copy of this plan, which is inserted herewith (Fig 7). He says :

From the accompanying diagram (Fig. 7) you will understand my plan for ventilation. While I should avail myself of the ordinary means, through raising and lowering windows, and by ventilators in the ceiling and gable ends, I should have a shaft in connection with the chimney, composed either of a section of the chimney

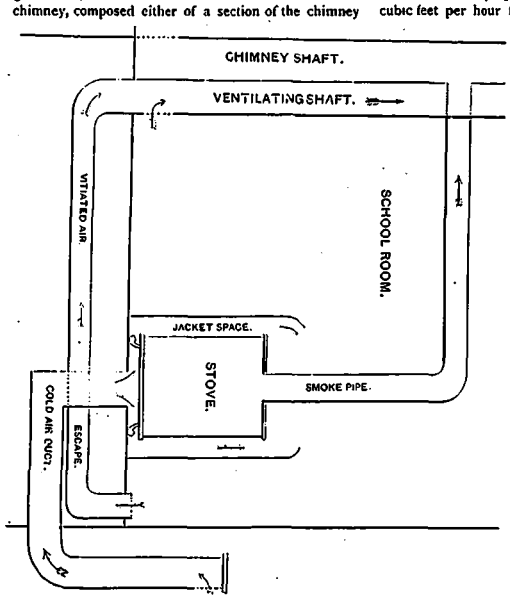

FIG. 8.

divided off by sheet iron (which would heat the air in the shaft), or by a pipe inside the chimney, either for the smoke or for ventilation. You will notice that I suggest cold air escapes at the floor into the basement, or into tubes opening outside the building ; higher up I suggest large ventilating registers to be under control of teacher.

Although a furnace or heater, in the basement, as illustrated by Mr. Fotheringham, is considered the best means of heating school rooms, yet the plan of heating them by stoves in the school room, is the most common. Without certain arrangements and precautions, this is a very faulty and unhealthy system. As a general rule, no provision is made for ventilation by the constant production of warmed air and the exit of vitiated air. The stove is often placed at one end of the room, and the pipe is carried over the heads of pupils—to their serious detriment. The only way to obviate these defects, if a stove must be used, is to place it near the north-east angle of the school room, and bring fresh cold air in from the north side of the school house, in the manner illustrated in the accompanying simple diagram.

It will be noticed, that in Fig. 9 one of the escapes for vitiated air is under the teacher's platform ; others are under the desks, etc. In no case should the fresh air be admitted from the ground level outside ; but it should be invariably taken from about three or four feet above the level, through an air duct, as shown in Fig. 8 with wire gauze covering or a register. The following illustration shows what would be the practical working of such a system in the school room :

The Cottier system of ventilation, recently adopted in the school houses of Portland, Oregon, has worked well. It is based upon the use of the attic as a warm air, or expansion chamber, out of which there is an ejection through the roof into the open air. From a detailed account by Mr. T. H. Crawford, City Superintendent of the Portland City Schools, has been condensed the following summary on the subject :—

" The tin flues for vitiated air used (four in each room) are ten inches by four in size. They reach from the rooms to the attic, and extend a few feet above the attic floor. To ensure a strong draught, hot-water coils (or hot air through flues will answer), are placed in the attic, some feet above the floor. To enforce a more rapid ventilations a gas burner is placed in each tin vitiated air flue, five feet from the floor, with a glass door opposite to it in the flue. The attic, or expansion chamber, is made air tight, and all doors leading to it closed. Hot air pipes are placed under the windows, etc., on two sides, or on one side and end, of the room. The warm air rises and receives the cold air from one-inch openings at the top of the windows and by transoms over doors. The openings are so small and numerous that no sensible draught can occur."

A Medical Commission was appointed in Germany not very long since, to report on certain questions relating to school house construction. In the report which the Commission prepared, it was laid down that 2,120 cubic feet per hour for each pupil was the minimum quantity of fresh air which should be supplied to each pupil. The Commission stated that in the best arranged ventilating shafts, of metal, fitted with gas-flames, stoves, or other artificial means of promoting the draught, the upward current of vitiated air will occasionally reach a velocity of a thousand feet per minutes in cold weather, although the average, in ordinary cases, is rarely more than five hundred feet and generally much less ; so that to ventilate a room containing sixty pupils thoroughly, it should have an outlet shaft of four square feet or more, in sectional area, to be even capable of such ventilation as is essential.

In conclusion it may be well to emphasize the statement in a recent report of the Board of Public Instruction for the City of Albany, N. Y., that no system of ventilation is automatic. And unless teachers will themselves attend to the regulation of the temperature of their room, and act upon the directions ordinarily given, not even in the most perfect system of heating and ventilation will keep room free from foul air, and the inmates from discomfort.

PLUMBING AND DRAINAGE.

By B. Kirk, Plumbing Inspector, Toronto.

TORONTO'S plumbing by-law has, in spite of many defects, worked good results. It has made the way of the skin plumbers hard. Better material is used, and the construction is much better. The standard of workmanship also is being elevated, which is the natural result of close inspection by practical men, the plumber being encouraged to do his best when he sees his work closely scrutinized by the inspector, who is constantly comparing the quality of his work with that of other plumbers.

There have been nineteen informations laid in the Police Court for violation of the by-law. Seven of these were against plumbers; the balance were against owners and builders for improperly laid drains. Convictions were secured in each case, but owing to ignorance of the provisions of the by-law the offenders were leniently dealt with.

The architects have been slow to recognize the provisions of the by-law. They do not submit their plans and specifications for approval, and many of their specifications call for material which is prohibited by the by-law. Venting of taps is often omitted, and some of the plumbers imagined that if they kept up to their specifications they were all right, however wrong the specifications might be. One of the defendants at the Police Court made the plea that although his work was not up to the requirements of the by-law, it was done in accordance with the provisions of his contract with the owner, whereupon the magistrate replied: "Then you made a contract to break the law."

This difficulty will be avoided since the city engineer has decided to refuse permits for private drains until the plans and specifications of plumbing and drainage have been filed in his office, and the same approved. This, with the withholding of water supply until the inspector's certificate has been obtained, will ensure a pretty strict conformity to the requirements of the by-law. These are some of the requirements : Ventilation of the drain and soil pipe ; an air inlet just inside the main trap ; soil pipe extended through the roof ; every fixture separately trapped, including rain water pipes when they open near windows ; trap ventilation ; all work to be left uncovered until inspected.

"Defective plumbing" is invariably the verdict rendered on finding any unpleasant odor in the dwelling, and a suspicious look comes over the face of the occupant as he peeps into the waste outlet of the kitchen sink, but he rarely thinks of looking for a defective drain, and they are legion. Wherever I see a tile drain in a house I regard it with suspicion. Fully four-fifths of the sewer gas that gets into dwellings comes from faulty drains. They are generally laid by laborers, some of whom may be very careful about their work, but the majority are not to be trusted with such important work. It may be said that a tile drain properly laid is as good as a cast iron one. That is probably true, but it is impossible for any inspector to certify that a tile drain is properly laid without seeing every portion of it being laid. Then after it has been covered with clay it is out of sight, and consequently out of mind. The question arises what should be substituted. The answer is *cast iron*, with the joints properly leaded, and when practicable run on the cellar walls, or suspended from the cellar ceiling, and if is necessary to run under cellar floor, let it be laid in a trench lined with brick, cemented and covered by boards or stone slabs so that it can be inspected at any time, and cleaning screws placed at convenient points for cleaning any stoppage which may occur at any time.

It is a good plan to expose to view all, or as much of the drainage and plumbing system as possible. There is a feeling of security where one can trace all the waste pipes and soil pipes to their connection with the drain, and then follow that up until you see it pass outside the walls of the house.

PURIFICATION OF WATER BY ELECTRICITY

THE purification of water by electricity is the latest electric discovery. This is said to have been accomplished by two Pittsburgh gentlemen, Prof. Blanck and R. W. Smith. A patent has been applied for and details are for obvious reasons suppressed; but it is claimed that very remarkable results have been achieved; and the destruction of all animal and vegetable life and the entire removal of everything deleterious to health, can be successfully accumplished, resulting in the production of water absolutely pure. It remains to be seen, says the Western Electrician, whether this can be accomplished on a sufficiently economical basis for general use. If so, it will be a great boon, as impure water is a fruitful cause of disease and there is probably very little water in use which is even approximately pure. In the rural districts the water obtained from wells and springs is largely impregnated with mineral impurities, and is surface water filtered through strata of rock and soil,

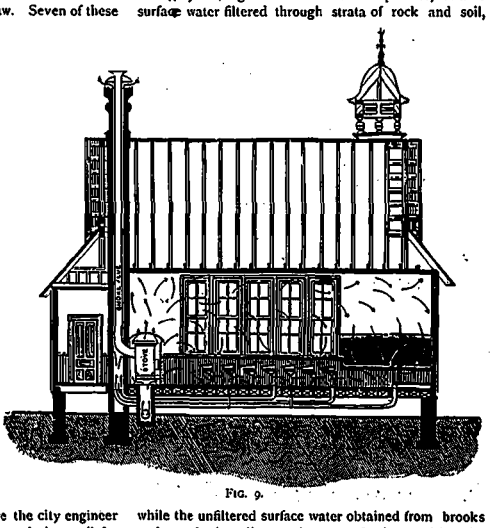

FIG. 9.

while the unfiltered surface water obtained from brooks and ponds is still more impure. In large cities the sewage is, in many cases a constant menace to the purity of the water, and wells in the vicinity of cemeteries, barnyards, and privy vaults are poisoned fountains.

Builders are invited to contribute of their experience to the columns of this paper.