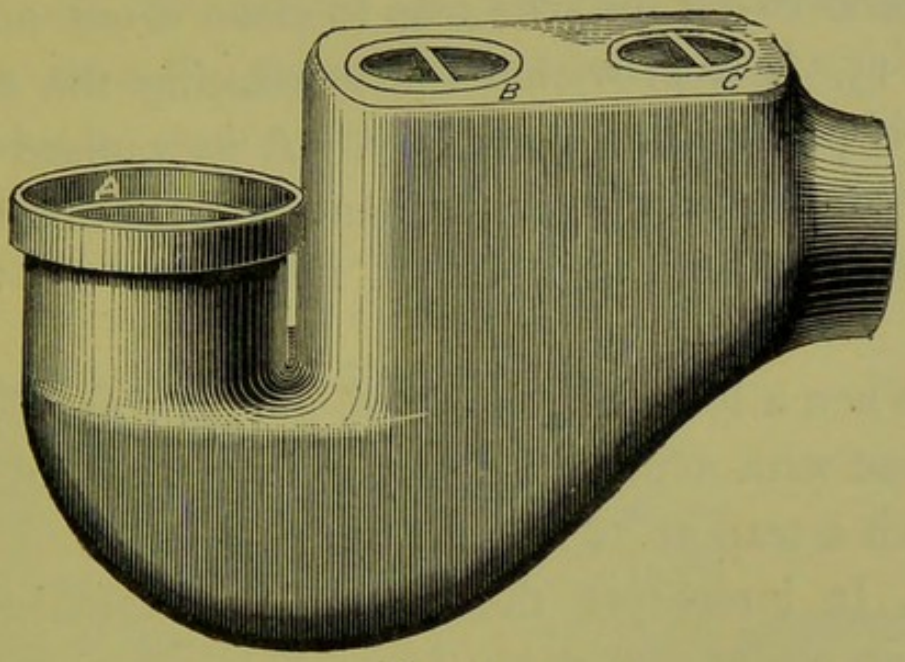



FIG. 15.

tions when inside the house. It is a round-pipe trap with a *water-dip* of $2\frac{1}{2}$ in. The inlet is kept low down, to receive the soil-pipe when it is brought through the external wall of the house, as shown in the lead soil-pipe trap, Fig. 14. But of course it is equally well adapted for receiving vertical soil-pipes. The soil-pipe can be "tafted" at the end, or a lead flange can be soldered at the foot of the pipe, as shown at *g*, Fig. 14, and fitted

* These traps are made in two sizes for 4-in. and $4\frac{1}{2}$-in. pipes, and for 5-in. and 6-in. soil-pipes, to fit 6-in. drains.

into the socket of the trap at A, Fig. 15. The waste-discharges will then drive everything foreign out of the trap; but when the soil-pipes are *branched* into the dip of the trap, foul matter is splashed all over the inlet part of the trap to make it filthy. B, Fig. 15, is a movable cap for the hand to get into the trap to clean it out, and C, Fig. 15, is a provision for ventilating the drain at this point when necessary. A galvanised iron plate can be fixed over the hand-hole of this trap, as shown to lead trap, *h*, Fig. 14.

Advantages of such a trap.

When a long length of soil-pipe is fixed *inside* a house with many closets upon it, the advantages of such a trap at its foot are great.

Intercepts drain.

1. It intercepts the drain-air, and makes it seek an outlet *outside the house.*

Always charged with water.

2. Being under the ground-level, the water does not evaporate, or if it does, it is but very little, and being at the foot of the soil-pipe, it does not get syphoned out.

Water-barrier between drain and house.

3. When there is a defect in the soil-pipe inside the house, through age or any other cause, this trap stands as a water-barrier at the foot of the pipe, to prevent any drain-air passing up and escaping through such defect into the house.

A protection when other traps fail.

4. When any trap or traps upon such a stack of soil-pipe get uncharged by evaporation (through want of usage), or become untrapped by

the syphoning action of other waste-discharges through the pipe, then this trap at the foot is the only protection between the drain and the house.

Ventilation necessary.

Of course it will be absolutely necessary when such a trap is fixed at the foot of the soil-pipe, to *ventilate* the soil-pipe at the top, or the air in the pipe will be *bottled up*, and the remedy prove worse than the disease. But no soil-pipe should be without such a ventilation in any case.

Double ventilation.

It will also be *very advantageous* to have a *second air-pipe*, or "foot-ventilation," to allow a

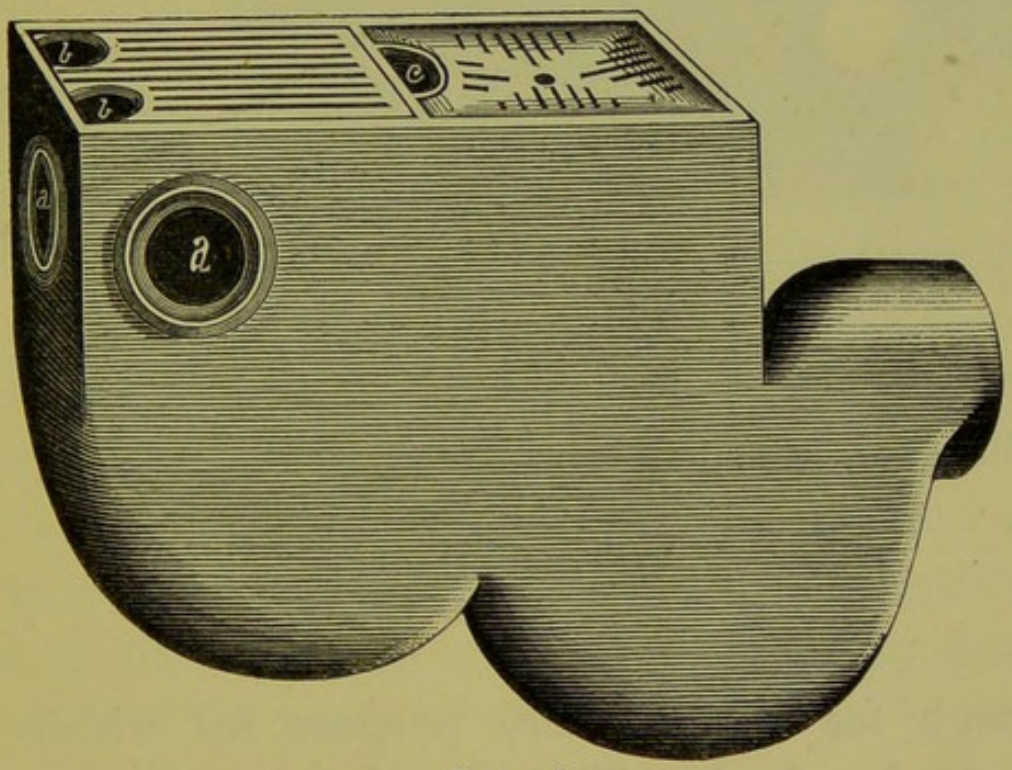



FIG. 16.



*current* of *air* to pass through the entire length of soil-pipe, and to provide an *escape* for the air driven down by the discharges. (See "Soil-pipe Ventilation," Chapter VIII., page 57; also Plate 1,

between pages 28 and 29, showing such an air-pipe fixed.)

Waste-receiver and drain-interceptor.

*Patent "Triple-dip Trap, or Waste-receiver and Drain-interceptor."*—The writer has taken out a patent for this trap. It can be made in any size, but the size, as given in Fig. 16, is large

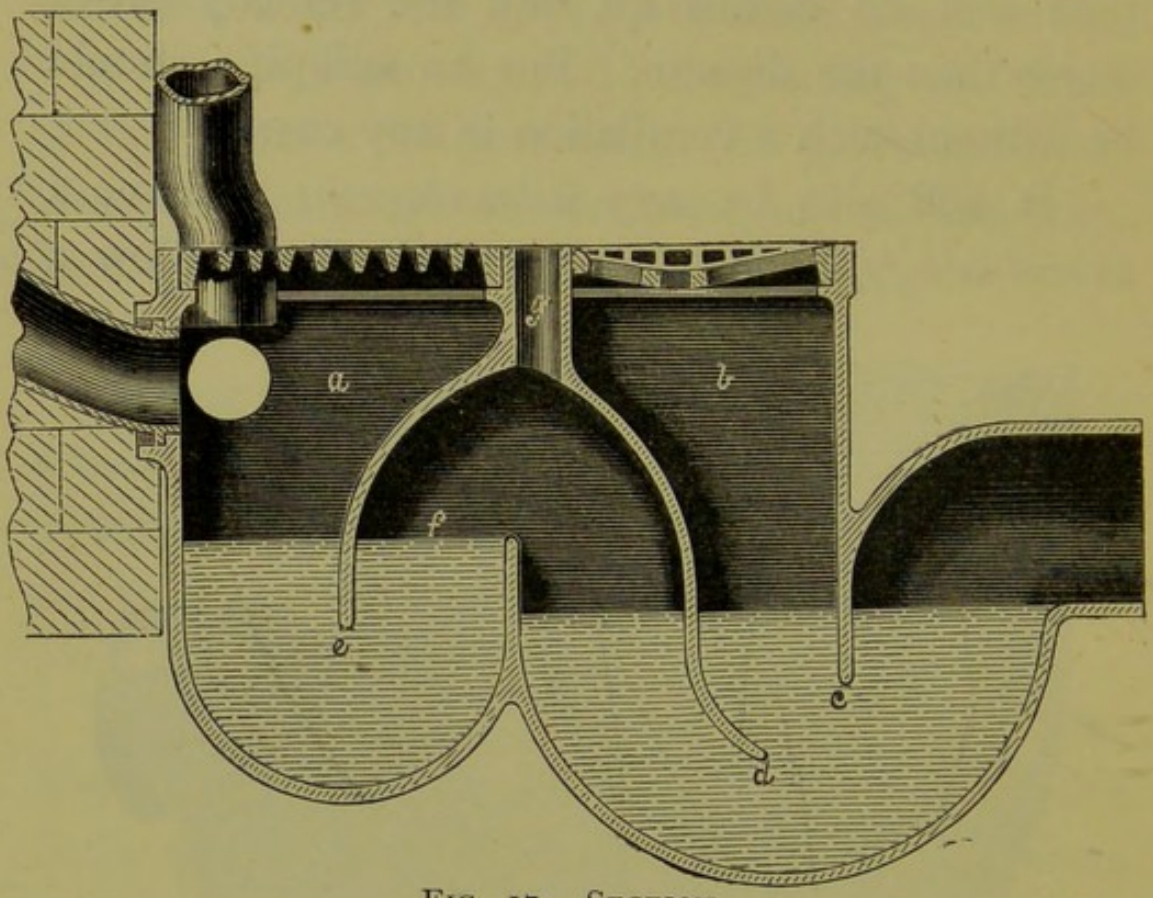



FIG. 17. SECTION.

enough for almost every purpose for which it should be used. The trap is made in cane-coloured pottery-ware. Fig. 16 shows a view of this trap, and Fig. 17 a section.

Made in two compartments.

This trap is divided into two compartments, and arranged so that the water in the one compartment is kept separate from that in the other,

to prevent the one polluting the other, if the water should in any way become foul.

Section and description.

The compartment *a*, Fig. 17, is used exclusively for receiving waste-pipes from baths, lavatories, sinks, and such-like wastes, but *not for sewage wastes.*

The compartment *b*, Fig. 17, is for taking away the surface drainage, when the trap is fixed in the area, yard, or any such place; and also for providing a way of escape into the open air for any strong current of air blowing through the drain, and for preventing its passing into the waste-receiving compartment, where the ends of the various waste-pipes are left open.

Three water-dips.

There are *three* water-dips (or water-locks) in this trap, and before any noxious gases from the drain can get to the waste-pipes emptying themselves into the waste-receiving compartment, they must push their way through two separate bodies of water and three water-dips—*i.e.*, a depth of $3\frac{3}{4}$ in. at the first two dips, and another depth of 2 in. at the third dip. The dip *c*, Fig. 17, goes down into the water $2\frac{1}{2}$ in.; the dip *d*, Fig. 17, goes down $1\frac{1}{4}$ in. lower into the same water. The dip *e*, Fig. 17, is in another compartment, and goes down into the water $2\frac{1}{2}$ in.

Difficult for any current of air to pass from the

Suppose a strong current of air to be blowing up through the drain, and to force its way through the *first* dip, *c*, Fig. 17, it would at once escape

drain to the waste-pipes.

into the external air through the compartment *b*, Fig. 17, for the *second* dip, *d*, Fig. 17, is 1¼ in. lower in the water. But even supposing this strong current of air in the drain forces itself under dip *d*, as well as *c*, into the compartment *f*, Fig. 17, it would at once escape through the air-pipe, *g*, and would never get into the compartment *a*, under the *third* dip, *e*, Fig. 17.

Gratings at top.

The top of the trap is protected by two separate galvanised iron* gratings, as shown in Fig. 16, that to the waste-receiving compartment is fitted to the pipes entering into the trap, and that to the other is sunk to receive the surface-water.

Means for receiving the waste-pipes.

Means are provided by a countersunk hole, as *a*, Fig. 16, in each of the three sides of the waste-receiving compartment, to receive "horizontal" waste-pipes, and when not required, such holes are filled up with a stopper, of the same ware as the trap, made for the purpose; or the waste-pipes can be taken in at the top, as shown in Fig. 17. When the pipes enter at the top they must not go more than 3 in. into the trap, or down to the same level as the pipes entering at the sides, so that the *ends* in each case may be

Open ends

left *open to the atmosphere*. This "waste-receiver" should always be fixed a yard or two away from

* The grating in the *Diagram*, Fig. 16, for taking away surface-water, is not shown with sufficient water-way.

windows and doors. (See Plate 3, Fig. 4, showing this trap fixed.)

Evils of waste-pipes discharging *outside* gratings.

When waste-pipes are made to discharge *over* a grating, or trap, the pipe being cut off a foot above the grating, according to the present mode of terminating such waste, a nasty mess is made all round such gratings or traps ; and when large bodies of waste water are delivered through them, a great deal of splashing occurs, and the filth is washed about everywhere at the foot of the waste-pipe.

# CHAPTER II.

## SOIL-PIPES, OR WATER-CLOSET WASTES.

Chases should be left for all pipes.

In all new buildings proper chases should be left or provided in the walls for the several pipes that will be required in the plumbing-work, and more especially for the soil, waste, and service pipes; and all such pipes should be cased in with wood framings with hinged doors, or movable casings, for easy access to the pipes.

Soil-pipes, size according to the number of water-closets upon the stack.

*Soil-pipes* receiving water-closet discharges ought never to be less than 4 in. in diameter, and when several closets empty themselves into the same stack of soil-pipe, the size of the main soil-pipe should be increased in proportion to the number of water-closets on the pipe, and likely to be used at the same time. As a rule, 4½ or 5 in. soil-pipe is large enough for any purpose, except in very large houses, where there are from a dozen to a score of water-closets upon one stack of pipe; then the diameter of the pipe should be increased to 6 inches; but this rarely occurs, except in large hotels and warehouses. Of course, all soil-pipes should be *round*, as they are more self-cleansing, and not so liable to get foul.

# PLATE I

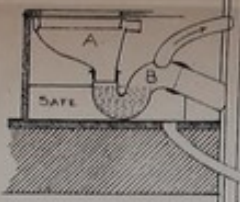



FIG. I.

A. PATENT ARTISAN W.C. BASIN AS FIG. 2

B. 4" PATENT CAST LEAD TRAP AS FIG. 7.

O
✱ (SEE BELOW)

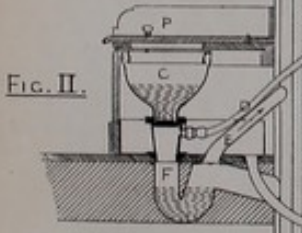



FIG. II.

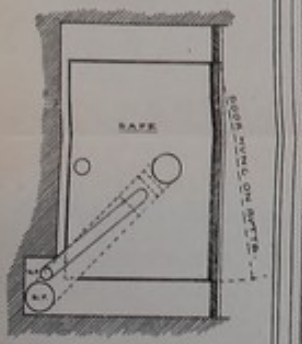
C. VALVE W.C. APPARATUS AS FIG. 23, BUT THE HANDLE IS SHOWN THROUGH THE FRAMING OF W.C. SEAT.

D. 1" AIR PIPE FROM APPARATUS WITH PERFORATED END OUTSIDE EXTERNAL WALL. (THIS PIPE IS NECESSARY ONLY WHEN A W.C. IS PLACED CLOSE TO A LIVING ROOM OR BED ROOM.)

E. 2" LEAD BRANCH AIR PIPE FROM TRAP.

F. 3 lb. "MANSION" W.C. TRAP.

G. 1½" LEAD WASTE PIPE FROM SAFE, WITH A COPPER HINGED FLAP SOLDERED ON END OF PIPE.




PLAN,
SHOWING POSITION OF INTERNAL SOIL AND VENTILATING PIPES.

H. 4½" 8 lb. BRANCH SOIL PIPE.

I. VENTILATING PIPE FROM TRAP.

K. 4½" 8 lb. LEAD SOIL PIPE.

L. 2" LEAD PIPE FOR VENTILATION TO SOIL PIPE.

M. SOIL PIPE TRAP AS FIG. 14.

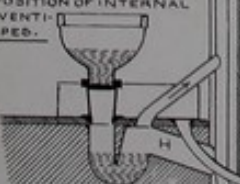



FIG. III.


FIG. IV.




W. J. Bellyse, Del. J.T. Lith.

Material for making soil-pipes.

It ought not to be necessary to say a word on the material of which soil-pipes should be made; but as there is a tendency in some quarters to use cast-iron, it may be well to look at this matter, and see what advantage *lead* has over *iron*.

Lead smoother, cleaner, and more durable than iron.

*Lead soil-pipe* is smoother and cleaner in its action than cast-iron pipe, and is therefore more wholesome; and, being of a closer texture, it is not so corrosive, and is consequently more durable.

More compact.

Lead soil-pipe can be bent to suit any position, and when in its place is more *compact* than cast-iron pipe, and does not occupy so much room.

Joints.

Then the joints and connections of lead soil-pipes are more to be depended upon than the cement-joints with iron pipe.

In iron soil-pipe, corrosion inside and rust out.

Urine is very corrosive, and acts much more on cast-iron than on lead. But not only is this corrosive action going on *inside* an iron pipe; there is another action taking place on the *outside* of the pipe when it is in cast-iron. The atmosphere of the house condenses on the pipes, and *rusts*, and eats its way into the pipe—so that whilst a corrosive action is wearing away the pipe on the inside, a similar rusting action is eating away on the outside. Of course, painting it periodically would prevent the atmospheric action; but this would involve a constant expense, and the back part of the pipe would not be got at even then. But with a lead soil-pipe, the action of any con-

densation is merely nominal; and hence, lead soil-pipes (when they are without soldered seams) are as sound on the *outside* years after they have been in use as they were when first fixed.

Difficulty in making reliable joints.

Then there is the difficulty of making *sound and reliable joints* in cast-iron soil-pipes with the lead branches, or with the traps, when the latter are of lead. And, I suppose, no man, with any sanitary knowledge of water-closet work, would recommend iron traps for water-closet use. There would not, of course, be the same difficulty in making a sound and durable joint if the two metals to be united were the same.

Iron pipe too thin to caulk in lead.

As the pipe generally used for soil-pipe, when cast-iron is required, is only of the ordinary rain-water pipe substance, the joints cannot be caulked in lead (the pipe is too thin to stand the knocking required for this) and are therefore made in *cement* —a very vague sort of thing, meaning anything or nothing; for *any sort* of *stopping* by some people is called "cement;" and there is this danger attending such joints—the front part of the pipe is often stopped; the back, or part next the wall, *un*stopped—because it cannot be reached.

No safety in cement joints.

With such joints as those referred to in the last paragraph there is no safety. The stopping may be imperfectly done, or may dry up, or the joint may be broken; for the two pipes are not really *united* by such a connection. And this

joint, when broken, will allow any bad air in the pipe to escape *insidiously* into the house; for, unfortunately, a leakage of *soil-pipe air* does not show itself like water, or proclaim itself like gas, but in a cowardly sort of way stabs you in the dark, or kills you by a slow kind of poison—a thousandth part of an inch at a time.

If a stronger pipe, evils, except that of jointing, remain the same.

But supposing a stronger pipe is used, so that the joints can be caulked in lead. This simply overcomes the difficulty of jointing, while the other evils remain. It involves the expense of lead without securing its advantages, for the corrosion, &c., referred to takes place as before, and the unwholesomeness is quite as great. Moreover, when a leak occurs in *iron* pipe, it cannot be soldered as in lead, and there is no help but to cut it out bodily. What is it worth as old material? Why, hardly sufficient to pay for taking it away. On the contrary, lead soil-pipe can be repaired when a leakage occurs, and when no longer fit for its original purpose it can be sold for *about* half its original cost.

Strength of lead soil-pipe.

All lead soil-pipe should be strong, and *never* of *less* substance than lead 6 lbs. to the superficial foot; but where cost is not the first consideration, and durability is required, the strength should be increased to 7 lbs. or 8 lbs., according to circumstances.

Chases in walls.

Proper chases should be provided in building the walls to receive all soil-pipes when fixed inside the house, for there is no better way of fixing funnel-pipes than on "blocks;" but this can only be properly done when the pipes are fixed in chases.

Blocks.

These blocks can be made of wood or stone, but the former is the cheaper, and is all that is necessary; they should be let into the wall at two opposite sides, the right hand and the left looking at the pipe, and they should be $2\frac{1}{2}$ in. or 3 in. thick, according to the weight of the pipe to be fixed upon them.

Distance apart. Centre support.

A block every 10 feet—which is the length of all lead funnel-pipes made by hydraulic pressure—*may* be all that is necessary for *air-pipes*, but for soil and waste pipes there should *always* be a *supporting-block* in the *centre—i.e.* a lead flange soldered to the pipe, and made to rest on a wood block similar to the block-joints; or a lead tack should be soldered to the pipe, about midway between the block-joints, as an additional support, or the pipe will be liable to "bag out," and break away at the joints. All funnel-pipes, air, soil, or waste, between 3 in. and 6 in. diameter, should have this supporting-block in the centre, regardless of the substance of the pipe.

Block-joint.

Fig. 18 shows the best way of making this block-joint at the connection of the two pipes.

The top of the block is countersunk, or rather rounded off, where the pipe passes through, and the end of the pipe is rounded back upon it, with a lead flange underneath, and the two pipes are then soldered together, as shown by Diagram,

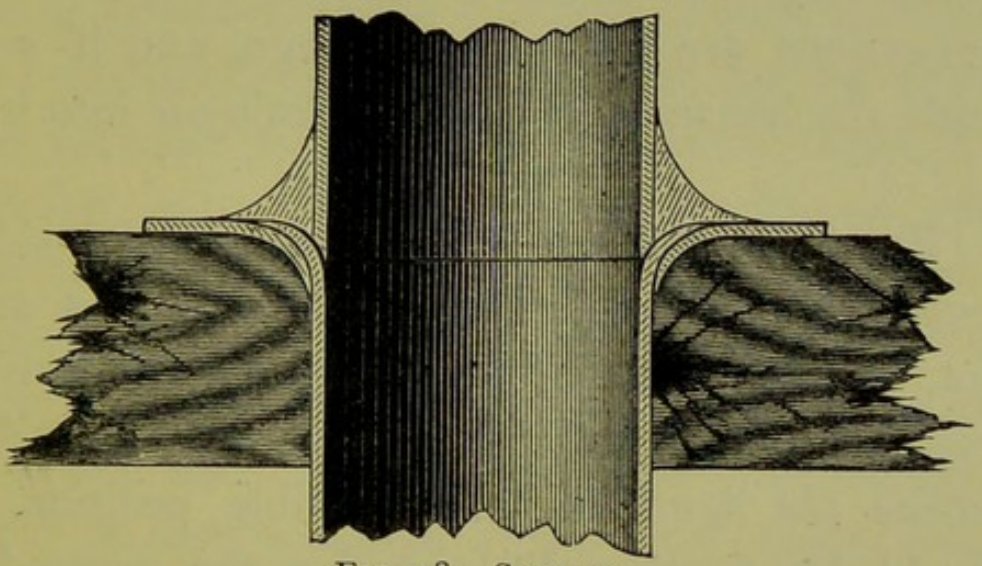


FIG. 18. SECTION.



Fig. 18. It takes more solder this way, but when the pipe is tafted back at right angles, as is often the case with some plumbers, the lower pipe is liable to break away at the taft.

Tacks: size and distance apart.

When there are no chases, and the pipes are fixed on tacks, the tacks should be strong, never less than of 7-lb. lead, and large enough to cover three joints of the brickwork, for soil-pipes, and two joints for air-pipes under 3 in. diameter—viz., 10 in. by 9 in. the large size, and 7 in. by 6 in. the smaller size; the largest part being soldered to the pipe so as to get three wall-hooks in the one and two in the other. These tacks should not be

more than about 3 ft. apart, and they should be fixed alternately to the right and left hand of the pipe.

Soil-pipes continued through the wall before connected to drain.

All soil-pipes, when fixed inside a house, should be *continued through the external wall* before they are connected with the drain, as these connections are liable to breakage, and if made inside the house, would let the drain-air into it.

Trap at foot of soil-pipe outside the house.

Every *stack* of soil-pipe, when fixed inside a house, should have an efficient *water-trap* at its foot, at the connection of the soil-pipe with the drain. And this trap, if possible, should be fixed *outside the house* in an accessible position. It should be fixed a little under the ground, to prevent the water from evaporating in summer and freezing in winter. A cap and screw should be soldered over it for occasional inspection, or cleansing, when necessary. (See Fig. 14, showing such a trap fixed; also Plate 1, Fig. 4.)

Shuts out drain-air.

This trap is more important than many allow. It *shuts out* the drain from the house, preventing noxious gases passing from the sewer and drain into the soil-pipe. I say this deliberately, knowing it is of the utmost importance that all pipes, whether soil, waste, or drain pipes, should be as *open* as possible; but then *no drain should be allowed to ventilate itself through a soil-pipe, when that soil-pipe is fixed inside a house*, and especially

if it is a great length of piping. This trap, fixed as it is at the bottom of a pipe, always gets a good rush of water upon it to keep it clean, and when made on the principle laid down at page 6, there is no danger of its becoming foul.

Soil-pipes perish. A foot-trap shuts off the drain in case of defect.

Again, lead soil-pipe, like everything else, in time perishes, and if a defect occurs, through age or accident, what is to prevent the air from the drain (and perhaps sewer) passing through such defect into the house? But with an efficient water-trap, as Figs. 12 and 14, at the foot of a soil-pipe, the drain is shut off—at any rate, to a great extent; and the worst that can occur, in case of any such defect in the soil-pipe, is that the air in the soil-pipe itself may come into the house; but as the soil-pipe, under the principles of this little work, would be *ventilated both at the top and bottom*, there would be no noxious gases or injurious air to come into the house.

There is another reason why great lengths of soil-pipes, with many water-closets upon them, should be trapped at the foot. Sometimes some of the water-closets upon the stack remain in disuse for weeks together, when the house in which they are fixed is not in full occupation. The result of this often is that the unused water-closet traps become uncharged, through evaporation and other causes, and then, if there is no trap at the foot of the soil-pipe, what is to

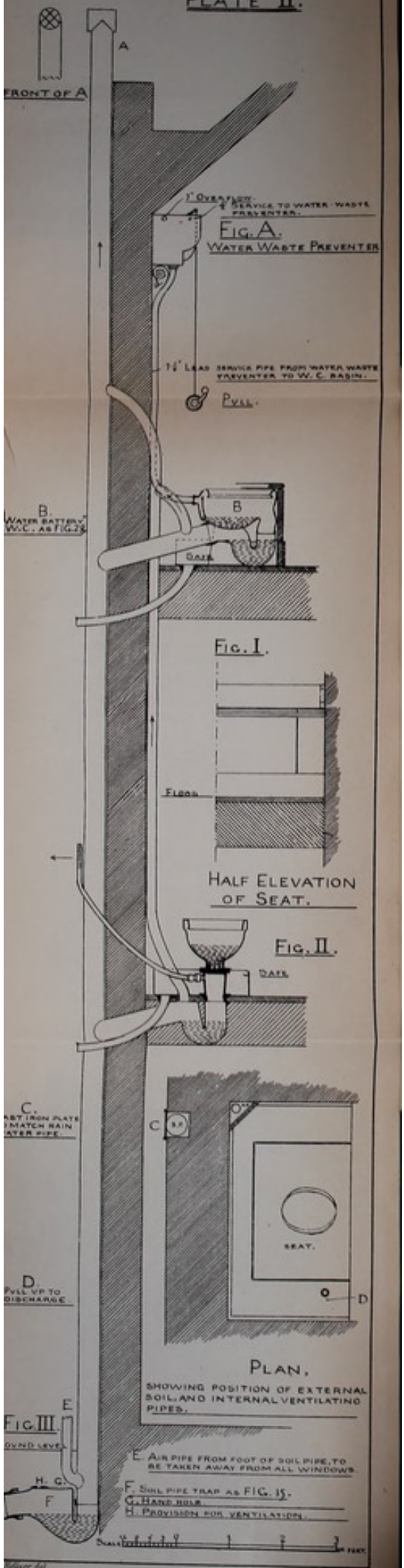
prevent the air from the drain (and perhaps sewer as well) passing through the uncharged traps into the house? But I have said enough to show the value of this trap. (See "Soil-pipe Trap," Fig. 14, Chapter I., and the advantages summarised, page 22.)

Important to ventilate the drain, and not to bottle it up.

Now, while it is important not to ventilate the drain through the soil-pipe inside a house, it is *more important still not to bottle up the air in the soil-pipe*, or, what is worse, shut up the drain. *Soil-pipes and drains cannot be too open, or too much ventilated*, and the nearer the ventilation of the drain is to this soil-pipe trap, the more effectual will the whole be.

*If the drain cannot be ventilated separately*, it is better that it should be ventilated through the soil-pipes by doing away with this foot-trap, rather than it should not be ventilated at all. (See "Ventilation of Soil-pipes and Drains," Chapter VIII. See Plate 1, between pages 28 and 29, showing a stack of soil-pipe fixed with water-closets upon it; air-pipe at top, ventilation at foot, and branch air-pipes from traps into same complete. Also see Plate 2, between pages 36 and 37, showing a stack of soil-pipe fixed *outside* the external wall, with another mode of ventilating the pipe at the foot, &c.)

# PLATE II.


A
FRONT OF A
1" OVERFLOW
1" SERVICE TO WATER WASTE PREVENTER.
FIG. A.
WATER WASTE PREVENTER
1½" LEAD SERVICE PIPE FROM WATER WASTE PREVENTER TO W.C. BASIN.
PVLL.
B.
WATER BATTERY W.C. AS FIG. 2
B
DATE
FIG. I.
FLOOR
HALF ELEVATION OF SEAT.
FIG. II.
DATE
C.
CAST IRON PLATE TO MATCH RAIN WATER PIPE
C
SEAT.
D
D.
PVLL VP TO DISCHARGE
PLAN,
SHOWING POSITION OF EXTERNAL SOIL AND INTERNAL VENTILATING PIPES.
E
FIG. III.
E. AIR PIPE FROM FOOT OF SOIL PIPE, TO BE TAKEN AWAY FROM ALL WINDOWS.
F. SOIL PIPE TRAP AS FIG. 15.
G. HAND HOLE.
H. PROVISION FOR VENTILATION.
H. G.
F

# CHAPTER III.

## SLOP-SINK WASTES.

BEFORE entering into the subject of slop-sink wastes, it may be well to say a word upon the trap which should be fixed under it, even at the risk of repetition, for where there is no valve or check between the trap and house, as in this case, the trap becomes even more important (if possible) than it is, for instance, under a *valve* water-closet apparatus. Any defect in the trap through an insufficient water-dip, &c., will at once allow any foul air in the waste-pipe to come through the trap, and then it is inside the house; for there is nothing to check it in the slop-sink itself, which is simply a conductor of the slops into the trap or waste proper.

The trap important, as there is no other check between the house and waste.

Slops are generally thrown into such places in pailfuls, and the disturbance of the water is very great in the trap under it. And, if there is an extensive length of waste-pipe from it, and the ventilation of the pipe is defective, the trap is almost sure to be uncharged by the rush of water through the waste, unless it has a proper water-dip.

Slops thrown down in pailfuls disturb the water in the traps.

Traps independent of the sink.

Again, such traps should always be independent * of the slop-sink, and when up-stairs or inside the house, should be connected by a *wiped soldered joint* to the lead waste-pipe. Trap, Fig. 7, page 12, is a very good one for this purpose, but it ought never to be less than 4 in., and then the end can be bossed or reduced to 3 in., the size of the branch waste, giving the trap a water-dip of not less than 2½ in. This will prevent its being unsyphoned, and will shut out all back draught through the waste-pipe.

Size of waste.

When there is only one slop-sink, a 3-in. pipe is large enough; but when there are three or more, and these are on different levels, the main waste should be 4 in. in diameter, with 3-in. branches from it to the various slop-sinks.

Strength of pipe.

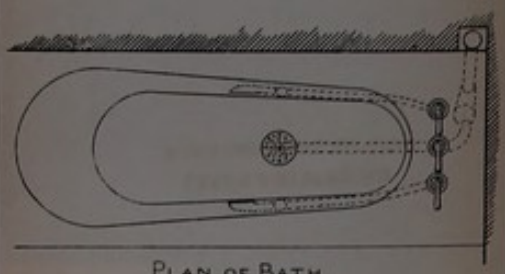
This pipe *should never be less* in substance than lead 8 lbs. to the superficial foot; and when there is a great deal of washing up, and a hot water "draw-off" cock over it, this should be increased to from 8-lb. to 12-lb. lead, according to the character of the house and the elasticity of the purse.

Empties with open end into waste-receiver.

Where possible, this waste-pipe should empty with an *open end* into a waste-receiver, just as the general wastes do, except, perhaps, when it has a long length of waste-pipe with several slop-sinks

* See "Traps independent of Fittings," page 3.

# PLATE III.



PLAN OF BATH.

FIG. II. A.

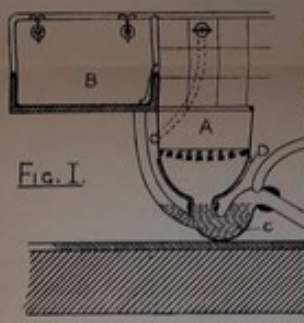



FIG. I.

A. PATENT "WATER & WASTE" SLOP SINK AS FIG. 30.
B. WOOD SINK, LINED WITH TINNED COPPER, 4 IN. PER FOOT RUN IN BOTTOM, AND 2½ IN. IN SIDES.
C. PATENT CAST LEAD TRAP, AS FIG. 7, WITH "UNION" BOSSED TO IT, TO GIVE GREATER WATER DIP, AND TO FIT BRANCH WASTE PIPE.
D. LEAD SEATING, SOLDERED TO INLET OF TRAP.

E. 5'6" TAPER "FIRST QUALITY COPPER BATH.
F. ½" "DURA" BATH VALVE.
G. 4" PATENT CAST LEAD TRAP, AS FIG. 7.
L. LEAD SAFE, UNDER BATH (5'-0" X 2'-0", WITH A "STAND-UP" OF 6" AT SIDES AND ENDS.)

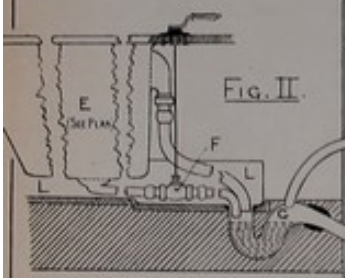
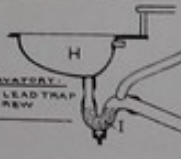



FIG. II.

18' LEAD AIR PIPE FROM LOWEST TRAP CONTINUED UP AND BRANCHED INTO AIR PIPE ON TOP OF WASTE-PIPE

3' LEAD WASTE PIPE, STRENGTH EQUAL TO 12 LB. LEAD.


PLAN OF FIG. III.




H. "ELBOW ROOM" LAVATORY.
I. 2" PATENT CAST LEAD TRAP WITH CAP AND SCREW AS FIG. 9.

FIG. III.

FIG. IV.

K. PATENT "WASTE, RECEIVER, AND DRAIN INTERCEPTER" AS FIG. 16 & 17.


SCALE 12 9 6 3 0 1 2 3 OF FEET

to face page 36

upon it, and they are much used for emptying chambers into the sink, and the waste-receiver is under, or near, a window of the house (which it never should be); then the *end* of this pipe should *dip into the water*, to prevent the whole length of pipe sending out its bad air to be "sucked" in at the window. Such a waste-pipe, in time, is anything but "sweet," for chamber utensils are freely emptied into it, and all sorts of slops. When the end of this pipe dips into the water of the waste-receiver, it should have an air-pipe not *less* than 1½ in. in diameter taken out at the foot, and carried 10 or 12 feet away from the nearest window, and left with a grated end, to allow a current of air to pass into the waste-pipe, to keep it wholesome.

Also ventilated at top.

This waste-pipe must always be ventilated at the *top*, as described for other wastes; and when there are many *branches* from the main wastes, such branches should have air-pipes as well. (See "Trap-ventilation," Chapter VIII., page 64.)

Mode of fixing.

This pipe should be fixed on blocks, in the way described for soil-pipe fixing (see last chapter); or, if no chases are provided for it, it must be fixed on tacks, as explained for soil-pipe fixing. (See Plate 3, showing a slop-sink fixed, and waste-pipe from it complete.)

# CHAPTER IV.

## CISTERN-WASTES.

At the very commencement of this subject of *general wastes*, let the following rule be laid down, and be as binding as the laws of the Medes and Persians :—

Rule for general wastes.

No waste-pipe, other than a water-closet waste, should under any circumstances be directly connected with a drain or sewage-waste; and *in all cases such wastes should be taken through the external wall of the house, and discharge with an open end into a "waste-receiver,"* or place properly prepared for receiving such wastes.

Wastes to cisterns turned into overflows by Act of Parliament.

*Cistern-wastes.*—According to the rules of the London Water Companies, legalised by Act of Parliament, there are now to be no wastes to cisterns in the London radius, and so the comfort of the householder has been ignored; the water to be delivered is to be *so pure* that it will never require changing, however long it remains in the cistern, and the cistern will, therefore, not need any cleaning out.

Overflow at the top no use for

True, the Metropolis Water Act provides for *overflow-pipes* in each cistern, but the water will

not jump up to the top of the cistern to go through this pipe when you want to clean it out. cleaning purposes.

And the size of this pipe—viz., *half an inch* in diameter—is of little use to the householder, however valuable it may be to the water companies; for how can a half-inch pipe, without any pressure upon it, take away the full charge from an *inch* ball-valve, with a pressure of from 40 to 70 ft. head-of-water upon it? Of course, when there is the constant service, a much smaller size ball-valve can be fixed; but even then such an overflow-pipe will not be large enough to take away the delivery, say from a ⅜-in. valve, when it is kept open by a small stone washed up under the seating of the ball-valve, or when the valve itself becomes defective.

Many of the water companies are gracious enough not to insist upon this small size overflow-pipe, and allow any size that may be required, provided that it is made to discharge where their servants can see if the water is wasting through a defective ball-valve, &c. And this they are justified in doing, for such trumpery ball-valves are used in many cases that they waste more water than the whole house consumes for its legitimate use. Any size overflow allowed by some water companies.

The size of the overflow-pipe should be determined from the size of the service, and the pressure of water likely to be upon the ball-valve. An Size of overflow should be twice the

size of the service.

overflow fixed to a cistern on the ground floor requires to be larger than an overflow fixed to a cistern on the third and fourth floor, if served from the same pipe and by the same size ball-valve.

As a rule, about *twice* the size of the service will give the size of the overflow, except in the smaller size services, but *no* overflow-pipe from a cistern supplied direct from a rising-main should be less than an inch and a quarter in diameter.

Should never discharge directly over a drain-trap.

No overflow or waste-pipe from a cistern should discharge *directly* over a grating to any trap fixed immediately over a sewage drain. The water in such traps evaporates in the summer, and often leaves the trap uncharged; or impurities are thrown off by the water in this trap, or sewer-gas escapes through it; and when there is this cistern-waste or overflow over it, the gas passes at once into the pipe, and is drawn up through the pipe, by the warmth of the house, to the water in the cistern. And it is useless to put a trap in this pipe to prevent this, for there are no means of keeping it charged without a great waste of water.

*The waste, or overflow, should always discharge some few feet away from the drain-trap*, and a channel should be formed from it to the trap, to conduct the waste water, when the cistern is being cleaned out, into the trap.

No better way of disposing it than taking it into a gutter.

Where possible, there is no better way of fixing this waste than by taking it into a gutter, with a copper-hinged flap soldered on the end of the pipe. Of course the end of this waste-pipe must never be fixed near the outlet end of a ventilating-pipe from a drain or soil pipe, or the vitiated air will pass through the waste to the water in the cistern, as before explained.

When the cisterns are too low for taking the waste from them into roof gutters, or where there are no roof-gutters to take them to, the pipe should be continued down through the house to the nearest surface-trap, *discharging some few feet away from the trap in all cases*, for reasons assigned above.

It is sometimes almost impossible to fix a waste-pipe in this way, except by a pipe as long as from "John-o'-Groat's to Land's End." When this difficulty occurs, and where there are no water companies to interfere, there is no better way of surmounting it than by the following plan, which may be adopted with the utmost safety :—

Sometimes this is too expensive, then follow this method.

Take an *overflow-pipe*, at least twice the size of the service-pipe, from the top of the cistern to the *nearest external wall* of the house, and let it stand two or three inches beyond the face of the wall, with a copper-hinged flap, 1, Fig. 19, soldered on the end of the pipe, to prevent birds building in it, and stopping it up, &c., and also to shut out the draught in case of frost. The

*Overflow* outlet lower than inlet.

*outlet end* of this overflow-pipe should always be a foot or more below the inlet in the cistern, to give a pressure of water upon the copper flap to keep it open during an overflow (see Fig. 19, H and I). Having provided an overflow-pipe—*i.e.*, for a failure in the ball-valve, the next important thing is to provide proper means for cleaning out the cistern. Fix a brass washer and waste connection in the cistern bottom in the usual way, and as this is only for cleaning out purposes, and not an overflow-pipe and waste combined, the size need not be more than 1 in. or 1¼ in. Then take an *under-waste* of 1¼ in. diameter lead pipe from it to the nearest rain-water pipe-head, as shown at F and G, Fig. 19; or, if there is no rain-pipe near or in the vicinity of the cistern, or if the rain-water is collected, then take the pipe into the nearest slop-sink trap, making the connection of the pipe with the trap at least 2½ in. below the water-line. And from this brass washer and waste in the cistern bottom, fix a standing pipe, as E, Fig. 19, and continue it up to the top of the cistern, with the *end*, D, *soldered over*, to act simply as a *plug* (an ordinary plug and washer with a long chain would answer the same purpose, but it is not so easy of management as the standard lead plug just named. If the chain-plug were pulled out by accident when the cistern was full of water, it would be difficult

Under-waste.

Standing-plug.

to replace it; but there would be no difficulty with a standard plug, which by force could be instantly replaced).

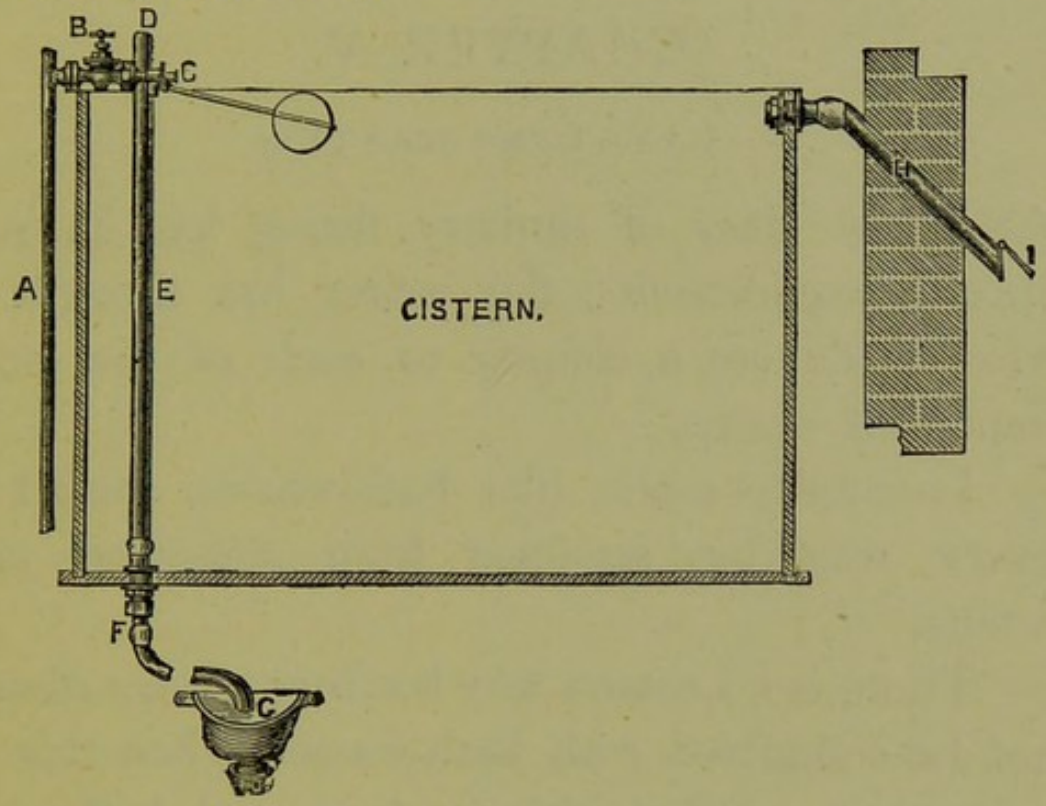



FIG. 19.

No danger in connecting with rain-water pipe.

With an arrangement of this kind, how can any air, foul or otherwise, pass through this pipe, with a *sealed end* at the top of the cistern? The only danger about such a mode is that it may not be properly done; but, at any rate, all cisterns *not* used for drinking-water could have their wastes disposed of in this way, and there would be this advantage about it, that at the same time the cistern was being cleaned out the soil-pipe drains would be flushed out as well.

# CHAPTER V.

## LAVATORY-WASTES.

Every waste has its own special requirements.

As every class of sanitary fitting has its own special requirements, the writer has thought it wise to devote a chapter to each of the more important wastes.

Separate from soil-pipe, &c.

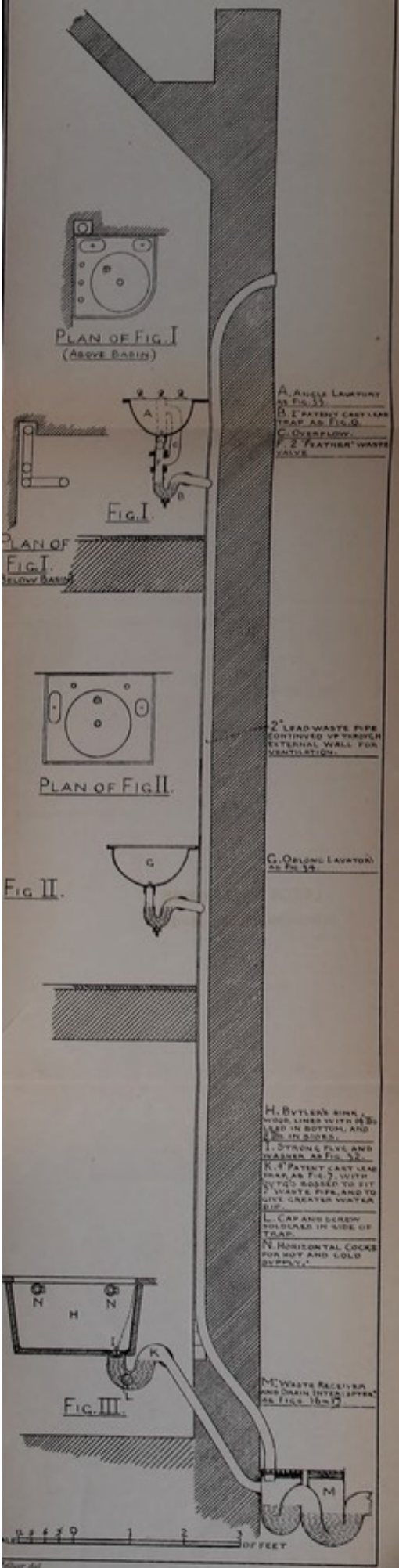
Lavatory-wastes, like bath-wastes, should in every way be separate from soil-pipes and drains.

May be connected with bath-wastes.

There is no reason why lavatory-wastes should not be connected with bath-wastes, when this is convenient. When this is done, and baths are fixed upon the same main waste, and on higher floors as well, there ought to be an air-pipe taken out of the *branch wastes** on the lower floors, and carried up into the air-pipe at the top of the waste, to prevent the discharges from the upper baths unsyphoning the small traps to the lavatories. There can be no danger from such syphoning out of the traps, when the waste-pipe is open at the discharging end, and also at the top through the air-pipe; but if the traps are unsyphoned, the entire length of main waste will be exposed to the house, and the unpleasant air from soapsuds, if

* As shown in Plate 3, and described on page 64.

# PLATE IV.




to face page 46.

not injurious, is offensive, and may as well be made to go outside as inside the house.

Not necessary with lavatory-wastes.

The waste discharges from a wash-hand basin are not quick enough—"tip-up" basins excepted—with an ordinary size waste-pipe to uncharge the traps fixed upon the same waste, and therefore it is not necessary, when there are no baths upon it, to fix air-pipes from the branches to relieve them.

Where there are no bath-wastes to receive lavatory-wastes, they should be taken down, and discharged into a "waste-receiver," as shown in Figs. 16 and 17, pages 23 and 24, with an *open end*, or made to empty themselves over a place properly prepared for receiving such wastes.

Waste never smaller than 1½ in.

As soap is corrosive, and adheres to the pipe, the waste should never be smaller than 1½ in. diameter. And if more than one basin is fixed upon the same waste, the size should be proportionately increased up to 3 in.

Lead trap.

A "patent cast-lead trap," with a cleansing cap and screw, as shown in Plate 4, Figs. 1 and 2, should be fixed immediately under each lavatory basin, and soldered to the branch waste, and this branch waste should be taken into the main waste with as great a fall as practicable.

Main waste turned through the wall at top to act as air-pipe.

The main waste should, in every case, be taken out through the external wall at the top, a few feet above the highest branch waste upon it, to act as a ventilating-pipe. (See Plate 4, showing a lavatory waste-pipe fixed complete.)

# CHAPTER VI.

## BATH-WASTES.

Wastes too small; bath should empty in two minutes.

WASTE-PIPES from baths are nearly always fixed too small to empty a bath in reasonable time, occupying as a rule from five to ten minutes. This is a great inconvenience and discomfort when the temperature of the water wants changing, or a second bath is needed. Of course, it depends as much upon the discharging-cock to the bath as upon the size of the waste-pipe; but there is no reason why a bath should not empty itself in two minutes with a proper provision.

Size and strength.

No bath-waste, as a rule, should be *less* than 2 in. diameter; and as large bodies of hot water pass through it, it should be *stronger* than ordinary waste-pipes.

Should discharge into a waste-receiver.

In all cases, such wastes should discharge into a *waste-receiver* with an *open end*, and it should never be connected direct with a soil-pipe or drain. (See Fig. 4, Plate 3).

Larger wastes where there are several baths.

Where there are *many* baths upon one waste-pipe, and they are much used, as in hospitals, &c., the waste ought not to be less than 3 in. diameter, and the substance should be equal to lead of

10 to 14 lbs. to the superficial foot, according to the work it will have to do.

Great care is required in fixing a *long length* of vertical waste-piping, when it receives the wastes from several baths, to allow for expansion and contraction. A bath full of *hot* water is discharged into the waste from one floor, and this is often immediately followed by a bath of *cold* water from another floor. And if the pipe is confined too much, especially at the junctions with the branch waste-pipes, it is in time sure to break away. Instead of the usual soldered joint *in such cases*, it should be fixed as follows :—

Great care required in fixing to allow for expansion.

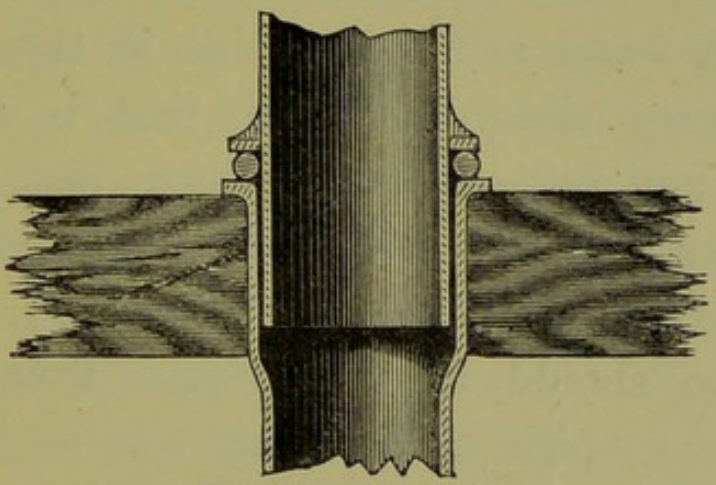


FIG. 20. SECTION.



Such waste-pipes should be fixed on "wood-blocks," one at every 6 ft., and instead of the ordinary soldered flange-joint, the connection should be made by a "slip" socket-joint, to allow for the expansion and contraction of the pipe; and this joint should be made air-tight by an india-

Mode of fixing.

rubber seating (an india-rubber ring) under a flange-joint soldered to the foot of the upper length, as Section, Fig. 20. The branch wastes should be connected immediately above these joints; but the branches should never be confined by brick or cement-work, and should never be very short—it is better to make a bend or two in the branches than have them too short to allow for expansion and contraction in the main waste. If this slip-joint should become defective, and allow air to escape through it, no harm can result, because the waste-pipe is both open at the bottom and top. And it is not like a urinal or soil-pipe waste, where foul matter is thrown down. When this main waste is fixed outside in the open air, an ordinary slip-joint is all that is necessary, without any india-rubber seating, just as a lead rain-water pipe, but with stronger tacks to carry it, on account of its greater weight.

Air-pipe. There should be an air-pipe from the top of this waste-pipe of the same size as the waste-pipe itself. (See Plate 3, Fig. 2.)

# CHAPTER VII.

## SINK-WASTES, ETC.

All plugged vessels should have overflows.

*Plugged Vessels.* — Perhaps this is the best place to remark that all vessels with plugs, whether lavatories, sinks, baths, &c., should have *overflow-pipes;* which should be of sufficient capacity to take away the full charge of the supply to such vessels, and prevent an overflow of water, should the servant leave the supply-cock open. If the water companies insist, there is no reason why this overflow-pipe should not be taken through an external wall, and made to show itself, according to their regulations for baths; but it ought to be sufficient to take it into the waste-pipe from the vessel *above* the trap, or into the side of the trap itself—*well under the water-line.*

Sink-wastes can be connected with slop-sink wastes.

*Wastes to Housemaids' Sinks.*—When these sinks are immediately adjoining a slop-sink, the waste-pipe may be taken directly into the trap under the slop-sink, and disposed of at once. (See Plate 3, Fig. 1; also Fig. 31.) This connection must be made on the *inlet* side of the trap, or 2½ in. below the water-level in the trap—that is, the *top* of the outlet end of the waste, at

the junction, must be 2½ in. or more *under the water*, to ensure a proper dip of water, and to prevent any air in the main waste coming through.

When there are no slop-sinks near it, the waste-pipe should be taken down and discharged into such a "waste-receiver" as Fig. 16, page 23, or a place properly prepared for receiving such wastes, with an *open end.* (See Chapter V., "Lavatory-wastes.")

Strength of waste and size.

The waste-pipe should be of lead of *medium* strength, and never less than 2 in. in diameter, and should be well supported with lead tacks soldered to the pipe, and secured to the wall by hooks made for such purposes.

Trap to sinks.

The patent cast-lead trap is specially adapted for attaching to such sinks and trapping off the wastes, but the size should not be *less* than 2 in., and when the waste-pipe is larger than 2 in., then a 3-in. or 4-in. trap should be used, with a screw-cap soldered to it for cleansing purposes.

Plug-washer, character of grating.

Just a word on the grating to the plug and washer. Gratings with *round holes* are time-wasters and temper-provokers, for the water only dribbles through such things. There ought to be no place for any lodgment round the side of a sink-grating, and whatever grating is used should be such that the waste water can pass through quickly, as in a cobweb grating (see Fig. 32).

Scullery-sink. Evils of grease. The old bell-trap.

*Scullery-sink Waste.*—It is a vexed question what to do with the grease from a scullery-sink. It chokes up traps and wastes, and in time drains as well. And when that *old offender, the bell-trap*, is used, it becomes a further source of evil. The scullery-maid swears, and the poker bangs, until the top—"even a worm will turn"—turns up, and though the bell-grate goes *out*, the smell comes *in*, and noxious gases from the drain too, and then, of course, "*it is a nuisance.*"

Trap to sink. Waste. Air-pipe on top of waste.

Nothing less than a 4-in. patent cast-lead trap, as Fig. 7, page 12, should be fixed to a scullery-sink, with a 4½ or 5 in. brass rim and movable grate over it in the bottom of the sink. And from this trap a 3 or 4 in. lead waste-pipe should be taken through the external wall and discharged into a grease-trap formed *outside the house;* the lead waste-pipe should be made to dip into this water about 3 in., to prevent the end of the pipe being stopped up, &c., by the grease which always accumulates on the top of the water in the grease-trap. From this waste-pipe, which is trapped at both ends, take a 2-in. air-pipe a foot or two up from the waste-pipe, to relieve it, and to keep it as wholesome as possible. Then, if any air from the drain should be blowing through the grease-trap, it will escape through this air-pipe, instead of pushing its way through the sink-trap into the house.

Grease-trap.

This grease-trap should not be too large, nor too small. It must to some extent depend upon the work it will have to do; but, as a rule, 2 ft. 6 in. by 1 ft. 6 in. is large enough for any place.

In brick and cement.

The best way of making this trap is in brick, well lined with Portland cement, and having a dip-stone in the centre, with a water-dip of 3 in. or more.

The inlet compartment should have a movable *grating* over it for cleaning-out purposes, and the other compartment should be sealed over—when any windows or doors are in any way near it—with a piece of York stone, and be well cemented down.

Outside the house.

This trap should always be outside the house, and the nearer the ventilation of the drain is to it, the better.

# CHAPTER VIII.

## VENTILATION TO SOIL-PIPES, WASTE-PIPES, TRAPS, AND DRAINS.

Ventilation.

"VENTILATE! Ventilate! Ventilate!" should be the cry of all occupiers and builders of houses.

Ignorance existing upon soil-pipe ventilation, &c. Bottled-up pipes as full as a gasometer.

Everybody is beginning to admit the necessity of ventilating soil-pipes and drains, but it is astonishing what ignorance exists upon this subject of pipe-ventilation. The old *bottled-up* soil-pipes in some of our country mansions (to tap which would be like tapping a gasometer) do not want ventilating more than the theories of some would-be scientific ventilators.

Soil-pipe ventilation.

*Soil-pipe Ventilation.*—All soil-pipes should be properly ventilated by a pipe, whose size, while varying with circumstances, should in *no case* be less than 2 in. internal diameter.

Demand for air in soil-pipes. Air-pipe same size as soil-pipe.

Where there is an extensive length of vertical soil-pipe, receiving branch pipes from water-closets on several floors, the air-pipe at the top of the soil-pipe should be increased in size in proportion to the number of water-closet apparatuses likely to be used at the same time, and the length of the stack of soil-pipe. It often

happens, in full and large houses, that the contents of several water-closets are discharged at the same time into the main stack of soil-pipe. The *demand for air* in such a case is very great. Wherever this is likely to occur, it is necessary to fix an air-pipe of the same size as the main pipe, or to continue the soil-pipe right up to the outside of the roof.

Acts both as an inlet and outlet.

Many suppose that this *air-pipe on the top of a soil-pipe* is solely for ventilating the soil-pipe—that is, for providing an *exit* for any noxious gases which may be generated in the soil-pipe. But the truth is, this air-pipe is both an *inlet* and an *outlet* pipe.

*Inlet* during the passage of the discharge.

During the discharge of a water-closet, especially if it be a *valve* water-closet, the soil-pipe wants air, and air it will have; for if there is no air-pipe on the soil-pipe, it will pull out the water in one or more of the water-closet traps upon the stack of soil-pipe, and draw in *air* through such traps. This is very easily understood if considered.

A handle of a water-closet apparatus is pulled up quickly, and the contents discharged suddenly through the trap into the soil-pipe. This discharge forms itself at once into a sort of *water-plug*, and in its passage down the soil-pipe acts as a pump-piston, and pulls everything behind it, unsyphoning all the traps on its way

to the drain, if not properly ventilated at the top. If any reader doubts this *demand for air* in the soil-pipe during the passage of the discharges, let him go on the top of his house, where there is an air-pipe, and place his pocket-handkerchief over the mouth of the pipe, and then order a *valve water-closet*—say on the second or third floor—to be filled with water and quickly discharged. He will then have a practical illustration of the pulling power in a soil or waste pipe during the passage of large bodies of water through it, and will return to his arm-chair a wiser, though perhaps a sadder, man, for probably he will have lost his pocket-handkerchief down the soil-pipe.

*Outlet* when soil-pipe is not in use.

When the fittings and pipe are at rest, this air-pipe acts as a ventilating-pipe, and allows any bad air to escape through it to the external air above it. (See Plates 1 and 2, showing a stack of soil-pipe with ventilating-pipe from top to outside of roof.)

Air-pipe at the foot of soil-pipes.

*Foot-ventilation of Soil-pipes.*—Having shown the necessity of a ventilating-pipe from the *top* of a soil-pipe, it remains to consider what advantages are to be gained by a ventilating-pipe fixed to the *foot* of a soil-pipe—*i.e.*, by giving it a *second* air-pipe. The advantages of this second air-pipe, or "foot-ventilation," are greater than

will be conceded, except by those who have gone thoroughly into the matter, and proved its value.

Its value tested practically.

The writer has thoroughly tested the working of this *second* air-pipe during the last seven or eight years upon soil-pipes and slop-sink waste-pipes, and in every case with the utmost satisfaction. Wherever a soil-pipe or slop-sink waste-pipe has consisted of an extensive length of vertical piping (receiving several branch waste-pipes from the various floors), with a water-trap at its foot to intercept the drain, this second air-pipe, or foot-ventilation, has been adopted with entire success.

Two advantages.

There are two important advantages gained by this air-pipe at the foot of a soil-pipe, and—

Air-pipe at foot prevents any disturbance in the various traps.

1. This air-pipe, at the foot of a soil-pipe, prevents any disturbance of the water in the various traps fixed upon the pipe, as it provides an *exit* for the air (driven down by the waste discharges) at the *foot* of the pipe.

When a body of water—as from a *valve* water-closet or slop-pail—is thrown suddenly into a soil or waste-pipe, it exerts two influences, the one a *pulling*, and the other a *driving* force. The former action, the pulling, or suction power, was considered under the head of "Soil-pipe Ventilation," page 56, and this is always *behind* the discharge, or "water-plug;" the latter, or

driving force, we are now considering, and this is always before, or *under*, the discharges.

Waste-discharge passing through a pipe drives all the air in the pipe before it.

The volume of water thrown down into the soil-pipe forms a sort of *water-plug* in the pipe, and whilst it acts as a piston, pulling or sucking everything after it, it also acts as a forcing-plug, and drives everything before it. Now when a soil-pipe is air-sealed at its foot by a water-trap, where is the air in the pipe, which this water-plug is forcing down before it, to go to? The pipe in its normal state is always full of air, and this must go somewhere. The pressure of this water-plug will prevent its passage to the air-pipe at the top of the soil-pipe, and escaping in that way, and so (when there is no air-pipe at the foot) it must force its way through some one or more water-closet traps below the discharge into the house.

How to test the experiment.

If any reader doubts whether the air in a soil-pipe is forced through a water-closet trap, where there is no foot-ventilation, by the discharge of a water-closet on a higher level, let him test it. He can easily do this by going into the lowest water-closet on the soil-pipe, say in the basement, and getting the apparatus removed, and then sending some one to discharge a valve water-closet at the highest point, on the third or fourth floor; and if *he* is not satisfied about it after making such an experiment, his tailor will be—if he stands anyway near the trap—for whatever

was in the trap before he made the experiment will be sent out of it into the room. The writer has seen the contents driven out, in such experiments, to a height of three and four feet above the trap. When this occurs, the house is without any protection as far as this trap is concerned.

An air-pipe at the foot of more value than a dozen at the top.

Some will say, "A *larger air-pipe* fixed at the *top* of a soil-pipe would obviate such an evil;" but the writer's experience is that it would not. An air-pipe as large as a tower will not counteract the *forcing power* of this *water-plug* when passing through a soil-pipe, and more especially if the soil-pipe is only 4 in. diameter; but a small air-pipe at the foot of the soil-pipe at once relieves it—in fact, an inch pipe at the *foot* (provided that the soil-pipe is ventilated at the top as well, by a medium-sized air-pipe) is of more value than a dozen air-pipes at the *top*, each of the same size as the soil-pipe itself. But this *air-pipe* at the *foot* of a soil-pipe ought never to be less than 1½ in. internal diameter; 2 in. pipe will be more effective. This will be found to be large enough for almost any soil-pipe ventilation at its foot.

Constant change of air in the pipe.

2. This *air-pipe* at the *foot* of a soil-pipe is extremely valuable, for by this means a constant change of air is taking place right throughout the entire length of pipe, to render it wholesome, and to prevent any air from becoming stagnant in any part of the pipe. For when the soil-pipe is not

in use, this *second air-pipe* at its foot acts as an air inlet.

With such a system of ventilation to the soil-pipe, or to waste-pipes, it is impossible for noxious gases to be generated in them, for a stream of fresh air is always passing through the pipe. (See Plates 1 and 2, showing two modes of fixing ventilating-pipes at the foot of soil-pipes.)

Air-pipes themselves.

*A word or two on the air-pipes themselves.*— In every case where air-pipes from soil-pipes or drains are fixed *inside* a house, they should be of lead, for reasons explained under "Soil-pipes," Chapter II., page 29. The *wiped* soldered joint can always be relied upon, and we thus prevent any air from escaping through the pipe-jointings to the house.

Top air-pipe never less than 2 in. dia.

The size of the air-pipe at the *top* of a soil-pipe should *never be less* than 2 in. internal diameter; and when there are two closets upon the same stack of soil-pipe, the air-pipe should be increased in size to $2\frac{1}{2}$ or 3 in. When the soil-pipe is of any great length, and there are several water-closets upon it, the air-pipe should be the same size as the soil-pipe itself—*i.e.*, the soil-pipe should be continued up to the outside of the roof.

Size of pipe for foot ventilation.

The size of the air-pipe at the *foot* of a soil-pipe must depend to a great extent upon circumstances. When there is a long length of

soil-pipe, it ought to be larger than when it is only a short length; but a 2-in. pipe is almost large enough for any circumstances, as explained above.

Fixed away from breathing-places.

If there are no windows or doors near, this air-pipe need only be taken a foot or two above the connection with the soil-pipe, with the end *enlarged*, and grated with copper wire, to prevent birds building in it. (See D, Fig. 14.) Then the air can escape out through, or pass into it, according to the needs of the soil-pipe. If there is much traffic near this air-pipe, it should be taken up 15 ft. or more above the ground-level, so as to prevent any one inhaling the air which would be sent out through this pipe when any of the water-closets were in action.

In towns and cities houses too crowded to fix such pipes through a wall.

But this method is generally impracticable, except in country houses, where there is ample space. In towns and cities, where the houses not only elbow each other, but keep one another upright by leaning against each other, it is impossible to stick out a pipe from one house without sticking it into the side of another. In such circumstances another plan must be adopted. Take a 2-in. lead pipe from the foot of the soil-pipe (as near the drain-intercepting trap as possible), and continue it up, inside or *outside* the house, according to circumstances, and terminate it in the *open air* at the most convenient

place, remembering that the nearer the outlet, or inlet, of an air-pipe is to the soil-pipe, the more perfect will be the ventilation; but it is important to keep such outlets away from all breathing-places, for a soil-pipe or waste-pipe, even ventilated in this way, can be offensive (especially when in use), and send forth an unpleasant smell.

Positions of air outlets important.

The *positions* of such *outlets*—as, in fact, of all ventilating-pipes—should be well considered. In no case should such outlets be near a drinking-water cistern, or the bad air emitted by these pipes will be imbibed by the water in the cistern. (See "Water-contamination," Chapter XV., page 120.)

When this second air-pipe, from the foot of a soil-pipe, is carried up above all windows, as just explained, it can be made to serve a double purpose, by receiving the branch air-pipes from the various water-closet traps fixed on that stack of soil-pipe. (See Plate 1, showing such an air-pipe fixed from the foot of a stack of soil-pipe, and receiving the branch air-pipes from traps, complete).

*Trap-ventilation.*—When two traps are fixed upon one waste-pipe without a ventilating-pipe to relieve them, and give them air, like two negatives in one sentence, they destroy each other.

Trap-ventilation to prevent unsyphoning.

*All* water-closet traps, slop-sink traps, and traps where large bodies of water are thrown quickly down, should be ventilated, to prevent one trap syphoning out another. This is not so essential where there is a *double* air-pipe in the waste—one at the top and one at the foot. But where there is this *second* air-pipe going up to the roof, as described above, there is no great additional cost in this. All that is necessary is to take a *two-inch* lead air-pipe from the top of the trap—*the outlet side of the dip*—and branch it into the air-pipe from the foot of the soil-pipe, as it is on its way up to the roof (see Figs. 1, 2, and 3, Plate 1).

Offensive air from water-closets. Branch ventilation.

Everybody must have noticed on using some water-closets, where the ventilation in the pipes was imperfect, the offensive gust of air emitted into the room on pulling up the handle of the water-closet apparatus. But where there is this *branch ventilation* from the trap under it, *except it is a pan water-closet apparatus*, this cannot occur, for what air is in the pipe or trap, when it is disturbed by the discharge from a water-closet, is sent up through the air-pipes from the trap to the roof.

Advantages of trap-ventilation.

This *trap-ventilation* is not without its advantages. It forms a valuable auxiliary to the "foot-ventilation," in preventing one trap from syphoning out another; but it also saves itself from being

unsyphoned by its own discharge. And such an advantage is worth gaining, for when a water-closet or slop-sink is fixed upon a long length of horizontal piping, say, during the passage of a discharge through this, it is without any ventilation on the trap-side at all, for the passing contents fill the pipe, and shut out whatever ventilation there may be in the main waste into which it is branched; and, then, the want of air behind this discharge gives it a suction power, as explained elsewhere, and a tendency to syphon out the water in the trap, leaving it uncharged. But where the trap is ventilated all this is obviated. Moreover, it provides an escape for any bad air or impurities thrown off by the water in the trap, and prevents anything being generated in the pipes, as it gives a circulation of fresh air throughout every part of it. (See Plates 1 and 2.)

*Slop-sink Waste Ventilation.*—Waste-pipes to slop-sinks should have the same system of ventilation as soil-pipes.

*Ventilation to General Wastes.*—Waste-pipes emptying themselves with an *open end*—and all general wastes should do this—do not require a *second* air-pipe, or *foot-ventilation*, for they ventilate themselves at the foot: the end of the pipe

Ventilation to general wastes.

being open, any air driven down by a discharge at once escapes into the open air. And, as the pipe is not in any way connected with the drain, there is not the same *necessity* for ventilation at the *top* of such wastes. But there is a great advantage in it.

Air-pipe at the top advantageous.

The *top-ventilation should not be dispensed with*, especially if there are several traps upon the same waste, as the air-pipe at the top prevents any disturbance of the water in the various traps when one is in use. Of course, when large bodies of water are thrown down, the action will be the same as explained in Chapter II., page 58; but such wastes as we are now considering, as a rule, do not receive any sudden discharges, at any rate sufficient to keep the pipe filled up to the last drain of water in the vessel discharged. Moreover, such ventilation allows a constant change of air in the entire length of waste-pipe to keep it wholesome.

The ends can be taken anywhere.

Such air-pipes can be taken just through the wall,* and left almost anywhere, as nothing injurious can come out of a pipe so open and free to the external air, though it is as well to take it a few feet away from any window or door, to prevent the warmer atmosphere inside the house "sucking" in the colder air from such pipes. (See Plates 3 and 4.)

* See Plate 4.

Drain-ventilation.

*Ventilation to Drains.*—Drain-ventilation is so closely connected with soil-pipe ventilation, and so essential to the proper working of the whole, that I cannot forbear saying a few words upon this important subject, though I may be hardly considered to have any concern with it in this treatise. But what would be the use of putting a damping course right round the walls of a house, and leaving a water-spring in the centre? or, what would be the use of filtering drinking-water into a cistern and leaving a cuttle-fish at its bottom? So what would be the use of purifying all the soil-pipes and waste-pipes *inside* a house by a complete system of ventilation, and then leaving a *cuttle-fish sort of drain* outside to generate noxious gases, and from its foul retreat to send up poisonous air through all these pipes?

Cuttle-fish drain.

Every drain should have two ventilating-pipes.

The drain to every house should have *two ventilating-pipes at least*, one at the lowest, and the other at the highest point, or as near these points as possible, so that a constant current of air may pass throughout the drain to keep it wholesome.

These air-pipes should be taken up against the side of the house (or tree) ten or twelve feet above all breathing-places, and twenty or thirty feet away from all windows.

When a house is in full occupation the air from such pipes is extremely offensive, and care should

be taken that they pour out their unpleasant contents in such places as not to offend anybody.

The vitiated air from ventilating-pipes beats down like smoke from chimneys.

Some people imagine that if such ventilating-pipes are taken a foot or two above a window, there will be no offence from them. Such people must be *near-sighted*, or wear opaque glasses, or they would have noticed smoke beating down on a dull heavy day, and in gusty weather, to a great many feet below the chimney-tops. And what occurs with smoke from the chimney occurs with the vitiated air sent out of these ventilating-pipes; they should therefore be taken high enough to avoid any offence from them. Of course, the nearer such outlets are to the drain the more effectual will be their ventilation.

Long drains cannot be too much ventilated.

In large houses, especially in the country, where there is often a long length of drainage, it is impossible to have too much ventilation in the drains.

Care taken to avoid long branches of drain.

In planning the drainage system round a large house, great care should be taken to *avoid long branches from the main drain*, unless such branches can be ventilated, for no length of drain-pipe should be without ventilation, or the means of a current of fresh air passing through it.

Make rain-water pipes act as air-pipes.

It is very advantageous and economical to make (wherever it is practicable) rain-water pipes act as ventilating-pipes to the drain. As these pipes are *outside* the house, it is of little moment

if the joints give way a little, but they should be well stopped when near any window.

Rain-water pipes flush the drains.

But such rain-water pipes will not dispense with the two ventilating-pipes before referred to, for during a great down-pour of rain they would be doing their more legitimate work, and cease their double action of ventilating and conducting. Then again, rain-water pipes help to flush out the drains and keep them clean and wholesome.

Air-pipes from drains *outside* the house.

No ventilating-pipe from a *drain* should be taken up *inside* a house if the drain can by any possibility be ventilated by carrying up an air-pipe *outside;* but rather than not have any ventilator at all, it is better to take a pipe through the house or anywhere.

When *inside* should be in lead.

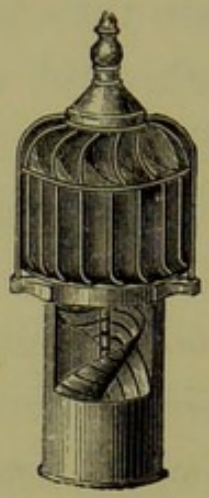
But when such pipes are taken up *inside* the house, they should be of *lead* with *wiped soldered joints*, to insure their being absolutely air-tight and sound in every part.

Means for creating a current of fresh air in the drain.

The following plan is a very good one for insuring a current of fresh air in the drain. From the two ends of the drain, the highest and lowest points (the extreme ends), fix a ventilating-pipe, and continue same up above all breathing-places, and away from all water-cisterns. At the top of one of these ventilating-pipes fix an *Archimedean screw ventilator*, as Fig. 21, to draw the air out; and on the top of the other ventilating-pipe fix a *revolving cowl*, as Fig. 22 (to act the reverse

Archimedean screw ventilator and cowl.

way of chimney-cowls), with its mouth *against* the wind—*i.e.*, for the wind always to be blowing in at one end of the drain and to be drawn out at the other. The screw ventilator should be



* Fig. 21.

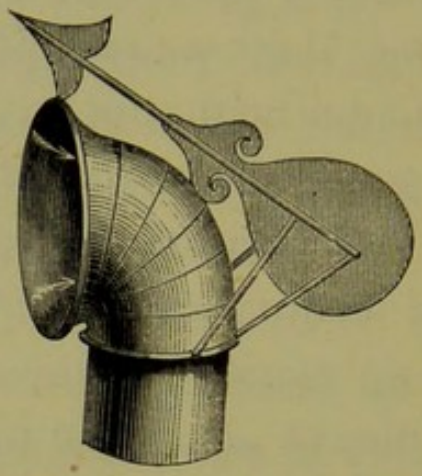


Fig. 22.†

on the ventilating-pipe at the lowest end of the drain (remotest from the house), the air going with the stream of waste water passing through the drain where it is practicable, but of course this arrangement can be reversed. An arrangement of this kind was fixed by us at a mansion in Norfolk, about three years ago, to ventilate a water-closet on the ground floor; with two pipes taken up to the roof, with an air-inlet cowl, as Fig. 22, on one, and a cowl with a reverse action on the other.

* Howorth's Patent Revolving Archimedean Screw Ventilator.

† Beard, Dent, and Hellyer's *Air-inlet Revolving Cowl.*

# CHAPTER IX.

## WATER-CLOSETS.

Water-closet rooms next external walls for light and ventilation.

It may be worth while, on the threshold of this subject, to say something as to the rooms where the water-closet apparatus are fixed. Water-closets should always be placed next an external wall for ventilation and light. The rooms should be *lofty* and airy, and, if convenient, should have a small lobby at the approach for privacy. *No water-closet should be built without proper means of ventilation*, and if this cannot be effected by the window, a zinc tube can always be made to conduct fresh air into the room by fixing an air-brick in the external face of the outside wall, and taking a zinc pipe, say 6 in. by 3 in., from the air-brick to the skirting of the water-closet room. A brass hit-and-miss ventilator should be fixed to this zinc tube (whether it comes through the skirting, or is brought up through the floor), to shut off the current of air when it is too great. It is not only necessary to bring fresh air *into* the room, but also necessary to provide a *means* of *escape* for the air *in* the room; and this should be done at the highest point or ceiling-line, so that any odour left in the room after the usage of the water-closet

Proper means of ventilation.

Inlet of air at the lowest point, outlet at the highest.

may escape without finding its way into the house.

A water-closet apparatus, however efficient, will not remove the evil of a bad trap or soil-pipe.

*Water-closet Apparatus.*—Many imagine that an offensive *water-closet* can be remedied by simply fixing a new *apparatus* in lieu of the old one. As well might a policeman put a new hat upon a drunkard's head and expect it to make him sober, as for a plumber to put a new water-closet apparatus upon a foul or defective trap and expect thus to make a wholesome water-closet. "What's bred in the bone will come out in the flesh" is an old adage; and, what's bred in the trap or soil-pipe will come out into the closet, unless a proper escape is made for the gases to go another way.

A wholesome closet.

A wholesome water-closet does not so much depend upon the apparatus as upon the traps and soil-pipe in connection with it, though of course the character of the water-closet apparatus is by no means unimportant.

Water-closet apparatus in every variety, but two classes, the "valve" and "pan," most in use.

Water-closet apparatus are made in every variety of shape and size, and fitted up under almost every principle that ingenuity can devise or genius invent. But the *two* classes of water-closets most in use are the *valve* and the *pan* closets. The former takes its name from the *valve* which keeps the water in the basin (and not from the *supply-valve* attached to the apparatus, as many suppose, and thereby make serious mistakes

for the pan-closet is also fitted up with a supply-valve attached to it). The "pan-closet" takes its name from the *copper pan* which keeps a small quantity of water up in the basin. The valve water-closet apparatus is chiefly fixed in good houses for private and visitors' use, and the pan for servants' use. Let us examine the merits of each.

The *valve* water-closet apparatus (see Section, Fig. 23) consists (apart from the working fittings) of a deep glazed earthenware basin, A, Fig. 23, which is kept about two-thirds full of water by means of a valve, B, at the bottom, and from this valve there is a short conducting-pipe,* C, Fig. 23, into the trap. No part of this apparatus can therefore in any way become foul or offensive, for there is no place where soil can accumulate. And if the handle E, Fig. 23, is only properly pulled up, *i.e.*, as far as it will go, at each usage of the water-closet, for the valve to be drawn back as shown in Section, this basin can be kept as clean, and as free from unwholesome matter, as a toilet basin in a bed-room.

On using this closet the soil passes at once into water, and directly the handle is pulled the

* This conducting-pipe, or "container" as it is called by the trade, is made in cast-iron. These conductors are much cleaner when *porcelain enamelled* on the inside, and the additional cost is very trifling.

deposit is carried right away by a good body of water (retained in the basin for the purpose) into

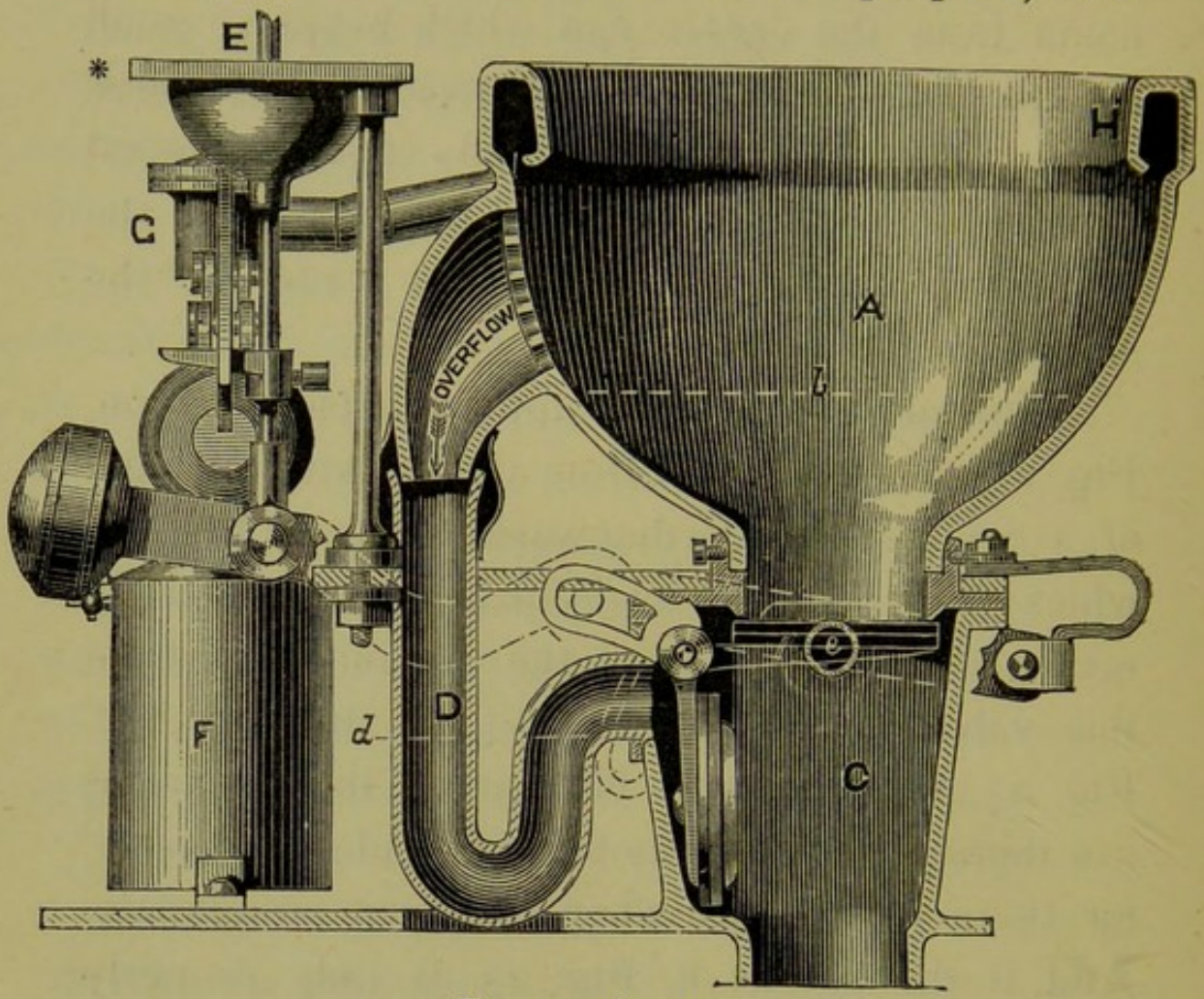



FIG. 23. SECTION.

A. Earthenware water-closet basin, with flushing rim, H.
*l.* Water-line in basin.
B. Valve to keep water in basin.
C. Conducting-pipe into trap.
D. Overflow-trap.
E. Pull-up.
F. Copper Bellows Regulator, with regulating cork.
G. Supply Valve.
*e.* Air-pipe to ventilate space between basin-valve and water in trap.

* Sunk dishes are great receptacles for dirt, and when made of brass are difficult to keep clean. It is a great improvement to have them encased with porcelain-ware (to match the basin) as they not only look nicer, but are easier cleaned. The best plan is to have a "pull-up" ivory knob connection, to work through the stile of the water-closet seat, as shown at P, Plate 3, and D, Plate 2.

the lower regions, without touching the basin or soiling the apparatus.

Of course, such a closet requires a good supply of water to keep it clean, and the trap and soil-pipe, &c., attached to it, wholesome, but so does every water-closet apparatus.

Valve closet wants proper usage.

No doubt a *valve* water-closet wants proper usage, but so does a chronometer. But with careful usage it will work *many years* without needing anything done to it, and will certainly last as long as a *pan* water-closet. And when the basin-valve is fitted up with an india-rubber seating, as Fig. 23, if the water leaks out of the basin after it has been in use for some time, all that is necessary to remedy this is to change the india-rubber seating, which anybody can do, and this seating or india-rubber flange, when so wanted, can be sent through the post by writing to the maker of the water-closet.

If with india-rubber seating, valve easily repaired.

To be good, a *valve* water-closet is somewhat expensive, but better pinch elsewhere than here—do away with a piece of needless furniture, or leave out some of the questionable ornamentation, rather than not have a good wholesome water-closet.

The most wholesome and efficient closet extant.

A *valve* water-closet is the most clean, wholesome, and efficient extant, nor is it likely to be superseded, for there is no part of it that can, with proper usage, become foul and nasty, or get out of order.

And if the plumbing-work in connection with this apparatus is done under the principles laid down in this treatise, it might be fixed, as it has been, in a bedroom, without the slightest risk to one's health, though it is always advisable to partition it off from the sleeping apartment.

When fixed in a bedroom.

When this closet is fixed in, or immediately adjoining, a bedroom, for invalid's use, there should be a ventilating-pipe, as *e*, Fig. 23, say an inch in diameter, taken out of the conducting-pipe, c, Fig. 23, and carried through the *external wall*, with a perforated end to prevent any strong current of air blowing into this compartment in frosty weather, and freezing the water in the trap. This pipe can be taken anywhere, so long as it is a few feet away from any window, as there is nothing injurious to come from it, but it must not, on any account, be connected with any other pipe —air-pipe or what not. (See Plate 1, Fig. 2, showing this air-pipe from the apparatus fixed complete.) But it is only necessary to ventilate such an apparatus when it is fixed immediately adjoining a bed-room or living-room.

Trap independent.

See Plate 1, Fig. 2, shewing a valve water-closet apparatus fixed complete. The trap is quite independent of the water-closet, as, in fact, all good closets should be.

Difficult to understand how such

*Pan* water-closet apparatus (see Section, Fig. 24). The writer has always been puzzled to

understand how this apparatus has become so great a favourite with the public, and been so extensively used by the craft. The only bliss that the public can have about so foul a thing is

a closet should be used.

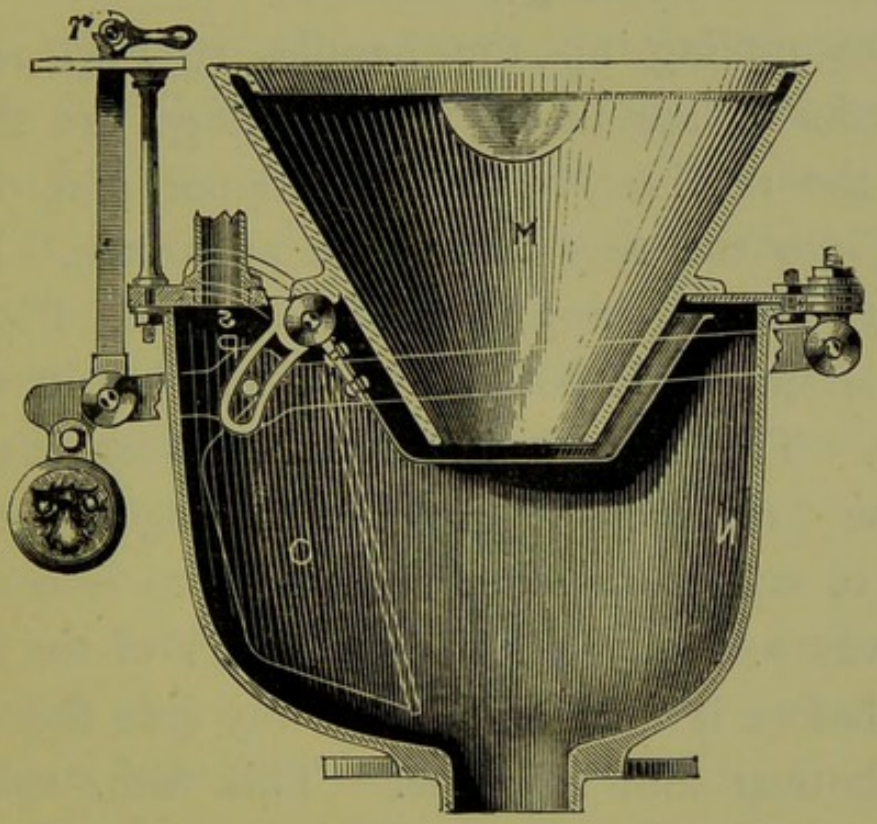



FIG. 24. SECTION.



"ignorance" of its nature, but what excuse to make for the plumber I know not, except that it was the custom of their fathers to fix a *pan-closet*, and this has become a law with them.

Description.

The *receiver*,* N, Fig. 24, is a large cast-iron receiver, or vessel, for the copper pan, O, to work inside, and to receive its contents when the water-closet is used. The vessel, O, is a copper

* This receiver is called by the trade a "container"—well, it does contain all sorts of nastiness after it has been in use a little while.

pan* (tinned on the inside) for keeping water to a depth of from 3 in. to 4 in. in the basin, M. This basin is made of glazed earthenware in various shapes and colours, and with "fan" water-spreaders or flushing rims.

Principle of working.

On pulling up the handle, *r*, Fig. 24, the contents of the basin, M, after usage, are thrown into the receiver, N, by the copper pan, O, and pass into the trap under the apparatus. But a glance at this apparatus in Section, Fig. 24, will show the impossibility of keeping it wholesome. The deposit is dashed against the side of the "receiver," N, by the tipping out of the pan, O, and is splashed from side to side of the receiver and all over the *outer side* of the *copper pan*, before it finally finds its way into the water-closet trap and soil-pipe. This filth, splashed about over the receiver and copper pan, is left to corrode, and to be added to by each usage of the closet, for it is impossible to get at it to clear it away, and especially the *under or outer side* of the copper pan, the *back part* of the *receiver* where the copper pan is hinged, and the *under side* of the top, P. Moreover, the basin, M, though made of pottery-ware, gets completely corroded with soil and urine up to the water-line on the *outer side* next the copper pan; and there is

Filth splashed about over the apparatus and left to foul it.

Basin gets corroded and nasty.

* This apparatus takes its name from this "pan," and not from the basin, M, Fig. 24.

no means of getting at this, nor is there any friction in the passage of the discharge to wash it away. The only way to thoroughly cleanse a closet of this description is to take it to pieces and burn off the corrosion over a fire.

Apparatus not shut off by the copper pan.

It is supposed by many that the copper pan, O, Fig. 24, when at rest, shuts off, by the dip of the basin into its water, the "container," N. Well, it does so, *but very imperfectly*, for any bad air in the "container" can always escape through the holes in its side where the axis is hinged. And if it does not escape there, it can easily find its way through the *air-hole* in the top of the "container," unless there is an air-pipe from it, which is very rarely the case. This air-hole in the top of the "container" is to give vent to the apparatus when in action, to allow the discharge to pass freely from the basin into the container.

Air-vent.

Air-bound.

Without this *vent* the *container* would be air-bound, or nearly so, by the water-dip of the basin at the top, and of the trap at the bottom, at the first moment of the discharge, and also when at rest, except that the joints at the axis bearings are never quite air-tight.

The filthy container exposed to the house when in action.

Moreover, every time the handle of such a water-closet is pulled the whole of the *filthy container* is entirely *exposed to the house*, for the copper pan is drawn back on one side by the action of the closet, thus leaving it to send out

what foul air is displaced by the body of water passing through it. The "puffs" of nasty smells which such apparatus send up, after they have been fixed for some time, are enough to make one wish for the old-fashioned privy again.

Air-pipe from it.

Where such an apparatus is used, an *air-pipe*, *s*, Fig. 24, should always be taken from the vent-hole at the top of the container through the external wall, and its diameter should not be less than $\frac{3}{4}$ in. This air-pipe* must not be connected with any other ventilating-pipe, to soil-pipes, traps, or what not, but must go out separate to the external air.

Enamelled iron containers.

These water-closets are very much improved by using "containers," or receivers, N, Fig. 24, *enamelled with porcelain on the inside*, and the extra cost of this is only about seven or eight shillings.

Earthenware ditto.

These closets are still further improved by *white glazed earthenware* "containers," but these are liable to breakage in transit and in fitting them up, unless great care is taken.

Pan-closet being con-

Having condemned the *pan water-closet ap-*

* To remedy the evil of a bad-smelling container a plumber is sometimes called in, and he at once fixes an air-pipe from the top of the container, and takes it into the air-pipe of the soil-pipe. The evil, by such means, is only augmented, and the remedy becomes worse than the disease —the writer knows of many such cases—the thing is so palpable that it is too absurd to explain.

*paratus* entirely, it becomes necessary to find a substitute for it, since it is quite clear that a *valve-closet* is too expensive for general use. There is no difficulty, as far as *out-door* water-closets are concerned, for there is always plenty of air around such closets to blow away any unpleasant smell arising from an imperfectly-cleansed basin. But in the *in-door* water-closets the character of the water-closet basin must be more fully considered, as any unpleasant smell arising here would soon spread over the house.

demned, a substitute to be found.

The most important part here—in the servants' *in-door* water-closet as well as in the best water-closet in the house—is the trap. And it is quite as important to have an efficient trap to the common as to the best water-closet in the house. For it is of little use to provide proper means for excluding the soil-pipe air generated in one part of the house, and leaving other parts exposed by an *inefficient* trap.

The most important part of a water-closet is the trap.

In deciding upon the kind of water-closet to use for servants, workmen, &c., where a *valve* water-closet would be too expensive, or be likely to receive too rough usage, there is nothing more simple, or cleaner, or more durable than a white glazed earthenware basin. Such basins are made in every variety of shape and size, but many are made without any adaptation for the work they have to do.

Servants' water-closet.

As this basin is simply for conducting the deposit into the trap, it is obvious that the smaller it is the better, and the less surface there is about it the cleaner will it be kept; for the supply of water to it will not have to travel over so much ground, but will be more confined and concentrated upon the work it has to do, viz., that of cleansing the basin and washing out the trap.

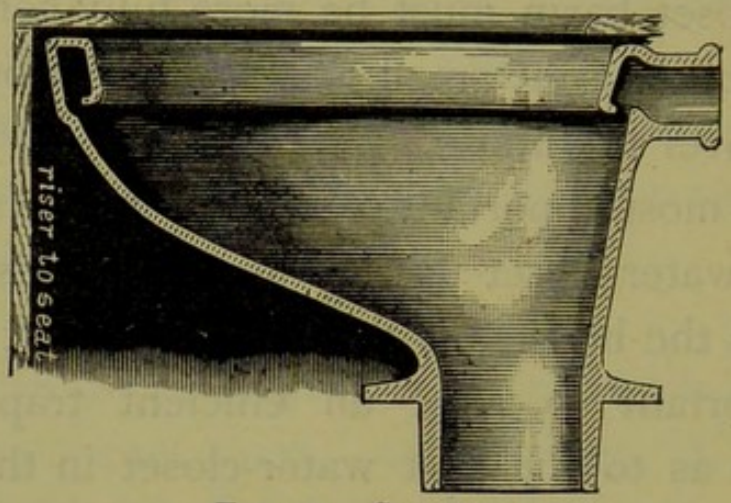



FIG. 25. SECTION.

Self-cleansing water-closet for the employé class.

*Patent "Artisan" Water-closet Flushing-rim Basin.*—This is a basin (see Fig. 25, Section), which the writer has specially designed for artisans' dwellings, and places where it is important to have a *simple* and *self-cleansing* water-closet, and where a *valve* water-closet, as Fig. 23, would be too expensive.

It is made for the *deposit* to *pass at once into the water of the trap without touching* the basin.

Small to get thoroughly washed.

It is as small as practicable, so as to confine the water, and give it as little surface to wash as possible.

The flushing-rim round the top of the basin is so regulated, and the configuration of the basin is such, that the water immediately on coming into the basin converges towards the outlet, and concentrates itself upon the trap, to drive everything foreign out of it. Moreover, the trap is independent, and can be of lead or earthenware, according to circumstances, and fixed *above the floor-line*, where it can be got at, at any time, without disturbing anything. (See Plate 1, Fig. 1, showing this water-closet fixed complete.)

Lead trap when up-stairs. Earthenware trap elsewhere.

When *up-stairs*,* this trap should be in lead, because its connection with the soil-pipe can be made by a *wiped* soldered joint, but when fixed in the area, or anywhere *where the door opens to the external air*, the jointing with the soil-pipe or drain-pipe is not so important, if the drains are well ventilated, for any escape through a defective jointing at the outgo of the trap would blow away. And as the trap would probably in such positions be directly connected with a drain-pipe, there could be nothing better than *glazed earthenware traps*, which being of the same material, could be securely and easily jointed to the drain-pipe. The great evil of earthenware

* *All "up-stair" water-closet traps*, and traps to fittings *inside* a house, are important. Whether the trap is under the *best* or *commonest* water-closet, it must be effectual, as also must be the connection of the *outgo* with the soil-pipe. Of what use is it to lock the *front door* and leave the *back door* unlocked?

traps is that they are made with an insufficient water-dip, or water-lock, to be of any value as a trap.

Traps for fixing to the "artisan" closet.

A special glazed earthenware trap is made to go with the "artisan" basin, with a water-dip of not *less* than 1½ in. for *out-door* positions, and when connected directly with the drain. When connected with a lead soil-pipe, a lead trap, as Fig. 7, can be fixed as shown on Diagram, Fig. 1, Plate 1.

FIG. 26.

Conical-shaped closet-basins ought never to be used.

"*Hopper*" *Closet-basins.*—The old-fashioned "hopper" water-closet basin, conical-shaped, as Fig. 26, whether the "long" or "short" hopper, ought never to be used, even in the very poorest water-closet. The soil on usage *falls on the side of the basin*, and as the basin is generally *dry*, hardly any amount of water-

pressure brought to bear upon it will wash it off. There it is left a "fixture," like the basin itself, which the *out-going* tenant is generous enough to leave behind him for the *in-coming* tenant to see, and have the benefit of without anything to pay.

Dribbling supply.

The *dribbling* supply of water which is generally laid on for such water-closets is hardly enough to *wet* the basin—it never attempts washing it. How is it possible for such closets to be kept clean and wholesome?

It is astonishing to think that such water-closet basins as just described should be used by the hundred, when a "Beggs'" or a "Sharp's" water-closet basin costs but a trifle more.

"Beggs'" and "Sharp's" water-closet basins.

"Beggs'" and "Sharp's" water-closet basins are infinitely superior to the "Hopper" closets just described. They are much the same in principle and shape as the "artisan" water-closet; the latter has a different flushing-rim from Beggs', and is *straighter at the back for the deposit to escape the side of the basin.* Sharp's basin is larger at the back, and more tapering than Beggs' basin, but the flushing-rim is better regulated for the distribution of the water-supply.

"Wash-out" water-closet basin.

*Patent "Wash-out" Water-closet Basin* (see Section, Fig. 27).—This water-closet was invented by the writer, but patented by Mr. Rowley, potter (Mr. Woodward's representative), to whom it was entrusted to be made. This water-

closet basin is specially designed to hold a body of water in the bottom of the basin, to receive the soil and prevent its adhering to the sides of the basin. The flushing-rim round the top of the basin is such that the water is carried round to the front, where it streams down and

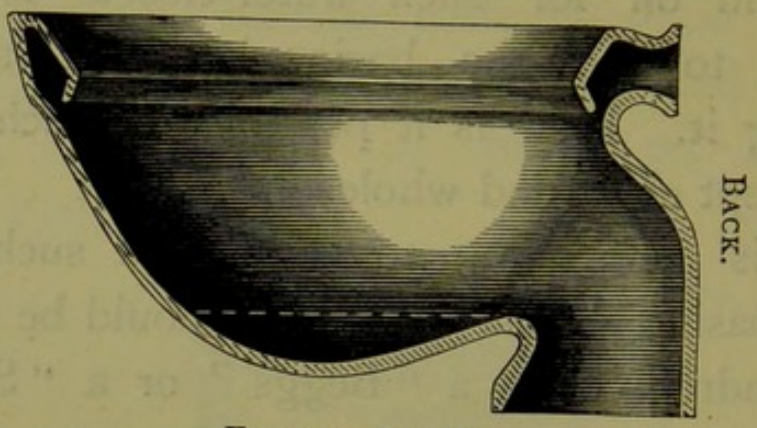



Fig. 27. Section.



washes the contents of the basin out into the trap under it.

The *outlet* of the basin being at the *back*, where everything is exposed to view, is somewhat objectionable. And, as the water has to travel round the rim from the back to the front, its power is diminished, but with a good pressure of service-water upon it, it makes a very good closet.

Water-battery water-closet basin.

*Patent "Double-inlet," or "Water-battery" Water-closet Basin* (see Fig. 28).—This "water-battery" water-closet is *similar* in principle and shape to the "wash-out" closet-basin, and has in

fact grown out of it. The writer has patented it, as he considers it an improvement on the "wash-out" closet.

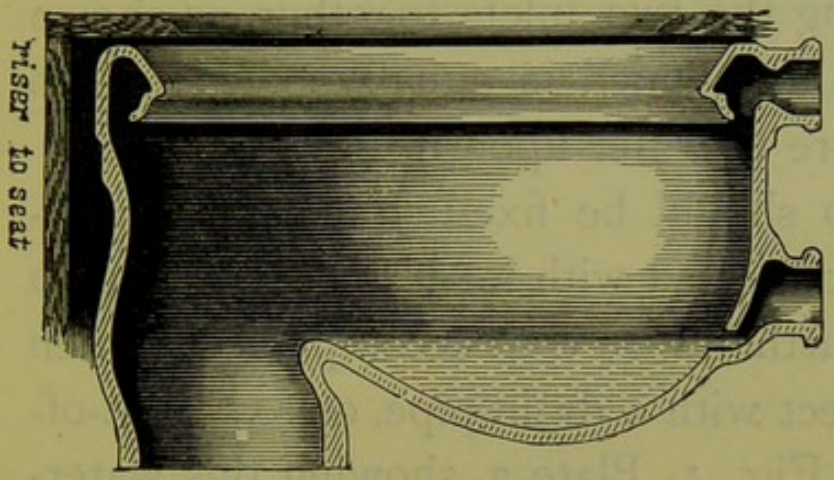



FIG. 28. SECTION.

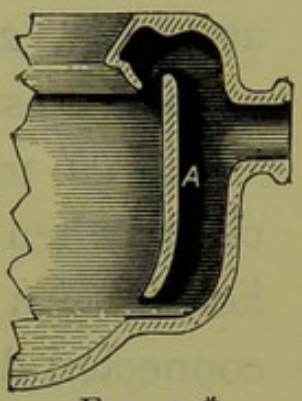



FIG. 29.*

It is made to retain a body of water in the bottom of the basin, as shown in Section, Fig. 28, for the *soil on usage to pass at once into water;* and the *outlet* is in *front*, and screened, therefore, from sight by the seat.

Water retained in the bottom to receive the deposit.

The water is brought in on the *opposite side* from the *outlet*, by a separate inlet-arm (see Section, Fig. 28), just on the level of the standing water in the basin, and when the handle of the closet, or valve-pull, is used, this inlet drives everything out of the basin. At the same time the water is taken round the top of the basin, through a hollow rim, by another inlet from the same service-pipe, and the perforations in the rim are so regulated that whilst the basin itself is thoroughly

Inlet for service supply.

* Fig. 29 shows another mode of bringing in the water, and which is equally effective when under a good pressure.

washed out, a *direct* stream of water is poured down into the trap, to drive everything foreign out of it. The basin is also made with *one inlet-arm*, by a pipe connecting the two inlets together, as shown at A, Fig. 29, and which is equally effective with a good pressure of water upon it.

Lead or earthenware trap under it.

A *lead* trap should be fixed under this water-closet when connected with lead soil-pipe inside a house. An earthenware trap accompanies it when connected direct with a drain-pipe, or fixed out-of-doors. (See Fig. 1, Plate 2, showing this water-closet fixed "up-stairs.")

Variety of closets in use.

There is such a variety of water-closets now in use that to attempt to describe each individual closet would take more time and space than the writer can afford. Let it suffice to say that nearly every water-closet made comes under the principle of one or other of those already described.

It is not my intention here to name the best makers of water-closet apparatus, for each maker has his own speciality, but the workmanship and material in some (as in everything else in this world) are so vastly superior, that it does not require a finger-pointer to point this out, but an open eye to see it.

Common sense in selecting the right closet.

All that is wanted in selecting a good water-closet is common sense. *Go to a good house of business*, and select a closet according to the prin-

ciples laid down in this chapter, and you will have done one great thing towards obtaining a wholesome water-closet; but remember that the most important item in this matter is the plumbing-work in connection with it.

# CHAPTER X.

## WATER-CLOSET SAFES AND SAFES UNDER CISTERNS.

Safes under water-closets.

*Safes under Water-closet Apparatus.* — To prevent damage to ceilings by an overflow of water from the apparatus, either through a "stoppage of the water-closet" or a break-down of the supply-valve, a safe should be fixed under each water-closet apparatus, on the floor-level, when the closet is *up-stairs*, or over an important ceiling.

Made of lead.

This safe should be made of lead, 4, 5, or 6 lbs. to the superficial foot—according to the character of the other work in connection with it. It should be turned up at each of the four sides from 4 to 6 in., and soldered at each angle. It should be made a few inches larger than the external size of the apparatus, so as to cause the water overflowing the apparatus to fall inside the safe.

Soldered to the trap.

When the trap is *under* the floor, the safe should be carefully soldered to the trap; but if it is fixed *on* the floor, with a horizontal branch soil-pipe from it, the safe should go under the trap, and be soldered round the outlet or branch soil-pipe, unless it stands high enough to admit the safe without interfering with its "stand-up."

*Waste-Pipes from Safes.—The old method* of fixing these wastes is very objectionable, nor is it of any value as a waste. The pipe, generally only of a diameter of ¾ in., is taken from the safe right into the water-closet trap. Now, when a water-closet gets stopped up, it is generally by a stoppage in the trap. Of what use can this little safe-waste be in such a case? And if the supply-valve should break down at the same time, where is the overflowing water to go but on the ceilings?

Old method.

There is another objection to this mode of disposing of this waste. When it is connected with the water-closet trap, this waste-pipe is often inserted into the trap about the water-level, so that the smallest disturbance of the water in the trap allows any air in the soil-pipe to escape through this pipe into the house.

Connection with the trap in wrong place.

*The more modern method* of fixing a separate trap under the safe, and connecting it with the soil-pipe by a 2-in. waste-pipe, is a great improvement on the old plan, but this is only an imperfect way of providing means for taking away the overflow from a closet.

The more modern method.

There is no fear of any *overflow* of water with a 6-in. D-trap, and a 2-in. waste-pipe from it into the soil-pipe; but there are *two* evils attending this method.

Two evils.

Trap becomes unsyphoned.

1. This safe-trap is *charged* by the *usage* of the water-closet in connection with it, and by this closet only; so that when other water-closets are in use upon this stack of pipe, and this water-closet remains in disuse, the water in this trap becomes unsyphoned, or it evaporates, and any air in the soil-pipe pushes its way through the *uncharged* safe-*trap* into the house, and will continue to do so until its own water-closet is used and the "weeping-pipe" recharges the trap.

Weeping-pipe stops up.

2. The "weeping-pipe"—which is connected at one end with the service to the water-closet basin, while the other end is made to discharge into the safe-trap—often fails in its service. A little sediment gets into the pipe, and after a time it becomes stopped up, and fails in its charges to the safe-trap, which soon becomes dry, and leaves the house exposed to the soil-pipe.

Proper way of fixing safe-wastes.

*The proper way of fixing safe-wastes* is to take a pipe from the safe and continue it through some external wall of the house, *without connecting it in any way with the soil-pipe or any other pipe.* (See Figs. 1 and 2, Plate 1, showing such a waste-pipe fixed complete.) The shorter this pipe is, the better, and care is required in fixing it, or the ceilings adjacent to the water-closet had better be insured. Its size must depend upon the size of the *service* to the water-closet, and the *pressure* of

Size of pipe.

water upon the supply-valve to the apparatus. But a 2-in. lead waste-pipe is large enough for *any* waste to a water-closet safe.

Outlet end lower than the inlet.

The outlet should always be a foot lower than the inlet end; and the inlet end should be opened out a little larger than its diameter, and soldered to the safe with a counter-sunk soldered joint, so as to give all the water-way possible into the pipe, and to ensure a pressure upon the copper flap, to keep it open when the closet is overflowing.

Copper flap in end of pipe.

A copper hinged flap should be soldered on the discharging end of all such waste-pipes, to prevent birds building in the pipe, and also, when from water-closet safes, to prevent the wind blowing through the pipe—for it can whistle through this pipe in a very objectionable way at times. (See Plate 2, Figs. 1 and 2.)

Cistern safes and wastes.

*Cistern-safes.*—All slate and iron cisterns, when fixed inside a house and over important ceilings, should have lead safes under them a few inches larger than the cistern itself, and the wastes from them should be treated in every way as described for water-closet safes.

# CHAPTER XI.

SINKS.—SLOP-SINK—PATENT "WATER-SHOOT" SLOP-SINK—HOUSEMAIDS', OR DRAW-OFF, SINKS—SCULLERY-SINKS—VEGETABLE-SINKS—OVERFLOWS.

Place for emptying slops.

*Slop-sink.*—A slop-sink, *i.e.*, a place for emptying slop-pails, is not so essential as a water-closet; but no house of any dimensions should be without one, not only as a convenience for the servants and a means of saving labour, but also as a protection to the water-closet apparatus.

On every floor in large houses.

In all large houses, mansions, club-houses, hotels, &c., there should be one slop-sink (or more) on every floor, and especially on the bedroom floors, and where much washing is done in keeping them clean.

When there are no slop-sinks servants throw them down the water-closets.

When there are no slop-sinks, the servants are sure to empty their pails down the nearest water-closet, and this they do, generally, leaving the slops to find their own way through the basin, trap, and soil-pipe, without even pulling up the handle of the apparatus to give it a free passage, or taking the smallest trouble to wash it away—no matter what may be the contents of the slop-pails. Then these corrosive matters from the chamber utensils are left in the water-closet where they

have been discharged, to foul the apparatus and trap for hours, and to send forth their unpleasant smell until the next legitimate use of the water-closet occurs.

But if no proper places are provided where the servants can empty their pails, what are they to do with the slops? Are they to take them down to their own water-closets in the area—which are certainly better adapted to receive them? What! lug a pail of slops right down through the house to splash their own water-closet seats all over! Well, that is hardly like the English servant of the period.

Many ways of forming a slop-sink.

A slop-sink can be formed in many ways. It can be fitted up by itself, or attached to an ordinary housemaid's washing-up sink; and thus the two may be combined (see Fig. 31). If cheapness is a consideration, it may be fitted up in a most inexpensive and simple way—in addition to the cost of the waste. All that is necessary is a pottery-ware basin (white inside), large enough to receive a pailful of slops, and for this an ordinary water-closet hopper will do very well. There should be a lead tray over it, standing up about 6 in. at the back and the two sides, and about 2 in. in the front, to prevent splashings over it; and this tray should fall towards the basin with the lead bossed down a couple of inches into it.

"Water-shoot" slop-sink.

*Patent "Water-shoot" Slop-sink.*—This is a sink, Fig. 30, which the writer has specially designed for receiving slops from pails and chamber utensils.

It consists of a deep hemispherical-shaped basin with a 3-in. clear water-way outlet at the

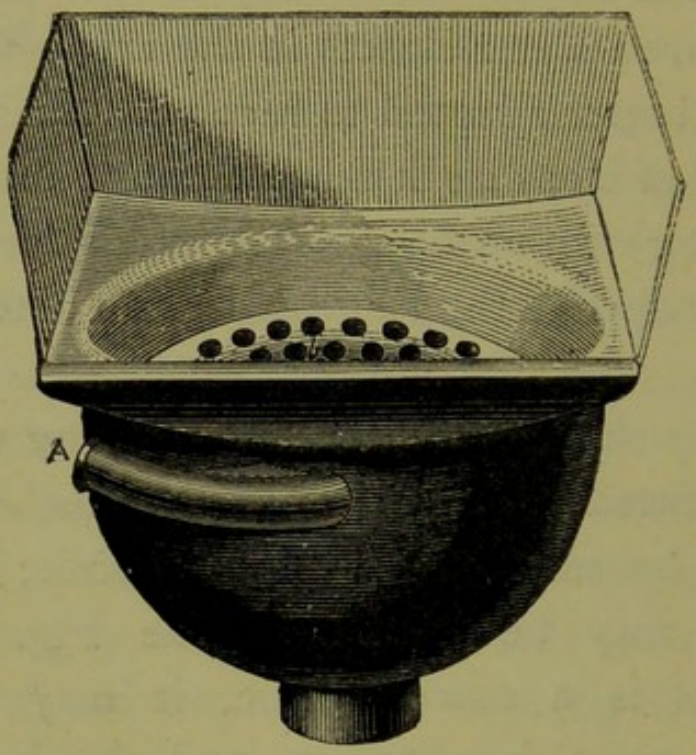



FIG. 30.



bottom. At the top of the basin three sides are made to stand up about 6 in. high, to prevent splashings over the basin, and the other side is lowered down to 2 in. high, to receive slop-pails, &c.

Grating or screener.

It is fitted on the inside with a strong white glazed earthenware screener, or grating, to arrest flannels, soaps, brushes, or anything which might accidentally be thrown away with the slops.

A means is provided, through an inlet-arm, A, Fig. 30, in the side of the basin, for flushing out the sink with water, and keeping it clean. Means for flushing.

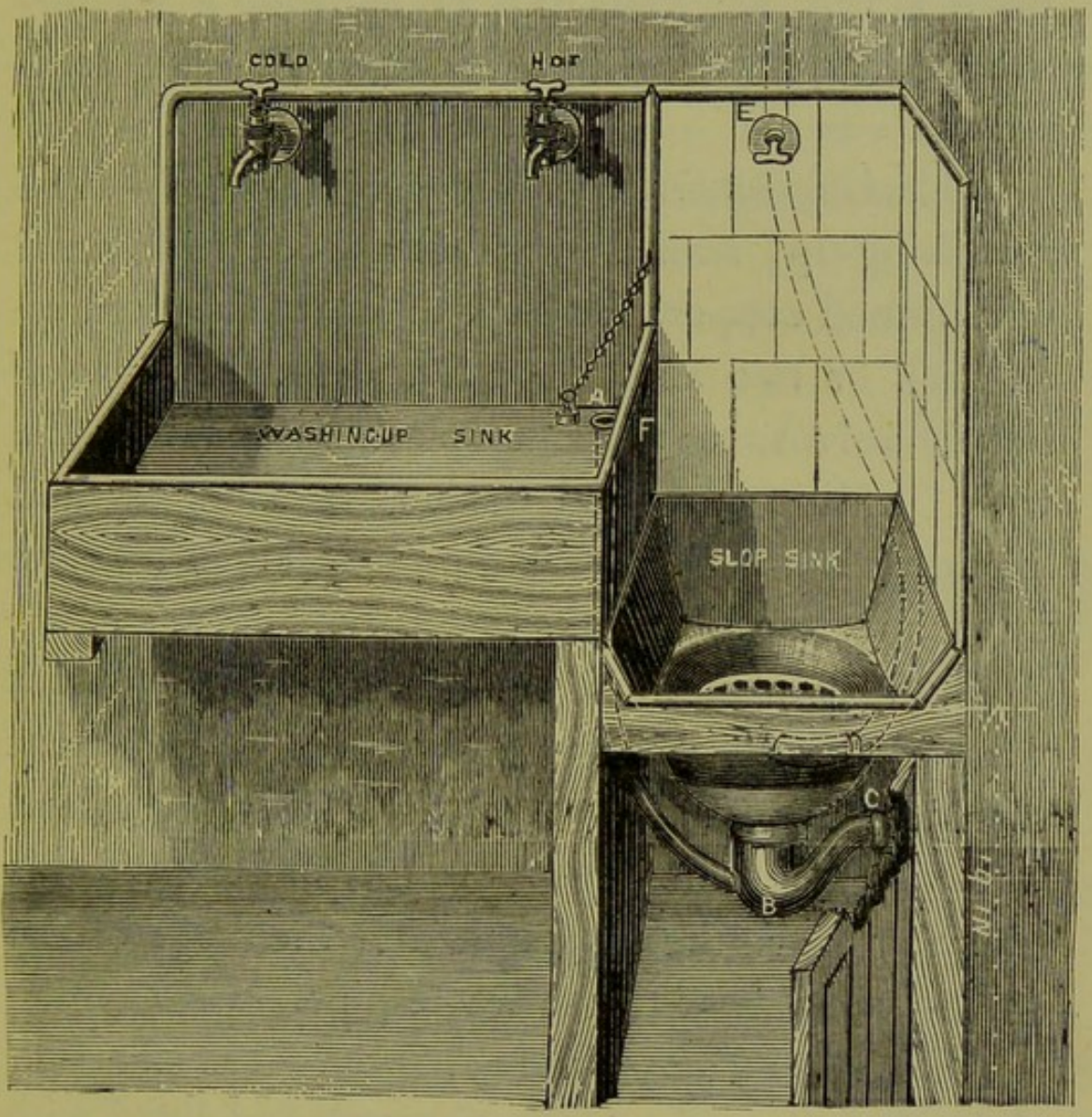



FIG. 31.

The sink itself is made of cast-iron, enamelled all over on the inside with *white porcelain enamel*, to prevent corrosion, and make it a clean sink. The configuration is such that there is no place of lodgment in any part of the sink for anything to remain in it to make it unwholesome. Porcelain enamelled on the inside.

Lead trap under the sink.

This sink, when fixed up-stairs or inside a house, having a lead waste-pipe from it, should always have a lead trap under it, as shown on Plate 3, Fig. 1. (See Fig. 31, showing a "water-shoot" slop-sink with a housemaid's sink combined.)

*Washing-up Sink and Slop-sink combined.*—The "washing-up" sink, Fig. 31, is a wood sink, lined with tinned copper, the back of which is taken up an inch or two above the hot and cold draw-off supply-valves, to prevent splashings against the wall. A is a plug and washer, as Fig. 32, and from this a 2-in. lead waste-pipe is taken into the trap under the slop-sink.

The slop-sink in the diagram is a patent "water-shoot," as Fig. 30, with a 4-in. patent cast-lead trap, B, Fig. 31, as Fig. 7. A lead "seating" is soldered on the top, or inlet, of this trap, to receive the slop-sink, and the *outgo* of the trap, C, is *soldered* to the waste-pipe.

Draw-off sinks.

*Housemaids', or Draw-off, Sinks.*—Housemaids' sinks are generally made of wood, and lined with lead, because they can be quickly made and easily adapted to any position. They can be made at an hour's notice, of any size and shape.

Lead not dangerous to crockery-ware.

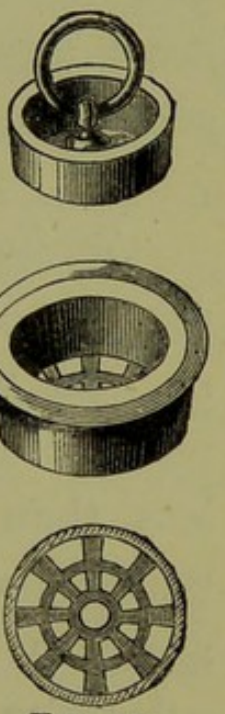
When the substance lead is of the proper strength, they are as durable as stone or slate, and are not liable to breakage like other sinks. Moreover, as the material is yielding, lead sinks

are not so dangerous to crockery-ware as slate or pottery-ware, &c.

These sinks should never be fitted with the common *pantry plug and washer*. The holes in such washer-gratings are small and round, and the waste water takes too long to run through, and these things are made so flimsily that servants soon destroy them.

Common pantry plugs too flimsy.

All such sinks should be fitted with a *strong* sunk plug and washer (see Fig. 32), with a grating formed in the shape of a cobweb in the bottom, for the water to run quickly through, and for durability.



Strong plug with cobweb grating.

Bottoms to slope to waste.

FIG. 32.

All sink-bottoms should be made to slope to the waste, which should be fixed in one of the two back angles of the sink, so as to be out of the way of anything to be washed up in the sink.

There is often a very poor economy shown in the lead linings to sinks, 5-lb. and 6-lb. lead to the superficial foot being the general rule, and 7-lb. and 8-lb. the exception. Now the cost of the stronger is so very little more than the weaker, that it is a wonder that the lighter lead should ever be used for such purposes. There are only a few superficial feet in an ordinary sink, and the extra cost of 8-lb. lead in lieu of

Poor economy in using thin lead.

6-lb. in a bottom would rarely exceed half a crown—and this amount the plumber would require to be paid simply to get him to *look* at the light sink after it had been in use a few months, and what he would want to *repair* it goodness knows.

Substance lead to use with hot-water supply.

Sinks with hot-water draw-offs over them, and when they have much work to do, should have 7-lb. lead sides and 10-lb. bottoms, or, if cost is no object, 8-lb. sides and 12-lb. bottoms.

Tinned copper sinks.

*Scullery-maids' Sinks*, where there is rough usage, and a great deal of rough work in connection with hot-water washings-up, should be made of deal, and lined with tinned copper not

Substance.

less than 4 lbs. to the superficial foot in the bottom, and 2½ lbs. at the sides. These sinks are very durable, and as they are of a smooth substance they can be kept clean and wholesome, and they are nothing like so damaging to crockery-ware as material of an unyielding nature, as slate, iron, stone, and pottery-ware, &c. Fig. 31 shows a "washing-up" sink lined with tinned copper as just described.

*Slate sinks* for washing vegetables.

*Vegetable-sinks.*—Sinks for washing up vegetables should always be made of slate, in which there is nothing poisonous. These sinks do not want enamelling. They should never be less

than a foot in depth, and there should be a partition across the centre, with a plug-and-washer grating in each compartment, so that both compartments may be filled with water at pleasure, and the one used for washing the vegetables and the other for rinsing them.

Overflow-pipes.

*Overflows to Sinks.*—All sinks with *plugs and washers* over the waste should have *overflow-pipes*, which should be of sufficient capacity to take away the water-supply of the service-valve or valves, should they become defective, or be left open by accident. The cost of such an overflow is nothing in comparison with a ceiling; and all that is wanted is to take a 2-in. pipe out of the top of the sink and continue it down to the trap under the sink.

The pipe should be opened out where it is connected with the sink to, say, 3 in. or 4 in. by 1½ in. or 2 in., to give all the water-way possible without decreasing the depth of the sink.

# CHAPTER XII.

## BATHS.

Baths as scarce as fountains in a desert.

INSTEAD of a bath in a house being the exception, it ought to be the rule. But one may as well look for a fountain in a desert as for a bath in any of our old English houses or modern ones even, below a large rental. It is not too much to say that there are scores of villages in England

Villages without a bath.

without a single bath in the entire village, except, perhaps, in the rector or squire's house. And many of our towns are scarcely better off, I am afraid, in this respect.

The cost frightens.

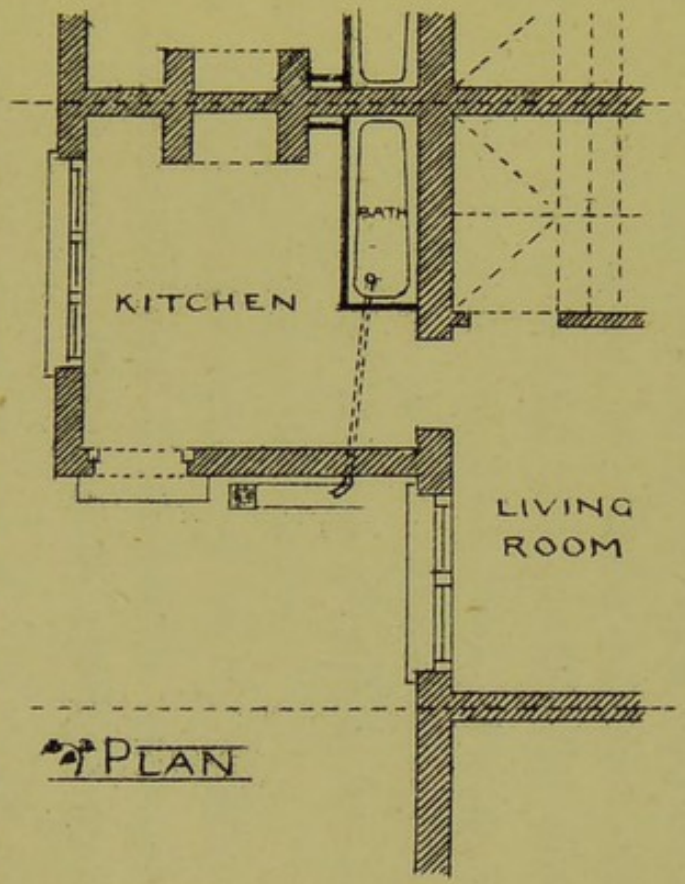
To mention a bath-room to a landlord or householder is to paint before his mind's eye, in a single word, the Bankruptcy Court. And to talk about having hot-water circulation throughout a house is to plunge landlord and tenant into *hot water*. And yet it is astonishing how far a sovereign will go, especially when drawn out into a *thin gold wire*.

Can be fitted up at any price.

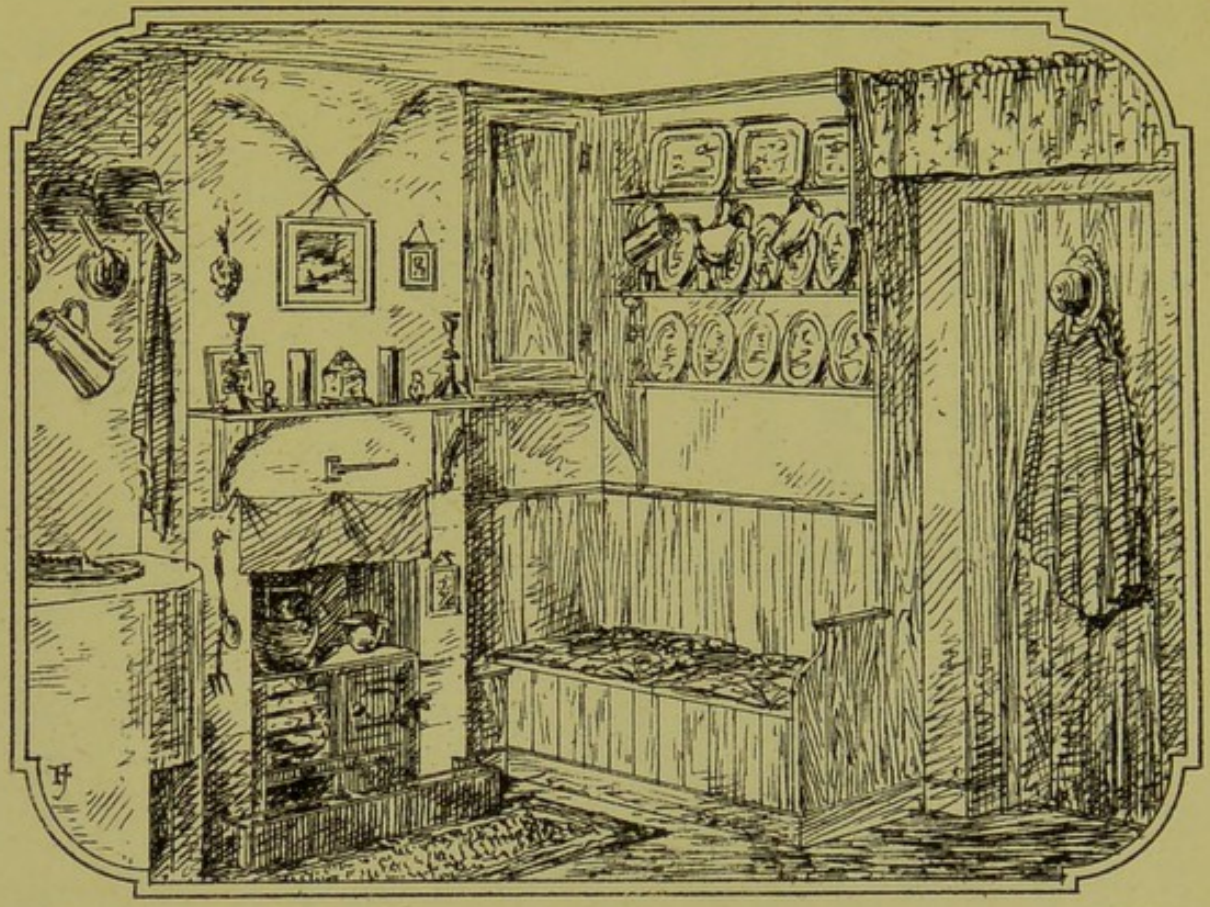
Instead of having to pay £30 or £40 for fitting up a bath, as many imagine, this can be done at any cost between £10 and £100.

A make-shift bath better than none.

If a West of England broadcloth is too expensive, fall back upon fustian, for any coat is better than no coat at all. And if a luxurious




PLAN



# BATH IN KITCHEN.

PLATE 5.

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bath-room, with all its convenient appurtenances, cannot be afforded, have a *make-shift* one; for "cleanliness is next to godliness," and any kind of bath is better than none at all.

A bath in every house.

Everybody should be induced to cultivate a habit of personal cleanliness by a bath fitted up with hot as well as cold water laid on, if possible, in every house. And the poorer the family the greater the need, perhaps, for such a bath.

Difficult to find any spare room for a bath except in the kitchen.

It seems the fashion for *large* families to crowd themselves into *small* houses, because, I suppose, "necessity has no law" with them, and they are only too glad to get any house entirely to themselves. It is difficult in such cases to find a room, or part of a room, that can be spared for fitting up a bath. But rather than not have a bath in the house, it would be better to fit one up in the kitchen. Nor is this such an unreasonable place as at first seems, for in such houses as we are considering there would be no servants, and if there were, it would not materially alter the case, as they could be sent into another part of the house when any of the adults wanted a bath. The advantages of such a position for a bath would be somewhat as follows :—

Advantages of such a position.

Kind of bath to save expense.

1. It could be fitted up at a trifling cost. The bath should be of cast-iron, enamelled on the inside, taper shape, with circular ends, and

rounded bottom, to take as little water as possible. These baths can be purchased for about fifty shillings, are much more durable than zinc or tinned iron, and do not require any wood "cradle" to support the sides. A plug and washer should be fitted in the bottom, and from this a $1\frac{1}{4}$-in. or $1\frac{1}{2}$-in. lead waste-pipe should be carried through the external wall, and discharged with an open end into a stone channel, leading into a surface-trap. This waste would not require any trap, but it must not be *connected* with any other waste, or with the drain.

Enclosed to look like a seat.

2. The bath could be enclosed in a wood casing, to look like, and to answer the purpose of, a *seat;* the cover should be hinged to the back rail, and made to open against the wall, and to button there with wood buttons, when the bath is in use.

Close to boiler for hot water.

3. Being close to the kitchen boiler, a few cans of hot water could be thrown into the bath without any labour or extra expense in heating it.

Near the cold-service.

4. As the service-pipe to the feed-cistern (which supplies the boiler) would be close at hand, it would be inexpensive to lay on a cold-water service-pipe with a draw-off tap to the bath.

Always a fire for comfort.

5. As there would always be a fire in the kitchen, the children could have the comforts of it when taking their Saturday night's bath,

without any extra cost or additional labour to the poor overworked mother. (See Plate 5, showing bath fixed in a kitchen.)

Baths for good houses.

Having explained the most economical way of providing a bath in the poorest houses, a few words will suffice on baths for good houses, remembering that the chief object in writing this treatise is to deal with the media, or conductors, or what may be considered as the vital parts of all such fittings. (See Plate 6, showing a best bath fitted up complete.)

Copper baths.

*Copper Bath.*—There is nothing better for good houses than a "first quality" taper *copper bath* (see Plate 3, Fig. 2 and Fig. 2A), with circular ends and rounded edges, tinned and well enamelled on the inside. It is *very durable*, and after years of wear, can be re-enamelled, and made as new for about a fourth of its cost, and when past repair can be sold as old metal for about an eighth of its original price.

Porcelain baths for hospitals, not so good for private houses.

*Rufford's or Finch's Porcelain Baths* are clean and durable, and nothing can be better for public baths or hospitals; but for private houses they are too heavy and cumbersome, and take too long to heat to the same temperature as the water, when a hot bath is quickly wanted.

Different lengths required.

Again, these baths are only made 5 ft. long; but as all men are not of the same stature, baths should not all be of the same length. A 5-ft. bath may be long enough for a Zaccheus, but how is a Saul to stretch himself out in such a bath? though a 5 ft. 6 in. bath is long enough as a rule for the present race of men, for there are *not* giants in these days.

Marble baths.

*Marble Baths*, when cut out of the solid, look extremely nice, and their appearance in the summer-time is very inviting; but in the winter, when a hot bath is needed, or when a bath is needed for invalids, they not only look cold, but strike so.

Variety of bath-valves and cocks.

There is such a variety of *bath-valves* and *bath-cocks*, that it will not be worth while to examine the merits of each. Let it suffice to say that *valves*—of whatever description—are always easier to "open" and "shut" than metal *ground-in plug-cocks*. The "screw-down" and "diaphragm" valves take so many turns of the handle to open or shut, and the water-way is so obstructed, that they are never likely to be extensively used, though they are very easy to open.

*Valves.*

"Quarter-turn" valves.

The "*quarter-turn*" *round-way valve* gives a larger water-way, and has this additional advantage—it opens and shuts at a quarter-turn of the circle.

(See Plate 3, Fig. 2, showing this kind of valve fixed.)

Bath-cocks.

When *plug-cocks* are used, they should be made of *gun-metal,* especially for the hot-water supply. Where there is a great pressure, gland stuffing-box cocks, with solid bottom, should be used—the only objection to them is the difficulty of opening and shutting them after they have been in disuse for a short time.

When *valves* are used, the waste-valve should never be less than 1¼ in., but 1½ in. or 2 in. is necessary when the bath is required to be quickly emptied.

Feather waste-valve.

When plug-*cocks* are determined, the waste-cock should be 1¼ in. as a rule, and round water-way. Or if a bath is wanted to empty in less than two minutes, a 3-in. *feather waste-valve* should be used with a pull-up connection through the top. This valve is easy to open, and will give a clear water-way equal to a pipe 2 in. in diameter, and is not so expensive as a large size waste-valve or cock.

Rapid supply and quick waste.

The service and waste pipes, with their valves, should always be considered, so as to provide for a quick supply and discharge. The service-water should never be brought into the bath through the waste-pipe, or the dregs of the previous bath may get washed back again.

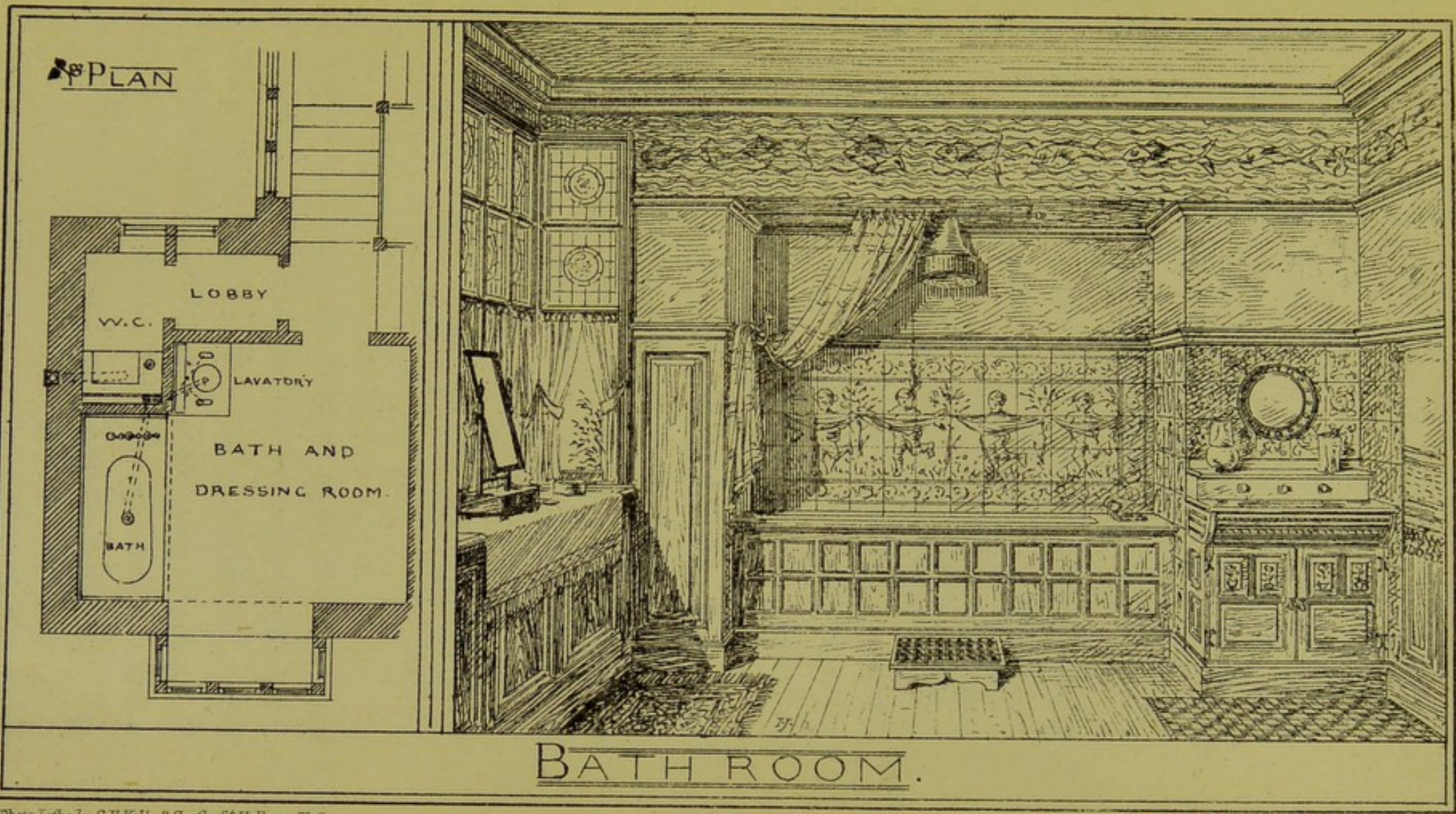
Service inlets; hot water not too high, to avoid steam.

According to the Metropolis Water Act the supply-pipes must come into the bath above the water-line, but this is too high for the hot-water service, as when a hot bath is needed, the water, if very hot, would fill the room with *steam*. The pipe should be brought into the bath a few inches above the bottom (in either of the two sides, or at the foot), and when the water is very hot the bath could be filled up to a few inches above the hot-water inlet with cold water before turning on the hot-water service; this would prevent steam from coming into the room.

Waste connections.

The waste-connections of baths are generally made too small, and then, whatever size the main waste may be, the bath will take a long time to empty. There should be a *large* tinned copper saucer fitted on the under side of the bottom of the copper bath, about the centre of the bottom, with four or five rings of holes in the bottom over the saucer, and from this saucer there should be a 1½-in. or 2-in. tinned copper waste-pipe leading to the waste-valve at the head or foot, as the case may be, to give a good passage of water to the main waste directly the waste-valve or cock is opened to discharge the bath. (See Plate 6. See "Bath-wastes," Chapter VI. Also Plate 3, Fig. 2., showing bath fixed, with waste-pipe, &c., all complete.)

Large for the water to run away quickly.




# BATH ROOM.

PLATE 6.

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# CHAPTER XIII.

## LAVATORIES.

Wash-hand basin on the ground floor.

It is a great convenience to have a wash-hand basin on the ground floor of all middle-sized houses—near the entrance-hall or garden-entrance—to save taking casual visitors up-stairs, &c.

And in dressing-rooms.

In large houses, where expense is no object, it is a great saving of servants' time to have a lavatory in all the dressing-rooms of the principal bedrooms, with hot and cold water laid on.

And bed-rooms in hotels.

In hotels and places of that kind the expense of fitting up a lavatory in connection with each bedroom would soon be saved in servants' labour. And there would be this advantage with this arrangement, that hot water would always be ready at hand without the trouble of ringing the bell for it, or waiting for a servant to fetch it.

Care in fixing traps and wastes.

It would require great care in such cases to see that the traps are sufficiently water-dipped, and that the waste-pipes are well ventilated, and disconnected from all other wastes and drains. If the plumbing-work is done in accordance with the principles laid down for "Lavatory-wastes" in

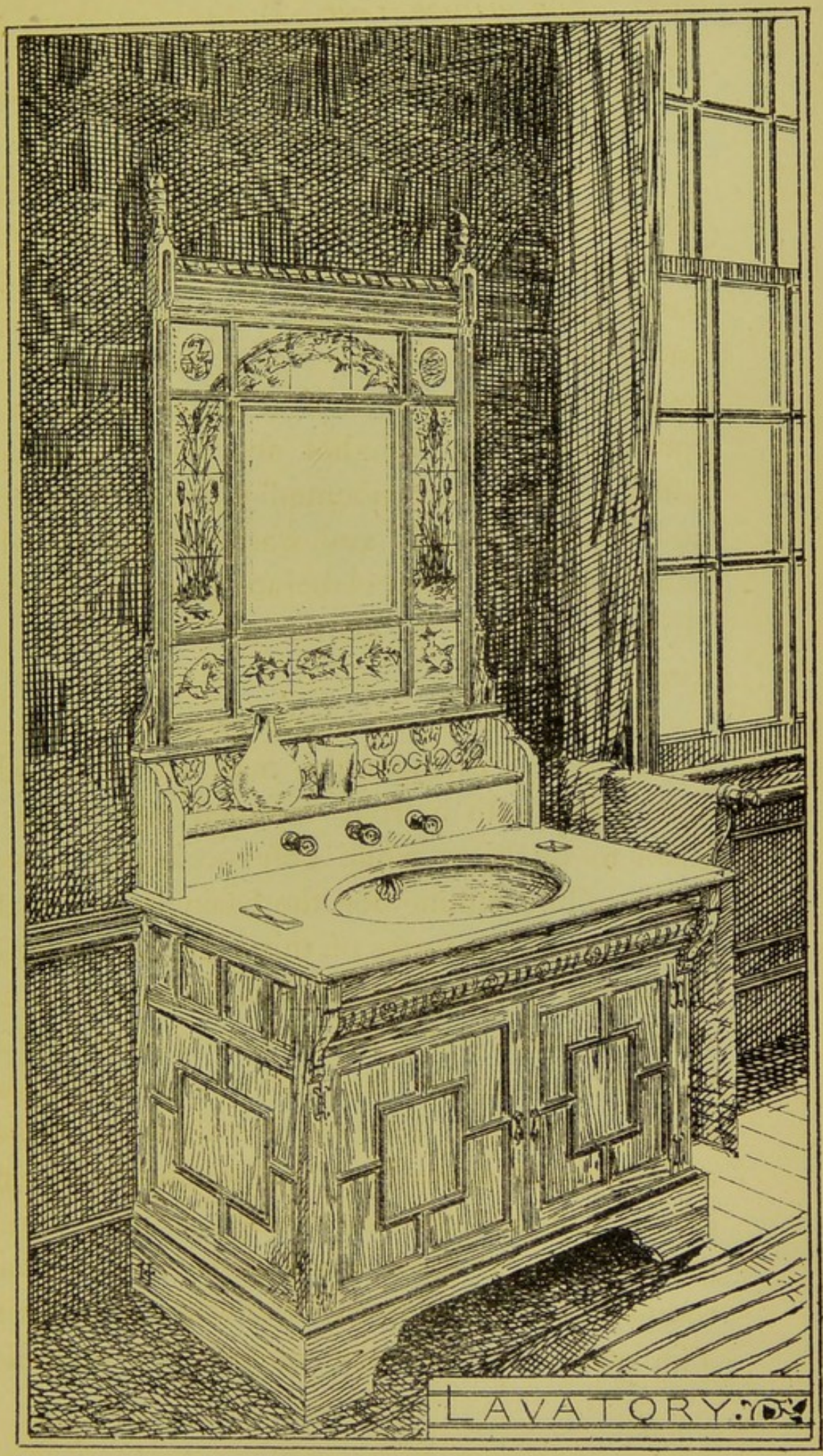
Chapter V. there will be no danger of any bad air or noxious gases from such fittings.

Great variety of styles.

Lavatories can be fitted up in a variety of styles, from a simple plug-basin, with a cold-water draw-off tap over same, to a gold fancy wash-hand basin, with marble top, and sinkings in it for soap and brush, and waste-pipes or drainers from same, together with marble shelf at back for brush and comb, pier-glass, &c., hot and cold water being laid on with ivory-mounted fittings for opening and shutting supply and waste-valves, the whole being enclosed in an elaborate piece of furniture. (Fig. 1, Plate 7, shows a lavatory of this kind.)

Angle lavatory and fittings.

Fig. 33 shows an *angle lavatory* (made in white glazed earthenware, marbled, or in white and gold) with a front rounded corner for the basin to be large while only occupying a small space. The sinking for the basin is deeper than in the usual lavatories of this kind, and there is a sinking for soap and brush, with drainers from each into the basin, and a small skirting at each of the two sides. Under the basin is a shelf for a chamber utensil. The supply-valves for hot and cold water are opened by a pull-up knob connection on the top, and are self-closing, or they can be made to stand open when there are no water companies to interfere and the water is bountiful. The waste-valve is also opened by a pull-up



LAVATORY.

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knob on the top, and will discharge the basin in *five seconds.* (See Plate 4, Fig. 1, showing this lavatory fixed.)

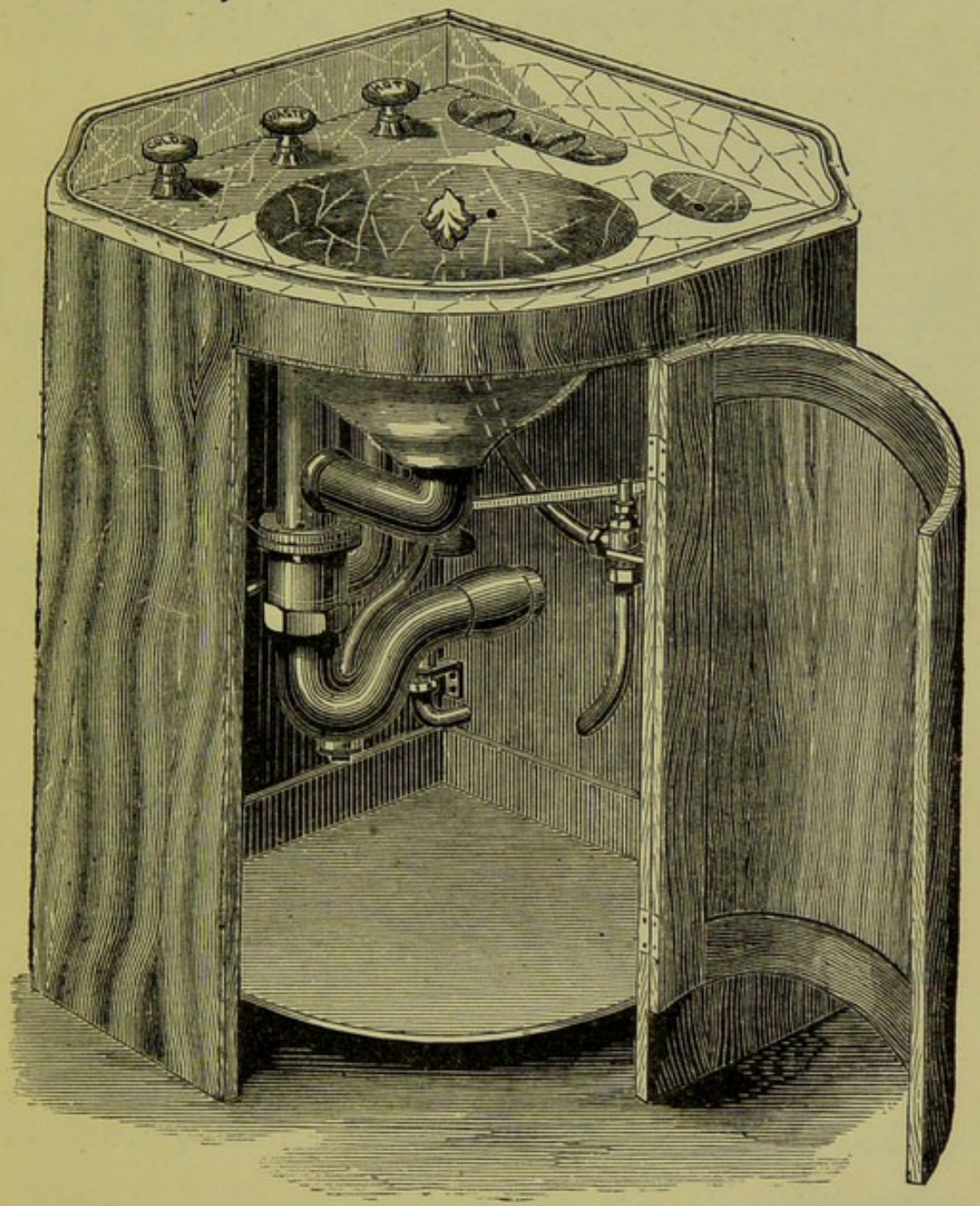

FIG. 33.

Oblong ditto.

Fig. 34 shows an oblong lavatory which can be fitted up in a similar way to the last, or as shown in the diagram, with cold pull-up supply and waste valves, while the overflow is direct

from the basin into the trap. (See Plate 4, Fig. 2, shewing this lavatory fixed.)

Overflows.

The overflow-pipes should always be large

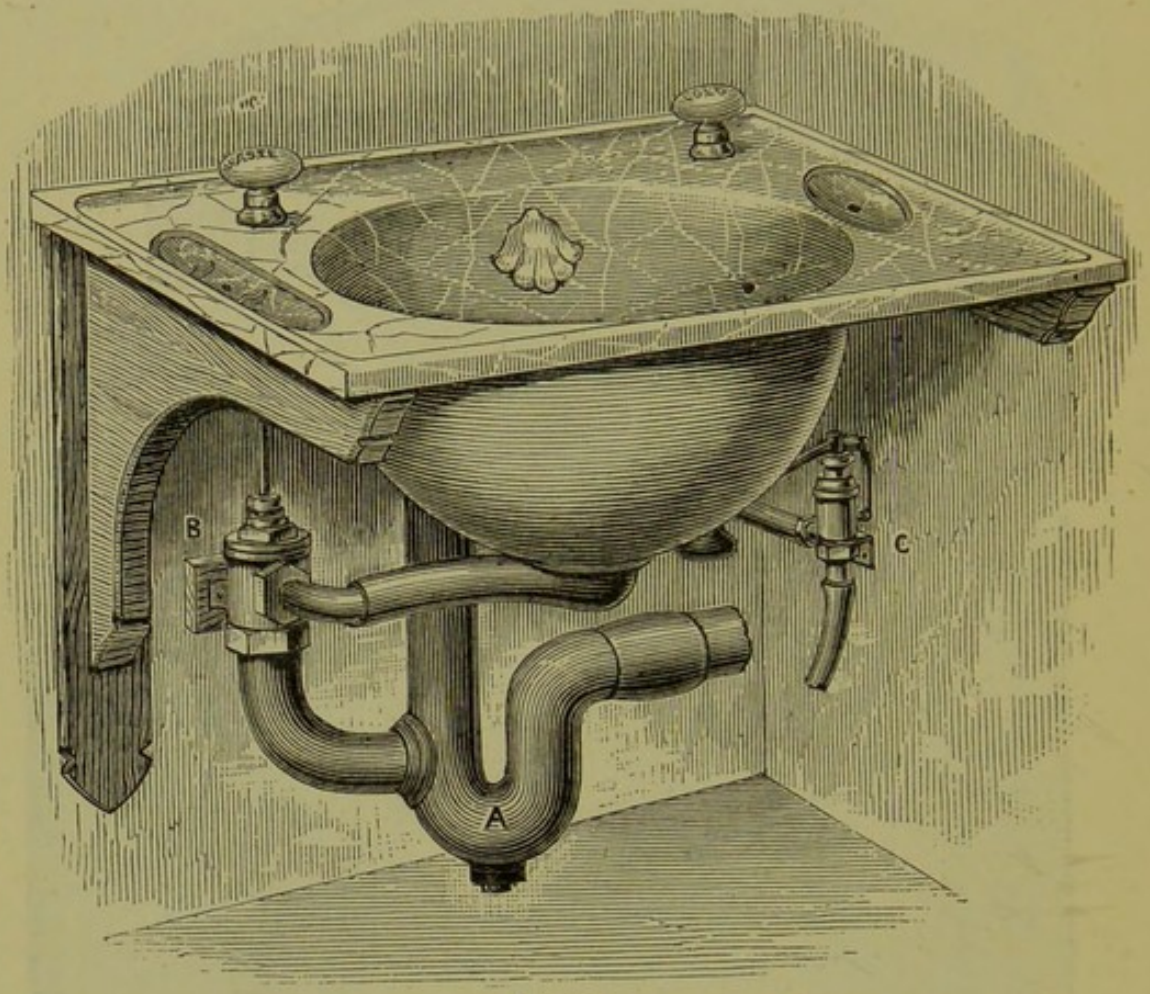


FIG. 34.

enough to take away the water should the service-valve be left open, to prevent damage by an overflow.

Emptying basins, plugs and washers.

When plug-basins are used, the plug and washer is generally so small that it takes a minute or two to empty a basin, but there is no reason why an *inch* plug and washer with cross-bars (to

prevent rings or pieces of soap washing through) should not be used; with such a plug-waste a basin of 16 in. internal diameter could be emptied in less than half a minute.

A "feather" waste-valve, as shown to lavatory, Fig. 33, will empty an 18 in. internal diameter basin in seven seconds: this is surely quick enough for anybody. Feather-valve.

*"Tip-up" Lavatories.*—These certainly empty the basin quickly, but they are deficient in cleanliness, nor are they the kind of lavatories to use in a bedroom and places where the slightest unpleasant odour from stale soap-suds would be objectionable. The water is *turned* out of the basin into a large *receiver*, where it splashes about on its way to the waste-pipe. And unless this receiver is cleaned, or rinsed out, the soap-suds are left to dry upon the sides of the receiver, and to send out into the room any unpleasant smell which strongly-scented soap (when used) can give. Tip-up basins. Receiver gets dirty.

Moreover, the contents of the basin are discharged so suddenly into the waste-pipe, that, unless it is of good size, they will unsyphon the traps upon it (except they are ventilated) in their passage through the waste to the drain. (See "Lavatory-wastes," Chapter V., and Plate 4, showing same fixed.)

# CHAPTER XIV.

## URINALS, ETC.

Urinals objectionable in private houses.

*Urinals* are objectionable things to have *inside a private house*, for they are indecent in appearance, and are liable to become sources for bad smells unless properly fitted up, while to keep them clean and wholesome they consume a good deal of water. As such places are chiefly necessary when there is a smoking or billiard room in the house, they should be fixed for the convenience of such rooms.

Urine corrosive.

Urine is so corrosive that it ought to be discharged into water, to be diluted, before passing into the waste-pipe; or water ought to be brought into the urinal-basin when it is used, to neutralise the effect of the urine upon the waste-pipe, &c., and prevent its becoming corroded and nasty.

Urinal-places light and airy.

Urinal-places cannot be too light and airy. The frequent use of such places by many persons will soon make the urinals offensive, unless they are properly constructed and the place well ventilated.

Urine confined to narrow limits.

Urine should never be allowed to spread itself over a large surface, but should be confined into as narrow limits as possible, to economise the supply

of water, which should be so arranged as to conduct it right away.

*Urinal-stalls* with backs and divisions going down to the floor, and with "aprons" to catch the "droppings"—whether in painted cast-iron, or slate, or enamelled slate—are but an imperfect way of providing accommodation for the public. Urine is discharged all over the lower part of the back and sides of the divisions without a chance of its being washed away (except when the attendant flushes out the place, perhaps, once a day), for the perforated supply-pipe only sends little channels of water down the *backs*, and as for the "aprons" and divisions, it does not even touch them, for, unlike the gun of our friend Pat, it cannot shoot round the corners.

Urinal-stalls an imperfect arrangement.

Fig. 35 shows a good arrangement for public urinals. The basins, A, are kept about half-full of water, to dilute the urine, and a constant change of water can be secured by opening the supply-valve, F, just sufficiently to allow the water to dribble into the basins, and then, once a day, or oftener, the waste-valve can be opened, and the urinals and waste-pipes thoroughly *flushed out*. The divisions are *dwarfed—i.e.*, they are taken down to within 16 in. of the floor, thus leaving a clear and open space under the entire range of urinals, free from all corners where dirt can accumulate. If the *top* of the divisions are 4 ft. 9 in. or 5 ft. from the

Basin arrangement for making urine into water; divisions dwarfed.

floor, this will be quite high enough, but to take them up to 6 ft. or 6 ft. 6 in. is to waste material, for nobody would crane his neck over a 5-ft. division to look into the next compartment, unless he had the neck of a giraffe, and did not know

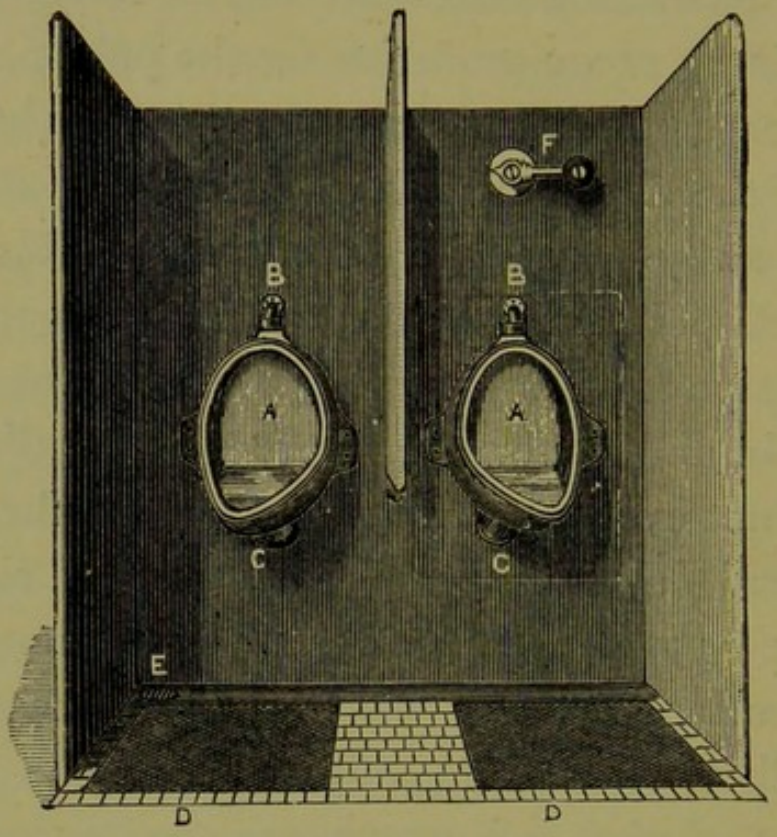


FIG. 35.

Slate channel.

what to do with his head. There should always be a *slate* or stone channel formed in the floor, along the back of the urinal range, and the floor should be sloped towards it, and immediately in front of each basin there should be a galvanised

Platform.

cast-iron platform-plate, D, Fig. 35, about 19 in. square, to stand upon when using the basin. This plate should be let into the stone, and rabbeted into the slate channel, and the top

should be made *rough* like the sole in a hob-nail boot, to conduct any "droppings" into the channel, and also to prevent the feet taking them up and carrying them about the place.

Channel waste.

It is important to have a large waste from the channel, and as all such places should be outside the main building, there will be no difficulty in bringing the drain-pipe right up to the urinals, and making good the same with a 4-in. earthenware trap under the slate channel outlet. A $4\frac{1}{2}$-in. brass rim, with a straight barred movable grating, E, Fig. 35, should be fixed over the inlet of the trap, for the hand to get at it when necessary.

Urinal-waste.

The waste-pipe from the urinal-basins must be carried along at the back of the range with branches to receive each basin. The branches should be made with 3-in. patent lead pipe, equal in substance to 9-lb. lead, or heavier, and the main waste should be of the same strength, but the size should not be less than 4 in.

Urinal-basin with treadle-action.

Fig. 36 shows a urinal-basin (with marble back and sides) supplied by treadle-action (see D, Fig. 36). This arrangement is more economical with the water, and better adapted for private places, perhaps, than the arrangement just described. Directly the feet are placed upon the *platform-grating*, D, the supply-valve is opened, and the water continues to flow into the basin until the feet are removed—*i.e.*, all the time urine

is passing into the basin water is flowing into it as well. Under the platform-grating there is a

Safes.

porcelain-enamelled cast-iron safe, to catch any droppings, which are immediately washed away by a supply of water branched from the service-

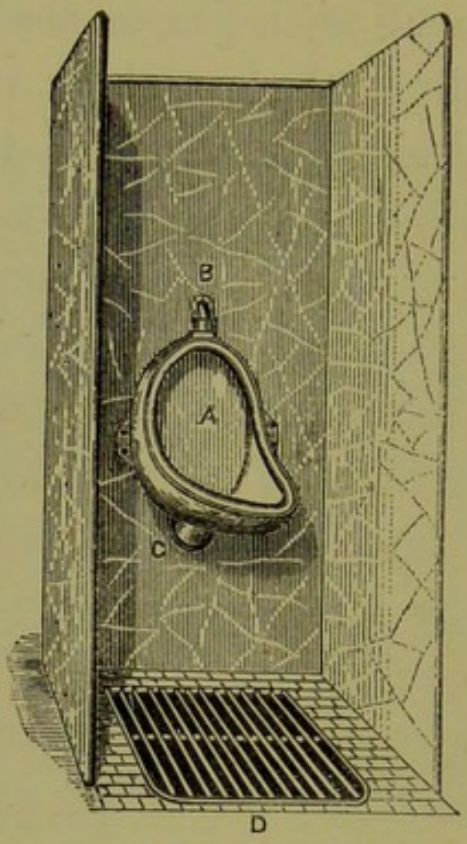




FIG. 36.

pipe to the basin. It is important to have a good supply of water, and when the cistern or head-of-

Supply-valve.

water is not over 20 ft., a ¾-in. treadle supply-valve should be used; above that head-of-water a ½-in. valve will be large enough. These valves require to be *strongly* and *well made*, and as they are self-closing, the *springs* require to be extra strong, and to prevent concussion in the service-

Air-vessels.

pipe, by the sudden closing of the valve, air-vessels should be fixed in the service.

# CHAPTER XV.

## WATER, AND ITS STORAGE.

Importance of pure water.

PURE water is of such importance in every household, that it ought to be the question of questions before renting a house or erecting one: Is the water supplied to this house *pure?* or can I get pure water here?

A polluted stream not the proper source.

A stream or river, polluted by the sewage of a village, town, or city, cannot be the proper source of our *drinking*-water. It is hardly possible, with our present system of filtration, to make the water taken from such sources at all times absolutely pure and fit for drinking.

But supposing such water to be filtered, and made wholesome, it will be difficult for the drinker to disassociate from his mind the fact that the water he is drinking has been before consumed in a similar way, and perhaps many times. Such an idea will hardly help a sick man to get better.

Double supply.

Where there is an insurmountable difficulty in getting a sufficient supply of *pure* water for both drinking and general household use, would it not be worth while to arrange *two* systems of supply to each house, one highly filtered and

made pure at any cost, and the other roughly filtered for water-closet and general use?

Storage capacity.

Care should always be taken to provide storage capacity for at least two days' consumption, in case of *non-supply* by the water company, or a *break-down* of any of the *service fittings* in the house. "One leak will sink a vessel" is an old adage, and one leaky tap or valve will empty a cistern. To store, therefore, all the water in a house in *one* cistern, is a worse policy than to put all the eggs into one basket; and, most assuredly, where this is done it will one day be found to be literally a cistern which holds no water.

Water should not be stored all in one cistern.

Place of storage.

Supposing you have been fortunate enough to obtain pure water, the next important consideration is the place of its storage, to prevent contamination.

Remote from all outlet air-pipes.

Water for drinking purposes should be stored remote from all places where bad air or noxious gases are likely to occur. And it is of the utmost importance *to store it away from all outlets to ventilating-pipes, from soil-pipes, general wastes, or drains.*

And not over water-closets.

It should not be stored directly over a series of water-closets or urinals, as is sometimes the case, and where the vitiated air of the rooms in which such apparatus are fixed can have easy access to the water.

Water absorbs air.

Water absorbs air, just as a sponge does water; and when any impure air is near, the water will soon become impregnated with the impurities of the air surrounding it.

Pail of water in a newly-painted room.

The strong painty smell of a newly-painted room is decreased by placing a pail of water in the room. A few hours after the water has been placed there, a coating of an oily nature will be seen floating on its top, proving that the water has been imbibing the vitiated air in the room.

Impurities of bad air imbibed by water.

And when a cistern of water is near a foul water-closet, or an outlet of a ventilating-pipe from a soil-pipe or drain, the impurities in the bad air are imbibed by the water in the cistern, which becomes contaminated just as the pail of water does in the painted room.

Ignorance concerning water-contamination.

A great deal of ignorance exists upon this subject of water-contamination. Many imagine that by putting a partition in a cistern, as Fig. 37, and dividing it thus into two compartments, that they have done all that is necessary to keep the two waters entirely separate from each other. They then confine one compartment to drinking purposes, and the other to water-closet uses, leaving the tops of each compartment open, even connecting them together by a waste-pipe, which takes the overflow from the two compartments. Now, the water in these two compartments is

Cistern with a partition.

The two waters separate as the Siamese twins.

about as separate as the late Siamese twins, and the protection thus secured as reliable as the ostrich's, when it hides its head in the sands, and leaves its body exposed to the huntsman's shots. For if the water in the water-closet service compartment becomes contaminated, what is to prevent the impurities from flying off from this body of water, and passing over the top of the partition to the water in the drinking compartment?

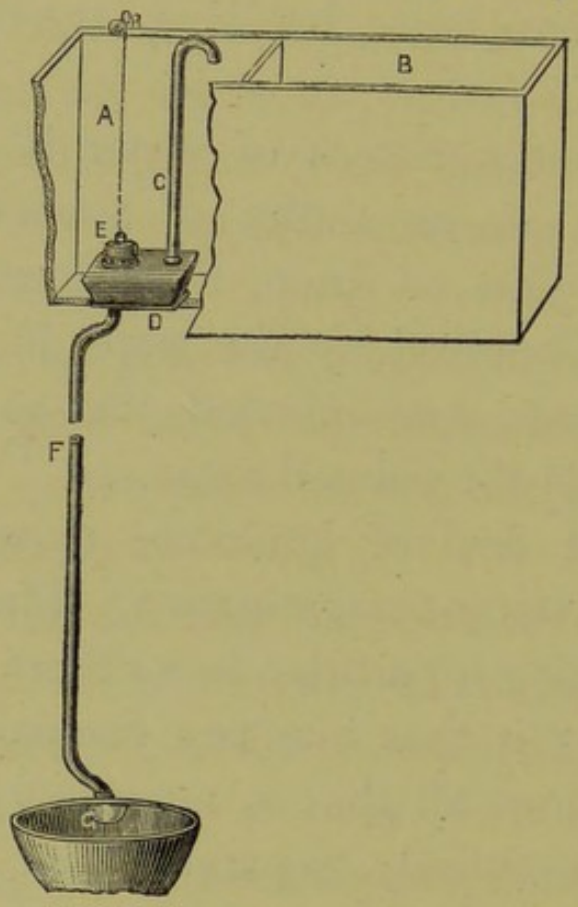


FIG. 37.



Service-box supply the medium of conveying bad air to the cistern-water.

Moreover, it is, as a rule, only when a *service-box supply* (see D and F, Fig. 37) is used for serving a water-closet apparatus, that the water in the cistern which supplies the apparatus gets contaminated: and one of the chief

means of this is the air-pipe, C, to the service-box, which is always taken up to about the level of the top of the cistern, so that it is almost as near one compartment as the other; and if it contaminates the water in the one compartment, it will speedily vitiate that in the other.

Contamination of cistern-water by water-closets.

It is supposed by many that it is impossible to supply a water-closet apparatus without in some way or another contaminating the water in the cistern from which the water is taken. But this entirely depends upon the *service fittings* by which the water-closet is supplied.

A "*supply-valve*" action.

A water-closet served by means of a *supply-valve* attached to the apparatus, no matter how near or distant the cistern or reservoir may be, always leaves the service-pipe between this valve and the cistern full of water; how then can any air—good or bad—pass back through this water-charged pipe to the cistern? Moreover, this valve is, in its normal position, always closed, and acting thus as a stop-valve, it most effectually shuts off all communication with the cistern, and becomes a *double* check to the passage of any air from the water-closet apparatus to the cistern.

A service-box allows the air from the apparatus

A water-closet supplied by a service-box, as shown in Fig. 37, always leaves the service-pipe, F, empty, and in direct and open communica-

to pass up to the water in the cistern.

tion (through the air-pipe, C), with the cistern which supplies it with water; and there is nothing to prevent any bad air which may be in the water-closet from passing up behind the "fan" of the basin, through the service-pipe, F, and service-box, D, into the air-pipe, C (to the service-box), and from this air-pipe into the cistern, A and B. But supposing this air-pipe to the service-box to be taken farther away to discharge into the open air instead of into the cistern, which is rarely if ever done, there is still a direct communication between the service-box in the cistern and the water-closet, and this communicating-pipe is always empty, and any bad air in the basin is sure to ascend into this pipe, and directly the valve, E, is open in the service-box will escape into the cistern. Thus in the one case—with the supply-valve attached to the apparatus—it is impossible for the cistern-water to be contaminated by supplying a water-closet, and in the other case—the service-box action—it is hardly possible to be otherwise.

Impossible to contaminate the water in the one case and easy in the other.

Cistern-cleaning.

Cisterns, like chimneys, want cleaning out periodically, and in every case proper means should be provided for this purpose, and an easy access made to each cistern—especially to the *drinking-cisterns*—so that any servant of the household may get at the cisterns to clean them out, and see that everything is right.

Access.

"Water Act" and overflows.

The "Metropolis Water Act of 1871" simply provides for an *overflow-pipe* to prevent waste of water, and to act as an *indicator* to the water companies when the ball-valve is defective. But this is not enough; every cistern should have a *waste-pipe* for cleansing purposes as well (see Fig. 19). And if this waste-pipe cannot be made to answer the *double* purpose of overflow and cleansing pipe, the cistern should have a separate waste, as it is absolutely necessary for the cisterns to be cleaned out occasionally, to keep them wholesome, and if proper means are not provided for this, they will only be imperfectly cleansed.

Overflow waste in one or in two separate pipes.

Periodical cistern-cleansing.

If anybody doubts the necessity of this periodical cistern-cleansing, let him take a broom and stir up the water in any cistern in his house after an interval of six or nine months since the last cleansing, and then dip a glass into the cistern and take it out full of water, and, after looking at it through a microscope, drink it off, or stand convinced of the necessity of cleaning out cisterns periodically. (See "Cistern-wastes," Chapter IV.)

Slate cisterns.

All cisterns or reservoirs for drinking-water should be made of slate, and never of lead when it can possibly be avoided. Cisterns for water-closet and general use can be made of lead, or any material which may be most convenient.

Lead cisterns.

Safes under cisterns.

*Slate and Galvanised Iron Cisterns* should in every case, where they are fixed over ceilings, have a lead safe under them, with an overflow-pipe from the safe discharging through an external wall. Lead cisterns, of course, do not require any safe. (See "Safes," Chapter X, page 92; also "Cistern-wastes," page 45.)

# CHAPTER XVI.

## WATER-SUPPLY.

Original intention to say only a word or two on services.

It was not the original intention of the writer to say more than a word or two upon services; but it is useless to have a fountain unless there is sufficient water to play it. And a good supply of water is so essential to the thorough cleansing of a closet, that he has thought it better to devote a chapter to water-supply services.

Water delivered to houses by water companies under certain rules and regulations.

Like Mrs. Glass, you must first catch your hare before you can cook it, and so you must get the water into the house before you can use it. Water, like almost everything else now-a-days, is *delivered.* It has neither to be fetched from the town pump, nor drawn up by a windlass, nor pumped up from the well in the yard, but is supplied to almost every house in city, town, and village by water companies, under certain rules and regulations. There can be no doubt that such water companies have a perfect right to make their own rules, within certain limits, but these should always be for the benefit of all concerned, and not solely for the shareholders. Poor shareholders! how the people waste their water! But how conservative the shareholders are of their water! It is a pity they cannot have a

Flow and return.

"flow and return circulation" to each house from their mains. Well, all the harm that we wish them is that they may always have a reserve of this beverage for their own consumption without anything to add to it. And as for the people who wilfully waste their water, they should be made to collect what they waste, and then be dipped in it by the water companies' servants.

Water companies can hardly be too strict, or look too sharply after their water, for there are such trumpery ball-cocks and ball-valves used, that they are really nothing less than water-wasters. And the general service supply fittings are, in many cases, of such a flimsy character that they break down almost as soon as they are used, and, like an icicle under the rays of the sun, begin to "drop, drop," until there is no more water left in the cistern to drop through such leaky valves. This is where the water companies should save. But to limit the supply of water to a water-closet or urinal, where it is so essential for health and cleanliness, is a step in the wrong direction. The means taken for the prevention of waste, and the appliances sanctioned, or insisted upon, by the various water companies, are so poor that it is hardly too much to say that more water is wasted under the new system than under the old. It is hardly likely that anybody—even to spite the water company which supplies his house

Trumpery ball valves.

Flimsy fittings soon begin to leak.

Limited supply to water-closets and urinals.

New appliances water-wasters.

with water—would care to stand with his nose over a water-closet apparatus on purpose to waste water, and if he does open the valve to flush out the water-closet and soil-pipe occasionally, he does a good thing for himself and his neighbourhood, for he helps thereby to keep his sanitary arrangements wholesome.

Rising main of lead, and certain strength.

The size of the main service into the house from the water company's main must generally be determined by the water company, though there is no difficulty in deciding upon the necessary size, which varies with circumstances. The pipes must be of lead, and of a certain strength for the metropolis, according to Act of Parliament. (See "Table of Pipe-weights," page 133.)

Stop-valves in main outside and inside house.

A stop-valve, with a "cock-box" over same, is required by the water companies to be fixed in each branch from their main, somewhere outside the house, for the sole use of the *turncock*. But it is always advisable to fix another stop-valve in the rising main, directly after the pipe has entered the house, for the occupant's use in case of accident to the rising main itself, or a break-down of any of the ball-valves fixed upon it.

Also in each branch.

In *large* houses, where there are several cisterns, and especially where there is a *constant service*, it is advantageous to have a stop-valve in each branch, fixed just behind, and connected with, the

ball-valve, as B, Fig. 19, page 45, to shut the water off one cistern, when necessary, without interfering with the supply to other cisterns.

Stop-valves in services from cisterns.

Stop-valves should be fixed in every service-pipe out of a cistern in convenient position, and as near the under side of the cistern as possible. It is necessary, in all such cases, when a good pressure and body of water are required, to have the stop-valve one size larger than the service-pipe, as all such valves obstruct, more or less, the free passage of the water through them, and are not like round-way stop-cocks, where the water-way is the same as in the pipe itself—full bore and straight through. The pipe between the cistern and the valve may be of same size as the valve itself.

Supply of water to closets: two gallons allowed.

*Water-closet Supply.*—The quantity of water allowed by the various water companies, and made legal by Act of Parliament, is two gallons for each usage of the closet. Publish it not in Gath, tell it not in Ascalon! Two gallons of water to carry away a deposit in a water-closet through some scores of feet of soil-pipe and drainage, flush these pipes out after its passage, and cleanse the whole! This is about as difficult a thing as making bricks without straw.

Where and

One is curious to know how and where

this exact quantity of water was calculated, and on what sort of water-closet it was tried. If one might make a guess, one would say it must have been somewhere in the dark, and if measured in pints it must have been on the principle of the baker's dozen. Let us look at the thing practically, *i.e.*, with an open eye. Suppose it takes two gallons of water for a water-closet fixed in the basement (where we have guessed the discovery to have been made), to cleanse the closet after usage, wash out the trap, and deliver the deposit into the sewer, how much water will it take for a closet fixed on the second or third floor at the rear of the building, with about fifty feet more soil-pipe, and fifty or sixty feet of additional drainage? Why, it would require this quantity of water to wet the pipe, and two or three such discharges to thoroughly cleanse the closet, trap, soil-pipe, and drain after the passage of the soil through it, and to keep it wholesome. The fact is, some closets require more water than others to keep them clean and wholesome, apart from their positions. And it must be quite evident, even to the most conservative of shareholders, that when a water-closet is fixed a long way off from the sewer or main drain, it must require a good supply of water to keep it, and all its appurtenances, in a sanitary condition.

how calculated.

Some closets require more water than others.

Valve and regulator supply.

Where there are no companies to interfere, there is no better way of supplying a water-closet with water than by an attached supply-valve and regulator to the apparatus, *if well made.* With this arrangement the water rushes into the closet-basin directly the handle is pulled; and one or two flushes can be given, according to circumstances, to flush out the apparatus and soil-pipe. To do this effectually it is necessary to have a large-enough valve and pipe.

Ignorance on water-pressure.

A great deal of ignorance exists upon water-pressure and the size of the pipe necessary to give a good flush of water to a closet; and, astonishing as it may seem, few people are more ignorant in this matter than plumbers. A small *feed-cistern* will give just the same pressure as the largest tank in the world, if fixed on the same level. What is wanted is height to give pressure, and where head-way of water cannot be obtained, then the service-pipe must be increased in size—not to give pressure, but to deliver a greater volume of water into the closet when the handle is pulled. The following table will give the size of the valve and pipe necessary according to the head-way of water above the water-closet apparatus :—

Head of water and not bulk.

TABLE SHOWING SIZE OF SERVICE-PIPE AND VALVE TO GIVE A GOOD FLUSH OF WATER.

Table of sizes of pipes and valves.

| Head-of-water, *i.e.*, Height of Cistern (bottom) above w.c. Apparatus. | Size of Pipe and Valve for *flushing-rim* Closets. | Size of Pipe and Valve for *fan* basins. |
|---|---|---|
| 4 feet and under 8 feet. . . | $1\frac{1}{4}$" pipe or $1\frac{1}{2}$" pipe, and $1\frac{1}{4}$" valve. | $1\frac{1}{4}$" pipe and valve. |
| 9 feet ,, 12 feet. . . | $1\frac{1}{4}$" pipe and ditto. | 1" pipe and 1" valve. |
| 13 feet ,, 18 feet. . . | 1" pipe and ditto. | $\frac{3}{4}$" pipe and $\frac{3}{4}$" valve. |
| Above 18 feet. . . . . | $\frac{3}{4}$" pipe and 1" valve. | $\frac{3}{4}$" pipe and $\frac{3}{4}$" valve. |

TABLE SHOWING WEIGHTS OF LEAD PIPE PER YARD.

| — | $\frac{1}{2}$ in. | $\frac{3}{4}$ in. | 1 in. | $1\frac{1}{4}$ in. | $1\frac{1}{2}$ in. | 2 in. |
|---|---|---|---|---|---|---|
| "Extra strong" lead pipe—*Water Companies' weights—as per Metropolis Water Act*, 1871 . . . . . | 6 lbs. | 9 lbs. | 12 lbs. | 16 lbs. | 21 lbs. | 28 lbs. |
| "Strong" service-pipe. . . | * $4\frac{1}{2}$ lbs. | * $7\frac{1}{4}$ lbs. | * $10\frac{1}{2}$ lbs | 14 lbs. | 18 lbs. | 24 lbs. |
| "Service-pipe," *light* . . . | * $3\frac{1}{4}$ lbs. | * $5\frac{3}{4}$ lbs. | * $8\frac{1}{2}$ lbs. | 12 lbs. | 16 lbs. | 21 lbs. |
| "Strong *waste*-pipe," same strength as "light" service-pipe . . . . . | | | | | | |
| "Warning-pipe"—Pipes "discharging with an *open end*" *minimum strength, as per Metropolis Water Act*, 1871 . | 3 lbs. | 5 lbs. | 7 lbs. | | | |
| "Waste-pipe" . . . . . | . . . . . | | | * $10\frac{1}{2}$ lbs | 12 lbs. | 18 lbs. |

Soil-pipes and waste-pipes made by hydraulic pressure, above 2 in. and under 6 in., made in any weight *to the strength of sheet lead*, from 6 lbs. to 14 lbs. per foot.

* Within a fraction of the exact weight.

Water-waste prevention a vexed subject.

*Closet-supply by Water-waste Preventors.*—The subject of water-waste preventors for supply to water-closets and urinals is such a vexed one, and there is such a variety of these things now in use, that the writer forbears entering into the subject at all. And though he has taken out patents for water-waste preventors, he believes, and his experience justifies his belief, that for the most part these so-called *water-waste preventors* are more *water-wasters* than the well-known water-closet supply-valve and regulator, when well made, except in certain circumstances; for instance, where there is any number of boys using the closets, and in public places; but in private houses the supply-valve and regulator is preferable, for in this case there is only *one* valve to get out of order, and if this is of good workmanship, it will shut off almost any pressure, and is, moreover, very durable and easily repaired when out of order. But in the other case, at any rate with the *majority* of the water-waste preventors, there are *three* valves—viz., the ball-valve to the feeder, the two-gallon supply-valve, and the supply-valve to the water-closet, any one of which getting out of order is liable to waste the water company's water.

Valve and regulator supply preferable, only *one* valve to get out of order in this case.

Water-waste preventing valve separate from

When a water-waste preventing *supply-valve* is used, it should have a small feed-cistern, and never be fixed in a drinking-water cistern, as the

drinking-cistern.

communicating or service-pipe from such valve to the water-closet apparatus in its normal state is always *empty, and open for any air in the water-closet basin to pass up to the valve in the cistern*, and when the valve is open, the air can easily pass into the cistern-water, and contaminate it.*

Size of services from water-waste preventors.

*Water-supply by Water-waste Preventors.*— The size of the service-pipe from water-waste preventors to *water-closets*, according to the Metropolis Water Act of 1871, must be 1¼ in., and to *urinals* 1 in.

Overflow-pipes.

From all water-waste preventing arrangements *with cisterns*, there must be an overflow-pipe taken from the cistern, and carried through the external wall, where the water companies' servants can see it. This pipe is to act as an indicator when the ball-valve is leaking. But there is no provision in the Act for indicating to the water companies' servants when any of the other valves are leaking in connection with such a water-waste preventing apparatus.

Twice the size of the ball-valve.

This overflow-pipe must be of lead, and, according to this Water Act, it must be ½ in. diameter, but this is not large enough, for it should never be less than *twice* the size of the ball-valve which supplies the apparatus, to prevent damage by an overflow of water, should the ball-valve fail to act.

* See remarks on service-box supply, page 122.

Where several, branched into one.

Where there are several water-waste preventors in a range, or on several floors over a tier of water-closets, it is better to branch the overflows into one main overflow-pipe, and to take this down and discharge it in the area, or where it can be seen. (See Plate 2, Fig. A, showing a water-waste preventor fixed, with 1¼-in. lead service-pipe from it to water-closet basin.)

# CHAPTER XVII.

## HAND-WORKERS.

VICTORY on the battle-field depends, no doubt, to a large extent upon the general; but in vain will be all his plans for conquest unless he can depend upon his soldiers. To fight battles successfully there must be trained soldiers, and to build sanitary houses there must be skilled workmen. A word or two then, before closing this small treatise, to *hand-workers*—the interpreters into bricks and mortar of the plans and ideas of the *head-workers*.

The workman is on the *spot*, and can see, if he is an intelligent tradesman, when this is right and that is wrong. Upon his skill and industry the success of any work chiefly depends. What is wanted is for every man to take an interest in his work, and to throw what skill and energy he possesses into it.

No man should rest satisfied with himself until he has thoroughly mastered his trade. Take the craft of plumber—how few understand the trade thoroughly, practically and theoretically? With some *anything* is "near enough;" but nothing is near enough unless it is *exactly right*. It takes

just the same time to make a disfigured joint that it does to make a symmetrical one ; just as long to fix a crooked pipe as a straight one ; and it takes no longer to put the trap in the right than in the wrong place ; nor is any time saved by making the *connections* anywhere, instead of exactly in the right position.

The costly labour of indolent men, and the destructive labour of unskilled workers, eats up, or wastes, the productive labour of the industrious and skilled tradesman. And to compensate for this non-productive labour of the idlers and the incompetent, inferior materials are often used, and tricks are resorted to which are a disgrace to all concerned.

If every worker earned his wages before holding out his hand to receive them, and remembered that if he is not building his *own* house, he is helping to build a house for somebody, and that this somebody will want the same *protection* and comfort from it that he would himself, were he going to live in it — if all concerned remembered this, *scamping-work* would be killed at the roots.

The public are not free from blame in this matter. Competition is good and healthy—it keeps the rust out of our activities; but *over*-competition is injurious, as when *because* one man offers to do a work for half a crown, another

will do it for a florin. But when the public find a man ready to give a guinea in exchange for a sovereign, they may be sure of one thing, that though it has the *guinea-stamp* it will not have the *guinea-gold*—something is out of square about it.

Union is strength, and hence men combine together into union societies. Trades-unions have, no doubt, done a good work, but they are far from being an *unmixed* good, and the man who falls back upon a society instead of depending upon himself levels the hills which he should manfully climb. Trades-unions are terrible *levellers*; they level upwards sometimes it is true, but they level downwards like ballast in a ship: chain eagles to turkeys, skylarks to bats. They unite the indolent and incompetent to the industrious and skilled, and then strike an average for the value. And whether a man is worth a shilling a day, or a shilling an hour, he must be paid according to the societies' rules, so much for every hour's work, whatever the worth of the workman. And yet the men who receive alike their 10d. per hour, or whatever the rate may be, differ as the stars.

The best trades-union for a man to join is to unite *his heart to his work;* such a man will not want any help from societies; wherever employed he will not be long in passing from

the outer circle of casual hands into the inner circle of regulars, where he will be respected as a workman and a friend. And from this inner circle there rises a spiral staircase, and when once his foot is upon it, he will find that it ever leads upwards.

Builders of other men's houses, but not builders of your own! But why build ye houses only for others to own? Why are ye not yourselves your own landlords? The fault is your own. The advance in wages in the last few years, if you care to use it rightly, would enable every skilled mechanic to purchase a house for himself, through any of the Building Societies, in about twelve years. Take the money spent in drink — these constant "little drops" — and appropriate it to buying your own house, and before twelve years have passed over your head you will each have a cottage of your own for your old age, and your constitution and you yourself will in every way be the better for your so doing. This is not depriving yourself of your dinner-beer or supper-beer, but simply abolishing these costly "little drops" at all hours of the day, which are good for neither body nor mind, and cost on an average weekly more than one day's wages. Hence the majority of artisans work one day a week, or two months of every year, to satisfy a *habit* which ought never to have been formed.

Let me speak specially to the twice fourscore men in our employ. For nearly a century and a half men skilled in all kinds of lead-work have been going in and out of the "old plumbers' shop, near the Strand." But never in any period of its history have the men, as a body, understood so thoroughly the principles of internal plumbing-work as at the present time. What your grandfathers did is not enough for you; the matter is *ventilated* more, and the why and wherefore of things sought out. The workmanship and thought put into the work by many of you is marked with such individuality that the writer has only to see the work to know the worker. With some of you the tendency is to rather *overdo* your work, *i.e.*, to *waste labour* upon it after it has already been well done; this is so much power lost, a gilding of fine gold.

All are still in the school-house learning, and many of you have a great deal to learn; but keep on learning until you have thoroughly mastered the trade, and by your skill and intelligence, honesty and sobriety, elevated, not yourself only, but the craft as well.

# INDEX.

CASSELL PETTER AND GALPIN, BELLE SAUVAGE WORKS, LONDON, E.C.