In choosing the pipe sizes consideration must be given to the way and manner in which the machines will be operated, as in case a considerable number of machines, all discharging into one main, should be shut off at the same time, the velocity in the main might easily be lowered to the point where it would not be sufficient to carry the material from the machines still in operation, and thus result in clogging the pipes. Accordingly, it is sometimes desirable to use velocities higher than the minimum to allow a factor of safety to cover this contingency.

The resistance of a round pipe to the flow of air is inversely proportional to the fifth power of the diameter of the pipe. Therefore, handling a given quantity of air through a larger pipe at a lower velocity decreases the frictional resistance very materially and correspondingly decreases the horse-power required at the fan, and thus it is very desirable to keep the air velocities throughout the system as low as possible, consistent with the major requirement that the material must be taken away as fast as made, without clogging the pipes, under the varying operating conditions met with from day to day in the plant.

The static suction required at the hood connections varies from 1 to 5 in. of water. The suction required depends upon many factors such as the relative size of the hoods and connections, kind and quantity of material handled, as well as its physical condition. In some states codes have been issued specifying suctions to be maintained for the more common dusts.

A suction standard should always be considered in conjunction with the shape of hood, and size connection, as these factors together determine the volume of air exhausted and its velocity which in turn are a measure of the effectiveness of the exhaust system.

TABLE 109. SUCTIONS REQUIRED AT HOODS FOR CONNECTIONS OF USUAL PROPORTIONS

| Work | Static Suction in In. of Water |
|---|---|
| Exhausting from Grinding and Buffing Wheels | 1–2 |
| Exhausting from tumbling barrels | 1–2 |
| Exhausting from wood-working machinery—light duty | 1–2 |
| Exhausting from wood-working machinery—heavy duty | 2–4 |
| Shoe Machinery Exhaust | 2–3 |
| Exhausting from rubber manufacturing processes | 1–2 |
| Flint grinding exhaust | 1–2 |
| Exhausting from pottery processes | 1–2 |
| Lead dust and fume exhaust | 1–4 |
| Fur and Felt Machinery Exhaust | 2–3 |
| Exhausting from textile machinery | 1–3 |
| Exhausting from elevating and crushing machinery | 1–2 |
| Conveying bulky and heavy materials | 3–5 |

The cubic feet of air of standard density taken into the system at each connection is given by the formula:

$$Q = 4000\, A\, f \sqrt{i}$$





where

$Q$ = Cubic feet of air per minute;
$A$ = Area of connection in square feet;
$f$ = Orifice or restriction coefficient;
$i$ = Static suction measured in inches of water.

The orifice coefficient $f$ is dependent upon the shape and construction of the hood and will range from 60 to 90 per cent. An average value is 70 per cent.

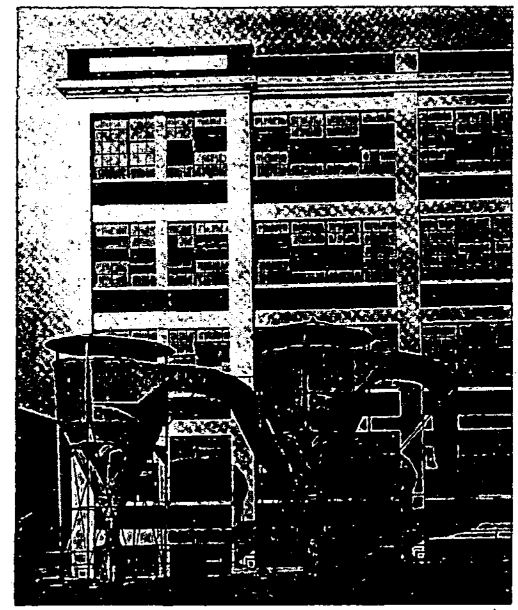

FIG. 72. COLLECTORS ON ROOF OF NEW JERSEY PIANO FACTORY

Knowing the suction at each hood and the diameter of each connection, the volume of air passing up each branch can be taken from the accompanying Table 110. The sum of all these volumes gives the total volume to be handled by the exhaust fan.

Common practice is to provide a main suction pipe having an area 20 to 25 per cent in excess of the sum of the areas of the branches entering it between the point in question and the dead end of the main. Similarly the discharge pipe leading from the fan outlet to collector is frequently made the same diameter as the large end of the main suction pipe. The reason for this increase in size is that a considerable power saving results from the lower air velocity. However, there is no technical