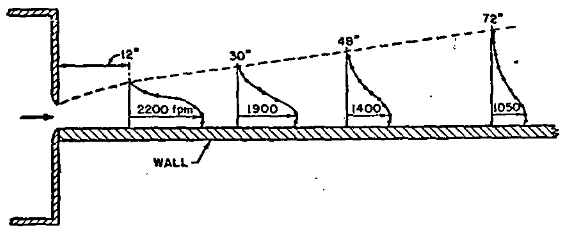

FIG. 8. JET VELOCITY PATTERNS FOR A SQUARE OUTLET DISCHARGING ALONG WALL OR CEILING
($V_0 = 2260$, $A = 0.10$, $C_d = 0.78$)

Effect of Walls and Ceilings

Jets discharging parallel to a wall with one edge of the outlet coinciding with the wall, take the form of one-half of an axial jet discharging from an outlet twice as large, similar to radial jets from ceiling plaques. Entrainment takes place practically only along the surface of a half cone and the maximum velocity remains close to the wall.[2] (See Fig 8). Values of K and K' are approximately those for a free jet multiplied by $\sqrt{2}$, that is to say, the normal maximum of 7.0 for K' for free jets becomes 9.9 for a similar jet adjacent to, and discharged parallel to, a wall, and in Fig. 3, $\frac{X}{\sqrt{2A_0}}$ should be used in place of $\frac{X}{\sqrt{A_0}}$

When a jet is discharged parallel to, but at some distance from a wall, its expansion in the direction of the wall is reduced and entrained air must be obtained by recirculation from the jet itself instead of from ambient air.[3, 9] The jet expands normally to within a short distance from the wall, which nearer to the outlet only affects velocity distribution in the outer shell of the jet, but further on also affects centerline velocities. This happens at some distance from a plane where the jet outline becomes parallel to the wall, and where the jet enters its fourth or terminal zone. Few engineering data are available on this important phase of jet expansion.[3]

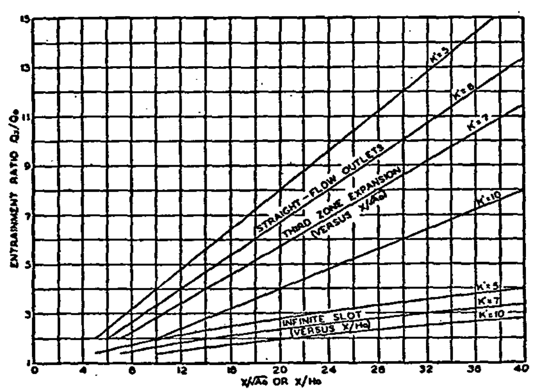

FIG. 9. ENTRAINMENT RATIOS FOR STRAIGHT-FLOW OUTLETS

Effect of Resistance on Return Path of Jet Air

Laboratory experiments on jets usually involve recirculated air with negligible resistance to flow on the return path of the jet air. Experience and experiments in tunnels of small cross-sectional area in mines, where considerable resistance is offered to the return flow of jet air to outlets, show that the expansion of the jet terminates abruptly at a distance that is independent of velocity of discharge and but slightly affected by size of outlet. Such distances are determined primarily by size and length of return path. In a long 5 ft x 6 ft tunnel, a jet may not travel more than 25 ft whereas in a relatively short opening, 25 by 60 ft, it may travel more than 250 ft. Few engineering data are available on this phase of jet expansion but it can be of great practical importance.[3]

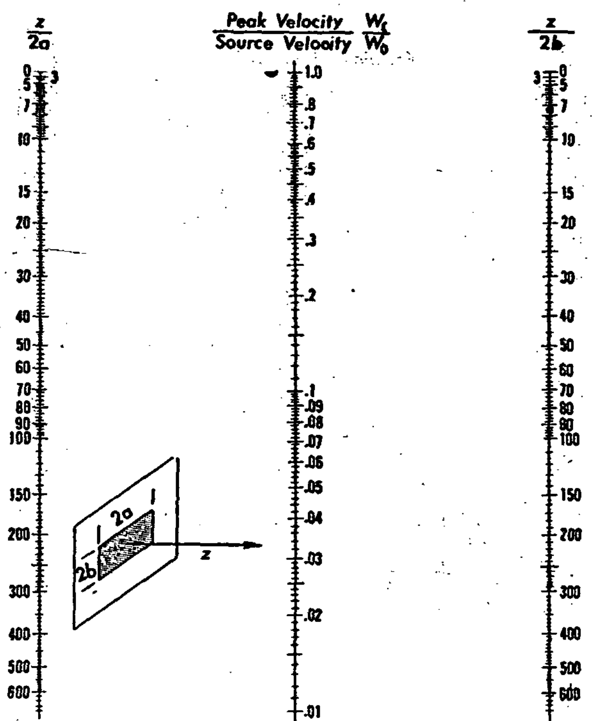

FIG. 10. NOMOGRAM FOR CENTER, OR PEAK, VELOCITIES FOR ROUNDED, RECTANGULAR JET SOURCES

Entrainment Ratios

Equations for the entrainment of circular jets and of jets from long slots have been mathematically derived.[10] They are:

For third zone expansion of circular jets,

$$\frac{Q_x}{Q_0} = \frac{2}{K'} \cdot \frac{X}{\sqrt{A_0}} \tag{8}$$