Heat Loss Studies in Four Identical Buildings to Determine the Effect of Insulation, by D. B. Anderson (A.S.H.V.E. TRANSACTIONS, Vol. 48, 1942, p. 471).

Simultaneous Heat and Vapor Transfer Characteristics of an Insulating Material, by F. G. Hechler, E. R. McLaughlin and E. R. Queer (A.S.H.V.E. TRANSACTIONS, Vol. 48, 1942, p. 505).

Comparative Resistance to Vapor Transmission of Various Building Materials, by L. V. Teesdale (A.S.H.V.E. TRANSACTIONS, Vol. 49, 1943, p. 124).

The Diffusion of Water Vapor Through Various Building Materials, by J. D. Babbitt (*Canadian Journal of Research*, Vol. 17, February, 1939, p. 15).

Effect of Ceiling Insulation upon Summer Comfort, by T. D. Phillips (*National Bureau of Standards*, Report BMS52, July 1, 1940).

Moisture Condensation in Building Walls, by H. W. Wooley (*National Bureau of Standards*, Report BMS63, December 14, 1940).

Heat Transmission Through Building Materials, by F. B. Rowley and A. B. Algren, (University of Minnesota *Engineering Experiment Station Bulletin* No. 8).

Building Insulation, by P. D. Close (*American Technical Society*, Chicago, 1945).

CHAPTER 7

Heat Transfer Surface Coils

Construction and Arrangement, Steam Coils, Water Coils, Direct-Expansion Coils, Flow Arrangement, Applications, Heat Transfer and Air Flow Resistance, Performance of Heating, Dry Cooling and Dehumidifying Coils, Coil Selection

THE coils described in this chapter are for heating or cooling an air stream under forced convection. Surface coil equipment may be made up of a number of banks assembled in the field, or the entire assembly may be factory constructed. The applications of each type of coil are limited to the field within which it is rated. Other limitations are imposed by code regulations, by proper choice of materials for the fluids used and the condition of the air handled, or by an economic analysis of the possible alternates on each installation.

For heating service, coils are used as preheaters, reheaters or booster heaters. The function of the coils is air heating only, but the apparatus assembly may include means for humidification and air cleaning. Steam or hot water are the usual heating media, although others are used in special cases, such as reheating by means of discharge gas from a refrigerating system.

Coils are used for air cooling with or without accompanying dehumidification. Examples of cooling applications without dehumidification are precooling coils using well water or other relatively high temperature water to reduce the load on the refrigerating machinery, or water cooled coils to remove sensible heat in connection with chemical moisture-absorption apparatus. By proper coil selection it is possible to handle both sensible cooling and dehumidification together as explained later. The assembly usually includes an air cleaning means to protect the coil from accumulation of dirt and to keep dust and foreign matter out of the conditioned space. Although cooling and dehumidification are the usual functions, there are cases of cooling coils purposely wetted to aid in air cleaning and odor absorption.

The usual cooling media used in surface coils are cold water or Group I (*ASA* Classification) refrigerants, but others are used in special cases. Brines are seldom required for the range of applications covered by this chapter, although there are cases where low entering air temperatures with large latent heat loads require a refrigerant temperature so low that water becomes impractical. Sometimes, also, brine from an industrial system already installed is the only convenient source of refrigeration.

For combined cooling and dehumidifying, surface coils present an alternate to spray dehumidifiers. For many applications it is possible, by proper selection of apparatus, choice of air velocities, refrigerant temperatures, etc., to perform the same duty with either. In a few cases both sprays and coils are used. The coils may then be installed within the spray chamber, either in series with the sprays or below them. In making the selection between spray and surface dehumidifiers, certain advantages of each should be considered. The fact that a spray dehumidifier is usually designed to deliver nearly saturated air tends to simplify the control problem. In this case the dry-bulb temperature is also the dew-point, and hence a dew-point control can be arranged by using a