$$\text{cfm} = \frac{200 \times 13.5}{(30.85 - 20.35)} = 257 \text{ cfm per ton.}$$

$$L = \frac{257 \times (76.0 - 14.4) \times 1044}{13.5 \times 7000} = 175.2 \text{ Btu.}$$

Check: $L = 200 - \left(\frac{257 \times 0.2415 \times 5}{13.5}\right) = 177.0$ Btu.

9 ● Why is it possible for a reversed cycle refrigeration unit to show a better performance in heating operation than when operating during the cooling season?

In normal use a refrigerating machine is arranged to remove heat and the heat removed is thrown away. The driving energy is converted into heat, most of which is added to the heat removed and is also thrown away.

In the reversed refrigeration cycle the heat removed is not thrown away, but, together with the heat converted from the driving energy, it is utilized to heat the building.

10 ● In a large ice plant, for approximately 147,000 Btu equivalent input to the motor driving the ammonia compressor a ton of ice is produced, in the production of which 288,000 Btu are removed from one ton of water at 32 F to transform it to ice at 32 F. What is the ratio of the heat removed in this process to the input of the motor?

In this case the heat removed, or pumped from the water to the air is approximately 1.96 times the heat equivalent of the input to the motor.

11 ● If the cycle is reversed in Question 10 and the heat is transferred or pumped from the air to the water, what is the ratio of the heat removed in the process to the motor input?

In this case 2.96 Btu is put into the water for each Btu equivalent input to the motor, for the total heat put into the water now represents the heat pumped plus the heat converted from the driving energy, or motor input.

Chapter 3

PHYSICAL AND PHYSIOLOGICAL PRINCIPLES OF AIR CONDITIONING

Vitiation of Air, Heat Regulation in Man, Effects of Heat, Effects of Cold and Temperature Changes, Acclimatization, Effective Temperature Index of Warmth, Optimum Air Conditions, Winter and Summer Comfort Zone, Optimum Humidity, Air Quality and Quantity, Air Movement and Distribution, Natural and Mechanical Ventilation, Heat and Moisture Losses, Ultra-Violet Radiation and Ionization, Recirculation and Ozone, Ventilation Standards

VENTILATION is defined in part as "the process of supplying or removing air by natural or mechanical means to or from any space." (See Chapter 44.) The word in itself implies quantity but not necessarily quality. From the standpoint of comfort and health, however, the problem is now considered to be one of securing air of the proper quality rather than of supplying a given quantity.

The term *air conditioning* in its broadest sense implies control of any or all of the physical or chemical qualities of the air. More particularly, it includes the simultaneous control of temperature, humidity, movement, and purity of the air. The term is broad enough to embrace whatever other additional factors may be found desirable for maintaining the atmosphere of occupied spaces at a condition best suited to the physiological requirements of the human body.

VITIATION OF AIR

Under the artificial conditions of indoor life, the air undergoes certain physical and chemical changes which are brought about by the occupants themselves. The oxygen content is somewhat reduced, and the carbon dioxide slightly increased by the respiratory processes. Organic matter, which is usually perceived as odors, comes from the nose, mouth, skin and clothing. The temperature of the air is increased by the metabolic processes, and the humidity raised by the moisture emitted from the skin and lungs. There is also a marked decrease in both positive and negative ions in the air of occupied rooms but the significance of this factor is still questionable[1].

Contrary to old theories, the usual changes in oxygen and carbon dioxide are of no physiological concern because they are much too small even under the worst conditions. The amount of carbon dioxide in air is

[1]Changes in Ionic Content in Occupied Rooms Ventilated. by Natural and Mechanical Methods, by C. P. Yaglou, L. C. Benjamin and S. P. Choate (A.S.H.V.E. TRANSACTIONS, Vol. 37, 1931).