for wetting it must be clean, and the temperature of the water should preferably be slightly above the wet-bulb temperature. An air stream velocity of 900 fpm is recommended, although higher velocities will result in greater accuracy [32]. This velocity is obtained with the sling psychrometer by whirling it rapidly, followed by reading the wet-bulb thermometer quickly before its indication changes. Owing to the human element involved in this method, more accurate results are obtained with types of psychrometers in which air is drawn over the thermometers by a fan, or by a bulb operated aspirator. In ducts, the air flow itself gives the proper evaporating conditions. Several observations should be made until the minimum temperature is reached. Relative humidity may be obtained from tables or psychrometric charts [33]. Although it is common practice to use the charts which are based on a barometric pressure of 29.92 in. Hg, a correction for barometric pressure is necessary for extreme accuracy. This correction is made by multiplying the relative humidity as determined from the chart by the ratio of the observed barometric pressure and the standard barometric pressure.

For temperatures below 32 F, the water on the wick is allowed to freeze, during which time the temperature will drop below the true wet-bulb. A thin film of ice is more desirable than a thick one, and it is satisfactory to remove the wick and freeze a thin film directly on the bulb. Care must be taken to read the temperatures accurately due to the slight wet-bulb depressions. Tables for ice conditions must be used [34].

Dew-point apparatus for humidity measurements consists of a polished plated container cooled by the evaporation of a volatile liquid within. The temperature at which the first slight water vapor forms on the polished surface is the dew-point. If the temperature is below 32 F, the deposit will appear as frost. Another method of determining humidity is by chemical means in which the water vapor is removed by a drying agent and weighed on a chemical balance. A thermal conductivity method is available for temperatures above 212 F or for extremely low humidities [35].

DUST DETERMINATION

The measurement of dust is complicated by the many kinds involved. Some of the collecting methods are impingement on viscous surfaces, impingement at high velocity under water, collection on porous crucibles or filter paper through which air passes, and electric precipitation. Determination may be by direct weighing of samples or by microscopic counting. A commonly used method employs the Smith-Greenburg impinger which collects samples in water or alcohol and in which particles are counted under a microscope in various cells such as the Hatch or Dunn cells. Another method employs the Lewis [36] sampling tube with the analytical determination of the increase in weight of a porous crucible. All reports should state the method of sampling and counting. The A.S.H.V.E. Code for Testing and Rating Air Cleaning Devices Used in General Ventilation Work specifies the porous crucible method [37].

HEAT TRANSFER THROUGH BUILDING MATERIALS

The A.S.H.V.E. Standard Test Code for Heat Transmission Through Walls [38] describes the construction and use of the guarded hot box for determining over-all heat transmission coefficients of built-up sections including surface resistances. This apparatus consists of inner and outer insulated boxes, each having one open side which is sealed tightly against

the wall specimen to be tested. The outer box serves as a guard and a zero temperature difference is maintained between the inner box and the air space separating it from the outer box. Electric heaters are provided to maintain any desired temperature within the boxes while at the same time the outer surface of the wall specimen is subjected to a low temperature. A common method of applying this low temperature is to fit the specimen into an opening in the wall of a refrigerated room. The air temperature difference between the two sides of the specimen, and the rate of heat input to the guarded hot box are measured, from which data an over-all heat flow coefficient can be calculated.

The Nicholls heat meter is very useful for determining the heat flow through walls of buildings [39]. This apparatus consists of a guarded plate on both sides of which are mounted a series of thermocouples. The plate is calibrated so that the rate of heat flow through it can be determined by observing the temperature difference between the two surfaces. In use, the meter is clamped tightly against the surface of the wall in question, and readings of heat flow of accuracy sufficient for many test purposes may be obtained.

In June 1942, the A.S.H.V.E. adopted a standard test procedure for determining the conductivity of materials by use of the guarded hot plate [40]. This method is adapted to homogeneous materials, and conductivities obtained do not include surface coefficients. The method involved is one in which two identical samples are arranged one on each side of a heated plate having a guard and a central test section. The resulting sandwich is placed between cold plates. In operation the same temperature is maintained in the guard section and test section of the heated plate and a lower temperature is maintained in each of the cold plates from a common source of cold water. Thermal conductivity is determined by measuring the amount of heat supplied to the center or guarded portion of the hot plate, the temperatures at the hot and cold surfaces and the thickness of the specimen. The apparatus requires careful, precise construction and its operation requires care and skill. The actual design of basic types of hot plates is described in an *A.S.T.M.* publication [41].

MEASUREMENT OF HEAT EXCHANGE FOR COMFORT CONDITIONS

Several instruments have been devised to measure the effect of various factors as they relate to the comfort of the body [42]. The principal ones are the Kata-thermometer, Dufton's eupatheoscope, Vernon's globe thermometer, Winslow and Greenburg's thermo-integrator, and Yaglou's heated globe [43, 44]. These instruments were designed to obtain a quantitative measurement of the thermal exchange between the human body and its environment.

COMBUSTION ANALYSIS

The analysis of flue gases to determine completeness and efficiency of combustion is usually made chemically with an Orsat apparatus. This consists of a measuring burette, a leveling bottle, and three pipettes. Carbon dioxide is absorbed in the first pipette by potassium hydroxide, oxygen in the second by potassium pyrogallate, and carbon monoxide in the third by cuprous chloride. A known volume of gas is drawn in, and