Oil Burners

Fig. 12 illustrates diagrammatically the essentials of an oil burner control circuit. Three thermostats are employed as shown in the illustration. Thermostat No. 1 will stop the burner when the room temperature is too high and No. 2 will stop the burner when the temperature of the heating medium exceeds the setting of thermostat No. 2. Both temperatures must be below their respective thermostat settings to start the burner. Thermostat No. 3 responds to the flame temperatures and in conjunction with the control switch acts as a safety to stop the burner if the latter fails to ignite or burn properly as demanded by thermostats Nos. 1 and 2.

Steam and hot water heating plants are often used to provide heat for the domestic hot water supply as well as for heating the building. Fig. 13 illustrates one such system. The burner control is similar to that shown in Fig. 12 except that either the room thermostat or the tank thermostat may cause the opening of the valves in the mains which supply them and start the fuel burner, but the burner will not stop unless both thermostats have closed their valves or the steam pressure shall have reached that allowed by the pressurestat. Much the same control is applied to gas burners and automatic coal stokers.

Gas Heating Appliances

On account of the ease and effectiveness with which the fuel can be controlled, gas-burning appliances are particularly adaptable to full automatic control. Standard equipment on a steam boiler generally includes provision for control through a room temperature thermostat, a steam pressure regulator and a device which shuts off the gas in the event that the water level becomes too low. Practically all gas boilers are or may be equipped with automatic safety pilots which shut off the gas if the pilot flame is too low.

Water boilers are adapted to operation under thermostatic room temperature control and are also provided with water temperature control equipment. Warm air furnaces can be under the control of thermostats in the spaces being heated, as well as thermostats located in the heat ducts for the purpose of preventing unpleasantly hot air reaching the heated spaces. Variations in the pressure under which the gas is supplied to the appliance are controlled by means of a gas-pressure regulator. This is an essential part of practically all makes of gas-burning heating appliances, in fact, a gas-pressure regulator is required by the *American Gas Association* on all approved gas boilers, warm air furnaces (except floor furnaces) and unit heaters.

ZONE CONTROL

Zone control is a step between a single thermostat and individual room temperature control. The building is first divided into sections or zones which may have quite different heat requirements. With this method of control:

First: The zoning should be done with reference to the compass, since the north and west quarters in most localities require considerably more heat during the heating season than do the south and east quarters.

Second: 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. For additional information on this subject, refer to Chapter 31.

COOLING UNITS

Cooling units are readily adaptable to thermostatic control. Several arrangements are as follows:

1. Room thermostat in conjunction with a magnetic or motor-operated valve to regulate the flow of refrigerant to coil. Usually the fans operate continuously.
2. Room thermostat to control operation of compressor. Fans operate continuously.
3. Room thermostat to control the operation of the fan motors.
4. Room thermostat to control the operation of fan motor and compressor motor simultaneously.
5. Room thermostat to control operation of the compressor with back pressure control to regulate the fans.

For further information on unit coolers, see Chapter 12.

INDUSTRIAL PROCESSES

There are many industrial processes requiring automatic temperature and humidity regulation. The control equipment operates on the same principles that have been described, but is often specially designed for each particular process. Each installation, or the installation for each process, is likely to be a problem peculiar to that process.

AIR CONDITIONING SYSTEMS

The following fundamental principles should be borne in mind in the solution of problems involving the control of air conditioning systems:

1. Dew-point temperatures vary only with the amount of moisture. That is, no matter how much a given mixture of air and water vapor is heated or cooled, the dew-point temperature remains the same, as long as there is no addition or subtraction of water. Cooling below the dew-point temperature will, of course, cause subtraction. *Also*, at the same temperature, there is always the same proportion of water vapor in the saturated mixture, provided sufficient water and time are furnished for saturation.

Table 2, Chapter 1, shows the amount of moisture required to saturate a space at various temperatures. When the proper amount of moisture is determined, it is only necessary to set the air washer (dew-point) thermostat for the corresponding temperature of saturation; then if the air entering the washer has more humidity than desired, the excess will be condensed; and if it has less, the deficiency will be absorbed from the sprays.

For example, the dew-point temperature at 70 F and 40 per cent relative humidity is 45 F. Therefore, if the air temperature is maintained at 45 F as it leaves an air washer (assuming it is fully saturated) and then is heated to 70 F, it will have a relative humidity of 40 per cent. If it is desired to maintain these conditions in a given space, the air temperature can be raised to any necessary point, say 120 F (at which the relative humidity will be only 9 per cent). When the heat in the air has been dissipated through the walls, roof, etc., the space temperature being maintained at 70 F, the relative humidity will be 40 per cent.

2. Within ordinary operating ranges, saturated air will have a relative humidity of approximately 50 per cent when its temperature is raised 20 deg. For example, satu-