

the spread of the air stream. For air emerging at room temperature, the drop or rise will be a function of the spread only and will be equal to:

$$H = L \times \tan \left(\frac{\text{Spread Angle}}{2} \right) \quad (8)$$

where

H = drop due to spread, feet.

L = throw, feet.

When there is a temperature difference between the air stream and the room, the additional drop or rise is approximately given by Equation 9:

$$H = \frac{n_1 (t_r - t_{as}) L n_2}{V_1} \quad (9)$$

where

n_1 and n_2 = constants (tentative suggested values $n_1 = 5$, $n_2 = 1.2$).

t_r = room temperature, degrees Fahrenheit.

t_{as} = supply air temperature, degrees Fahrenheit.

V_1 = jet velocity, feet per minute.

For cooling application H is subtracted from the outlet height, for heating H is added.

Effect of Aspect Ratio on Entrainment

In slotted outlets, the air entrainment of the primary jet is a function of aspect ratio ¹. This effect is most pronounced when large changes in the ratio are made. A comparison between a slot of aspect ratio 24 and a square opening of the same area is given in curves A and B of Fig. 2. At a distance of 8 ft from the outlet, the entrainment of the slot is 8.1 as compared with 6.9 for the square, or an increase of about 17 per cent.

Curve C shows the further increase in entrainment obtained by using an aspect ratio of 48. An increase of 40 per cent is obtained over the 24 in. x 1 in. slot. This indicates that long narrow slots produce air streams that give high induction of secondary air.

Parallel Slots

The use of several slots in parallel to vary the rate of air entrainment depends mainly on the distance between the slots. If close together, the air pattern is about the same as a single opening of equal area. Spacing the openings farther apart gives an increase in entrainment as shown on curves C, D and E of Fig. 2. It will be noted that 2 openings 24 in. x 1/4 in. located very close together will obtain an entrainment which is

TABLE 1. VALUES OF ROOM CIRCULATION FACTOR (F) IN EQUATION 11

OUTLET VELOCITY FPM V_1	AVERAGE ROOM VELOCITY FPM, V_r					OUTLET VELOCITY FPM V_1	AVERAGE ROOM VELOCITY FPM, V_r				
	10	20	30	40	50		10	20	30	40	50
200	6.0	12.0	18.0	24.0	30.0	900	1.3	2.7	4.0	5.3	6.7
300	4.0	8.0	12.0	16.0	20.0	1000	1.2	2.4	3.6	4.8	6.0
400	3.0	6.0	9.0	12.0	15.0	1200	1.0	2.0	3.0	4.0	5.0
500	2.4	4.8	7.2	9.6	12.0	1400	0.9	1.7	2.6	3.4	4.3
600	2.0	4.0	6.0	8.0	10.0	1600	0.8	1.5	2.3	3.0	3.8
700	1.7	3.4	5.1	6.8	8.5	1800	0.7	1.4	2.0	2.7	3.4
800	1.5	3.0	4.5	6.0	7.5	2000	0.6	1.2	1.8	2.4	3.0

about the same as obtained with one 24 in. x 1/2 in. opening. However, if the slots are spaced 6 1/2 in. apart there is a marked increase in entrainment.

Room Air Motion

The air motion in the occupied zone is usually such that the air travels across the room in reverse direction to the blow of the outlet. The cross-

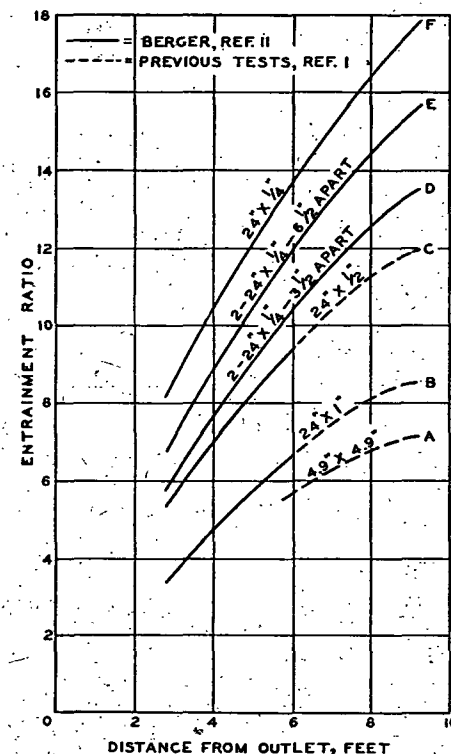


FIG. 2. TYPICAL RELATION OF ENTRAINMENT RATIO TO DISTANCE FROM OUTLET FOR SLOTTED OUTLETS. (BASED ON 800 FPM OUTLET VELOCITY.)

sectional area of this stream is equal to the outlet wall area less the stream area and the area obstructed by furnishings. Equation 10 gives the average room velocity in the occupied zone as a function of the air volume, Q_1 , supplied per square foot of outlet wall area and the outlet velocity.

$$V_r = \frac{Q_1}{AZ} \quad (10)$$

where

$Q_1 = Q_1 + Q_2$ = mixture of primary and secondary air, cfm.

V_r = average room velocity, feet per minute.