CHAPTER XVII.

FLUSHING.

Notwithstanding the fact that of late years the grades and sizes of sewers have been more carefully determined and more accurately proportioned to the work required of them, and that they are now so built that the scouring and suspending power of the running sewage at no time gets below a predetermined minimum, yet accumulations of silt and filth often occur which must be cared for by some special means. There are two ways by which such deposits may be removed, by flushing, or washing out the obstruction with a strong flow of water, and by scraping or dragging it out with a suitably designed hoe or scraper.

The water for flushing may be obtained in several ways. Where the topography admits of it, water from some stream may be introduced at the upper parts of the system and discharged into the same stream at a lower level; in the case of a seaside city the high tide may be allowed to enter the sewer and flow out at some point where the tide is lower; a reservoir may be filled at high tide, and discharged after the tide has fallen; rain-water, waste water from baths, factories, etc., may be accumulated for a time, and then discharged into the sewer; the public water-supply may be used; or, finally, the sewage itself may be dammed up and made to act as flush-water. In planning the flushing arrangements, it must be borne in mind that a quiet flow of sewage or water, however large, is of little effect in removing obstructions once formed, and that to be effective the flush-wave must be sudden, of large volume, and introduced within a short distance of the obstruction. This wave-action, in all cases except where the stream-flow is always sufficient to fill the pipes, must be formed by a sudden discharge through a gate or other device. This may be done either automatically, or by hand; at fixed intervals, or whenever deemed necessary. In this country a reservoir accumulating water from the public water-supply and discharging through an automatic gate (the so-called automatic flush-tank) is the flushing method in general use. In many cases, however, it would seem a sad lack of judgment to neglect to provide, when it can be easily and cheaply done, other means of washing out the mains and laterals of a-system.

When hand-gates are used, limited, on account of weight, to pipes of about 20 inches diameter, either the water-supply or sewage may be used. For this purpose the brickwork on the lower side of the manhole beyond which it is suspected that deposits may occur is brought up in a plane around the pipe from the bottom, and a bearing-surface for the gate bolted on; or a frame in which the gate may slide up and down may be secured to the manhole wall. The end of the pipe may form the bearing-surface, or the pipe may be closed by a plug.
Large sewers, especially storm-water sewers in which the flow-volume varies largely, require gates too large and heavy to be raised directly by hand, and a screw or windlass must be provided. If such a gate is located at a point in the sewer where an overflow into some stream can be arranged, it provides for the contingency of a gate sticking or broken mechanism or the negligence of attendants.

Automatic flush-tanks, generally used with 6- and 8-inch sewers, in this country are of two types, viz., operating through some movable part or through the starting up of a large siphon. Of the first type is that made in Schenectady, N. Y., by the Van Vranken Flush-tank Co., the following description and drawing of which is taken from the circular (see Fig. 45):

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The siphon-tank was invented by Mr. Field, so far as its present form is concerned, was afterwards improved by Col. Waring, and is known as the "Field-Waring Tank." The following description, together with a sectional drawing, is taken from the circular (see Fig. 46):

"The siphon invented and patented by Rogers Field and improved by Col. George E. Waring, Jr., consists (in the form shown) of an annular intaking limb, and a discharging limb at the top of which is an annular lip or mouthpiece, the bottom of which is tapered to less diameter. The discharging limb
terminates in a weir-chamber which when full to its overflow-point just seals the limb. Over the crest of the weir is a small siphon whose function is to draw the water from the weir-chamber and thus unseal the siphon. At the lower end of the small siphon is a dam or obstruction to retard its breaking. The main siphon is brought into action (on the tank being filled) by means of a small stream of water flowing over the annular mouthpiece and falling free of the sides of the discharging limb. As soon as the lower end of the discharging limb has been sealed by filling the weir-chamber the falling stream of water gathers up and carries out with it a portion of the contained air, thus producing a slight rarefaction.

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"This rarefaction causes the water to rise in the intaking limb higher than in the basin outside, and hence increases the stream of water flowing over the mouthpiece, which in turn increases the rarefaction, and the siphon is soon brought into full play.

"On the tank being emptied to the bottom of the intaking limb the flow is checked, and the small siphon over the crest of the weir draws the water from the weir-chamber, air enters the discharging limb, and the siphon is vented ready for the tank to again fill.

"These siphons are largely in use and are giving excellent satisfaction; made in two sizes for flushing sewers."

A slight modification of this tank was made by Benezette Williams, and the improved tank was manufactured under the name of "The Rhoads-Williams Siphon." It has been much used in the West and has proved very satisfactory. The catalogue gives the following description and table, which latter will serve as a general index of the capacity of flush-tanks:

"The Rhoads-Williams Siphon, as illustrated in Fig. 47, consists of an annular intaking limb or bell, and a discharging limb terminating in a deep trap below the level of the sewer. Below the permanent water-line in the discharging limb is connected one end of a blow-off, or relief-trap, having a less depth of seal than the main trap, the other end of which joins the main trap on the opposite side at its entrance to the sewer and above the water-line of the trap.

"The bell has a vent-pipe terminating at a given point above the bottom of the bell, and extends above the high-water line. The pipe which extends above
the bell has a cap on it with the proper size sniff-hole for venting the siphon.

"As the tank fills (the main trap being full) the water rises in the intaking limb or bell, even with the level of the water in the tank, until, reaching the end of the vent-pipe, a volume of air is confined in the two limbs of the siphon between the water in the intaking limb and the water in the main trap. As the water rises higher in the tank the confined volume of air is compressed, and the water is depressed in the main trap and in the blow-off trap. This process goes on until the water in the tank reaches its highest level above the top of the intaking limb, at which time the water is depressed in the blow-off trap to the lowest point and the confined air breaks through the seal, carrying the water with it out of the trap, thus releasing the confined air and allowing an inflow from the tank, putting the siphon into operation.

"On the tank being discharged to the bottom of the intaking limb the flow is checked, and the siphon is vented by the admission of air to it through the vent-pipe."

**Table XIX.**

**RHOADS-WILLIAMS AUTOMATIC SIPHON.**

<table>
<thead>
<tr>
<th>Diameter of Discharging Limb, Inches</th>
<th>Diameter of Sewer, Inches</th>
<th>Size and Capacity of Tank, with Siphons of Standard Length</th>
<th>Water required to fill 100 Lineal Feet of Sewer, Cubic Feet</th>
<th>Price at Factory for Siphons of Standard Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>6</td>
<td>4</td>
<td>36</td>
<td>27</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>4½</td>
<td>3½</td>
<td>40</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>5</td>
<td>6</td>
<td>59</td>
</tr>
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<td>6</td>
<td>36</td>
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<tr>
<td>12</td>
<td>15</td>
<td>7</td>
<td>40</td>
<td>128</td>
</tr>
</tbody>
</table>
SEWER DESIGN.

The Miller tank is the latest development and is probably the best and most reliable tank to be had to-day. The following description from the catalogue explains the workings of the several parts:

"The Standard Design Miller Siphon, as shown by accompanying illustration (see Fig. 48) consists of but two parts: the discharging limb or deep-seal trap (with the discharge mouth integral therewith), and the intaking limb or bell, which is placed over the longer leg of the siphon and held securely in place by its own weight, both parts being plain castings with no machine work whatever.

"This siphon has no moving parts to get out of order, no joints to leak, and no small tubes to clog up or choke, and is universally acknowledged to be the simplest and most durable device of its kind ever made.

[From London Engineering.]

"... The action of this siphon is as follows: As the water entering the tank rises above the lower edge of the bell it encloses the air within, the lower portion of the trap being, of course, filled with water. As the water-level of the tank rises the confined air gradually forces the water out of the long leg of the trap, until a point is reached when the air just endeavors to escape around the lower bend. Now as the difference of water-level in the two legs of the trap equals the difference of the levels between the water in the tank and the water within the bell, it will be seen that the column of water in the short discharge leg has practically the same depth as the head of water in the tank above the level at which it stands in the bell. The two columns of water therefore counterbalance each other at a certain fixed depth in the tank. As soon as this depth is increased by a further supply, however small, a portion of the confined air is forced around the lower bend, and by its upward

Fig. 48.
rush carries with it some of the water in the short leg, thus destroying the equilibrium and the siphon is brought into full action immediately. The water is then drawn out of the tank to the bottom of the bell, the siphon vented by the admission of air through the sniff-hole, and the operation repeated. The secret of this invention is the free projection of the overflow edge of the short leg of the trap, which allows of the instantaneous escape or falling away of the heaved-up water. Thus if the discharge mouth were formed as an ordinary bend, the siphon would not act (although the confined air rushes around the lower bend), for the simple reason that the heaved-up water has no means of instantaneous escape, and therefore the equilibrium is not sufficiently disturbed. It will thus be seen that the action of this siphon depends, not on the escape of air, but on the sudden reduction of a counterbalancing column of water.

"Repeated trials with a 6-inch (Miller) siphon have shown that it will discharge full bore a 500 gallon tank, fed so slowly as only to be filled in fourteen days.

"There being no internal obstruction, the discharge is extremely rapid.

"We have had the opportunity of seeing one of these siphons at work in the excellent Sanitary Museum at Hackney, and, though severely tried, the siphon worked perfectly."

A special form of the "Miller Tank," designed by Andrew Rosewater for use in the city of Omaha, Neb. (see Fig. 49), is now manufactured. It is claimed that it discharges 40 per cent faster than any other siphon of the same size. It does not take the place of the inspection manhole, but affords easy access for inspection during the working of the siphon.