temperature for a period of time prior to the advent of the peak load, when the heat gain begins to increase to peak conditions, some of the increase is used in raising the temperature of the furniture, fixtures, etc., to the design conditions and the cooling load can be reduced accordingly. However, unless very accurate data with regard to the mass, surface, specific heat, etc., of the items within the space are available, due caution must be used in discounting the cooling load for this storage effect. In the absence of reliable data it is often a matter of experience rather than calculation.

Where air conditioning supply and return ducts pass through unconditioned spaces there will be a transfer of heat from these spaces to the air in the ducts, even though these ducts are well insulated. An allowance

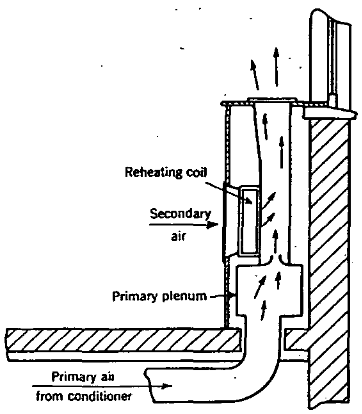

FIG. 10. INDUCTION UNIT (LOW PRESSURE TYPE)

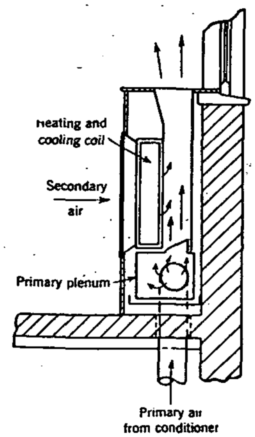

FIG. 11. INDUCTION UNIT (HIGH PRESSURE TYPE)

should be made for this heat gain and included in the heat estimate so that air can be supplied at a temperature low enough to offset the rise caused by this heat gain (see Chapter 43). There will also be some heat gain to the air in ducts passing through conditioned spaces, but since a cooling effect is produced in the space through which the duct passes, this is not a loss and usually can be compensated for by adjustment of air quantities between the various spaces.

Heating Load

Methods of calculating the heating load are shown in Chapter 6. Many of the factors outlined previously under Cooling Load, such as zoning, non-simultaneous peaks, and diversity, apply in the reverse manner due to the heating requirement instead of the cooling requirement. However, these factors enter into the heating load picture from a stand-

point of control of inside conditions, overall performance and economy of operation more than from a capacity of equipment standpoint.

Where heating is concerned it is not only necessary to heat a building or space to its design conditions when there is but the merest fraction of normal occupancy, practically no lights, internal heat, or solar radiation, but it is also necessary to provide capacity to heat the building quickly after a shut-down such as when a sudden cold snap follows relatively warm weather, or after a week-end or holiday. However, in normal operation during week-ends and holidays, buildings are usually kept at a *holding* temperature to prevent the freezing of services and conserve fuel. In many cases it requires less fuel to keep a building or space at a temperature of 50 to 65 F for some time than to shut the system down and then bring the temperature up again.

Apparatus Dew-point

The term *apparatus dew-point* is commonly applied to the temperature of the air leaving the dehumidifier, or in the case of winter air conditioning systems, the humidifier. To a certain extent this is a misnomer since only in an apparatus having a saturating efficiency of 100 per cent is the dry-bulb temperature of the air leaving the dehumidifier equal to the dew-point temperature. This is seldom encountered in actual practice, and some commercial dehumidifiers may have a spread of 3 to 5 F between the dew-point and dry-bulb temperatures. Note that in winter, saturation of the air is usually undesirable for practical reasons. The determination of the apparatus dew-point required for a system is one of the most important steps in the design of the system since the minimum air quantity that can be used on a given system is dependent on this.

For summer cooling, in order to maintain a given temperature and humidity within a space, *both latent and sensible heat gains must be absorbed by the air supplied to the space in the exact ratio in which these occur.* This ratio may be expressed in a number of ways such as latent heat to sensible heat, latent heat to total heat, or sensible heat to total heat. The latter perhaps is the most common since it is a natural result of summarizing the heat gain estimate. This ratio is known as the *sensible heat factor* and is expressed in Equation 1 as:

$$\text{S.H.F.} = \frac{H_{sr}}{H_{sr} + H_{sl}} = \frac{H_{sr}}{H_{rt}} \qquad (1)$$

where

H_{sr} = room sensible heat, Btu per hour.
H_{sl} = room latent heat, Btu per hour.
H_{rt} = room total heat, Btu per hour.

If the sensible heat of the room or space is to be absorbed as it occurs within the space in order to maintain a given temperature, then the relationship between the quantity of air supplied, temperature of air supplied, room temperature and room sensible heat gain must be:

$$Q = \frac{H_{sr}}{(t_r - t_e)\, d \times c_p \times 60}$$