TABLE 16

Calculation of Exhaust System Pressure Losses

Hood and duct section	C.f.m. through duct section	Average design velocity (l.f.m.)	From friction chart: Nearest duct diam. (in.)	From friction chart: Actual duct vel. (l.f.m.)	From friction chart: Friction/100 ft. (in. H_2O)	Total equiv. straight duct (ft.)	Total friction (in. H_2O)	Summary of Losses: Hood V.P. / % loss	A	B or C	D	E	Corrected E
								In. H_2O	*0.53*	*0.46*	*0.52*	*0.45*	*0.61*
A-1	800	4000	6	4100	4.3	15	0.65	—	0.65	—	—	—	—
B-2	300	4000	4	3500	5.1	19	0.97	—	—	0.97	—	—	—
C-3	300	4000	4	3500	5.1	19	0.97	—	—	—	—	—	—
4	1400	4000	8	4000	2.9	20	0.58	—	0.58	0.58	—	—	—
D-5	600	4000	5.5	3700	4.0	31	1.24	—	—	—	1.24	—	—
6	2000	4000	9.5	4100	2.5	10	0.25	—	0.25	0.25	0.25	—	—
E-7	1000	4000	7	3800	3.0	34	1.02	—	—	—	—	1.02	—
E-7 corrected	1000	—	6.5	4400	4.5	33	1.49	—	—	—	—	—	1.49
8	3000	4000	12	3800	1.6	15	0.24	—	0.24	0.24	0.24	0.24	0.24
								2.25	*2.50*	*2.25*	*1.71*	*2.34*	
Subtotal for Balancing Purposes:										2.00	*dust collector*		
9	3000	3000	14	2800	0.75	19	0.14	—	—	0.14	—	—	—
10	3000	2000	16	2200	0.39	30	0.12	—	—	0.12	—	—	—

Total Resistance of System Using Maximum Branch Resistance: 4.76

Figure 24. Line diagram of an exhaust system.

C. RELATION BETWEEN AIR VELOCITY AND VELOCITY PRESSURE

The dynamic or kinetic energy of moving air may be expressed in terms of the equivalent static or potential energy of a vertical column of water. Thus, the downward pressure exerted by a column of water 1 inch high is enough to balance the pressure created by an air stream that impinges against a stationary surface with a velocity of approximately 4000 l.f.m. We say, therefore, that 4000 l.f.m. has a "velocity head" or "velocity pressure" of 1 inch of water. Conversely, if the kinetic pressure of 1 inch of water is allowed to escape to the atmosphere through a frictionless orifice, it will emerge with a velocity of 4000 l.f.m.

For most applications in the field, the following approximate formula can be used. Either of the two forms given:

$$\text{Air velocity, or } V = 4000\sqrt{VP}$$

$$\text{Velocity pressure, or } VP = (V/4000)^2$$

D. AIR-DUCT FRICTION

The friction chart (Figure 22) applies to the flow of dry air at 70° F. and 29.92 inches Hg barometer through round straight galvanized sheet-metal ducts of spiral construction with about 40 slip joints per hundred feet.

Friction losses in pipes or ducts that differ considerably from the conventional sheet-metal construction can be computed from the following formula in combination with Tables 17 and 18:

$$\frac{\text{inches of water}}{\text{hundred feet}} = f\left(\frac{1200}{\text{diameter in inches}}\right)\left(\frac{\text{l.f.m.}}{4000}\right)^2$$

The procedure is to: (1) select an appropriate roughness measure (ϵ) from Table 17; (2) compute relative roughness, ϵ/D, in which D is pipe diameter in feet; (3) compute Reynolds Number from formula on page 339; (4) use Reynolds Number