LECTURE XI.

APPARATUS USED FOR HOUSE DRAINAGE.

Next to traps, there is no fixture used in connection with modern house drainage of so much importance as the water-closet. A great deal of inventive talent has been expended upon these contrivances, and though they have been a good deal improved of late, there is still room for further improvement. Several quite distinct classes are now in use and sold by the dealers, having each certain merits and faults of their own, which may render each class more suitable to certain places than others. Let us then examine these several types in detail.

The forms in most common use, and therefore best known in our community are the "pan-closet" and the "hopper."

The pan-closet is shown in section by Figure 22. It consists, beginning at the bottom, of a trap just below the floor, generally four inches in diameter, and constructed of iron or preferably of lead, unless the iron be enamelled on the interior, to avoid the rough surface of cast-iron. Above the floor is the cast-iron receiver, to which, on its top, the crockery bowl is attached by putty. A copper pan of one or two quarts' capacity is hung under the bowl, upon a pivot, so that when level and full of water, this water stands two or three inches deep in the bowl, and forms there a second trap so long as the closet is at rest and supplied with water. When the closet is used, the handle is raised and the pan is tilted on its pivot, emptying its contents into the iron receiver and thence into the trap below.
To the superficial observer, this seems to be a perfectly safe device. The circulation between the soil-pipe and the room is ordinarily guarded by two traps, and as the pan is supposed to be kept full of water, the fecal matter is dropped directly into this water and becomes thereby somewhat deodorized. But though so popular and almost universally used in our country, this closet is a very defective one, and often becomes a great nuisance in a house from the following causes. The cast-iron receiver is soon smeared and spattered with filth all over its interior, which goes on accumulating by successive spatterings, till the decomposition of this lining, kept moist and warm, keeps the interior filled with foul odors. In fact, it violates the cardinal principles of house drainage, by affording a harbor for the continual and certain accumulation of filth within the house. We are told that the water in the pan above prevents its free access to the room; but the pivot hole, by which the pan is tilted, is subject to constant wear, and is seldom air-tight. Moreover, the putty in which the bowl is bedded on the top of the receiver, is often found cracked, or gnawed away by rats, and however perfect these joints may be, there is a quart or two of the foul gas of the receiver always displaced by the tilting and emptying of the pan. The trap below the floor prevents it from escaping below, and it necessarily comes upward into the room. Attempts have been made to avoid this by providing vent-pipes to keep the air sweet in the receiver, but this is so foul that such attempts can at best be only palliative, while these separate vent-pipes extending from each water-closet receiver, all the way to the open air, if large enough to be of any use, would add so much to the cost of the device as to remove the chief argument for its use—cheapness. The only good reason for using the pan-closet anywhere, is this, that it can, if kept tight and in good repair, be made to answer a tolerable purpose with a more moderate supply of water than almost any other kind. Hence, it may often be used, if well cared for, by small families who have but a limited water supply, raised by hand pumping, or where no sewers exist, and where the filling of the cesspool at frequent intervals by a more copious discharge of water might prove a serious inconvenience. In such cases, and wherever used, the inside of the cast-iron receiver should always be coated with porcelain enamel, so that its surface may not so readily accumulate filth as the ordinary rough castings. But wherever water can be obtained in sufficient quantities and afterwards properly disposed of, we should remember that an adequate supply is absolutely essential to the success of the water-carriage
system, and that we can never economize the use of water in such apparatus below a certain point without incurring serious risks. We must see to it that water enough is applied to quickly remove all the filth, or we are not justified in using the apparatus in our houses.

It is desirable to have water-closets located on the exterior walls of houses, so that outer air can be readily obtained by opening a window. But as this is often found difficult to accomplish on account of exposure to frost in the country, or the supposed greater value of light and air for other apartments in city houses, some substitute for the open window is desirable wherever water-closets are located in the interior of houses. The best arrangement is to apply a small tin pipe, say two or three inches diameter, to draw air from under the seat, using the kitchen chimney draught, as has been before explained, for aspiration. Some forms of closets have a vent-hole in the bowl, above the trap, to which this tin pipe can be applied. The form of hopper made at Worcester, Mass., and Henderson’s bowl, have this attachment. Where no such device exists, it is best to apply the mouth of the draught-

FIGURE 23.

pipe directly under the seat. An annular flat tube is made for this purpose at Charlestown, Mass., of galvanized-iron, with slots around
the inner edge, to be placed directly over the bowl and under the seat, as shown in Figure 23. This leads to the consideration of this form of closet, known as the "hopper," many forms of which have been in the market for years, but which has been generally considered an inferior article, owing to defects in its details and the inadequate supply of water generally given to it. These defects can easily be remedied, and are as follows:

Rough interior, leading to accumulation of filth, remedied by using crockery ware, or enamelled iron.

Improper application of the flushing water, which is often applied in the direction of a tangent to the circle, causing the water to spin about the inside of the bowl and fall by degrees, instead of dropping at once into the trap to expel its contents.

Lastly, insufficient supply of water, or the admission of water by dribblets through an open faucet, depending on the uncertain memory or attention of the person using it, and using large quantities when left running, without giving that sudden dash required to clean the trap. The best form of water-supply to all closets is that from a special tank immediately over them, actuated by large valves and conducted thence to the closets by large pipes, never of less than one and a quarter inches calibre. With these precautions, the hopper closet can be made one of the most desirable forms for general use, its simplicity being a strong point in its favor. In order to ensure proper flushing, the quantity of water should be metered by a waste-preventing cistern, such as have been used for many years in England, and now manufactured here. (See Figure 24.) The automatic apparatus illustrated in this figure where the water-supply is operated by the weight on the seat, when properly adjusted, with
strong and well-fitted apparatus, has many advantages, rendering the flushing independent of the uncertain memory of the person using it, and definite in its quantity.

All forms of hopper-closets should have the water-supply so adjusted as to be delivered with a dash, and not by driblets, the object being to completely expel the contents of the trap, which would soon become offensive if allowed to remain there.

The short hopper with the trap above the floor, shown in Figure 24, has the advantage, when properly proportioned, of holding the water higher than the long hopper (shown in Figure 23), and thereby exposing less surface above the water from contamination. If the trap, when located above the floor, would be exposed to frost, it is better to use the long hopper and put it below the floor.

The wood-casing around water-closets is liable to become soaked with spatterings of urine, and even if washed carefully every day, as it always should be, is often offensive, especially if much used by children or careless persons. This has led to the invention shown in Figure 25. This form dispenses with all wood-work, a most desirable feature for hospitals and other public institutions, if the floor is made of tiles, which are smooth and non-absorbent. This is a very cleanly piece of apparatus, and well adapted to warm climates or heated apartments.

Another form of water-closet has been used to some extent within a few years, being first introduced here by Mr. Jenning's patent, viz.: the plunger-closet, several styles of which are now in the market, viz.: Jennings's, Zane's, Demorest's and Pearson's. They are used either with or without traps, as shown in Figures 26 and 27. The water is retained in bowls up to a certain level by a plunger or large plug, to be lifted by hand when discharged. The plunger is in an upright cylinder alongside the bowl, with which it communicates on the side. In this cylinder, or attached to it, is a float, which governs the water
supply, maintaining it at a definite level by opening or closing a valve on the supply pipe. The advantages of this sort of closet are in its definite and adequate supply of water, maintained at such a height as to be sure of receiving all the fecal matter, and to thus avoid the soiling of the bowl by having it drop upon this dry surface, as sometimes happens in hopper-closets. The disadvantages are in the liability of the float-chamber to become foul by degrees, by filth adhering to its sides. Those patterns which have the smallest float-chambers are therefore the better ones. Since the float apparatus is not always certain in its action, such closets must always have an overflow, and in order to prevent the circulation of air from below, this must be trapped, which involves another risk, viz.: the loss of the trap-water by evaporation, if the overflow occurs but seldom. To guard against this, a driblet of water is sometimes thrown into the overflow trap every time the closet is used, by a small pipe branching from the supply-pipe. These closets deliver suddenly such a large body of water when discharged, that they flush the drain below very well; but they also, for this reason, occasion the risk of syphoning their own traps and others in connection with the same soil-pipe, if not guarded by good air-vents to supply the vacuum. These are applied directly under the plunger, to admit air to follow the water as it descends.

It will be seen that all these plunger-closets take their water-supply through a valve attached to the apparatus, governed by the float, and governing in turn the supply of flushing water. The construction of these valves is various, and their action is not always reliable, which has at times caused considerable annoyance. If these valves can be made more certain in their action, and the float-chamber made more accessible for frequent cleaning, the apparatus can be made a very satisfactory one; but it needs careful treatment and good care.

Still another variety of water-closets remains to be described, viz.: those in which the base of the bowl is closed by a valve or flap,
retaining the water and hinged on a pivot, which is rotated by lifting a handle, thereby discharging the contents of the bowl into a small chamber directly above the trap. (See Fig. 28). As the flap needs less room than the old-fashioned pan, this chamber for its accommodation is made quite small, so that but little surface is left for the deposit of filth, and an air-pipe connected directly below the valve and above the trap is depended on for the ventilation of this chamber. But if this air-pipe connects with the one by which the soil-pipe is ventilated, an air-passage is thus provided quite around the trap-water, and the trap becomes superfluous. Therefore, in order to avail ourselves of the security afforded by the trap, this vent-pipe must have a separate course to the open air. The trap, however, in this style of closet, as well as in the plunger-closets, is of doubtful utility, and useful only in those emergencies when the flap or the plunger gets out of order and fails to keep the water in the bowl. Whenever the bowl is filled, no air can pass up from below; neither can it while the plunger or flap is held up and the water rushing down, for the quantity of water held by all these closets is so great, and the discharge so sudden, that a downward current of air must always accompany and follow their discharge. When these valve-closets are well constructed, so that they are not likely to break down or get leaky at the flap, they form a very good piece of apparatus. The one here illustrated is the best of its kind in the market, and appears to be thoroughly well made. This kind of closet should never be used without a special tank and waste-preventing service-box, by which an adequate and sudden supply of water can be depended upon for flushing.