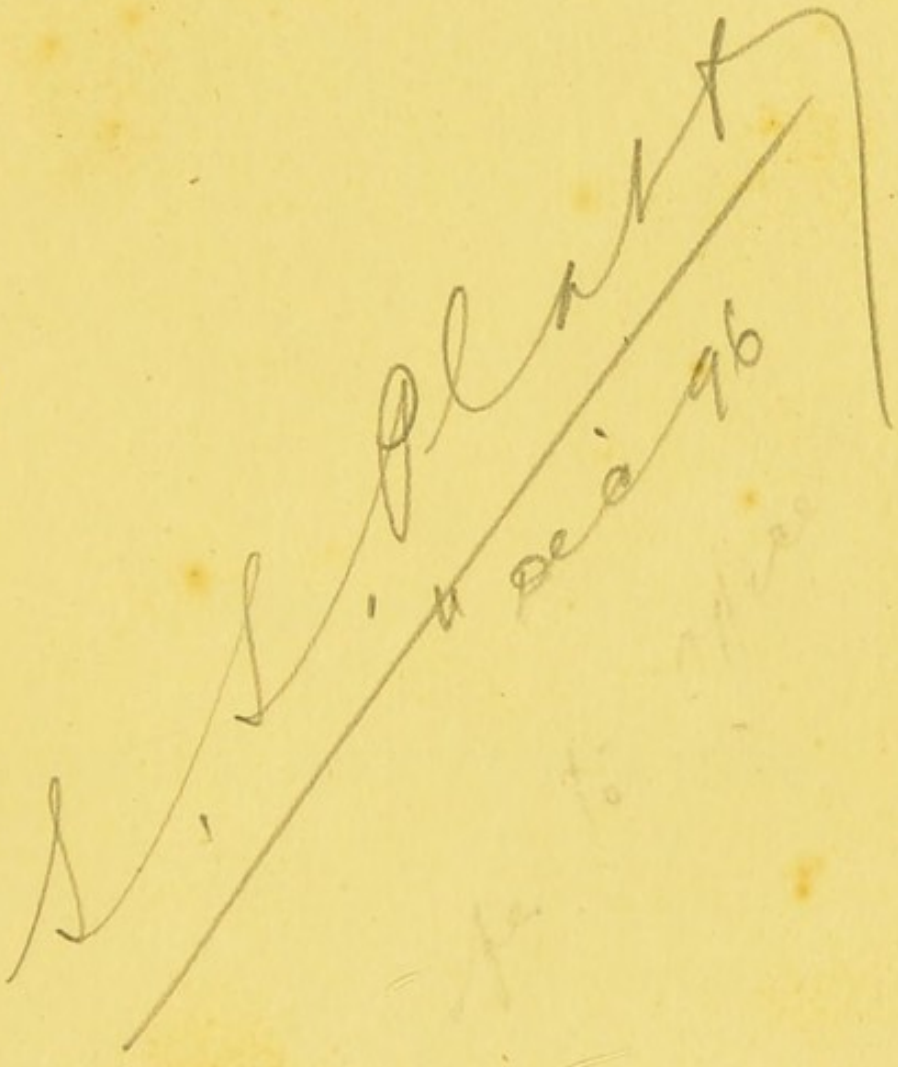
Disease and defective house sanitation : being two lectures delivered before the Harveian Society of London / by W. H. Corfield.

DISEASE
AND
DEFECTIVE HOUSE SANITATION

CORFIELD



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BEING TWO LECTURES DELIVERED BEFORE THE HARVEIAN SOCIETY OF LONDON

BY

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PREFACE.

THE following pages contain the substance of two of the Harveian Lectures delivered by me before the Harveian Society of London in December, 1893. At the close of the third lecture I was requested by the meeting to publish them, but pressure of other work has prevented my doing this sooner. The third lecture, in which a description was given of good sanitary appliances and arrangements in houses, is omitted because those subjects are treated of more in detail in my little work on "Dwelling Houses, their Sanitary Construction and Arrangements."

The figures are selected, with the kind permission of Messrs. Cassell and Co., from those illustrating my article on Defective Sanitary Appliances and Arrangements in a work edited by Mr. Shirley Murphy, and entitled "Our Homes, and How to make them Healthy."

W. H. C.

19 Savile Row, London, W.
June, 1896.

DISEASE

AND

DEFECTIVE HOUSE SANITATION.

HAVING for more than twenty years devoted myself especially to the practical side of Hygiene, and among other branches of it more particularly to those which relate to the disposal of refuse matters and to the efficient sanitary arrangements of dwelling houses, I propose to direct your attention in this and the following lectures to the connection of disease with defective conditions in and about houses, and to the prevention of such disease by the adoption of improved arrangements and appliances.

The possibility of a house being in such a condition as to communicate diseases to the inhabitants thereof has been recognised from very early times.

The ancient Egyptians, from whom we have learnt the rudiments of sanitary as well as of most other sciences, and whose sanitary practice we

find recorded in the books of Moses, were fully aware that a house might become infected. In the description given by Moses of the methods for preventing the spread of leprosy, we find that the house in which a leper had lived was to be emptied "that all that is in the house be not made unclean." The priest was then to inspect the house and close it for seven days, after which time he was to inspect it again, and "if the plague be spread in the walls of the house then the priest shall command that they take away the stones in which the plague is, and they shall cast them into an unclean place without the city, and he shall cause the house to be scraped within, round about, and they shall pour out the dust that they scraped off without the city into an unclean place, and they shall take other stones and put in the place of those stones, and he shall take other mortar and shall plaster the house; and if the plague come again and break out in the house, after that he hath taken away the stones, and after he hath scraped the house, and after it is plastered . . . . . he shall break down the house and the stones of it, and the timber thereof, and all the mortar of the house, and he shall carry them forth out of the city into an unclean place."

The above passage clearly shows that those

ancient sanitarians thoroughly well undertsood that a building, and especially the surfaces of the walls inside might become so infected with the poison of a communicable disease as to infect persons coming into the house, and the precautions taken for preventing the spread of a disease in such a manner were even more thorough than those we now insist on.

The very title of one of the works of Hippocrates, "*Airs, Waters, and Places*" shows the importance that he attached to locality in connection with disease, while the fact that communicable diseases could be conveyed by means of water, air, and food was so well understood in ancient times that even Virgil alludes to the fact in unmistakable terms, thus translated by Dryden;—

> "Here from the vicious air and sickly skies,
> A plague did on the dumb creation rise;
> During th'autumnal heats th'infection grew,
> Dumb cattle and the beasts of nature slew.
> Poisoning the standing lakes and pools impure:
> Nor was the foodful grass in fields secure."

The ancient Romans, indeed, were so impressed with the importance of supplying the houses in their great cities with pure water that they brought it from considerable distances by means of aqueducts. The aqueducts which supplied the

City of Rome itself with water are so well known, and have been so often described, that it is unnecessary to refer to them further, and those which supplied the other Roman cities in Italy, in Gaul, and along the north coast of Africa, were for the most part similar to them; but two of the three which supplied the City of Lugdunum (now Lyons) were far more remarkable in their construction, as they crossed wide and deep valleys by means of inverted lead siphons, shewing that the ancient Roman Engineers thoroughly well understood the principles of practical hydraulics. I carefully examined the remains of the most important of the aqueducts of Lugdunum and described them in the Anniversary address to the Sanitary Institute in 1885 (*Trans. San. Inst.*, Vol. VII).

The ancient Romans also recognised the fact that the drainage of the soil under and about houses was an important factor in the healthiness of places, and the great drain of Rome was constructed by Tarquinius Priscus with the object of drying the ground around the forum, because it was swampy and the houses in the neighbourhood were unhealthy. This great drain, which still performs its function, was constructed as drains should be—pervious to water—so that the surplus

water of the subsoil might get into it and so be conveyed to the River, but it was soon found by the ancient Romans that the great drain was a most convenient receptacle for all kinds of filth, and was also a most convenient channel with which to connect the overflows of their cesspools, and so it soon became converted into a sewer, and received the name of the Cloaca Maxima, "Receptaculum omnium expurgamentorum Urbis," as Livy tells us.

Although most of the houses in ancient Roman cities were provided with cesspools, we have evidence that the water carriage system for the removal of excretal matters from houses was also employed, as not only at the palace of the Cæsars in Rome, but also in houses at Herculaneum, and at Pompeii, an arrangement of the nature of a water-closet has been found.

In considering the diseases which are favoured by unhealthy houses, I must first mention the Oriental Plague, about which there is plenty of evidence to show that its spread was facilitated by filth and overcrowding in dwellings, and that it has gradually disappeared in various countries since cleanliness, not only of persons, but of dwellings, has become more general. The same may be said of Cholera, a disease which especially

favours insanitary dwellings, and is spread by a contaminated water-supply, and of Typhus Fever, especially connected with overcrowding.

I now pass on to consider the diseases which have been brought under my own personal notice as being connected with insanitary conditions of houses.

I have for the purpose of these lectures gone through the records of more than a thousand cases occurring in my private practice, and I find the following diseases mentioned as having been caused, or supposed to have been caused by defective sanitary arrangements in houses—

Sore Throats,
Diphtheria,
Scarlet Fever,
Blood Poisoning,
Puerperal Fever,
Pneumonia,
Diarrhœa,
Enteric Fever,

besides general malaise.

Some remarkable instances have occurred to me where whole families have for years suffered from ill-defined symptoms. Sometimes it has been a country-house, and the members of the family have found that so far from getting re-

freshed and invigorated by their visit to the country, they have always felt depressed and weakened, and generally out of sorts during their stay in the country, especially those members of the family who spent more time than the rest in the house.

In one case this was found to be due to the fact that the house was built on a very porous soil, and had not an impervious basement floor; the result of which was, that, especially at night when the windows and doors were closed, a considerable proportion of the air supplied to the house came through the ground.

In another instance, that of a large country mansion,—the owner of which complained that he never was well when he was there, although he spent his days in hunting, and that his family were always ill in one way or another,—numerous old brick drains were found under the building, and underneath two rooms on the ground floor, where the air had often been noticed to be disagreeable, it was found that there was an old culvert which had been disused for many years, but was still connected with the main sewer of the building, a large brick flat bottomed sewer containing a considerable amount of foul sediment; and that there was actually a shaft from

this disused culvert right up into the space under the floor of one of the sitting-rooms, only loosely covered with a piece of stone.

In yet a third instance of the same kind a very similar state of things was found, except that in this instance, as in others that I have known, the foul air from the disused drain got into the hollow walls and travelled about the house, appearing more especially in one of the upstairs bedrooms. After this disused drain had been done away with, and the sanitary arrangements of the house put into good order, a considerable improvement was noticed in the health of the family.

Sore Throats are perhaps the most common manifestations of foul air of any kind, in living, and especially in sleeping rooms.

We have all heard of hospital sore throats, and also of sewer air sore throats, and in the course of my experience I have noted a great number of sore throats in houses, produced by foul air coming from the drains and sewers, sometimes directly from defective drains under the basement of the house, the foul air finding its way through the interstices of the soil or through runs made by rats into the house. In one instance of this kind where sore throats were prevalent in a house in which the sanitary arrangements had been put

into excellent order, it was found that rats had made their way from a defective drain underneath the next house, being unable to get up into that house by reason of a concrete basement floor which had been laid there (fig. 1).

Very frequently also sore throats are caused by foul air escaping from defective soil-pipes, waste-pipes, or rain-water pipes, inside houses and con-

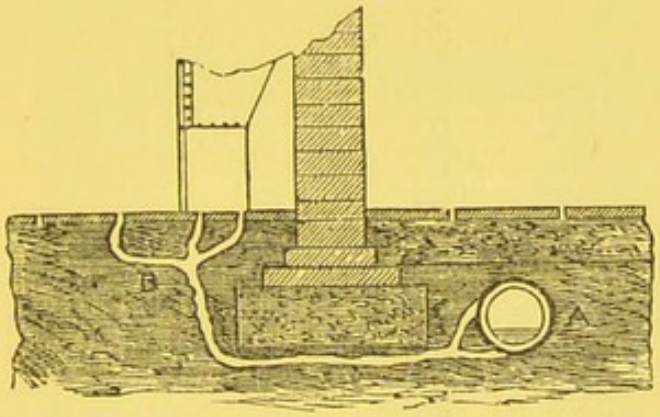

FIG. 1.—Rat-run from defective drain of one house into basement of another. A. Defective drain. B. Rat-run. *N.B.* Over A is a layer of concrete.

nected with the drains (fig. 2); thus in one instance, where there had been several serious outbreaks of sore throat, it was found that one of the principal water-closets in the house had underneath it a zinc D-trap connected with an unventilated soil-pipe, which was in its turn connected with a drain discharging directly into an unventilated cesspool. The foul air of cesspools and drains very rapidly destroys pipes of lead or zinc if confined in them,

so it was not surprising that the *zinc* D-trap of this water-closet was found to be perforated with holes which allowed the foul air from the cesspool free access to the house; not only so, but the waste-pipe of the cistern which supplied water

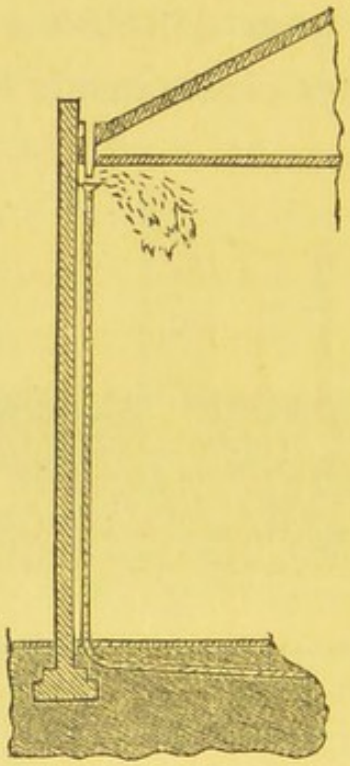

FIG. 2.—Rain-water pipe open under ceiling and ventilating drain into honse.

to a tap over an adjoining sink (as well as the water-closet) discharged into this same D-trap.

In numerous instances perforations in lead soil-pipes inside houses, and even in larders, have been the cause of sore throats (figs. 3 and 4). The waste-pipes of cisterns, whether used for the supply of drinking water or not, if connected with

the soil-pipes or drains, form channels by which the foul air can get into the house and thus produce sore throats, as I have known in many instances.

Sometimes instead of disconnecting the waste-pipes from the drains, traps are put on them to

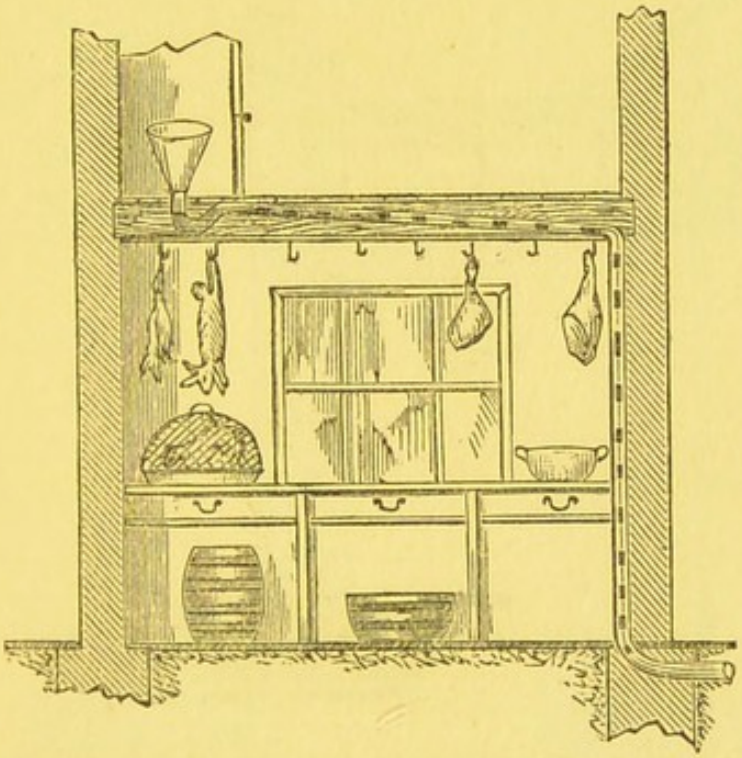

FIG. 3.—Holes made by foul air in an unventilated seamed lead soil-pipe passing through larder.

prevent the foul air getting into the cisterns and into the house, but the most remarkable instance I ever came across of an arrangement which was intended to do this and to ventilate the drain at the same time through the cistern, was in the case of a house where it having been found that foul

air came through the waste-pipe of a cistern supplying a water-closet, and produced sore throats and diarrhœa, the builder who was called upon to remedy the defect, instead of cutting the waste-pipe off from the drain and making it dis-

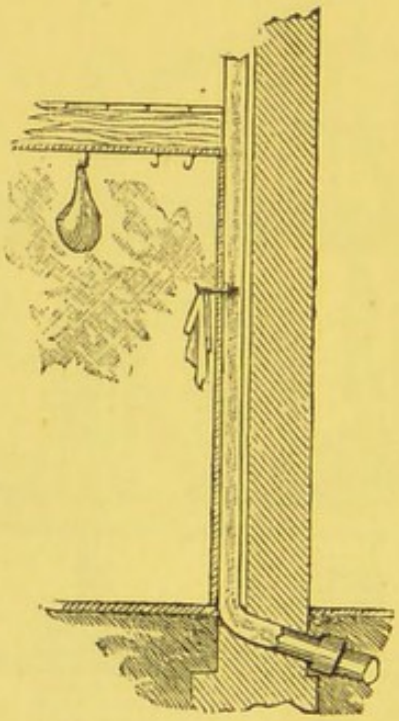

FIG. 4.—Nail driven into soil-pipe in larder wall. Foul air escaping into larder.

charge into the open air, fixed a cone of zinc in such a position that it covered the top of the waste-pipe, and carried a zinc pipe from the top of the cone up through the roof of the house. When the cistern was full of water up to the top of the overflow pipe the edges of the cone dipped

in the water, and the foul air instead of coming into the house passed up the pipe leading through the roof, and this was what the builder intended should always happen, but of course as soon as

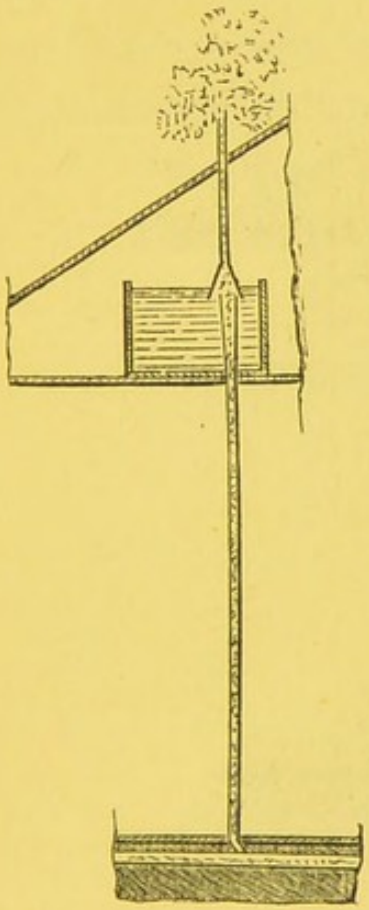

FIG. 5. — Ventilating-pipe over waste-pipe of cistern taking foul air from drain through roof when cistern is full.

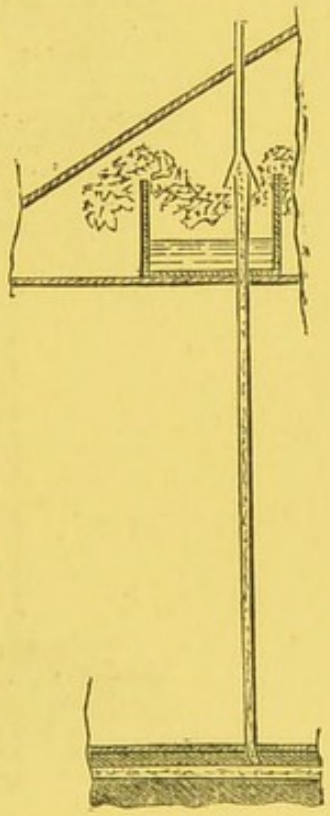

FIG. 6.—Same arrangement with cistern partly empty and foul air escaping into the house.

any water was drawn, the level of the water in the cistern was lowered, the edge of the cone no longer dipped in the water, and the foul air came into the apartment as before (figs. 5 and 6).

Not unfrequently when removing defective drains from houses where sore throats have been prevalent the workmen doing so suffer, and sometimes severely, from sore throats.

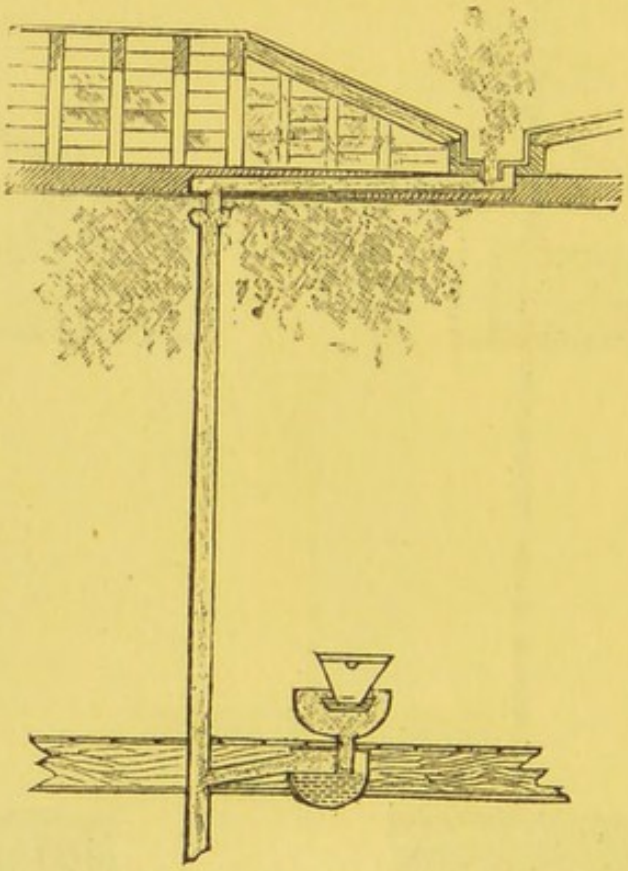

FIG. 7.—Soil-pipe with open head in cupboard upstairs and rain-water gutter discharging into it.

The following are a few examples of the defects found in houses where there had been cases of sore throat.

Soil-pipe with open head inside a cupboard on nursery floor (fig. 7).

Rain-water pipe open at top in scullery, and ventilating the soil-drain into it (fig. 8).

Ventilator of soil-pipe open inside air shaft of house.

Rain-water pipe with defective joints passing down through best bedroom, drawing-room and dining-room walls into the drain.

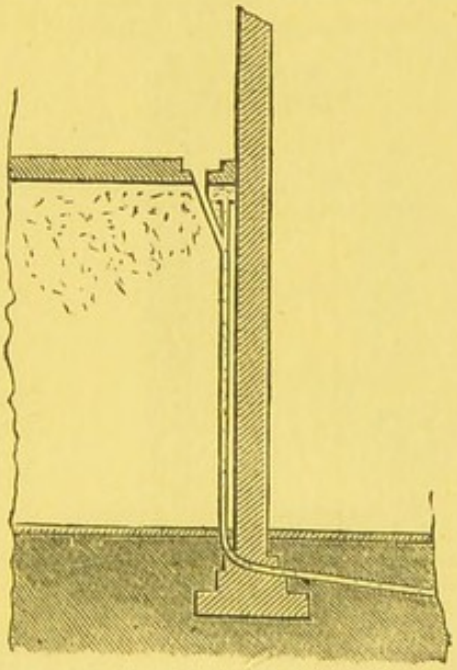

FIG. 8.—Rain-water pipe at head of drain and ventilating it into scullery.

Rain-water pipes connected with drains and with open heads near to bedroom windows (fig. 9), sometimes with water-closets discharging into them (fig. 10).

Soil-pipe discharging into a space between arches under the floor of a schoolroom and

thence by another pipe, open under the floor, into the drain.

Soil-pipes ventilated near to windows.

I have selected three curious examples of this; in the first (fig. 11) a ventilating-pipe only half an inch in diameter was attached to an internal

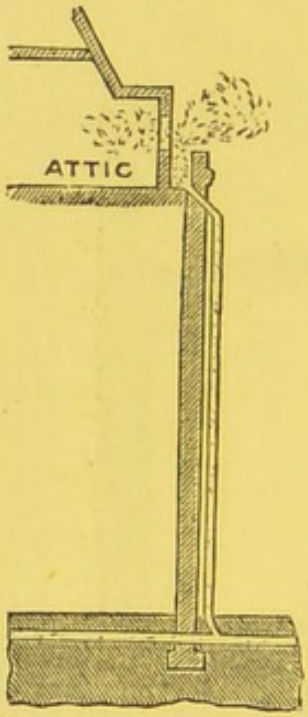

FIG. 9.—Rain-water pipe directly connected with drain and ventilating it under attic window.

soil-pipe, not at the top of it, but about half-way between the water-closet and the drain, and was carried through the wall and up outside, ending just under a window.

In the second (fig. 12) the ventilating-pipe was connected with a properly disconnected rain-water pipe with head close to a window, the

waste-pipe of a cistern joining the same pipe; and in the third (fig. 13) the waste-pipe of a cistern discharged over a small lead head at the top of the ventilating-pipe and just below a window.

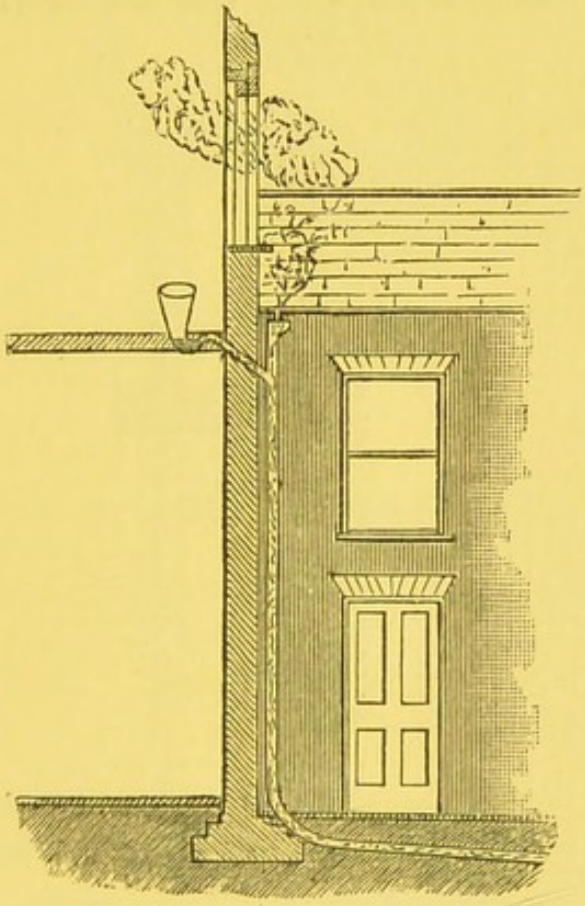

FIG. 10.—Water-closet discharging into a rain-water pipe with open head near window.

I have also known cases of sore throat to occur in bedrooms through which, or under the floors of which, open rain-water gutters passed. Such gutters always have in them a sediment containing rotten leaves and dirt off the roofs, and gener-

ally smell more or less offensively, if they are not used, as they too often are, for throwing bedroom slops down (fig. 14).

At an Orphanage where there was an outbreak of sore throats among the inmates, among other defects it was found that the waste-pipe of the

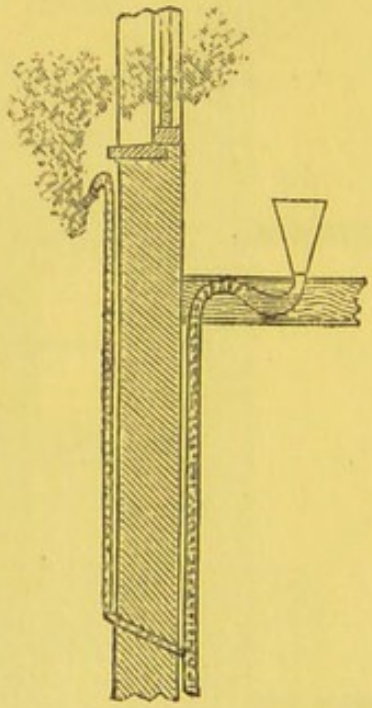

FIG. 11.—Small ventilating-pipe taken from *middle* of soil-pipe and ending under a window.

scullery sink was directly connected with the drain without any trap, and at another small Charitable Institution similar defects produced similar results (fig. 15).

Several instances have come under my notice of sore throats in houses where the waste-pipes of

the sinks, although disconnected from the drains, were not trapped, especially in the cases of men-servants sleeping in rooms where there were

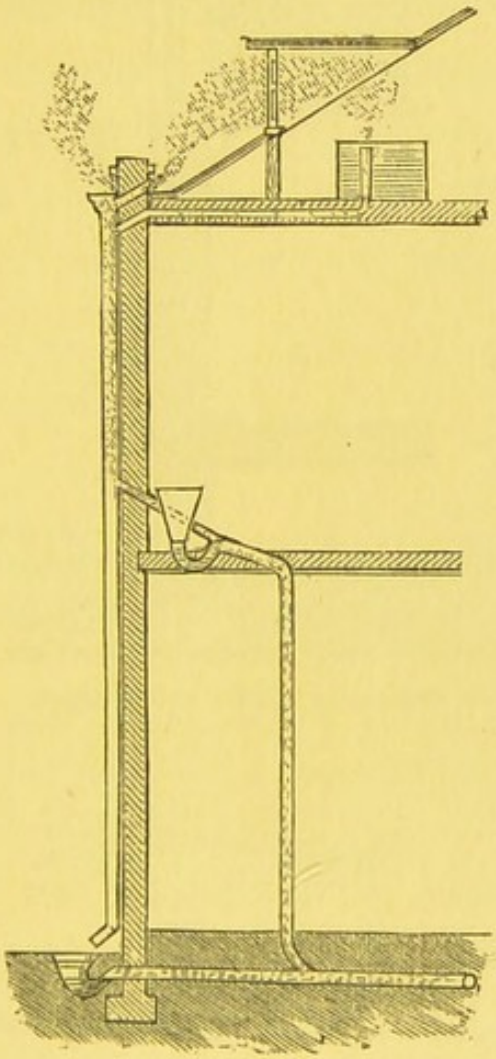

FIG. 12.—Rain-water pipe properly disconnected at foot, but with ventilator of soil-pipe, and also waste-pipe of cistern, connected with it.

sinks, and also in the case of housemaids' sinks upstairs with long untrapped waste-pipes discharging into gullies in the areas. In these

instances, although the pipes are disconnected from the drains, their interior surfaces get coated

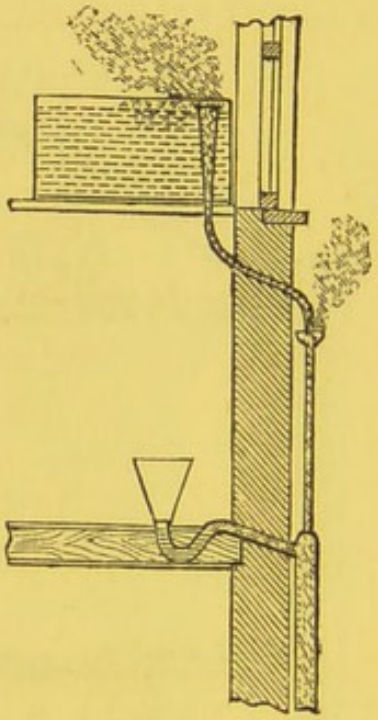

FIG. 13.—Soil-pipe ventilated under window by small open head into which the waste-pipe of cistern discharges.

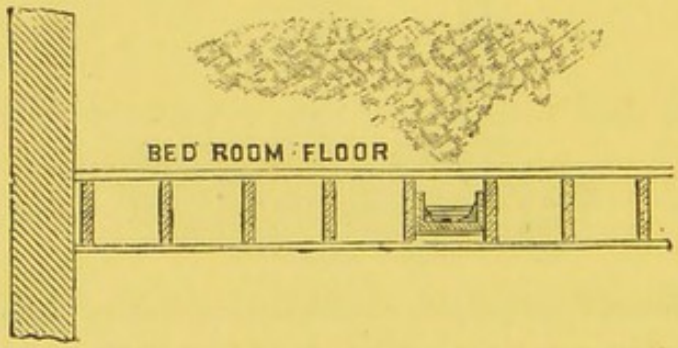

FIG. 14.—Open rain-water gutter under bedroom floor.

with foul matters, and the air that gets into the house through them is rendered impure and sometimes very offensive indeed.

I have known an instance of the waste-pipe of a scullery sink only about three feet long, and disconnected from the drain but not trapped in itself, becoming in such a foul state that the air coming in through it was excessively offensive and pervaded a great part of the house.

In other instances the presence of foul pan water-closets with D-traps under them and with safe-trays, the waste-pipes of which were con-

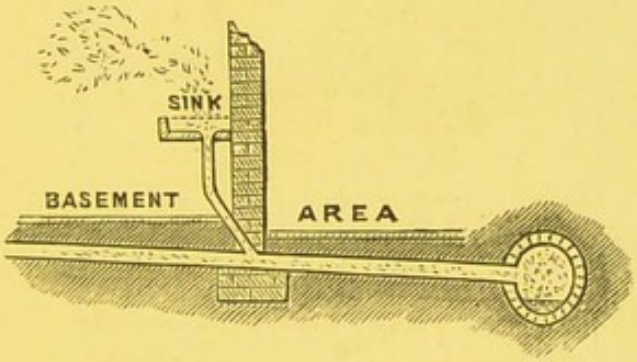

FIG. 15.—House-drain directly connected with main sewer; sink-waste untrapped, and directly connected with house-drain; air from sewer escaping into the house.

nected with the D-traps, have been presumably the cause of the sore throats in the houses in question (fig. 16).

In a house where there was a case of sore throat described as diphtheritic I found foul air from defective drains escaping into the basement rooms, and also a split in the soil-pipe upstairs, allowing foul air to escape directly into the upper part of the house.

A very curious instance was one in which a brick shaft with open grating on the top, which had been intended to admit fresh air to the cellar, had, when the house was re-drained, been connected with the new drains and so ventilated them into the house (fig. 17).

But there are other sources of foul air in houses, producing sore throats.

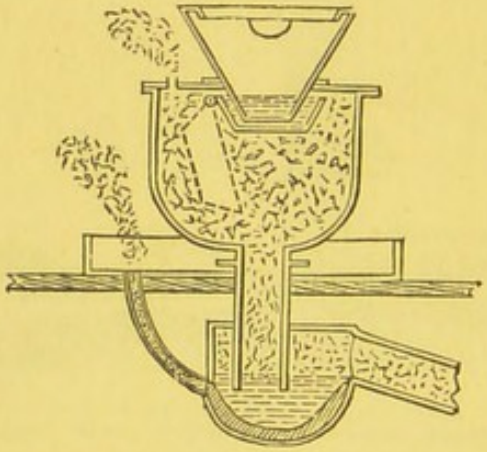

FIG. 16.—Pan closet with foul air escaping from "container" by ventilating opening. Waste of safe-tray into D-trap.

Sometime ago I read a paper before the Society of Medical Officers of Health in which I described a number of instances where sore throats had been caused in houses by slight escapes of *coal-gas* through defective fittings, more particularly in bedrooms, and as since that time further experience has confirmed those observations it is fitting that I should mention here some of the

more striking cases which have come under my notice, and which were described in that paper.

"In 1884 I was suddenly summoned to a large country house, where the sanitary arrangements had been put into perfect order under my own direction shortly before, the internal soil-pipes

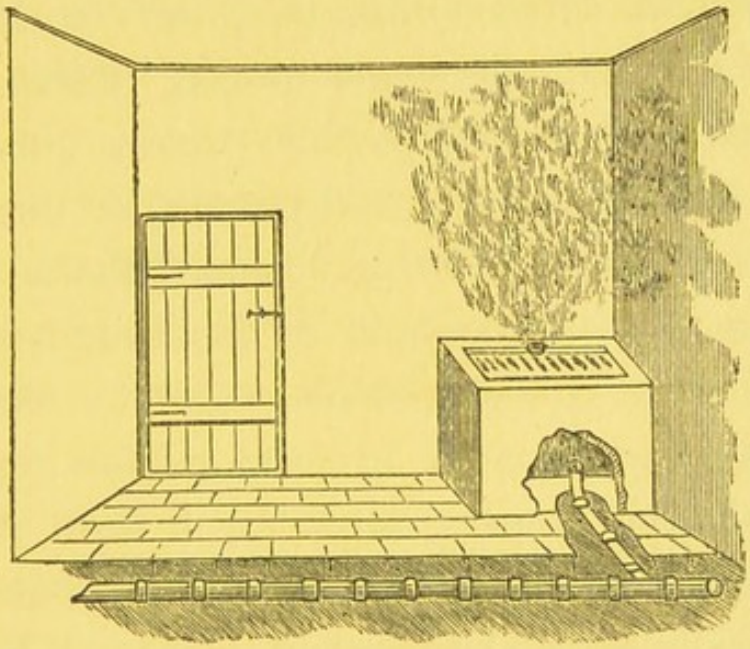

FIG. 17.—Drain connected with inlet for fresh air to cellar.

having been removed, and new soil-pipes fixed and soil drains laid externally to the house, with proper disconnecting arrangements and ventilating pipes, by a telegram stating that there 'were several severe cases of diphtheritic sore throat' in the house. On inspection the sanitary arrangements were found in perfect order, and there was

no escape whatever of foul air from the drains or soil-pipes into the house. The first case that had occurred was one of ulcerated sore throat in the person of a footman, who slept with two others in a particular room on the ground floor, with no basement under it; on entering this room I noticed an escape of gas from a tap on one of the brackets, but did not think much of it at the time. As one of the sink-water drains (disconnected from the soil-drains) passed directly under this room, I had it exposed, but found that there was no defect in it. On being informed that a serious nuisance had been created in the neighbourhood of that room by an earth-closet, which the men-servants had brought in from outside and had used, without properly supplying it with earth, I thought that it was possible that this might have been the cause of the mischief, and went back to Town. A few days afterwards I received another telegram stating that another case of 'diphtheritic sore throat' had appeared in the same room as the first case, and went down at once to make a further investigation. I was then informed by the lady of the house that among the thirteen or fourteen cases which had occurred, four were those of visitors who had slept successively in a particular room, and who were taken ill with sore

throats after leaving the house, one of them so severely that he was unwell for a month. I slept in that room myself, and on examining it my attention was arrested by a very evident escape of coal-gas from one of the brackets, the gas having, moreover, a very foul smell from being insufficiently purified, as is often the case with gas made at country houses. I then remembered having noticed the escape in the footmen's room on the previous occasion, and on inspecting other rooms in the house, where cases had occurred, found other escapes. The brackets were repaired, new ones being fixed where necessary, and no more cases of sore throat have since occurred there.

"The next instance which came under my notice was that of a large house in London, where the sanitary arrangements had recently been put into perfect order, but where an outbreak of sore throats occurred on the return of the family from the country. It was thought by the medical attendant to be due to some defect in the drainage arrangements, but this was soon shown to be out of the question, and on examining the gas-brackets many of them were found to be defective, and especially those in that part of the house in which most of the inmates had suffered. The

leaky brackets were repaired, and no more sore throats occurred in the house.

"At another house I found an escape of gas, in such a quantity that it could be lighted, from a defective bend in a gas-pipe under the floor of the sitting room, the inmates of which had suffered from severe headaches and sore throats. This house shortly afterwards passed into other hands. The new tenant had 22 superfluous gas-brackets removed, and neither he nor any of his household have suffered from sore throats.

"At a country house, in which the sanitary arrangements had been put into perfect order, and where there was no drain under the house, and no soil-pipe inside it, an outbreak of sore throats occurred in a family who took the house; they were ordered to the sea-side, and the doctor who saw them there was convinced that there must be some defective drainage arrangements in the house in question. On examination no such defect could be found, but escapes of coal-gas were found from the brackets in the hall, and in the passages upstairs, and a slight smell due to these escapes was perceptible all over the house and especially on the bedroom floor. I recommended that the brackets should be re-paired, and have not heard that any more cases have occurred.

"The next case, which I investigated quite recently, was that of a house in the west end of London, but in this instance there was a complication caused by a defect in the sanitary arrangements upstairs. A slop-sink had been recently fixed in the housemaids' closet, and its waste-pipe connected with that of the housemaids' sink which was there previously, the waste-pipe having been properly trapped and disconnected. I found that when water was thrown down the slop-sink, the trap of the housemaids' sink and also that of the slop-sink itself were both siphoned out. The trap of a wash-hand basin, the waste-pipe of which discharged into an open head outside the house on the course of the pipe into which the waste-pipe of the other sinks discharged, was also siphoned out when the basin was emptied, and a bad smell had been noticed in the room in which the wash-hand basin was, and which opened into one of the nurseries, and also in the housemaids' closet; this was probably the cause of the sore throats occurring in the upper part of the house; but severe cases of sore throat also occurred among some of the men-servants who slept in the basement. One case was that of the butler, in whose bedroom a serious escape of coal-gas was found to take place from the tap supplying the

gas fire in his room; another was that of a footman who slept in the pantry, where there was also a very marked escape of coal-gas. These defects were remedied, and no more cases have occurred.

"At about the same time an outbreak of sore throats took place in another house in London. On testing the drains, soil-pipes, &c., which were properly disconnected and ventilated, no escape of foul air was found in the house. The first case in this house was that of a boy who slept in the bedroom on the top floor; in this room there was no gas-bracket, but I found a gas-plug in the wall with a very evident escape of gas from it. Other escapes were found in the rooms in which the other cases occurred. They were all remedied, those who were attacked speedily got well, and there have been no further cases.

"Not long ago both my wife and I suffered from troublesome relaxed (and in her case ulcerated) sore throats, which I found were due to an escape of coal-gas from a leaky pipe in the wall of our bedroom. I had this cut off and stopped under the floor, and since that time we have had nothing the matter with our throats.

"Coal-gas may get into houses in various other ways, which would take me too long to enumerate,

but I wish to point out that it may come directly from defective mains in the streets. In a house in which I formerly lived, on more than one occasion the front rooms were filled with gas to an alarming extent, on account of the main in the street having been crushed by a steam roller; the gas found its way through the wall of the house and up behind the panelling of the rooms.

"I must not omit to mention that the smell caused by a slight escape of coal-gas into a room is somewhat peculiar, and is usually described when noticed as "stuffiness" or "closeness." It does not suggest to an ordinary observer the idea of coal-gas at all, and the notion that it is caused by coal-gas is frequently regarded as being too absurd to be entertained. When mixed with other odours, such as that of new carpets, leather trunks, furniture polish, the smell of cooking, or that of a housemaids' sink, it is often difficult even for an experienced observer to detect the smell produced in the air of a room by a slight escape of coal-gas.

"From the cases I have observed I have been forced to come to the conclusion that sore throats are frequently caused by the breathing, especially at night, of air contaminated by a small proportion of coal-gas, and I think it most probable that

the effective agents in producing the irritation in the throat are the bisulphide of carbon and other sulphur-compounds known to be contained in coal-gas.

"To our hospital throats and sewer-air throats we must add coal-gas throats, and I am convinced that these ulcerated throats are frequently thought to be due to foul air from drains, when they are really due to escapes from gas-pipes and fittings."

Sore throats are, I find, very common among men-servants who sleep in basement rooms with gas-brackets or gas-pendants in them.

Sore throats are also sometimes produced by the escape of foul air from defective flues, and this source of foul air in houses is much more common than is generally supposed, especially in old houses. It usually occurs from the cracking of the mortar lining of a chimney by the soot taking fire in it, and so is most common in the chimney of the kitchen or still-room.

The air from the flue escapes through the cracked lining and through the defective brick-work into the rooms, and more especially into the spaces between the floors and ceilings where the front of the flue is not covered with plaster. This air has a peculiar smell, and is often excessively foul, so that it is mistaken by the inhabitants of

the house for sewer air. Its foulness is no doubt caused in part by the fact that the lining of all old chimneys, and of many new ones too, consists of a mixture of cow-dung and mortar, but in any case the smell of air from a defective flue is always very disagreeable. The foul air escaping between the floors and the ceilings can usually find access to the room between the boards of the floor or along the line of the skirting board, but where it cannot do this it can almost always escape by means of the small tubes in which the bell wires are placed, and I have many times detected the source of bad smells in rooms by observing the foul air to come from the apertures in the boxes of the bell pulls.

I have come across many instances in which DIPHTHERIA has been attributed by the medical attendants to some defect in the sanitary arrangements, and on inspecting the houses have generally found that foul air from the drains was escaping into them in some way or another, very often by means of soil-pipes with defective joints or with holes in them; thus in one house where there was a case of diphtheria it was found that foul air escaped into the house through a defective soil-pipe in one of the water-closets. In another instance a case of diphtheria occurred

in a room, the balcony of which drained into a rain-water pipe directly connected with the house-drain and with the main sewer, the trap on the house-drain having been removed because it was liable to get blocked up. In another instance, in a country house, the soil-pipe of the best water-closet upstairs leaked badly, and there were other defects.

In another country house where there was a case of diphtheria among the children, I found that the trap of the school-room water-closet was defective in construction, so that it did not prevent the drain-air from entering the school apartments.

In another large country house where there was a fatal case of diphtheria, among other defects, the soil-pipes had slip-joints which allowed foul air from the drains to escape from them, so that the pipes were actually blackened by it above the joints. There was also an escape of air from the drains into two of the water-closets, and so into the house.

In an instance which has recently come under my notice in a large country house, the most glaring sanitary defects existed. There were bell-traps in the floors of the larders perfectly dry, and directly connected with the soil-drain, which itself discharged into a cesspool in the

garden; the waste-pipe of the drinking water cistern discharged into a receiver under the floor of the scullery to which the air from the soil-drain had direct access, and on applying a chemical test to the drain, the smell of it was observed in the larders, the scullery, the kitchen, the staircase out of which opened the room in which the person slept who had diphtheria, and also in the cistern-room. This was also, I found, not the first time that illness had occurred among persons sleeping in rooms on that staircase, as there had been cases of sore throat there before.

On the other hand it has not unfrequently happened that in houses where there have been cases of diphtheria, I have been unable to find any sanitary defect to account for them. This has been the case in private houses, as well as in schools and public institutions.

In one instance I remember an outbreak of diphtheria occurred in some model dwellings where there had been no case of infectious disease for ten years, with the single exception of one case of Scarlet Fever, and where the sanitary arrangements although not absolutely perfect were so good that it could not be suggested that they had anything to do with the prevalence of the disease.

In another instance in a large private school the slight defects which were found in the sanitary arrangements could not reasonably be considered to be the cause of an outbreak of diphtheria which resulted in the dispersion of the school.

It is therefore clear to me that cases of diphtheria frequently occur in houses where the cause cannot be put down to sanitary defects, and that on the other hand, cases also occur in houses where there are very obvious and very serious defects in the sanitary arrangements, allowing the escape of foul air into the houses. The question arises, have the sanitary defects in the latter series of cases, anything at all to do with the disease. According to my experience the admission of foul air from drains, cesspools, &c., into houses, or indeed, of foul air from any other cause, results in the vast majority of cases in the production of sore throats, and I have no hesitation in saying that I have been consulted about defects in the sanitary arrangements of houses on account of sore throat more than on account of any other disease. I do not suppose that anyone will question that a state of things which will bring about severe forms of sore throat must be favourable to the dissemination of diphtheria, so that whether we allow that diphtheria may be

produced or spread by drain air or not, we must, I think, admit that the presence of drain air in houses is favourable to the dissemination of the disease, if the poison is brought there.

As is well known, diphtheria has for many years past been a disease especially occurring in isolated country houses, and has until the last few years obtained very little hold upon our large towns. Now, however, it is spreading to an alarming extent in London and in several other large towns, so much so that in London during the last twelve months there have been nearly twice as many deaths from diphtheria as from scarlet fever, although we have had an outbreak of the latter disease which has filled more than 3000 beds in the Hospitals of the Metropolitan Asylums' Board for many months.

Why diphtheria was formerly a country disease and is now becoming a town disease, has not yet been explained. That it is pre-eminently a communicable disease is generally admitted, and this of course accounts at once for the cases where no defects in the sanitary arrangements have been found, although the most rigorous tests have been applied, but whether when we have a case in a house where there are serious sanitary defects, as has very often happened, we are to attribute the

disease to diphtheria poison introduced by foul air on account of those defects, or whether we are to consider that the foul air has merely produced a state of things (as sore throat) which has favoured the development of diphtheria, the poison having been introduced from elsewhere, cannot, I think, yet positively be decided.

It seems to me that if diphtheria were chiefly spread directly by means of foul air, it ought to be even more prevalent than it is, and it ought to have been much more widely spread in our large towns many years ago.

Whether diphtheria can be communicated by means of contaminated drinking water is another point that has not yet been positively decided, although some observations and experiments brought by Dr. Browning before the Society of Medical Officers of Health some years ago seem to show that it may be spread in this way.

SCARLET FEVER.—Although sometimes called in to inspect houses on account of scarlet fever cases, I have no reason to suppose that it is connected with bad sanitary arrangements, although no doubt the presence of foul air in houses tends to retard recovery from this as from other diseases.

BLOOD-POISONING.—A large number of cases in which what has been described by the medical

attendants under this name has been connected with serious defects in sanitary arrangements of houses, have come under my notice.

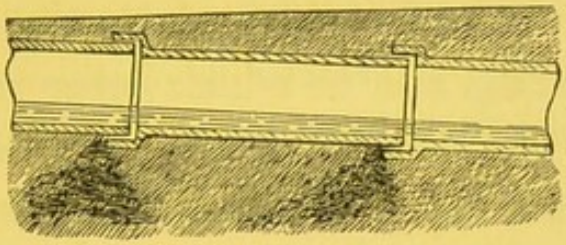

FIG. 18.—Stoneware pipes "laid dry."

The following are some characteristic cases :—

1. Drain pipes "laid dry," that is to say without any cement or other jointing material in the sockets, so that the sewage leaked out into the

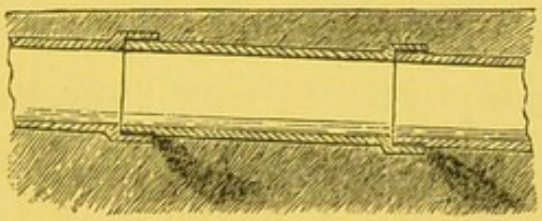

FIG. 19.—Stoneware pipes laid wrong way.

soil under the house, and the air from the drain escaped into it (fig. 18) ; the drain had also a bad fall so that it sometimes became blocked.

There was, moreover, no disconnecting-trap on it, so that when the drain was not blocked sewer air filled it and escaped into the house.

2. Another case with a leaky drain laid in a circuitous course under the house. Sometimes the pipes are laid the wrong way, which favours leakage from the joints (fig. 19).

3. An instance in which there was a case of blood-poisoning, and in which other members of the family had bad throats. In this instance there was an old pan water-closet with D-trap discharging into an iron rain-water pipe with defective joints, and with open head close to the staircase window.

4. The air from the drain was escaping into the house through a hole one inch long at the back of the soil-pipe, and also from the old waste-pipe of the safe-tray which discharged into the soil-pipe beyond the trap of the water-closet and was only loosely plugged with a piece of wood.

5. The drain under the house leaking so badly that it could not be filled with water. On applying the smoke test smoke escaped underneath the cistern in the scullery and also into the water-closet on the ground floor.

6. Serious defect involving an escape of drain air into the water-closet in kitchen lobby. The water-closets upstairs discharged into a rain-water pipe with open head near a window at the top of the house.

7. Untrapped opening into the drain in a small area at the back of the house with windows all round it.

8. The drain so leaky that it could not be filled; it was also very badly ventilated. No disconnecting-trap on the drain, the water-closets in the middle of the house discharging into an internal soil-pipe which was defective, as shown by chemical tests.

9. In this case not only did the owner of the house suffer from blood-poisoning so severely that he died, although removed to Brighton, but several of the workmen who took up the old drains also suffered from blood-poisoning and had to be sent home; one of them was seriously ill for a month. The drains and soil-pipes were defective. The stable drains and rain-water drains passed close to the well and leaked into it to such an extent that on opening up the stable drain beyond the well and pouring water down the gullies in the stables no water ran through the drain beyond the well, and after laying new house and stable drains the well no longer supplied a sufficient amount of water for the house, and a new well had to be sunk.

10. In this house the smoke test showed a serious escape from the drain at the foot of the

soil-pipe in the servants' hall, the smoke passing up behind the casing into the ground-floor water-closet, and also into the water-closet on the third half-landing.

11. Escape of drain air from a defective soil-pipe into the cupboard under the basement stairs, and into the main staircase of the house.

12. This was a case of a set of rooms on the basement floor of some fashionable chambers. The sanitary arrangements were found in very good order, but there was a disused or forgotten water-closet on the same floor, which discharged into the drain beyond the disconnecting chamber, and so directly into the main sewer. The trap of this water-closet was found to be dry, and sewer air was entering the building through it.

An escape of coal-gas may also produce effects described as due to blood-poisoning, as will be seen from the following case. In 1883 I was asked to inspect the sanitary arrangements of a public institution, the superintendent of which had been taken ill with what was described as blood-poisoning; this was attributed by the medical attendant to some defect in the sanitary arrangements of the building, and more especially of the superintendent's office itself. A peculiar smell, which was believed to proceed from some

defective drain or pipe connected with the drains, was observed in the room. A great deal of trouble had already been taken to find out the cause of the evil, and among other things the floor had been taken up, the earth under it removed to a depth of several feet to search for drains or cesspools, and replaced by concrete, but all was of no avail: as soon as the superintendent occupied the office again the illness recurred, and the person was advised to give up the situation. On inspecting the building no defect in the sanitary arrangements could be found which would account for the illness; but after having the superintendent's office shut up from Saturday till Monday morning, on entering it a distinct smell of coal-gas was perceived, and on further examination a defect was found in the connection of the gas-pendant with the pipe near the ceiling; this was remedied with the result that nothing further was heard of the illness.

As foul air produces "blood-poisoning" it is not surprising that PUERPERAL FEVER should also have been traced to it. The following are some cases in point:—

1. No disconnecting-trap on the main drain, which discharged directly into the sewer. The waste-pipe of the scullery sink was connected

directly with the drain and so with the sewer, the only protection against the direct entrance of sewer air into the house being a loose bell-trap in the sink (fig. 20).

2. The raking arm of the trap in the disconnecting chamber was not stopped, so that sewer air escaped freely into the house-drain. The waste-pipe of a lavatory basin was connected

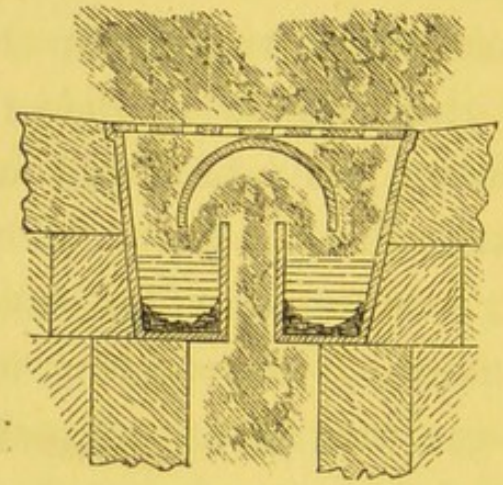

FIG. 20.—Bell-trap, with water reduced by evaporation, so that the "bell" no longer dips into it; foul air escaping into the house.

with this drain, and the trap under the basin was siphoned out each time that the basin was emptied, so that sewer-air had direct access to the house.

3. In this instance I was telegraphed for to Scotland on account of a case of puerperal fever which had been given up as hopeless by the medical attendants. The patient had been doing

well until she was removed into a boudoir adjoining her bedroom a fortnight after her confinement. She then developed symptoms of puerperal septicæmia and became rapidly worse. I found a defective soil-pipe in the passage adjoining the boudoir, and insisted on the immediate removal of the patient, the result being her speedy recovery.

4. I mention this case here because it is an example of some in which precautionary measures were properly taken before confinement. A hole half an inch in diameter was found in a soil-pipe in the space under the floor in the lobby of the room in which the confinement was to take place. Foul smells had often been noticed at this spot, but their origin had not previously been traced.

PNEUMONIA.—I have seldom been called in to inspect houses on account of this disease as it is apparently not recognised that it may be produced by foul air. The most notable instance was in the case of a large school where there was an outbreak of pneumonia amongst the boys. I found various defects admitting drain air directly into the school building, and also a very foul ventilator in the roadway close by the entrance to the school-house. Air from this ventilator had been

often complained of, and was certainly very offensive at the time of my inspection.

DIARRHŒA.—This is not usually considered of sufficient importance to make a special inspection of the house necessary. In one instance where there were several cases the cisterns were found to be filthy, and one of the water-closets opened directly out of the pastry larder.

In another a blocked soil-pipe was found, and the waste-pipe of the cistern was connected with the D-trap of the water-closet.

The most remarkable instance that has come under my notice was in the case of an infants' home where five deaths from choleraic diarrhœa occurred within a very short time. The sanitary arrangements had been recently carried out on approved principles, and a new water-tight drain laid, but it was found that the trap of the disconnecting-chamber had been fixed in a tilted position, so that there was no water seal, and air from the sewer passed through it and escaped into the front area where the larder was, and through the windows into the front rooms of the building. This defect was remedied and I have not heard of any case since.

ENTERIC FEVER.—A very large number of instances in which this disease has been associated

with defective sanitary arrangements of houses have naturally come under my notice.

One of the first was a case which excited a great deal of public interest, and which prominently drew attention to the connection of this disease with defective sanitary arrangements. It had been stated that there were cesspools under the house, one of them being directly under the water-closet in connection with the suite of rooms which had been occupied by one of those who were attacked by the disease. I was requested to make an inspection, and found that there were no cesspools under the house, and that there was nothing the matter with the water closet in question, which certainly was not the cause of the attack. There was, however, a defective pan water-closet in the hall, and the main drain of the house had no trap nor disconnecting arrangement on it, so that sewer-air could obtain access to the water-closet in the hall, and it was impossible to say that the disease might not have been contracted in that house. A detailed description of the sanitary arrangements there appeared in a letter which I wrote by request, and which was published in the "The Times" of Jan. 22nd, 1872.

Another most interesting case, which I investigated a good many years ago, was one in which

only one servant in a large country house contracted the disease, and I was at first told that no other case of enteric fever had been known in the house nor in the neighbourhood for miles around. The case was that of a girl who slept in a partitioned dormitory with eleven other female servants. A drain in the yard below the windows of this dormitory, and with which a water-closet in the yard was connected, had been blocked and was opened up, emitting a foul smell. Not long after this the girl in question, who was not very well at the time, having overworked herself, sickened with enteric fever; no one else took the disease. On going fully into the facts I found that two men who had been working in the rick-yard a short time before this had suffered from diarrhœa, one of them being the sweetheart of one of the maid-servants, and having no doubt frequently used the water-closet in the yard. On pursuing my investigations I found that the other of these two men had died of enteric fever in a cottage six miles off, and that there had been shortly before another case of the disease in that cottage in the person of a boy who worked in a canal-boat, and so was in the habit of visiting various places.

In a small country town where there was a

serious outbreak of the disease, I traced it distinctly to the water of the well at the hotel at which I was staying. People who had not wells of their own came from various parts of the little town and fetched water from the pump in the hotel yard. There were various sources of contamination of the well-water in the shape of a privy, leaky drains, &c.

In a small lying-in hospital in London, where the sanitary arrangements had all been recently carried out, watertight drains having been laid, &c., a single case of enteric fever occurred, in the person of the matron, who had not been out of the establishment for a considerable time. On investigation I found that the tap over the pantry sink was supplied with water from a cistern in the ground-floor water-closet. This faulty arrangement had no doubt been allowed under the idea that as the water-closet was supplied by a regulator-valve the water in the cistern could not be contaminated from it. It is never right to supply taps from cisterns supplying water-closets, but of course it is still worse if the cistern is actually in the water-closet itself.

In a boys' school where earth-closets were used and were badly mismanaged, too little earth being used and the compost kept in a heap in a wet and

very foul condition, an outbreak of enteric fever occurred. Where earth-closets are used the compost should not be kept, but should be dug into the ground as soon as it is taken out of the closets.

The following are some of the defects found in houses where there were cases of enteric fever.

1. Old brick drains with bell-traps in areas, lip-trap in the scullery floor, and no disconnecting-trap to prevent the entrance of sewer air.

2. Bell-trap (fig. 20) in scullery, waste-pipe of sink connected with the drain, no disconnecting-trap and no ventilating-pipe to the drain.

3. Rain-water pipe of lead flat discharging into the soil-pipe.

4. Cistern in larder with waste-pipe discharging into the drain (fig. 21), soil-pipe not ventilated, and other defects.

5 and 6. Various defects, no disconnecting-traps.

7. Waste-pipes of sink and cistern discharging into the drain, other defects, no disconnecting-trap.

8. Trap of nursery water-closet siphoned out when another water-closet, discharging into the same soil-pipe, was used. In this house there were two cases, both of children using this particular water-closet. The third child was too

young to use a water-closet and did not contract the disease. In this instance two inspections of the house had been previously made and two reports prepared, one for the landlord and one for the occupier. I was asked to make a third in-

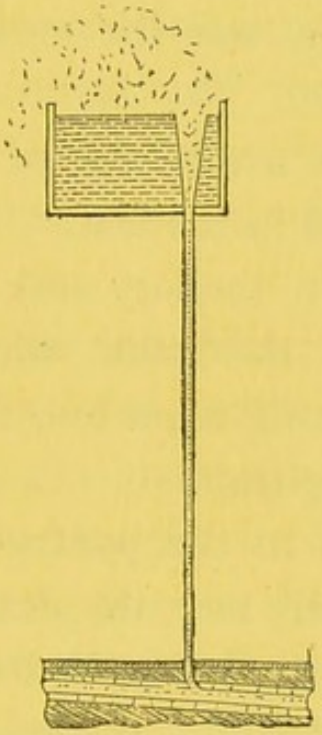

FIG. 21.—Waste-pipe of cistern discharging into drain and ventilating it into house.

spection and report, and also to give an opinion upon the two reports already received.

In neither of the reports was the siphonage of this water-closet mentioned, and in one of them it was assumed that the four water-closets all discharged into the same soil-pipe, whereas they discharged into two soil-pipes, both buried in the

wall, one of them, into which the water-closet in question discharged, being very inefficiently ventilated.

With regard to one of the reports I came to the conclusion that the part relating to the basement must have referred to the basement of some other house, at least that was the most charitable view I could take.

9. In this case a very similar defect produced the same result as in the last.

10. Bell-trap in scullery sink with waste-pipe discharging into the drain, which ran under a kitchen and a sitting-room into the sewer without any disconnecting-trap.

11. Two sinks in the pantry with waste-pipes discharging directly into the drain, soil-pipe very inefficiently ventilated, tap in butler's room supplied from a cistern in the water-closet in the front area.

12. In this case there was a defective dipstone-trap on the main drain, the stone not reaching the top of the trap, so that the sewer-air passed freely through it into the drain. On testing the drain with chemicals the house was immediately filled with the smell, which was especially noticeable in the pantry and servants' hall, on the staircase, and in the rooms on the two top floors.

13. A defect in a soil-pipe outside the house. When the closet was used water leaked through the defect and ran down the soil-pipe into a cistern, the water of which was used for drinking.

14. In a school-house where some cases occurred, the drains were found to be defective. On applying a chemical test a serious escape was found in the basement, and the smell ascended the staircase. There was no disconnecting-trap on the drain, so that sewer-air freely entered the house.

15. In another instance where there was a case in a large country house, it was found that there were defective drains under the basement which discharged into a cesspool in the park. There was no disconnecting-trap on the main drain, and the waste-pipe of the drinking water tank discharged directly into the soil-drain. This was remedied by constructing new soil-drains entirely outside of the house with proper inspection and disconnecting arrangements, by disconnecting all the waste-pipes from the drains, and by removing all sinks and water-closets connected with the basement drains, disconnecting these from the soil-drains and making them discharge into a land-drain in the park, so that they served to dry the basement of the house.

16. In another instance the defects found were that the disconnecting-chamber was inside the house, the plug of the raking-arm (by means of which the drain beyond the trap could be cleared) loose, and the cover of the disconnecting-chamber not air-tight, so that air from the sewer got directly into the house.

This leads me to say that disconnecting-chambers should never be inside houses where it is possible to have them outside, and that inspection-chambers to drains, where it is necessary to have them inside the house, should be specially constructed, and provided with two separate air-tight iron covers. Wherever it is practicable, such inspection-chambers should be outside the house.

17. In this instance a new drain had been laid under the house, but a piece of old brick drain had been left connecting the soil-pipe with the new drain. On testing, a serious escape was found from this old drain into the house.

18. The last instance which I will give is that of a large country house where there were found old brick drains under the house connected with a cesspool in the park, and not even having a dipstone-trap on their course. The air from these drains escaped freely into the house in

various places, and especially into a cupboard in the smoking-room, where there was a wash-hand-basin with an untrapped waste-pipe connected with the drain. These and other defects were all remedied, new soil-drains being laid outside the house, and no cases have appeared since.

I may also note as an interesting fact that I was sometime ago called to inspect a large country school, where a solitary case of enteric fever had occurred among the boys. I found the sanitary arrangements so good and the precautions taken so perfect, that I felt myself justified in advising the school-master that the disease would not spread, and that there was no need for him to disperse his school. I, however, also advised him to send a circular to each of the parents acquainting them with the facts, and also with my opinion. This was done, the patient was kept there until well, and no other case occurred.

This appears to me to shew very clearly the importance of good sanitary arrangements in preventing the spread of enteric fever in a community.

In discovering defects in sanitary arrangements the most minute attention to detail is required, and in remedying the defects, and more especially in carrying out new sanitary arrangements, the

greatest pains require to be taken, and the most careful supervision of the work to be made. This can only be properly done by those who have had many years' experience of such work, and that is why many persons consider sanitary work expensive, but there is nothing to which the proverb "cheap and nasty" is more applicable than to this work. Good sanitary work is really cheap in the long run, because it does not require to be renewed for a great number of years, and because it requires very little attention, although it is desirable to have all sanitary appliances carefully examined and tested at least once a year.

On the other hand cheap sanitary work is very expensive in the long run, as it frequently has to be repaired or patched in some way, and soon has to be done again altogether.

An immense amount of such cheap sanitary work has been done in recent years, and will all have to be done again at no distant date, and in fact this is already beginning to be found out.

There are so many ways in which defects may occur, and so many directions in which work may be scamped, especially as most of it has to be covered up, that sanitary work requires efficient supervision and testing during its progress and not merely on completion.

It is most important that medical men should impress this upon their patients, and should insist upon their having the sanitary condition of their houses in as perfect a state as possible, and upon their not occupying houses until they are quite satisfied that this is the case.

Only by such means as these can householders prevent the occurrence of defects due to ignorance or carelessness, and the appearance in their families of the diseases that I have mentioned.