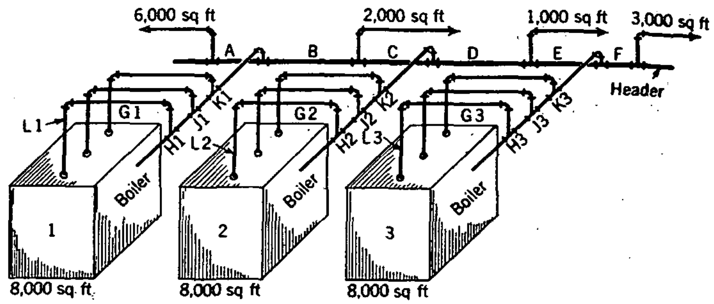

Fig. 8. Boiler Steam Header and Connections

boiler and the horizontal main or runout is compensated for by the use of reducing ells (Figs. 5 and 6).

The following example illustrates the sizing of the boiler connections shown in Fig. 8.

Example 4. Determine the size of boiler steam header and connections (Fig. 8) if there are three boilers, two to carry 50 per cent of the load each, and the third to be used as a spare. The steam mains are based on ⅛-lb drop per 100 sq ft of equivalent direct radiation (EDR).

Solution:

Size of Boiler Header

When Operating on Boilers	Load on Various Portions of Header						Maximum Load
	A	B	C	D	E	F	
Nos. 1 and 2	6000	0	2000	4000	3000	3000	6000
Nos. 2 and 3	6000	6000	8000	2000	3000	3000	8000
Nos. 3 and 1	6000	0	2000	2000	3000	3000	6000
Max. Load	6000	6000	8000	4000	3000	3000	8000

8000 sq ft @ ⅛ lb per 100 ft = 6 in. main. (See Table 7.)

Size of Boiler Runouts

The three runouts

$G_1, G_2, G_3 = \frac{8000}{3} = 2667$ sq ft each @ ⅛ lb per 100 ft = 4 in. pipe.

$H_1, H_2, H_3 = 2667$ sq ft each @ ⅛ lb per 100 ft = 4 in. pipe[4] (See Table 7).

$J_1, J_2, J_3 = 5333$ sq ft each @ ⅛ lb per 100 ft = 5 in. pipe[4] (See Table 7).

$K_1, K_2, K_3 = 8000$ sq ft each @ ⅛ lb per 100 ft = 6 in. pipe[4] (See Table 7).

The uptakes from the boiler probably would be 6 in. pipe with a 6 in. × 4 in. reducing ell at top.

Return connections to boilers in gravity systems are made the same size as the return main itself. Where the return is split and connected to two tappings on the same boiler, both connections are made the full size of the return line. Where two or more boilers are in use, the return to each may be sized to carry the full amount of return for the maximum load which that boiler will be required to carry. Where two boilers are used, one of them being a spare, the full size of the return main would be carried to each boiler, but if three boilers are installed, with one spare, the return line to each boiler would require only half of the capacity of the entire system, or, if the boiler capacity were more than one-half the entire system load, the return would be sized on the basis of the maximum boiler capacity. As the return piping around the boiler is usually small and short, it should not be sized to the minimum.

[4]*Note.*—As K_1, K_2, K_3 all carry 8000 sq ft and are 6 in. pipe, the whole runout including J_1, J_2 and J_3 would be made 6 in. pipe, also.

With returns pumped from a vacuum or receiver return pump, the size of the line may be calculated from the water rate on the pump discharge when it is operating, and the line sized for a very small pressure drop, the size being obtained from the Chart for Friction Losses for Various Rates of Flow of Water, Fig. 3, Chapter 35. The relative boiler loads should be considered, as in the case of gravity return connections.

Radiator Connections

Radiator connections are important on account of the number of repetitions which occur in every heating installation. They must be properly pitched and they must be arranged to allow not only for movement in the riser but, in frame buildings, for the shrinkage of the building. In a three story building this sometimes amounts to 1 in. or more. The simplest connection is that for the one-pipe system where only one radiator connection is necessary. Where the radiator runouts are located on the ceiling or under the floor, sufficient space usually is available to make a good swing joint with plenty of pitch, but where the runouts must come above the floor the vertical space is small and the runouts can project out into the room only a short distance. Fig. 9 illustrates two satisfactory methods of making runouts on a one-pipe gravity air vent system of either the up-feed or down-feed type, the runout below the floor being indicated in full lines and the runout above the floor in dotted lines. Sometimes it is necessary to set a radiator on pedestals, or to use high legs, in order to obtain sufficient vertical distance to accommodate above-the-floor runouts. Particular attention must be given to the riser expansion as it will raise the runout and thereby reduce the pitch.

Similar connections for a two-pipe system of the gravity air vent type are illustrated in Fig. 10 for the old steam type radiator. If the water type is used, the supply tapping is at the top instead of at the bottom, the runouts otherwise remaining as shown in Fig. 10. A satisfactory type of radiator connection for atmospheric, vapor, vacuum, sub-atmospheric, and orifice systems of both the up-feed and down-feed types is shown in Fig. 11.

While short radiators, not exceeding 8 to 10 sections, may be supplied and returned from the same end as indicated in Fig. 12, the top-and-bottom-opposite-end method is to be preferred in all cases where it can be used. On down-feed systems of the atmospheric, vapor, vacuum, sub-atmospheric, and orifice types, the bottom of the supply riser must be dripped into the return somewhat as illustrated in Fig. 13. On up-feed systems of the vapor and atmospheric types, where radiators in the