

not as a rule use so tight concrete as that made of Portland Cement in England for covering stoneware drains. The writer has seen such drains carefully laid and covered with a concrete of American (Rosendale) Cement, as good as the average of cellar bottoms, yet incapable of preventing an escape of sewer gas into the house. It came up, without a doubt, through the pores of the concrete before putting in an outside trap, showing that this stoneware pipe is far inferior to cast iron with lead joints for use within the walls of the house.

We would call particular attention to the clause requiring ventilation *at both ends* of the drain within the house, so as to secure a constant flow of pure air through it.

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

The above regulation is a very important one, and but poorly understood and appreciated by many of our drain layers. Our climate is more favorable than that of the eastern part of England in enabling us to avail ourselves of the rain fall for flushing house drains at frequent intervals. That is, we have violent rains at more frequent intervals than near London. Yet many drains are laid here with too little inclination, or too large to be self-cleansing, and with no provision for admitting rain or any other means of flushing. The best automatic apparatus for this purpose we have ever seen is the flushing tank of Mr. Rogers Field of London, which is now to be found at some of our sanitary warehouses.

"§ 4.—Every drain shall be ventilated by one or more suitable pipes or openings, and no pipe or opening shall be used for ventilation unless the same be carried upwards without angles or horizontal lengths, and with tight joints. The size of such pipes or openings shall be fully equal to that of the drain pipe ventilated, except in particular cases where the Sanitary Authority shall give permission for the use of a smaller size, which shall, however, be under no circumstances less than four inches bore. Rain water pipes shall not be used as ventilators, except in particular cases where their upper extremities are at a distance from any windows, openings or projecting eaves, so that there is no danger of the escape of foul air into the interior of the house from such pipes."

This regulation is similar to the practice often recommended in our columns. In applying ventilating pipes to old systems in houses which have soil pipes without them, it may not be always practicable to run them up "without angles." It is doubtless best to have them as direct as possible, but it might often occur that a perfectly straight line of pipe would so deface an old house that it would be better to deflect it by smooth bends, to accommodate the circumstances of the case. A smooth bend in a pipe does not obstruct the flow of air by any additional friction, properly so called, but merely by loss of *momentum* in the moving column. The pipes should, however, always be as direct as possible.

The objection urged in § 4 against using rain-water pipes as ventilators is a sound one.

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

This is what we have always recommended in our columns, as is now generally done by all the best authorities. The only excuse for its omission is the most thoroughly constructed and perfectly ventilated system of sewers, such as hardly exist to our knowledge. Where no sewers are yet built and where cesspools are used instead, the use of this trap is of still greater importance.

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

This regulation is doubtless well adapted to an English climate, but if applied in our own, in the latitude of New York or Boston, the inward draft of such openings of the cold air in extreme weather, would in a few hours fill the drain with an accumulation of frozen sewage, and finally break it up by the expansion produced in the process of freezing. Such ventilation inlet holes if constructed as large as above described for summer use in our

climate, would require to be filled with straw or similar non-conductor of heat in winter, largely diminishing the amount of air that can enter, and keeping its quantity so limited that it can be warmed up to 32° by the heat of the drain and its surrounding soil.

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

This section is universal in its application and should never be disregarded. If a direct connection be made, the foul air of the drain will pass up through such subsoil drains to the cellar, and thus pervade the house. Of course the flow of water from such drains is so uncertain and subject to such long intermissions in times of drouth, that no reliance could be placed upon a trap in these drains, which might be dry by evaporation during half the time.

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

This is in accordance with the practice recommended hitherto in our columns. We would call attention particularly to the condemnation of the D trap, and would class with it the Boston cylinder traps and all others which hoard up filth for decomposition by any shape of lateral expansion of their walls. They are, one and all, inventions of the enemy.

"§ 9.—Except in the particular cases provided for in § 4, where a rain water pipe may be used as a ventilator, no rain water pipe shall pass directly to any drain or sewer, but shall be disconnected therefrom by delivering into an open channel or over an open gully with a suitable trap, or in some other way so as to have its discharging end open to the air."

The importance of such protection as here described arises from the fact that no trap in the line of the rain water conductor is reliable in the time of drouth, a reason which operates with even greater force here than in England. The provision of open gullies as recommended above must always be so modified as to exclude frost in our climate; so that this provision is often difficult to enforce with us, except in certain favored situations, or modified by entering the rain water in a ventilating well over the main drain trap.

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

The last paragraph of this regulation is applicable here without qualification; but the rigor of our climate forbids our adoption of the first paragraph, viz.: discharging waste pipes from lavatories, bath tubs, sinks, &c., "into the open air" in winter. Such a course would soon build up a pyramid of frozen sewage at every point of discharge. It is well enough to discharge the overflow of tanks and safes into the open air, for they do not deliver water enough to make trouble by its freezing. But even with these a more convenient and equally safe method can be adopted without going through the house walls, viz.: overflow the tank into the bath tub, and the safe wastes over the kitchen sink or cellar floor. In either case their discharge would attract attention to the fault above, before any harm would be done. As to overflows of lavatories, bath tubs, plunger water closets, etc., we consider it safe to discharge them into their own wastes above or into the traps which should always be provided as close as possible to the point of discharge of the vessel to be emptied. These wastes can also be safely discharged into soil pipes or main drains if each waste be properly trapped. The trap should be a running or syphon trap, and provided with an air vent as large as the waste to guard against it being emptied by syphoning.

Such an arrangement seems to be giving satisfactory results