Aug. 19, 1947. J. H. BUCKNAM ET AL 2,425,710

BLOWPIPE NOZZLE

Filed Nov. 1, 1944

Fig. 1.

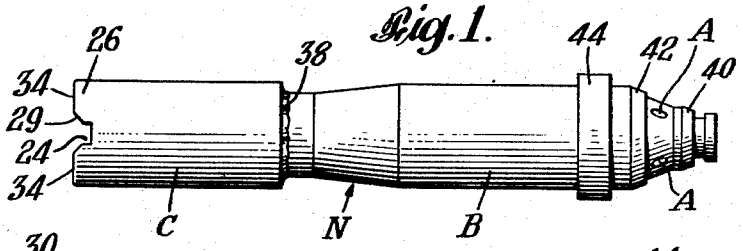


Fig. 2.

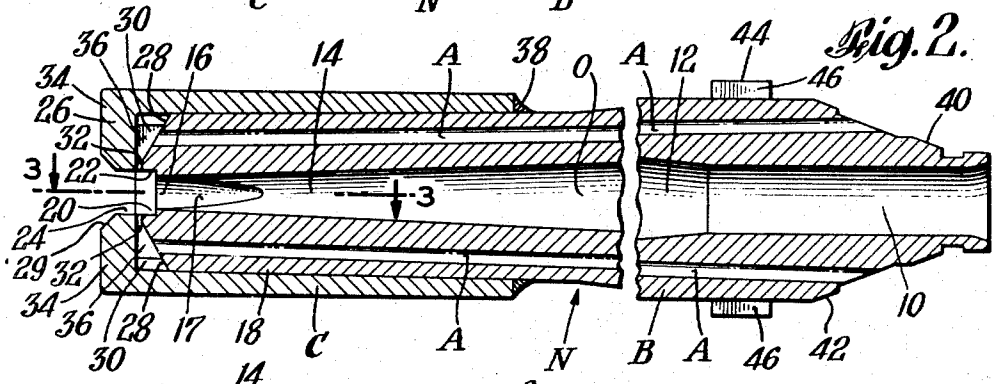


Fig. 3.

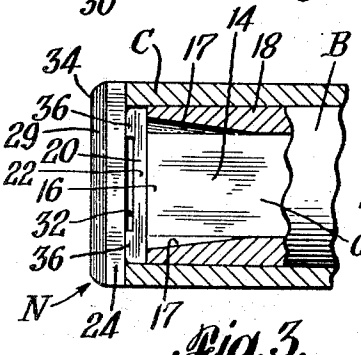


Fig. 4.

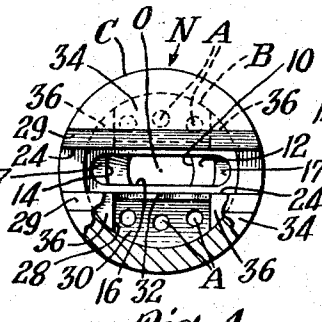


Fig. 5.

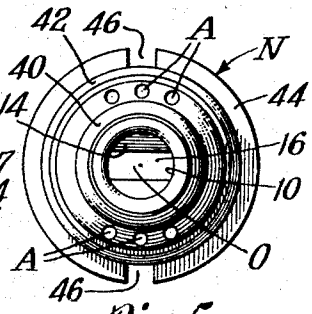


Fig. 6.

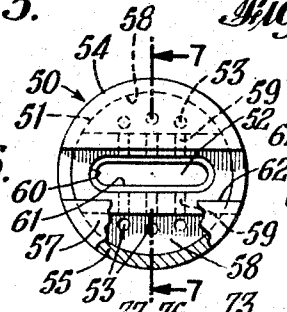


Fig. 7.

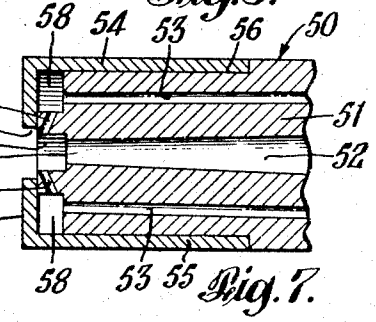


Fig. 8.

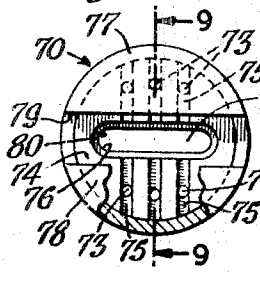
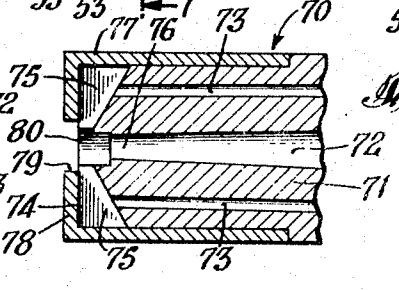


Fig. 9.



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BLOWPIPE NOZZLE

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Application November 1, 1944, Serial No. 561,358

10 Claims. (Cl. 158—27.4)

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This application is a continuation-in-part of application Serial No. 478,202, filed March 6, 1943, for Blowpipe nozzle, and application Serial No. 517,472 filed January 7, 1944, for Process of thermochemically conditioning metal bodies.

The invention relates to post-mixed oxy-fuel gas scarfing nozzles, and more particularly to two-piece slotted nozzles in which oxygen and acetylene or other fuel gas mix and burn at the point of exit from the nozzle. The acetylene is directed into an outer fringe of a cutting oxygen stream, which supplies the oxygen for supporting combustion of the acetylene. During initial preheating, the oxygen is supplied at low velocity and during cutting at high velocity.

The main objects of the invention are to provide an improved postmixed oxy-fuel gas scarfing nozzle; post-mixed nozzles that are effective and efficient in operation, and relatively easy to keep clean and maintain in proper operating condition; and nozzles of this type that are capable of being manufactured in production.

In accordance with the invention, there is provided a blowpipe nozzle including a body, and an end cap which is removably secured to the body. The rear end portion of the nozzle body and cutting oxygen passage are similar to conventional oxy-acetylene scarfing nozzles of the premixed type. The front end portion of the nozzle body and the preheat gas passages, however, are different. The outside diameter of the front end portion of the body is reduced to permit slipping the cap over the end portion of the body. The end wall of this cap acts as a baffle to direct the acetylene, issuing from the preheat holes, into the cutting oxygen stream. The cap is provided with a transverse slot extending across the face that is slightly wider than the small dimension of a slot in the nozzle body. The cap slot is alined with the body slot when the cap is installed on the body to provide an outlet passage for the stream of cutting oxygen. In a preferred modification, acetylene chambers are provided across the end face of the nozzle body by continuous grooves, one on each side, milled in at right angles to the slot. The bottoms of such grooves are sloped at an angle to facilitate cleaning through the slots. As the cutting oxygen stream is ordinarily at too high a velocity during scarfing to hold a flame, a step is provided in the cutting oxygen passage by milling the slot across the end of the nozzle. Such step acts, thru the "edge effect" of the sharp corner, to divert a lateral portion of the oxygen stream to mix with the acetylene. The external dimensions of the nozzle

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are the same as those of standard premixed nozzles, of the premixed type, so that they are interchangeable with such premixed nozzles, as far as the nozzle shoes and head are concerned.

In the drawings:

Figure 1 is a view in side elevation of a nozzle exemplifying the invention;

Figure 2 is an enlarged fragmentary longitudinal sectional view of the nozzle shown in Figure 1;

Figure 3 is a fragmentary longitudinal sectional view taken on line 3—3 of Figure 2;

Figure 4 is a view in front end elevation of the nozzle, a portion of the end wall of the cap being broken away;

Figure 5 is a view in rear end elevation of the nozzle;

Figure 6 is a view similar to Figure 4 of a modification;

Figure 7 is a fragmentary sectional view taken on line 7—7 of Figure 6; and

Figures 8 and 9 are views similar to Figures 4 and 7, respectively, of another modification.

The two-piece post-mixed oxy-fuel gas scarfing nozzle N, shown in Figures 1–5, consists of a body B and a cap C, each being composed of a highly heat-conductive metal such as copper. The body B has an oxygen supply passage O and a plurality of acetylene supply passages A. The oxygen supply passage O includes an inlet portion 10 of substantially constant diameter, a flared portion 12, a short medial portion (not shown) of constant diameter, and an outlet portion 14 which gradually changes from circular to flat cross-section, the discharge orifice 16 of the oxygen passage O being oblong and having broached lateral walls 17. This causes the central oxygen passage O to discharge a characteristic desurfacing or scarfing oxygen stream, generally known as the "cutting" oxygen stream.

The front end portion 18 of the body B is provided with a transverse slot 20 which is in alinement with and wider than the oxygen discharge orifice 16 to provide a recess or step 22 which acts to divert a lateral portion of the otherwise solid cutting oxygen stream, surrounding the latter by an oxygen skirt in the nature of an eddy current fringe. The cap C is also provided with a transverse slot 24 extending across its relatively thick wall 26 in alinement with the body slot 20. The cap slot 24 is only slightly wider than the body slot 20 to insure an aspirating effect upon the acetylene. Acetylene passages or chambers are provided across the end face of the nozzle body by continuous grooves 28, one on each side of the

nozzle, which are milled in at right angles to the slot 20. Such grooves are approximately .020 inch deep at the point of exit into the slot 20 and have bottoms that are sloped at an angle of the order of 30° to a plane which is perpendicular to the longitudinal axis of the oxygen passage, to facilitate cleaning.

Thus, when the cap C is secured in place on the front end portion in the body B, enlarged distribution acetylene chambers 30 are provided between the cap and the body, acetylene being supplied to such chambers through the acetylene supply passages or holes A, and discharged from the chambers through narrow slots or ports 32 located in the walls of the slot 20, and covered by half portions 34 of the end wall 26 of the cap. Such half portions 34 of the end wall of the cap are supported by four end face segments or portions 36 of the nozzle body. The cap is removably secured in place on the front end portion 18 of the nozzle body by any suitable means, such as a fillet weld 38 which may be melted, when desired, to remove the cap from the nozzle body. The opposed walls of the cap slot 24 are bevelled at 29 so that a cleaning tool may be inserted through slot 24 into the acetylene ports 32.

The gas inlet end portion of the body B is provided with a pair of radially and longitudinally spaced frustoconical annular seats 40 and 42 which are adapted to mate in gas-tight relation with corresponding seats in a conventional head (not shown) of a desurfacing unit or blowpipe. The body B is also provided with an annular flange 44 having longitudinal slots 46 for receiving tongues (not shown) for locating the nozzle in proper position with respect to the head. The nozzle is coupled to the head in the usual way so that acetylene is delivered to the acetylene passages A, and oxygen is delivered to the oxygen passage O.

In operation, oxygen is first supplied to the oxygen supply passage O only in sufficient quantities to mix with the acetylene discharged by the opposed ports 32 in the walls of the oxygen slot 20 to produce an elongated externally mixed oxy-acetylene flame for initially heating work to start the scarfing or desurfacing operation. After the work has thus been initially heated, the velocity of the oxygen stream discharged by the supply passage O is increased to a desired value, depending upon the nature of the operation to be performed, in this case scarfing, without altering the quantity of acetylene supplied to the nozzle. The otherwise solid desurfacing oxygen stream thereupon is provided at its opposite lateral surfaces with elongated preheating flames composed of a mixture of oxygen and acetylene, mixed externally of the nozzle. Such flames are concentrated in the scarfing zone, and are quite satisfactory for desurfacing hot steel. Such nozzle, under ideal conditions is more efficient than a standard nozzle of the premixed type.

In order to avoid gouges or ruts between cuts when attempting to obtain deep cuts, the angle of diversion of the broached-out side walls 17 of the outlet portion 14 of the oxygen supply passage O, is preferably of the order of 15°. This causes a slight ridge between grooves or cuts under most conditions, but the quality of the cuts is superior to that obtained with standard premixed desurfacing nozzles. The main reason for this is that the cutting streams do not spread as much and consequently do not interfere with each other as much on multiple nozzle set-ups. Cuts having a depth in excess of $\frac{1}{8}$ inch have been obtained that are relatively flat, with the exception of a slight ridge approximately $\frac{1}{64}$ inch to $\frac{1}{32}$ inch high between the individual cuts.

The surface of the oxygen supply passage O is preferably chromium plated to inhibit erosion. The nozzle is constructed so that the cap C can be replaced, in case the cap becomes damaged or burned in use. Maintenance of the nozzle N when installed in a desurfacing machine is quite simple. It consists merely of cleaning the loose carbon and slag off the face of the nozzle, out of the acetylene ports, and out of the step in the cutting oxygen passage. Usually this is much easier to do than it is to drill out the preheat holes on standard premixed nozzles.

In the modification shown in Figs. 6 and 7, a blowpipe nozzle 50 is provided which comprises a tubular body or member 51 having a central oxygen supply passage 52 extending longitudinally therethrough and also having a plurality of acetylene supply passages 53 arranged in spaced relation to the oxygen passage 52; the discharge ends of all of such passages terminating in the front end face of the member 51. The nozzle 50 also includes an end cap 54 having a cylindrical skirt 55 fitting a reduced annular end portion 56 of the tubular body member 51, the bottom panel 57 of the cap 54 being seated on the end face of the body so that such bottom panel is supported by such end face. The cap 54 is secured in place on the member 51 by any suitable means.

The body member 51 and the end cap 54 are provided with enlarged acetylene distributing chambers 58, 58 there-between into which the acetylene supply passages 53 discharge, the chambers 58 being formed by removing sections of the end portion 56 from opposite sides thereof. The end portion 56 of the member 51 is also provided with a plurality of inclined acetylene discharge holes 59 connecting the acetylene distributing chambers 58 to the enlarged orifice or slot 60 in line with the oxygen supply passage 52 for discharging the acetylene inwardly and forwardly against opposite sides of the single stream of oxygen as the latter leaves the discharge orifice 61 of the oxygen supply passage 52. The oxygen orifice 61, the slot 60 and the panel slot opening 62 are oblong in cross section, so that a flat but solid stream of cutting oxygen is discharged by the nozzle 50, the acetylene distributing chambers 58 being located parallel to the long sides of the panel opening. The acetylene discharge holes 59 are arranged in parallel relation to each other, there being a hole 59 corresponding to each acetylene passage 53, and the holes 59 are shown round, but may be flat so as to provide slots the wide sides of which are parallel to the wide sides of the oblong oxygen orifice.

It has been found that it is probably better to use flat acetylene slots than round holes for discharging the acetylene against the oxygen stream, perhaps because a certain amount of oxygen is taken from the side of the oxygen stream by each jet of acetylene in its combustion and this lack of oxygen in line with the pure acetylene holes leaves a ridge in the surface of the work when such holes are round. Such ridge in some cases is undesirable in that it is somewhat higher than the balance of the work. If five acetylene preheat holes that are round are used, for example, five ridges may be formed on the work surface. By using several flat holes or

flat slots for the acetylene such undesirable ridge condition is minimized; although, of course, with a long acetylene slot 32, as shown in Figs. 1 to 5, no ridges are formed in the work surface. An advantage of the post-mixed nozzle with flat acetylene holes is that the acetylene outlet passages are easier to keep clean. The operation of the nozzle shown in Figs. 6 and 7 is substantially similar to that described above in connection with the nozzle shown in Figs. 1 to 5.

Referring to Figs. 8 and 9, the illustrated blowpipe nozzle 70 comprises a generally tubular body 71 having a central oxygen supply passage 72 extending longitudinally therethrough and also having a plurality of acetylene supply passages 73 in spaced relation to such oxygen passage. The discharge ends of the passages 72 and 73 terminate in an end face 74 of the member 71, which end face is provided with a plurality of transverse grooves 75 forming separate enlarged acetylene chambers the bottoms of which are inclined inwardly and forwardly toward the discharge end 76 of the oxygen passage 72. An end cap 77 fits the end portion of the body 71 and is provided with a bottom panel 78 which engages the end face 74 so as to be supported thereby. The bottom panel 78 is provided with an opening 79 the inner edges of which are laterally offset with respect to the edges of the discharge orifice 76 of the oxygen passage 72. Such discharge orifice 76 of the oxygen passage is provided with a peripheral recess or slot 80 and is entirely open for discharging only a single stream of oxygen through the slot or opening 79 of the cap. The grooves 75 are disposed so that the acetylene ports direct the acetylene discharged by the acetylene supply passages 73 inwardly toward the single stream of oxygen as the latter leaves the discharge end 76 of the oxygen passage 72. The opening 79, the slot 80 and the discharge orifice 76 of the oxygen passage 72 are all oblong in cross section, and the grooves or slots 75 are disposed in parallel relation to each other and at opposite sides of the stream of oxygen so that the formation of ridges in the work may be inhibited. The operation of the nozzle 70 is substantially similar to that of nozzle N.

What is claimed is:

1. A two-piece post-mixed oxy-fuel gas scarfing nozzle including a body having an oxygen supply passage provided with a single oblong oxygen discharge orifice which is axially in line with such oxygen supply passage, the front end portion of said body having a transverse slot which is in alinement with and wider than such orifice, fuel gas outlet ports located in opposite walls of said slot, fuel gas supply passage means communicating with such fuel gas ports, and a cap removably secured to the front end portion of said body, said cap having an end wall provided with a transverse slot which is in alinement with and only slightly wider than the slot in the front end portion of said body, said fuel gas passage means comprising enlarged fuel gas chambers located between the cap and body, the fuel gas passage means directly upstream of said fuel gas ports having inclined bottom surfaces.

2. A two-piece post-mixed oxy-fuel gas scarfing nozzle, as defined by claim 1, in which the fuel gas outlet ports are located between the end wall of said cap and the front end of said body.

3. A two-piece post-mixed oxy-fuel gas scarfing nozzle, as defined by claim 1, in which the fuel gas outlet ports are connected to the fuel-gas chambers by inclined fuel gas discharge holes in the front end portion of the body.

4. A blowpipe nozzle comprising a member having an oxygen supply passage extending therethrough and also having acetylene supply passage means arranged in spaced relation to said oxygen supply passage, the discharge ends of all of said passages terminating in an end face of said member, an end cap having a skirt fitting an end portion of said member, the bottom panel of said cap engaging said end face so as to be supported thereby, said bottom panel being provided with an opening the inner edge of which is laterally offset with respect to the edge of the discharge orifice of said oxygen supply passage, said discharge orifice of the oxygen supply passage being provided with a peripheral recess and being entirely open for discharging only a single stream of oxygen, and said end face having grooves the bottoms of which are inclined inwardly and outwardly, said grooves being disposed so as to direct the acetylene discharged by said acetylene passage means inwardly toward said single stream of oxygen as the latter leaves the discharge end of said oxygen passage.

5. A blowpipe nozzle as claimed by claim 4, in which said opening and the discharge orifice of said oxygen supply passage are oblong in cross section, and said grooves are disposed in parallel relation to each other and at opposite sides of the long edges of said discharge orifice of said oxygen supply passage.

6. In a blowpipe nozzle for flame heating and removing metal thermochemically from a metal body with fuel gas and oxygen, the combination comprising, means including an orifice for discharging a stream of oxygen from the nozzle, means including a step in said orifice for creating an eddy current fringe of oxygen adjacent the main part of such stream, and means for discharging fuel gas from the nozzle to mix with such eddy current fringe, forming a combustible mixture which, when ignited, produces a flame extending alongside the main part of such stream of oxygen, said last named means comprising a lateral fuel gas outlet in the side wall of said step for directing fuel gas laterally toward the stream of oxygen, said fuel gas outlet having a bottom wall which is inclined with respect to such side wall.

7. A post-mixed desurfacing blowpipe nozzle having a first single oblong discharge orifice for discharging a stream of oxygen, said nozzle having an oxygen supply passage upstream of and axially in line with said orifice, said oxygen supply passage having an outlet portion upstream of said orifice which gradually changes from circular to oblong cross-section and merges with said first orifice, each longer side of said passage being provided with a lateral step portion for creating an eddy current fringe of oxygen downstream of said orifice, the step portions forming an enlarged passage, said enlarged passage terminating in a second discharge orifice, means forming enlarged fuel gas chambers adjacent opposite longer sides of the enlarged passage, fuel gas supply passages in said nozzle discharging into said chambers, and restricted passage means providing communication between said chambers and said enlarged portion.

8. A post-mixed desurfacing blowpipe nozzle as defined by claim 7, in which the restricted passage means, providing communication between said chambers and said enlarged portion, consist

of narrow elongated slots extending parallel to the longer axis of the first oblong oxygen discharge orifice.

9. A post-mixed desurfacing blowpipe nozzle as defined by claim 7, in which the restricted passage means, providing communication between said chambers and said enlarged portion, consist of inclined holes.

10. A post-mixed desurfacing blowpipe nozzle as defined by claim 7, in which the restricted passage means, providing communication between said chambers and said enlarged portion, consist of transverse grooves.

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