4. Humidistat or wet-bulb thermostat *D* in return air, acting through relay, causes *C* to take outside air when the relative humidity rises above 55 per cent (or the wet-bulb temperature rises above 60 F); also, if necessary, shuts off the water supply to the spray heads in the air washer and opens the supply to the flooding nozzles at the eliminator plates, by operating threeway valve *U* (Fig. 15). The relative humidity must, of course, be changed to suit the requirements. It must be maintained low enough to avoid condensation on walls or windows[3].

5. Reverse-acting thermostat *E* in discharge end of air washer operates a threeway valve (*V*, Fig. 15) in water circulating line, so as to cause water to pass through or around a heating unit in order to produce the correct dew-point temperature by adding any necessary heat to the water. It may also operate reverse valve *W* (Fig. 15) in the steam supply to the heating unit. The heat added may be only that sufficient to make up the temperature drop through the washer, due to evaporation. This thermostat is reverse-acting to prevent over-humidification in case of failure of motive power.

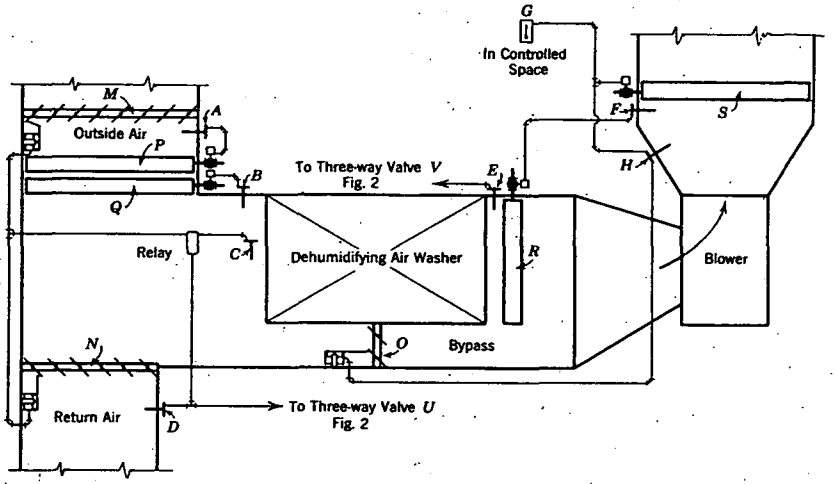

FIG. 14. DIAGRAMMATIC ARRANGEMENT OF VARIOUS PHASES OF CONTROL FOR A CENTRAL FAN AIR CONDITIONING SYSTEM

6. Direct-acting thermostat *F* in fan discharge operates a direct-acting valve in steam supply to heater *R* to produce the lowest temperature at which air can be introduced into the conditioned space, without complaints of draft. This varies from 60 to 70 F, depending on the velocity through, and location of, the supply grilles.

7. Direct-acting room thermostat *G* in a representative location controls direct-acting valve in steam supply to coil or coils *S* which supply the heat to replace the loss from the conditioned space.

Summer Operation (with refrigeration)

Thermostats *A*, *B*, *F* and *G* all hold their valves closed during summer temperatures which are above the thermostat settings, although this is unimportant while no steam is being supplied.

1. Thermostat *C*, having been set for 50 F, supplies power to open wide the intake damper and close the return air damper under the higher summer temperatures and this

[3]See discussion of condensation in Chapter 7. Also see paper entitled, Frost and Condensation on Windows, by L. W. Leonhard and J. A. Grant (A.S.H.V.E. TRANSACTIONS, Vol. 35, 1929).

power can be passed through a graduating switch to permit manual operation of the dampers. As the wet-bulb temperature (or total heat) of the outdoor air is now normally greater than that of the return air, it is desirable, in order to keep down cooling costs, to recirculate the maximum amount of air.

2. Humidistat *D* is by-passed so that main power is applied direct to threeway valve *U* (Fig. 15) to prevent shutting off sprays. This by-pass can be arranged for cutting in manually, or automatically, with the starting of the refrigerating machinery.

3. Thermostat *E*, operating threeway valve *V* (Fig. 15), now determines whether the spray water is passed through refrigerated coils or is recirculated without treatment, and thus regulates the dew-point temperature. It is assumed that steam and refrigeration are not both turned on at the same time.

4. Direct-acting thermostat *H* operates a normally open damper *O* in the by-pass space around the air washer so as to mix the warmer return air with the cold air leaving the dehumidifier in such proportions as to give the minimum temperature at which air can be introduced into the conditioned space. This might be 70 F for a room temperature of 85 F. A switch should be installed in the branch line from *H*, and so connected to a main line as to permit keeping normally-open damper *O* closed during winter operation.

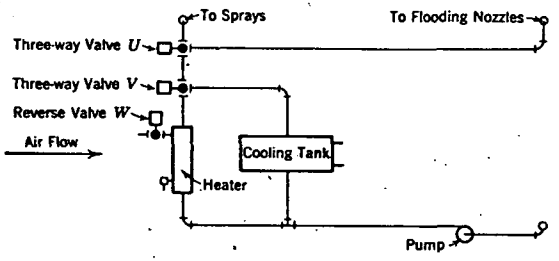

FIG. 15. CONTROL VALVES FOR A DEHUMIDIFYING AIR WASHER

5. Thermostat *G*, in addition to operating valve on heating unit *S*, acts as a pilot for thermostat *H* so as to retard the action of the latter in closing the by-pass damper, when the space temperature is below the desired point.

Spring and Fall Operation

During a considerable part of the year, conditioning can be accomplished merely by using all outside air or by mixing it with returned air. For example, when the total sensible heat gain in an auditorium is 2.4 Btu per pound of air being treated, outside air will be raised from 60 F to 70 F by the heat gain. During this period when dry-bulb temperatures are to be maintained at, or not much above, 70 F, the gain in sensible heat is the only factor that need be considered, because it is large in comparison with the gain in latent heat, except in restaurants and some classes of industrial work. The intake and recirculating dampers can then be operated by thermostat *F* set at 60 F. (It is assumed that such an outlet temperature can be used; if not, the volume of air should be increased). Thermostat *H*, being set higher for hot weather, holds by-pass damper *O* open to provide a maximum volume of air. In order to minimize over-humidification, the air washer and by-pass are arranged so that the return air stream tends to use the by-pass. However, since dehumidification is not required, as previously stated, the humidity control is obtained by shutting off the spray water by humidistat *D*.