Air Quantity

The quantity of air to be circulated through an occupied space, whether by natural or mechanical means, or whether the air is conditioned or not, must in all cases be sufficient to maintain the required standards of air temperature, quality, motion and distribution. The factors which determine air quantity include the type and nature of the building, locality, climate, height of rooms, floor area, window area, extent of occupancy, and last but not least, the method of distribution.

The quantity of air supplied to a room by an air conditioning or ventilating system serves two purposes: *First*, the supply of sufficient outside air for the needs of the occupants; and *second*, the setting up of circulation or air motion within the room. Until recently it was considered that 30 cfm were necessary in any occupied space, particularly in a classroom. It has since been demonstrated that 10 cfm of outside air per person is frequently sufficient to remove body heat, insure against body odors, and provide the chemical needs of respiration. However, it is found that a greater volume should be circulated in the average room in order to provide the required air motion. It is now customary to supply the minimum amount of outside or conditioned air required for removing heat and odors, and to recirculate the additional volume.

In offices and small rooms where the occupants smoke, from 6 to 7 cfm of outside air per occupant will be necessary to eliminate the nuisance effects of the smoke; this quantity of air, however, may be a part of that necessary for other ventilation requirements. Restaurants which permit smoking, because of the exposed food and the necessity that restaurant air seem very clean, need from 10 to 12 cfm of outside air per occupant to care for the smoke condition. This air, likewise, need not be in addition to that required for other ventilation purposes.

Temperature Rise

The total quantity of air introduced is governed largely by the needs for controlling temperature and humidity when either heating or cooling is required. As a rule, the introduction and distribution of warm air into an occupied space does not present as many difficulties as does the introduction of cold air. The former is determined from the amount of heat to be given up to the space, and the latter is determined from the amount of heat to be removed from the space, using a temperature rise that will produce uniform distribution without the production of disagreeable drafts.

Fig. 4 shows the changes in carbon dioxide concentration and moisture content resulting from occupation, in the atmosphere of a room supplied with various volumes of outside air. Data are given for an adult, 5 ft 8 in. in height weighing 150 pounds and having a body surface area of 19.5 sq ft, and for a child, 12 years of age, 4 ft 7 in. in height, weighing 76.6 pounds and having a body surface area of 12.6 sq ft. It is a recognized fact that the dissipation of heat and moisture to the atmosphere, the addition of carbon dioxide, and all metabolic changes take place in proportion to the surface area of the individual. Hence, data for persons of other sizes may be obtained by interpolating among the curves given. The rate of sensible heat production is given in Fig. 7. Fig. 4 also gives

the temperature of the incoming air necessary to maintain a room temperature of either 70 or 80 F as indicated, assuming that there is no heat gain or loss to the room by transmission through the walls, solar radiation or other sources.

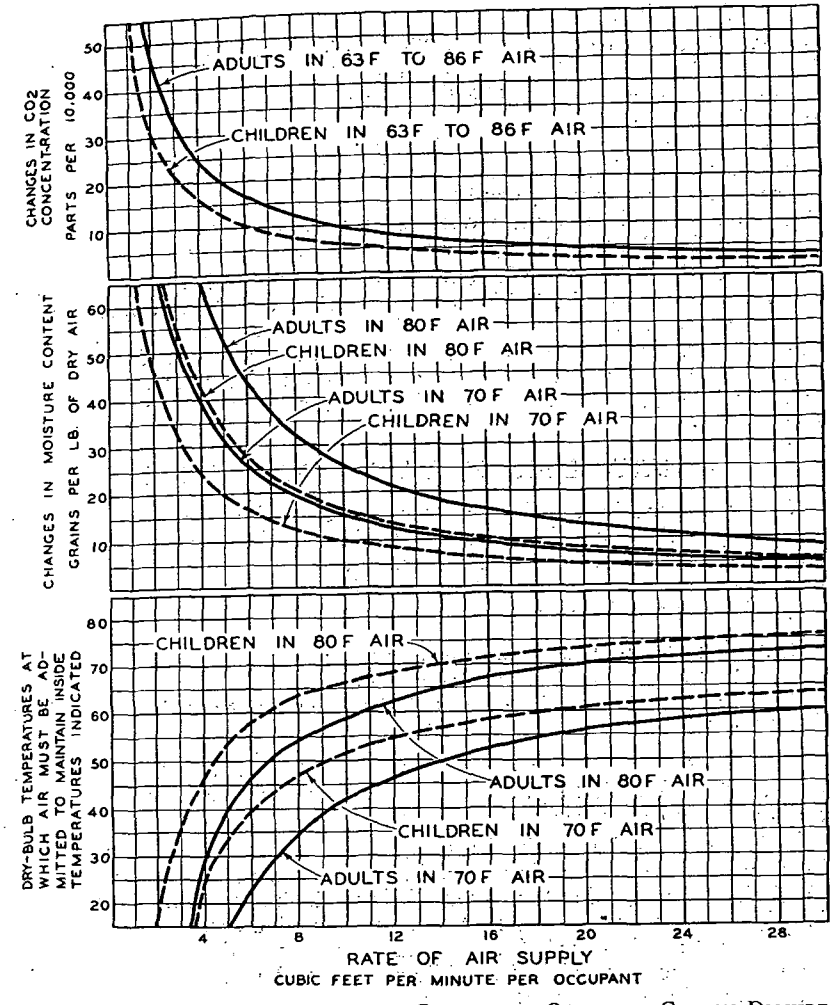

Fig. 4. Relation Among Rate of Air Change per Occupant, Carbon Dioxide Concentration and Moisture Content of Enclosure, and Dry-Bulb Temperature of Incoming Air

Two of the most important factors on which the *temperature rise* depends are (1) the method of distribution and (2) the most economical temperature rise for the conditions involved. Some systems of distri-