

mechanical impediment to the return of sewer gas. This, of course, should not be the case. Some form of trap should be placed as near as possible to the proximal end of every waste-pipe. (*Here a variety of wet-traps were shown.*)

I have also a "dry trap" with flap-valve and ingeniously contrived hinge; but as it cannot compare with the wet trap, properly vented, in point of usefulness and effectiveness for house purposes, for many reasons which I have not now time to point out, I will not take up your time with it, or other forms of dry-traps.

2. Where there are traps they are liable to be forced. Some think that if they have a trap all is right, but let me say that a trap without a vent outside of it is of hardly any practical value. A trap with a protecting depth of water (commonly called the "seal") of three inches (a three-inch seal) only resists a pressure of some two ounces to the square inch.

Now I hold in my hand a two-inch trap with a good seal, which I have filled with coloured fluid; the bottom of it being of glass, you will see the fluid displaced by my blowing, even with a slight force, into one end of the tube. If I now uncork the opening on the distal side of the trap (replacing the cork by a vent-tube), I can blow my hardest without displacing the fluid.

Now what influences are at work to force gas back through traps?

a. The expansive force caused by pouring water into a drain. Two bodies cannot occupy the same space at the same time. If the lower part of the drain be full, or its mouth closed by water in the sewer into which it empties, then the sudden pouring in of water will cause the confined air to burst its way back through the trap.

b. Storm water suddenly filling the sewers has the same action.

c. The expansive force of hot water entering and increasing the temperature and consequently the bulk of the air. If raised suddenly from 50° to 150° the result would be a pressure equal to nearly seven feet head of water.

d. Direct afflation through the sewer. The wind blowing up the sewers, e.g., a south wind in Toronto. Some engineers have proposed flap gates at the mouth. But don't have this,

let the fresh air blow up, but make vents for it to sweep through and purify the sewers.

e. Partial choking of the drain gives rise to confined air constantly increasing and expanding and being displaced. A vent allows the escape of all gas which would otherwise force the trap.

3. Again sewer gas may be admitted by the trap being emptied by syphoning, the water being syphoned out. If I add this tube to the distal end of the trap, it forms the long leg of a syphon, this portion of the trap being the short leg; being closed and a full stream poured through the trap, the water will syphon out of it, leaving the seal broken, as I have often proved by actual experiment with this trap. An opening at the arch of the syphon will, of course, prevent this.

I remember your once asking me, Mr. President, if a waste basin trap could be syphoned in this way, the pipe below being generally larger than the exit from the basin. Since that time I have seen at least two cases: one of a kitchen sink, which had to be remedied by inserting a vent tube; the other, a wash basin, which may be still experimented upon at the Grand Central Hotel.

4. A large body of water rushing full bore down a pipe into which a trapped tube empties, will suck the water out of the said trap. I now show you a vertical 4-inch pipe with a junction, into which I fit my glass trap. I have often sucked the water out of the trap by this apparatus.

The vent will, of course, prevent this.

5. Alterations may leave some pipe open or unsealed.

6. Disuse of trap for a long time will allow evaporation and emptying of trap, giving room for free passage backwards of gas.

7. Corrosion of pipes and traps, or bad workmanship in joints, will often allow escape of gas.

8. Absorption through contents of traps. Gas absorbed and given through. Forbes experimented with ammonia, and found it transmitted in about twenty minutes.

This may be obviated by having a second vent-tube, and these two will form a circula-