AIR MOVEMENT DETERMINATIONS

Temperature, humidity and volume of air supply or exhaust do not appear to be the only determining factors of atmospheric comfort. Air movement is a vital factor in the prevention of stagnant areas and bodily discomfort. Where a determination of air movement is desirable the Kata thermometer, as developed by Dr. Leonard Hill, of England, may be used. (See Report of Committee on Standard Methods for Examination of Air, *American Public Health Association, American Journal of Public Health*, Vol. 7, No. 1, January, 1917. The wet Kata-thermometer gives the rate of cooling by radiation, convection and evaporation. The dry Kata-thermometer gives the rate of cooling by radiation and convection. The difference between the two is the rate of heat loss due solely to evaporation. Air movement is a consideration in the determination of the effective temperature.

Air movement may be approximately determined by observation of the movement of a smoke cloud and the use of a stop watch, the smoke cloud being formed by means of an ammonium cloud device, or by a smoke bomb. Carefully balanced gas balloons may also be used.

The synthetic air chart devised by Dr. E. Vernon Hill, and revised on the basis of investigations by the Society's Research Laboratory has been frequently used as a means of graphically recording the measurements of air conditions as found. This will be found fully described in Chapter XXXIV. (For original of this chart see also Ventilation Standards and the Synthetic Air Chart, TRANSACTIONS 1917, Vol. 23, pp. 607 to 628.)

The weighting given to the different factors for which provision is made therein may be subject to modification and to the experienced judgment of the Engineer. Obviously weightings of these factors as given for a school room may not do for an industrial plant, garages, etc.

As more becomes known about the physiologic effects and the threshold concentrations of various kinds of dusts, gases, bacteria, and odors, it may be able to more definitely determine the characteristics of such a chart as may be more generally useful and acceptable.

PHYSIOLOGICAL EFFECTS OF VENTILATION[1]

THE atmospheric condition of space for human occupancy should be based upon the relation and effect of the various factors entering into the well being of the individual as regards his physiological reaction, feeling of comfort, psychological reaction, and morale. A person's well being may be positively improved, unaffected, or positively harmed by the condition of the air with which he is surrounded. Whether satisfactory ventilation demands only a condition which is not positively harmful or whether it demands a condition which is positively beneficial depends upon one's point of view.

To the public health official charged with inspection of sanitary conditions in industrial plants it is usually sufficient that the condition of the air be not a positive menace to the health of workers. To the efficiency expert and to the engineer in charge of designing equipment for conditioning air for schools and audience halls, it is desirable to produce a condition which is positively beneficial to comfort, health, and morale. To the management of places of amusement it is decidedly advantageous to produce a condition of maximum comfort. This difference in point of view is no doubt responsible for much of the difference of opinion in regard to proper atmospheric conditions.

[1]Prepared by F. C. Houghten.

The factors which may affect a person's health, comfort, or well being are: (1) temperature, (2) humidity, (3) motion of the air, (4) dustiness, (5) bacteria content, (6) odors present, (7) other injurious substances.

The first three factors taken together determine a person's feeling of warmth and influence elimination of body heat. As such, they are the three most important factors in the physiological effects of the surrounding atmosphere. Besides their combined effect on heat elimination from the body and one's sense of warmth, moisture content and motion of the air may otherwise affect a person's well being.

Dust, bacteria, and odors may be of less importance when compared with the combined effect of temperature, humidity, and air motion but they are nevertheless important factors, and must be given consideration.

HOW TEMPERATURE, HUMIDITY, AND AIR MOTION AFFECT HUMAN COMFORT

A person's feeling of warmth is not due alone to the temperature of the surrounding air as registered by a dry bulb thermometer; neither does it depend solely upon the temperature indicated by a wet bulb thermometer. Dry air at a relatively high temperature may feel cooler than air of considerably lower temperature with a high moisture content.

Air motion makes any moderate condition feel cooler.

Human comfort or discomfort, as regards feeling of warmth, depends largely upon the body temperature, and, therefore, upon the relation between the rate of production and dissipation of heat. By the process of metabolism heat is constantly generated within the body, which heat must be eliminated from the surface of the body and the respiratory tract by radiation, convection and evaporation. To maintain a constant body temperature the heat loss must equal the heat produced. It is, therefore, apparent that any interference with the elimination of heat from the body is accompanied by a rise in temperature and a feeling of discomfort.

There are three principal factors affecting loss of body heat: (1) temperature, (2) humidity, (3) air motion.

As the temperature of the air and surrounding objects rises, the loss of heat by convection and radiation decreases. When the air temperature reaches that of the body, the loss by radiation and convection ceases. Finally as the air temperature exceeds that of the body, heat is transferred from the air to the body.

As the temperature of the air rises and heat loss by radiation and convection decreases, the body endeavors to maintain temperature equilibrium by making available more perspiration and a resulting greater heat loss by evaporation.

From the above, it is concluded that there must necessarily exist certain