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.

INFILTRATION

THE problem of inleakage or infiltration is always a serious problem confronting the heating engineer in figuring on the heating of any building. The cracks around windows and doors permit the entrance of cold air, dust, soot, rain, etc., and the amount of this inleakage is in proportion to the number and size of openings and its volume has been found to be in proportion to the wind velocity.

In the construction of any building, it is necessary to build the brick, tile or stone work around the frame of a window or door. The frame being exposed to rain and atmospheric conditions in addition to being in contact with the mortar in the brick or tile work, absorbs moisture, which causes considerable swelling of the wood. Later when the building is plastered more moisture is absorbed. While the frames are in this swelled condition, the sashes are fitted, due allowances being made in fitting the sashes and doors for further swelling by the sash. To allow free operation of the sashes, a crack between the sash and frame of at least $\frac{1}{16}$ in. is necessary, but very often a crack of $\frac{1}{8}$ in. is made. When the heating plant is put in operation, the process of shrinking usually begins and continues for an indefinite period, and cases have been found, at the end of the second heating season, where the crack between the sash and the frame has been in creased to $\frac{1}{4}$ in. in size.

Assuming an average crack all around the sashes is only $\frac{1}{8}$ in. the infiltration through a 3x7 ft. window would be equal to the volume of air that would pass, at a given velocity, through an orifice having an area of $34\frac{1}{2}$ in., therefore the infiltration is directly proportional to the area of the crack aperture. This is fundamental and not conditional. As long as it is necessary for a building to have windows and doors for the purpose of light and ventilation, infiltration will be the first essential in determining the size and operation of a heating plant.

According to tests (See report of S. F. Voorhees in A. S. H. V. E. GUIDE 1922, and O. W. Armspach in *Heating and Ventilating Magazine*, April, 1916), the infiltration through a double hung window can be figured on a basis of 114 cu. ft., 55.8 cu. ft. and 24. cu ft. of air per hr. per lineal foot of crack (the last two are through metal weather strips of a different type.)

The B.t.u. losses due to infiltration can be computed from the expression, $W_p \times I \times 0.02 \ (T_i - T_o)$

in which W_p = Window crack perimeter
I = Infiltration in cubic feet per hour per lineal foot of cracks
T_i = Inside temperature
T_o = Outside temperature

Material for this section was prepared especially for THE GUIDE 1923 by E. P. Bradley, Jr., St. Louis, Mo.