2. *Duct Thermostats.* These instruments are constructed so that the thermostatic element is in the air duct or chamber and the remainder of the instrument is on the outside of the duct. This type of thermostat is generally used to control the temperature of the air in various parts of ventilating and air conditioning systems.

3. *Two-Temperature Thermostats.* These instruments are used when it is desired to control at two distinct temperatures at different periods by means of a single thermostat. For example, a temperature of approximately 70 F may be desired during the day, while

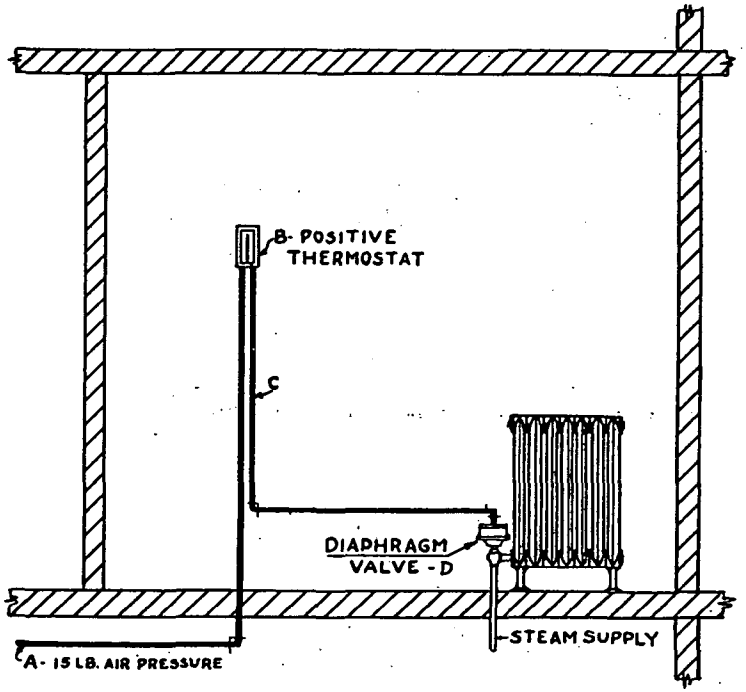

FIG. 6. CONTROL OF DIRECT RADIATOR WITH POSITIVE THERMOSTAT

some lower temperature is satisfactory during the night. Shifting from the high to the low temperature may be accomplished at some remote point by means of a clock or a manual switch.

4. *Clock Thermostats.* These instruments are arranged with clock mechanisms to maintain predetermined temperatures at predetermined hours, such as a low night temperature which may be automatically increased at a certain hour to the proper day temperature.

5. *Weather Compensating Thermostats.* These instruments control the temperature of a building with respect to the outdoor temperature. Two thermostatic elements, one of which is placed outdoors and the other attached to a radiator, are arranged so as to operate the supply of heat in conjunction with each other. The temperature of the radiator is thus decreased as the weather temperature rises. This system may control the temperature of hot water, the pressure on a steam boiler, the volume of steam supplied from outside the building, the amount of gas or oil fuel consumed or the operating rate of a coal stoker.

TEMPERATURE CONTROL SYSTEMS

The foregoing discussion has concerned the sensitive element of the thermostat and its work. The following pertains to the types of control used for (1) direct radiators, (2) unit heaters, (3) unit ventilators, and (4) central fan systems.

Direct Radiators

The control of rooms heated by direct radiators may be accomplished in several different ways. The problem is to control the heating units located at one or more points in or adjacent to the room. The circulation of air is not rapid, and the rate of temperature change usually is slow. The types of controls commonly used are: *first*, the direct-acting radiator valves with the thermostatic element at the valve, or at some adjacent point in the room and connected to the valve by means of a capillary tube; and *second*, the indirect-acting thermostat controlling either air or electri-

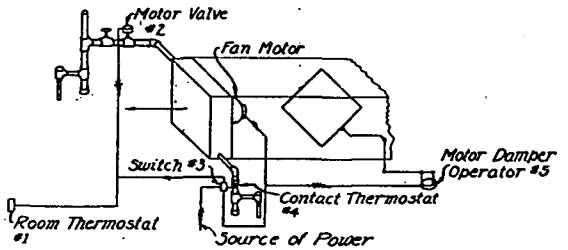

FIG. 7. ARRANGEMENT OF AUTOMATIC CONTROL FOR A UNIT HEATER

cally operated valves. Fig. 6 shows a radiator controlled by an indirect-acting thermostat.

Unit Heaters

Unit heaters present a different problem of control because the circulation within the room usually is different than with direct radiators. The simplest control is a thermostat which, directly or indirectly, will stop and start the fan motor to maintain the desired temperature, heat being supplied to the unit whether the fan is running or not. A more complete control is obtained if the valve on the heating coil is closed when the fan motor is stopped, and opened when the motor is started.

Fig. 7 shows an efficient control for a unit heater, taking into consideration all the factors which may arise. The room thermostat No. 1 calls for heat and passes electric current to motor valve No. 2, which operates, admitting steam to the heater. The same impulse from thermostat No. 1 also seeks to operate switch No. 3 and so to cause operation of the fan motor, but is prevented by contact thermostat No. 4 coiled around the return pipe of the heater. Thus unless the heater is warm its fan cannot operate and the ensuing cold drafts are avoided. As soon as the contact thermostat No. 4 becomes warm it permits operation of switch No. 3, starting the fan motor, and where desired also permits the motor