Insulated Tile Type.—The insulating material, which is diatomaceous earth, is molded to the inside of a split tile conduit. The pipes are supported on rollers, which in turn are supported by an iron frame which extends through the conduit and rests on a tile base which also serves as an underdrain. The space between the pipes and the insulating conduit lining may also be filled with an insulating filler. The conduit, insulation, piping and earth load are supported by the base drain. A few inches of gravel or crushed rock are placed about the conduit and the base drain.

Sectional Insulation Type (Tile Conduit).—Each pipe is insulated in the usual way with any desired type of sectional pipe insulation over which is placed a jacket of standard asphalt waterproof roofing with cemented joints. The pipes are enclosed in a split tile conduit which is placed on a bed of crushed rock or gravel from 4 to 6 in. thick. This gravel bed is extended upward so as to come about 2 in. above the parting lines of the tile. Underdrains are sometimes omitted where this type is used, any water which seeps into the conduit being allowed to flow down the bottom of the conduit to the nearest manhole. Drains are laid from the floor of each manhole to some point of free discharge. The pipes are supported on roller frames and these, according to the type of conduit used, are either supported by the conduit itself or have their lower parts set in concrete thus supporting the pipes independent of the conduit.

Sectional Insulation Type (Tile or Concrete Trench).—In a type of construction frequently used in city streets, where service connections are required at frequent intervals, the pipes are insulated as described in the preceding paragraph, and are enclosed in a box or trench made either entirely of concrete, or with concrete bottom and specially constructed tile sides and tops. The pipes are supported on roll frames secured in the concrete.

Sectional Insulation Type (Bituminized Fibre Conduit).—Each pipe is individually insulated and encased in a bituminized fibre conduit. The insulating material is 85 per cent carbonate of magnesia sectional pipe covering, applied in the usual manner as on overhead pipes, except that bands are omitted. After every fifth section of magnesia covering there is applied a short, hollow section of very hard asbestos material in the bottom portion of which rests a grooved-iron plate carrying ball-bearings upon which the pipe rides when expanding or contracting. This short expansion section is of the same outside diameter as the adjacent 85 per cent magnesia covering. Over the pipe covering and expansion device there are placed two layers of bituminized fibre conduit with all joints staggered and the surface of each conduit finished with liquid cement. Conduits are placed on a bed of crushed rock or gravel, approximately 6 in. deep, and this is extended upward to about the center line of the conduit when trench is backfilled. Underdrains leading to points of free discharge are placed in the gravel or crushed rock beds.

Wooden Conduit.—Each pipe is enclosed in a tin-lined wooden casing. Sufficient space is allowed between the pipe and the casing to provide for the insertion of pipe guides or rollers which rest on the bottom of the casing. The casings are bedded in gravel or broken stone and one or more tile underdrains are laid beneath them.

PART II—VENTILATION

CHAPTER XVI

MODERN STANDARDS OF VENTILATION

GENERAL REQUIREMENTS

VENTILATION is the science that treats of the proper conditioning of air to make it satisfactory for the human system. A study of ventilation is a study of the best methods of conditioning and handling air, and a study of the effect of that air on the human system. The test of good ventilation is the measure of health and comfort derived from it. Health and comfort are the proper basis for measuring the quality of ventilation.

In the present status of the art of ventilation it is no longer felt that chemical composition of the air is the important factor, but that proper ventilation depends more largely upon a number of other factors which may be stated in the order of their importance as follows:

1. Air Supply.
2. Air Temperature
3. Relative humidity.
4. Air motion.

(1–4:) These four factors, in combination, are the basis of what is termed "Effective Temperature."

5. Air cleanliness, in reference to its freedom from dust, bacteria and other suspended matter.
6. Air Distribution, with reference to freedom from drafts.
7. Freedom from odors.
8. Freedom from injurious substances such as gases and fumes.
9. Psychological Reactions.

Air supply is put at the head of the list because, while this is no longer considered to be the all important factor in ventilation, the amount of air to be supplied per person or the number of air changes to be furnished for any particular space will always be the starting point, for without air supply there can be no effective ventilation.

Air Supply for Ventilation

A comparatively small quantity of air supply is required to take care of the needs of the lungs. A very much larger quantity is required to take care of the needs of the outside of the body and to provide the heat control necessary for the maintenance of body health and comfort. In order to provide the necessary air movement to maintain uniform temperature conditions, remove odors and provide comfort, the delivery by the ventilating plant of the following quantities of air, are usually found desirable and necessary:

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