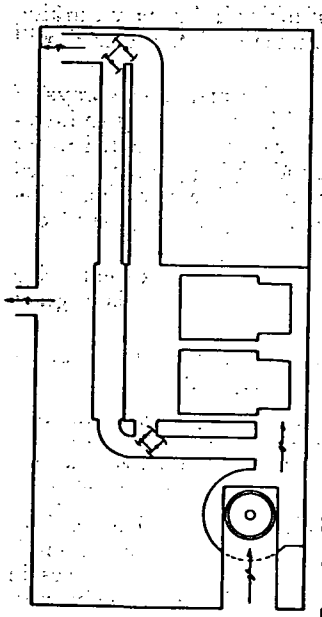

FIG. 6. HEATER ARRANGED TO USE OUTSIDE AIR, WITH TEMPERED AIR CHAMBER ABOVE WARM AIR CHAMBER SHOWING DOUBLE DUCT DISTRIBUTING SYSTEM AND MIXING DAMPERS AT BASE OF RISERS

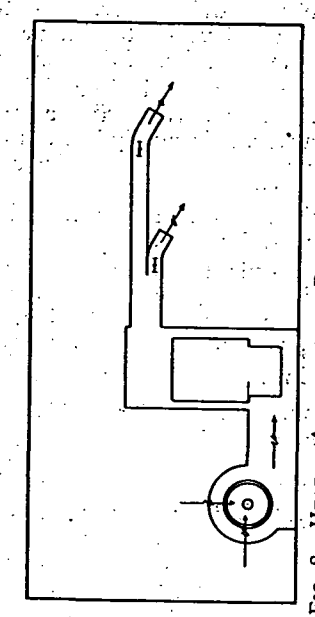

FIG. 8. HEATER ARRANGED FOR RECIRCULATION WITH TRUNK LINE DISTRIBUTING SYSTEM SHOWING TEMPERATURES CONTROL BY AIR VOLUME AT OUTLET, OR DIRECT ON HEATER

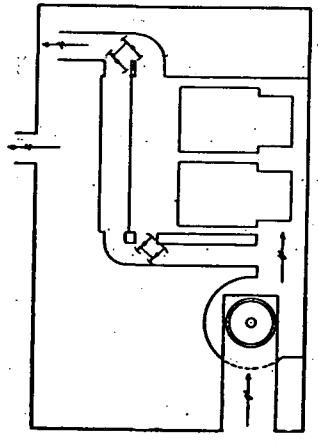

FIG. 5. HEATER ARRANGED TO USE COMPLETE OUTSIDE AIR WITH TEMPERED AIR CHAMBER ABOVE WARM AIR CHAMBER SHOWING MIXING DAMPER TO TEMPER AIR, ALSO MIXING DAMPER TO DUCT FROM WARM AND TEMPERED AIR CHAMBERS

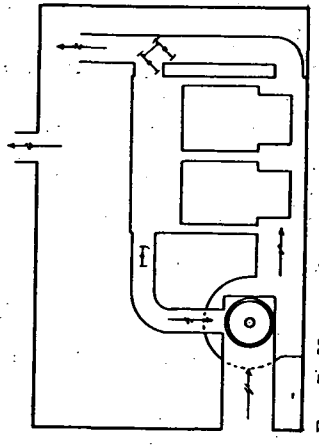

FIG. 7. HEATER ARRANGED FOR OUTSIDE AIR WITH WARM AIR CONNECTION TO FAN INLET TO TEMPER AIR, ALSO MIXING DAMPERS FROM WARM AIR AND TEMPERED AIR CHAMBER

paratus for filtering or spraying, humidifying, and blowing the air. Practically all are provided with by-passes or open fans, so that gravity circulation may be obtained. A few are built in compactly arranged integral casings.

Capacities range from the normal gravity warm-air furnace capacities of 40,000 Btu per square foot of grate per hour to three times as much or 120,000 Btu per square foot grate per hour. The capacity obtained is largely a matter of combustion rate. With an adequate flue draft, combustion rates of 12 to 14 lb per square foot of grate may be obtained, whereas normal gravity operation averages about 4 lb per square foot. Thus, fuel consumption determines the rating of fan furnaces, the quantity of air being a dependent factor. For good efficiencies, velocities through the heater above 500 fpm and combustion rates below 6 lb are necessary.

In obtaining high capacity and efficiency it is the practice to reduce the normal free area of the gravity equipment by inserting baffles which restrict the area and produce high velocity heat transfer. By this process relatively small heaters can be forced to produce high capacities, and there is economy in space, weight and cost.

Tests have shown that unless the fans are capable of producing velocities of 500 fpm through the net area of the casing, there is little value in their use. In other words the fan flow must exceed the gravity flow appreciably if it is to be capable of forcing the capacity to higher limits than can be obtained by gravity. Systems for fan furnace operation should be designed for fan duty. Systems intended for gravity are usually unbalanced by the application of forced circulation.

Residence-Type Oil-Fired Fan Furnaces

Special types of fan furnaces adapted to oil fuel, which include air conditioning apparatus, are also available.

Oil-fired heaters must be equipped with high temperature limit control to cut off the oil burner in case of fan failure. Oil-fired fan furnaces are usually provided with direct acting thermostats connected to the burner for maintaining the proper temperature. A device should be provided to cut off the fan whenever the thermostat cuts off the burners, to prevent overheating of rooms that are thermostatically controlled.

Residence-Type Gas-Fired Fan Furnaces

For gas fuel, high efficiencies have been obtained through the use of large areas of heating surface concentrated in banks of plate heaters through which the air is forced at high velocity. High operating efficiencies, further, are assured through the use of throttling gas valves, which, actuated by thermostats, proportion the consumption of fuel to the demand for heat, and thereby lessen the losses due to excessive flue temperatures and radiation.

When high efficiencies are attained in gas-fired units provision must be made for disposal of the condensation formed in the passages of the heater, and for protecting the surfaces from the corrosive action of the sulphurous or sulphuric acid formed.

In special cases provision must be made for producing a draft in the flue pipe and for protection against the formation of condensation therein.