3. To avoid the overheating of certain rooms through gravity action during off periods.

4. To have a sufficient supply of heat available at all times to avoid lag when the room thermostat calls for heat.

5. To avoid heat loss through the chimney by keeping stack temperatures low.

6. To provide quick response to the thermostat, with protection against overrun.

7. To provide for humidity control.

8. To provide a means of summer control of cooling.

9. To protect against fire hazards.

The following controls are desirable:

1. A *thermostat* located at a point where maximum fluctuation in temperature can be expected, in order to secure frequent operation of fans, drafts, and burners. This location would be near an outside wall, in a sun room, or in a room with some unusual exposure. The thermostat, of course, should not be located where it will be affected by direct radiant heat from the sun or from a fireplace, or by direct heat from any warm air duct or register.

2. A *furnacestat* to open and close the drafts according to bonnet temperature. The operating range of a furnacestat is approximately between 125 and 175 F, depending to a large extent upon outside weather conditions. In operation it may be necessary to adjust the setting for particular installations and readjust it for extremes of weather. The furnacestat should be installed either in the bonnet or in a main duct just outside the bonnet.

3. A *stack limit control* to shut down the system independently of the thermostat if the stack temperature exceeds 1000 F and thus prevent overheating of the furnace, and fuel waste.

4. On oil and gas burner installations, a control is usually included which will shut down the system if the fire goes out or if there is a failure of the ignition system.

5. A *humidistat* to regulate the moisture supplied to the rooms.

6. A device to open drafts, regardless of thermostat settings, whenever the bonnet temperature indicates that the fire is dying.

SELECTING THE FURNACE

The following formula may be used to compute the grate area of the furnace, assuming a ratio of heating surface to grate area of 20 to 1:

$$G = \frac{H}{F \times C \times E} \qquad (1)$$

where

G = required grate area, square feet.
H = total heat loss from building, Btu per hour.
F = calorific value of coal, Btu per pound.
C = combustion rate in pounds of fuel per square foot of grate per hour.
E = furnace efficiency based on heat available at register faces.

In practice it is customary to use the following constants:

F = 13,000 (For specific values, see Fig. 1, Chapter 27).
C = 5 to 10 lb (Use 8 lb as maximum in residence work).
E = 55 per cent to 65 per cent depending on fuel burned. Lower efficiency must be used with highly volatile solid fuel.

Where ratio of heating surface to grate area is less or greater than 20 to 1, deduct or add 2 per cent from or to rating of furnace for each unit decrease or increase in ratio, as the case may be. The foregoing procedure

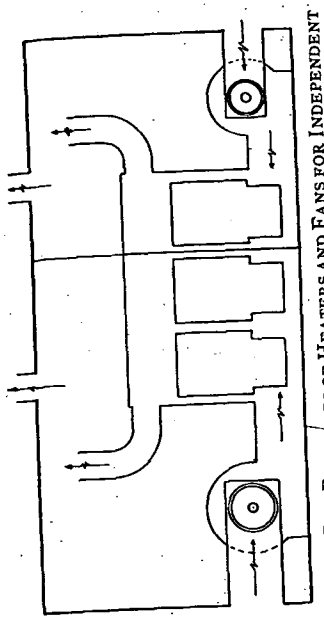

Fig. 7. Two Batteries of Heaters and Fans for Independent Service Using Outside Air and Exhaust to Atmosphere

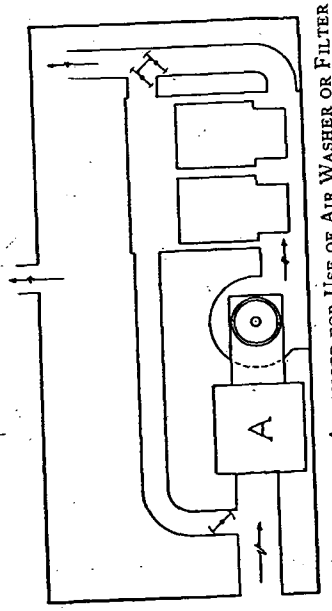

Fig. 9. Heater Arranged for Use of Air Washer or Filter (A) with Heated Air to Mix with Outside Air for Tempering, Showing Mixing Damper from Warm Air and Tempered Air and Exhaust to Atmosphere

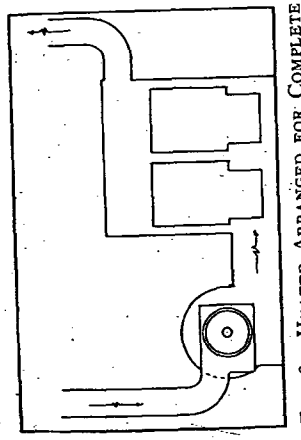

Fig. 6. Heater Arranged for Complete Recirculation of Air with Temperature Control Direct on Heater

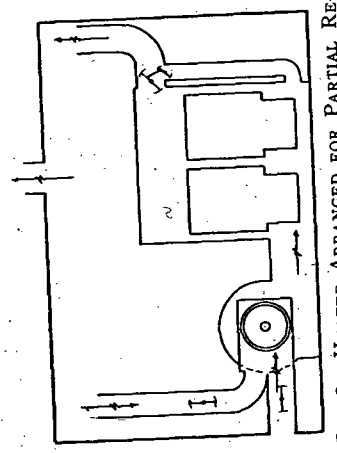

Fig. 8. Heater Arranged for Partial Recirculation, Also Showing Mixing Damper from Warm Air and Tempered Air Chambers, and Partial Exhaust to Atmosphere