Subtracting this from the total available resistance: 0.35 in. − 0.163 in. = 0.187 in. available for duct resistance.

Known length of run	150 ft

The duct width is then estimated for the following elbow calculations:

Four 150% ratio elbows, 4 x 13 x 3.5 ft	182 ft
Three 75% ratio elbows, 3 x 35 x 1.5 ft	158 ft
Total estimated length	490 ft

The duct friction per 100 ft is then 0.187 ÷ 4.90 = 0.0382 in. and the mains and branches are sized from the 0.038 in. friction line in Fig. 2.

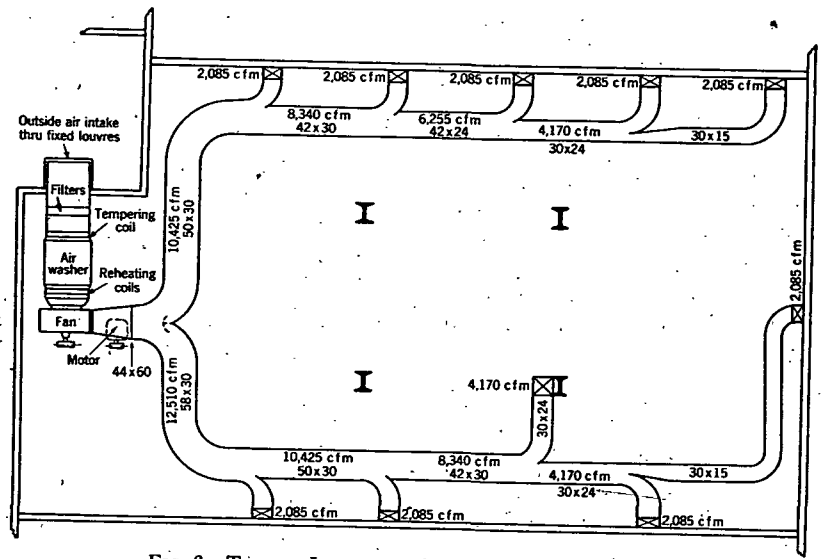

FIG. 6. TYPICAL LAYOUT OF AIR DISTRIBUTION SYSTEM

If it is desired to size each branch for equal resistance, the total resistance back to the point of juncture is calculated and the branch is then sized in a manner similar to that outlined in Example 3.

DUCT CONSTRUCTION DETAILS

Straight sections of round duct are usually formed by rolling the sheets to the proper radius and grooving the longitudinal seam. Rectangular ducts are generally constructed by breaking the corners and grooving the longitudinal seam, although some fabricators still use the standing seam due to lack of equipment. Elbows and transformation sections are generally formed with *Pittsburgh* corner seams because this seam is easier to lock in place than the double seam, but complicated fittings such as double compounded elbows are usually constructed with double seam corners.

The construction of these various seams as well as the types of girth connections are shown in Fig. 7. The application of the various slips and connections is outlined in Table 5. The end slip may be used wherever *S* slips are recommended. Where drive slips are used the end slip may be applied on the narrow side of the duct and only the drive slips on the maximum side. Ducts 25 to 30 in. in size should be reinforced between the joints, but not necessarily at the joint. Ducts 31 in. and up should be reinforced at the joint and between the joints; if drive slips are used the

TABLE 5. RECOMMENDED SHEET METAL GAGES FOR RECTANGULAR DUCT CONSTRUCTION[a]

U. S. STD. GAGE	MAXIMUM SIDE, INCHES	TYPE OF TRANSVERSE JOINT CONNECTIONS[b]	BRACING
26	Up to 12	S, Drive, Pocket or Bar Slips, on 7 ft 10 in. centers	None
24	13 to 24	S, Drive, Pocket or Bar Slips, on 7 ft 10 in. centers	None
	25 to 30	S, Drive, 1 in. Pocket or 1 in. Bar Slips, on 7 ft 10 in. centers[c]	1 x 1 x ⅛ in. angles 4 ft from joint
22	31 to 40	Drive, 1 in. Pocket or 1 in. Bar Slips, on 7 ft 10 in. centers[c]	1 x 1 x ⅛ in. angles 4 ft from joint
	41 to 60	1½ in. Angle Connections, or 1½ in. Pocket or 1½ in. Bar Slips with 1⅜ in. x ⅛ in. bar reinforcing on 7 ft 10 in. centers[c]	1½ x 1½ x ⅛ in. angles 4 ft from joint
20	61 to 90	1½ in. Angle Connections, or 1½ in. Pocket or 1½ in. Bar Slips 3 ft 9 in. maximum centers with 1⅜ x ⅛ in. bar reinforcing	1½ x 1½ x ⅛ in. diagonal angles, or 1½ x 1½ x ⅛ in. angles 2 ft from joint
18	91 and up	2 in. Angle Connections or 1½ in. Pocket or 1½ in. Bar Slips 3 ft 9 in. maximum centers with 1⅜ x ⅛ in. bar reinforcing[d]	1½ x 1½ x ⅛ in. diagonal angles, or 1½ x 1½ x ⅛ in. angles 2 ft from joint

[a]For normal pressures and velocities (see Table 3) utilized in typical ventilating and air conditioning systems. Where special rigidity or stiffness is required, ducts should be constructed of metal two gages heavier. All uninsulated ducts 18 in. and larger should be cross-broken. Cross-breaking may be omitted on uninsulated ducts if two gages of heavier metal are used.

[b]Other joint connections of equivalent mechanical strength and air tightness may be used.

[c]Duct sections of 3 ft 9 in. may be used with bracing angles omitted, instead of 7 ft 10 in. lengths with joints indicated.

[d]Ducts 91 in. and larger require special field study for hanging and supporting methods.

angles are usually riveted to the duct about 2 in. from the slips. It is good practice to cross-break or kink all flat surfaces to prevent vibration or buckling due to the air flow and accompanying variations in internal pressure. Round ducts are sometimes swedged 1.5 in. from the ends so that the larger end will butt against the swedge and are held in place with sheet metal screws. Where swedges are not used it is general practice to paste the joint with asbestos paper to insure a tight joint.

The construction of elbows and changes of shape cannot be definitely outlined because of the varied conditions encountered in the field, but in