low for ordinary methods of distribution. One of these devices usually is provided under each window in place of the customary direct radiator, and combines the air distribution system with the heating system. An air conditioning system without induction convectors may require installation of direct radiation for maintenance of minimum temperatures during air conditioning shut-down periods, but when induction convectors are used they may be selected with heating coils of sufficient capacity to maintain, by thermal circulation, a reasonable temperature when the primary-air supply system is shut off. The use of low temperatere, dehumidified air which has not been reheated or mixed with room air before delivery to the room, may permit a reduction in fan capacity and the use of smaller ducts. In some cases a bypass may be desirable in order to maintain the primary air volume and to provide additional control. This system

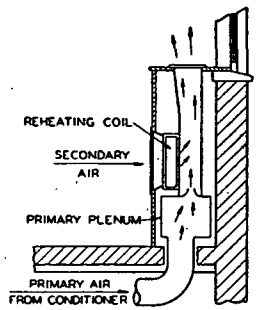

FIG. 4. INDUCTION UNIT (LOW PRESSURE TYPE)

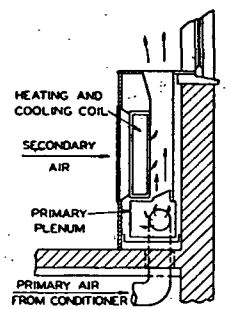

FIG. 5. INDUCTION UNIT (HIGH PRESSURE TYPE)

can provide a degree of zoning that is usually difficult with conventional design since the air delivered by each unit can be controlled individually. Selection of induction convectors should be made with due regard to noise level. The inductive capacity of the device increases with the jet velocity, but high jet velocities may result in objectionable noise.

The units are supplied with primary air from one or more central stations with the primary air providing all ventilation and handling the entire cooling load. The central apparatus is arranged in general conformity to Fig. 1 except that the central reheater is omitted since each unit has its own reheater. The controls are arranged to maintain a substantially constant supply air temperature equal to that required for maximum cooling. Final control is obtained by means of a room thermostat, or remote bulb thermostat in the unit having its measuring element in the recirculated air stream. The controlling thermostat operates the coil supply valve and a damper operator on the primary air damper in sequence. At maximum heating load the valve is wide open and the primary air quantity is at a minimum. As the space temperature tends to rise, the valve is first gradually closed, then the primary-air quantity is gradually increased from minimum to maximum. Alternately the primary-air quantity can be kept constant and all final control achieved by the individual heating coils. If variable air quantities are to be handled by the primary-air fan, some form of fan-capacity control is necessary.

Induction Convectors—High Pressure Type

Another type of induction convector, Fig. 5, employs nozzles which produce a high velocity air jet without objectionable noise. The term, high pressure, is to some extent inaccurate, since the air pressure at the nozzles, while several times that used with a low pressure induction convector, is still less than the total resistance pressure of a conventional central system. The high velocity jet of primary air induces a flow of air from the room through coils located in the secondary air stream and supplied with chilled water in summer and with hot water in winter. The chilled water removes a large portion of the sensible heat in summer and the hot water supplies the sensible heat loss in winter. The primary air is delivered at a sufficiently low dew point to compensate for the latent heat gain in summer. In winter the primary air is supplied at a

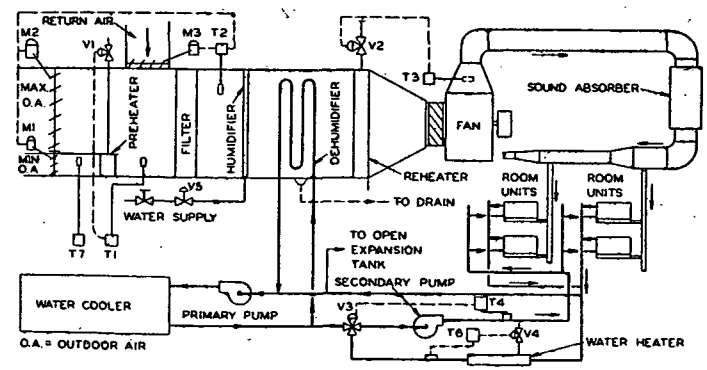

FIG. 6. TYPICAL INDUCTION UNIT SYSTEM

sufficiently high dew point to take care of latent heat losses. Control of temperature is obtained by throttling the water quantity supplied to the secondary coil. The required flow of primary air is greatly reduced due to the fact that a portion of the sensible heat load is carried by the secondary air stream. Since the primary quantity is small, very high velocities can be maintained in the supply ducts without requiring fan power in excess of that for a conventional system. Therefore, the supply ducts or pipes can be very small and can be run in chases, or furred in at columns along with the water pipes. The primary air is treated in the usual manner to reach the required dew point and a surface or spray dehumidifier or a dehydrator may be used. The primary-air quantity is sufficient for ventilation purposes and frequently consists entirely of outdoor air.

Fig. 6 shows the general arrangement and control of the system. The operation of the controls is as follows:

The final temperatures in the spaces are controlled by individual valves, either automatic or manual, which throttle the flow of secondary water to the unit coils. Where automatic valves are used, the thermostats are of the heating-cooling type so that a rise in room temperature opens the valve when cold water is circulated and closes the valve when hot water is being supplied. Thermostat T1 controls the preheater steam valve V1 to maintain a temperature of about 45 F leaving the preheater. Thermostat T2 controls the maximum outdoor-air and return-air dampers so that