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 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.

The *continuous type of roof ventilator* is illustrated in Fig. 11. It furnishes a continuous opening in the roof throughout the length of the building, and is in effect a ridge louvre or monitor. It is stated that the high temperature of the air immediately beneath the sheathing, resulting from exposure of the roof to the sun's rays, induces a powerful convective effect along the pitched roof toward the opening which offers a direct avenue of escape, whereas in the unit type of ventilator, the free egress of the air is confined to definite points along the roof, and the natural upward flow is diverted with some loss, to a longitudinal movement. These ventilators are expected to function by the force of temperature difference alone, and have no external features designed to generate a suction by the action of the wind. The absence of a conspicuous external structure makes this type of ventilator particularly suitable for certain types of buildings.

Stacks are really chimneys and utilize both the inductive effect of the wind and the force of temperature difference (the so-called *gravity* action). While their openings projecting above the roof are not provided with any special construction for developing suction by the action of the wind, the plain vertical opening is nevertheless almost as efficient in this respect as any roof ventilator, and like the roof ventilator, the stack outlet should be located so that the wind may act upon it from any direction.

By means of stacks, even multi-story buildings of the school or office type, may be supplied with adequate air change. With little or no wind, chimney effect or temperature difference will produce inflow equally through windows in all sides of the building. With wind, the inductive force at the top of ventilating shafts is more powerful than that on the leeward side of the building, so that air is drawn in through leeward openings by a combination of the forces of wind and temperature difference. On the windward side, the direct forcing pressure of the wind is of course added to the temperature difference effect. Thus forces are available for causing inflow at practically every window of a building of this kind. Adequacy of stack size must be provided, and it must of course be recognized that the motive forces are not of the same intensity at all openings.

Selection of Roof Ventilators

While the average efficiency of one class of roof ventilators will be higher or lower than the average efficiency of another class, this does not in any way determine the capacity of individual ventilators, as ventilators of the same class and, which from a casual observation appear to be the same, may have entirely different characteristics, due to the fact that some of the fundamentals have been overlooked or changed in one or the other.

The principles which should be followed in the selection of roof ventilators are:

A—Stationary Ventilators.

1. A head sufficiently large to produce a large low-pressure area on the side opposite the wind, and to give an area of outlet for the air leaving the head large enough to obviate undue resistance to flow. At the same time the head should not be so large as to be unwieldy in handling or to be structurally weak when erected.
2. A storm band on stationary non-siphoning ventilators should be sufficiently wide and so placed as to prevent the entrance of external air into the ventilator head.
3. If the ventilator is a siphoning type, additional outlet air space must be provided in the head in order not to restrict the air passage from the exhaust pipe.

B—Rotary Ventilators.

1. A flaring outlet from a rotary ventilator will give a better exhaust than a straight outlet.
2. Practically frictionless and noiseless turning of the ventilator head, when the wind direction changes. The head should turn at very low wind velocities.
3. Smallest possible change of direction of the air ascending from the building and least possible resistance to its egress by louvres or other obstructions at the outlet opening.

C—All Ventilators.

1. Freest possible outlet for the air from the building, with large areas and smallest possible change of direction of the air flow.
2. Freedom from down drafts and from entrance of rain or snow.
3. Freedom from being rendered inoperative by collection of snow or formation of ice on ventilator.

Capacities of 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 TRANSACTIONS, 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,