30 ft to as much as 200 ft from the unit. This makes possible the location of these units at considerable distances from each other, thus reducing greatly the piping and loss of floor space due to the heating equipment. Propeller-type units, illustrated in Fig. 1, with outlet velocities of from 300 to 1000 fpm are usually placed from 30 up to 100 ft apart.

Two methods of application of unit heaters are commonly used. Floor mounted units, shown in Fig. 2 are available either with or without the air by-pass, and withdraw the cold air from the floor and discharge the heated air above the working zone. Suspended type units are located in an elevated position withdrawing air from this higher level and discharging the heated air down into the working zone. In closely occupied spaces where direct air drafts into the working zone are not permitted,

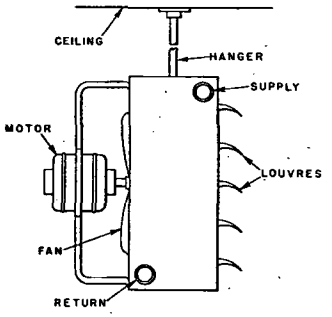

FIG. 1. SUSPENDED UNIT HEATER, PROPELLER TYPE FAN

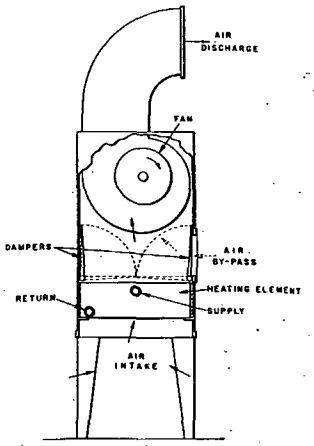

FIG. 2. FLOOR MOUNTED UNIT HEATER, HOUSED TYPE FAN

the floor mounted unit will give more uniform temperature distribution. On the other hand, if opportunity is provided to deliver the heated air from suspended units down into the working zone, excellent temperature distribution is possible. A suspended high-velocity type unit heater connected to an outside air intake with damper to control the volume of ventilation is shown in Fig. 3. A code[4] governing the number of sizes of propeller type unit heaters offered for sale by a manufacturer, as well as a standard method of specifying outlet air velocities has been adopted.

A wide variety of structural designs is available. All employ some form of convector, supplied with either steam or hot water, although occasionally equipped for gas or electric heat. Air is always forced over these convectors by a fan of either the propeller or centrifugal type. Heating surfaces may be in the form of steel pipe coils, non-ferrous tubes or pipes with extended surfaces, cast-iron, and pressed or built-up sections of the cartridge or automotive type.

[4]Standards for Propeller Type Unit Heaters prepared and adopted by the *Industrial Unit Heater Association*, June, 1938.

AIR TEMPERATURES[5]

For recirculating heaters with intakes at the floor level, the temperature to be maintained in the room should be considered as the temperature of the air entering the heater. Where outside air is introduced, the temperature of the mixture must be calculated and used as the entering air temperature to the heater. Where suspended heaters are used without any intake boxes extending down to the floor level, a higher entering air temperature should be used than that at which the room is to be maintained.

With suspended unit heaters taking air at some distance above the floor, the temperature variation from floor to ceiling may reach as much as 1 deg for each foot of elevation during the periods when the maximum capacity of the heaters is required. Thus this allowance should be made in calculating the capacity of suspended heaters. High velocity discharge

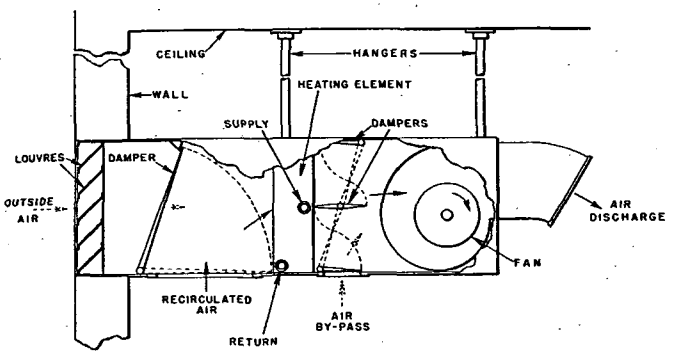

FIG. 3. SUSPENDED TYPE UNIT HEATER, HOUSED TYPE FAN

units (blower type) will maintain slightly lower temperature differences than will low velocity units (propeller type). Unit heaters taking in recirculated air at the floor level should maintain temperature differentials of less than 0.5 deg per foot of elevation when the maximum capacity of the heaters is required. This temperature difference per foot of elevation is less than the corresponding variations for spaces heated by direct radiation.

OUTPUT OF HEATERS

It is standard practice to rate unit heaters in Btu per hour at a given temperature of air entering the heater and at a given steam pressure maintained in the coil. Steam at 2 lb pressure and air entering at 60 F are used as the standard basis of rating[6]. The capacity of a heater increases as the steam pressure increases, and decreases as the entering air temperature

[5]A.S.H.V.E. RESEARCH REPORT No. 958—Temperature Gradient Observations in a Large Heated Space, by G. L. Larson, D. W. Nelson, and O. C. Cromer (A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933, p. 243).

A.S.H.V.E. RESEARCH REPORT No. 1011—Tests of Three Heating Systems in an Industrial Type of Building, by G. L. Larson, D. W. Nelson, and John James (A.S.H.V.E. TRANSACTIONS, Vol. 41, 1935, p. 185).

[6]A.S.H.V.E. Standard Code for Testing and Rating Steam Unit Heaters (A.S.H.V.E. TRANSACTIONS, Vol. 36, 1930, p. 165).