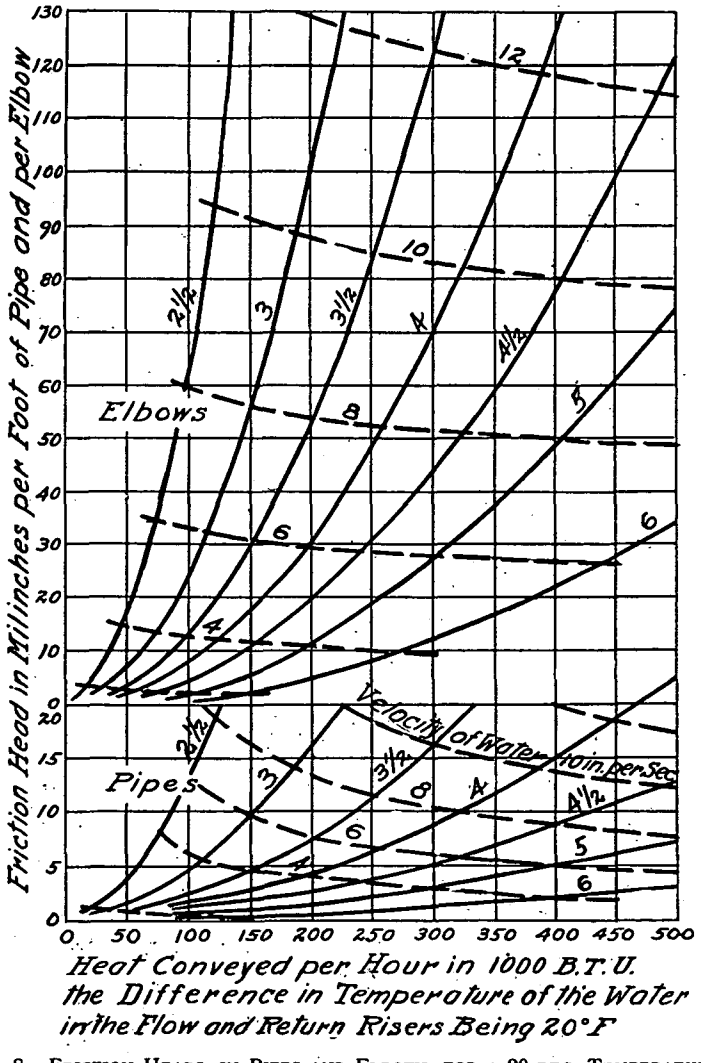

FIG. 8. FRICTION HEADS, IN PIPES AND ELBOWS, FOR A 20 DEG. TEMPERATURE DIFFERENCE OF THE WATER IN THE FLOW AND RETURN LINES

per elbow. Incidentally, we note also that the velocity will be about 5 in. per second.

The total friction is, therefore,

$$22 \times 18 = 396$$
$$9 \times 35 = 315 \quad 711 \text{ milinches.}$$

As this is slightly more than the available pressure head of 630 milinches, a 1-in. pipe is a trifle too small. However, the difference between the calculated friction head and the available pressure head is so small that the 1-in. pipe can safely be used.

If a 1¼-in. pipe were used, the pressure head would be

$$22 \times 5 = 110$$
$$9 \times 11 = 99 \quad 209 \text{ milinches, or less}$$

than one-third of the available pressure head. Consequently, a 1¼-in. pipe would be entirely too large.

The calculation shows how easily friction head calculations can be made. For more complicated installations, the calculations are more complicated, but in all cases, they are fairly simple. More detailed instructions than can be given here for such calculations may be found in textbooks and in magazine articles.

EMPIRICAL RULES

A very great demand exists for empirical rules or tables by means of which pipe sizes for hot-water heating systems can be determined according to the radiation which the pipe is to serve and without the necessity of friction head and pressure head calculations.

It is not possible to prepare such tables or rules which would have any degree of accuracy.

For example, in the elementary heating system shown in Fig. 5, a 1-in. pipe is practically the correct size. If the radiator were placed about 10 or 14 ft. above the heater instead of 7 ft., a 1-in. pipe would be entirely too large; or, if the radiator were placed at a considerably greater distance from the heater so that the number of elbows and the length of the pipe of the circuit were increased materially, a 1-in. pipe would be too small. So in this simple case, under different circumstances, a ¾-in. pipe, a 1-in. pipe, or a 1¼-in. pipe would be the correct size to select. In the 10 types of pipe systems shown in Fig. 4, it is quite evident that no empirical rule could be devised which would correctly give the pipe sizes to be used in every one of the ten cases shown there.

There are a number of empirical rules, however, contained in the catalogue data of the various manufacturers of hot-water heating apparatus which may be used with success if properly applied to such ordinary problems as these manufacturers have found them applicable to. Where the runs are not long and the various branches of the system can be fairly well equalized as to length of run and amounts of radiation, these practical rules, when applied to residences and other relatively small buildings of ordinary ceiling lengths, prove quite successful.

There are also a number of practical suggestions, to be found in these data, as to piping details and different kinds of connections.

GRAVITY HOT WATER HEATING[1] FOR SMALLER INSTALLATIONS

In the average small hot-water heating system such as is used for bungalows, cottages and even the modest sized home or residence, it is

[1]Compiled by H. L. Alt, Philadelphia.