Control of Unit Heaters

Automatic control of unit heaters may be accomplished with and without by-pass units. There are two general methods of automatic control that may be applied to the unit without by-pass. One is to stop and start the unit heater motors individually or in a group by means of a room thermostat. The other is to control the steam supply either to individual units or to a group of units by means of a gradual-acting valve operated from a room thermostat. Where a steam valve control is used, the return system must be equipped with a vacuum pump, as an appreciable pressure difference between supply and return connections necessarily exists when the steam is throttled.

A combination of these two methods is sometimes used wherein the steam supply to the units is cut off completely before the unit heater motor is stopped and is turned on just before the motor is started again. The purpose of this control is to cool off the heater casing and to prevent possible discomfort to persons close to the unit from the radiant heat if steam is left on the coils when the motor is stopped. This is accomplished by two thermostats, one for controlling the motor and the other for controlling the steam valve. With this combination control, there is some possibility of draft complaint, for at times the fans may deliver cool air.

Gradual-acting control of the steam valve should not be applied to heaters with outside air connections unless some protection against freezing is also used. This protection can be accomplished by separating the heater coil into two parts, one of which acts as a tempering coil and is controlled from an outside air thermostat which will keep steam at full pressure on the coil whenever the entering air is below freezing, and which will cut off the steam when the entering air goes above freezing. The main coil is controlled from the room thermostat and is depended upon for temperature regulation. Another method of protection is to immerse in the return condensate a thermostat which controls a positive-acting by-pass valve and which will admit additional steam if the temperature of the condensate falls to the freezing point. This is purely a safety device and assumes that no condition of normal regulation will require enough throttling to make freezing possible. If this were not the case, such a method would not be suitable, as it prevents regulation beyond the point where the by-pass valve opens.

As a precaution against allowing the unit heater motors to continue to run if the steam supply fails or is for some reason shut off, either a pressurestat or thermostat in the supply line, or a thermostat on the return line may be installed to stop the motor when the pressure or temperature in the supply line, or the temperature in the return line, drops below a predetermined point.

The by-pass-type units are equipped with a by-pass opening and two interconnected dampers, so arranged that all or any portion of the air may be passed through or around the coil without being heated. It is possible to obtain a fair degree of temperature regulation by manually operating the dampers, but with the application of automatic controls, unusually good temperature control is obtained.

There are two types of control applicable to the by-pass units. The

older method is the *pneumatic* while the newer method is the *electric*. For the former, an air motor is installed on the unit to actuate the dampers. A pneumatic room thermostat is connected by means of small air lines to this air motor as well as to a source of compressed air supply. Should the room temperature tend to rise above the thermostat setting, the position of the dampers will shift to allow more air to be by-passed and less air to be heated through the coil. This produces a lower discharge temperature, which restores the desired temperature condition in the room. Conversely, should the room temperature tend to fall, the damper positions shift, so that less air is by-passed and more air is heated in going through the coil and a greater quantity of heat is supplied to the room.

The electric controls are similar to the pneumatic controls. In place of the air motor, a small reversible electric motor is used, and this is actuated by a room thermostat. When more heat is required, the thermostat makes a contact which causes the motor to shift the damper positions so that less air is by-passed and more air is drawn through the coil. When

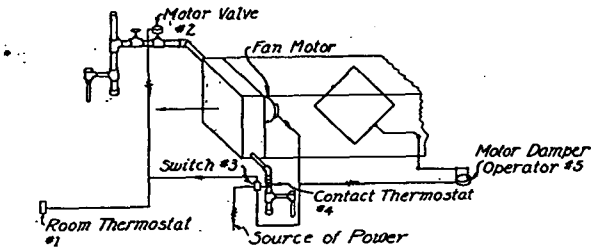

FIG. 7. ARRANGEMENT OF AUTOMATIC CONTROL FOR A UNIT HEATER

less heat is required, the thermostat makes another contact which causes the motor to operate in the reverse direction.

Where conditions require, an additional thermostat may be used to stop the fan motor when the by-pass damper is wide open and the coil damper tightly closed. Also, a thermostat may be applied to the return line which will stop the fan motor should the steam supply fail.

Fig. 7 shows a control for a unit heater which takes into consideration 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 damper operator No. 5 to open the intake damper from outside. The fan always stops and the damper always closes when the heater is cold.