than 200 fpm at the point of origin. For granite dust generated by pneumatic devices, velocities from 150 to 200 fpm, depending on the type of hood used, are recommended as sufficient for safe control[2]. Considering the character of the industry, air velocities of this order may be extended to similar dusty operations. The method for approximately determining these velocities in terms of the velocity at the hood opening is given in Equation 3.

No set rule can be given regarding the shape of a hood for a particular operation, but it is well to remember that its essential function is to create an adequate velocity distribution. The fact that the zone of greatest effectiveness does not extend laterally from the edges of the opening may frequently be utilized in estimating the size of hood required. Where complete enclosure of a dusty operation is contemplated, it is desirable to leave enough free space to equal the area of the connecting duct. Hoods for grinding, polishing and buffing should fit closely, but at the same time should provide an easy means for changing the wheels. It is advisable to design these hoods with a removable hopper at the base to capture the heavy dust and articles dropped by the operator. Such provisions are of assistance in keeping the ducts clear. Air volumes used to control many dust discharges may often be reduced by effective baffling or partial enclosure of an operation. This procedure is strongly urged where dusts are directed beyond the zone of influence of the hood.

Axial Velocity Formula for Hoods

When the normal flow of air into a hood is unobstructed, Equation 3 may be used to determine the air velocity at any point along the axis[3]:

$$V = \frac{0.1\,Q}{x^2 + 0.1\,A} \tag{3}$$

where

V = velocity at point, feet per minute.
Q = volume of air handled, cubic feet per minute.
x = distance along axis, feet.
A = area of opening, square feet.

Velocity Contours

It is possible by use of a specially constructed Pitot tube[4] to map contours of equal velocity in any axial plane located in the field of influence. It has been found that the positions of these contours for any hood can be expressed as percentages of the velocity at the hood opening and are purely functions of the shape of the hood[5].

Further, the velocity contours are identical for similar hood shapes when the hoods are reduced to the same basis of comparison. These facts are applicable to all hood problems so that when the velocity contour

[2]Control of the Silicosis Hazard in the Hard Rock Industries. I. A Laboratory Study of the Design of Dust Control Systems for Use with Pneumatic Granite Cutting Tools, by Theodore Hatch, Philip Drinker and Sarah P. Choate. (*Journal of Industrial Hygiene*, Vol. XII, No. 3, March, 1930).

[3]The Control of Industrial Dust, by J. M. DallaValle (*Mechanical Engineering*, Vol. 55, No. 10, October, 1933).

[4]Studies in the Design of Local Exhaust Hoods, by J. M. DallaValle and Theodore Hatch (*A.S.M.E. Transactions*, Vol. 54, 1932).

[5]Velocity Characteristics of Hoods under Suction, by J. M. DallaValle (A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932, p. 387).

distribution is known, the air flow required can be determined. Fig. 1 shows the contour distribution in two axial planes perpendicular to the sides of a rectangular hood with a side ratio of one-half. The distribution shown is identical for all openings with a similar side ratio provided the mapping is as shown in the figure. The contours, of course, are expressed as percentages of the velocity at the opening.

Low Velocity Systems

On multiple installations of the same operation it is often possible to institute a great saving in power cost by designing an exhaust system

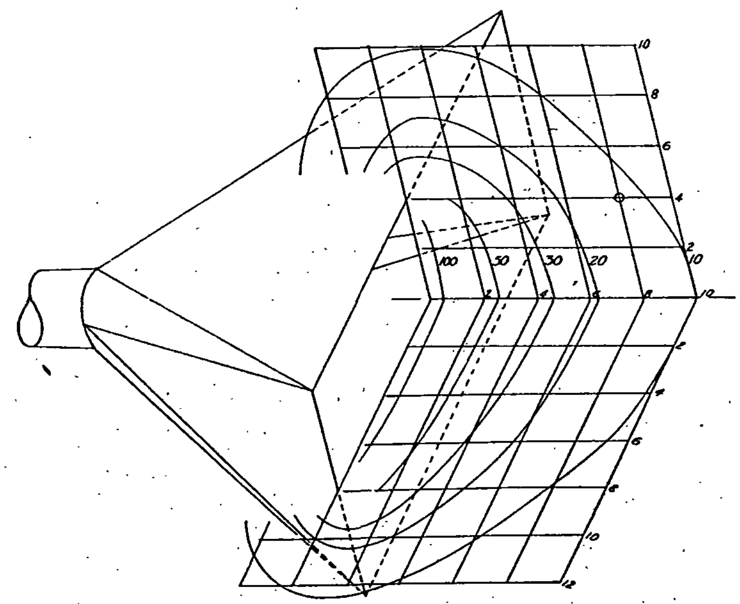

FIG. 1. VELOCITY CONTOURS FOR A RECTANGULAR OPENING WITH A SIDE RATIO OF ONE-HALF. CONTOURS ARE EXPRESSED AS PERCENTAGES OF THE VELOCITY AT THE OPENING

using low velocities in the main ducts. Such a system for use in grinding and shaping porcelain has been described[6]. In these operations, the separate machines are grouped around a central plenum chamber and exhausted by means of a low pressure fan connected to the plenum. In this case a power saving of over 90 per cent was obtained. A similar design technique has been described[7] for use in ventilating plating tanks.

Large Open Hoods

Large hoods, such as may be used for electroplating and pickling tanks, should be sub-divided so the area of the connecting duct is not less than

[6]Low Velocity Exhaust Systems, by Theodore Hatch (*Heating and Ventilating*, October, 1940, p. 27).

[7]Tank Ventilating Power Costs Cut by Low Velocity Systems, by William B. Harris (*Heating and Ventilating*, July, 1942, p. 42).