TABLE 45. CAPACITIES OF ONE PIPE RISERS

Allowable Velocity in Feet per Second

Dia. of Pipe In.	18			22		
	Cond. lb. hr.	B.t.u. loss hr.	Sq. ft. Rad. Based on 240 B.t.u.	Cond. lb. hr.	B.t.u. loss hr.	Sq. ft. Rad. Based on 240 B.t.u.
¾	8.9	8,640	36.0	10.9	10,580	44.1
1	14.5	14,070	58.6	17.8	17,270	72.0
1¼	25.2	24,460	101.9	30.8	29,890	124.5
1½	34.2	33,190	138.1	41.8	40,560	169.0
2	56.5	54,830	228.4	69.0	66,960	279.0

The table gives the capacity of the pipe in pounds of steam per hour, B.t.u. transmitted per hour, and square feet of radiation based on 240 B.t.u. per sq. ft.

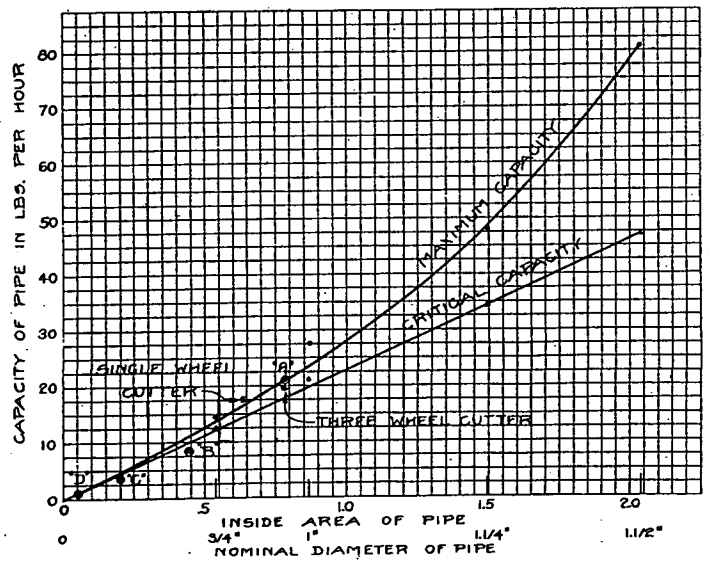

FIG. 31. CURVES SHOWING EFFECT OF CONSTRICTIONS IN VARIOUS SIZES OF PIPE

The investigation has brought out the following outstanding points which seem of sufficient importance to the heating industry to be summarized:

1. All pipe should be reamed—pipe cut by an ordinary wheel cutter and not reamed will decrease the capacity of a one-pipe system by as much as 30 per cent;
2. Pipe with any unusually large bump, blister, or other constriction on the inside should not be used—the capacity of a one-pipe system is no greater than the capacity of the free area left by its greatest constriction;
3. Unions and all other fittings entering into a riser should be of full size opening;
4. The size of pipe for one-pipe risers carrying any quantity of steam should be determined in accordance with Column 1 of Table 45, or by Column 2 after applying the desired factor of safety.

HOT WATER HEATING

HOT water heating may be divided into two classes, forced and gravity circulation. The first is used on large units and other installations where it would be difficult to obtain uniform heating by gravity circulation. In many cases, approaching the natural dividing line between the two systems, a combination of forced and gravity circulation is installed, in which a pump is used as an auxiliary to circulate the water during periods of heavy firing.

GRAVITY HOT WATER SYSTEMS

Gravity hot-water heating may be divided into several classes, depending on the method of running the flow and return mains. For residences, the two-pipe, up-feed system generally is used. This means that the flow and return mains are run on the ceiling of the basement, with branches and risers feeding the several radiators from below. Where attic space is available, and in shops and factories the down-feed system often is used. This may have either single or double drops, although the single drop is preferable. The chief advantage of the down-feed system is that it raises the mean effective circulating head, and obviates many of the fine adjustments that are required with the up-feed system. Sometimes, when there is plenty of circulating head available, a two-pipe up-feed system with a single-pipe basement circuit is installed. This system, while it cuts down the amount of piping in the basement, increases the size of the mains because it divides the available circulating head into two circuits.

The basic principle of gravity circulation is shown in Fig. 32. As the water in column *A* is heated, and its density decreases it is overbalanced by the cold water in *B*. The water in column *B*, being colder, always outweighs the water in column *A*, and thus circulation is established. As the temperature difference between these two columns is increased, the difference in weight increases, with a consequent increase in the velocity of circulation. The velocity of circulation also varies with the difference in elevation between the heater and the radiators.

A circuit similar to that shown in Fig. 33 will not circulate, because the hot water is not overbalanced by the cold. Adding pressure to the water will not increase the velocity of circulation in any way, except that it may allow greater temperature differences to exist between the flow and return columns. The velocity of circulation cannot be increased or decreased by changing the pitch of the mains.

In actual practice, the circulation of water in a hot-water heating system is much more complicated than that shown in a simple circuit

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