variations in outside temperatures which influence the chimney effect; (5) the relative area and resistance of openings on the windward and leeward sides, and on the lower floors and on the upper floors; and (6) the influence of a planned air supply and the related outlet vents. Tight construction is essential for preventing large heat loss due to infiltration.

INFILTRATION DUE TO WIND PRESSURE

The wind causes a pressure to be exerted on one or two sides of a building. As a result, air comes into the building on the windward side through cracks or porous construction, and a similar quantity of air leaves on the leeward side through like openings. In general, the resistance to air movement is similar on the windward to that on the leeward side. This causes a building up of pressure within the building, and a lesser air leakage than that experienced in single wall tests as determined in the laboratory. It is assumed

TABLE 1. INFILTRATION THROUGH WALLS[a]

Expressed in cubic feet per square foot per hour

Type of Wall	Wind Velocity, Miles per Hour					
	5	10	15	20	25	30
8½ in. Brick Wall[b] — Plain	2	4	8	12	19	23
8½ in. Brick Wall[b] — Plastered[c]	0.02	0.04	0.07	0.11	0.16	0.24
13 in. Brick Wall[b] — Plain	1	4	7	12	16	21
13 in. Brick Wall[b] — Plastered[c]	0.01	0.01	0.03	0.04	0.07	0.10
13 in. Brick Wall[b] — Plastered[d]	0.03	0.10	0.21	0.36	0.53	0.72
Frame Wall, with lath and plaster[e]	0.03	0.07	0.13	0.18	0.23	0.26

[a] The values given in this table are 20 percent less than test values to allow for building up of pressure in rooms, and are based on test data reported in the papers listed in chapter footnotes.

[b] Constructed of porous brick and lime mortar—workmanship poor.

[c] Two coats prepared gypsum plaster on brick.

[d] Furring, lath, and two coats prepared gypsum plaster on brick.

[e] Wall construction: Bevel siding painted or cedar shingles, sheathing, building paper, wood lath and three coats gypsum plaster.

that actual building leakages, owing to this building up of pressure, will be 80 percent of laboratory test values. While there are cases where this is not true, tests in actual buildings substantiate the factor for the general case. Mechanical ventilating systems are frequently designed to produce positive or negative pressures in an enclosure, which are greater or lower than prevalent wind pressures. In such designs, if the specified rate at which air is to be supplied to, or removed from, the enclosure by positive means, exceeds the infiltration rate, it is common practice to use the greater value in determining the heating capacity to warm the outside air.

Infiltration Through Walls

Data on infiltration through brick and frame walls are given in Table 1. The brick walls listed in this table are walls which show poor workmanship, and which are constructed of porous brick and lime mortar. For good workmanship, the leakage through hard brick walls with cement-lime mortar does not exceed one-third the values given. These tests indicate that plastering reduces the leakage by about 96 percent; a heavy

coat of cold water paint, 50 percent; and three coats of oil paint carefully applied, 28 percent. The infiltration through walls ranges from 6 to 25 percent of that through windows and doors in a 10-story office building, with imperfect sealing of plaster at the baseboards of the rooms. With perfect sealing the range is from 0.5 to 2.7 percent; or a practically negligible quantity, which indicates the importance of good workmanship in proper sealing at the baseboard. It will be noted from Table 1 that the infiltration through properly plastered walls can be neglected.

The value of building paper, when applied between sheathing and shingles, is indicated by Fig. 1, which represents the effect on outside construction only, without lath and plaster. The effectiveness of plaster properly applied is no justification for the use of low grade building paper, or of the poor construction of the wall containing it. Not only is it diffi-

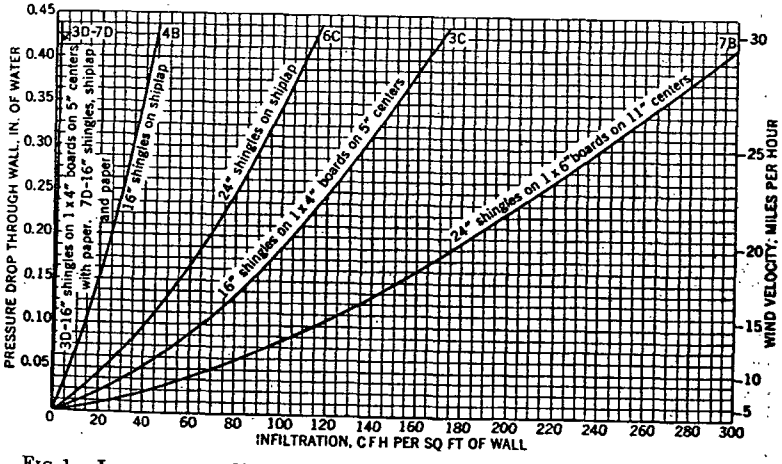

FIG 1. INFILTRATION THROUGH VARIOUS TYPES OF SHINGLE CONSTRUCTION

cult to secure and maintain the full effectiveness of the plaster, but also it is highly desirable to have two points of high resistance to air flow with an air space between them. The infiltration indicated in Fig. 1 is that determined in the laboratory, and should be multiplied by the factor 0.80 to give proper working values.

Window and Door Leakage

There are two methods of estimating air leakage through window and door cracks, namely, (1) the crack method, and (2) the air change method. The crack method is generally regarded as being more accurate than the air change method, provided the variables, such as crack width and clearance, can be properly evaluated.

Crack Method

The crack method is based on known air leakage factors for various types of windows, and widths of crack and clearance. The wind velocity and length of crack are also considered when the crack method is employed.