located some distance away from any source of heat or on exterior walls, as is found in conveniences which are placed in a shed or outhouse, a downward motion takes place by which the efficiency is lessened and the ventilating influence on the sewer is reduced considerably. Since the efficiency of house drains is greatest if all pipes are placed in a warm location, provision should be made in local by-laws compelling owners of houses to continue the soil pipe to a sufficient height above the roof, and in the case of new buildings the soil pipes should be placed as close as possible to a chimney. In this manner the irregularity caused by the house drains in cold locations would be overcome, and more house connections would co-operate in the removal of the sewer air. The greater the suction, and the more house connections there are, the better would be the condition of the sewer air.

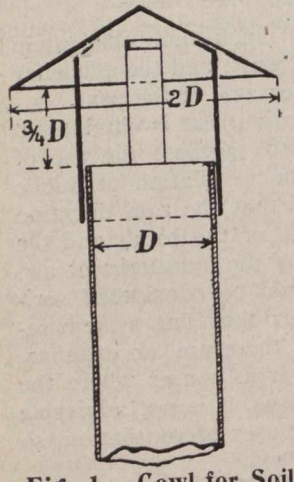

Fig. 1.—Cowl for Soil Pipe.

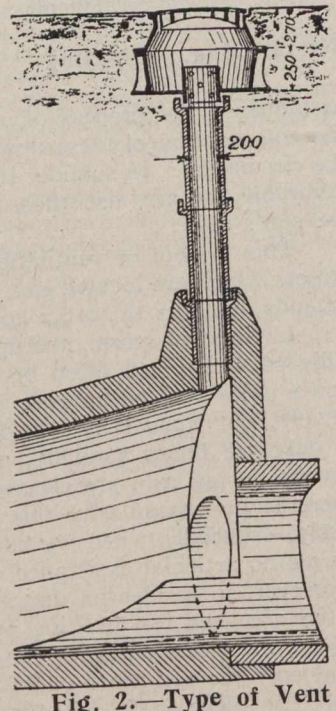

Fig. 2.—Type of Vent Shaft.

It might be mentioned here, that occasionally a downward current of air is caused by waste water from sinks and baths, but this discharge is generally of such short duration that the matter is not worth considering. On the other hand, if the question is raised against the downward current, it should always be borne in mind that a reversion of direction helps to flush the house drains thoroughly, and owing to the large number of remaining house drains it does not interfere with the general process of ventilation and is, therefore, desirable. If the ventilating efficiency of the soil pipes is irregular, the reason can generally be found in the absence of, or defective, air inlet.

We will now consider the second group, viz., the connections between the sewer and the atmosphere at the street level. These air inlets consist principally of perforated manhole covers. The distance separating these covers should range, in small sewers, from ninety to one hundred and fifty feet, and in large sewers from one hundred and eighty feet to three hundred and thirty feet. If the distances are greater than this, the addition of a special shaft would be necessary.

Under normal conditions, in dry weather, a continuous circulation from the manholes through the sewer to the houses takes place and the constant current will only be occasionally interrupted, as stated above. In times of storm, these conditions would be different. On a shower of rain entering a sewer an energetic air current is caused, which has a reverse direction to that during dry weather. A large volume of air is attracted through the down pipes by the accelerated falling velocity of the rain, and is conveyed into the sewers. The mixture of air and water fills the sewer, causing air tension.

Since the house connections, in time of rain, are soon submerged, the air cannot escape from the sewer through these drains, it will, therefore, try to find its way through the sewer to the street gullies. It cannot escape through these gullies owing to the quantity of surface water discharging from them. If the seal in the trap of the gulley is sufficient to resist the air pressure the escape of sewer air is prevented, and thus the only exit would be through the perforated manhole covers. If these covers are not perforated the air cannot escape and the sewers will become air-bound, so that the gullies will not be able to discharge into them, thus causing the streets to become flooded, and the pressure of air in the sewer would still be increasing until the manhole covers are forced and the joints of the sewer blown, causing considerable damage.*

In spite of the provision of perforated manhole covers flooding may still occur unless care is taken to have a sufficient number of manholes and their covers provided with an adequate number of perforations such that they will not be ventilating covers in name only. Many proposals have been previously made on account of the former unreliability to use only the perforated manhole covers or only the house connections for the ventilation of the sewers, but all these have been rejected. No group *per se* could be both inlet and outlet. On the other hand, heavy showers displace the sewer air by completely filling the cross-sections of the sewers, thus promoting circulation as well as in dry weather the differences in levels and temperature. We would not abstract from considering showers as favorable for the ventilation, but it would be better to improve the existing defects so that all trouble which may occur during storms will be avoided. An installation often resorted to is the provision of vent shafts similar to those shown in Figs. 2 and 3. Although these vent pipes are most essential during periods of rain, they also materially assist the circulation during dry weather.

These vent shafts serve two purposes, viz., to assist the manhole inlets when these are a considerable distance apart and to act as outlets for sewer air during heavy rains, when the house connections to the sewer are submerged. Thus, the installation of these vent shafts is recommended as an auxiliary means to promote thorough ventilation.

Since the connections of the sewer with the atmosphere at street level have serious disadvantages in some cases such as the danger to traffic caused by the holes in the manhole covers, the difficulty of cleaning and keeping the holes in the cover open, which is of vital importance for circulation, attempts have been made to substitute the perforated manhole covers by providing air inlets from the sidewalks or by the gullies.

The first method, that of inlets from the sidewalks, would scarcely answer the purpose, apart from the initial cost, as the maintenance would be a prohibitive expense, if adequate circulation is to be constantly maintained, on

*[NOTE.—An illustration of such an occurrence was reported in the Toronto daily press following a severe rainstorm on June 7th last. The pressure became so great in the Garrison Creek sewer that a section 20 feet in length was blown out; flooding Willowvale Park, it is announced, to a depth of 3 feet, with water and sewage.—Editor.]