air, the absorption of the contained carbon dioxide in a caustic potash solution, and the remeasurement 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, air samples may be collected in prepared bottles having rubber stoppers, and these may be subjected to laboratory analysis.

Dust

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 F. 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 F) for a period of five days.

Volumetric Air Measurements

Volumetric air measurements must be made with skill and precision and great care must be exercised in securing the right conditions under which such measurements are made. There are two general methods in use for measuring air volumes, the first, by means of an anemometer, and the second, by means of a Pitot tube.

Anemometers and Pitot Tubes

When it is necessary to employ an anemometer for measuring air volume, the instrument must have been recently calibrated, and the greatest care must be exercised in methods of manipulation. The influence of obstructions at the register face, the distance from the register at which the anemometer is held and the great variation in velocities which exists over the area of most air discharge openings all combine to make an exact quantitative measurement of air by an anemometer a difficult matter.

For a further discussion of the measurement of air flow by means of the anemometer and Pitot tube, see Chapter 32.

Air Movement Determinations

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 Chapter 32).

Air movement may be determined approximately 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 chloride cloud device, or by a smoke bomb. Carefully balanced gas balloons may also be used.

WATER

Composition of Water. Water is a chemical compound (H_2O) formed by the union of two volumes of hydrogen and one volume of oxygen, or two parts by weight of hydrogen and sixteen parts by weight of oxygen.

Density of Water. Water is at its greatest density at 39.2 F, and it expands when heated or cooled from this temperature. At 62 F a U. S. gallon of 231 cu in. of water weighs approximately 8⅓ lb, and a cubic foot of water is equal to 7.48 gal. The specific volume of water depends on the temperature and it is always the reciprocal of its specific density. (See Table 3).

Water Pressures. Pressures are often stated in feet or inches of water column. At 62 F, with h equal to the head in feet, the pressure of a column of water is $62.355h$ lb per square foot, or $0.433h$ lb per square inch. A column of water 2.309 ft (27.71 in.) high exerts a pressure of one pound per square inch at 62 F.

Boiling Point of Water. The boiling point of water varies with the pressure; it is lower at higher altitudes. A change in pressure will always be accompanied by a change in the boiling point, and there will be a corresponding change in the latent heat of evaporation.

Specific Heat. The specific heat of water, or the amount of heat (Btu) required to raise the temperature of one pound of water one degree Fahrenheit, varies with the temperature, but it is commonly assumed to be unity at all temperatures. Steam tables are based on exact values, however. The specific heat of ice at 32 F is 0.463 Btu per pound. The amount of heat required to raise one pound of water at 32 F through a known temperature interval depends on the average specific heat for the temperature range.

Sensible and Latent Heat. The heat necessary to raise the temperature of one pound of water from 32 F to the boiling point is known as the *heat of the liquid or sensible heat.* When more heat is added, the water begins to evaporate and expand at constant temperature until the water is entirely changed into steam. The heat thus added is known as the *latent heat of evaporation.*

STEAM

Steam is water vapor which exists in the vaporous condition because sufficient heat has been added to the water to supply the latent heat of evaporation and change the liquid into vapor. This change in state takes place at a definite and constant temperature which is determined solely by the pressure of the steam. The volume of a pound of steam is known as the specific volume and it decreases as the pressure increases. The reciprocal of this, or the weight of steam per cubic foot, is known as the density. (See Table 4).

Steam which is in contact with the water from which it was generated is