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GAS-FUELED RADIANT BURNER

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FIG. 4

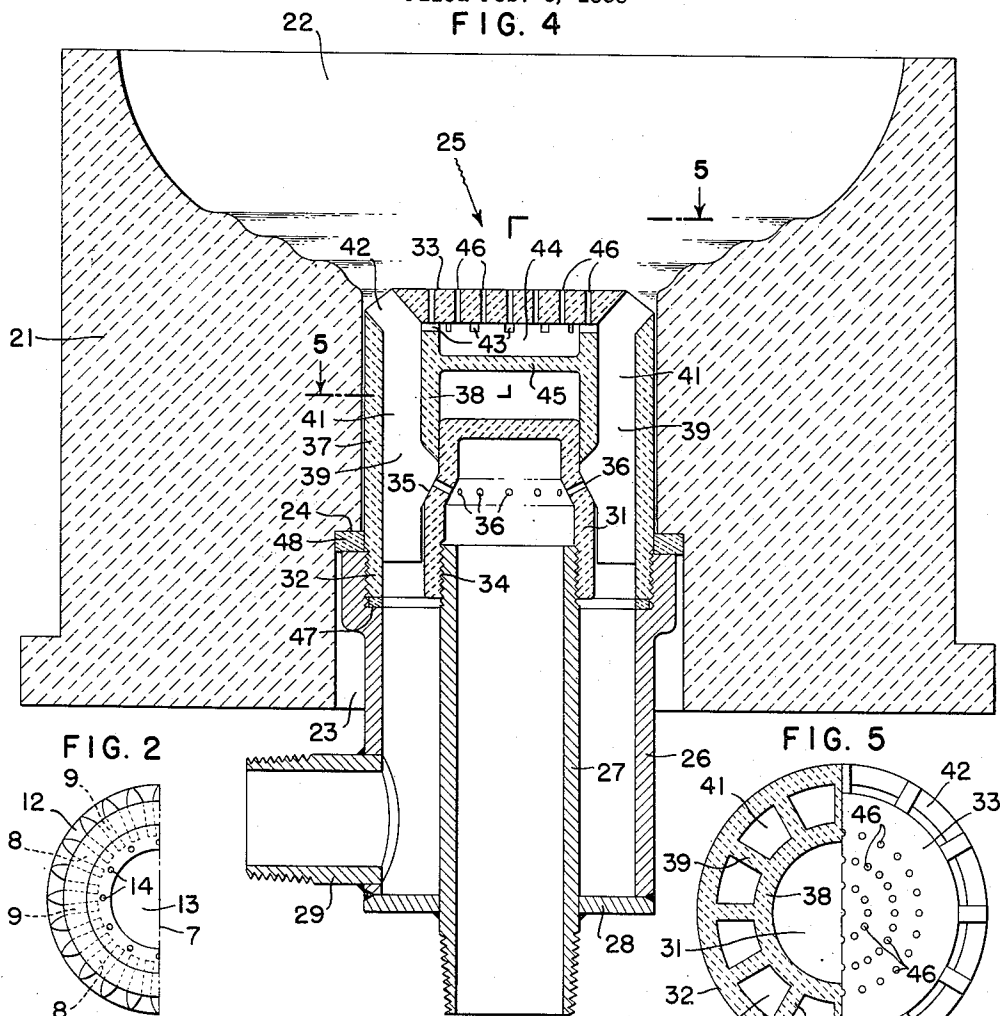
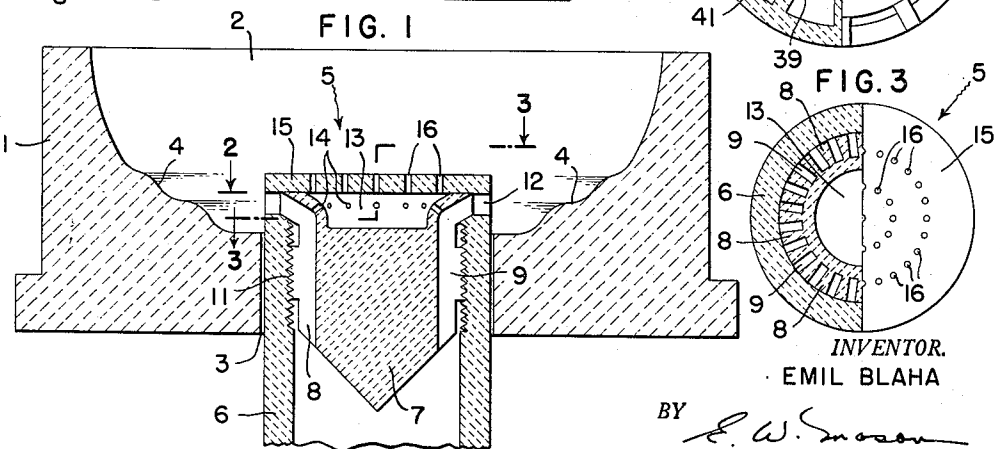


FIG. 2

FIG. 5

FIG. 1

FIG. 3



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GAS-FUELED RADIANT BURNER

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4 Claims. (Cl. 158—113)

The present invention relates to radiant gas burners, and more particularly to the construction of such burners and the distributor tip thereof in which the normal involution of combustion gases is overcome.

Radiant burners of the type with which the present invention is concerned are disclosed in Hess Patent 2,215,079 issued September 17, 1940. Such a burner includes a cup-shaped combustion space in which a combustible fuel mixture is burned to heat the surface of the space to incandescence. As explained in that patent, the fuel is burned as a series of radially directed flames. Since the flames are moving radially away from a centrally located distributor member or tip, a low pressure area is created in the center of the combustion space above the tip. As a result of this low pressure area, gases of combustion and, frequently, vapors and gases from the space being heated, are drawn into the center of the combustion space and circulated with the burning combustible mixture. Since the distributor tip at the center of the burner is cooler than the remainder of the burner cup surface, the vapors drawn into the combustion space have a tendency to condense on the end of the distributor. Over a period of time, the condensed material will build up on the distributor and obstruct the fuel ports, thus rendering the burner inoperative.

The above mentioned difficulty occurs particularly when radiant cup type burners are used in glass furnaces and some types of ceramic kilns. In a glass furnace, the glass vapors are carried into the combustion space and condense upon the end of the distributor. After a relatively short period of operation, the end of the distributor is vitrified and the fuel ports are clogged up. In some ceramic kilns where there is dust of a fluxing nature the same thing occurs. The dust is carried with the combustion gases into the combustion space. It is there deposited on the distributor to clog the fuel ports.

It is an object of the present invention to provide a radiant cup type burner in which the involution of the gases in the combustion space is eliminated. It is a further object of the invention to provide a distributor tip or member for use with a radiant cup type gas burner which is so designed that it will prevent the involution of gases into the combustion space of the burner.

In practicing the invention, the distributor tip or member is provided with a chamber immediately back of the end extending into the combustion space. This chamber is supplied with fuel mixture from the supply passages. The side of the chamber toward the combustion space is provided with a plurality of openings through which the fuel mixture can be discharged to burn at the end face of the distributor. The burning at the face of the distributor increases the pressure at that region sufficiently to prevent the involution of combustion gases and therefore the deposit of foreign material thereon.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its ad-

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vantages and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

In the drawings:

Figure 1 is a sectional view through one form of the burner;

Figure 2 is a section of a portion of the distributor taken on line 2—2 of Figure 1;

Figure 3 is a view partly in section taken on line 3—3 of Figure 1;

Figure 4 is a sectional view of a different embodiment of the invention, and

Figure 5 is a view taken on line 5—5 of Figure 2.

Referring to Figures 1 to 3 of the drawing, there is shown a refractory ceramic block 1 formed of some material such as zircon which is adapted to be inserted in the wall of a furnace or other structure to be heated. The face of this block toward the heated area is provided with a cup-shaped depression 2 having an opening 3 formed in the base thereof extending to the opposite face of the block. Concentrically arranged around the portion of the depression adjacent to the base thereof are a series of ripples 4 the purpose of which will be described below.

Extending through the opening 3 and into the base of the depression 2 is a distributor assembly 5 through which fuel is supplied to the depression to be burned therein. This assembly includes a cylindrical ceramic member 6 which is mounted on the exterior of the furnace wall in any suitable manner, so that it will extend into the opening 3 of the block. Mounted in the end of the cylinder 6 and extending into the depression 2 is a distributor member or tip 7. This tip is provided around its periphery with a plurality of radially directed flanges 8 which form between them axially directed channels 9 through which a fuel mixture is adapted to flow into the depression. It is noted that the exterior edges of the flanges are provided with grooves that form a series of threads as indicated at 11, so that the distributor tip can be threaded into the end of the holder 6 to be maintained therein and properly positioned with respect thereto.

The upper ends of the channels 9 bend outwardly in a generally radial direction as shown in Figure 1 of the drawing. The outer ends of the channels are flared as indicated best at 12 in Figure 2. This flaring or widening of the channels at their exits is for the purpose of increasing the volume and therefore decreasing the velocity of the fuel mixture as it is moving into the depression or combustion space of the burner. The upper end of the distributor is provided with a centrally located depression which is closed by a plate 15 to form a chamber 13 in the end thereof. This chamber is connected with various of the channels 9 by means of small passages 14. As shown herein, there is provided a passage 14 between the chamber 13 and every other one of the channels 9. It will be obvious that more or less of these passages may be provided if desired. Plate 15 is of a diameter equal to that of the cylinder 6 so the top flaring portions 12 of the channels 9 are closed. This insures that the fuel mixture flowing through the channels will be discharged in a radial direction. The cap 15 is provided with a plurality of openings 16 so that the interior of the chamber 13 can communicate with the central portion of the combustion space of the burner.

In the operation of the burner, fuel comprising of a combustible mixture of gas and air is supplied from a suitable mixing machine through the cylindrical holder 6 to the channels 9. From these channels, the fuel mixture flows out through the flaring openings 12 in a radial direction into the combustion space 2 of the burner.

The fuel is ignited and burns as a plurality of radially

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directed flames which are directed across the surface of the depression. The flaring openings 12 of the distributor permit an increase in volume and, therefore, a decrease in velocity of the fuel mixture, so that the mixture can be more readily ignited than would be the case if it entered the chamber at a high velocity and consequently ignition will take place closer to the exits of the channels. In addition, the passage of the jets of mixture across the ripples 4 produces a series of concentric low pressure areas between the ripples in which some of the mixture is trapped to further slow it down and, therefore, insure the immediate ignition of the mixture so that burning will take place within and along the surface of the depression regardless of the ignition characteristics of the fuel being used. As the mixture is burned in the depression, the surface thereof will be heated to incandescence so that radiant heat is projected forwardly from the depression into the areas to be heated. Normally, all of the mixture will be burned within the depression so that only products of combustion will be projected into the heated area.

With burners of this type, there is produced a low pressure region immediately in front of the end of the tip. This, as explained in the above mentioned Patent 2,215,079, causes an involution of gases toward the center of the cup. With the present burner, however, such involution is done away with because of the construction of the distributor tip. During the time that fuel is flowing through the channels 9, a portion thereof will bleed through the passages 14 into the chamber 13. This gas will flow through opening 16 in the cap and be burned in a series of small flames in front of the cap. The pressure produced as a result of the gases expanding due to combustion will prevent the creation of a low pressure area immediately in front of the distributor and will insure that the pressure in the entire depression is slightly above that in the space to be heated. Therefore, the above mentioned involution of the gases cannot take place.

A burner of the type described above is particularly useful in the heating of glass furnaces, for example, where the ordinary type of radiant burner combustion gas and vapors are drawn into the depression and condensed upon the surface of the tip. With the present construction, this cannot take place, and, therefore, there is no tendency for these vapors to be drawn into the cup. Consequently, for uses of this type, the useful life of the burner is considerably increased.

The embodiment of the invention disclosed in Figure 4 is intended to be used with a burner of a larger capacity than burners of the type shown in Figures 1 to 3. In this embodiment, there is provided a burner block 21 having a depression 22 formed in its surface. The base of the block is connected with the other face thereof by means of an opening 23 of two diameters. The junction between the two diameters is defined by a shoulder 24.

In this case, the distributor assembly 25 is held in position in the opening of the block by means of a holder comprising an outer tubular member 26 and an inner tubular member 27 that are fastened together and in concentric relation with each other by means of a disc 28. These parts are preferably formed of metal and are welded into a single unit. It is noted that the outer member 26 is provided with a supply pipe 29.

The upper end of the distributor assembly comprises, in this case, three ceramic pieces 31, 32 and 33, the latter two of which are permanently joined together. The inner ceramic piece 31 is formed in the shape of a cup and is provided with threads as indicated at 34 so that it may be threaded to the upper end of the tube 27. This piece has a reduced upper end that is joined to the lower portion by a sloping surface 35 through which extend a plurality of openings 36.

The second ceramic piece 32 comprises an outer wall 37 and shorter inner wall 38 that are joined by webs 39. The space between each of the webs forms fuel passages or channels 41. It is noted that the webs 39 extend below the end of wall 38 and are shaped to follow the outer

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contour of member 31. Thus, the channels 41 extend substantially to the lower end of the distributor. The upper ends of channels 41 flare outwardly as indicated at 42 in the drawing and the inner wall of each channel, formed by the upper end of the portion 33, is provided with a groove 43. This leads into a space or chamber 44, the lower wall of which is formed by a partition 45 extending across the interior of the portion 38. The third ceramic piece 33 is in the form of a disc that is fitted to and is attached permanently to the upper end of the member 32 at the flaring portion 42 of the channels. Thus, the disc forms the top of chamber 44 and one wall of the portions 42 of the channels where it closes the space between the webs 39. It is noted that this disc is provided with a series of openings 46 that extend from the combustion space 22 to the chamber 44. It is also noted that the upper end of the channels terminate partially in the periphery and partially in the end of the distributor. Thus, gas flowing through them has both a radial and an axial component.

In assembling the apparatus, member 31 is threaded to the upper end of the tube 27 and the assembled members 32 and 33 are fitted over 31 as shown in Figure 4 of the drawing and threaded into the upper end of the tube 25. A suitable washer 47 is provided between these parts in order to form a pressure tight connection. The entire assembly is then moved into the opening 23 in the block until the upper surface of the member 26 bears against the shoulder 24 between the two diameters of the opening 23. A washer 48 of some suitable material such as asbestos is preferably placed between the end of sleeve 26 and the surface 24 in order to insure a tight fit between these parts. It is noted that the distributor member is so dimensioned with respect to the burner block 21 that the upper end of the assembly terminates slightly below the base of the cup.

In the operation of this burner, gas under a suitable pressure is supplied to the tube 27 and air under a suitable pressure and in an amount to form a combustible mixture with the gas is supplied through the pipe 29 to the cylindrical member 26. Gas flows through the openings 26 into the channels 41 and mixes with the air flowing through these channels to form a combustible mixture in the upper portions of the channels. This mixture is discharged through the flared portions 42 of the channels into the base of the cup 22 where it is burned. The contour of the cup is such that concentric low pressure areas created around the base of the cup which tend to pull the jets of the mixture outwardly in a radial direction, so that they will burn in a plurality of flames along the surface of the cup-shaped depression 22. The surface of the depression is thereby heated to incandescence to supply radiant heat to the region to be heated in front of the burner. A portion of the mixture also flows through the channels 43 from the channels 41 into the chamber 44. This mixture is discharged through openings 46 on the face of the distributor and burns in front of these openings in a plurality of small flames.

The expansion of the gases created by the burning of the mixture issuing from openings 46 creates enough pressure to prevent a low pressure area from occurring in the center of the depression. Therefore, there will be no involution of the combustion gases into the depression. In this manner, the drawing in of any vapors from the area being heated is prevented. Consequently, there will be no deposit on the front of the burner and the burner will have a much longer life than would otherwise be the case.

From the above, it will be seen that I have provided a burner of the radiant cup type which is adapted to be used in places where objectionable vapors or dust are in the atmosphere to be heated. This burner operates in such a manner that a large amount of radiant heat is produced and projected into the region to be heated without the objectionable involution of gases that was inherent in previous burners of this type.

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While in accordance with the provisions of the statutes, I have illustrated and described the best form of my invention now known to me it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit and scope of the invention as set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What is claimed is:

1. In a radiant cup type gas burner, the combination of a refractory ceramic block having a pair of opposed faces, one of said faces being provided with a cup shaped depression forming a combustion space, said block being provided with an opening extending from the base of said depression to the opposite face thereof, and means to supply a fuel mixture to said depression including a holder and a distributor carried thereby and extending through said opening toward said depression, said distributor being provided with means forming a plurality of axially extending channels around the same adjacent to the periphery thereof extending from the interior of said holder to said depression and through which fuel flows to said depression, said distributor being provided with an enclosed chamber adjacent to the end thereof toward said depression, means forming passages between some of said channels and said chamber, and means forming passages from said chamber to said depression whereby fuel can flow from said channels through said chamber to said depression to be burned therein.

2. A distributor member for use in a radiant cup type gas burner comprising a substantially cylindrical body having an end thereof adapted to extend into the zone to be heated, means forming around the body a plurality of substantially axially extending channels through which fuel is adapted to flow, said channels bending radially outward adjacent to said end, said body being provided

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with a chamber located centrally of said channels, means forming passages extending between some of said channels and said chamber, and means forming a plurality of passages extending from said chamber to said end whereby fuel can flow from said channels through said chamber and be discharged at said end.

3. A fuel distributor for use in a radiant type burner comprising a cylindrical block of refractory material, a plurality of flanges projecting radially from the periphery of said body and extending in an axial direction, said body flaring outwardly at one end thereof, said body being formed with a recess in the flared end thereof, said block being formed with a passage extending from between some of said flanges to said recesses, and a cap attached to the flared end of said body to cover said recess and form a chamber thereof, said cap being provided with a plurality of apertures that extend from the exterior thereof to said chamber.

4. A fuel distributor for use in a radiant type burner comprising a cylindrical member of refractory material, said body being formed with a plurality of axial channels around the periphery thereof, said channels bending radially outward at one end of said body to terminate partly in the end and partly in the periphery of the body, said body being formed near said end with a centrally located chamber that is surrounded by said channels, means forming a passage between some of said channels and said chamber, and means forming a plurality of passages between said chamber and said end of said body.

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