April 22, 1952 F. TODD 2,594,094

GAS BURNER WITH FLAME RETENTION PORTS

Filed March 11, 1948 2 SHEETS—SHEET 1

Fig. 1

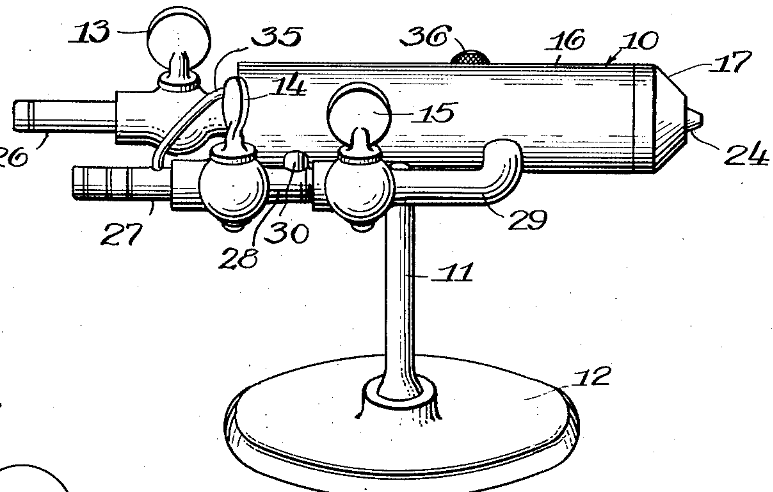


Fig. 2

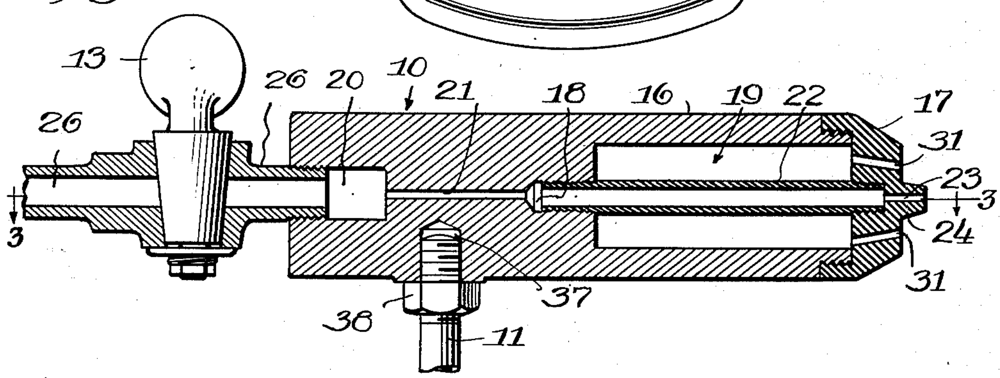
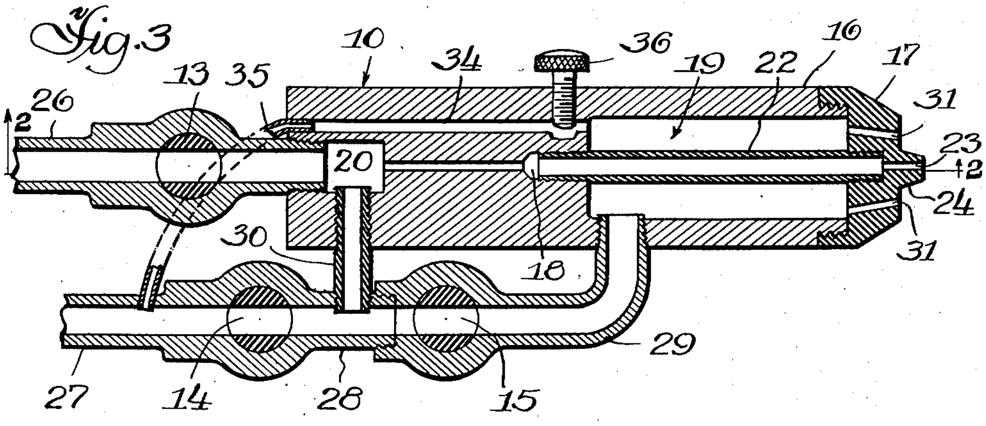


Fig. 3



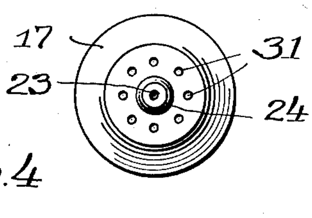


Fig. 4

INVENTOR.
Floyd Todd,
BY
Zabel and Gritzbaugh
Attys.

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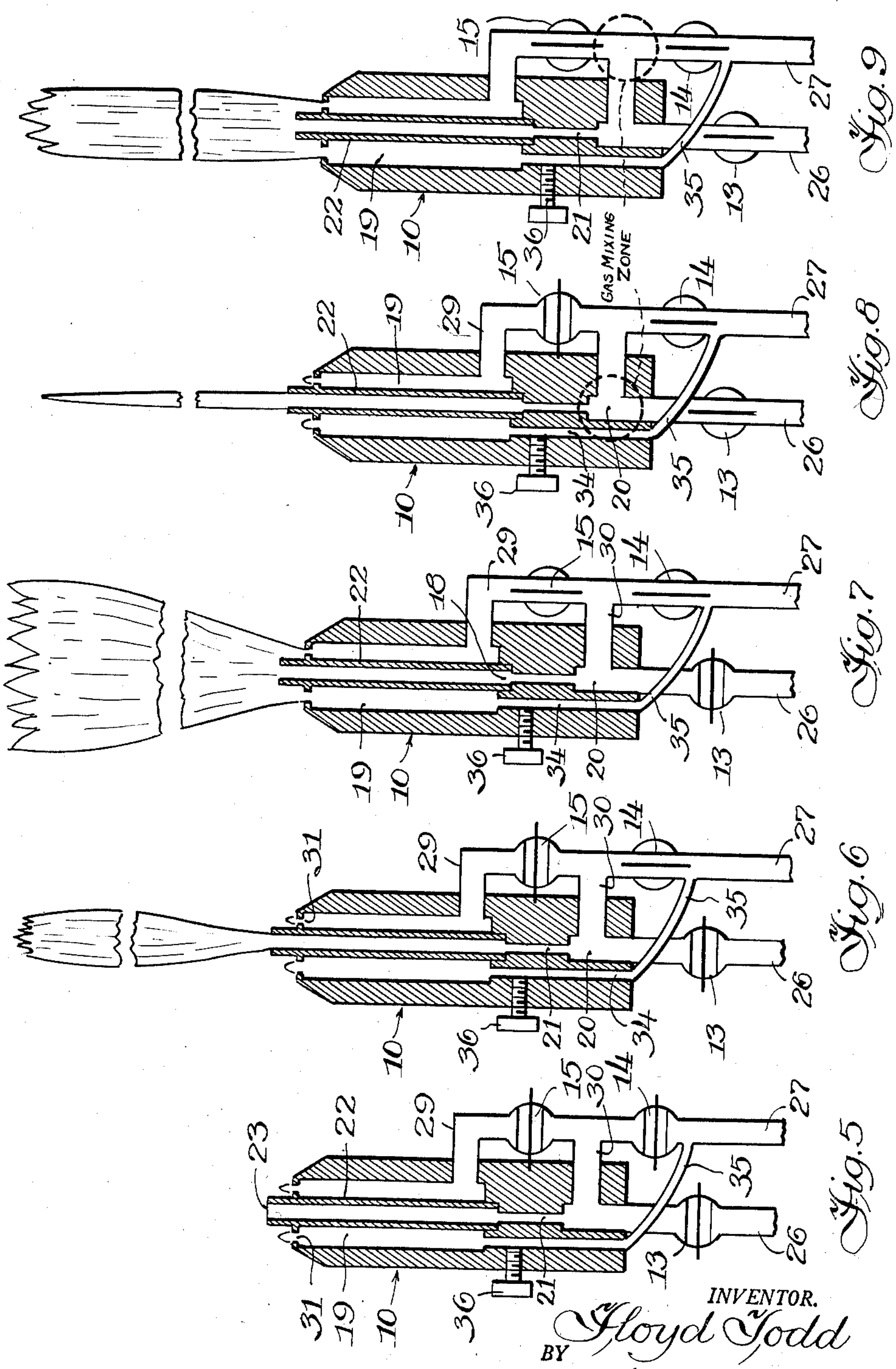

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GAS BURNER WITH FLAME RETENTION PORTS

Floyd Todd, Springfield, Pa., assignor to Fisher Scientific Company, Pittsburgh, Pa., a corporation of Pennsylvania

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9 Claims. (Cl. 158—27.4)

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This invention relates to improvements in gas burners, and in particular, to gas burners of the type used in glass blowing.

It is an object of my invention to provide a gas burner which is capable of providing a wide variety of size, shape and temperature of flame, and in particular, of providing both large and small flames of either the annealing or sealing type.

A further object of my invention is to provide a gas burner embodying means for effecting a predetermined mixture of gases, and having separate jet forming means for providing either small flames or large flames, in combination with means for shifting the operation substantially instantaneously from a large flame to a small flame, or vice versa, without shifting substantially the proportions of the gas mixture.

Another object is to provide a burner having pilot light means built in and integral with the burner itself, and which produces a pilot flame which will not interfere with the shape of the working flame.

Still another object is to provide a gas burner capable of producing a silent sealing flame. In this connection, it could be pointed out that in glass blowing terminology, annealing flame refers to a relatively cool flame, such as is used in annealing glass, whereas sealing flame refers to a comparatively hot flame, which is used in the actual working or blowing of glass. This difference in temperature is effected, in large measure, by introducing air or oxygen into the gas jet, which, up to a certain optimum amount, increases the temperature of the flame considerably. However, this is accomplished in the usual burner in a manner which produces a very noisy flame, termed a blast flame.

The gas burner which comprises my invention produces a comparatively silent flame by virtue of the fact that the mixing of the combustible gas and the combustion supporting gas is effected not in the jet of the flame itself, but is premixed in the burner, and prior to the time that it passes through the jet producing means.

A still further object of my invention is to provide a burner in which the aforementioned mixing is effected in two stages or zones.

Other objects, features, and advantages will become apparent as the description proceeds.

With reference now to the accompanying drawings, in which like reference numerals designate like parts—

Fig. 1 is an elevation of a preferred embodiment of my invention;

Fig. 2 is a vertical sectional view of the burner proper taken on line 2—2 of Fig. 3;

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Fig. 3 is a horizontal sectional view taken along line 3—3 of Fig. 2;

Fig. 4 is an end view of the cap; and

Figs. 5 to 9, inclusive, are diagrammatic representations of the burner showing the different modes of operation.

In Fig. 1, the burner is designated generally by the reference numeral 10 and is mounted on a supporting rod 11, which extends upwardly from a suitable base 12. The burner is provided with gas supply valves 13 and 14, respectively, and also with a control valve 15, the purpose of which will later become apparent.

The burner comprises a suitable body member 16, the front end of which is provided with a cap 17. Extending inwardly from the front of the body member are a bore and a counterbore, the bore being designated by the reference numeral 18, and the counterbore forming a diffusion chamber designated by the reference numeral 19. Extending inwardly from the rear surface of the body member is another bore, concentric with bore 18, and forming a chamber 20. The bores 18 and the chamber 20 are connected by a passageway 21 of comparatively small diameter. A tube 22 is threaded or otherwise secured at one end in the bore 18, and the other end is received within the cap 17. Tube 22 forms a second diffusion chamber. The cap 17 is apertured to provide a central orifice 23 for the tube 22. The cap is also apertured to provide a series of concentric orifices 31 for the chamber 19. The central portion of the cap is extended, thereby forming an apertured tip 24 which contains the central orifice 23.

The constricted passageway 21, the bore 18, the tube 22 and the orifice 23 are collectively referred to as the "central orifice path" as contrasted with the "concentric orifice path" which includes chamber 19 and the concentric orifices 31.

One end of a supply conduit 26 terminates in chamber 20, the supply valve 13 being disposed in the conduit.

A second supply conduit 27 connects with the chamber 19, this conduit including supply valve 14, control valve 15, a short portion 28 disposed between valves 14 and 15, and an elbow portion 29 disposed between valve 15 and the body member 16. A cross connection 30, in the form of a short length of pipe, extends between portion 28 and chamber 20. The portion 28, control valve 15 and elbow portion 29, together with chamber 19, and orifices 31, constitute the concentric orifice path above mentioned.

It will be seen that when the conduits 26 and 27 are connected to separate sources of gas, that a separate orifice path is provided for each gas. However, the cross connection provides a means for diverting some of the gas from one source into the path associated with the other source, thereby providing a source of mixed gas and also providing a means by which the volume flowing through the separate paths may be regulated. When the valves 13, 14 and 15 are all the way open, however, the constriction in the central orifice path causes a portion of the gas from conduit 26 to be diverted through the cross connection 30, and to flow through the concentric orifice path in which it commingles with the gas coming from the conduit 27. Thus, the flame will consist of two concentric jets, the inner jet consisting of gas of the type supplied by conduit 26, and the outer jet consisting of a mixture of the gases supplied by both conduits.

As the control valve 15 is moved toward its closed position, there will be a point at which the resistance offered by the alternative paths are equal to each other, and at this point, there would be no gas flow through the cross connection in either direction, with the result that the flame will consist of an inner jet of one gas and an outer jet of the other gas. This operation will also cause the outer jet to be reduced in size or volume, and the inner jet to be increased. Further movement of the valve 15 into its closed position will cause all of the gas from conduit 27 to flow through the central orifice path, and to produce a gas jet which is considerably smaller than the combined gas jet which was produced when the valve 15 was all the way open. At the same time, the flame will be of a narrow pencil-like shape, as contrasted with the large flaring flame produced in the first instance.

Thus, it will be seen that by the manipulation of control valve 15, a considerable variation in size and shape of flame may be obtained without manipulating the gas supply valves 13 and 14, which latter manipulation would require extreme care if the proportions of the two gases are to be maintained constant.

Although the present burner may be used with any two types of gas, in its normal operation, the burner is intended for use with a combustible gas, such as acetylene or propane, and a combustion supporting gas, such as air or oxygen. I prefer to connect the conduit 27 to the source of supply of the combustible gas, and the conduit 26 to the source of supply of the combustion supporting gas, for the reason that when the control valve 15 is open, I prefer to have a flame in which the inner jet consists of the combustion supporting gas, rather than of the combustible gas. However, the connection can be reversed if the latter type of flame is desired.

As shown in Fig. 2, the supporting rod 11 is threaded into a threaded bore 37 in the body member 16, and a jam nut 38 serves to maintain the parts in fixed relationship. A suitable swivel connection may be provided between the supporting rod 11 and the base 12, which enables the burner to be placed in any desired position.

A passageway 34 is formed in the body member 16, parallel to the passageway 21, and communicating with the chamber 19. A tube 35 provides connection between the rear end of passageway 34 and the gas supply means which is intended to supply the combustible gas, in this instance, gas conduit 27. The connection with gas conduit 27 is made at a point rearwardly of the valve 14. A control valve 36 is provided in the body member 16, to regulate the amount of gas passing through the passageway 34 into the chamber 19.

The elements 34 and 35 provide a means bypassing the valves 14 and 15; thus a small amount of gas is supplied to the chamber 19 and emanates from the orifices 31 to form a pilot light, as shown diagrammatically in Fig. 5. Due to the protruded tip 24, the substantially annular jet of gas forming the pilot light is maintained separate from the jet produced by the central orifice 23, provided that the flow of gas through the elements 34 and 35 is sufficiently small. This fact, together with the radial symmetry of the pilot light flame results in an arrangement whereby the jet produced by the orifice 23 is not deformed by the pilot light. Furthermore, the protruded tip makes it more difficult to blow out the pilot light flame.

Figs. 5 to 9, inclusive, are diagrammatic representations of the various types of flames which are provided by the burner. When the valves 13 and 14 are both closed, the only flame is the pilot light, as shown in Fig. 5. When the combustible gas valve 14 is opened, and the remaining valves closed, a small annealing flame is produced, as shown in Fig. 6. This flame is produced merely by opening valve 14, the jet formed by orifice 23 being automatically ignited by the pilot light. It will be observed that the symmetry of the small annealing flame is not destroyed by the pilot light, and this is the case even if the burner is disposed in the horizontal position. By opening the control valve 15, the combustible gas is also caused to flow through the concentric orifice path, thereby producing the large annealing flame shown in Fig. 7.

The small sealing flame is produced by opening both valves 13 and 14, as shown in Fig. 8, but permitting the control valve 15 to remain closed. The jet formed by orifice 23 is automatically ignited by the pilot light flame, and symmetry is maintained. In this instance, the combustible gas flows from right to left through the cross connection 30 and mixes in chamber 20 with the combustion suporting gas supplied by conduit 26, this initial mixing being effected by the turbulence of these intersecting gas streams. In flowing from this initial gas mixing area through the central orifice path, the tube 22 provides a chamber of larger diameter than the constricted passageway 21, and permits the initially mixed gases to become more thoroughly diffused one into the other, thereby providing a silent flame. When all three valves are opened, as shown in Fig. 9, the concentric orifice path offers a lesser resistance than the central orifice path, with the result that the combustion supporting gas passes from left to right, as viewed in Fig. 9, through the cross connection 30. Here, then, the initial mixing takes place in portion 28, and the initially mixed gas in passing into and through the chamber 19, becomes further diffused with the result that a silent flame is produced, insofar as the concentric jet is concerned. The central jet consists only of the combustion supporting gas and serves to increase the surface area of the flame.

It is, of course, obvious that a much greater variety of flame shapes can be produced by setting the valves 13, 14 and 15 to various combinations of intermediate positions, the positions shown in the diagrams representing only the extreme open or closed positions. However, the positions shown do show the four basic types of flame which are used in glass blowing, and it is evident that by the provision of two separate and concentric jet producing means, in combination with the control valve 15 which regulates the outer jet producing means, I am enabled to provide a much greater variety in flame size and shape than would be produced by only one jet producing means for the reason that regulation of the amount of gas flowing through a single jet producing means, while it might affect the size of the flame, would not readily change the shape of the flame. With the present arrangement, however, it is obvious that a wide variety of shapes can be produced which are intermediate the extreme small and large flame shapes represented in the diagrams. Furthermore, a substantial and useful variation in flame shape can be produced merely by regulating the control valve 15 without the necessity of changing the supply valves 13 and 14.

I claim:

1. A gas burner comprising a nozzle providing inner jet forming means and outer jet forming means substantially concentric therewith, two separate gas supply means, first means providing communication between one of said supply means and said inner jet, second means providing communication between the other of said supply means and said outer jet, a cross connection between said first and second means, a constriction in said first means, and a control valve in said second means to regulate the amount of gas flowing therethrough with respect to the amount flowing through said first means.

2. A gas burner comprising a nozzle providing inner jet forming means and outer jet forming means substantially concentric therewith, two separate gas supply means, first means providing communication between one of said supply means and said inner jet, second means providing communication between the other of said supply means and said outer jet, a cross connection between said first and second means, a constriction in said first means, a control valve disposed between said cross connnection and said outer jet forming means in said second means to regulate the amount of gas flowing therethrough with respect to said first means, a supply valve for each of said gas supply means, and third means providing communication between one of said gas supply means and said outer jet forming means, said third means bypassing the supply valve operatively associated with said last mentioned gas supply means and said control valve.

3. A gas burner having a body member providing inner and outer concentric chambers, a cap mounted on said body member and forming a closure for said chambers, said cap being apertured to provide jet forming orifices for each of said chambers, first gas supply means in series connection with said inner chamber, second gas supply means in series connection with said outer chamber, a cross connection between said two gas supply means and providing at either end of said cross connection a mixing zone, the path between that one of said mixing zones, which is operatively associated with said inner concentric chamber, and its related orifice being of greater resistance to the passage of gas than the path between that one of said mixing zones, which is operatively associated with said outer concentric chamber, and its related orifice, and a valve in said latter path.

4. A gas burner comprising means providing two separate paths for the flow of gas therethrough, one of said paths including jet forming means, a diffusion chamber adjacent thereto and communicating therewith, and a passageway opening into said diffusion chamber and of a smaller cross sectional area than said chamber, the other of said paths including jet forming means, a diffusion chamber adjacent thereto and communicating therewith, and a passageway opening into said diffusion chamber and of a smaller cross sectional area than said diffusion chamber, separate gas supply means connecting with each of said passageways, and a cross connection between said gas supply means providing, at either end of said cross connection, zones of initial gas mixing, one of said paths normally offering a lesser resistance to the passage of gas therethrough than the other of said paths and including a valve for the regulation of the gas passing therethrough.

5. A gas burner comprising means providing two separate paths for the flow of gas therethrough, each of said paths including jet forming means, a diffusion chamber adjacent thereto and communicating therewith, and a passageway opening into said diffusion chamber and of a smaller cross sectional area than said chamber, separate gas supply means connecting with each of said passageways, and means connecting said separate gas supply means, a valve disposed in one of said paths for the regulation of the gas passing therethrough, the diffusion chamber and jet forming means of said last mentioned path surrounding the diffusion chamber and jet forming means of said other path.

6. A gas burner comprising a nozzle providing inner jet forming means and outer jet forming means substantially concentric therewith, two separate gas supply means, first means providing communication between both of said gas supply means and said inner jet forming means for providing a working flame of mixed gas, and second means providing communication between just one of said gas supply means and said outer jet forming means for providing a pilot flame.

7. A gas burner comprising a body member having concentric inner and outer chambers, a cap for said body member providing a central orifice for said inner chamber and a series of concentric orifices for said outer chamber, said central orifice being disposed forwardly of said concentric orifices, means for supplying gas to said central chamber for providing a working flame, means for supplying a limited amount of gas to said outer chamber for providing a pilot flame, second means for supplying gas to said outer chamber and including a valve for regulation of the gas supplied thereto, said second means being operative to increase the amount of gas supplied to said outer chamber over that supplied by said first-mentioned supply means to produce a concentric flame of a size which will merge with said central working flame.

8. A gas burner comprising means providing a central path terminating in an orifice for producing a narrow gas jet, second means providing a concentric path terminating in an orifice for producing a flaring gas jet substantially concentric to said narrow gas jet, valve means for regulating the flow of gas through said concentric path for varying the size and shape of the flame provided by both of said gas jets, and separate means for supplying gas to said concentric path for producing a pilot flame which is separate from the flame produced by said narrow gas jet when said valve means is closed and which merges with the working flame produced by said

flaring gas jet when said valve means is opened.

9. A gas burner comprising two separate gas supply means, a cross connection between said separate gas supply means and provided at either end thereof an initial gas mixing zone, means providing a first path leading from one of said initial gas mixing zones, said means including a jet producing means, a diffusion chamber in communication therewith, and a passageway between said diffusion chamber and said first-mentioned initial gas mixing zone, means providing a second path leading from the other one of said initial gas mixing zones, said means including a jet producing means concentrically disposed with respect to said first-mentioned jet producing means, a diffusion chamber in communication therewith, and a passageway between said diffusion chamber and said other initial gas mixing zone, each of said passageways having a cross sectional area smaller than that of its associated diffusion chamber, and means for regulating the flow of gas through one of said passageways.

FLOYD TODD.

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