Second: The period of occupancy should be taken into account, since much heat is wasted if office-hour temperatures are maintained during 24 hours for each day of the entire heating season. Office hours average about 50 per week, or about 1,500 per heating season. The heating season is approximately 5,040 hours, so that it becomes at once evident that much can be done toward reducing the overall heat cost in office buildings by lowering the temperatures during the hours of non-occupancy.

Third: Most large office buildings have more or less space occupied by merchants, and some by clubs, restaurants, etc., which have short hours of occupancy. Much can be accomplished in zoning with reference to the kind of occupancy of space.

There are other schemes employing various pressure devices for maintaining temperatures in radiators to meet controlled heat requirements.

Individual control on each heating unit is in wide use with thermostats and valves. Disregarding investment and operating cost, this system is ideal. However, when an open window permits cool air to touch the thermostat it must turn on the heat, defeating the purpose of the open window and resulting in overheating and waste.

Possibly some day all office windows will be sealed and all air will be brought to the rooms metered and washed and at the temperature desired, in which event, of course, there will be no open windows to upset the thermostats.

FACTORY HEATING

Automatic heat control in factories is of the greatest importance, since the most productive returns come from man power and this power is vitally influenced by the temperatures and condition of the air in the work rooms.

Window control of heat and ventilation is always wasteful, but may in some cases be justified, as for instance, where a factory generates its own electric or mechanical power by means of steam engines. The exhaust steam from engines may be sufficient at all times to supply the required heat. In fact, it may even be economical to waste considerable heat through the radiation to increase the efficiency of the engines generating the power by reducing back pressure.

Hot water, circulated mechanically, lends itself to factory heating where air conditioning is not a primary requirement. This is on account of the fact that the temperature of the heating medium can readily be raised and lowered at the central plant to meet the requirements. Unless some process work demands special temperature conditions and if the entire space can be given approximately the same temperatures, the control of temperatures may rest solely with the operator at the central plant when hot water is used.

If certain parts of the factory need higher temperatures than others, automatic heat control can readily be applied to both the direct and indirect distribution systems and can be subdivided to the most minute degree.

It is well to remember that if several heating units are controlled from one thermostat and the heating medium is steam, the thermostat, unless

placed near the last radiator on the circuit, will tend to over-throttle the supply valves and finally will close them when the desired temperature has reached the thermostat and before the radiator has become warm. This may lead to complaint of uneven heating and to unfair criticism of the heating device or the thermostats.

Fig. 8 shows an arrangement of automatic control for a unit heater whereby thermostat No. 1 asks 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 damper operator No. 5 to open the intake

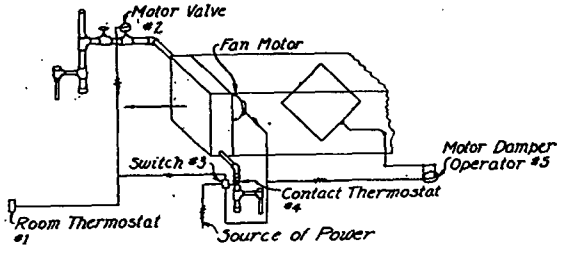

Fig. 8. Arrangement of Automatic Control for a Unit Heater

damper from outside. The fan always stops and the damper always closes when the heater is cold.

Electric heating finds many uses in factories where small spaces need higher temperatures than the average, or where heat is desired temporarily at times when the balance of the factory requires no heat or very little heat. Electric heating lends itself perfectly to automatic control, since its efficiency is 100 per cent, that is, every heat unit does useful work and there is no lead or lag due to accumulated heat in the radiator after the supply of energy is shut off. (See Chapter 13, Heating by Electricity).

THEATER HEATING

The modern theater requires temperature control of the most exacting type. Large volumes of air are handled. When this comes from outside it must be warmed or cooled and its moisture must be regulated. With the rapid air changes and the wide fluctuations in heat demand due to electric lights and varying intensity of occupation, there is a real necessity for automatic heat control.

The heat requirement curve of a modern theater will usually indicate the radiation working to maximum capacity one hour before the curtain rises and as the auditorium begins to fill with people this requirement curve rapidly drops until finally the curve crosses the zero line and cooling