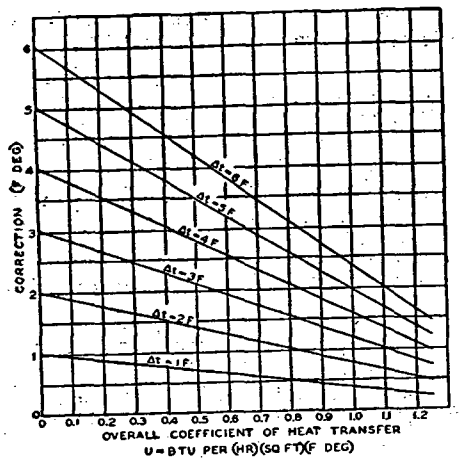

FIG. 13. INSIDE WALL SURFACE TEMPERATURE CORRECTION FOR INSIDE AIR TEMPERATURES OTHER THAN 70 F

$\Delta t = t_a - 70$
If Δt is positive: $t_w' = t_w +$ correction
If Δt is negative: $t_w' = t_w -$ correction

t_a = inside air temperature
t_w = inside wall surface temperature based on t_a = 70 F
t_w' = actual inside wall surface temperature

2. *Calculation of Room Heat Loss*

The heat transmission coefficients of the room surfaces are given in Fig. 14. They would usually be obtained from Chapter 9. The room heat loss can be calculated in the conventional manner, as outlined in Chapter 12. The calculations are shown in Table 1. The heat loss through the surface areas containing the heating medium is not included in the calculation.

The calculated rate of heat loss will determine the amount of heat which must be supplied by the heating panels to the room.

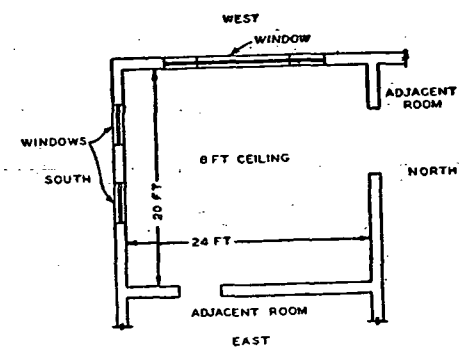

FIG. 14. ROOM PLAN FOR ILLUSTRATION OF METHOD OF DESIGNING A PANEL HEATING SYSTEM

Data: Values of overall heat transfer coefficients as calculated:
1. Outside walls $U = 0.10$
2. Ceiling $U = 0.08$
3. Floor $U = 0.36$
4. Windows $U = 0.55$

TABLE 1. CALCULATED HEAT LOSS OF ROOM (Fig. 14)

SURFACES	AREA SQ FT	U	CALCULATION	HEAT LOSS BTU/HR
Outside walls	272	0.10	272 x 0.10 x 80	2,176
Glass	80	0.55	80 x 0.55 x 80	3,520
Inside walls	352	—	No heat loss	0
Ceiling	480	0.08	480 x 0.08 x 80	3,072
Floor	480	—	Heating panel	0
Infiltration	—	—	3,840 cu ft x 1.50 x 80 x 0.018	8,295
Total heat loss				17,063

3. *Determination of UMRT*

The calculations for determining UMRT are shown in Table 2. The inside surface temperatures shown in the fourth column were determined from Fig. 12.

TABLE 2. CALCULATION OF UMRT

SURFACE		AREA SQ FT	INSIDE SURFACE[a] TEMPERATURE F	PRODUCT (AREA x TEMPERATURE)
Outside walls	0.10	272	65	17,680
Adjacent inside walls	—	352	70	24,640
Ceiling	0.08	480	66	31,680
Glass	0.55	80	43	3,440
Total		1,184		77,440

$$\text{UMRT} = \frac{\text{Total of products}}{\text{Total area}} = \frac{77{,}440}{1{,}184} = 65.4\ \text{F}$$

[a] Values of inside wall surface temperature for various U values and outside design temperatures found in Fig. 12.

4. *Determination of Panel Output*

Values of total panel output for various panel positions, panel surface temperatures and unheated MRT are given in Fig. 11. From Fig. 11, with a floor panel surface temperature of 85 F and a UMRT of 65.4 F, the total panel output is 34 Btu per (hr) (sq ft of panel surface).

Panel area = 24 x 20 = 480 sq ft
Panel output = 480 x 34 = 16,320 Btu per hr

This panel output of 16,320 Btu per hr is reasonably close to the calculated room loss of 17,063, and is satisfactory. If this value of total heat output from panel to the room were much less, *i.e.*, 10 or more percent less, than the calculated heat loss from the room, some method of supplementary heating would be needed. Floor panel surface temperatures exceeding 85 F are not recommended.

5. *Determination of Panel Input and Water Temperature*

Fig. 15 presents a graphical method of determining the required water temperature and total heat input to a panel for various cover depths, tube or pipe sizes and spacings, and rate of heat output to the room.

The panel output for this example has previously been found to be 34 Btu per (hr) (sq ft). Since some of the heat input to the panel is lost to the ground, it is necessary to supply more than 34 Btu per (hr) (sq ft) to the panel by means of the hot water heating medium. The amount of heat which must be supplied to the panel to give the required output may be determined graphically from Fig. 15. Assume that the panel has ¾ in. pipes, spaced on 12 in. centers, and that the depth of cover from top of panel surface to top of pipes is 2.5 in. The four sections of Fig.