6 ● What are the essential differences between a high velocity long throw and short throw grille?

Generally, a high velocity long throw grille is used where a large compact mass of air is projected with a reduction in the periphery of the air stream whereas, with a short throw grille design the periphery of the air stream is expanded as much as possible to increase the scrubbing action between the incoming air stream and the stationary air.

7 ● What type of system is generally used in a large continuously operated theatre?

Most large continuously operated theatres are provided with a complete downward system of air distribution. With this system a large number of outlet openings are provided each of which discharges air in a thin horizontal stream at high velocity in order that the cool air would be mixed with the area in the theatre before it reaches the patrons. In this type of system the best distribution is obtained when a sufficient number of exhaust openings are located under the seats.

8 ● What means are available for balancing a system to secure the desired amount of air in each space?

Ways in which this may be accomplished are by: *a.* dampers on supply and return grilles, *b.* dampers in supply and return ducts, *c.* reduction of the effective area of some outlets by blank-offs, and *d.* combination of dampers in both supply and return air duct systems.

Chapter 20

AIR DUCT DESIGN

Pressure Losses, Friction Losses, Friction Loss Chart, Proportioning the Losses, Sizes of Ducts, General Rules, Procedure for Duct Design, Air Velocities, Proportioning the Size for Friction, Main Trunk Ducts, Equal Friction Method, Duct Construction Details

THE flow of air due to large pressure differences is most accurately stated by thermodynamic formulae for air discharge under conditions of adiabatic flow, but such formulae are complicated, and the error occasioned by the assumption that the gas density remains constant throughout the flow may be considered negligible when only such pressure differences are involved as occur in ordinary heating and ventilating practice.

In the development of the formulae, diagrams, and tables for the flow of air, use is made of the following basic equation for the flow of fluids:

If H_v be the velocity head in feet of a fluid, and the velocity, V, be expressed in feet per minute, the fundamental equation is

$$V = 60\sqrt{2g\,H_v}$$

The factor g is the acceleration due to gravity, or 32.16 ft per second per second.

It is usual to express the head in inches of water for ventilating work and, since the heads are inversely proportional to the densities of the fluids,

$$\frac{H_v}{\frac{h_v}{12}} = \frac{62.4}{d}$$

or

$$H_v = 5.2\,\frac{h_v}{d}$$

therefore,

$$V = 1096.5\sqrt{\frac{h_v}{d}} \qquad (1)$$

where

V = velocity in feet per minute.
h_v = velocity head or pressure in inches of water.
d = weight of air in pounds per cubic foot.

For standard air (70 F and 29.921 in. barometer) $d = 0.07492$ lb per cubic foot. Substituting this value in Equation 1:

$$V = 1096.5\sqrt{\frac{h_v}{0.07492}} = 4005\sqrt{h_v} \qquad (2)$$