

2. Mechanical supply ventilation taking air from out-of-doors, delivered horizontally directly toward the face and breast of each operative through an adjustable nozzle of about one-half square foot area at a velocity of about 800 fpm. This nozzle should be about 2 ft from the man.

3. The inlet to the mechanical supply ducts should be taken if possible from the north or shady side of the building, or from a shaded court, never from above a sunny black roof, since the normal out-door air will gain considerable heat when drawn into the building over such a surface.

COLD STORAGE WAREHOUSES

Fruit and vegetables are alive until they begin to decay and if they are to remain alive and well they must be given an ample supply of air and favorable humidity conditions. Conclusive demonstration has been made of the necessity of controlled ventilation for rooms in which fruit and vegetables are stored, even though the temperature in such rooms may be kept very low. It is possible to obtain well developed proprietary systems of ventilation for cold storage warehouses, and as the volume of air to be changed may be comparatively small, the cost for extra refrigeration due to ventilation is trifling, and often is more than compensated for by the improved interior air circulation and the elimination of air-stratification.

Warehouses for fruit storage where no refrigeration is employed should have many doors and windows, which may be opened during the night in warm weather, and closed during the day. The product should be piled in such manner as to allow very free air circulation between the cases and around them. Fans for driving new air quickly through and around the cases often are employed to good advantage.

LACQUER SPRAY BOOTHS

In general there must be an exhaust fan which will provide an air velocity of at least 150 fpm through the opening into the hood from the room. It is preferable in installations of this type to use a pressure fan with an inductor-jet or nozzle so that the carried-away lacquer does not enter the fan at all. It is proper to make the exhaust duct in the vicinity of the booth of such type that accumulations of paint may be removed when they begin to clog the air ways.

In many automobile body spray booths the ducts for exhausting from the spray hood will range from 30 to 48 in. in diameter. A 30 in. duct usually requires about 2 hp for the fan, which maintains on the 5 in. nozzle pipe, pressure equal to a column of water about 7 in. high. For a 48 in. duct the fan requires about 5 hp and the pressure is 10 in. of water on a 6½ in. nozzle pipe. There are proprietary systems of this type.

Chapter 26

NATURAL VENTILATION

Motive Forces; Means of Effecting Natural Ventilation; Roof Ventilators; Application of Natural Ventilation.

VENTILATION systems may be classified as *natural* and *mechanical*. Natural systems are those which employ natural forces *only* to bring about the desired air change, whereas mechanical systems are those in which air motion is obtained by mechanical means. For data on mechanical systems of ventilation, see Chapters 25 and 31.

Factory or industrial buildings are usually ventilated by natural forces, and most commonly by means of windows arranged in side walls and in monitors of some form. The vast amount of opening made available by operative sash gives opportunity for tremendously great air movements, even with forces of but slight intensity. Roof ventilators are used on buildings of all kinds, particularly where fumes and gases are produced.

Dwelling houses depend almost entirely upon natural forces for ventilation, occasionally by means of roof ventilators, but almost always by windows. Natural ventilation has an important application in dairy stables and other buildings housing live stock.

MOTIVE FORCES IN NATURAL VENTILATION

The natural forces available for the displacement of air in buildings are the wind and the difference of temperature of the air inside and outside the building. The arrangement and control of ventilating openings should be such that the two forces act cooperatively and not in opposition.

The magnitudes of the forces of wind and temperature difference are variable in amount and beyond the control of man. However, their effect in producing ventilation may be graduated from the maximum as desired, by a proper control of the amount of ventilating openings and their disposition about a building. Natural ventilation finds its best application in buildings of the industrial type, which are usually open throughout from floor to roof, and in which enormous ventilating areas can be made available both in side walls and roof.

Wind Action¹

The wind operates to produce regions of pressure or suction about the exterior of a building as compared with the conditions that would exist in these regions if the air were still. The principal effects of the wind when blowing directly against one face of a building are illustrated in Fig. 1. The

¹See *Airation of Industrial Buildings*, by W. C. Randall (A.S.H.V.E. TRANSACTIONS, Vol. 34, 1928).