

beneath the sections. In most boilers each section has its own burner. In all cases the sections are placed quite closely together; much closer than would be possible when burning a soot-forming fuel. The effort of the designer is always to break the hot gas up into thin streams, so that all particles of the heat-carrying gases can come as closely as possible to the heat-absorbing surfaces. Because there is no fuel bed resistance and because the gas company supplies the motive power to draw in the air necessary for combustion (in the form of the initial gas pressure), draft losses through gas boilers are low.

Either snap action or throttling control is available for gas boiler operation. This is especially advantageous in straight steam systems because steam pressures can be maintained at desired points, while at the same time complete cut-off of gas is possible when the thermostat calls for it.

Warm Air Furnaces

There are two general classes of gas-fired warm air furnaces, the gravity system which depends upon the natural tendency of heated air to rise, providing the proper circulation of heated air into the room, and the mechanical circulation system by which the air to be heated is forced through or drawn through the furnace by means of a fan.

Warm air furnaces are variously constructed of cast iron, sheet metal and combinations of the two materials. If sheet metal is used, it must be of such a character that it will have the maximum resistance to the corrosive effect of the products of combustion. With some varieties of manufactured gases, this effect is quite pronounced. Warm air furnaces are obtainable in sizes from those sufficient to heat the largest residence down to sizes applicable to a single room. The practice of installing a number of separate furnaces to heat individual rooms is peculiar to mild climates, such as that of southern California. Small furnaces, frequently controlled by electrical valves actuated by push-buttons in the room above, are often installed to heat rooms where heat may be desired for an hour or so each day. These furnaces are used also for heating groups of rooms in larger residences. In a system of this type each furnace should supply a group of rooms in which the heating requirements for each room in the group are similar as far as the period of heating and temperature to be maintained are concerned. Bedroom suites, living and dining rooms, etc., usually present excellent possibilities for this type of unit heating.

The same fundamental principle of design that is followed in the construction of boilers, that is, breaking the hot gas up into fine streams, so that all particles are brought as close as possible to the heating surface, is equally applicable to the design of warm air furnaces. The desirability of using an appliance designed for gas, when gas is to be the fuel, applies even more strongly to furnaces than to boilers.

Codes for proportioning warm air heating plants, such as that formulated by the *National Warm Air Heating Association* (see note p. 93), are equally applicable to gas furnaces and coal furnaces. Recirculation should always be practiced with gas-fired warm air furnaces. It not only aids in heating, but is essential to economy. Where fans are used in connection with warm air furnaces for residence heating, it is well to

have the control of the fan and of the gas so coordinated that there will be sufficient delay between the turning on of the gas and the starting of the fan, to prevent blasts of cold air being blown into the heated rooms. An additional thermostat in the air duct easily may be arranged to accomplish this.

Warm Air Floor Furnaces

Warm air floor furnaces are well adapted for heating first floors, or where heat is required in only one or two rooms. A number may be used to provide heat for the entire building where all rooms are on the ground floor, thus giving the heating system flexibility as any number of rooms may be heated without heating the others. With the usual type the register is installed in the floor, the heating element and gas piping being suspended below. Air is taken downward between the two sheets of the double casing and discharged upward over the heating surfaces and into the room. The appliance is controlled from the room to be heated by means of a control lever located near the edge of the register. The handle of the control is removable as a precaution against accidental turning on or off of the gas to the furnace.

Industrial Unit Heaters

A recent development in gas burning equipment is the direct-fired industrial unit heater. These heaters are of the warm air type and are equipped either with fans or with blowers which cause the air to pass over the heating surfaces at a fairly high velocity and then direct the warm air in to the space to be heated in such a way as to give a positive distribution of the heated air. As is the case with the steam fed unit heaters, the gas fired appliances may be used for heating stores, shops, warehouses, etc. They usually are suspended in the space to be heated and in most instances leave the entire floor and wall area free for commercial use. Partial or complete automatic control also may be secured on appliances of this type.

Space Heaters

As indicated by the foregoing classification, there are many types of space heaters. Appliances of this kind are generally used for auxiliary heating, but may be, and are in many cases, installed for furnishing heat to entire buildings. Space heaters are quite extensively used for house heating in milder climates such as exist in the South and Southwest. With the exception of wall heaters, they are portable, and can be easily removed and stored during the summer season. Although they should be connected with solid piping it is sometimes desirable to connect them with flexible gas tubing in which case a gas shut-off on the heater is not permitted, and only A.G.A. approved tubing should be used.

Parlor furnaces or *circulators* are usually constructed to resemble a cabinet radio. They heat the room entirely by convection, i.e. the cold air of the room is drawn in near the base and passes up inside the jacket around a drum or heating section, and out of the heater at or near the top. These heaters cause a continuous circulation of the air in the room during the time they are in operation. The burner or burners are located in the