

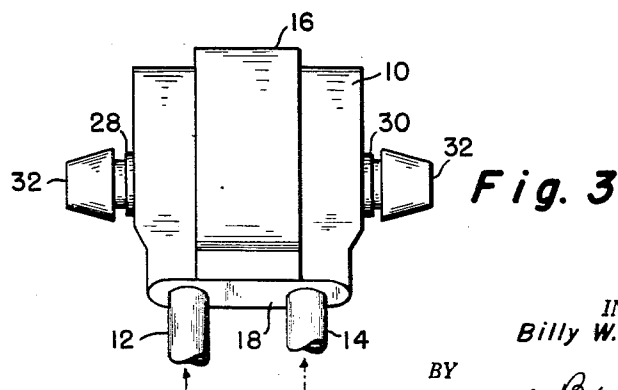
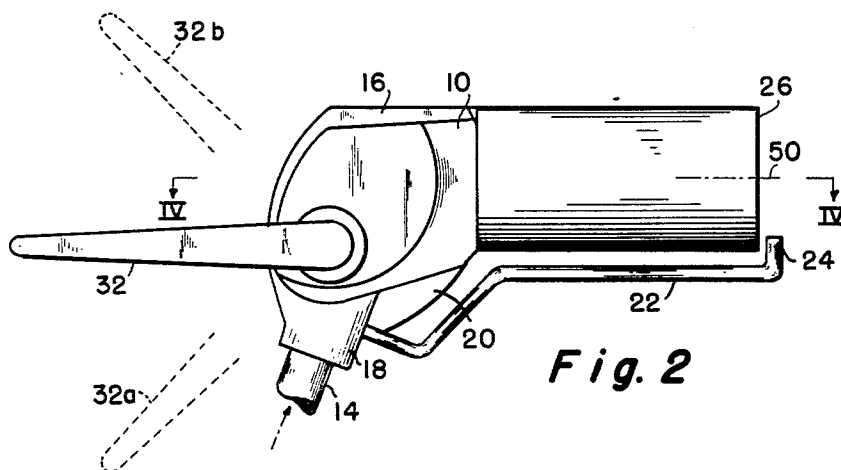
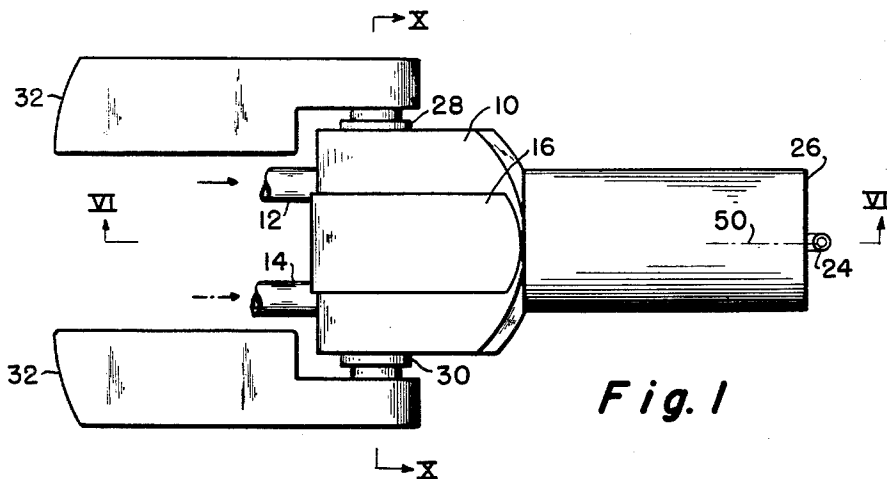
June 28, 1960

B. W. TAYLOR
GAS BURNER

2,942,655

Filed April 27, 1955

4 Sheets-Sheet 1



INVENTOR.
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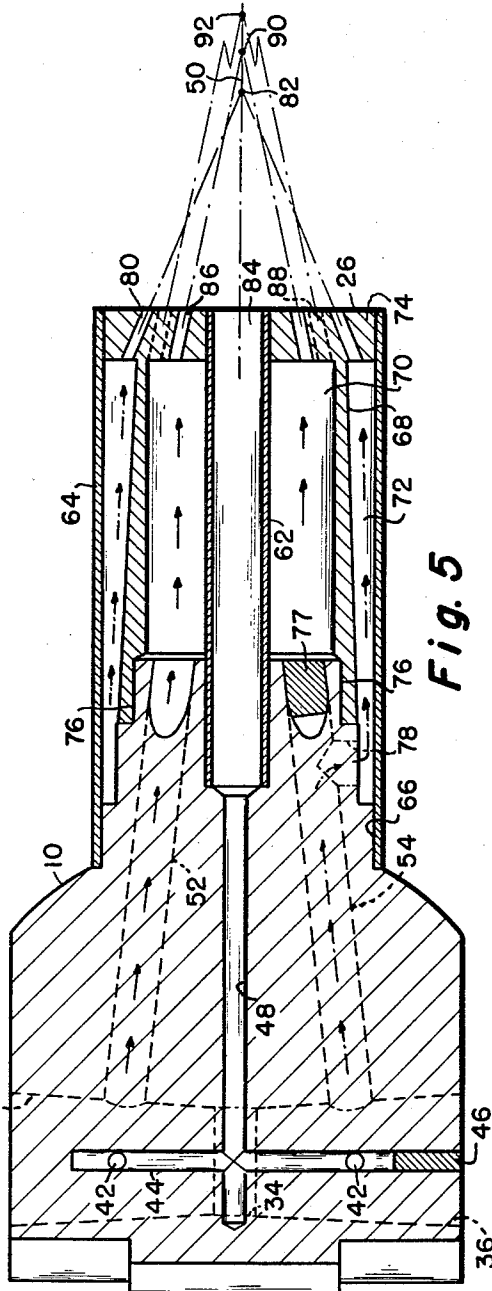
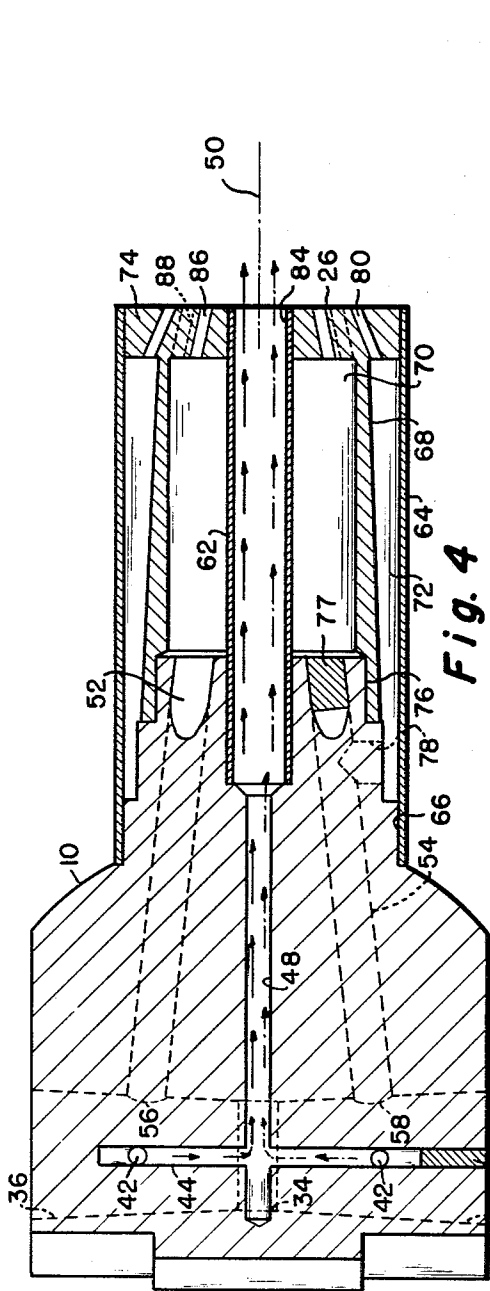
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4 Sheets-Sheet 2



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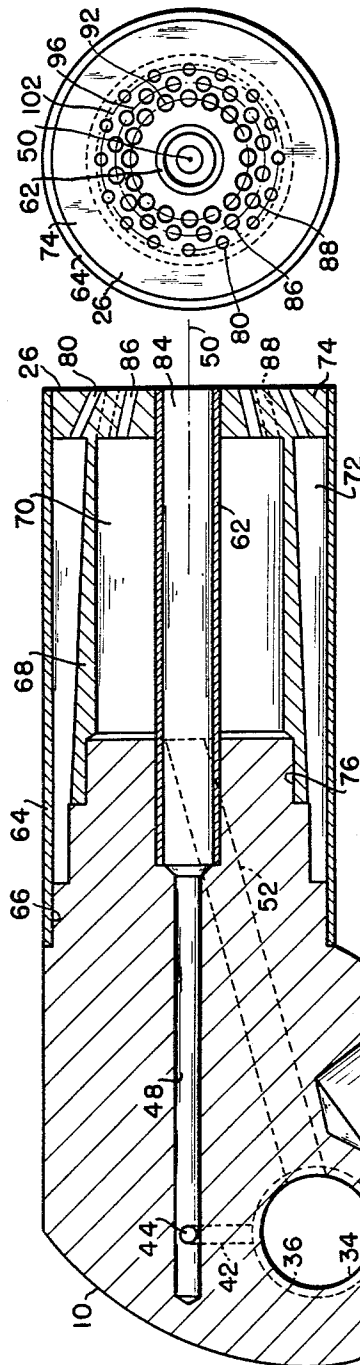
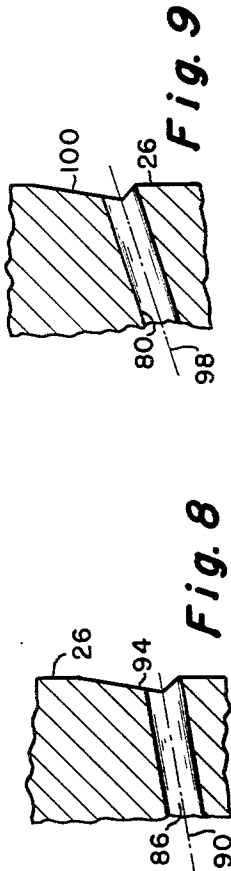
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4 Sheets-Sheet 4

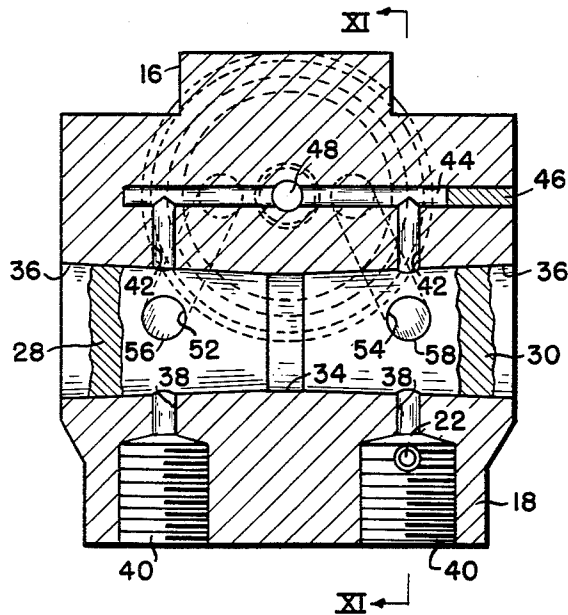


Fig. 10

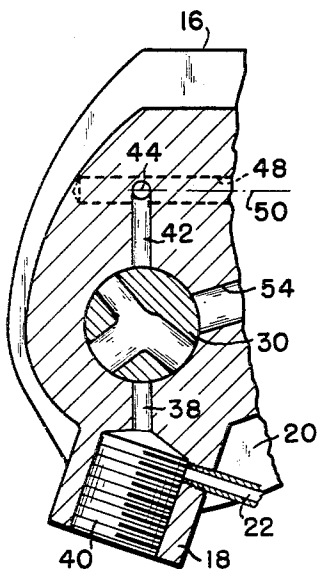


Fig. 11

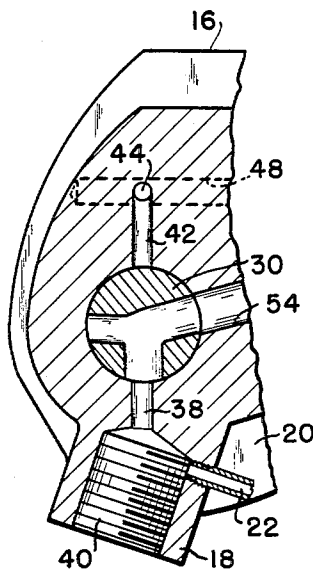


Fig. 12

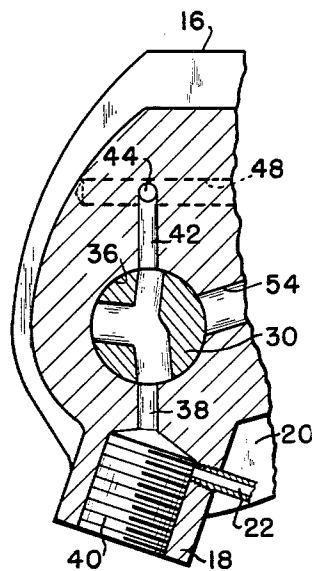


Fig. 13

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2,942,655

GAS BURNER

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5 Claims. (Cl. 158—27.4)

The present application relates to a burner, particularly to a glass heating burner primarily intended for use in the glass blowing trade.

The burner invention herein disclosed provides selectively for two different flames for heating glass, one being a relatively short narrow sealing flame and the other being a bushy hot flame for the general heating of glassware being formed. In the present two-flame burner, as well as in one or more analogous prior known burners, each of the selected flames is the product of a combustion process involving a combustion supporting medium, commonly gaseous oxygen, and a combustible medium, such as natural or artificial gas. These gases, when employed for producing the narrow type flame in which flame flashback is no particular problem, are ordinarily premixed internally of the burner prior to combustion, whereas the relatively greater volumes necessary for the gases for the hot bushy flame are externally mixed in the presence of and simultaneously with the combustion process, thereby obviating flashback into the burner of the relatively large volumes of combustible mixture then being handled when the burner is turned off.

In one of these prior known burners, for instance, the burner, according to the Haak Patent No. 2,598,787, there are several disadvantageous features of operation which have been materially reduced or substantially eliminated by means of my presently improved burner. On inspection, it is apparent from the Haak patent that the burner is controlled from separate handles remote thereto and is supplied with gas from a mixing manifold separate from the burner. I bought and tested a burner made according to this Patent No. 2,598,787 and found that, in addition to the disadvantages of the remote handles and separate mixing manifold, the burner in operation delivered more gas than was required for the oxygen available and caused carbon deposits to be formed about the holes for the oxygen so as to plug them. During employment of the bushy flame in the Haak burner, the burner sputtered and the flame was unstable. The presently improved burner herein disclosed utilizes valve handles unitary with the burner, utilizes a self-contained internal mixing chamber, produces a quiet and stable flame and does not cause carbon deposits to be formed about the holes of the burner nozzle jets.

By means of the presently improved burner, moreover, the gases producing the flame, and especially the externally mixed gases, are directed in jets so as to concentrate or converge at the core or base of the flame. More particularly, the gases are directed in jets through a multiplicity of passages which are disposed so as to converge at the core of the common resulting jet and which are proportioned in their individual sizes to produce an inherently proper gas mixture ratio for a well-mixed and yellow-free proper combustion. According to a feature of this multiplicity of passages, the gases directed therethrough tend to be emitted in a relatively quiet fashion and in the form of a plurality of individual jets

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which blend and merge with one another to produce a relatively stable flame.

In the drawings,

Figures 1, 2, and 3 are respectively top plan, side elevation and rear elevation views of my improved burner;

Figure 4 is a longitudinal sectional view in plan taken along the section lines IV—IV of Figure 2;

Figure 5 is a view corresponding to Figure 4 but showing a different pattern of burner gas circulation;

Figure 6 is a longitudinal sectional view in elevation taken along the section lines VI—VI of Figure 1;

Figure 7 is an end view of the burner of Figure 6 showing the face of the nozzle tip;

Figures 8 and 9 are fragmentary enlargements of the two different types of passages of Figure 6 and corresponding to the showing of Figure 6;

Figure 10 is a transverse sectional view taken along the lines X—X through a valve in Figure 1; and

Figures 11, 12, and 13 are fragmentary sectional showings corresponding to the section lines XI—XI of Figure 10 and showing a sequence of operation of the valve of Figure 10.

In Figures 1, 2, and 3 particularly, a two-flame burner is shown having a body 10 adapted to be supplied through a pair of spaced apart conduits 12 and 14 with a combustion supporting gas and with a combustible gas, respectively. Preferably, the gas for the conduit 12 is compressed gaseous oxygen and the gas admitted through the conduit 14 is compressed natural gas supplied at ordinary pressures. The body 10 has a top upraised rib 16 terminating in a faced-off boss 18 at the rear of which the conduits 12 and 14 are connected. The body 10 has a bottom external rib 20 extending forwardly from the vicinity of the boss having the face 18. A pilot light tube 22 connected at the rear to the gas conduit 14 extends forwardly under the burner and terminates in an upwardly extending jet portion 24 disposed transversely to but closely spaced forwardly from the face 26 of the burner tip. The conduits 12 and 14 are respectively controlled by means of a pair of rotatable valve members 28 and 30 which are hereinafter described in greater detail and which are adapted to be manually set in desired positions of rotation by means of the independently operable pair of handles 32. Each of the handles 32 has a neutral position shown by solid lines in Figure 2 from which it is movable, respectively, downwardly to the position shown by the dotted lines 32a and upwardly into a position shown by the dotted lines 32b.

In Figures 4, 5 and 6, the burner body 10 is provided with a transverse horizontally extending through bore 34 which at each of its opposite ends is chamfered to form an outwardly opened valve receiving counterbore 36. The oxygen and gas conduits 12 and 14 respectively communicate with the bore 34 through individual vertically extending passages such as at 38 at the head of a drilled and tapped fitting receiving opening 40 which receives and directly communicates with each of the conduits 12 and 14, as the case may be. The vertically extending passages 38, one at each side of the body 10, each have an upper extension portion on the top side of the bore 36 indicated at 42. The extreme upper ends of the extension portions 42 are intersected by a common horizontally extending transverse passage 44 provided by means of a blind-drilled bore which may be plugged at one end by means of a plug 46. The mid-portion 44 of the common passage is intersected by a longitudinally extending passage 48 within the valve body 10 which centrally contains therewithin the longitudinal central axis of the burner indicated at 50. A pair of forwardly and upwardly extending passages 52 and 54, respectively, are formed in the burner body 10 and at their rear ends

intersect the common bore 34 at transversely spaced apart locations at 56 and 58, respectively.

The lower rib 20 about the circumference of the valve body 10 may be provided with a blind bore or socket 60 for receiving a pedestal or support for the burner. The passage 48 which extends longitudinally of the valve body 10 is counterbored at its forward end to receive the inner end of a central sleeve 62 which fits within the counterbore in a self-holding press fit. Concentrically disposed about the central sleeve 62, there is provided another larger sleeve 64 which at its inner end is similarly press fitted to an annular shoulder 66 formed on an exterior cylindrical surface of the valve body 10. The concentric sleeves 62, 64, which are coaxial with respect to the central axis 50 of the burner, define an included annular space within which there is received a machined fitting, such as at 68, which may be of brass and which within its inner circumference cooperates with the smaller sleeve 62 to define an annular oxygen chamber 70 and which cooperates at its outer periphery with the larger sleeve 64 to define a gas chamber or conduit 72. The fitting 68 has a transverse flange 74 at the forward end thereof which may be suitably welded at its inner and outer peripheries to the respective inner and outer sleeves 62, 64 so as to provide a gastight joint. The rear end of the fitting 68 is press fitted about an annular shoulder 76 formed on the burner body 10.

The noted forwardly and upwardly extending oxygen passage 52 terminates at its forward end in a port in the floor of the oxygen chamber 70 whereas the companion forwardly and upwardly extending gas passage 54 is provided with a plug at 77 to close off the forward end thereof and communicates through a short transversely extending intersecting passage 78 with the annular gas chamber 72. Passages 80 leading from the gas chamber 72 are drilled in the end 74 of the fitting 68 and are spaced in a circular path of revolution about the central axis 50 of the nozzle. The jet passages 80 serve to discharge gas in jets from the chamber 72 in a mutually converging pattern with the other jet passages 80 whose axes intersect with one another at a common point 82 along the burner central axis 50 and spaced apart from the face of the tip 26 by a predetermined amount. Each of the jet passages 80 occupies a common plane different from the plane of the adjacent passages 80 but containing the central axis 50 and having an axis disposed at a predetermined angle to the latter. Between the outer passages 80 and a central narrow flame passage 84 defined by the inner sleeve 62, there is provided a first and a second intermediate row of oxygen discharge passages 86 and 88 which are disposed in a circular path of revolution similar to the outer gas passages 80. The first row of intermediate passages 86 are arranged to concentrate their streams of oxygen at a point forwardly of the face 26 of the nozzle tip and their axes commonly intersect at a point 90 on the central axis of the burner at 50. Each passage axis of the first intermediate passages 86 is contained in a plane containing the axis 50 and forms a predetermined angle with respect to the latter. Similarly, the second intermediate gas passages 88 have convergent axes which intersect one another at a point 92 located along the central axis 50 with a resulting predetermined angularity between the axis of each passage 88 and the central axis 50. It will be noted that the point of intersecting axes for the first intermediate row of gas passages 86 is located at 90 which is nearer to the face 26 of the tip than the intersecting point 92 but which is farther away from the plane of the tip than the point 82, at which the outer passages 80 have their axes intersect. It will be appreciated from the foregoing that the jet paths of gas produced by the passages 80 successively intersect the jets from the second intermediate oxygen passages 88 and the jets from the first intermediate oxygen passages 86 so as to provide a well-mixed, quiet, and stable mixture which accordingly burns in a stable bushy

flame for the purposes described. The latter mixture occurs in the presence of and simultaneously with the combustion process producing the bushy flame. On the other hand, the common passage 44 extending horizontally and transversely within the rear of the body 10 provides an internal mixing chamber from which an internally formed mixture of oxygen and gas proceeds forwardly through the central passage 48 and into the expanded counterbored section occupied by the inner sleeve 62. The resulting pre-mixed oxygen and gas is conducted in an expanded path through the interior of the tube at 84 and is discharged forwardly in a narrow small flame as compared with the relatively hot bushy flame produced by the respective sets of jet passages 80, 86, and 88.

In Figures 7, 8 and 9, specific arrangement of the circularly disposed rows of jet passages 80, 86, and 88 may be clearly seen. The first intermediate row of oxygen passages 86, seen in both Figures 7 and 8, is disposed such that their end openings and central axes as at 90 conform to a common circle shown at 92 and accurately defined by means of the apex of a wedge-shaped groove 94 which is depressed slightly below the surface of the face 26 of the nozzle tip. The groove 94, which may be of a wedge-shaped angularity of 120 degrees at its apex, is a convenient expedient as a drill starting shoulder for the multitude of drilled passages 86 and helps during drilling to preserve their uniform circular arrangement about the central reference axis 50 as a center. The second intermediate row of oxygen passages 88 is formed according to the same pattern as the row 86 just discussed with the only difference being that no passage in either row is radially aligned with a passage of the other row. It is, of course, readily apparent that the row of centers of the second intermediate passages 88 is radially spaced about the row of centers 92 along a line indicated at 96. The row of outer passages 80 is best seen in Figures 7 and 9 and, similarly to the intermediate gas passages just considered, the passages 80 have their axes at 98 which intersect with an annular groove 100 serving as a drill starter or drill locating shoulder in the face 26 of the nozzle tip. The line of centers of the gas discharge passages 80 is indicated at 102 in Figure 7.

The means which is provided for selectively controlling the narrow and bushy flames desired is constituted by the valves 28 and 30 previously considered.

In Figures 10, 11, 12, and 13, this valve means at 28 and 30 will be seen to occupy the respective outwardly flared or chamfered ends of the transverse bore 34 for selectively supplying pre-mixed gas and oxygen into the narrow flame passage at 48 or into the subsequently mixing forwardly and upwardly extending passages 52 and 54 for the oxygen and gas, respectively. In the interests of brevity, only the gas valve 30 will be described, inasmuch as the oxygen valve 28 is symmetrically identical thereto. The valve 30 has three positions, of which the off position of Figure 11 corresponds to the solid line showing of Figure 2, of which a bushy flame position in accordance with Figure 12 corresponds to the lower dotted line showing 32a of Figure 2, and of which a narrow flame position of Figure 13 corresponds to the upper dotted line position 32b of Figure 2. Regardless, however, of the position of the gas controlling valve 30, the pilot tube 22, Figures 10 and 11, is continually supplied with gas whenever the conduit 14 is so charged and the resulting unmixed gas burns freely in the presence of the ambient atmosphere adjacent the jet portion 24 of the pilot light tube 22. The valve 30 has three intersecting radial bores therewithin in the shape of a Y, and these three bores in the off position of the valve shown in Figure 11 communicate neither with the gas conduit connected passage 38, its upper extension 42, nor with the forwardly and upwardly extending gas conduit 54. In the bushy flame position of Figure 12, the valve 30 has one of the legs of its Y-shaped bores communicating with

the passage 38 and has the base of the Y in communication with the forwardly and upwardly extending gas passage 54 so as to transmit gas through the respectively transverse passages 78, Figure 5, and the chamber 72, thence through the jet passages 80 for discharge from the tip face 26 of the burner nozzle. It is, of course, understood that the oxygen valve 28 is similarly positioned for simultaneously conducting oxygen forwardly through the passage 52 and the oxygen chamber 70 for discharge from the first and second intermediate rows of oxygen jet passages 86 and 88. In the narrow flame position of Figure 13, the gas valve 38 is disposed such that the base of its Y-shaped bores communicates with the passage 38 therebelow whereas one of the legs of the Y transmits the gas into the respective upwardly extending, transversely extending, and forwardly extending internal passages 42, 44, and 48. It is to be understood, of course, that simultaneously the oxygen valve 28 is similarly positioned for conducting oxygen into the corresponding vertically extending, transversely extending, and forwardly extending passages 42, 44, and 48 with the result that the oxygen and the gas are pre-mixed within the passage 48 and the expanded passage 84 prior to burning adjacent the face 26 of the nozzle tip.

The following is given as an example of the number, sizes, and ring diameters of the rings or rows of jet passages in the transverse flange 70 which will be noted to be of a thickness such that the length to diameter ratio of each passage is considerably greater than unity, namely, between 3 to 1 and 6 to 1:

	Diameter, inches	No. Per Ring	Diameter of Ring, inches
Gas Passages 80.....	.020	16	23 $\frac{3}{32}$
First Intermediate Row 86.....	.040	16	15 $\frac{1}{32}$
Second Intermediate Row 88.....	.040	16	19 $\frac{1}{32}$

The following is given as an example of the angularity of the foregoing jet passages so as to produce good mixing with little or no yellow flame, the angle given being in terms of the passage axis at its point of intersection with and with respect to the central burner axis 50. Also included is a dimension of the resulting flame cone, under normal tap pressure for the natural gas and under 5 p.s.i. oxygen pressure.

Outer 80, degrees	2 Intermediate, degrees	Length of Cone, inches
18	7	3
18	9	2 $\frac{3}{4}$
18	11	3 $\frac{1}{2}$
21	7	3 $\frac{1}{4}$
21	9	3 $\frac{1}{2}$

It has been found in practice that the angularity of the intermediate passages 86 and 88 with respect to the central axis 50 is preferably within the range above specified but, in some cases, this angularity can satisfactorily be varied between zero degrees (that is, convergence at infinity) and nine degrees with satisfactory results provided that the other passages 80 appropriately converge in a forward direction in the general manner outlined. In any case, the convergence of the jets of gas from the jet passages 80 as they leave the face of the nozzle tip, Figure 7, is such as to direct the gases and concentrate them at the core of the jet of the flame, thus producing a stable, thoroughly mixed and quiet flame which burns simultaneously with and in the presence of the actual external mixing process for the bushy flame. The flexibility of the present two-flame nozzle is readily realizable in the selection of its two flames by reason of the fact that the burner body 10 incorporates the control valves 28 and 30 as a unitary part thereof and makes possible, for instance, the internal mixing of the narrow flame gases in

a self-confined space incorporated actually within the burner body 10 well behind the tip face 26.

While I have described certain presently preferred embodiments of my invention, it is to be understood that it may be otherwise embodied within the scope of the appended claims.

I claim:

1. A burner for selectively providing for the internal mixing or for the external mixing of two gases, said burner having a separate conduit for supplying each of said gases, a nozzle, a central passage disposed on the longitudinal axis of the nozzle and discharging substantially in the plane of the nozzle tip, means forming separate passages between the central passage and each of the conduits for internally mixing the gases prior to their discharge from the central passage, a multiplicity of discharge passages disposed in a first circular path of revolution about the central passage and communicatively connected exclusively to one of the two conduits, said passages being arranged at an angle such that their axes converge with one another in a forward direction, and a multiplicity of discharge passages disposed in a second circular path of revolution between the first-named path and the central passage and communicatively connected exclusively to the other of the two conduits, the axis of each of the passages in said second path being disposed in a plane containing the longitudinal axis of the nozzle.

2. A burner having a longitudinal axis passing through the tip thereof, a central passage for discharging through the tip in a single jet along said central axis concentrically therewith, sets of intermediate and outer discharge passages disposed in circular paths of revolution about said jet, each of said passages having a greater than unity length to diameter ratio and arranged with the axes of the outer set thereof being angularly related to one another and converging at a common external point forwardly of the burner tip and with the axes of another set of said passages intermediate said one set and the central passage being angularly related to one another and converging at a different distance forwardly of the tip from the first named point, the axis of each intermediate and outer discharge passage lying in a plane containing the burner axis, separate supply passage means having a common portion for internally mixing oxygen and a combustible gas within said burner behind the tip and communicatively connected through the common portion to the central passage for discharging the mixture therefrom, means through which oxygen is adapted to be introduced in unmixed state into the intermediate converging passages of said other set, and means through which the combustible gas is adapted to be introduced into the said one set of passages for external mixture of the same with the oxygen from the said intermediate set of passages.

3. A burner having a longitudinal axis passing through the tip thereof, a central passage for discharging through the tip in a single jet along said central axis concentrically therewith, sets of intermediate and outer discharge passages disposed in circular paths of revolution about said jet, each of said passages having a greater than unity length to diameter ratio with the axes of the passages of one set being angularly related to one another and converging at a common external point forwardly of the burner tip and with the axes of another set of said passages intermediate said one set and the central passage being angularly related to one another and converging at a common external point beyond the first-named point, the axis of each intermediate and outer discharge passage lying in a plane containing the burner axis, separate supply passage means having a common portion for internally mixing first and second gases within said burner behind the tip and communicatively connected through the common portion to the central passage for discharging the mixture in said single jet therefrom, passage means adapted to introduce the first gas in unmixed state into the intermediate converging passages of said one set of pas-

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sages, and passage means adapted to introduce the second gas into said other set of passages for external mixing of the same with the first gas from the said one set.

4. Burner means for discharging a pre-mixed jet of burnable gases or for selectively discharging gases to be mixed in a concentrated external jet, said burner means having a nozzle tip, a central passage in the nozzle tip coinciding with the longitudinal axis of the burner means, a circular row of individual outer passages in the nozzle tip disposed about the central passage, said passages converging with the longitudinal axis of the burner means and with the axes of one another toward a first common point spaced forwardly from the tip and concentrating the core of the jet, a plurality of circular rows of intermediate passages in the nozzle tip disposed between the central passage and the outer passages, the passages of each row of intermediate passages converging with the axis of the nozzle mean and with the axes of one another toward a common point spaced forwardly from the tip different from the aforesaid first common point and different from the common point of the other circular row of intermediate passages, the passages of said outer row corresponding in number to the passages of each of said intermediate rows but having a smaller individual passage diameter than said intermediate passages.

5. A burner nozzle tip having a longitudinal axis passing therethrough, a central passage for discharging through the nozzle tip in a single jet along said central axis concentrically therewith, a circular row of individual outer passages in the nozzle tip disposed about the central

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passage, said passages converging with the longitudinal axis of the nozzle tip and with the axes of one another toward a common point spaced forwardly from the tip for concentrating the core of a compound jet, and a plurality of circular rows of intermediate passages in the nozzle tip disposed between the central passage and the outer passages, the individual passages of each row of intermediate passages converging with the axis of the burner means and with the axes of one another toward a more remote common point that the aforesaid common point forwardly from the tip and different from the point of convergence of other rows of intermediate passages, the face of said nozzle tip having at least one drill locating annular groove of general V-shape, of which the apex coincides with the line of centers of a circular row of passages aforesaid.

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