type of heater specified for any condition of steam pressure, air velocity through heater, entering air temperature and final air temperature desired. The amount of heating surface shall then be multiplied by the condensation per square foot to obtain the total condensation in pounds of steam per hour. This same amount of condensation may be checked from the air quantity specified, by the following formula:

$$\text{Cond. pounds per hour} = \frac{\text{cu. ft. of air per min.} \times 60 \times \text{temp. rise deg. fahr.}}{55.6 \times \text{latent heat of steam}}$$

Case 1—When all of the air passing through indirect heater is recirculated air:

$M_o = 0$; $M_h = M_r = M$; Temperature of air entering heater, $t_1 = t$; $M = \frac{H}{0.24\,(t_y - t)}$ ....(1)

Case 2—When all of the air passing through the indirect heater is drawn from the outside:

$M_r = 0$; $M_h = M = M_o$ Temperature of air entering heater, $t_1 = t_o$ $M = \frac{H}{0.24\,(t_y - t)}$ ....(2)

Case 3—When a portion of the air passing through the indirect heater is outside air and the remainder recirculated air:

$$M_h = M = M_r + M_o = \frac{H}{0.24\,(t_y - t)} \quad \text{.....(3)}$$

In this case M_o is known from the ventilating requirements and the amount of air to be recirculated is ascertained by the following formula: $M_r = M - M_o$ or $M_r = \frac{H}{0.24\,(t_y - t)} - M_o$ .....(4)

The mean temperature of the air entering the indirect heater is ascertained by the following formula:

$$t_1 = \frac{M_o\,(t_o + 460) + M_r\,(t + 460)}{M_o + M_r} - 460 \quad \text{.....(5)}$$

Case 4—When all of the air circulated is drawn from the outside and passed through a tempering coil, air washer or humidifier and reheater.

The temperature of the air t_1 entering the reheater will have the same dew-point temperature as the air in the room or building to which the air is delivered, having temperature t and relative humidity as specified. If the relative humidity is not specified it shall be assumed as 35 per cent. If the room temperature is not specified it shall be assumed as 70 deg. fahr.

A relative humidity of 35 per cent for a room temperature of 70 deg. has been selected because this is the highest percentage of moisture which the air can hold without producing dripping on single-thickness windows in cold weather.

In this case: $M = M_o = M_h = \frac{H}{0.24\,(t_y - t)}$ .....(6)

If it is desired to maintain a room temperature of 70 deg. with 35 per cent relative humidity from an outside temperature of zero and with simply an air washer without any water heater in connection, the tempering coil must be of sufficient capacity to heat the entering air from the outside temperature to 88 deg. dry bulb temperature and 52 deg. wet bulb temperature, and this will be represented by t_a in the diagram. In this case the difference is 36 deg. between the wet bulb temperature and the dry bulb temperature and assuming the washer to be 67 per cent efficient, moisture will be evaporated into the air in sufficient quantity to bring the temperature down to 24 deg. which is 67 per cent of 36 deg. Subtracting 24 deg. drop in temperature through the air washer from 88 deg. dry bulb temperature of the air entering the air washer, gives 64 deg. as the final temperature of the air leaving the air washer, the wet bulb temperature remaining at 52 deg. The reheater will heat the air to any temperature necessary to take care of the heat losses since room heating is desired.

The dew-point temperature of the air leaving the air washer and in the room itself will be 41 deg.

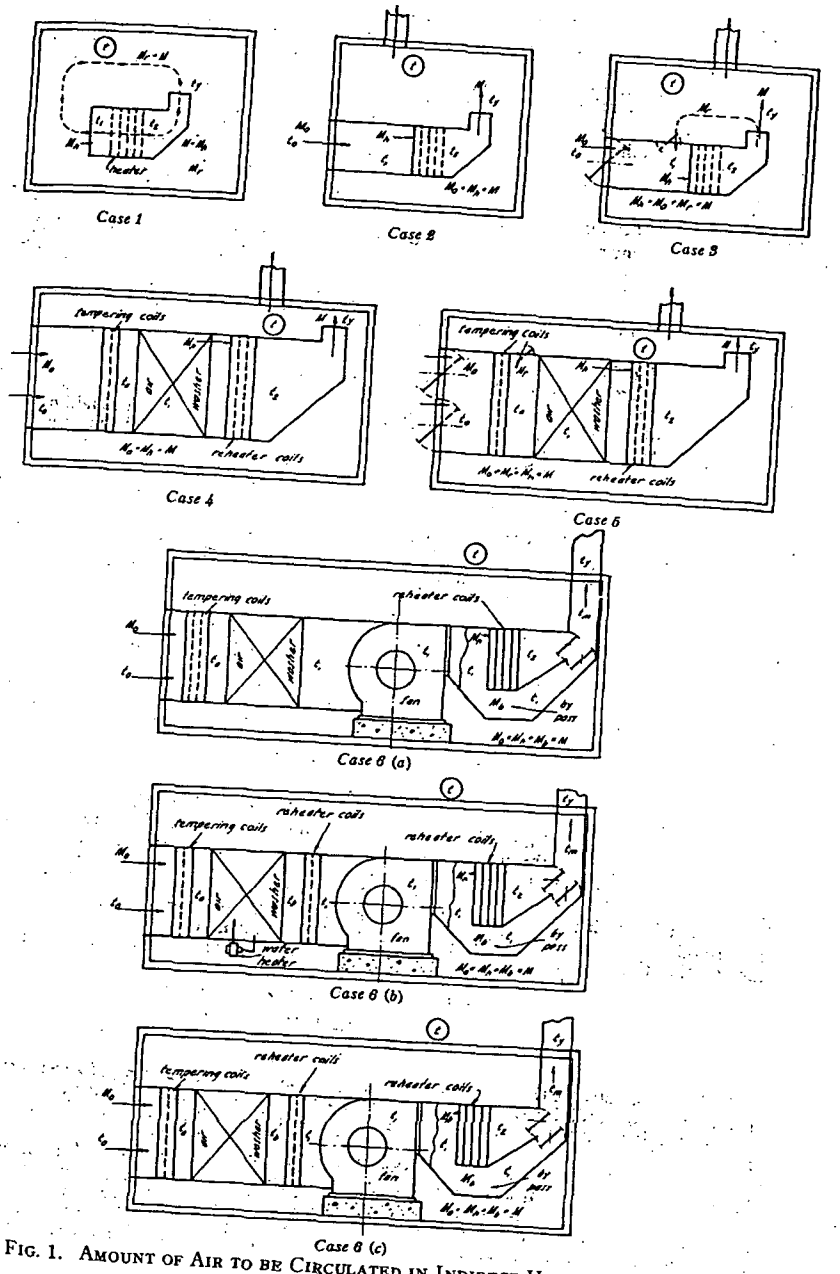

FIG. 1. AMOUNT OF AIR TO BE CIRCULATED IN INDIRECT HEATING SYSTEMS