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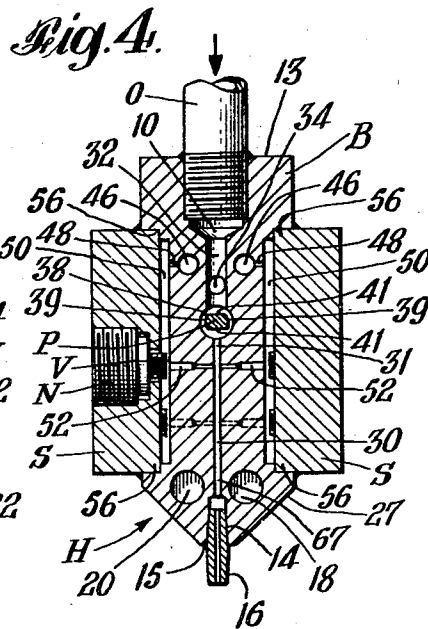
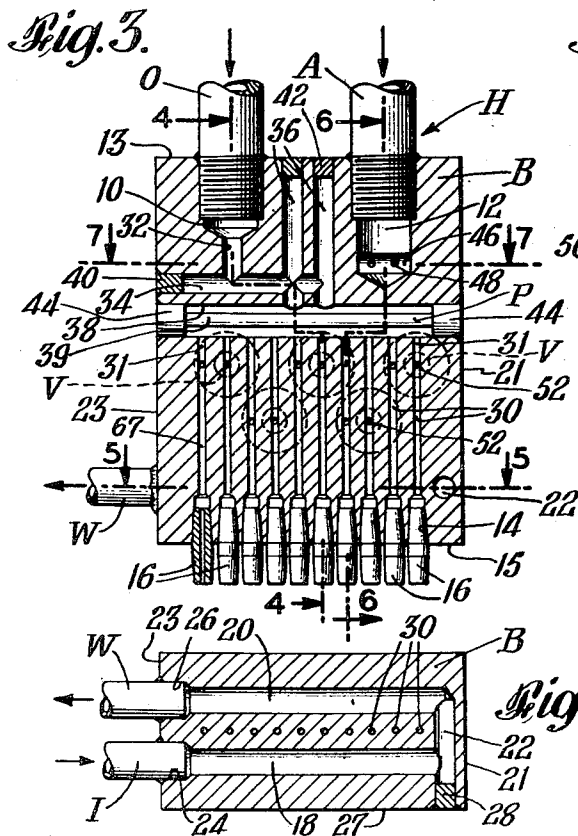
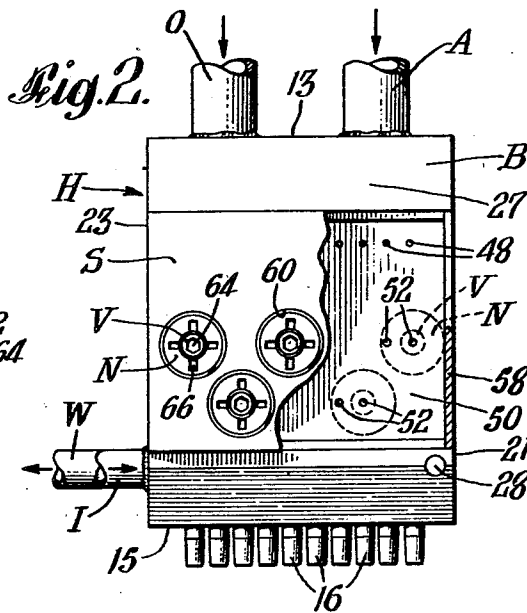
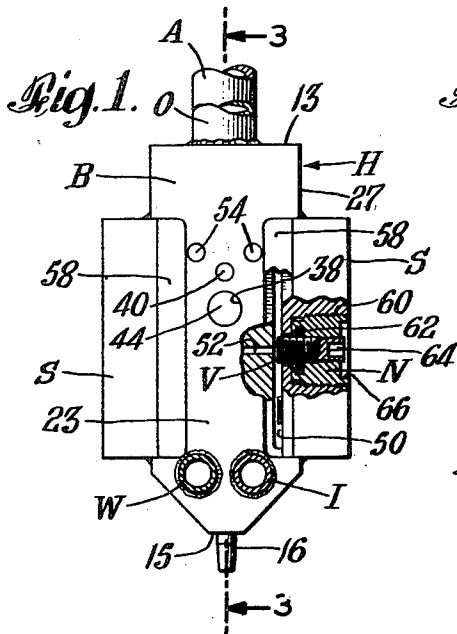
J. C. ROBBINS ET AL

2,442,437

MULTIFLAME BLOWPIPE HEAD

Filed Aug. 19, 1944

3 Sheets-Sheet 1



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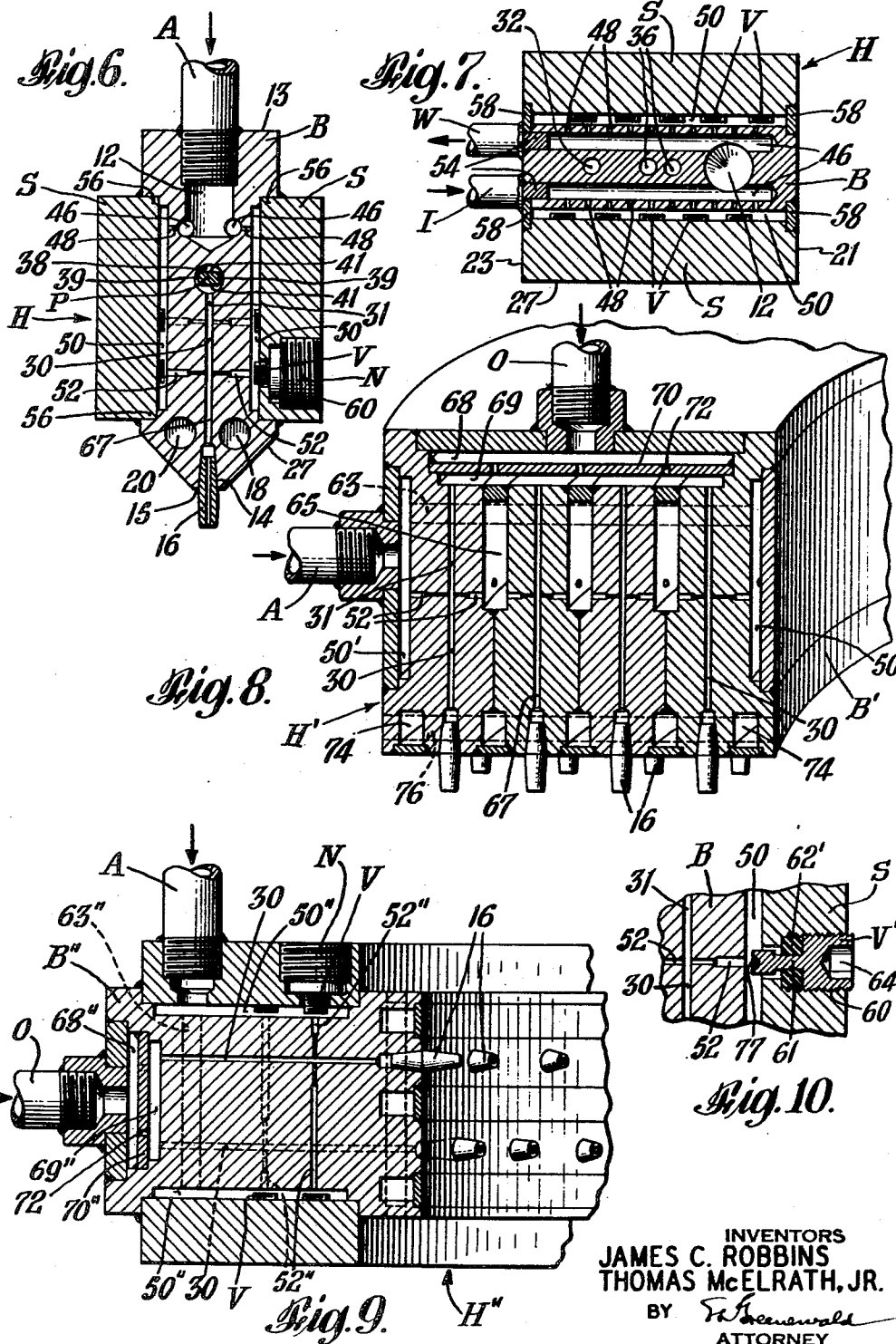
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

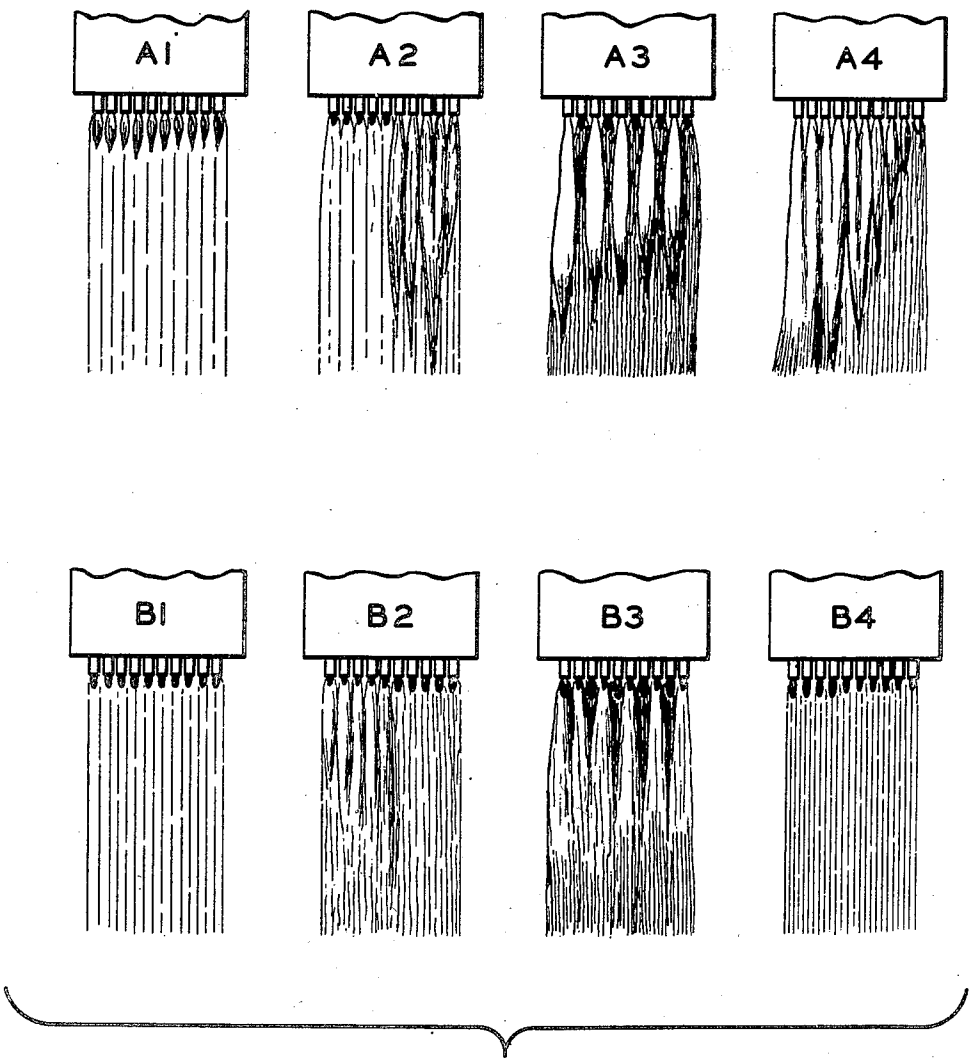


Fig. 11.

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MULTIFLAME BLOWPIPE HEAD

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2 Claims. (Cl. 158—27.4)

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This invention relates to multi-flame oxy-fuel gas blowpipe heads and more particularly to "self-mixing" blowpipe heads within which fuel gas and combustion-supporting gas are mixed to form a separate combustible mixture for each flame.

In the past, it has been customary to first mix an oxidizing gas such as oxygen and a fuel gas such as acetylene in a conventional blowpipe and then to deliver the gas mixture to a blowpipe head having a plurality of discharge passages so as to provide a plurality of flames. Large capacity heating heads of such type have been found to be somewhat impracticable because of the size limitation of the blowpipe. Since the gas mixture is highly combustible, it is subject to flashbacks and backfire, which is not only dangerous but fouls the interior of the blowpipe with carbon, which is very difficult to remove, requiring all of the parts of the apparatus to be disassembled for cleaning and reassembled thereafter. Such heads have been also unsatisfactory due to continuous undesirable popping which interferes with the effective operation thereof. For example, in tube welding the molten metal is blown away from the work by each explosion, disrupting the welding operation.

The main objects of this invention are to provide: multi-flame oxy-fuel gas heads of the self-mixing type which overcome the difficulties and disadvantages of the prior art; a multi-flame head that has extremely high flashback resistance; a blowpipe burner in which mixed gas headers are eliminated; a multi-flame blowpipe head which is not subject to undesirable popping, or loud noise, in lighting or in operation; a head having the foregoing advantages which is simple and economical in its parts, light in weight, easily cleaned, and entirely satisfactory in operation.

In the drawings:

Figure 1 is a view in end elevation, with parts broken away and shown in cross-section, of a multi-flame oxy-fuel gas blowpipe head exemplifying the invention;

Figure 2 is a view in side elevation of the head with a portion of the side walls broken away to show the interior;

Figure 3 is a view mainly in vertical cross-section taken on line 3—3 of Figure 1;

Figure 4 is a vertical cross-sectional view taken on line 4—4 of Figure 3;

Figure 5 is a horizontal sectional view taken on line 5—5 of Figure 3;

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Figure 6 is a vertical cross-sectional view taken on line 6—6 of Figure 3;

Figure 7 is a horizontal cross-sectional view taken on line 7—7 of Figure 3;

Figure 8 is a fragmentary view partly in cross-section and partly in perspective of a modification;

Figure 9 is a fragmentary view partly in cross-section and partly in side elevation of another modification;

Figure 10 is a fragmentary view in cross-section of a modified form of fuel-gas valve; and

Figure 11 shows in side elevation several types of flames produced by the head shown in Figs 1—6.

Referring to Figures 1 through 7 of the drawings, an oxy-fuel gas head H is provided which comprises a body B which is preferably composed of a block of suitable heat-conductive metal such as brass or copper. The body B is provided with an oxygen inlet socket 10 and a fuel-gas inlet socket 12. Such sockets are suitably threaded to receive an oxygen supply pipe O and a fuel-gas supply pipe A, respectively. The body B is also provided with a plurality of mixed gas outlet sockets 14 which are provided with removable tips 16. The gas inlet sockets 10 and 12 are disposed in one face of the block B, in this case the top face 13, while the gas outlet sockets 14 are disposed in the opposite face, in this case the bottom face 15, of the block. The oxygen and fuel gas are mixed inside of the head and discharged from such tips in the form of a combustible mixture of the proper proportion.

Overheating of the head H is prevented by circulating a cooling fluid, such as water, through longitudinal passage 18 and 20 in the block B, these passages being connected by a cross passage 22 located adjacent one end 21 of the block, cooling fluid inlet and outlet pipes I and W being attached to the opposite end 23 of the block B in suitable sockets 24 and 26 in line with the passages 18 and 20, respectively. The end portions of the pipes I and W are silver soldered or bronze welded in the sockets 24 and 26. The cross passage 22, which preferably is a drilling from one side 27 of the block, is closed by a plug 28 which also is silver-soldered or welded in place. The cooling fluid passages are preferably located near the flame face 15 of the block B, so as to prevent overheating of the latter, and of the flame tips 16.

The block B is provided with a plurality of substantially parallel gas passages 30, there being a passage 30 axially aligned with each outlet

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socket 14 for mixing and delivering a separate mixture of oxygen and fuel-gas to the latter. Oxygen is supplied to the upper inlet portion 31 of each of the passages 30 by an oxygen conduit system including a short vertical passage 32, a short horizontal passage 34, a pair of vertical passages 36, 36, and a horizontal oxygen distribution chamber 38. The passage 32 is axially aligned with the oxygen inlet socket 10. The horizontal passage 34 extends about half-way from one end of the block B to the other, being preferably a drilling extending from one end 23 of the block, the open end of the passage being closed by a suitable plug 40 which may be silver-soldered or bronze-welded in place. The pair of vertical passages 36, 36, are preferably arranged in parallel relation to each other, and in the central plane of the block so as to be unaffected by the horizontal passage 34 so that oxygen delivered to the passages 36 is conducted to the mid-portion of the oxygen distribution chamber 38. The passages 36 are preferably drillings from the top face 13 of the block B, the upper ends of the passages being provided with closure plugs 42 which may be welded in place.

The chamber 38 is preferably in the shape of a cylinder which extends from one end of the block B to the other. Disposed within the chamber 38 is a baffle P in the form of a flattened bar the opposite sides 39 of which are symmetrical with the internal wall of the chamber 38 while the top and bottom 41 of the bar are flat and parallel with each other. The end portions 44, 44 of the baffle P fit and close the opposite ends of the chamber 38, being silver-soldered or welded in place to prevent any gas leakage. With this arrangement, oxygen is delivered uniformly to the upper inlet portions 31 of the passages 30.

Fuel-gas, preferably acetylene is delivered to opposite sides of each of the passages 30 by a fuel-gas passage system within the body B which includes parallel horizontal passages 46, 46, short cross passages 48, lateral fuel-gas distribution chambers 50, 50, and the opposed passages 52, 52. Each passage 30 is provided with a pair of the opposed fuel-gas passages 52. The horizontal passages 46 are preferably arranged symmetrical-ly and in parallel relation across opposite sides of the fuel-gas inlet socket 12, preferably being drillings which extend from one end 23 of the block B and terminate in spaced relation to the other end 21 of the block. The open ends of the bores 46 are provided with suitable closure plugs 54 which may be welded in place. The cross passages 48 deliver fuel gas from the passages 46 to the distribution chambers 50 which are located at opposite sides of the block B. The arrangement is such that substantially equal amounts of fuel gas are supplied to each of the chambers 50. The chambers 50 are formed by providing lateral recesses in opposite faces of the block B, and enclosing the recesses with relatively thick plates or walls S. The inner, upper and lower corners 56 fit corresponding recesses in the body B the mating members being silver-soldered or bronze-welded together to prevent any leakage of fuel gas. The opposite ends of the fuel-gas distribution chambers 50 are provided with suitable counter-sunk closure strips 58 which are welded in place.

The amount of fuel-gas delivered to each of the passages 30 is adjusted by a valve V in the form of a screw which is threaded to a nut N which in turn is threaded to a suitable socket 60 in the plate S, there being a valve V provided for one

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passage 52 leading to each passage 30. Each nut N is provided with an annular elastic member 62 which engages the screw V to prevent any gas leakage and to secure the screw in adjusted position. The exposed side of each screw and each nut is provided with a tool receiving socket 64 and 66, respectively, the socket 64 being hexagonal and the socket 66 being in the form of a cross.

With this arrangement outer surfaces of the plates S are free of any objectionable projecting parts. The valves V are preferably staggered so that the passages 30 may be closely spaced in a row.

In operation, the oxygen and acetylene supply pipes O and A are connected to suitable gas sources of supply, and the water pipe I is also connected to a suitable water source of supply. The oxygen and acetylene delivered to each passage 30 are mixed in an outlet portion 67 of such passage, the mixed gases being delivered to the tip 16 through socket 14. The mixed gases discharged from the tip 16 when ignited produce oxy-acetylene flames which are suitable for heat treating, pressure welding, mechanical welding and the like. The flash-back resistance of these flames is excellent. Undesirable popping is also entirely eliminated. The oxy-acetylene ratio of the various flames may be adjusted by the valves V to any predetermined value, as shown in Fig. 11. If desired, alternate flames may be adjusted to any desired oxy-acetylene ratio to obtain the best heating results.

The block B may form one of the units of a multi-unit head which is rectangular or round. For example, a modified unit B' is used in the circular head H' of Fig. 8. The units B' are segments of a cylinder, which are welded together to form the head. In this case, the fuel gas supply pipe A is radially located at one side of the head, while the oxygen supply pipe O is located at the top of the head. The fuel gas or acetylene passage system includes concentric lateral curved chambers 50', 50', radial cross-passages 63, and common internal chambers 65. The oxidizing gas or oxygen passage system includes parallel top chambers 68 and 69 which are separated by a partition 70 provided with passages 72 for uniformly distributing oxygen to the inlet ends 31 of passages 30. Cooling fluid channels 74 are located in the head adjacent the flame face, the channels being concentric and connected by radial cross passages 76. Oxygen and acetylene supplied to the head H' through pipes A and O are conducted to the passages 30 wherein such gases are mixed in the outlet portion 67, the gas mixture being discharged through the tips 16, forming flames when ignited. The head H' may be closed on itself or only a segment of a ring.

As shown in Fig. 9, the flame tips 16 may be located radially within a ring-type head H'' composed of one or more block units B'' having a plurality of radial passages 30 arranged in two parallel rows. Oxygen is supplied through the pipe O, and acetylene through the pipe A. The oxygen channels 68'' and 69'' are concentric, being separated by the partition 70'' having holes 72 for distributing the oxygen uniformly to the passages 30. The acetylene chambers 50'' and 50'' are parallel and connected by transverse passages 63''. Acetylene entering the opposed passages 52'' from the chambers 50'' is adjusted by screwing the valves V in the nuts N, as pointed out above in connection with Figs. 1 through 7. The gases are mixed in the passages 30 and discharged from the tips 16, forming inwardly di-

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rected radial combustible jets within the head H''.

From the foregoing it will be evident that the invention involves entirely novel self-mixing multi-flame heads. Such heads have proven to be entirely satisfactory for welding and suitable for operations not possible with prior premixed multi-flame welding heads. Such an operation might be the carrying of a large welding puddle, the sparks from which would cause popping explosions and resulting holes in the work with the use of premixed oxygen and acetylene. The principle of the invention may be employed to produce a single or a plurality of rows of closely spaced oxy-fuel gas flames and for circular heads with axially or radially directed flames. Heads embodying the invention may be used for miscellaneous heating, heat-treating, pressure welding, mechanical welding, and the like.

Heads composed of copper and brass embodying the invention have been constructed and tested in the laboratory and in the field. Such heads produce a single row of flames suitable for mechanical welding. In these heads a No. 60 (0.040 in. diameter) drill was used to produce passages corresponding to the passages 30. The hole 67 extended from the flame face of the head for a distance of $13/16$ in. at which point two No. 77 (0.018 in. diameter) drillings 52 were diametrically opposed to each other and disposed at 90° from and at intersecting relation with the No. 60 drilling 30. These No. 77 drillings were about $5/32$ in. long from the sides of the block. The passages 52 were counterbored, as shown, to facilitate the drilling operation. The No. 60 drilling 30 continued beyond the intersection with drillings 52 for a distance of at least $3/32$ of an inch to the oxygen passage, to form the portions 31. This last mentioned drilling 31 may be of the same size or smaller than the drilling 67 with equally good results. These four drillings determine a plane perpendicular to the length of the head. Similar planes containing similar sets of drillings may be spaced a minimum distance of 0.085 inch apart. A flame spacing of $1/8$ in. between flames has been used for eight-flame heads, and a flame spacing of 0.085 in. between flames has been employed for 21-flame heads. As pointed out above in the description of the drawings, acetylene is distributed evenly to each acetylene passage, and oxygen is fed evenly to each oxygen passage, the component parts of the head being silver-soldered together.

According to the invention a type of construction is provided which maintains all of the properties of the individual flames and provides for any number of rows of flames. In the latter case the construction involves the drilling of flame ports in unit blocks and fastening the blocks together by any suitable means. Then, gas is fed to each flame port as is done in the single row construction. The oxy-acetylene ratio of the various flames may be individually adjusted as desired, the arrangement being such that the acetylene valves when removed provide access to the small acetylene drillings. The acetylene valves may, of course, be omitted if desired, or only certain ones of the acetylene passages may be provided with valves.

The metering or full control of one or both of the acetylene passages feeding each flame may be like that shown in the drawings or a tapered shank may be employed which projects into the counterbore to cause a restriction to the acety-

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lene flow. By controlling the position of such shank, the flow of acetylene may be regulated.

The method of acetylene control illustrated in the drawings utilizes a shank larger in diameter than the acetylene hole and the metering is accomplished by the proximity of the shank to the smaller acetylene hole. Acetylene enters the metered port from the acetylene distributing diameter. A bolt or screw which may be attached to or integral with such shank is threaded through the cover of the acetylene chamber and may be positioned from the outside of the head. The threaded seal and firm grip between this adjusting bolt or screw and the cover may be accomplished by the use of an "elastic stop nut" threaded on the outside as well as the inside so as to be easily inserted and sealed in place. Replacement of the nut would thus require but a short time, and "stop nuts" of convenient size are now manufactured as standard equipment. The acetylene drilling may be serviced by merely removing the valve screw and inserting a drill of the proper size in the acetylene passage.

As shown in Fig. 10 the fuel-gas valve V' may be a screw threaded in the socket 60, and having a shank 61 of reduced diameter on which is mounted an elastic ring 62' which is also threaded in the socket to prevent any gas leakage. The valve V' has a conical recess 67 facing the fuel-gas inlet 52 to insure satisfactory operation of the valve with respect to the face of the body B in the acetylene compartment 50.

Another important advantage derived from this type of construction is the adjustability of the oxy-acetylene ratio of individual flames to any predetermined value. Thus, a duplex type of head embodying the invention could be made by merely adjusting some of the flames to a highly oxidizing ratio, as shown in Fig. 11, B2. These flames could also be given a higher velocity by enlarging the internal drillings. A head of this type could also be adjusted to provide flames having a uniformly changing oxy-acetylene ratio from one end of the head to the other as shown in Fig. 11, B4. Close flame spacing using this type of construction is obtained by staggering the location of the valves not only from side to side of the head, but also vertically.

In Fig. 11 eight different flame adjustments are shown. The series A1, A2, A3 and A4 have the same acetylene valve settings as the corresponding view of series B1, B2, B3 and B4, but the supply of oxygen is increased in the latter. View A1 shows slightly excess acetylene flames and view B1 shows neutral flames. View A2 shows half of the flames neutral and half carburizing, while view B2 shows half of the flames oxidizing and half neutral. In view A3 every other flame is carburizing, the alternate flames being neutral, whereas in view B3 the flames are alternately neutral and oxidizing. View A4 shows flames, the oxy-acetylene ratio of which progressively increases from an excess of acetylene to neutral, while view B4 shows the oxy-acetylene ratio of the flames progressively decreasing from neutral to an excess of oxygen.

Advantages of the present invention over the prior art in multi-flame welding reside in better flashback resistance and the absence of popping, when the combustible jets are first ignited and especially where the process involves molten puddles, the sparks from which agitate the welding head. Mixed-gas headers are also entirely eliminated. The oxy-acetylene ratio of the individual flames is readily adjustable and the internal pas-

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sages may be cleaned and serviced without trouble. Other advantages are apparent or will occur to those skilled in the art.

The tips 16 may of course be omitted in which case the outlet portions 67 of the passages 30 are made of the proper size and shape to discharge the oxy-fuel gas mixture directly from the flame face of the block to form the flames. This arrangement is entirely satisfactory, but servicing of the passages and the life of the head are improved by use of the separable tips 16.

We claim:

1. A multi-flame blowpipe head which is free of undesirable popping in use, comprising, in combination, a body composed of a block of solid metal having a row of closely spaced gas mixing passages and lateral recesses in spaced relation to opposite sides of said passages, and cover plates enclosing said recesses to provide lateral fuel-gas chambers, said block also having fuel-gas passages extending from said chambers to opposite sides of each gas mixing passage, and means for supplying fuel gas to both of said chambers, the length of each of said gas mixing passages being great and its cross-sectional area minute whereby complete gas mixing is accomplished with as small a mixed-gas capacity as possible, and popping is minute, being restricted to each mixed-gas passage.

2. In an oxy-fuel gas multi-flame blowpipe head, means acting to increase flashback resistance and inhibit undesirable popping which comprises passage means including a row of parallel oxygen and fuel-gas mixing passages each having an oxygen inlet portion of constant diameter aligned with a mixed-gas outlet portion of the same diameter, and a pair of diametrically opposed fuel-gas passages perpendicularly inter-

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secting each mixed gas passage at the juncture of said inlet and outlet portions, an oxygen distribution chamber in communication with said inlet portions, and lateral fuel-gas distribution chambers in communication with said fuel-gas passages, each of said outlet portions discharging an oxy-fuel gas mixture which, when ignited, forms a single flame, the shape of each outlet portion being long and narrow whereby the oxygen and fuel gas are properly mixed before discharge therefrom, while the mixed-gas capacity of such portion is such that popping is minimized and confined thereto.

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