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.

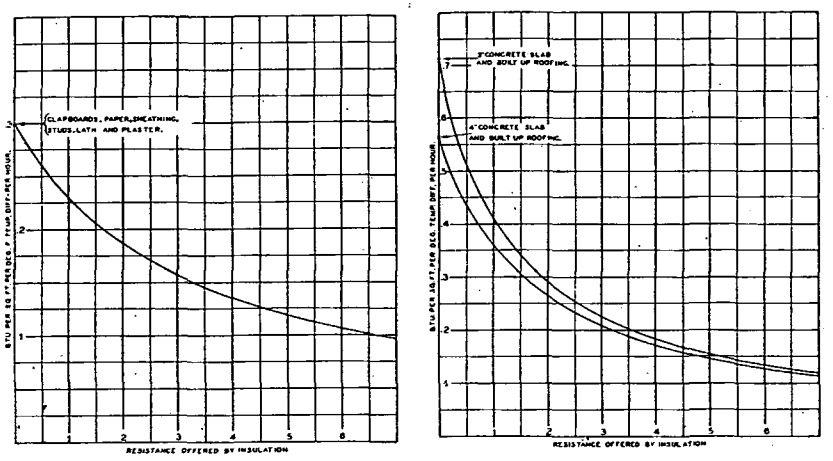
BUILDING INSULATION

Through the use of insulating materials in building construction, the losses through such constructions are greatly decreased; therefore, the saving in fuel, also the effect on the heating equipment required are of considerable interest.

Fig. 71, section A shows the reduction in heat losses through frame building construction, due to insulation of various degrees of effectiveness. The topmost point on the curve represents the rate of heat loss through construction consisting of clapboards, paper, sheating, studs, lath and plaster, but without insulation. If insulation is used in addition to the construction outlined, the rate of heat loss through the entire wall is given by the ordinate of the curve at the point on the horizontal scale

corresponding to the resistance of the insulation added. The curve may therefore be used in connection with any insulating material by determining its resistance for the thickness under consideration. In the accompanying tabulation are given the resistances per 1 in. thick of several well known materials. For thicknesses other than 1 in., multiply the value from the table by the thickness in inches. (In case the insulation completely fills the space between the studs, so that there is no air space, subtract 1.0 from the total resistance so obtained, conversely when the insulation is so placed as to provide an additional air space, add 1.0 to the total resistance.)

Insulation of frame building walls often produces a greater reduction in heat losses than the estimated values because of the increased tightness of the construction against air leakage.



A—Frame Building Walls B—Concrete Roof Slabs

FIG. 71. EFFECT OF INSULATION IN REDUCING HEAT LOSSES THROUGH WALLS AND ROOFS

ROOF INSULATION

Fig. 71, section B shows the effect of insulation in reducing the losses through concrete roof slabs. The topmost point on each curve represents the rate of heat loss through the given thickness of slab, with built-up roof, but without insulation. In order to determine the rate of loss through the roof construction, when any given thickness of insulation is added, determine the resistance of the insulation by multiplying the resistance per 1 in. thick, by the thickness in inches. The ordinate of the curve at the point on the horizontal scale, corresponding to the resistance so determined, gives the rate of heat loss through the entire construction.

In addition to reducing the fuel and heating equipment requirements, one of the most important functions of roof insulation is that it greatly reduces the temperature differential between the lower side of the roof