drops into the top of the boiler header through a boiler stop valve. No drips are provided on this type of runout except a very small one which is sometimes installed on the boiler side of the stop valve. Fig. 6 shows a type of boiler connection which is regarded as superior to that shown in Fig. 5 and which is the type illustrated in the system diagrams in Chapter 31. This type is similar to that shown in Fig. 5 except that the horizontal branches from the uptakes are connected into the main boiler runout, and the steam is carried toward the rear of the boiler. The branch to the building or boiler header is taken off *behind* the last horizontal boiler connection. At the rear end of this main runout, a large size drip, or balance pipe, is dropped down into the boiler return, or into the top of the Hartford Loop, which is described in a following paragraph. As a result, any water carried over from the boiler follows the direction of steam flow

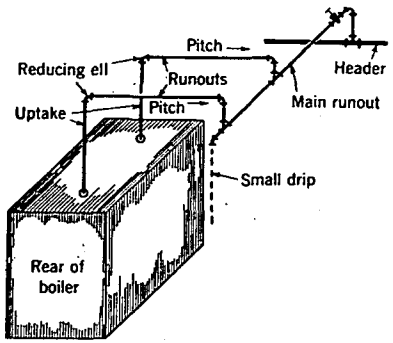


FIG. 5. OLD STYLE STANDARD BOILER CONNECTIONS

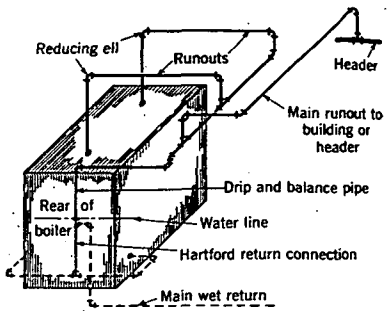


FIG. 6. APPROVED METHOD OF BOILER CONNECTIONS

toward the rear and is discharged into the rear drip, or balance pipe, without being carried over into the system.

Return

Cast-iron boilers are generally provided with return tappings on both sides, but steel boilers often are equipped with only one return tapping. A boiler with side return tappings will usually have a more effective circulation if both tappings are used. Check valves generally should not be used on the return connection to steam heating boilers because they are not always dependable inasmuch as a small piece of scale or dirt lodged on the seat will hold the tongue open and make the check useless. These valves also offer a certain amount of resistance to the returns coming back to the boiler, and in gravity systems will raise the water line in the far end of the wet return several inches[3]. However, if check valves are omitted and the steam pressure is raised with the boiler steam valve closed, the water in the boiler will be blown out into the return system with the accompanying danger of boiler damage. These objections are largely overcome with the Hartford return connection.

[3]See method of calculating height above water line for gravity one-pipe systems in Chapter 31.

Hartford Return Connection

In order to prevent the boiler from losing its water under any circumstances, the use of the Hartford Connection, or the Underwriters Loop, is recommended. Fig. 7 shows this connection for both single boiler and two-boiler installations. By balancing the column of water in the loop against the steam pressure, the water cannot be blown out of the loop whatever the relative pressure conditions in the boiler, steam lines, or return lines. This balancing is done by raising the return to approximately the normal water line of the boiler, looping it back to the boiler inlet and connecting the top of this loop by means of a balance pipe with the steam runout from the boiler. It is important that this balance pipe be connected into the boiler steam line on the boiler side of all valves.

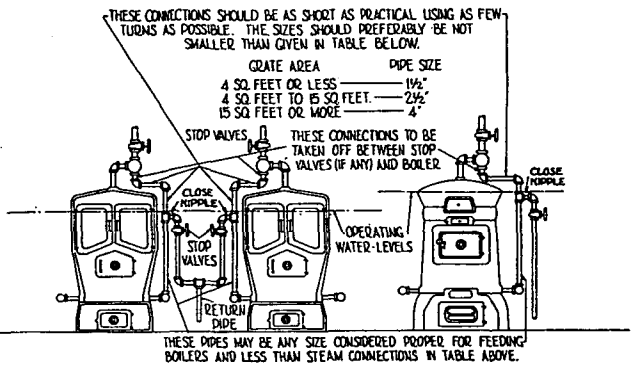


FIG. 7. THE HARTFORD RETURN CONNECTION

Theoretically, the top of the loop should be at the normal boiler water line but since this installation often causes trouble from water hammer in the top of the loop, this top is usually made 2 in. below the normal boiler water line to keep the horizontal pipe at the top submerged under all normal conditions. It is important that this top of the loop be made with the shortest possible horizontal pipe, a close nipple being employed.

Sizing Boiler Connections

Little authentic information is available on the sizing of boiler runouts and steam headers. Although many engineers prefer an enlarged steam header to serve as additional steam storage space, there ordinarily is no sudden demand for steam in a steam heating system except during the heating-up period, at which time a large steam header is a disadvantage rather than an advantage. The boiler header may be sized by first computing the maximum load that must be carried by any portion of the header under any conceivable method of operation, and then applying the same schedule of pipe sizing to the header as is used on the steam mains for the building. The horizontal runouts from the boiler, or boilers, may be sized by calculating the heaviest load that will be placed on the boiler at any time, and sizing the runout on the same basis as the building mains. The difference in size between the vertical uptakes from the