the analogy of electrical resistance-capacitance networks to thermal systems.[24]

For two dimensional problems in steady state conduction, additional techniques of solution are found in flux plotting,[5,19] and in the use of a potential tank.[5,19] These methods are of most direct use in problems in which the boundaries of the two dimensional shape are made up of isothermal and adiabatic surfaces.

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CHAPTER 6
PHYSIOLOGICAL PRINCIPLES

Chemical Vitiation of Air, Physical Impurities in Air, Thermal Interchanges Between the Body and Its Environment, High Temperature Hazards, Acclimatization, Upper Limits of Heat for Men at Work, Application of Physiologic Principles to Air Conditioning Problems, Effective Temperature Index and Comfort Zones

VENTILATION is defined in part as *the process of supplying air to, or removing air from, any space by natural or mechanical means.* The word in itself implies quantity, but air must be of the proper quality also. The term *air conditioning* in its broadest sense implies control of any or all of the physical or chemical qualities of the air. The A.S.H.V.E. Code of Minimum Requirements for Comfort Air Conditioning[1] defines it "as the process by which simultaneously the temperature, moisture content, movement and quality of the air in enclosed spaces intended for human occupancy may be maintained within required limits. If an installation cannot perform all of these functions, it shall be designated by a name that describes only the function or functions performed."

CHEMICAL VITIATION OF AIR

People living indoors bring about certain physical and chemical changes in the air about them. The oxygen content of the air diminishes and the carbon dioxide increases, but these changes are too slight to be significant except in air tight spaces as in submarines. Organic matter which is usually perceived as odors, comes from the body or clothes. Moisture and heat are given off by the body. There is no evidence of any toxic volatile material given off by man to the ambient air. Stale air may be offensive because of odors and may induce loss of appetite and loss of energy. Objectionable body odors have the same effects. These reasons, whether esthetic or physiological, usually make it desirable in the design of air conditioning systems to provide for the elimination or control of odors arising from occupancy, cooking, or other sources. This may be accomplished by introducing odor-free air in sufficient quantities to reduce odor concentrations by dilution to a level which is not objectionable. Odor-free air may be outdoor air or air which has been cleared of odors by sorption, washing, or other appropriate means.

In the case of vitiation by a few hazardous gases such as carbon monoxide from heating, cooking, and certain industrial processes, no satisfactory chemical treatment for the elimination of the impurity has been found. The only satisfactory solution is elimination at the source by local exhaust ventilation; or, if this is impossible, reduction to a safe concentration by dilution. (See Chapter 8.) In the case of contamination by other matter, including volatile vapors and gases, chemical treatment for the removal or reduction of the impurities has been made available through air cleaning methods, which are discussed in Chapter 34.

When the only source of contamination is the human occupant, and overheating is not a problem, the minimum quantity of outdoor air needed appears to be that required to remove objectionable body odors, or tobacco smoke. The concentration of body odor in a room, in turn, depends