plus the linear feet of sash section in contact with steel work (at a different leakage rate) at mullions. The crack length for *frame windows* (when frame is not calked) is the perimeter of the frame. Steel sash frame properly grouted with cement mortar into brickwork or concrete is not to be counted as crack. Leakage through various parts of wood windows is shown by the curves of Fig. 4. The effect of various clearances of wood sash is indicated by the curves of Fig. 5; the value of storm sash is shown by the curves of Figs. 6 and 7. A study of the curves leads to the conclusion that a storm sash is of little value in reducing infiltration when applied to a well fitted window, but that a reduction of 50 per cent might be expected when storm sash is applied to a poorly fitted or loose window. Infiltration through door cracks may be assumed to be twice that of window cracks.

TABLE 2. INFILTRATION THROUGH WINDOWS

Expressed in cubic feet per foot of crack per hour[a]

TYPE OF WINDOW		WIND VELOCITY, MILES PER HOUR					
		5	10	15	20	25	30
Double-Hung Wood Sash Windows (unlocked)	Around uncalked frame[b]	1.4	11.3	22.6	31.1	.....	53.6
	Around sash, 1/16-in. crack and 7/64-in. clearance.[c] Plain non-stripped[d]	39.3	84.9	124	161	.....	233
	Average weatherstripped[d]	3	11.7	22.9	34.9	.....	59.6
Double-Hung Metal Windows[e]	Non-weatherstripped, locked	20	45	70	96	125	154
	Non-weatherstripped, unlocked	20	47	74	104	137	170
	Weatherstripped, unlocked	6	19	32	46	60	76
Rolled Section Steel Sash Windows[j]	Industrial pivoted,[f] 1/16-in. crack	52	108	176	244	304	372
	Architectural projected,[g] 3/64-in. crack	20	52	88	116	152	208
	Residential casement,[h] 1/32-in. crack	14	32	52	76	100	128
	Heavy casement section, projected,[i] 1/32-in. crack	8	24	38	54	72	96
Hollow Metal, vertically pivoted window[e]		30	88	145	186	221	242

[a]The values given in this table are 20 per cent less than test values to allow for building up of pressure in rooms.

[b]Practically all leakage around frames can be stopped by proper calking.

[c]Most new sash are fitted with crack at least 1/16 in., which becomes greater as sash dries out and shrinks. Values of the table apply to any window of this type with crack up to 1/4 in.

[d]Values given include "elsewhere" leakage through frame but not leakage through uncalked crack around frame.

[e]Windows tested in place in building.

[f]Industrial pivoted window generally used in industrial buildings. Ventilators horizontally pivoted at center or slightly above, lower part swinging out.

[g]Architectural projected made of same sections as industrial pivoted except that outside framing member is heavier, and refinements in weathering and hardware. Used in semi-monumental buildings such as schools. Ventilators swing in or out and are balanced on side arms.

[h]Of same design and section shapes as so-called *heavy section casement* but of lighter weight.

[i]Made of heavy sections. Ventilators swing in or out and stay set at any degree of opening.

[j]With reasonable care in installation, leakage at contacts where windows are attached to steel framework and at mullions is negligible. With 1/64-in. crack, representing poor installation, leakage at contact with steel framework is about one third, and at mullions about one sixth of that given for industrial pivoted windows in the table.

WIND VELOCITY FACTORS

Although all authorities do not agree upon the value of the wind velocity that should be chosen for any given locality, it is common engineering practice to use the average wind velocity during the three coldest months of the year.[2] Until this point is definitely established the practice of using average values will be followed. Average wind velocities for the months of December, January and February for various cities in the United States and Canada are given in Table 3, Chapter 5.

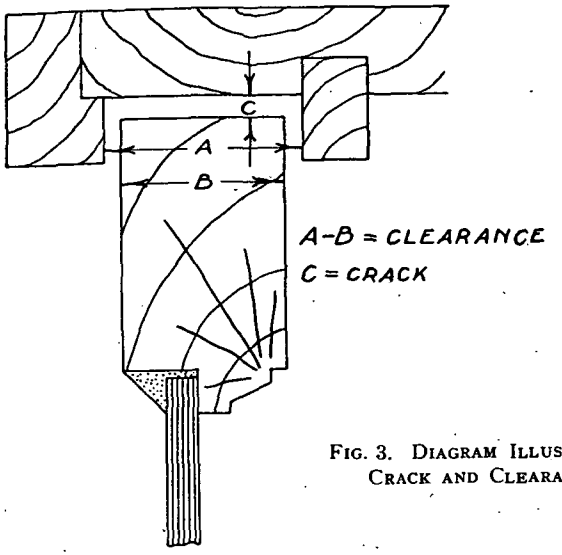

FIG. 3. DIAGRAM ILLUSTRATING CRACK AND CLEARANCE

DETERMINATION OF TOTAL AMOUNT OF CRACK

The direction of prevailing winds may usually be included within an angle of about 90 deg. The windows that are to be figured for prevailing and non-prevailing winds will ordinarily each occupy about one-half the perimeter of the structure, the proportion varying to a considerable extent with the plan of the structure, as illustrated by Fig. 8.

In tall buildings, infiltration may be considerably influenced by temperature difference or chimney effect which will operate to produce a head that will add to the effect of the wind at lower levels and subtract

[2]See *Pressure Difference across Windows in Relation to Wind Velocity*, by Emswiler and Randall [A.S.H.V.E. JOURNAL (Heating, Piping and Air Conditioning), October, 1929].