where

H_t = Btu per hour under test conditions.
W_s = condensation in pounds per hour.
h_{fg} = latent heat in Btu per pound.

H_t may be converted to standard conditions of code ratings by using the proper correction factor from the following formulae:

For radiators:

$$C_s = \left(\frac{215 - 70}{T_s - T_r}\right)^{1.3} = \left(\frac{145}{T_s - T_r}\right)^{1.3} \quad (2)$$

For convectors:

$$C_s = \left(\frac{215 - 65}{T_s - T_i}\right)^{1.5} = \left(\frac{150}{T_s - T_i}\right)^{1.5} \quad (3)$$

The output under standard conditions will be:

$$H_s = C_s H_t \quad (4)$$

where

C_s = correction factor.
T_s = steam temperature during test, degrees Fahrenheit.
T_r = room temperature during test, degrees Fahrenheit.
T_i = inlet air temperature during test, degrees Fahrenheit.
H_s = heat emission rating under standard conditions, Btu per hour.

Similarly, for *hot water convectors*, the output under test conditions may be determined as follows:

$$H = W(\theta_1 - \theta_2)\frac{3600}{t} \quad (5)$$

where

H = Btu per hour under test conditions.
W = pounds of water handled during test.
θ_1 = average temperature of inlet water, degrees Fahrenheit.
θ_2 = average temperature of outlet water, degrees Fahrenheit.
t = duration of test, seconds.

To convert test results to standard conditions, the following correction factor is used:

$$C = \left(\frac{170 - 65}{\frac{\theta_1 + \theta_2}{2} - T_i}\right)^{1.5} = \left(\frac{105}{\frac{\theta_1 + \theta_2}{2} - T_i}\right)^{1.5} \quad (6)$$

It has been shown that when the exponent 1.5 is used the range of error is less than 3 per cent[13] for convectors.

GRAVITY-INDIRECT HEATING SYSTEMS[14]

The heating units for this system are usually of the extended surface type for steam or hot water, and are installed about as shown in Fig. 6. The temperature and volume of the air leaving the register must be great

[13]Loc. Cit. Note 10.

[14]For further information on this subject see A.S.H.V.E. Code of Minimum Requirements for the Heating and Ventilation of Buildings (edition of 1929) and *Mechanical Equipment of Buildings*, by Harding and Willard. Vol. 1, second edition, 1929.

enough so that in cooling to room temperature the heat available will just equal the heat loss during the same time. In cases where ventilation is a requirement, the air volume needed may become so large that the entering air temperature will be but slightly above the room temperature. To establish and maintain a constant heat flow, provision must be made for removing the air in the room, after it has cooled to the desired room temperature, by a system of vent flues or ducts. As the air flow is maintained

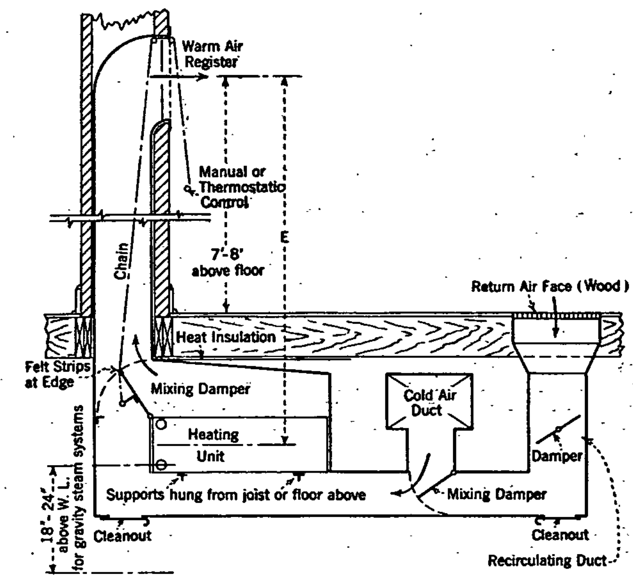

FIG. 6. GRAVITY-INDIRECT HEATING SYSTEM[a]

[a]See *Mechanical Equipment of Buildings*, by Harding and Willard, Vol. I, second edition, 1929.

by natural draft and this gravity head is very slight, it is necessary to make all ducts as short as possible, especially the runs from the heating units to the base of the vertical warm air flues. Gravity-indirect arrangements, such as illustrated in Fig. 6, are not to be generally recommended for hot water systems unless the water temperature can be maintained at a reasonably high temperature and rapid circulation of the water can be had.

PROBLEMS IN PRACTICE

1 ● What is the effect on the heat output of a wall radiator when installed on the ceiling of a room?

Because the temperature differential is increased between the floor level and the ceiling when a wall radiator is placed near the ceiling, the heat output may be decreased from 5 to 10 per cent. Under such circumstances it becomes difficult to heat the living zone of a room satisfactorily.