May 19, 1953 L. F. VIXLER 2,638,976

GAS BURNER CAP WITH BRANCHED OUTLET PORTS

Filed Dec. 16, 1952

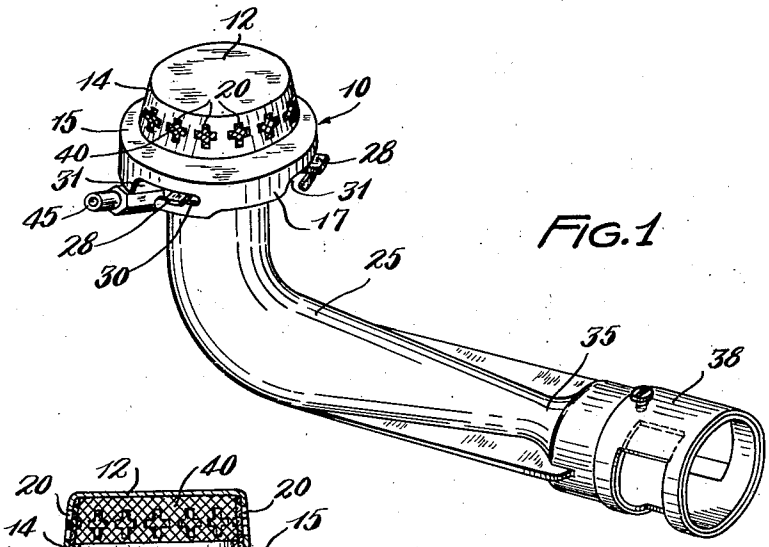

FIG. 1

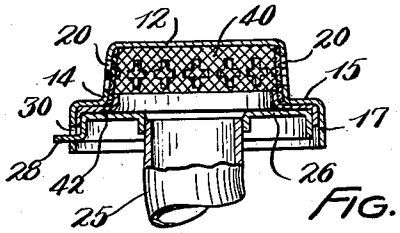

FIG. 2

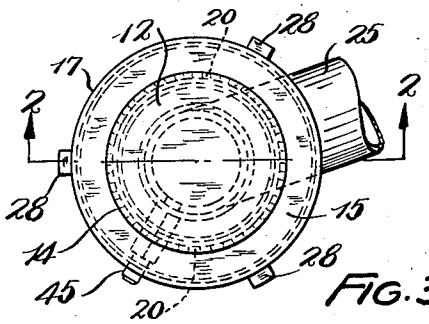

FIG. 3

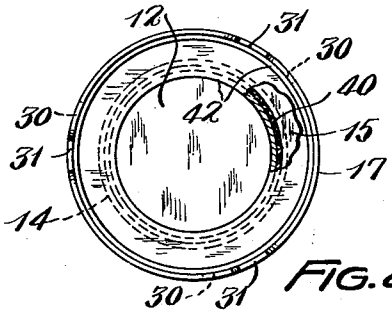

FIG. 4

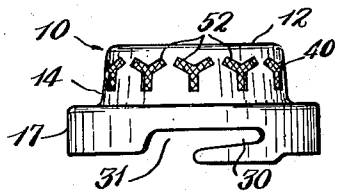

FIG. 5

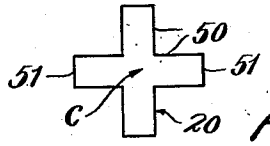

FIG. 6

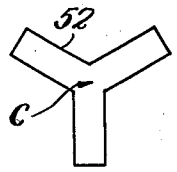

FIG. 7

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Patented May 19, 1953 2,638,976

UNITED STATES PATENT OFFICE

2,638,976

GAS BURNER CAP WITH BRANCHED OUTLET PORTS

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Application December 16, 1952, Serial No. 326,336

7 Claims. (Cl. 158—116)

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My invention relates to a gaseous fuel burner, and more particularly, to atmospheric burners which may be used for gas cooking or similar purposes.

This application is a continuation-in-part of my prior application, Serial No. 138,749, filed January 16, 1950, for "Gaseous Fuel Burner." The present application supersedes the former application in view of formal abandonment thereof.

It has been common practice in the industry to use a burner having a multiplicity of comparatively small holes or apertures from which gas discharges to support a flame. These burners are generally in the form of a circle whose diameter or circumference is comparatively large in relation to their effective burner port area. When these large burners are used for domestic gas cooking, it is common practice to supply so-called center ports in the middle of the burner, in order to give satisfactory cooking performance. These center ports are used to overcome a lack of heat or a so-called cold spot in the burner center which is inherent with the design of these burners of large diameter. In some burner designs it has been necessary to add an expensive independent small burner within the circumference of the outer burner ports to eliminate this cold spot feature. Generally, when these separate dual burners are supplied, they are constructed so that by means of an independent fuel supply, they can be separately controlled and are used for so-called simmer burners. The latter are more expensive in cost and harder to ignite automatically. They also give rise to additional service and cleaning requirements.

Accordingly, it is an object of this invention to provide a burner having the essential merits of the above general type, which is relatively small in diameter and contains specially designed port structures positioned and arranged to cooperate in a novel and advantageous manner.

Other objects of this invention are to provide improved performance at low input burner rates, without the use of center ports or a separate simmer burner, and to provide more efficient performance at low, medium, and high input burner rates.

Another object is to provide a burner having a diameter or perimeter which is relatively small compared to its capacity of operation. To this end a burner is provided having a capacity as great as the customary burner. However, the diameter of such burner is about one-half that of the customary burner. The size and shape of

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the burner is such that it can be easily adapted to a limited or small space and still maintain uniform flame distribution over the area to be heated.

Another object is to provide an efficient port structure or design, and wherein the spacing and arrangement of the ports is such that good flame travel can be procured with ignition at one point, and each port will be provided with an adequate, but not too great, amount of secondary air.

Another object is to provide an efficient burner of such flexibility that the range of input can be effectively controlled within close limits of operation.

Still further objects include the provision of a very light weight burner assembly comprising my new burner head and a mixing tube; the provision of a burner in which the contained volume, exclusive of the mixer tube section, is within the head member alone and is very small; and mechanically so constructing the burner head containing my novel ports that it may be quickly and easily fastened in operative position and be readily detached from the supporting burner tube.

Another object is to provide a burner adapted to be formed by a stamping operation and thus provide a simple burner structure which may be cheaply manufactured and which may be easily and quickly assembled and taken apart for cleaning purposes.

In carrying out my invention I am enabled to attain other notable advantages including, particularly, attaining close proximity of the burner ports, and, of course, the flames therefrom to the bottom of the utensil being heated. In this connection the burner ports are arranged in an annular zone close to a substantially flat burner head top, thus attaining greater efficiency, and which characteristic taken with the small diameter size of the burner head avoids any "central cold spot."

The annular row of burner ports is preferably arranged above an outwardly extending flange or shoulder which may be readily formed in the thin metal stamping comprising the burner head proper.

My new burner is adapted to be used for different types of fuel gas. The nature of my burner head is such that it lends itself to the simple and effective provision of a screen within the burner ports—sometimes desirable to prevent flash-back when the burner is used with fast burning gases.

Other and further objects will become ap-

parent during the course of the following disclosures.

In the drawings forming a part of this specification:

Fig. 1 is a perspective view of my burner head with its mixing tube;

Fig. 2 is a vertical sectional view through the head showing its connection to the upper portion of the mixing tube, the plane of the section being indicated by the line 2—2 of Fig. 3;

Fig. 3 is a top plan view of the burner head and adjacent portion of the mixing tube;

Fig. 4 is a bottom plan view of the burner head element removed from the supporting part being shown partly in section to illustrate the screen-retaining construction;

Fig. 5 is an elevation of the burner head showing a modified form of burner ports; and

Figs. 6 and 7 are enlarged diagrammatic views illustrating the outline of contour of the forms of burner ports shown in Figs. 1 and 5, respectively.

Standard designs of commercially available burners follow a general pattern of construction. For any given amount of gas to be utilized by an atmospheric type burner of multiple port construction, there must be a certain ratio of burner port area to the total air-gas mixture supplied in order to obtain satisfactory flame characteristics.

With the usual type burner the total port area that would be required to support 9,000 B. t. u. per hr. flames would be between .45 and .60 square inches. This total port area is obtained by the drilling of multiple small holes around the periphery of a burner cap. The diameter of such a burner will be around 3 inches, because about 40–56 holes will be required, each no greater than about .120'' diameter and spaced no less than $\frac{1}{16}$'' apart.

If the port is too large, it will cause trouble. That is, the ignition velocity of the gas must be in correct ratio with the velocity of the gas issuing from the burner port, otherwise, if the ignition velocity is greater than the port velocity, the flame will tend to burn behind the burner port which is known to be quite objectionable. Thus, to avoid this objection, small port sizes, such as a 36 or 38 drill size or about .104'' are used, and about 44 of these holes are required to pass the necessary amount of gas. All these and other requirements tend to keep the diameter of the burner at present large sizes.

It is also generally known that so-called secondary air supply at base of flame should be such that the boundary of the outer mantle of the flame is reasonably well defined and that no streaming occurs. In order to obtain this adequate supply of secondary air, the burner ports must be so spaced that one port does not interfere with or rob the next adjacent port of the required secondary air necessary for proper flame characteristics. This required port spacing adds still further to the diameter or circumference of the burner so that the optimum ratio of burner periphery to B. t. u. input per burner port is sacrificed to a lesser degree in my burner than in a conventional burner.

In the novel slot-like construction of my burner, it is noted that no part of the port slot aperture is wider than the diameter of the usual drilled hole found in contemporary burner design. Yet, the total port area of each aperture is equal to several regular drilled burner ports. As will be evident from analysis, higher primary air injection will be obtained from similar conditions of operation when a small number of large ports are used than when a relatively large number of smaller ports giving the same total port area are employed, for the reason that the larger port has a higher discharge coefficient per unit of port area and less resistance to flow.

The novel arrangement of my port construction also permits easy access of adequate secondary air to the entire perimeter of the specially shaped port or aperture for satisfactory flame characteristics. The design and construction of my burner does not follow the pattern of present known burner construction. Although the same ratio of actual total port area to the amount of B. t. u. per hour to be passed through the burner remains approximately the same as contemporary burners, my design requires only 13–14 burner ports to pass the same amount of gas. This is approximately one-third the number of ports as is required for present day burners. In using fewer burner ports, I am able to reduce the size of my burner head approximately one-half. This construction also lends itself to the manufacture by stamping thin metal, instead of using bulky and expensive cast iron and aluminum castings. This affords considerable saving in fabricating costs and greatly reduces the weight.

The flame and operating characteristics of my burner are quite novel. When full gas rate is being emitted from the burner, the characteristic flame produced is quite long in comparison to the short flame produced by present day burners as used for the same purpose. The length of these flames is such that the flame pattern diameter, at the flame tips, approximates the size of the flame pattern diameter developed by the small flames of the larger diameter burners. Inasmuch as the same amount of gas is being consumed in both conditions, the same amount of heat is also supplied. However, my burner flames, being much longer and extending over a larger area of heating surface, will tend to "scrub" more area of the heating surface, thus adding to the overall efficiency. These flames being of elongated form will tend to parallel the heating surface and thus can be placed closer to the utensil without direct flame impingement, thereby adding still further to the burner efficiency.

In the drawings, forming a part of this specification and showing an illustrative embodiment of this invention, the numeral **10** indicates my burner head of the general form of an inverted cup, preferably formed of thin sheet metal such as stainless steel or the like. The shape and conformation, among other advantages, lends itself to manufacture by stamping and punching operations.

The head member is shown as having a substantially flat top wall **12**; a substantially vertical annular side wall portion **14**; a flat horizontal outwardly extending flange **15**, and a depending skirt **17**. The side wall **14** is provided with an annular row of ports **20** extending from near the flange **15** to points near the plane of the top wall **12**, and formed in the special port shapes, as will presently appear.

This head is adapted to be conveniently attached and detached from the mixing tube **25**, which is shown as having an outwardly extending flat supporting flange member **26** rigid with the upwardly extending end of the mixing tube, and as having a downwardly offset portion within the skirt **17**; and also as having outwardly

extending arms 28 adapted to engage a locking portion 30 of offset slots 31 formed in the skirt 17, and by which convenient removal and bayonet locking action is provided for holding the burner head onto the mixing tube member.

As usual, the mixer tube is shown as having a horizontal portion and a reduced Venturi portion 35 adjacent to the usual mixer which may be provided with an air control such as a rotatable sleeve 38 serving as a mixer shutter. Any suitable air mixer control, of course, may be used. It may be noted, however, that the mixer tube is correspondingly of a very light construction, which, taken with the extremely light-weight burner head construction, lends itself to the relatively light weight of the assembly.

Within the wall 14 and extending around and across the burner ports 20, I may provide a screen 40 which may be held in position by an upwardly turned edge formed on an offset disk member 42 having a portion fitted tightly within the skirt 17 and then lying along the flange 15 and extending upwardly inside the lower edge of the screen. This securing member may be held by a forced-fit, or by welding, or the like.

A lighter tip 45, mounted on the burner head 25, is connected to a flash lighter structure, not shown, for igniting the burner 10 in a well known manner, the spacing of the individual ports 20 permitting ready travel of the flame from the lighter tube around the burner head.

One form of my novel type of burner ports, by which the foregoing objects are attained, appears in Figs. 1, 2, and 6. These ports are in the form of a Greek cross. Proportions of the openings in this form, which have been found most satisfactory, are approximately as follows: The elongated slot-like radiating portions 50 are approximately $\frac{1}{16}$ of an inch wide, while the overall dimensions between the ends 51 (see diagram, Fig. 6) are included in a dimension of about ¼ of an inch. The spacing between the individual port openings is preferably not less than the width of one of the elongated openings. That is, the space between the adjacent openings of ports should be $\frac{1}{16}$ of an inch or more to assure access of secondary air to the zone between the ports.

The height of the wall 14 of the burner head is preferably only slightly more than the height of the burner openings; whereby, it will be seen that the volume within the burner head; that is, between the top wall 12 and the supporting member 26, is very small in relation to that of burners of comparable capacity.

Instead of the Greek cross form, I have found that a comparably efficient type of port openings may be that of the Y form, shown in Figs. 5 and 7. Here, of course, are three elongated slot-like portions 52 radiating from a common open central portion, and the dimensions are such as to form a port of comparable area and approximately the same circumferential and vertical dimensions.

In each of these illustrative ports, it will be seen that the central open portion C, from which the elongated openings radiate, will form the central cone of the flame issuing from the port, and in which area the flow of gas is more free and thus more rapid than in the elongated radiating portions, there being a relative resistance or drag, in proportion to the volume, at the outer portions of the radiating slots. As indicated, in outlining the foregoing objects and in describing the operation and efficiency of my

burner above, this phenomenon, coupled with the fact that such a port shape provides a relatively large area of opening with relation to the edges of the port defining its perimeter; and also the fact that all portions of the flame are relatively thin, attains the objective of assuring the easy access of secondary air to the flame as it issues from the port.

The outwardly extending flange 15 forms a shield below the flames, preventing upward rush of air from tending to extinguish the flames at the ports, while still permitting this free and efficient access of the secondary air to the flames as they issue from the ports. An effect of this construction is that the burner operates efficiently when placed only one-half of the usual distance from the bottom of the utensil.

I have found that with a burner head having a diameter of approximately 1½ inches, I may provide 12 to 14 of the Greek cross shaped or Y shaped ports closely arranged in a horizontal row, as shown, and that such a burner will support combustion at its normal fuel input of 9000 B. t. u. per hour.

Furthermore, I have found that by the special arrangement and construction of the burner head these novel ports will maintain combustion efficiently at as low a rate as 500 B. t. u. per hour, or less. This is highly desirable for maintaining the simmering ranges of burning.

The American Standard gas input rating for regular gas range top burners is 9000 B. t. u. per hour. A larger size is referred to as a "giant" range top burner which will produce 12,000 B. t. u. per hour. I have found that by slightly increasing the diameter of the burner head, I may arrange 17 ports of these novel shapes in the circumference, and with desired spacing therebetween, and may readily obtain this higher or maximum 12,000 B. t. u. per hour rating. This same larger type may likewise be regulated to and burn efficiently at a low input rating for simmering purposes.

With the dimensions given, it may be noted, for convenience and for thorough understanding of the design of my burner, that the total port area in the burner head of 1½ inches diameter with 12 or 14 ports, may preferably be between .40 and .60 square inch. The area of one Greek cross port opening, illustrated in Fig. 6; for example, is .028 square inch. The perimeter of this same port is one inch. The volume of the burner head within the space between the top 12 and the supporting plate 26 is approximately ¾ of a cubic inch.

The relationships between the port areas, perimeter of individual ports, and circumference and volume of the burner head, which have been found to produce sufficient results, and based upon these illustrtaive dimensions, with reasonable modifications thereof, are defined in the appended claims.

Obviously, various modifications may be made within the scope, intent, and teachings of the foregoing, while attaining the objects and requirements of given specified applications or uses.

Having thus described my invention, what I claim is:

1. A burner of the class described, comprising means for mixing gas and air and including a burner head forming a chamber communicating with said mixing means, and having a substantially imperforate top and a substantially vertically disposed side wall, said side wall having a series of separate outlet ports arranged around

and extending through the periphery of said side wall, each port comprising three or more elongated narrow open portions radiating from a common central opening of substantially the width of said elongated portions, and in which each of the ports has a perimeter, the value of the numbers indicating its length in linear inches ranging from twenty to fifty times the value of the number indicating its area expressed in square inches.

2. The burner described in claim 1 in which the ports are separated a distance at least as great as the width of one of said elongated open portions.

3. The burner described in claim 1 in which an annular screen is disposed within the burner head, and extends across the openings of said ports on the inside thereof.

4. The burner described in claim 1 in which the shape of the burner ports is that of a Greek cross.

5. A burner of the class described, comprising means for mixing gas and air and including a burner head having a substantially vertical wall surface through which extend burner ports arranged in a horizontal zone around said wall and in which each port is formed to comprise at least three slots radiating from a common central opening of substantially the width of said radiating slots, and the total area of the ports, expressed in a number indicating value in square inches, being approximately in the ratio of one-ninth to one-fourteenth of the periphery of the burner head, expressed in a number indicating linear inches.

6. A burner of the class described comprising a means for mixing gas and air, and a burner head communicating with the mixing means, the burner head being formed to include a thin walled chamber having a substantially flat top and a bottom wall spaced therefrom, and having an opening through which the mixing means communicates, said burner head having an annular row of ports arranged around the burner head between the top and bottom walls, and each port being formed to comprise single openings including three or more elongated narrow portions extending from a common central open portion

of substantially the same width as said narrow portions, the walls of the burner head including a volume which, expressed in a figure indicating cubic inches, has a relation to a figure indicating the periphery of the chamber expressed in linear inches in substantially the order of three-fourths cubic inch to between four and six linear inches.

7. A burner of the class described, comprising means for mixing gas and air, and a burner head communicating with the mixing means, the burner head being formed in the shape of a thin walled chamber having a substantially flat top, said burner head having an annular row of ports substantially parallel with the top, and each port being formed with three or more elongated narrow portions extending from a common central opening of substantially the width of said narrow portions, the burner head having an outwardly extending annular flange below and adjacent to the row of ports, the ports being separated, and the total area of said ports, expressed in a number indicating value in square inches, being approximately in the ratio of one-ninth to one-fourteenth of the periphery, expressed in a number indicating linear inches, and whereby as a result of the shape of the ports and the function of said flange a sufficient supply of secondary air to the flame is provided to support efficient combustion while burning from simmering flame to the top B. t. u. range of the burner.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
555,070	Billings	Feb. 25, 1896
1,595,638	Beard	Aug. 19, 1926
1,657,995	Garneau	Jan. 31, 1928
2,015,266	Gerer	Sept 24, 1935
2,190,099	Hahn	Feb. 13, 1940
2,441,242	Harkins	May 11, 1948
2,546,009	McGowan et al.	Mar. 20, 1951

FOREIGN PATENTS

Number	Country	Date
526,476	Great Britain	Sept. 19, 1940