10 diameters long; while with a center line radius 1½ times the diameter, the resistance is apparently the same as that of seven diameters of straight pipe.

AIR CLEANING EQUIPMENT

Primary dust separators depend for their air cleaning action on centrifuging out the dust particles or on imparting to the transporting air stream a quick change in direction, accompanied by a sudden reduction in velocity. They may be applied to exhaust systems from polishing and buffing wheels and, in some cases, as a preliminary separator ahead of a final dust arrester.

Dust particles which cannot be caught in inertia type separators are usually removed by one of the following methods:

1. *Filtration.* Of the filter arresters the cloth type, either of the screen, envelope, or bag construction, is most generally used for industrial exhaust systems. Cloth arresters properly engineered for this job and handling dust for which they are suited operate at a good efficiency.

2. *Wet Collectors.* Wet collectors have been in use for many years, but only recently have been introduced for collection of industrial dust from exhaust systems. They are particularly applicable where moisture is present in the air being exhausted. The resistance is relatively low in wet collectors suitable for dust removal and remains constant for a given exhaust system.

3. *High-tension Electrical Precipitation.* High-tension electrical precipitation has been applied to removal of dust, fumes, and mists from air and other gases. (See section on Electric Precipitators in Chapter 33.)

4. *Dynamic Precipitators.* This equipment effects removal of entrained dusts by means of a specially designed fan in which the rotating element imparts a centrifugal force to the dust particles. Originally these precipitators were intended for the collection of dry dust, but recently the construction has been modified to permit the introduction of water into the dirty air intake, thus increasing its application to more kinds of dust. Consideration must be given to the type of dust handled [13].

For additional information on dust and cinders, see Chapter 33, Air Cleaning Devices.

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 duct system.

The loss through the hoods is usually assumed to be equal to the suction maintained at the hoods. Where possible the resistance of the particular collector to be used should be obtained from the manufacturer.

TABLE 8. LOSS THROUGH 90-DEG ELBOWS

ELBOW CENTER LINE RADIUS IN PER CENT OF PIPE DIAMETER OR DEPTH	APPROXIMATE LOSS IN PER CENT OF VELOCITY HEAD
50	75
100	26
150	17
200–300	14

TABLE 9. CORROSION RESISTING MATERIALS FOR EXHAUST SYSTEMS[a]

MATERIAL	ACID[b]											
	ACETIC		CHROMIC		HYDRO-CHLORIC		HYDRO-FLUORIC		NITRIC		PHOS-PHORIC		SUL-PHUROUS		SUL-PHURIC	
METALS	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.	Dil.	Conc.
Aluminum	Good		Fair		Poor		No Data		Poor	Good	Poor		Poor		Poor	
Magnesium and Alloys	No Data		Good	Poor	No Data		Poor	Good	No Data		No Data		No Data		No Data	
Lead and Lead-Coated	Poor		Good		Poor		Poor		Poor		Poor		Good		Good	Poor
Moly Alloy (60 *Ni*—20*Mo*—20 *Fe*)	Good		No Data		Fair		No Data		Poor		Poor		No Data		Good	
Monel Metal	Fair		Poor		Fair	Poor	Good[d]		Fair	Poor	Fair		Poor		Good	Poor
Bronze	Poor												Good			
Silicon Iron	Fair	Good	No Data		Fair		Poor		Good		Good		No Data		Good	
Stainless Steel[c] (18 *Cr*-8 *Ni*)	Good		Good		Poor		No Data		Good		Poor		Good		Poor	Good[e]
Enameled Steel	No Data		No Data		Good		Poor		Good		Poor		No Data		Good	
MISCELLANEOUS																
Asbestos Comp.					Good except against strong acids and alkalies											
Wood	Some woods are decomposed or softened faster than others.															
Rubber									Poor						Poor	
Plastics	In general plastics resist weak acids and are decomposed by concentrated acid.															

[a] Standard Practice Sheet No. 115 (Division of Industrial Hygiene, New York State Labor Department).
[b] Acid mists in air are more corrosive than as liquid in storage tank. Galvanized iron not resistant to acid.
[c] Stainless steel of (24 *Cr*—10 *Ni*) fairly resistant at low temperature for HCl and H_3PO_4.
[d] Under most conditions.
[e] At room temperatures.

Friction drop in the pipes must be computed for each section where there is a change in area or in velocity. The velocities should be found 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 8 in this chapter and Fig. 2, Chapter 41. 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.

EFFICIENCY OF EXHAUST SYSTEMS

The efficiency of an exhaust system depends upon its effectiveness in reducing the concentration of dusts, fumes, vapors and gases below the safe or threshold limits [14].

Too much emphasis cannot be placed on the necessity of testing exhaust systems frequently by determining the concentration of atmospheric contamination at the worker's breathing level [15]. Commonly accepted values of threshold limits for usual atmospheric contaminants will be found in Tables 3, 4 and 5, Chapter 10.

AIR FLOW PRODUCING EQUIPMENT

In any type of exhaust system some form of air flow producing equipment should be required to create the pressure necessary to cause the air