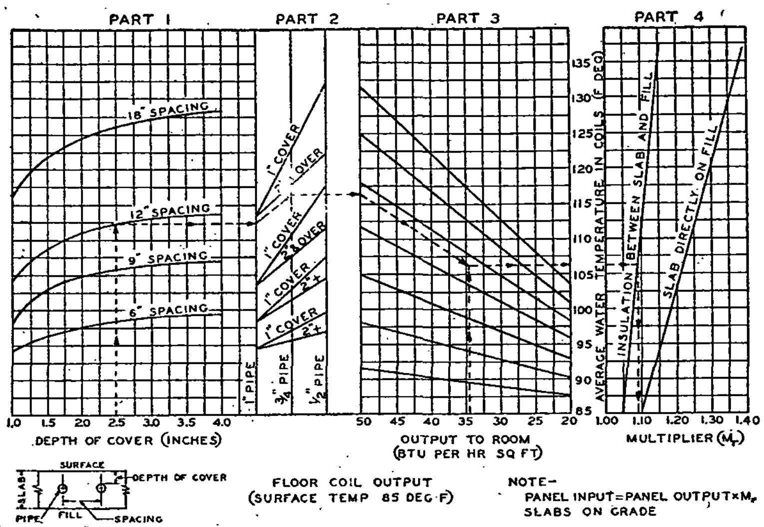

Fig. 15. Relation of Water Temperatures and Coil Outputs to Coil Spacing and Depth of Bury for Floor Coils in Slabs on Grade

15 are marked Part 1 to Part 4 and, as will be evident by following the dashed line on the chart, are used as follows:

Part 1. Starting from the depth of cover (2.5 in.), proceed vertically to the line representing pipe spacing on centers (12 in.), and then horizontally to the first ordinate of Part 2.

Part 2. Move parallel to the nearest upward sloping line, indicating "2 in. & over" cover, to intersect the ordinate representing ¾ in. pipe, and then proceed horizontally to the first ordinate of Part 3.

Part 3. Proceed parallel to and along the nearest downward sloping line to an intersection with the ordinate representing the panel output (34 Btu per sq ft), and then move horizontally to the right hand scale of Part 3 and read a required average water temperature in the coil of 106 F.

Part 4. From the water temperature 106 F just found in Part 3, proceed horizontally into Part 4 to intersect the line representing insulation between the slab and fill. Directly below this intersection read 1.09 (on the bottom scale) as the multiplier to be used.

The required panel input is, therefore, 1.09 x panel output, or 1.09 x 34 = 37.1 Btu per (sq ft) (hr).

The total required panel input is 37.1 x panel area = 37.1 x 480 = 17800 Btuh.

CEILING AND WALL PANEL DESIGN

Where coils are imbedded in plaster on ceilings or walls, design procedure is simplified considerably by the physical limitations of the space available. For tubing fastened to the underside of lath, the largest practical size is ⅝ in. O.D., while for ferrous pipes above the lath, it is 1 in. I.P.S. Therefore, the actual tube or pipe size selected is usually determined by the length of coil circuit and its flow resistance in consideration of the available circulating head.

In order to obtain a reasonably even heat distribution over the finished

plaster heating surface, pipes or tubes should be spaced on about 6 in. centers, and not over 9 in. centers. Within these limitations it is found in practice that heat output rates do not vary too seriously with variations in pipe and tube size and tube spacing.

In general, for plaster ceiling panels with tubes or pipes spaced on 4½ to 9 in. centers, the temperature of the circulating water is about 10 to 25 deg above the desired surface temperature.

The hourly heat output per square foot of panel surface may be found by means of Figs. 11, 12, and 13, and the calculations for room heat loss and UMRT, as previously illustrated in the example of floor panel design.

HOT WATER PIPING

When water is used as the heating medium, the piping layout and arrangement should be based on the design principles outlined in Chapter 21 for Two-Pipe Forced Circulation Systems. The pressure drops through the coils should be carefully calculated, and it is recommended that all branch circuits and coils be balanced to provide for uniform distribution by means of regulating valves or tees. Generally, a 15 to 20 deg total temperature drop is used in determining water flow rates, and a total pump head of more than 30 ft is undesirable due to noise caused by high water velocity.

Panel systems involving several rooms and panels comprising a single zone, require that all coils be selected for the same inlet water temperatures. Panel areas and pipe spacing must be selected to make this possible.

INSTALLATION DETAILS, ACCESSORIES, AND CONTROLS

Installation details, as given in Chapter 21, Hot Water Systems, also apply to piping systems for panel heating. Control problems of panel heating systems are discussed in Chapter 34, Automatic Control.

Efficient venting of air from the coils may be obtained by arranging the circulation so that the air moves in the direction of water flow to a high point in the system where an automatic float-type vent or connection to expansion tank should be provided for its release. Coils should be installed as nearly level as possible or, if they are on sloping surfaces due to structural conditions, they should be arranged to vent air at their high points. Arrangements of pumps, expansion tanks, drainage, and flow and return mains may be generally the same as for conventional hot water heating systems.

REFERENCES

[1] Standard Specifications for Gypsum Plastering, including Requirements for Lathing and Plastering (*American Standards Association*, A42.1, 1946).

[2] Code and Manual for the Design and Installation of Warm Air Ceiling Panel Systems (Manual 7-A of the *National Warm Air Heating and Air Conditioning Association*).

[3] Various investigations of W. Nusselt (1915–1928) as discussed in Chap. 23 and Chap. 25, and tabulated in Author Index of *Heat Transfer*, by Max Jakob, Vol. I, 1949 (John Wiley and Sons, New York).

[4] The Transmission of Heat by Radiation and Convection, by Griffiths & Davis (*Special Report No.* 9, 1922, *Department of Scientific & Industrial Research*, His Majesty's Stationery Office, London, England).

[5] Radiation and Convection from Surfaces in Various Positions, by G. B. Wilkes and C. M. F. Peterson (ASHVE Transactions, Vol. 44, 1938, page 513).