7. ● State the advantages and disadvantages of tunnels over conduits.

The advantages of pipe tunnels over conduits are:

1. Accommodation for miscellaneous services other than steam.
2. Provision of an underground passage between buildings.
3. Easy installation of additional pipes and easy replacement of existing pipes with larger sizes.
4. Easy inspection and maintenance of pipes.

The disadvantages of pipe tunnels over conduits are:

1. Higher first cost.
2. Higher maintenance cost in general.

8 ● Is the steam consumption less in a building that shuts off its steam at night than in one that does not? Why?

It has been thoroughly demonstrated that the steam consumption is less in a building where the steam is shut off at night. Although there is, in some cases, an increased consumption of heat when steam is again turned on in the morning, there is a large net saving which may be explained by the fact that the lower inside temperature maintained during the night obviously results in lower heat loss from the building, and less heat need therefore be supplied.

9 ● Is the condensate from a building supplied with purchased steam always discharged to the sewer?

No. In some cities where the customers are not spread over too wide a territory and where natural water conditions make the treatment of boiler feed water expensive, the steam company provides mains for the return of the condensate to the boilers.

10 ● What are the common methods for salvaging heat in condensate?

The most common methods are:

1. The use of a water heating economizer for preheating the hot water supply to the building.
2. The use of a cooling radiator.

11 ● What are the common means used to graduate the heat supply according to variations in outside temperature?

a. A weather compensating thermostat regulates the steam supply automatically according to the outdoor temperature, and gives frequent short intervals of intermittent steam supply; at the same time it insures delivery of steam to all the radiators.

b. Another method which is very simple is the use of an ordinary vacuum return line system in which the pressure in the radiators is varied between a high vacuum and a few pounds to produce some control over the heat output.

c. The use of an orifice system graduates heat supply.

d. The time-limit control which may be set to provide no service, continuous service, or periodic service, is also used. For periodic service, steam may be supplied during each period in increments of a certain number of minutes for each successive setting of the switch, steam being shut off during the balance of the period. This type of service is provided by several intermittent settings. A night switch will maintain the intermittent day setting, or interrupt the day operation and cut off the supply of steam at night during any desired hours.

Chapter 38

RADIANT HEATING

Physical and Physiological Factors, British Equivalent Temperature, Control of Heat Losses, Application Methods, Calculation Principles, Mean Radiant Temperature, Measurement of Radiant Heating

HEATING for comfort is generally understood to mean that heat must be supplied to control the rate of heat loss from the human body so that the physiological reactions are conducive to a feeling of comfort in the individual. While in convection heating, as described in Chapter 30, heat is transferred from a heating unit to the air and thence to the occupant, the primary object of radiant heating is to warm the occupant directly without heating the air to any extent. Thus, the difference between convection heating and radiant heating is partly physical and partly physiological.

Comfort requires that heat be removed from the body at the same rate as it is generated by the oxidation of the foodstuffs in the body tissues. The normal rate of heat production in a sedentary individual is about 400 Btu per hour[1], or, since the entire surface area of an average adult is 19.5 sq ft, about 20.5 Btu per square foot per hour. Conditions should be such as to remove heat at this rate if the surface is to be maintained at the mean normal surface temperature of the human body.

Heat is transferred from any warm dry body to cooler surroundings principally by convection and by radiation, the approximate total rate of heat loss being the sum of the two. Where the body surface is moist there is additional loss of heat through evaporation from both the body surface and the respiratory tract.

The rate of heat loss by convection depends upon the difference between the temperature of the body and that of the surrounding air, and on the rate of air motion over the body. The loss by radiation depends entirely upon the difference between the temperature of the body and the mean surface temperature of the surrounding walls and objects. This latter temperature is called the *mean radiant temperature* (MRT). Because these two types of heat loss act in a supplementary manner toward each other, a required rate of heat loss can be secured by having a relatively low air temperature and a relatively high MRT, or *vice versa*. Thus, if the air is reduced from a given temperature to a lower temperature, the amount of heat lost from the body by convection is increased, and this

[1]Heat and Moisture Losses from the Human Body and Their Relation to Air Conditioning Problems, by F. C. Houghten, W. W. Teague, W. E. Miller, and W. P. Yant (A.S.H.V.E. TRANSACTIONS, Vol. 35, 1929).