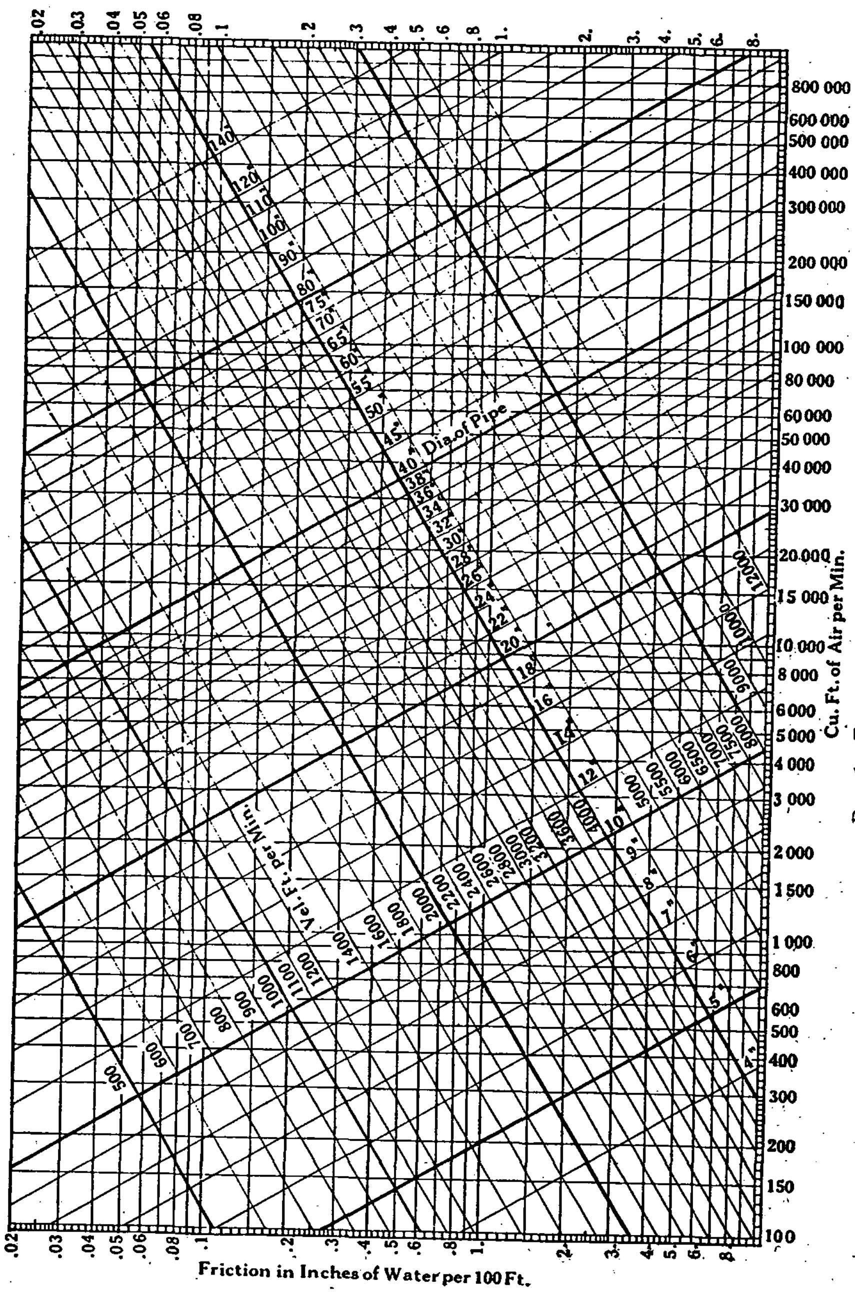

FIG. 1. FRICTION OF AIR IN PIPES

(at a velocity of 2,000 ft. per minute) in a length equal to 50 diameters of 24-in. galvanized swedged pipe.

As an example of the use of the chart: Assume that it is desired to pass 10,000 cu. ft. of air per minute through 75 ft. of 24-in. diameter pipe. Find 10,000 cu. ft. of air per minute on the right scale and move horizontally left to the diagonal line marked 24 in. The other intersecting diagonal shows that the velocity in the pipe is 3,200 ft. per minute. Directly below the intersection it is found that the friction per 100 ft. is 0.59 in., then for 75 ft. it will be $0.75 \times 0.59 = 0.44$ in. In a like manner any two variables may be determined by the intersection of the lines representing the other two variables.

Other losses of pressure are at the entrance to the duct, through heater, air washer, etc. In ordinary practice it is usual to keep the sum of the piping losses ⅓ to ½ and the loss through heater at less than one half of the static pressure. The remainder is then available for producing velocity.

In the design of an ideal duct system, all factors should be taken into consideration and the air velocities proportioned so that the resistance will be practically equal in all ducts regardless of length.

Friction in Elbows

Experience has shown that with an elbow of radius $R = 1\frac{1}{2} D$, fairly good results may be obtained. The loss with such an elbow will be about 17 per cent of a velocity head for round ducts and about 8 per cent of a velocity head for square ducts. It has been found of little or no advantage in making an elbow of a radius greater than two diameters. If, however, a smaller radius than $1\frac{1}{2} D$ be used, the losses increase rapidly. For instance, the loss for an elbow of $R = 1\ D$ will be as high as 17.5 per cent of a velocity head for square ducts and 25.5 per cent for round ducts.

For ordinary calculations one easy long radius elbow ($R = 1\frac{1}{2} D$) in a circular pipe may be considered as equal in friction loss to 10 diameters of straight pipe.

Proportioning the Size for Friction

By means of Figs. 2 and 3 the diameter of branch pipes necessary to carry a given percentage of the total air in the main pipe with the same friction per foot of the length may be determined.

For example: Suppose a 60-in. main pipe is to be used, and it is desired to know the size of branch pipe required to carry 50 per cent of the total air in the main. Find 50 per cent at the left of the chart, move right to the 60-in. diagonal line and note directly above at the top of the chart, that the branch pipe will be a 45.5-in. diameter.

Where rectangular ducts are used it is frequently desirable to know the equivalent diameter of round pipe to carry the same capacity and have the same friction per foot of length. Table 3 gives directly the circular equivalent of rectangular ducts for equal friction and capacity.

To obtain the size of rectangular pipes for different capacities but of the same friction per foot of length, first obtain the equivalent round pipe for equal friction. Thus, if a branch of sufficient size to carry 30 per cent of a 12 x 36-in. pipe is desired, it is found from Table 3 that