of course, eliminated in well designed ventilators, but must be kept in mind.

In Fig. 10, is shown a rotary or air-turbine ventilator, which rotates continuously under the action of the wind, the motion being produced by the difference of wind pressure on the convex and concave sides of the

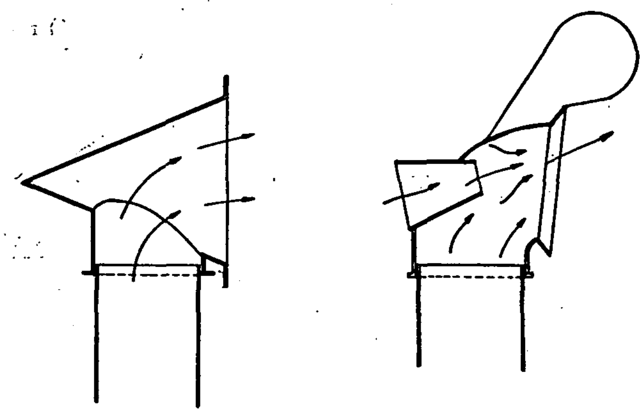

Fig. 8 Fig. 9
Rotary Ventilators

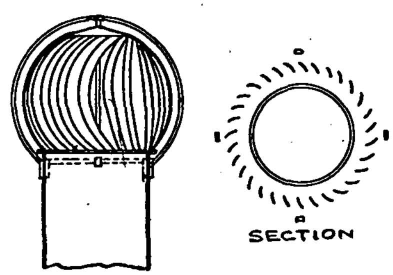

Fig. 10
Air-Turbine Ventilator

vanes. This type of ventilator must be very carefully designed if it is to be leak-proof, and if the noises and impact forces, due to ice accumulating on the vanes in the winter are to be eliminated.

CAPACITIES OF UNIT TYPE ROOF VENTILATORS

The variety of factors affecting capacity makes it essential for the user of ventilators to exercise great care in respect to the item of capacity. All comparisons of capacity must be referred to a given dimension, namely the throat area, corresponding to the nominal size of the ventilator.

Careful tests of ventilators of various types have been made by reliable investigators, and the reader is referred to their work for information on

capacities (See Trans. A. S. H. & V. E., Vol. 27, 1921, p. 67; Vol. 28, 1922, p. 189; and Vol. 29, 1923, p. 39. Also Bulletin No. 14, Engineering Experiment Station, Kansas State Agricultural College).

Conservative figures for the best types of ventilators now on the market, under conditions of unrestricted flow of air to the ventilator, are given by the equation:

$$Q = A \times \left[\frac{36 \times \sqrt{H \times (t_i - t_o)}}{6 + V} + 20 \times V\right]$$

where

Q = cubic feet of air exhausted per hour through a ventilator having a free area at the throat of A square inches, mounted on a roof at a height of H feet from the center of the ventilator outlet to the inlet opening of the building, and with a wind velocity of V miles per hour, and average temperature t_i inside t_o outside.

High class ventilators, for instance those of the ejector type, will, under favorable conditions, discharge continuously 25 per cent more air than these conservative figures indicate. Capacities are lower, on the other hand, if ventilators of lower efficiency are used, or if the flow of air into or through the building is restricted, or if the ventilator is not exposed to the free sweep of the wind. Tests occasionally show considerably higher discharge rates over short periods of time. These abnormally high results are produced by the action of the wind upon certain openings of the building; they are not due to the ventilator itself, and cannot be depended upon for continuous ventilation if the direction of the wind changes. In the smaller sizes of ventilators (12 in. or less in throat diameter) the air discharge per square inch of cross-sectional area is reduced, on account of the frictional resistance and, in the rotary types, on account of reduction of free area by the supports, bearings, etc.

Example.—What is the capacity of an 18 in. ventilator, located 35 ft. above the inlet openings, with 6 miles per hour wind velocity, 50 deg. fahr. outside temperature, 68 deg. fahr. inside temperature?

Answer.—$A = 0.7854 \times (18)^2 = 255$ sq. in.

$$Q = 255 \times \left[\frac{36 \times \sqrt{35 \times (68 - 50)}}{6 + 6} + 20 \times 6\right] = 50{,}000 \text{ cu. ft. per hour,}$$

average capacity under these conditions.

The air supply per person and per hour, or the number of the renewals of air contents per hour is given in Chapter I. (See also Chapter I under "Infiltration," and Chapter XXVI).

To obtain effective, uniform ventilation and avoid local drafts, the ventilators should not be placed more than 30 ft. apart; 20 ft. apart is a good average. It is best, although not absolutely necessary, to locate the ventilator at the ridge of the roof, unless the building exceeds 40 ft. in width, in which case two rows of smaller ventilators should be used. Where the building to be ventilated is surrounded by higher buildings