The loss in the elbows can be assumed to be 12W or 10 ft, the friction loss of head per 100 equivalent ft is then

$$\text{for duct (1)} \quad \frac{0.10}{0.15 + 2 \times 0.10} = 0.286 \text{ in.}$$

$$\text{for duct (2)} \quad \frac{0.08}{0.10 + 0.10} = 0.4 \text{ in.}$$

Using Friction Chart Fig. 1, the duct diameter of Section B to carry 750 cfm with a loss of 0.286 in. per 100 ft is found as 10 in. and the duct diameter of Section D to carry 750 cfm with a loss of 0.4 in. per 100 ft is 9.8 in. Equivalent rectangular ducts are 10 × 8 in., the velocity in both ducts is 1350 fpm.

The actual loss in ducts (1) and (2) is:

$$0.04 + 20 \times \frac{0.286}{100} + 15 \times \frac{0.286}{100} + 0.12 = 0.26$$

$$0.06 + 10 \times \frac{0.4}{100} + 10 \times \frac{0.4}{100} + 0.12 = 0.26$$

For final survey of ducts selected see Table 6 (Tabulation of Results).

3. Static Regain Method

When this method is used,[20] the velocity is reduced at each branch or take-off so that the recovery in static pressure due to this reduction will offset the friction in the succeeding section. This method is based on the convertibility of static pressure and velocity pressure as discussed in section Pressure Changes. If no loss from friction or shock occurred, the change in velocity head would be completely converted into a regain in static pressure, that is to say for standard air:

$$h_r' = \left(\frac{V_1}{4005}\right)^2 - \left(\frac{V_2}{4005}\right)^2 \tag{17}$$

where

V_1 = initial velocity, fpm
V_2 = velocity after reduction, fpm
h_r' = theoretical head recovered (static regain)

Under ideal conditions, 0.7 to 0.8 of the velocity head is actually recovered, but for practical design an average recovery of 0.5 is assumed. The actual velocity head recovered h_r, becomes then

$$h_r = 0.5\left[\left(\frac{V_1}{4005}\right)^2 - \left(\frac{V_2}{4005}\right)^2\right] \tag{18}$$

Charts based upon Equation 18 and designed to facilitate selection of duct sizes by the static regain method are found in Reference 20. See also chart included in Reference 18.

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. 9. The application of the various slips and connections is outlined in Table 7. 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 the drive slips on only the maximum side. Ducts 25 to 30 in. in size should be reinforced between

TABLE 7. 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 4) 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.

Note: Aluminum ducts, well supported, should be 2 (B & S) gages heavier than steel ducts.

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 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