trarily to distinguish the two principal air passages which are found in double hung windows, and they will be used frequently throughout the report and should not be confused.

"Four sets of sash were fitted with cracks of $\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$ and $\frac{1}{4}$ in. Each set was tested with clearances varying from $\frac{1}{32}$ to $\frac{1}{4}$ in. Each test was repeated a number of times because no two tests gave exactly the same leakage, and it was necessary to obtain average results. Before duplicating any test the window was opened and closed, and the stops were removed and then returned to as nearly the same position as possible. The weather-stripped sashes were tested in the same way.

Fig. 6 gives the results of tests on a plain window with various clearances. The tests proved that the size of the crack around the perimeter of the sash has no appreciable effect on the leakage. Therefore the results apply to any window of the type tested with a crack of from $\frac{1}{16}$ to $\frac{1}{4}$ in. In practice most new sashes are fitted with the crack at least $\frac{1}{16}$ in., and this crack becomes greater as the sash dries out and shrinks. It should be clearly understood that each curve is the average obtained from a number of tests, and the results of any one test may vary from the given curve by four or five per cent. The figure shows that the leakage increases rapidly with increase in clearance.

Calculations for Infiltrations

In order to arrive at the heat required for warming up the air entering by infiltration, the following procedure is necessary:

First, determine the average wind movement in miles per hour for the locality in question (Table 2);

Second, determine the inleakage of outside air per lineal foot of the given window or door crack in cubic feet per minute at the given wind velocity, Table 14 or 15;

Third, express the heat equivalent in B.t.u. per hour per foot of crack to heat this air 1 deg. fahr.

Thus, for a plain window having $\frac{1}{16}$ in. *crack* and $\frac{7}{64}$ in. *clearance* (see Fig. 5), which means the air channel around the edge of the sash is approximately $\frac{1}{16}$ in. wide, the heat equivalent of the air leaking in for a 0–70 deg. fahr. temperature difference is 157 B.t.u. per foot of crack per hour (Table 14, Part II). This value is found in the seventh column of the table. The computation for obtaining 157 is:

$$124 \times 0.075 \times 0.24 \times 70 = 157 \text{ B.t.u.},$$

where

124 = cubic feet of air per foot of crack per hour for a 15 mi. wind for $\frac{7}{64}$ in. clearance from the 6th column of Table 14.
0.075 = air density at 70 deg. fahr., pound per cubic foot.
0.24 = specific heat of air, and
70 = difference in temperature between inside and outside air.

The most convenient values for use in infiltration calculations are the coefficients of infiltration for the particular kind of crackage with a wind velocity of 15 miles per hour under average conditions, with $\frac{1}{16}$ in. *crack* and $\frac{7}{64}$ in. *clearance* reduced by 20 per cent (Table 14, Part II).

For a wind velocity other than 15 miles per hour, use the proper velocity for that locality in place of 15.

(1) Plain unstripped window:

$$124 \times 0.075 \times 0.24 = 2.23 \text{ B.t.u. per hour per foot of crack.}$$

(2) Weather-stripped window:

$$22.9 \times 0.075 \times 0.24 = 0.41 \text{ B.t.u. per hour per foot of crack.}$$

Hence, use the values 2.23, and 0.41 for the heat to be supplied in B.t.u. per hour, per foot of crack for an average wind velocity of 15 miles per hour for each of the two kinds of cracks respectively. In case of very good double hung plain windows use $\frac{2.23}{2} = 1.11$.

For special cases, select proper values from Table 14 or 15 and compute the B.t.u. per foot of crack as already shown for the average case, using the proper wind velocity in miles per hour.

HEAT SOURCES

Heat Available from Sources other than Heating Plant

The heat supplied by persons, lights, motors and machinery should always be ascertained in the case of theaters, assembly halls, and industrial plants, but allowances for such heat sources must be made only after careful consideration of all local conditions. In many cases, these heat sources should not be allowed to affect the size of the installation at all, although they may have a marked effect on the operation and control of the system later. In general, it is safe to say that where audiences are involved, the heating installation must have sufficient capacity to bring the building up to the stipulated inside temperature before the audience arrives. In industrial plants, quite a different condition exists, and heat sources, if they are always available during the period of human occupancy, may be substituted for a portion of the heating installation. In no case should the actual heating installation (exclusive of heat sources) be reduced below that required to maintain at least 40 deg. fahr. in the building. The following allowances may be made when required:

TABLE 16. HEAT GIVEN UP BY PERSONS AND LIGHTS

*PERSONS:	
Man at rest	400 B.t.u. per hr.
Man at work	500 B.t.u. per hr.
LIGHTS:	
Electric lamps, B.t.u. per hr. equals watts per lamp × number of lamps × 3.415	
Gas lighting:	
1 cu. ft. producer gas	150 B.t.u.
1 cu. ft. illuminating gas	700 B.t.u.
1 cu. ft. natural gas	1000 B.t.u.

A Welsbach burner averages 3 cu. ft. of gas per hour and a fish tail burner 5 cu. ft. per hour.

*For more detailed information see Table 17, Heat Emitted by Persons per Hour at Different Room Temperatures.

Motors and the machinery which they drive, if both are located in the room, convert all of the electrical energy supplied into heat, which is retained in the room if the product being manufactured is not removed until its temperature is the same as the room temperature.