

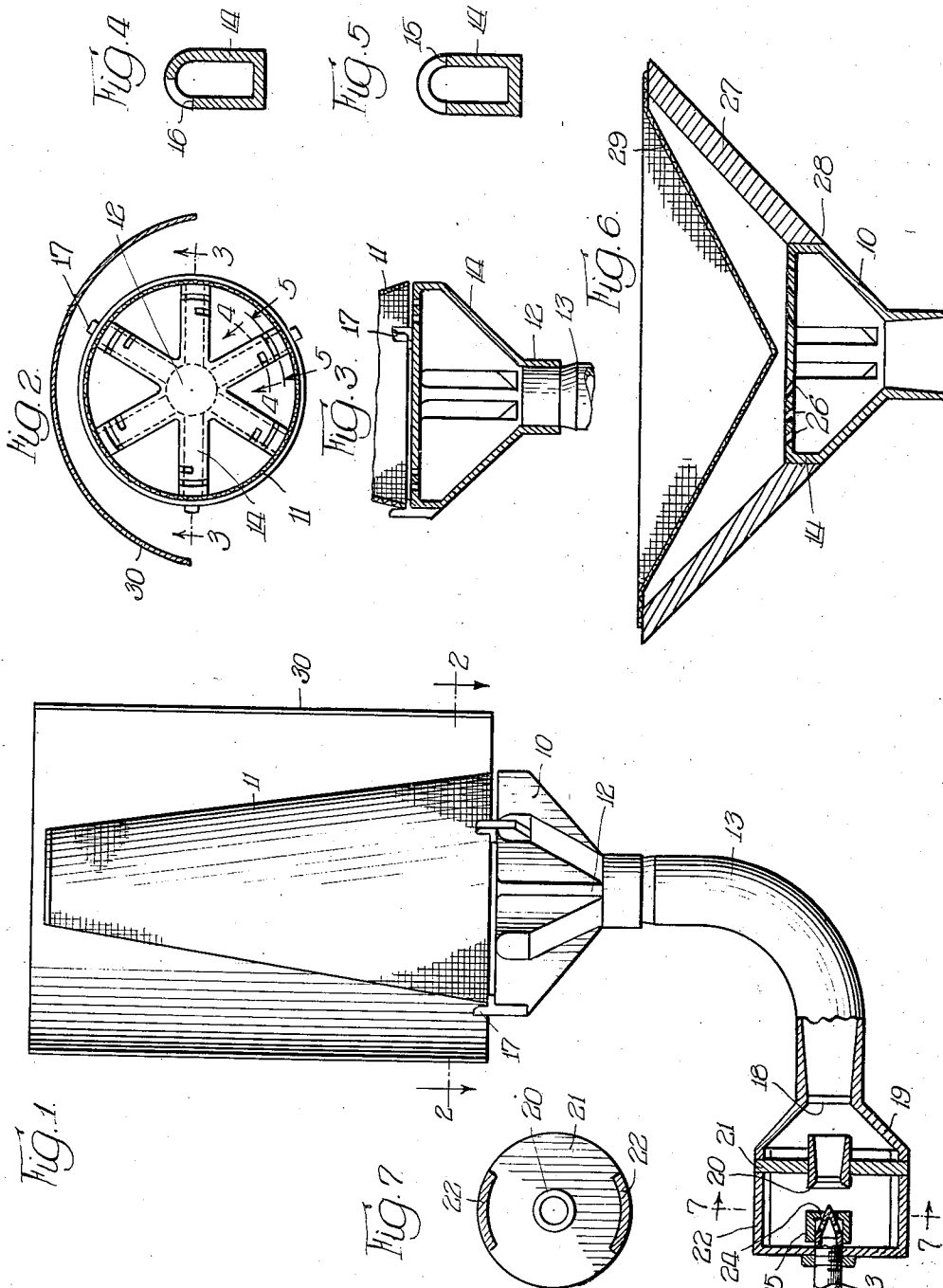
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RADIANT HEATER

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RADIANT HEATER

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The present invention relates to a gas burner which converts a large part of the heat energy into light rays or radiant heat.

Heretofore gas has been burned with a blue flame with little or no provision for controlling the amount of air surrounding the flame. As a result, the products of combustion were considerably cooled by this air before the heat energy reached the object to be heated. For example, in heating a pot two inches above the flame, excess secondary air rises with the jets of flame, and this must be heated before the heat energy reaches the pot; consequently, the temperature of the gases reaching the pot is a great deal lower than necessary. If the pot is placed too near the fire, the tips of the flame cool and are partially extinguished when they contact the relatively cold pot.

In forming a radiant heat by heating the radiant element with a blue flame in the presence of excess air, the same problem arises.

It is therefore an object of the present invention to provide a new and improved type of gas burner which will insure more complete combustion of the gas.

It is another object to provide a burner which causes the gas to burn in a space which is above the ignition temperature of the fuel with all excess cold air excluded from the presence of the combustion, thereby permitting a leaner fuel mixture and increasing the time in which complete combustion can take place.

It is a further object to provide a burner which will minimize the amount of exhaust gases with a resulting reduction in the amount of heat carried off thereby.

It is another object to provide a burner wherein the heat energy is converted into light energy or radiant heat.

It is a further object to provide a burner wherein the heat rays may be directed or focused as desired, or may be uniformly projected in all directions, depending upon the use to which the burner is put.

It is another object to provide a burner which automatically restricts the amount of air contacting the flame to that which is required for complete combustion.

Referring to the drawing—

Figure 1 is a view partly in elevation and partly in cross-section of a device embodying the present invention;

Figure 2 is a cross-section taken in the plane represented by the lines 2—2 of Figure 1;

Figure 3 is a fragmentary section taken in the plane 3—3 of Figure 2;

Figure 4 is a cross-section taken in the plane 4—4 of Figure 2;

Figure 5 is a cross-section taken in the plane 5—5 of Figure 2;

Figure 6 is an elevation in cross-section showing a modification of the present invention; and

Figure 7 is a sectional view taken on the line 7—7 of Figure 1.

Referring now more in detail to the drawing, and particularly Figure 1 thereof, an embodiment selected to illustrate the present invention is shown as a burner head 10 upon which is supported a frusto-conical shaped radiant member 11.

As more clearly shown in Figure 2, the burner head 10 consists of a number of arms 14 projecting outwardly from a central portion 12, to which the duct 13 is connected. Each arm is provided with two slots 15 and 16, which are shown in cross-section in Figures 4 and 5. The slots 15 are relatively thin and curve slightly to conform to the circumference of the radiant member 11. These slots are positioned near the ends of the arms 14 and are spaced inwardly from the radiant member. The slots 16 are spaced inwardly from the slots 15, and are confined to one side of the arms. The slots 16 also have a curve conforming to the circumference of the radiant member 11. In cross-section the slots 15 extend across the curved upper portions of the arms 14, and the slots 16 extend across one-half of the curved portions. The slots 16 are on the same side of each arm.

The arms 14 are hollow and taper from the point where they join the central portion 12 of the burner head toward their ends, as is more clearly shown in Figure 3. The ends of the alternate arms are provided with projecting lugs 17 for positioning the radiant member 11.

The lower end of the duct 13 is provided with a Venturi throat 18 consisting of a narrowing of the duct adjacent an enlarged portion 19. A second Venturi throat 20 is positioned adjacent the open end of the enlarged portion 19 and extends partly within. The Venturi throat 20 is supported by a cross member 21 between frame members 22. A fuel supply pipe 23 terminates in a tapered nozzle 24 which is spaced from Venturi throat 20 and in alignment with it. The nozzle is provided with a cap nut 25 having a small outlet opening which may be screwed toward or away from the nozzle to decrease or in-

crease the flow of fuel through it. The pipe 23 is screwed through the front part of the frame 22.

The radiant member 11 preferably is of a frusto-conical shape, having a diameter at its base substantially corresponding to that of the burner head 10. A preferred embodiment of the radiant member is made of nickel chromium wire, cloth or screen. The size of the mesh will depend upon the heating value and pressure of the gas used. For example, where ordinary city gas is used having a heating value of 550 British thermal units per cubic foot under a pressure of two to three inches of water, a .016 gauge screening having 400 mesh to the square inch has been found desirable, but for natural gases having 1000 British thermal units per cubic foot under a higher pressure, a smaller mesh and heavier wire is better. It is to be understood that this invention is not limited to a nickel chromium screen. A screen of tungsten, for example, may be used to advantage where high temperatures are involved; likewise perforated, slotted or stretched sheet metal may be used in place of screening; in fact any suitable reticulated material may be used. The radiant member is provided with a closure at its upper end, such as a metal disc which may be frictionally or otherwise suitably secured to the radiant member.

A reflector 30 is provided which is positioned to direct the heat rays in a particular direction. The reflector is semi-cylindrical in contour and is spaced from the radiant member 11. It may be made of polished sheet metal or other suitable material.

An embodiment of the present invention particularly adapted for use in a kitchen range is shown in Figure 6. The burner head is substantially as described above, with the exception of the orifices 26, which will be described later. An inverted frusto-conical member 27 is supported adjacent the ends of the arms 14 by the lugs 28. This member is preferably made of fire-clay or other material having low properties of conductivity. The outer face of the member 27 is disposed at an angle to the axis of the burner head corresponding to that of the under faces of the arms 14, and the inner face extends from the upper surfaces of the arms adjacent their outer extremities. The contour of this member may be varied to suit the purpose for which the burner is intended.

An inverted cone-shaped radiant member 29 is supported adjacent its periphery by the rim of the member 27, the apex thereof being suspended above the center of the burner head. This radiant member may be constructed of the same material as previously set forth in connection with radiant member 11.

The orifices 26 are circular in cross-section, and are so disposed that the axis of the orifices are at an angle to the plane of the axis of the radiant member 29, and are also at an angle to the plane of the surface of the radiant member. It is not necessary that the orifices in each arm be uniformly spaced from each other, but it is desirable that spacing of the orifices in any one arm be the same as that of the other arms. Similarly, the angle at which the orifices in any one arm are disposed need not be uniform, but it is desirable that the angular disposition of an orifice in any one arm be the same as that of the corresponding orifices in the other arms. This

will insure a more uniform heating of the radiant member by the flames from the orifices.

The angular disposition of the orifices is such that the flame of the ignited gas issuing from the orifices will cover as much as possible of the radiating surface. The distance of the orifices from the radiant member and the pressure of the gas issuing from the orifices, as well as the spacing of the openings, are factors to be considered in determining this angular disposition. By having the axis of the orifices at an angle to the plane of the axis of the radiant member, not only is the area of the radiant member covered by flames increased, but the flames are given a rotary movement which tends to cover the entire surface of the radiant member with a sheet of flame.

The angle of the axis of the orifices with respect to the surface of the radiant member will be as small as possible so that the flame will be almost parallel to the surface of the radiant member. However, this is not practical with respect to the orifices near the ends of the burner arms 14, which are farther from the radiant surface than are the orifices nearer the center of the burner head, and consequently the angle is made larger.

While the operation of the two embodiments shown is substantially the same, this description will first proceed with particular reference to the embodiment shown in Figure 1. Gas is supplied through pipe 23 and passes through nozzle 24, the flow being regulated by cap nut 25. The gas then passes through venturi 20, drawing in some air from the atmosphere. As the mixture passes from venturi 20 to venturi 18, additional air is drawn in, and as it passes through venturi 18 its velocity is increased and the mixture becomes more homogeneous. The mixture then passes through the duct 13 into burner head 10 and out of the slots 15 and 16 in the burner arms 14, where it is ignited. The pressure of the gas before it issues from the orifices is higher when two venturis are used than when only one is used, and this increased pressure projects the gas farther and more accurately from the orifices than would otherwise be possible.

From the slots 15 a thin flat fan-shaped flame is projected at a slight angle and nearly parallel to the surface of radiant member 11. The thin cross-section of the flame permits a large surface exposure to the secondary air which has entered from the bottom between the arms 14. The construction of the radiant member 11, as previously described, is such that outside air will not pass through it into the combustion chamber, and all of the air must enter from the bottom. The radiant member is so designed that the products of combustion may escape through it to a limited extent. As the secondary air rises through the bottom and expands due to the heat of the radiant member, a slight back pressure develops within the combustion chamber since only a limited amount of air can pass out through the radiant member; consequently, the flow of secondary air which may enter through the bottom is throttled. Some of the air supplies oxygen to the flames as the gas issues from the orifices, whereas the balance rises within the radiant member and unites with gases as they rise higher, making a considerably longer flame and covering a greater area of the radiant member.

Since the flames are projected as described above, the oxygen must be supplied on the side of the flame away from the radiant member,

resulting in an evenly distributed sheet of flame covering the walls of the radiant member. The flames issuing from the slots 16 are projected at an angle, resulting in thin rotating flames that tend to give the entire flame lining a rotary movement and uniformly cover the entire radiant member. It will be noted that the mesh or apertures of the radiant member are sufficiently small to prevent the combustible mixture from escaping and burning beyond the radiant member, and at the same time not small enough to throttle the combustion.

The reflector 30 may be of any shape and contour that will focus the reflected rays of heat on the object to be heated. For example, in the ordinary domestic furnace, a series of burners of the type shown in Figure 1 may be arranged in rows adjacent the walls of the furnace, in which instance the reflectors or a single reflector would be placed in the center of the furnace in order to reflect the heat rays from each of the burners against the adjacent walls of the furnace. Similarly, the burner may be placed in a horizontal position in an oven, for example, and the reflector placed above the radiant member to reflect the heat rays downwardly, as for toasting or broiling. Likewise, the reflector may be placed under the radiant member to reflect the rays upwardly, as for heating an oven above it.

For some uses, the reflector would neither be necessary nor desirable; for example, in a water heater where tubing is helically wound around the radiant member and spaced from it, with cold water entering at the top and hot water delivered at the bottom. In this instance, the rays of heat would directly contact the surrounding coils without need of a reflector. The flames from the burner cannot contact the cold coils as in the ordinary type of water heater, which partially extinguishes the flames and prevents complete combustion. The flames are enclosed by the radiant member and all of the combustion take place within the radiant member, which is at a temperature far above that of flame propagation.

The heat from the products of combustion may be utilized to advantage in this type of burner by placing a helically wound tube above the radiant member in the path of the hot products of combustion and supplying air from a blower through the tubing to the venturi. The air supplied in this manner takes the place of the induced air, as previously described, and the temperature of the resulting flame is greatly increased. The efficiency of the burner and amount of energy converted into light rays is considerably improved by this method of recuperation.

The principles of operation of the range burner shown in Figure 6 are substantially the same as previously described in connection with the embodiment shown in Figure 1. The gas and primary air are supplied to the burner head as described above. The mixture is ignited as it issues from the orifices 26 and the flames are projected at a slight angle and nearly parallel to the under surface of the radiant member 29. The axis of the orifices 26 being disposed at an angle to the axis of the radiant member, gives the flames a rotary movement and causes them to be more evenly distributed over the entire under surface of the radiant member.

The member 27 prevents an unlimited amount of cold outer air from contacting the flames;

the only secondary air enters, as before, between the arms 14 of the burner head 10. The amount of air which may enter is likewise limited to that necessary for complete combustion; the radiant member 29 throttles this flow of air. The inverted cone shape of the radiant member causes some of the air to rise to the uppermost parts of the radiant member, insuring complete combustion over the entire surface of the radiant member. The flames do not pass through the radiant member and cannot impinge upon a relatively cold pot or other object being heated above the radiant member, which would partially extinguish them by cooling them below the temperature necessary for flame propagation. In this embodiment there is no need for a reflector as the heat is radiated directly on the object being heated.

I claim:

1. A fuel consuming device comprising a combustion chamber and fuel discharge means communicating therewith, said combustion chamber having a cone-forming reticulated surface, said fuel discharge means being axially disposed with respect to said surface and having a plurality of radially disposed discharge ducts provided with slots concentrically disposed with respect to said reticulated surface and adjacent thereto.

2. A fuel consuming device comprising a combustion chamber and fuel discharge means communicating therewith, said combustion chamber having a cone-forming reticulated wall portion, said outlet means being so constructed and arranged as to discharge fuel in a whirl substantially parallel to and in contact with said wall portion.

3. A fuel consuming device comprising a combustion chamber and fuel discharge means communicating therewith, said combustion chamber having a reticulated wall portion, said discharge means having a plurality of radially disposed arms, said arms having discharge orifices having their axis disposed at an acute angle to said wall portion and having a direction of discharge such as to impart a rotary motion to said fuel, said arms providing for the entrance of combustion supporting medium therebetween.

4. A fuel consuming device comprising a combustion chamber having a reticulated wall portion, means for discharging fuel in a whirl longitudinally of said combustion chamber and adjacent said wall portion, and means for supplying combustion supporting medium to said chamber remote from the inner surface of said wall portion.

5. A fuel consuming device comprising a frusto-conical reticulated member and fuel discharge means communicating with said member, said outlet means comprising a plurality of orifices having a direction of discharge substantially parallel to the surface of said member, and a plurality of orifices having a direction of discharge at an angle to the surface of said member and longitudinally of said member.

6. A fuel consuming device comprising a combustion chamber having a metallic reticulated cone-forming surface, means associated with said chamber for discharging fuel in a whirling sheet confined by said surface, and means for supplying a limited amount of combustion supporting medium to the space enveloped by said sheet.

7. A fuel consuming device comprising a combustion chamber having a metallic screen wall portion, and fuel supply means having orifices adapted to project a thin sheet of flame in-

teriorly of said chamber and adjacent said wall portion, said orifices having a direction of discharge such as to impart a rotary motion to said sheet of flame.

8. A fuel consuming device comprising a combustion chamber having a metallic screen wall portion, and fuel supply means having orifices

for projecting a thin sheet of flame adjacent the inner surface of said wall portion, said orifices having a direction of discharge to impart a spiral and upward movement to said sheet with respect to said chamber.

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