and C and active sweating is not required. The sharp rise in heat escape by evaporation above this point reflects the onset of active sweating, which is called for because R and C no longer compensate for M. Below 80° F. storage is negative and the magnitude of heat depletion increases as the environment becomes progressively cooler. In contrast, heat storage does not increase significantly above zero in warm environments, owing to the beneficial effects of sweating and evaporation. For the resting man in light clothing, environmental temperatures of 80 to 85° F. are thus seen to constitute a zone of thermal neutrality where conditions are not too hot or too cold. The individual has to exert no special effort (such as shivering or sweating) to maintain thermal balance. In this zone the loss of heat from the body is distributed approximately as follows: evapora-

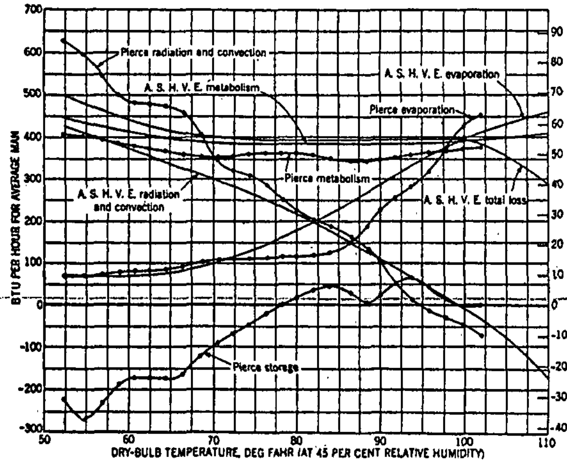

Figure 1. Relation between metabolism, storage, evaporation, radiation plus convection and temperature for the clothed subject. (Reprinted by permission from *Heating, Ventilating Air Conditioning Guide 1957*, Chapter 6.)

tion, 20 per cent; radiation, 40 per cent; convection, 40 per cent. For a little distance on either side of the neutral point there exists a zone of *vasomotor* regulation against heat and cold within which blood flow to the surface is automatically adjusted to promote heat flow from deep-body tissues or to conserve body heat. Below this region is the zone of *metabolic regulation* against cold. Above it lies the zone of *evaporative regulation* against heat, which, up to the point of 100 per cent wetted surface, is adequate to offset the heat load (M + $R + C$). In this zone, moisture content of the air is most important.

A. EFFECTIVE TEMPERATURE SCALE AND COMFORT ZONE

The four environmental factors are independently variable and may be combined in many different ways to produce the same thermal effect on man.

Thus, an increase in air velocity will offset a rise in air temperature. Extreme radiant heat can be compensated by lowering the air temperature. A considerable elevation in air temperature can be tolerated if the relative humidity is low. Combinations of thermal conditions that induce the same thermal sensations are

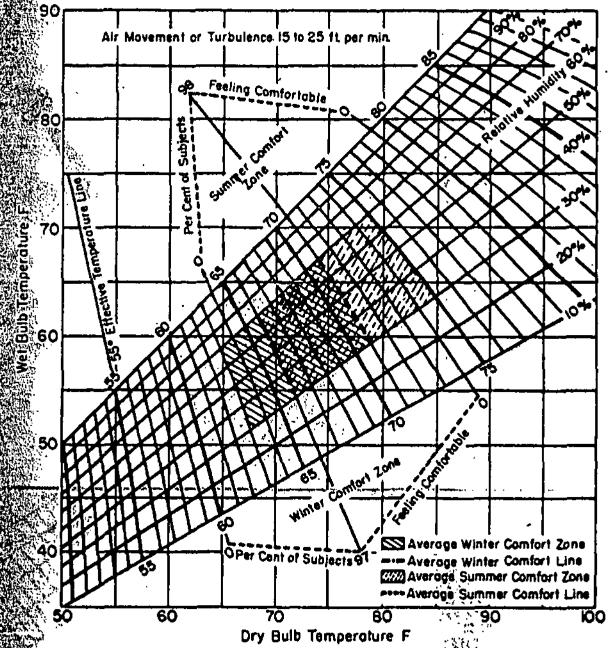

Figure 2. Comfort chart for still air. Both summer and winter comfort zones apply to the inhabitants of the United States only. Application of winter comfort line is further limited to rooms heated by central station systems of the convection type; the line does not apply to rooms heated by radiant methods. Application of summer comfort line is limited to homes, offices and the like, where occupants become fully adapted to the artificial air conditions; the line does not apply to theaters, department stores, and the like, where the exposure is less than 3 hours. The optimum summer comfort line shown pertains to the northern portion of the United States and southern Canada, and elevations not in excess of 1000 feet above sea level. An increase of one degree in effective temperature should be made approximately per five degrees reduction in north latitude. (Reprinted by permission from *Transactions ASHVE*, Vol. 38, 1932, Report No. 933.)

called thermoequivalent conditions. The Effective Temperature charts of the American Society of Heating and Air-Conditioning Engineers, shown in Figures 2, 3, and 4, give the combinations of equivalent conditions for clothed sedentary individuals and for workers stripped to the waist. According to the ET scale, any combinations of dry-bulb temperature, wet-bulb temperature, and air velocity