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SANITARY  
**HOUSE-DRAINAGE.**

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By Milbrey Green, M. D.,

(Reprint from Mass. E. M. Journal.)

BOSTON.

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# SANITARY HOUSE-DRAINAGE.

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BY MILBREY GREEN, M. D., BOSTON.

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REPRINT FROM MASS. E. M. JOURNAL.

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EVERY year Boards of Health and Health Officers throughout the country report a large number of cases of typhoid fever, diphtheria and other zymotic diseases, traced directly to bad house-drainage. During the past three months there has been an unusual amount of typhoid fever in Boston, and many cases have been traced to this cause.

Every year we hear of instances where, owing to faulty plumbing—neglect of proper trapping, or the use of imperfectly constructed or porous traps—the deadly miasma from sewers, and waste and soil pipes, has impregnated the air, food and drink of households, and infected the clothes, furniture, carpets, and even the walls, and swept away nearly entire families. We have seen that houses impregnated with the miasma from sewers and soil pipes are more dangerous than those infected by small-pox, and more difficult to render safe.

Bad house-drainage is frequently the result of ignorance, cupidity and a mistaken sense of economy. There are many plumbers who have little or no knowledge of hydrostatics and mechanics, but are employed by builders equally ignorant, because they work cheap. Of the plumbers who thoroughly understand their business some fail to do their work well because they take their contracts so low they can make no profit if they use first-class materials and employ skillful workmen. A large proportion of men who build houses to lease or sell care very little how the plumbing is done, provided their walls and ceilings are not

stained by leakage from pipes and tanks, or their houses rendered uninhabitable by strong odors from water-closets and sewers. They give the plumbing work to the lowest bidders, and as they pay only for cheap work they are quite sure to get it. Plumbers do not claim to be more honest than other mechanics, and cannot be expected to give better material and better work than they are paid to furnish. In order to meet competitive bidding they cipher close and economize in every possible way, and use as cheap material as the often loosely drawn contract allows, and employ the cheapest workmen they can find. Under such circumstances competent plumbers neglect many precautions in properly trapping, and other details, they know are essential to health, when they would have done differently had they been paid for first-class work. The same thing sometimes occurs in houses built by men for their own residence, where a mistaken sense of economy leads them to contract for cheap plumbing while they spend money freely for external and internal ornamentation.

Much of the evil resulting from the cupidity, dishonesty and ignorance of plumbers and builders might be abated by a proper regulation of house-drainage by law. In almost every city there are ordinances regulating the construction of buildings, prescribing the size of timber, thickness of walls, and other details, so that no unsafe buildings shall be constructed, and carpenters are obliged to conform to these regulations, or lay themselves liable to a fine. We hear no complaint of this being an unjust law, and no one can deny that a city has as much right to prescribe how the plumbing of a building shall be done as the carpenter work. House-drainage, as well as the work of connecting houses with sewers and water supplies, ought to be regulated by law. The danger from shabby buildings is often apparent to ordinary observers, but the evil results of poor plumbing and defective drainage are often unsuspected until sickness, and sometimes death, makes them manifest.

Massachusetts, in 1877, enacted a law authorizing Boards of Health "to prepare and enforce, in their respective cities, such regulations as they may deem necessary for the safety and health of the people with reference to house-drainage and its connection with public sewers, where such connections is made." This enactment was subject to acceptance by a majority of the legal voters of the several cities of Massachusetts, present at a meeting called for the purpose of acting thereon. In 1881 this act was amended in regard to sewer connection.

Under this Act the Board of Health of Cambridge, in 1881, adopted certain regulations in relation to the construction of

house-drainage, embracing directions for materials to be used, grades, traps, ventilation, workmanship, etc., and the city ordinances were amended in accordance with these regulations, and there has been no difficulty in enforcing them. Two other cities have followed the example of Cambridge, and it is to be hoped that every Board of Health in the State will soon do so. The Municipal Assembly of St. Louis, in January, 1880, passed an ordinance to regulate the construction of house-drains, and I have been informed by the Chairman of the Board of Health, and several prominent physicians there, that the ordinance has worked well.

Boston will soon have completed the best system of sewers in the United States, but unless some good system of house-drainage is adopted and enforced, the death rate from zymotic diseases will still continue high.

The last Annual Report of the Massachusetts State Board of Health, Lunacy and Charity contains some excellent suggestions in regard to house-drainage. They are the result of much study and research, and until something better is proposed much good will result if they are followed by builders throughout the country :

“(a) All drain-pipes inside the house should be of metal, and all joints of well-calked lead or solder. Metal is recommended in preference to stoneware, owing to the difficulty in keeping tight the joints of the latter. All connections between lead and iron should be by a calked brass nipple and solder. It is best to keep drain-pipes in sight, or at least of easy access. They should never be *hidden* under the ground. If needed below the basement or cellar floor, they should be placed in a trench lined with brick walls, with movable covers on the trench. It is a good plan to paint the pipes white, so that any slight leakage of gas may be seen readily; for such gas generally discolours the paint.

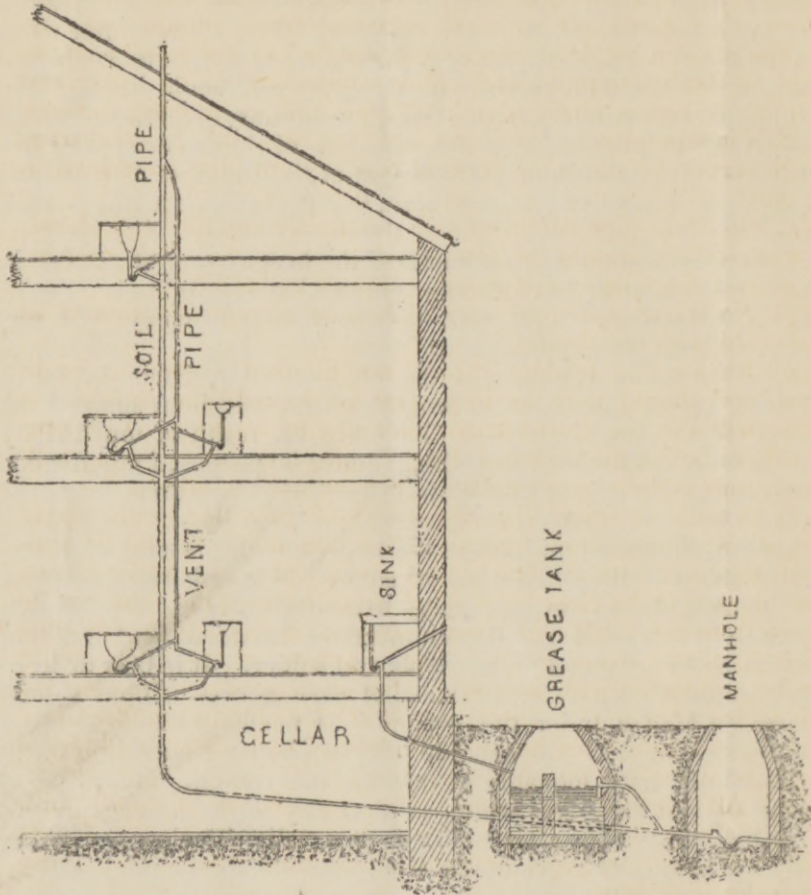
(b) Changes of direction in iron pipes should be made mostly by Y-branches, leaving an open hub, to be closed by a brass nipple calked in with a movable brass clearing-screw as large as the drain, to be removed for inspection and cleaning. In straight reaches of fifty feet or more in length, these Y-branches and clearing-holes should be introduced at intervals of not over forty feet.

(c) No T-branches should be allowed, except in vertical pipes.

(d) All pipes should be put together by a series of straight lines, and with a general direction as straight as possible.

(e) All pipes should have a fall of not less than two per cent. of their length, where no special apparatus is provided for flushing. All drains should be kept free from deposit; and, if this

cannot be effected without flushing, special apparatus should be applied for this purpose.



(f) A trap should be placed on the main drain outside the house-walls, made of glazed earthenware, with a vent-hole as large as the pipe directly above the trap, communicating with the open air (as shown in the cut). This should be made accessible for cleaning out, and a rain-spout had best be discharged into it or into the drain at some point above it. This trap should be near the house, and can be alongside the grease-tank, if convenient.

(g) Every separate stack of soil or waste pipe within the house should extend out through the roof, at least four inches in diameter: smaller pipes than this are liable to be choked with ice from condensation of steam in winter.

(*h*) Separate traps should be placed under all receptacles of drainage, as close to them as possible, and no other traps allowed to intervene between these and the outside or main trap described above (*f*). Each one of these separate traps should have an air-pipe of iron or lead connected just below the water-seal, as large as the waste-pipe, and either connecting at its upper end with the soil-pipe above all other branches, or passing through the roof independently, as found most convenient. Several traps can be served by the same vertical line of vent-pipe, as shown in the cut.

(*i*) No drain-pipe from any safe-pan under any tub, sink, bowl, or water-closet, should be connected below to the drain system, but should discharge over an open sink or cellar floor.

(*j*) No waste-pipe from an ice-chest or refrigerator should be connected with the drains.

(*k*) Rain-water leaders should not be used as soil or drain pipes, nor should they be depended on to ventilate drains. If connected with the drains at all, care should be taken to so connect them below the water of some trap, otherwise supplied with water, unless their upper ends are remote from windows.

(*l*) A tank or small cistern should be provided in the upper part of the house, from which the kitchen boiler should be supplied, together with the bowls and sinks; also any water-closets that happen to be close by. The drinking-water should not be drawn from this tank, but from a separate tap on the supply-pipe direct from the street main. The overflow of this tank should not be connected with any drain, but discharge as directed for safe drains above (*i*). It is common in mild climates to discharge such pipes through the house-wall into the open air; but this plan would be worthless in frosty climates.

(*m*) All water-closets should be supplied by a small tank directly above them, and not by valves attached to the closets themselves, nor by pipes branched from those from which drinking-water is drawn.

(*n*) Concentrate the fixtures used for drainage—such as water-closets, bowls, sinks, tubs, etc.—as nearly as possible in vertical groups, to avoid waste-pipes passing across under floors, which are rarely satisfactory.

(*o*) Never locate a fixture, especially a water-closet, in a dark corner where a good ventilation cannot be had. If outer air cannot be got, seek to draw off the foul air from the closet by a pipe leading up through the kitchen-fire flue to the chimney-top, built into the chimney for the purpose, at least four inches in diameter. Small pipes branched into the fire-flues for this purpose soon get choked with soot at their mouths, and become worthless, unless extending quite to the top of the chimney."

After securing as good house-drainage as possible, it is necessary to see that it is kept in order. Everyone knows that even the best constructed houses need occasional repairs, as well as the heating apparatus and everything connected with them. No means have yet been found to render houses perfectly secure from sewer gas, and only by vigilance in maintaining as good plumbing as possible can comparative safety be expected.

C. F. Wingate, an expert in sanitary engineering, says: "It must always be remembered that no plumber's work, however complete it may be at first, can be relied upon to remain perfect. The best plumbing will not last forever, but needs attention. . . ."

Leaks may occur to permit the admission of sewer gas from drain-pipes due to defective castings, or to walls settling in houses built on made ground, or from the strain of the alternate expansion and contraction from hot water, or even from the forcing of lead joints by the pressure of steam discharged from manufactories into the public sewer.

A no less serious evil is the corrosion of lead traps or lead waste-pipes, particularly in old houses which have unventilated drains. This may be caused by the action of sewer-gas, or from the use of certain popular disinfecting fluids. Lengths of pipe have been found completely honey-combed in this way. As such corruptions usually occur on the upper side of traps, or horizontal pipes, it is not easy to detect their presence, from the absence of leakage, and the only safeguard is to avoid carrying waste or soil pipes horizontally; also, to extend their upper ends through the roof, and leave them open for ventilation. Lastly, to substitute iron pipes for lead wherever possible, which is now the general rule in all good plumbing practice.

Corrosion sometimes occurs at the joints of lead pipes, contiguous to the line of solder, and is attributed to galvanic action created by the contact of the zinc and lead; but as these openings are apt to leak they are more liable to discovery. It is a good plan to overhaul all plumbing periodically—say every year or two—to guard against accidents.

And here it should be remarked that *sewer-gas is created not in the sewers alone*; but every inch of waste-pipe in a house, even though used to convey nothing but soapy water or the waste of melted ice from a refrigerator, can, and commonly does, produce foul gases. The worst odors are from just such sources, and they are certainly unwholesome."

The danger from defective house-drainage, where there are cesspools and privy-vaults, is scarcely less than where there are sewer connections, and yet, as a general rule, much less attention is given to it, especially in regard to trapping. A prominent



CORRECTION.—In the fifth line from the bottom, on page 7, the words “*and the cap secured,*” should be omitted. The Bower and Nicholson traps are also excellent.

M. G.

physician, in one of our neighboring cities, writing of the condition of houses in that city, where cesspools are used, says:

“House-drains are seldom either trapped or ventilated. The ordinary dwellings have no traps to their kitchen-sink waste-pipes. . . . It is the usual custom to trap the soil pipe with a half or full S bend, and then connect with this, without separate traps, the waste-pipes of bath-tubs and wash-bowls on the same floor of the house.” Late reports show that this state of affairs still exists to some extent, in every community.

A distinguished sanitary engineer, after speaking of the evils resulting from cesspools, said: “But cesspools, in the absence of sewers, become a necessity. Large numbers of our people are driven by the increase of population to live on quarter-acre lots, and even smaller ones, with their old privy-vaults, cesspools and wells for drinking-water, within one or two rods of one another.” This picture is true, not only of villages and small cities where there are no sewers, but also of sections of every city in New England where sewers have been constructed.

We know this to be the case among some of the finest residences of Cambridge, Roxbury, Dorchester and various districts of Boston, as well as among tenement houses. Within a week a physician in Cambridge reported his attending several members of one family where the sickness was produced by just such a condition of their premises as that above described—the privy-vault, cesspool and well being in juxtaposition. The same physician reported a case of typhoid fever in a fine residence on one of the best streets in that city, where a cesspool and privy-vault were the cause of the disease. Many cases of this kind might be cited from the reports of physicians in all the cities mentioned, but as such experiences are common throughout the country it is unnecessary.

Before closing I wish to call attention to a condition of many city houses that are left vacant every summer, where ordinary traps are used. The traps become dry and unsealed long before the summer is over, and the sewer-gas pervades the houses, infecting bedding, carpets, furniture, and sometimes the walls. This has frequently been the cause of sickness in families within a few weeks after their return from seashore or mountain summer resorts. One of the best safeguard against this evil is the Cudell trap, in which the pipe is closed by a ball, ~~and the cap secured~~ in such a way that it cannot become unsealed, although the water in the trap may evaporate, when the pipe is left long unused.

In regard to the term “sewer-gas,” about which there has been much dispute, I think the definition given by Dr. F. H. Hamil-

ton is a good one. He says: "What has been called 'sewer-gas' is composed of air, vapor, and gases in constantly varying proportions, together with living germs—vegetable and animal—and minute particles of putrescent matter. In short, it is composed of whatever is sufficiently volatile or buoyant to float in the atmosphere, and in consequence of which buoyancy it is permitted to escape through the various sewer outlets."

