FUEL OIL Journal

# Piping Design for Oil-firing

## BASEMENT PIPING OFTEN HANDCUFFS THE BURNER

*By*
*O.O. OAKS*
*Chief Engineer, American Radiator Co.*

POOR DESIGN of basement piping is a major source of heating troubles in automatic, one-pipe, steam heating systems. If originally designed for solid fuel firing, these systems sometimes make the passage of steam through the pipes as difficult as though cold No. 6 oil were pumped through a half-inch pipe. Unless the cellar piping is altered, the system cannot produce uniform heating, whether the firing method is automatic or not.

My previous article[1] told why the distribution of heat evenly is important; how coal-designed plants are often unsuitable for burner operation, and why correct piping and air venting are necessary. That article urged the same careful consideration of heat distribution that is given to the design and operation of a burner or a boiler. Now I will discuss redesigning the basement piping when installing an oilburning boiler, a boiler-burner unit, or a conversion burner.

Fortunately, the dealer or contractor need not rip out every foot of piping to satisfy the standards of a good oil-fired heating system. If the house has sufficient and adequately vented radiation, and the upstairs piping is in good condition, he need go no further than the basement. There pipes are exposed and easy to handle.

First the installer must study the existing layout. He will find that most one-pipe systems designed for coal are of the progressive heating type; that is, all risers and first-floor branches to radiators are taken from one steam main, which starts at the boiler and roams around the cellar. It terminates beyond the last radiator, where it is vented, dropped below the water line of the boiler, and carried back to the boiler as a wet return[2]. One or both steam outlets of the boiler may be connected to a single steam main. This is the customary basement-piping layout of a one-pipe steam system.

The chief aim of the piping designer is to establish a central point from which steam can be quickly and equally distributed to all parts of the system. Heretofore, the boiler itself has been the central distributing point,

Photo by Blank-Stoller, Inc.

O. O. OAKS

*"Omitting a few dollars' worth of piping may develop heating complaints"*

irrespective of the location of mains, risers, branches, or radiators. The chimney location generally dictates the position of the boiler, whether or not that location is the best for efficient heat distribution. Occasionally, the boiler can be located at the ideal spot for central heating, but more often the two do not coincide. Furthermore, the boiler must be connected to the chimney with a smokepipe of reasonable length, as a long smokepipe is unsightly, and may result in faulty operation of the boiler.

To show how this and other piping problems may be easily and correctly handled, I have chosen an actual oilburner installation. Even though the piping for this job was designed only recently, and by the heating department of a prominent architect, the plans specified the orthodox layout for solid fuel. They called for many things that should not be done when designing piping for oil-firing. Before the system was installed a new plan was prepared, giving the correct piping layout.

If the plan, Fig. 1, page 6, had been followed, all steam would have been distributed at the boiler, and in one direction. In addition to being an undesirable layout because of retarded steam distribution, several of the branches from the main are too long. Branch "B," for example, is 16 feet long, and branches "D" and "C" are each approximately 10 feet long. The radiation on branch "C" might have received sufficient steam because the branch is taken from the two and one-half inch main. Radiators on branch "D," however, could never be depended upon to heat properly. To reach them, steam would have to travel through four pipes of different sizes before arriving at the radiators. In its travels, the steam would pass through two "tees" and six elbows. Even if steam could be coaxed to the radiators on branch "B," it would be retarded either by air or returning condensate, since branch "B" terminates in a dead end, which is neither dripped nor vented.

Branch "D" is not as long as "B," but the advantage of shorter length is nullified since it supplies steam to the last riser and radiator in the entire steam circuit. In designing basement piping, a good rule to follow for automatic burner installations is that no branch from a main to a riser, or from a main to first-floor radiator, should be over five feet long.

### CORRECT LAYOUT

FIG. 2, the new layout, indicates how the installation was actually made. Point "A" was selected as the best place to centralize the steam distribution. This choice was somewhat influenced by the awkward location, from a heating design viewpoint, of radiation at "F" and "G". By distributing the steam supply at "A," it was possible to run a main directly to "F" and "G". This not only assured quick delivery of steam but reduced the lengths of these branches.

To make "A" the central steam-distributing point, instead of the boiler, a four-inch steam header, connected to the boiler with four-inch pipe, the full size of the boiler openings, was installed over the boiler. The first designer made the common mistake of reducing the size of the header and pipes at the boiler openings.

[1] "How Intermittent Firing Affects Uniform Heat," FUEL OIL JOURNAL, Feb., 1931

[2] Wet return: When a return line is dropped below the water-line level of the boiler, and returned to the boiler below that level, it is described as a "wet return". A dry return, therefore, is a return line that is installed above the water-line level.

Instead of having a header only over the boiler, it is continued to point "A" after being reduced from four to two and one-half inches. By means of these large pipe sizes (four inches and two and one-half inches), and because no branches are taken off the header between the boiler and point "A," it is possible to deliver the entire boiler steam output to "A".

## THREE CIRCUITS

STARTING AT "AA," there are now three steam circuits, instead of one. These circuits may be traced on Fig. 2 as follows: circuit one, from "A" to "B" to "C"; circuit two, from "A" to "D" to "C"; and circuit three, from "A" to "E" to "C".

With the new high point of the steam mains at "A," the condensate returns to the boiler by three separate routes, indicated by the arrows. The lower circuit, instead of terminating at a dead end, now has its own wet return to the boiler, so that steam flow to the radiators, and water flow back to the boiler, is further facilitated.

In place of one drip connection and air vent, the new piping design (Fig. 2) includes a separate drip and vent for each of the three steam circuits. Now when the steam pressure rises, air is expelled from three parts of the system at the same time. This is another aid for quick and even heat distribution.

The cost of making the improved piping layout is about 10 per cent more than the antiquated, but persistently popular, layout shown in Fig. 1. Stated differently, if the cost of the basement piping in Fig. 1 amounted to $100, the cost of the piping in Fig. 2, including material and labor, would not exceed $110. In old installations, the cost of making the suggested changes is justified by the increased heating satisfaction and decreased fuel cost.

Complete piping specifications and details are not given here as they represent the standard practice of the American Society of Heating and Ventilating Engineers. For comprehensive information and data on heating, the burner dealer will find the Guide of the A.S.H.&V.E. invaluable. Included are tables which give the correct sizes of steam-pipes and radiators to be used, how and where pipe connections should be made, as well as other useful data.

Not every installation, of course, will have the same basement-piping design, but the basic reasoning and methods of handling will always be similar to those described above. Among important design principles to be observed are: all radiators should receive steam at approximately the same time; steam should be delivered to radiators as quickly as possible; pipe friction must be reduced to a minimum and the evils of progressive heating must be counteracted by additional mains, short branches, ample size drips at ends of mains, and as equal loads as possible on all mains. If the radiation is more compact and easily reached than that illustrated, two steam circuits may suffice, although three are usually desirable.

If the owner is to get even heating, basement-piping design is important whether or not a new boiler is installed. Many thousands of burner installations have been made without consideration of quick and even distribution of the heating medium. In these, the fuel saving resulting from minor alterations would more than pay the small additional expense. Perhaps, with conversion burners sold under present pricing and installation methods, no general improvement may be expected. Moreover, the home owner will often overlook slight heating difficulties in return for convenience of operation.

## IMPROVED PIPING

HOWEVER, immediate improvement in basement-piping design, and in customer satisfaction, may be expected in the thousands of boiler-burner, and oilburning boiler installations that will be installed in the immediate future. Faulty piping layout in such installations is inexcusable since needed piping changes can be economically done when the new piping connections are made to the boiler. Omitting a few dollars' worth of piping may develop complaints of unsatisfactory heating or excessive fuel costs from customers who demand more heating satisfaction from a $700 or $900 boiler and burner installation than from a conversion burner costing half as much.

FJO

## *Third Heating Show to be Held Feb. 5-9*

THE THIRD International Heating & Ventilating Exposition will be held at the Grand Central Palace, NewYork, during the week of February 5, 1934. The American Society of Heating & Ventilating Engineers, which is sponsoring the exposition, will also hold its annual meeting at the same time in New York.

Because of the large population of the New York area, it is expected that the third heating show will draw a bigger crowd than either of the two previous expositions. The first, held in Philadelphia in 1930, drew 57,500 people from 32 states and 11 foreign countries. Manufacturers of all kinds of heating, ventilating and air-conditioning equipment will exhibit their products at the 1934 sho.

FJO

## *Lord, Detroit Lubricator, Dies*

HERBERT I. LORD, first vice-president of the Detroit Lubricator Co., a subsidiary of the American Radiator & Standard Sanitary Corp., NewYork, died in Detroit May 25.

Educated at the Massachusetts Institute of Technology, Mr. Lord joined the sales force of the American Radiator Co. in Boston. Later he was transferred to Chicago as assistant to C. K. Foster, and then was appointed first vice-president of Detroit Lubricator.

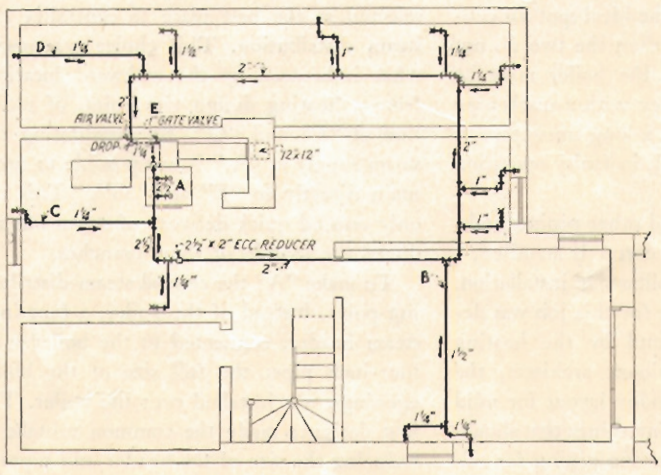


FIG. 1. PROGRESSIVE HEATING HINDERS BURNER

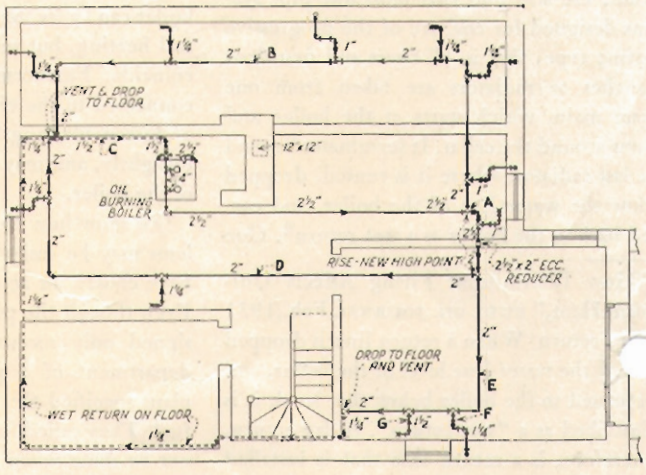


FIG. 2. MODERN BASEMENT PIPING FOR OILHEATING