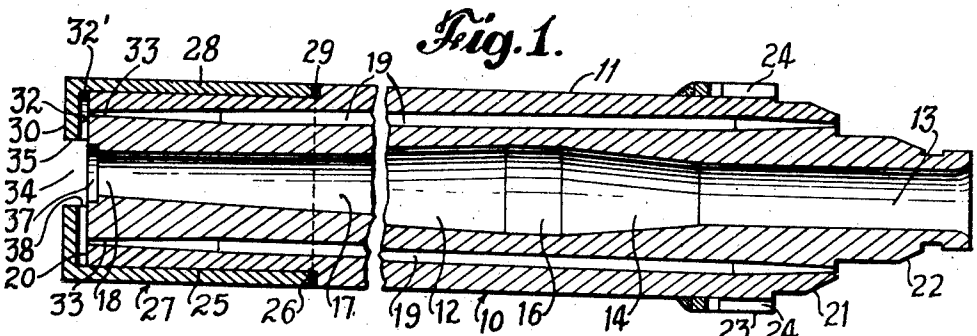
Aug. 19, 1947. J. H. BUCKNAM ET AL 2,425,709

BLOWPIPE NOZZLE

Filed March 6, 1943 2 Sheets-Sheet 1

Fig. 1.



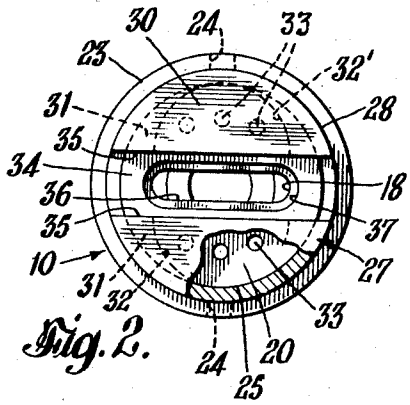


Fig. 2.

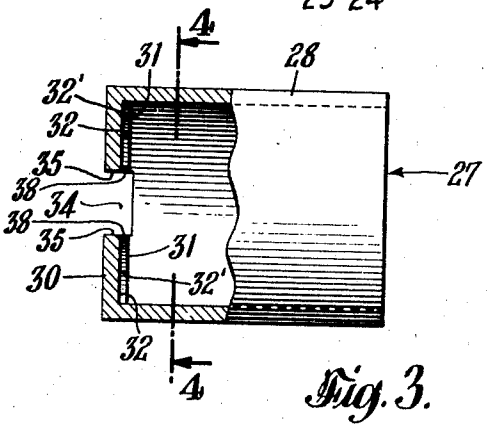


Fig. 3.

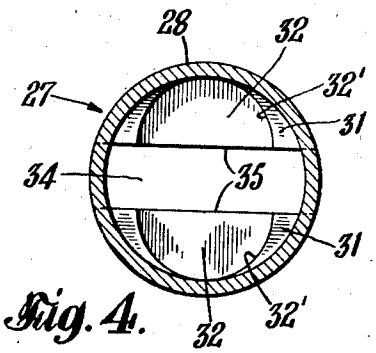


Fig. 4.

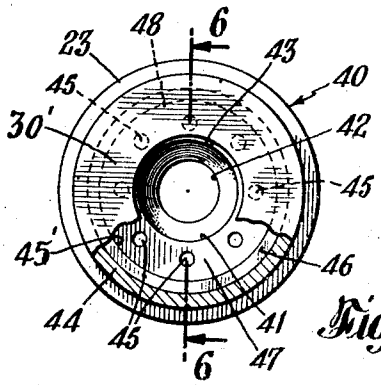


Fig. 5.

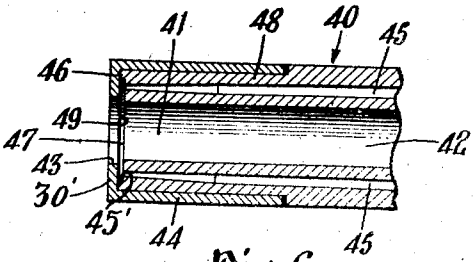


Fig. 6.

INVENTORS
JAMES H. BUCKNAM
IVAN P. THOMPSON
BY F. E. Baumwald
ATTORNEY

Aug. 19, 1947. J. H. BUCKNAM ET AL 2,425,709

BLOWPIPE NOZZLE

Filed March 6, 1943 2 Sheets-Sheet 2

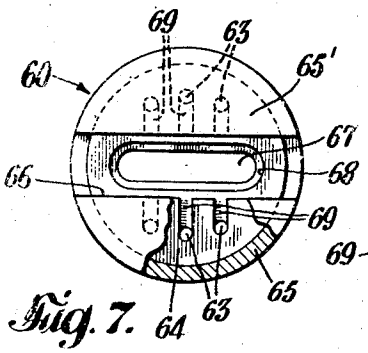


Fig. 7.

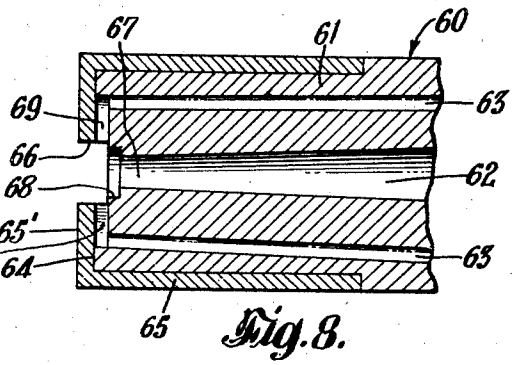


Fig. 8.

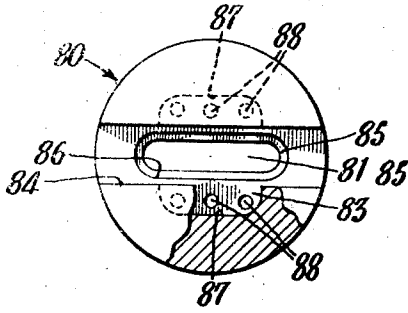


Fig. 9.

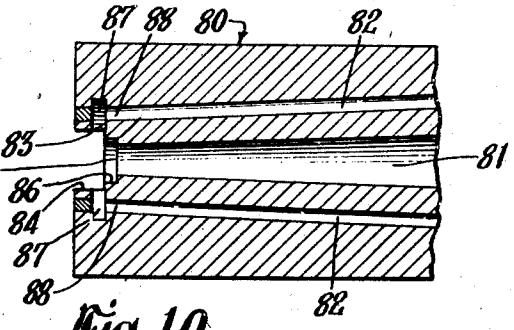


Fig. 10.

INVENTORS
JAMES H. BUCKNAM
IVAN P. THOMPSON
BY E. E. Greenewald
ATTORNEY

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BLOWPIPE NOZZLE

James H. Bucknam, Cranford, and Ivan P. Thompson, Elizabeth, N. J., assignors to The Linde Air Products Company, a corporation of Ohio

Application March 6, 1943, Serial No. 478,202

17 Claims. (Cl. 158—27.4)

1

This invention relates to blowpipe nozzles and more particularly to nozzles for simultaneously discharging an oxygen stream and a post-mixed oxy-acetylene preheating flame useful in thermochemically cutting, desurfacing, deseaming, spalling, boring, and the like, with oxygen.

The main objects of the invention are to provide an improved preheating and oxidizing gas discharge nozzle of the post-mixed or externally mixed type, that is to say, of the type adapted to mix the flame-forming gases such as oxygen and acetylene outside of the nozzle; an improved post-mixed nozzle for desurfacing or deseaming ferrous metal bodies; and an improved blowpipe adapted for heating and oxidizing work such as thermochemically cutting or conditioning ferrous metal with oxygen.

The novel process disclosed herein is claimed in our application Serial No. 517,472, filed January 7, 1944, for Process of thermochemically conditioning metal bodies, which is, in part, a continuation of the present application.

According to the invention, there is provided a desurfacing nozzle, for example, in which fuel gas such as acetylene is fed to a region in front of the cutting oxygen orifice and mixes with a relatively small quantity of oxygen immediately after the latter is discharged by the cutting oxygen passage, to produce a post-mixed oxy-acetylene flame for initially heating the work. The flow of cutting oxygen is then increased to a desurfacing velocity without changing the flow of acetylene. A special construction at the exit of the nozzle causes the formation of an externally mixed preheating flame adjacent the oxygen stream even when the oxygen stream flows at a desurfacing velocity, since the acetylene continues to discharge inwardly against the surface of the oxygen stream to produce a combustible gas mixture only along and adjacent the surface of the desurfacing oxygen stream. The nozzle may be of the round or flat "slotted" oxygen orifice type and may be used for cutting as well as desurfacing and deseaming. Furthermore, the oxidizing gas stream may contain powdered material such as iron for starting purposes with ferrous metal solids, or for continuously promoting the desired thermochemical reaction in working oxidation resistant solids such as stainless steel.

Referring to the drawing:

Fig. 1 is a longitudinal cross-sectional view of a post-mixed desurfacing nozzle exemplifying the invention;

Fig. 2 is an enlarged view in front elevation of the discharge end of the nozzle, part of the end

2

cap of the nozzle being broken away to show a portion of the end face of the tubular body;

Fig. 3 is a detail view partially in side elevation and partially in section of the end cap;

Fig. 4 is a cross-sectional view of the cap taken on line 4—4 of Fig. 3;

Fig. 5 is a view similar to Fig. 2 of a modification for deseaming;

Fig. 6 is a reduced fragmentary sectional view taken on line 6—6 of Fig. 5;

Fig. 7 is an enlarged view in front elevation of a modification in which a plurality of grooves are provided on the end face of the nozzle body for the acetylene slots, a portion of the end cap of the nozzle being broken away to show the end face of the body member;

Fig. 8 is a view in longitudinal cross section of the modification shown in Fig. 7;

Fig. 9 is a view in front elevation of the discharge end of a one-piece post-mixed nozzle embodying features of the invention; and

Fig. 10 is a longitudinal cross-sectional view of the one-piece nozzle shown in Fig. 9.

As shown in Figs. 1 through 4 of the drawing, a desurfacing nozzle 10 is provided which comprises an elongated generally tubular body or member 11 having a central cutting oxygen passage 12 extending longitudinally therethrough. The central oxygen passage 12 is preferably of the shape shown and claimed in Patent No. 2,267,623, and includes an inlet portion 13 of constant diameter, a flared portion 14, a short portion 16 of constant diameter and a single outlet portion 17 which gradually changes from circular to oblate or flat cross section, the discharge end of the central oxygen passage 12 being oblong as shown at 18. This causes the central oxygen passage 12 to discharge a characteristic desurfacing oxidizing gas stream which is well-known to those skilled in the art. The oxygen is discharged from the single outlet 18 in the form of a single solid or compact stream as distinguished from a tubular stream or a plurality of parallel streams. The tubular body 11 is also provided with a plurality of acetylene passages 19 arranged in spaced substantially parallel relation to the oxygen passage 12, all of the passages 12 and 19 terminating in an end face 20 of the member 11 which lies in a plane disposed at right angles to the longitudinal axis of the member 11.

The gas inlet end of the tubular body 11 is provided with a pair of radially and longitudinally spaced frusto-conical annular seats 21 and 22 which are adapted to mate with corresponding seats in a conventional head (not shown) of a

desurfacing unit or blowpipe. The body 11 is also provided with an annular flange 23 having longitudinal slots 24 for receiving tongues (not shown) for locating the nozzle 10 in proper position with respect to the blowpipe head. The nozzle 10 is coupled to the blowpipe head in the usual way so that acetylene is delivered to the acetylene passages 19 and oxygen is delivered to the central oxygen passage 12.

The tubular body 11 is provided with a cylindrical end portion 25 of reduced diameter between the end face 20 and an annular shoulder 26. Mounted on such end portion 25 is an end cap 27 having a cylindrical skirt 28 fitting such end portion, the edge of the skirt being bronze welded or silver soldered at 29 to the shoulder 26 to secure the cap 28 and body member 11 in assembled relation. The cap 27 includes a bottom panel 30 having a shoulder 31 seated on the end face 20 to space the inner surface 32 of the panel 30 at a fixed distance from the face 20. The shoulders 31 are shaped so as to provide with the nozzle end face 20 a semi-circular chamber or slot 32' around the discharge ends 33 of each group of acetylene passages 19, there being three such acetylene passages above and three below the oxygen orifice 18 in the present example.

The bottom panel 30 of the cap 27 has a transverse opening 34, the inner parallel edges 35 of which are laterally offset with respect to or spaced farther apart than the inner parallel edges 36 of the discharge end 18 of the central oxygen passage 12. The orifice 18 of the oxygen passage is also provided with a peripheral recess or groove 37. The recess 37 causes eddy currents on the surface layer of the single discharging oxygen stream and thus provides a fringe of low velocity oxygen around the otherwise unbroken or solid stream of oxygen, for admixture with the acetylene, to form a post-mixed preheating flame, when the oxygen stream is discharged at a desurfacing velocity; and prevents such flame being blown out. With this arrangement, acetylene flowing through the acetylene passages 19 into chambers 32' is discharged as two thin wide streams from chambers 32' and directed inwardly against the wide upper and lower sides of the single oblong stream of oxygen discharged by the central passage 12 immediately after the oxygen stream leaves the discharge orifice of the passage 12. In some cases, only one acetylene passage 19 might be provided instead of three at each side of the oxygen passage, and also acetylene might be fed against only one side of the discharging oxygen stream, preferably the upper side.

In operation, oxygen is first supplied to the central oxygen passage 12 only in sufficient volume and pressure to mix with the acetylene discharged by the parallel outlets 38 of chambers 32' above and below the "slotted" oxygen orifice 18 to produce an externally mixed oxy-acetylene flame for heating the work to start the desurfacing operation when the velocity of the oxygen stream is subsequently increased. The velocity of the central oxygen stream discharged by the orifice 18 is then increased to a desired value (depending upon the nature of the operation to be performed, in this case to a desurfacing velocity) without altering the quantity of acetylene supplied to the nozzle and discharged against both sides of the oxygen stream. The desurfacing oxygen stream is thereby provided at each of its flat surfaces with a preheating flame composed of a mixture of oxygen and acetylene which is mixed externally of the nozzle, owing to the unique construction of the working end of the nozzle. Iron powder or the like may of course be supplied to the oxygen or acetylene before it enters the nozzle, or as it flows through the nozzle, or after it is discharged from the nozzle, for the purpose of starting the reaction with iron bodies or for continuously carrying on the reaction with oxidation resistant bodies.

Referring to Figs. 5 and 6 there is shown a deseaming nozzle 40 of somewhat similar construction to that described above in connection with Figs. 1 to 4, with the exception that the discharge end 41 of the central oxygen passage 42 is round, the opening 43 in the end cap 44 also being round and coaxial with but radially offset with respect to the inner edge of the discharge end of the oxygen passage 42. Another difference is that the acetylene passages 45 are arranged in a circle about and concentric with the central oxygen passage 42, and an integral annular shoulder 46 is provided on the end face 47 of the tubular nozzle body 48, to space the inner surface 49 of the bottom panel 30' of the cap 44 away from the end face 47 of the tubular body 48 of the nozzle 40. In such case, the bottom panel 50 is of uniform thickness and of even less expensive construction than that of the cap 27. In some cases, the shoulder might be entirely omitted from the cap or end of the nozzle by utilizing the length of the skirt on the cap to space the inner surface of the bottom panel of the cap at a predetermined distance from the end face of the body portion. In the nozzle 40 a recess corresponding to recess 37 of nozzle 10 is omitted, but may be used if desired or necessary depending upon the velocity of the cutting oxygen stream.

In the operation of the deseaming nozzle shown in Figs. 5 and 6, after the work has been preheated by a preheating flame produced by supplying oxygen at a relatively low velocity to the passage 42 while supplying acetylene through the acetylene passages 45 into the annular chamber 45' and thence radially inwardly as an annular jet against the issuing oxygen stream, the velocity of the oxygen flowing through the passage 42 is increased to a deseaming velocity without changing the quantity of acetylene supplied to the passages 45 and discharged inwardly from the chamber 45'. In this case the central stream of oxygen discharged by the nozzle 40 is surrounded by an oxyacetylene preheating flame which is mixed externally of the nozzle, the arrangement being such that the flame continues to burn at the increased velocity of the oxygen.

In some cases the post-mixed nozzles shown in Figs. 1 to 6 of the drawings are subject to a disadvantage in that the narrow acetylene outlets from which the acetylene is discharged inwardly against the sides of the solid stream of oxygen are apt to be changed in width or closed either by expansion of the metal or by mechanical abuse of the end panels of the caps. Such disadvantage is overcome by the modifications shown in Figs. 7 and 8 in which the bottom panel of the cap engages and is supported by the end face of the tubular body, especially in the areas along the edge of the opening in the bottom panel.

Referring to Figs. 7 and 8, there is shown a blowpipe nozzle 60 comprising a tubular body 61 having a central oxygen passage 62 extending longitudinally therethrough, and also having a plurality of acetylene passages 63 arranged in spaced relation to the oxygen passage 62. The discharge ends of the passages 62 and 63 termi-

nate in the end face 64 of the member 61. An end cap 65 having a cylindrical skirt fits the annular end portion of the tubular body, and is secured in place on such member with the bottom panel 65' of the cap in supporting relation with the end face 64 of the member 61. The bottom panel 65' is provided with an opening 66 the inner edges of which are laterally offset with respect to the discharge end 67 of the oxygen passage 62. The discharge end 67 of the oxygen passage has a peripheral recess 68 and is entirely open for discharging only a single solid stream of oxygen. The end face 64 of the body member 61 is provided with a plurality of parallel grooves 69 disposed so as to direct the acetylene discharged by the acetylene passages 63 inwardly toward the single stream of oxygen as the latter leaves the discharge end of the oxygen passage 62. The grooves 69 are of rectangular cross section so as to provide acetylene slots which discharge the acetylene inwardly against the oxygen stream as it leaves the oxygen passage, there being a groove or slot 69 for each acetylene passage 63. The operation of the post-mixed nozzle shown in Figs. 7 and 8 is similar to that described above in connection with Figs. 1 to 4. Since the bottom panel of the cap engages the end face 64 of the body between the grooves 69, however, the arrangement is such that it is impossible for the panel to close the grooves 69 du to warpage or other injury.

The modification of the invention shown in Figs. 9 and 10 consists of a one-piece nozzle 80 having a central oxygen passage 81 and a plurality of acetylene passages 82 all of which terminate in a common plane 83. The tubular nozzle 80 is provided with an oblong opening 84 the inner longitudinal edges of which are laterally offset with respect to the corresponding edges of the oblong discharge end 85 of the oxygen passage 81 in the plane 83. The nozzle has a peripheral recess 86 located directly downstream with respect to such discharge end 85 of the oxygen passage, which is entirely open for discharging a single stream of oxygen. The discharge end of the nozzle 80 is provided with an acetylene chamber or slot 87 at each side of the recess 86, each chamber being disposed so as to direct the acetylene discharged by the corresponding group of acetylene passages 82 inwardly against the single stream of oxygen as the latter leaves the discharge end 85 of the oxygen passage. The discharge ends 88 of the acetylene passages 82 are ararnged in rows, as shown, parallel to the longitudina ledges of the opening 84, and the wide side of each chamber or slot 87 is parallel to the wide side of the oblong discharge end 85 of the oxygen passage 81. With this arrangement, distortion of the acetylene slots 87 is inhibited, as is the formation of ridges in work desurfaced by the nozzle 80.

The end cap of the two-piece nozzle modifications of the present invention may be copper, but an oxidation and heat resistant metal or alloy is preferable, such as stainless steel or Monel metal alone or coated with "Stellite" alloy. In such case the end cap serves not only to protect the end of the body member from wear and damage in use but also serves to direct the acetylene toward the oxygen orifice of the nozzle.

It will be appreciated by those skilled in the art that the present invention includes the use of standard parts which are readily available, and produces an oxidizing gas stream and a preheating flame simultaneously without danger of backfires or flashbacks which are inherent in blowpipe apparatus which utilizes premixed oxygen and acetylene to produce the preheating flames.

The term "acetylene" as used herein includes any equivalent fuel gas, such as propane or mixtures of two or more fuel gases, but not mixtures of fuel gas and combustion supporting gas.

Our copending application Serial No. 561,358, filed November 1, 1944, for "Blowpipe nozzles," is, in part, a continuation of the present application.

What is claimed is:

1. A blowpipe nozzle comprising an elongated member having a central oxygen passage extending longitudinally therethrough and also having a plurality of acetylene passages arranged in spaced substantially parallel relation to said oxygen passage, the discharge ends of all of said passages terminating in one end of said member having a face lying in a plane disposed at right angles to the longitudinal axis of said member, an end cap having a cylindrical skirt fitting an annular end portion of said member, the bottom panel of said cap having a shoulder seated on said end face to space the inner surface of said panel a fixed distance from said face, and means securing said cap in place on said member, said cap also having a bottom panel provided with an opening the inner edge of which is laterally offset with respect to the inner edge of the discharge end of said oxygen passage, said discharge end of the oxygen passage having a peripheral recess and being entirely open for discharging only a single stream of oxygen, and said bottom panel being disposed so as to direct the acetylene discharged by said acetylene passages inwardly toward said single stream of oxygen as the latter leaves the discharge end of said oxygen passage.

2. A blowpipe nozzle comprising an elongated member having a central oxygen passage extending longitudinally therethrough and also having a plurality of fuel gas passages arranged in spaced relation to said oxygen passage, the discharge ends of all of said passages terminating in an end face of said member, an end cap having a cylindrical skirt fitting an annular end portion of said member, said cap also having a bottom panel, means spacing an inner surface portion of said bottom panel a fixed distance from said end face; and means securing said cap in place on said member, the bottom panel of said cap having an opening the edge of which is laterally offset with respect to the edge of the discharge end of said oxygen passage, said discharge end of the oxygen passage having a lateral recess and being entirely open for discharging only a single stream of oxygen having a fringe of lower velocity than that of the inner part, and said bottom panel being disposed so as to direct the fuel gas discharged by said fuel gas passages inwardly toward said single stream of oxygen as the latter leaves the discharge end of said oxygen passage.

3. A blowpipe nozzle as claimed by claim 2, in which said discharge end of said oxygen passage is oblong in cross section, and said opening in said bottom panel of said end cap is also oblong, whereby a flat but solid stream of oxygen suitable for desurfacing work can be discharged by the nozzle.

4. A blowpipe nozzle as claimed by claim 2, in which said discharge end of said oxygen passage is round in cross section, and said opening in said bottom panel of said end cap is also round, whereby a round but solid stream of oxygen suitable for deseaming work can be discharged by the nozzle.

5. A blowpipe nozzle comprising a member having an oxygen passage extending therethrough and also having a fuel gas passage arranged in spaced relation to said oxygen passage, the discharge end of each of said passages terminating in a portion of an end face of said member, an end cap having a skirt fitting an end portion of said member, said cap also having a bottom panel, the inner surface of said bottom panel having a portion spaced a fixed distance from said end face portion; and means securing said cap in place on said member, the bottom panel of said cap having an opening the edge of which is laterally offset with respect to the edge of the discharge end of said oxygen passage, said discharge end of the oxygen passage being entirely open for discharging only a single stream of oxygen, and said bottom panel being disposed so as to direct the fuel gas discharged by said fuel gas passage inwardly toward said single stream of oxygen as the latter leaves the discharge end of said oxygen passage, said discharge end of said oxygen passage being provided with a recess.

6. A blowpipe nozzle comprising an elongated member having a central oxygen passage extending longitudinally therethrough and also having acetylene passage means arranged in spaced relation to said oxygen passage, the discharge ends of all of said passages terminating in an end face of said member, an end cap having a cylindrical skirt fitting an annular end portion of said member, and means securing said cap in place on said member with the bottom panel of said cap in supporting relation with the end face of said member, said bottom panel being provided with an opening, the inner edge of which is laterally offset with respect to the edge of the discharge end of said oxygen passage, said discharge end of the oxygen passage having a peripheral recess and being entirely open for discharging only a single stream of oxygen, and said end face being provided with a plurality of grooves of rectangular cross section 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.

7. A blowpipe nozzle as claimed by claim 6, in which said grooves are flat so as to provide acetylene slots which introduce the acetylene to the oxygen stream as it leaves said oxygen passage.

8. A blowpipe nozzle comprising a tubular member having a central oxygen passage extending longitudinally therethrough and also having acetylene passage means arranged in spaced relation to said oxygen passage, the discharge ends of all of said passages terminating in a common plane, said tubular member being provided with an opening the inner edge of which is laterally offset with respect to the edge of the discharge end of said oxygen passage in said plane, said discharge end of the oxygen passage having a peripheral recess and being entirely open for discharging a single stream of oxygen, and said member being provided with an acetylene slot disposed so as to direct the acetylene discharged by said acetylene passage means inwardly toward said single stream of oxygen as the latter leaves said discharge end of said oxygen passage.

9. A blowpipe nozzle as claimed by claim 8, in which said acetylene slot is flat, said discharge end of said oxygen passage is oblong in cross section, and the wide side of said flat slot is parallel to the wide side of said oblong discharge end of said oxygen passage.

10. A desurfacing blowpipe nozzle comprising an elongated member having a longitudinally disposed oxygen passage terminating in oblong stepped orifices at one end of said member, said member also having a longitudinally disposed fuel-gas passage terminating in such end of said member, and an end cap secured to such end of said member, said cap having an oblong opening axially aligned with said oxygen passage, said cap also having panel means in line with said fuel-gas passage for deflecting the gas discharged thereby substantially perpendicularly toward only one side of said oblong opening, and means providing a space communicatively connecting the fuel-gas passage with the oblong opening.

11. A post-mixed desurfacing blowpipe nozzle having a single oblong discharge orifice and an oxygen supply passage axially in line with such orifice, said nozzle also having fuel gas supply passages and two fuel gas chambers, said chambers opening into two opposite sides of such oxygen passage through narrow elongated slots parallel to the longer axis of such orifice, said orifice being wider than the adjacent end of said oxygen supply passage the construction and arrangement being such that, when the nozzle is disposed in operating position with the longer axis of such orifice parallel to the work surface and a preheating oxygen stream of low velocity is discharged therethrough, two wide streams of fuel gas will be discharged from such narrow slots against the top and bottom sides of the oxygen stream, to produce wide and extended streams of combustible mixture for work preheating, and, when the velocity of the oxygen stream is increased for desurfacing, the two wide fuel streams will continue to impinge against the top and bottom sides of the oxygen stream as before, to produce even more extended heating flames for assisting the desurfacing operation as it advances.

12. A blowpipe nozzle comprising means having a passage for discharging a stream of cutting oxygen from the nozzle, and means having a way for feeding fuel gas against the periphery of said cutting oxygen stream as said cutting oxygen stream leaves said passage, said passage having an outlet end, and means providing a lateral recess located directly downstream of said outlet end, said recess communicating with and cooperating with said way and outlet end so that a combustible mixture of oxygen and fuel gas is formed adjacent said cutting oxygen stream outside of the nozzle.

13. A blowpipe nozzle having a cutting oxygen passage the outlet end of which is open for discharging a stream of cutting oxygen, said nozzle having a lateral recess adjacent the outlet end of said cutting oxygen passage, and said nozzle also having a fuel gas passage the outlet end of which opens at an angle to one side of such recess at the outlet end of said cutting oxygen passage, whereby when cutting oxygen is delivered to said oxygen passage at a relatively low velocity, such oxygen mixes with the fuel gas discharged from the outlet end of said fuel gas passages to form an externally mixed oxy-fuel gas flame, and, when the velocity of said cutting oxygen is increased, while the velocity of the fuel gas remains constant, only a portion of the discharged oxygen mixes with the fuel gas, thereby forming an externally mixed flame beside the cutting oxygen stream which flame is stable by virtue of said recess.

14. A blowpipe nozzle for cutting, deseaming and like thermochemical metal-removing operations, said nozzle comprising an elongated body having an oxygen passage extending longitudinally therethrough and terminating in a single discharge passage adapted to discharge a single stream of metal-removing oxygen, said passage being enlarged adjacent its outlet end to cause eddy currents and a fringe of low velocity oxygen adjacent the core of said stream of oxygen, said body also having a fuel gas passage extending therethrough and comprising a longitudinal portion extending longitudinally of said body and spaced from said oxygen passage and a portion shorter than said longitudinal portion and extending toward the axis of said single oxygen discharge passage, such shorter portion of said fuel gas passage having a fuel gas discharge opening disposed forwardly of and radially outwardly of said single oxygen discharge passage to discharge fuel gas inwardly against the external surface of said single oxygen stream immediately after said oxygen stream issues from said single oxygen discharge orifice, to mix the low velocity fringe of oxygen adjacent said oxygen stream with the issuing fuel gas to produce a preheating gas mixture and flame adjacent said oxygen stream after both said single oxygen stream and the fuel gas have discharged from said oxygen passage and said fuel gas passage, respectively.

15. An elongated blowpipe nozzle having a longitudinally extending cutting oxygen passage terminating in an enlarged entirely open outlet portion, said nozzle also having a plurality of fuel gas passages terminating at said enlarged outlet portion of said oxygen passage, and said nozzle having a single common outlet opening for the oxygen and fuel gas discharged by such passages, which common outlet opening is laterally enlarged with respect to the enlarged outlet portion of said oxygen passage.

16. A blowpipe nozzle comprising a body having an unrestricted axially extending cutting oxygen passage and a longitudinally extending fuel gas passage, a cap non-adjustably secured to the outlet end of said body and having an opening in line with said cutting oxygen passage, said cap and body being internally shaped at the outlet end of said fuel gas passage to provide a fuel gas chamber near the outlet end of the

nozzle, the cap and body also being internally shaped to provide said chamber with a fuel gas port laterally facing the cutting oxygen passage, the opening in said cap being radially offset with respect such cutting oxygen passage to insure mixing of the fuel gas and oxygen discharged from said port and cutting oxygen passage.

17. A blowpipe nozzle having an unrestricted axially extending cutting oxygen passage and a longitudinally extending fuel gas passage, said nozzle having a fuel gas chamber in communication with said fuel gas passage and located near the outlet end of the nozzle, said nozzle also having a fuel gas port connected to said chamber and laterally facing the cutting oxygen passage, the downstream section of the passage being radially offset with respect to the upstream section of such cutting oxygen passage adjacent said port, to insure mixing of the fuel gas and oxygen discharged from said port and cutting oxygen passage.

JAMES H. BUCKNAM.
IVAN P. THOMPSON.

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