

too much steam to pass before its heating effect reaches the thermostat. Therefore some device is needed to vary the flow in accordance with the weather. This may be a simple long range thermostat that restricts the flow as the weather moderates, or one that turns the steam off and on, on oftener and for longer periods in cold weather. One device is designed to directly control radiator temperatures at progressively lower points as the weather becomes warmer. Most outside thermostats have provision for sun and wind effect. They do not produce close control of indoor temperature, and are usually accompanied by hand switching devices for raising and lowering the control point, where individual room control is not included. They are, as stated previously, valuable adjuncts of room control.

For a hot water heating system, zone control consists of an outdoor thermostat varying the temperature of the water in accordance with the weather. This may be done by changing the amount of heat applied to the water, or by mixing hot water with recirculated water so as to produce the proper temperature. Inside zone thermostats may be used to correct improper action of weather thermostats, or, where only one outside instrument is used for a number of zones, to start and stop circulating pumps in accordance with the demand for heat in the various zones.

For both steam and hot water systems, zone control is primarily to reduce the general heating effect in moderate weather. Thus the term is used to describe a type of control system, though a building may have but a single zone.

In air conditioning systems, zone control may be applied to separate fan systems in different parts of a building or to two or more sections of the air distributing system from a single fan. The zone thermostat may be room type, or insertion type located in the return air duct from the zone. Where each zone has its own fan, the control may be the same as for an independent system. If one fan serves more than one zone, there will be heating and cooling coils for each, or a damper to mix air volumes of two temperatures to provide the proper conditions for the zone.

Zone control for an all-year air conditioning system presents problems that do not arise in either the heating or the cooling cycle alone. As a zone is normally selected for similarity of conditions, and the distribution of temperature effect to the various rooms adjusted so that one control point is sufficient, it is important that the similarity of conditions applies equally to heating and cooling. Two rooms that have like heating loads and that work well together in the heating season, may have entirely different cooling loads. This difficulty can be overcome by the use of sub-zones or individual room control where necessary.

CENTRAL FAN SYSTEMS

Central systems for air conditioning are described in Chapter 21. For explanation of the control problems for such systems, the various functions, such as heating, humidification, and cooling, are treated independently.

Ventilating Systems

A control system for a central fan ventilating system using all outdoor air and discharging air at a predetermined temperature is illustrated in

Fig. 2. Thermostat T_1 located in the outdoor air intake is set just above freezing, and controls valve V_1 on the first heating coil. This arrangement, where the valve is held completely open or closed to avoid danger of freezing, must be used where the coil is not specially designed for uniform steam distribution across its face. The by-pass damper around the heaters and the other two valves V_2 and V_3 are controlled by thermostat T_2 located in the discharge duct from the fan. When the temperature of the discharge air is too high, T_2 closes V_3 and V_2 , gradually and in sequence, then if V_1 is open and supplying too much heat, T_2 opens the by-pass damper. The control of the damper and valves V_2 and V_3 must be gradual to prevent wide fluctuation in temperature.

In ventilating systems it is customary to supply air to the ventilated spaces at an inlet temperature approximately equal to the temperature maintained in the rooms. The radiators therefore are designed to take care of all the heat losses from the rooms and in order to maintain controlled room temperatures it is necessary to control the radiators independently of the ventilation control.

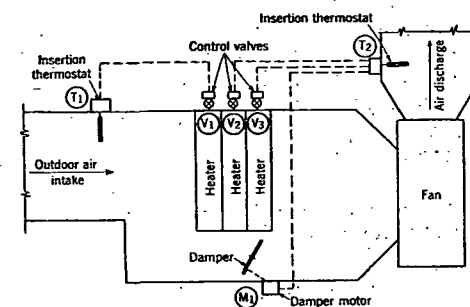


FIG. 2. CONTROL OF A CENTRAL SYSTEM FOR VENTILATION

In central fan systems, air washers are sometimes used and in such cases, due to the effect of temperatures on humidity, additional control is required. The heating coils are then divided, one or two at the inlet and usually two at the outlet, generally called preheaters and reheaters. There should be no by-pass under the former, because of the danger of a stratum of cold air freezing the water. To maintain relative humidity at a constant point a dew-point thermostat is inserted into the air stream between the two sets of coils, to control the preheaters. Cold-air control of preheaters cannot be used because at temperatures just below freezing a standard heating coil, which will protect an air washer against freezing in zero weather, will give a too high dew-point temperature. Therefore, the one or two preheater coils must be controlled from the dew-point thermostat. This is preferably placed at the discharge side of the washer and set for about 40 or 45 F. As there is some cooling effect from the water, this provides a slightly higher temperature leaving the coils. In such cases, the throttled steam must be fairly uniformly distributed across the face of the coil, to prevent a stratum of cold air that would freeze water in the coil or in the washer.