

Electric Analogger Studies on Panels with Imbedded Tubes, by Carl F. Kayan (ASHVE TRANSACTIONS, Vol. 56, 1950, p. 205).

ASHVE RESEARCH REPORT No. 1345—Ground Temperature Distribution with a Floor Panel Heating System, By A. B. Algren (ASHVE TRANSACTIONS, Vol. 54, 1948, p. 321).

ASHVE RESEARCH REPORT No. 1407—Losses from a Floor-Type Panel Heating System, by F. W. Hutchinson, D. L. Mills and L. J. LaTart (ASHVE TRANSACTIONS, Vol. 57, 1951, p. 37).

ASHVE RESEARCH REPORT No. 1418—Field Studies of Heat Losses from Concrete Floor Panels, by C. M. Humphreys, C. V. Franks and L. F. Schutrum (ASHVE TRANSACTIONS, Vol. 57, 1951, p. 221).

Losses from Heated Floors, by N. S. Billington (*Journal of the Institution of Heating and Ventilating Engineers*, June, 1953).

ASHAE REPORT No. 1498—Heat Flow Characteristics of Hot Water Floor Panels, by E. L. Sartain and W. S. Harris (ASHAE TRANSACTIONS, Vol. 60, 1954, p. 103).

ASHVE RESEARCH REPORT No. 1213—Heat Loss Through Basement Walls and Floors, by F. C. Houghton, S. I. Taimuty, Carl Gutberlet and C. J. Brown (ASHVE TRANSACTIONS, Vol. 48, 1942, p. 369).

Measurements of Heat Losses from Slab Floor, by R. S. Dill, W. C. Robinson and H. E. Robinson (*National Bureau of Standards, Building Materials and Structures Report BMS 103*).

Temperature and Heat Loss Characteristics of Concrete Floors Laid on Ground, by H. A. Bareither, A. N. Fleming and B. E. Alberty (*American Artisan*, Vol. 87, No. 3, March, 1950).

Heat Loss Through Solid Ground Floors, by N. S. Billington (*Journal of the Institution of Heating and Ventilating Engineers*, November, 1951).

ASHVE RESEARCH REPORT No. 1449—Warm-Air Perimeter Heating—Heat Losses from Floor Slab—Part III, by J. R. Jamieson, R. W. Roose and S. Konzo (ASHVE TRANSACTIONS, Vol. 53, 1952, p. 217).

Estimating the Heat Loss from Slab Floors and Basements by M. Baker, J. M. O'Byrne, and A. M. Levy (*Heating, Piping and Air Conditioning*, November 1952).

Experiments with Intermittently Operated Floor Panels, by N. S. Billington and E. W. Shaw (*Journal of the Institution of Heating and Ventilating Engineers*, June, 1952).

Heat Loss Through Solid Ground Floors—II, by N. S. Billington (*Journal of the Institution of Heating and Ventilating Engineers*, November, 1952).

Effect of Edge Insulation Upon Temperature and Condensation on Concrete Slab Floors, by H. R. Martin, P. R. Achenbach and R. S. Dill (*National Bureau of Standards, Building Materials and Structures Report No. 138*, October 1953).

Measurement of Angular Emissivity, by Aydin Umur, G. V. Parmelee, and L. F. Schutrum (ASHAE TRANSACTIONS, Vol. 61, 1955, p. 111).

ASHVE RESEARCH REPORT No. 1426—Laboratory Studies of the Thermal Characteristics of Plaster Panels, by C. M. Humphreys, C. V. Franks, and L. F. Schutrum (ASHVE TRANSACTIONS, Vol. 57, 1951, p. 363).

ASHVE RESEARCH REPORT No. 1491—Further studies of the Thermal Characteristics of Plaster Panels, by L. F. Schutrum, C. M. Humphreys (ASHVE TRANSACTIONS, Vol. 59, 1953, p. 511).

ASHVE RESEARCH REPORT No. 1492—Heat Flow Analysis in Panel Heating or Cooling Sections, Case II—Floor Slab on Earth with Uniformly Spaced Pipes or Tubes at the Slab-Earth Interface, by H. B. Nottage, C. V. Franks, L. E. Hulbert, and L. F. Schutrum (ASHVE TRANSACTIONS, Vol. 59, 1953, p. 527).

ASHVE RESEARCH REPORT No. 1387—Laboratory Studies on Heat Flow Within a Concrete Panel, By C. M. Humphreys, H. B. Nottage, C. V. Franks, R. G. Huebscher, L. F. Schutrum and D. W. Locklin (ASHVE TRANSACTIONS, Vol. 56, 1950, p. 175).

Cold Wall Effects in a Ceiling-Panel-Heated Room, by L. F. Schutrum and T. C. Min (ASHAE JOURNAL SECTION, *Heating, Piping and Air Conditioning*, Aug. 1956, p. 125).

CHAPTER 24

UNIT HEATERS AND UNIT VENTILATORS

Definitions; Unit Heaters: Classification, Application, Ratings, Location, Space Temperatures, Control, Piping, Maintenance, Boiler Capacity; Unit Ventilators: Ratings, Capacity Requirements, Application, Selection, Control, Location, Exhaust Flues; Window Ventilators

THE generally accepted meaning of the word *unit* in the terms unit heaters, unit ventilators, and unit humidifiers, is that of a factory-made encased assembly of the functional elements indicated by its name.

The term *unit heater* denotes an assembly of elements, the principal function of which is heating. The essential elements of a unit heater are a fan and motor, a heating element, a housing, and outlet vanes or diffusers. Some types are shown in Figs. 1 to 4.

The term *unit ventilator* denotes an assembly, the principal function of which is to ventilate and cool the space by the introduction of outdoor air. It may serve to heat and circulate the air within the space, or introduce air from outdoors, or may accomplish both in varying proportions. The essential elements of a unit ventilator are fans and motor, heating element, dampers, and outlet grilles or diffusers, all encased in a housing.

UNIT HEATERS

Classification

The various types of unit heaters which are at present available can usually be classified according to one of the three following methods:

1. *By type of heater.* Under this classification there are three types of heating elements to be considered: (a) the *steam or hot water type*, (b) the *electric type*, and (c) the *direct fired type* which may be *gas*, *oil*, or *coal fired*.

2. *By type of fan.* Under this classification there are two types of fans to be considered: (a) the *propeller type* and (b) the *centrifugal type*. Either type may be arranged for horizontal or vertical delivery of air.

3. *By arrangement of elements.* Under this classification there are two types of heaters to be considered: (a) the *draw-through type*, in which the fan draws air through, and (b) the *blow-through type*, in which the fan blows air through the heater.

Unit heaters are available in any combination of the three preceding general classifications. For example, the steam or hot water type may be secured with either the propeller or centrifugal type of fans, and in either the draw-through or blow-through type.

Unit heaters also vary in other minor respects. For example, steam and return inlets and outlets may be located on top and bottom, respectively, or on the same side of the unit. Some units are supported by the piping and some have independent supports. The heating surface of steam or water type units is generally made up of a non-ferrous tube-and-fin assembly; or it may be fabricated of steel, or cast in steel or iron.