2. High column radiators placed at the sides of window openings do not produce as comfortable heating effects as long, low, direct radiators placed beneath a window opening.

3. Smaller floor to ceiling temperature differentials can be maintained with long, low, direct radiators, than is possible with high, direct, column radiators.

4. High column and tubular types of direct radiators give the major portion of the floor to ceiling temperature differential above the breathing line level.

5. The comfort level (approximately 2 ft-6 in. above floor) is below the breathing line level (approximately 5 ft-0 in. above floor), and temperatures taken at the breathing line may not be indicative of the actual heating effect of a radiator in the room. The comfort indicating temperature should be taken below the breathing line level.

WEIGHTS AND VOLUMES OF RADIATORS

The weights and volumes of radiators are often of considerable importance in heating problems. Cast-iron radiators average from 5 to 7 lb per equivalent square foot of heating surface, although specific types may vary somewhat from this figure.

The internal volume is often required for the purpose of making comparisons and for computing the amount of steam in a steam system and the amount of water in a hot-water system. Approximate values are given in Table 5.

HEATING UP THE UNIT

It is often very important to know the maximum condensation that occurs in a heating unit when steam is turned on. Fig. 2 shows a typical curve for the condensation rate in pounds per hour for the time elapsing after steam is turned into a cast-iron radiator. In practice the rate of steam supply to the heating unit while heating up is frequently retarded by controlled elimination of air through air valves or traps. Automatic control valves may also retard the supply of steam.

LOCATION OF RADIATORS

Radiators should be installed beneath or near the area of greatest heat loss. The best location is underneath an outside window for the following reasons:

1. Cold air leaking in through the window is warmed before it reaches the interior of the room or floor.

2. Air currents from the radiators pass upward, mingling with the cold infiltering air, and form a screen of warm air protecting against cold window drafts.

SELECTION OF RADIATORS

In selecting the proper radiators for heating a given room or space, the following procedure should be used:

1. Estimate the total loss from the room or space to be heated in accordance with the procedure outlined in Chapter 2, making proper allowance for exposure, wind velocity, height of ceiling, etc.

2. Decide upon the type and the number of radiators to be used. Then find from manufacturers' guaranteed performance tables for the particular type of radiator selected as given in the Catalog Data Section of THE GUIDE or elsewhere, the number of sections or the size of each unit required to supply the heat loss from the room.

Chapter 7

GRAVITY CONVECTORS

Cabinet or Wall-Enclosed Heating Units; Output of Wall or Cabinet Convectors; Selection of Wall or Cabinet Convectors; Gravity-Indirect Heating Systems.

A HEATING unit, if placed within an enclosure, is a convector. The unit may be placed in (1) a cabinet located within the room, (2) a flue in a wall adjacent to the room or (3) a casing or enclosure located exterior to the room. There are, however, various modifications of these arrangements. An inlet for the cooled air and an outlet for the heated air must necessarily be provided. If the heating unit is located in the basement, ducts leading to and from the enclosure must also be provided. If the air flow over the unit takes place by natural convection, it is termed a *gravity convector*, whereas if the air flow is produced by a fan or blower, it is termed a *fan convector*. (See Chapter 31, Design of Central Fan Systems).

It will be evident that a gravity convection system is essentially an indirect system of heating in which the air is recirculated from the floor of the room and delivered back again through the outlets at the top of the flue or cabinet at a temperature sufficiently great so that in cooling to the inlet temperature it gives up enough heat to supply the heat loss from the room. An exactly similar process goes on in a gravity circulating warm-air furnace heating system in which the air is returned to the furnace from the house. While gravity warm air heating could be included in this classification, the principles involved are entirely different and this type of system is treated separately in Chapter 5.

An enclosed heating unit containing steam or hot water (convector) emits practically all of its heat by conduction to the air surrounding it and this heated air is in turn transmitted by convection to the rooms or spaces to be warmed, the heat emitted by radiation being negligible. A small amount of heat is transmitted by radiation to the inside surface of the enclosure, the amount so transmitted diminishing as the surface temperature of the enclosure approaches the surface temperature of the heating unit. A partially shielded unit located within the space to be heated will transmit heat by radiation to the objects in the space it can *see*.

CABINET OR WALL-ENCLOSED HEATING UNITS

Radiator-Type Heating Units

The general effect of an enclosure placed about a heating unit of the type used as a direct radiator is to decrease the amount of steam that the