no permanent effects on blood and no effect on the general metabolism of human beings.

Ionization, on the other hand, seems to offer a fruitful field for research. Recent experiments[23] show that in occupied rooms there is a marked decrease in both positive and negative small ions. As shown in Fig. 4, the ionic content fell abruptly soon after the occupants assembled to a very low level which was maintained until the occupants left the room. Both positive and negative ions began to rise again as soon as the occupants departed. The problem now is to determine whether such alterations in the electrical quality of air have any significant bearing on com-

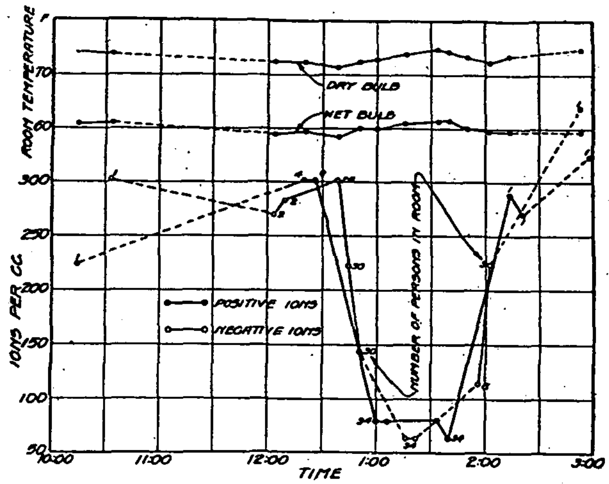

FIG. 4. INFLUENCE OF ROOM OCCUPANCY ON IONIC CONTENT[a]
(CUBICAL CONTENTS OF ROOM, 10,000 CU FT; NUMBER OF OCCUPANTS, 34)

[a] *Changes in Ionic Content in Occupied Rooms, Ventilated by Natural and Mechanical Methods*, by C. P. Yaglou, L. C. Benjamin and S. P. Choate (*Heating, Piping and Air Conditioning*, October, 1931).

fort and health. If this proves to be the case, some artificial source of ionization must be employed in occupied rooms.

HEAT AND MOISTURE GIVEN UP BY HUMAN BODY

In order to solve air conditioning problems involving the human body it is necessary to know the rate at which sensible and latent heat is given up by the body under various conditions of temperature and activity. Research at the A.S.H.V.E. Laboratory[24] has resulted in the data given in Figs. 5, 6, 7 and 8. Table 2 gives the metabolic rates for various degrees of activity.

[23] *Changes in Ionic Content in Occupied Rooms, Ventilated by Natural and Mechanical Methods*, by C. P. Yaglou, L. C. Benjamin and S. P. Choate (*Heating, Piping and Air Conditioning*, October, 1931).

[24] *Heat and Moisture Losses from Men at Work and Application to Air Conditioning Problems*, by F. C. Houghten, W. W. Teague, W. E. Miller and W. P. Yant (*Heating, Piping and Air Conditioning*, June, 1931).

The experimental data from which the curves were drawn indicates that total heat loss does not vary appreciably within the comfort zone range (see Fig. 5). Above or below this range the variation seems to be approximately a function of effective temperature. Sensible and latent heat losses (Figs. 6 and 8) on the other hand, vary greatly within the comfort zone range, the variation following more closely the dry-bulb temperature than any other factor.

Although total heat loss and sensible and latent heat losses are not

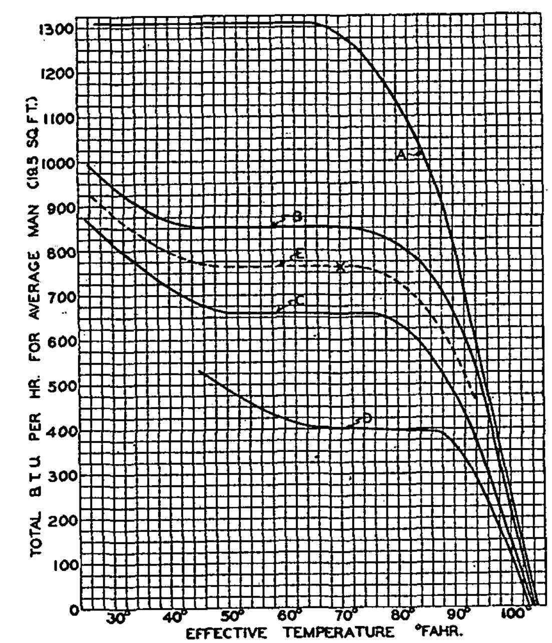

FIG. 5. RELATION BETWEEN TOTAL HEAT LOSS FROM THE HUMAN BODY AND EFFECTIVE TEMPERATURE FOR STILL AIR*

*Curve *A*—Men working, 66,160 ft-lb per hour. Curve *B*—Men working 33,075 ft-lb per hour. Curve *C*—Men working 16,538 ft-lb per hour. Curve *D*—Men seated at rest. Curves *A* and *C* drawn from data at an effective temperature of 70 deg only and extrapolating the relation between curves *B* and *D*, which were drawn from data at many temperatures.

exact functions of effective and dry-bulb temperature, respectively, for all conditions of humidity and air motion, they are plotted as such in the curves. This is accomplished by approximations not always rigidly accurate, but sufficiently so for application in most practical problems.

An atmospheric condition resulting in sensible perspiration is to be avoided for good air conditions. Tables 3 and 4 give the approximate effective temperatures at which perspiration is noticeable in different degrees by most individuals for 95 per cent and 20 per cent relative humidity.

In theaters, auditoriums, department stores and other crowded enclosures, the amount of heat and moisture given off by the people is so