It is a familiar fact that a room may be comfortable at one temperature and yet decidedly uncomfortable at another time at the same dry bulb temperature. This fact may be due either to a change of relative humidity or to air motion. On the other hand a room may feel equally comfortable with different dry bulb temperatures provided the relative humidity or air motion is varied to produce this effect, Other factors enter into this problem, such as changes of clothing (seasonal or otherwise), acclimatization, degree of activity, etc.

The prolonged effect of temperature, humidity and air motion upon health is not so well understood as their effect upon comfort. Strictly speaking good ventilation is merely a relative term, but today ventilation is considered necessary for personal comfort and for good health. These reactions are further discussed under Physiological Effects of Ventilation in this Chapter.

TESTING METHODS AND APPARATA

Temperatures

In the measuring of room temperatures care must be exercised to prevent the results from being affected, by the body heat of the observer, by drafts from doors, windows and other openings or by radiant heat from some local source such as a radiator, a wall, etc. All thermometers should be mercury thermometers with engraved stems. The total graduations of the thermometers should be from 20 to 120 deg. fahr., in one degree graduations. No ten degrees should occupy a space of less than ½ in. The accuracy throughout the whole scale must be within one-half degree. The operator should take hold of the top and no part of the body, including the hand, should be nearer than 10 in. to the bulb. The thermometer should not be closer than 5 ft. to any door, window, or other opening; should not be closer than 12 in. to any wall, and should be between 4 and 6 ft. from the floor. A sling instrument should be used for extreme accuracy.

For measuring duct temperatures an angle duct thermometer should be used, having a flange to bolt on the side of the duct, with the bolt extending into the duct at least 6 in.

Recording thermometers, generally have considerable lag and should not be used for the taking of temperatures for testing, but rather for giving continuous records of the operation of the plant, as the charts will indicate any lack of attention on the part of those responsible for the operation of the plant.

Humidity

The sling psychrometer is the recognized standard instrument for determining humidities. In order to obtain accurate readings considerable skill is required on the part of the operator. The wicking must be clean, distilled water should be used, and the temperature of the water should be slightly above the wet bulb temperature of the surrounding air.

The psychrometer should be swung rapidly and two or three observations should be made to see that the wet bulb temperature has gotten to a point where it is stationary before the final reading is noted. Errors

in reading wet and dry bulb thermometers are usually because of not obtaining a complete depression of the wet bulb temperature.

The standard dry and wet bulb tables giving the relative humidity should be used with sling psychrometer readings.

In taking humidity readings in ducts it is practically impossible to use a sling psychrometer. For this work the stationary hygrodeik arranged for bolting on to the side of the ducts, with two bolts extending into the ducts, will be found very convenient. Due to the velocity of the air passing over the bolts within the ducts an accurate reading will be secured, corresponding to those given by the sling psychrometer.

CO_2 Determinations

The amount of carbon dioxide in the air, while not a harmful element, is a convenient index of the rate of air supply, or of the frequency of air change in an occupied room, and of the distribution of the air within large rooms. A high carbon dioxide value indicates air stagnation and liability to stale odors and overheating.

The Peterson-Palmquist apparatus has been generally accepted as the standard device for the determination of carbon dioxide in air investigations. The principle involved is the measurement of a given volume of air, the absorption of the contained carbon dioxide in a caustic potash solution, and the re-measurement of the volume of air at the original pressure in a finely graduated capillary tube, the difference in volume representing the absorbed carbon dioxide. See Report of Committee on Standard Methods for Examination of Air, *American Public Health Association*, Vol. 7, No. 1 *American Journal of Public Health*, Jan., 1917.)

Where field conditions are such that this apparatus may not be conveniently used, as in street cars, the laboratory method is recommended.

Dust

Atmospheric dust becomes of great importance in certain industrial processes, and if the dust be siliceous in nature the hazard to health may be very serious.

The Hill Dust Counter is a simple device with which to measure the number of very large particles of dust in the air, while more exact studies of dust may be made with the Konimeter, or with the Impinger. (See Public Health Bulletin No. 144, 1925, U. S. Public Health Service.)

Bacteria

The number of bacteria which are attached to heavy particles of dust or drops of moisture may be determined by the number of colonies that develop on a culture plate which has been exposed for two minutes. A standard 4 in. Petrie dish, with agar-agar for a media, is used for this purpose. The plates are incubated from 24 to 48 hours at a temperature of 98 deg. fahr. At the end of this time the separate colonies have developed to a size which are easily counted. If an incubator is not available, cultures may be grown at room temperatures (70 deg.) for a period of five days.

The number of bacteria actually present in the air may be determined by the use of the Wallace and Tiernan Sampling Pump or the Impinger, with subsequent plating.