occur during these times can be used provided the cumulative effect or heat gain lag is taken into consideration in the estimate.

Outdoor Air

Standards affecting the quantity of outdoor air have been established in Chapter 2. These standards relate the minimum amount of outside air to be introduced into the conditioned space for both the number of occupants and the type of occupancy, *i.e.*, people smoking, etc. This, of course, is the common-sense approach to the problem, but there are some cases, such as those spaces having a very low occupancy with regard to the cubical content where mustiness may develop unless a sufficient air change is provided. Where such a condition exists in a few spaces out of several which are being handled by a central system, the *averaging* ability of the central system may cope with the situation satisfactorily. This is

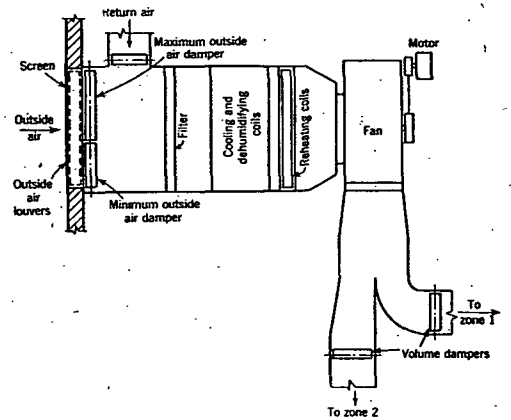

FIG. 8. CENTRAL SYSTEM WITH ZONING BY VOLUME CONTROL

due to the fact that the return air from the particular space is mixed thoroughly with the return air from all the other spaces and all the outside air supplied.

It should be noted that the minimum quantity of outdoor air is affected by infiltration and leakage. Infiltration will reduce the quantity to be introduced by the system while leakage may have to be offset by an increase in the quantity of outdoor air.

Most summer and year 'round air conditioning systems should be so designed and arranged that a quantity of outside air at least equal to the quantity of cooled or dehumidified air can be taken in when desired. In the intermediate seasons and in the cooling season it is more economical to take all outside air into the dehumidifier when the outdoor air wet-bulb temperature is lower than the inside wet-bulb temperature to be maintained. Also, where using a spray type dehumidifier or air washer, whenever the outdoor wet-bulb temperature is below the apparatus dew-point temperature required, the system can be operated on an evaporative cooling basis, dispensing with the need for refrigeration though cooling may be required. Automatic controls are available for accomplishing this and on reasonably large systems are justifiable from an economic standpoint.

Cooling Load

The method of determining the cooling load for a conditioned space or spaces is outlined in Chapter 7. As pointed out therein, many of the items of heat gain are variable and do not reach their maximum values simultaneously. Proper consideration of these *peaks* and the avoidance of pyramiding these peaks in the cooling load calculations are stressed. Maximum solar heat gain on an east exposure is seldom coincident with the maximum outdoor wet-bulb.

A large difference in the incidence of the peaks between various spaces or parts of the same space indicates the necessity for zoning. In a building having an east and west exposure where solar heat gain forms a fair share of the cooling load, the times of their individual peaks are apt to be hours apart, and the peak load of one plus the off peak load of the other will be

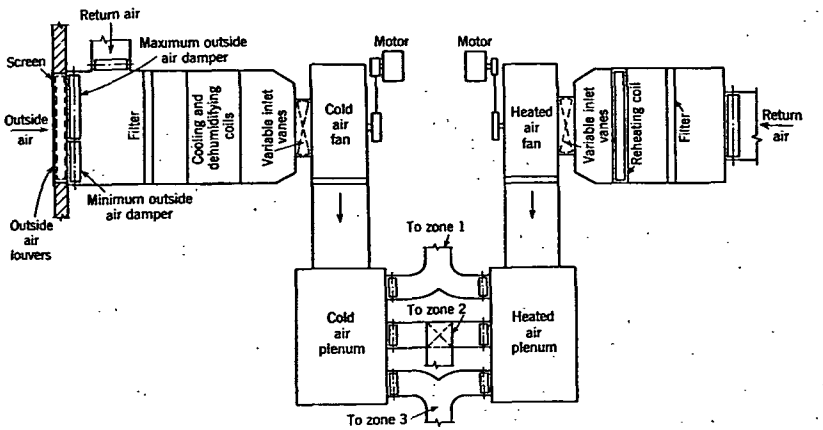

FIG. 9. CENTRAL SYSTEM USING DUAL DUCT METHOD OF ZONING

substantially less than their combined peak loads. Proper zoning will permit taking full advantage of this condition or similar conditions of non-simultaneous peaks and will result in a lower total load, reflecting itself in savings in equipment.

A factor, similar in effect and closely related to the non-simultaneous occurrence of peak loads is *diversity*. Typical of this is the case of a large department store where the air handling equipment serving a certain space must be sufficient to handle the load created by the throngs of people attending sales in that space. Under such a condition the number of people in other spaces is usually normal or below. While this means that the air handling equipment for certain departments must be large enough to cope with the situation, the refrigeration equipment must be only large enough to handle the average maximum. If a system employing zone recirculating fans and a single central fan and dehumidifier were used, the saving would be reflected in the capacity of the central fan and dehumidifier. Another example of this diversity is found in an office building having restaurants and stores of certain types on the first floor and basement. At noon, when the restaurants and stores are crowded, the offices are below normal occupancy.

Heat lag should be carefully considered in the cooling load calculations.