has adopted the following standards: Code for Testing Radiators (1927); Codes for Testing and Rating Concealed Gravity Type Radiation (Steam, 1932, and Hot Water, 1933).

For steam services the actual condensation weight is taken without any allowance for heating effect; for hot water services the weight of circulated water is used without allowance for heating effect. In all cases the total heat transmission varies as the 1.3 power of the temperature difference between that inside the radiator and the air in the room, and is expressed in Btu or *Mb* per hour.

Standard test conditions specify either a steam pressure of 1 lb gage (215 F), or hot water at 170 F and a room temperature of 70 F for radiators, or an inlet air temperature of 65 F for convectors. The heating capacity of a *steam radiator* or *steam convector* is determined as follows:

$$H_t = W_s h_{fg} \qquad (1)$$

where

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

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

For radiators:

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

For convectors:

$$C_s = \left(\frac{215 - 65}{T_s - T_i}\right)^{1.3} = \left(\frac{150}{T_s - T_i}\right)^{1.3} \qquad (3)$$

The output under standard conditions will be:

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

where

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

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

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

where

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

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

$$C = \left(\frac{170 - 65}{\frac{\theta_1 + \theta_2}{2} - T_i}\right)^{1.3} = \left(\frac{105}{\frac{\theta_1 - \theta_2}{2} - T_i}\right)^{1.3} \qquad (6)$$

It has been shown for the exponent 1.3 that the range of error when it is used is less than 5 per cent[7].

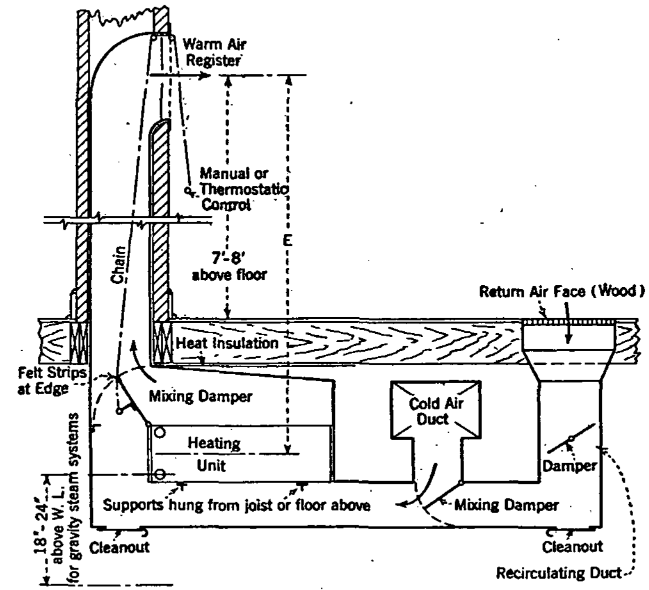

FIG. 8. GRAVITY-INDIRECT HEATING SYSTEM[a]

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

GRAVITY-INDIRECT HEATING SYSTEMS[8]

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. 8. The temperature and volume of the air leaving the register must be great 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

[7]Tests of Convectors in a Warm Wall Testing Booth, by A. P. Kratz, M. K. Fahnestock, and E. L. Broderick (*Heating, Piping and Air Conditioning*, August, 1933).

[8]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. I, second edition, 1929.