TABLE 6. DIAMETERS OF BRANCH PIPES AND CALCULATIONS OF MAIN FOR TYPICAL EXHAUST SYSTEM ILLUSTRATED IN FIG. 1

MACHINE	DIAMETER OF BRANCH PIPES	AREA SQ. INCHES	TOTAL LOAD AREA SQ. INCHES	TOTAL LOAD AREA SQ. INCHES + 25%	SECTION OF MAIN	DIAMETER OF MAIN IN EVEN INCHES
Rip Saw	5 in.	19.6	19.6	25	*B*	6 in.
Cut-off Saw	4 in.	12.6	32.2	40	*C*	7 in.
Band Saw	5 in.	19.6	51.8	65	*D*	9 in.
Planer Top Connection	6 in.	28.3	80.1	100		
Planer Bottom Connection	6 in.	28.3	108.4	135	*E & F*	13 in.

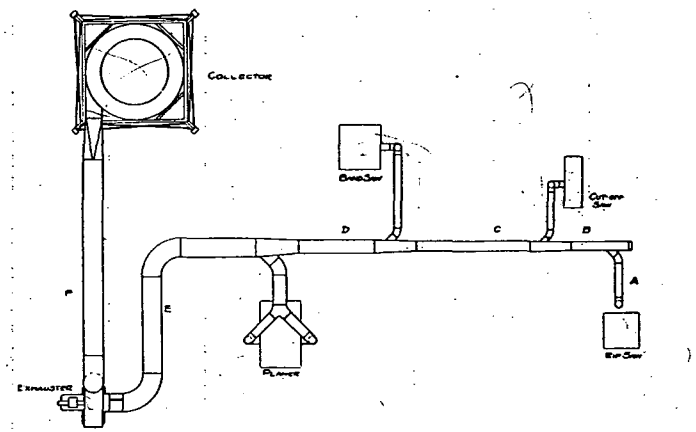


FIG. 1. TYPICAL EXHAUST SYSTEM

TABLE 7. DETAILS OF CALCULATION OF FRICTION OF PIPING SYSTEM ILLUSTRATED IN FIG. 1

SECTION OF PIPING	EFFECTIVE LENGTH OF PIPE TAKEN AS:	DIAMETER OF PIPE IN INCHES	AREA OF PIPE IN SQ. FT.	CFM	VELOCITY OF AIR FLOW, FEET PER MINUTE	FRICTION PER 100 FT. OF LENGTH	PIPE FRICTION
A	20 ft.	5	0.136	605	4450	7.4	1.48
B	10 ft.	6	0.195	605	3100	3.1	0.31
C	10 ft.	7	0.267	991	3700	3.8	0.38
D	15 ft.	9	0.442	1,596	3600	2.8	0.42
E	20 ft.	13	0.922	3,330	3600	2.0	0.40
F	25 ft.	13	0.922	3,330	3600	2.0	0.50
TOTAL pipe friction							3.49

Resistance of System

The maintained resistance of the exhaust system is composed of three factors: (1) loss through the hoods; (2) collector drop; and (3) friction drop in the pipes.

The loss through the hoods is usually assumed to be equal to the suction maintained at the hoods. The collector drop in inches of water is given roughly by Equation 2, but where possible the resistance of the particular collector to be used should be ascertained from the manufacturer as these resistances differ quite widely.

$$\text{Drop} = C\left(\frac{V}{1{,}000}\right)^2 \qquad (2)$$

where

C = a constant which depends upon the type of collector and ranges from 0.065 to 0.145.

V = velocity in feet per minute of air entering the collector.

Friction drop in the pipes must be computed for each section where there is a change in area or in velocity. Find the velocities in each section of pipe starting with the branch most remote from the fan. The friction drop for these sections can be determined by reference to Table 5. Total friction loss in the piping system is the friction drop in the most remote branch plus the drop in the various sections of the main, plus the drop in the discharge pipe.

TYPICAL LAYOUT AND CALCULATIONS

To illustrate the method of laying out and calculating the elements of an exhaust system, assume a small wood-working shop, having one 16 in. diameter rip saw, one 12 in. diameter cut-off saw, one band saw with 2 in. blades, and one planer with 10 in. knives, and with the general arrangement of the machines and exhaust system as shown in Fig. 1.

First, determine the sizes to be used for the branch connection to the hoods. These sizes can be taken from Table 1 giving due consideration to the type and size of machines as well as the class of work handled. (See Table 6).

The next step is to determine the size of the main, which varies in diameter, increasing from its dead end towards the fan, as necessitated by the branch pipes entering it. Its exact diameter at any point is determined according to the following rule:

The area of the main at any point should be 20 per cent 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. Floor sweeps, if equipped with efficient blast gates, need not be included in computing the area of the main.

According to Table 3, 2 in. suction at the hoods is suitable for exhausting from wood-working machinery where the duty is light, as would be the case in this problem. The volume of air to be handled by the system is determined from Table 4.