July 31, 1945. R. S. BABCOCK 2,380,570

BLOWPIPE NOZZLE

Filed June 21, 1941

Fig. 1.

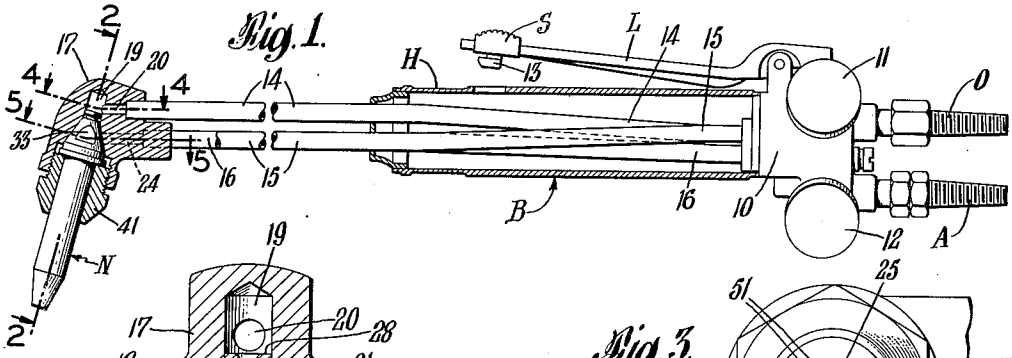


Fig. 2.

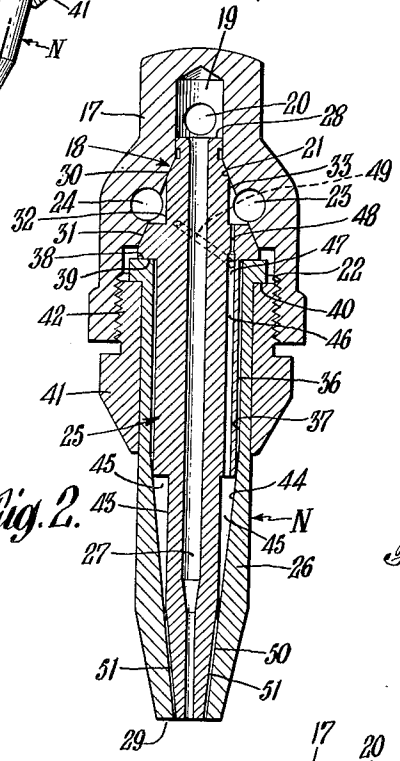


Fig. 3.

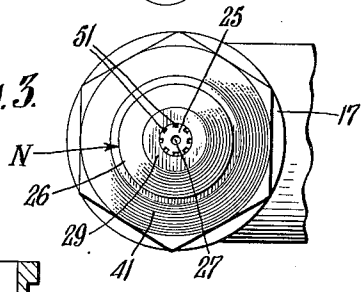


Fig. 8.

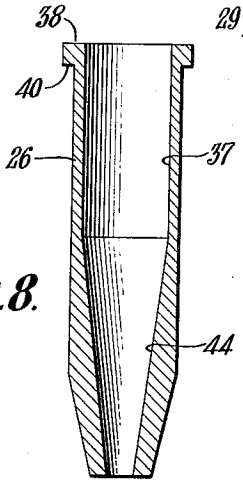


Fig. 7.

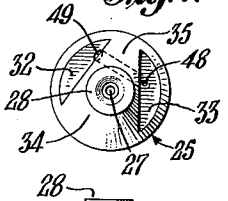


Fig. 4.

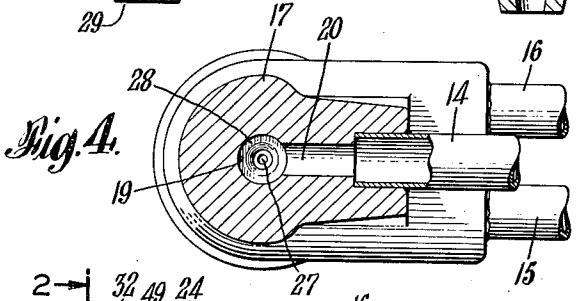


Fig. 5.

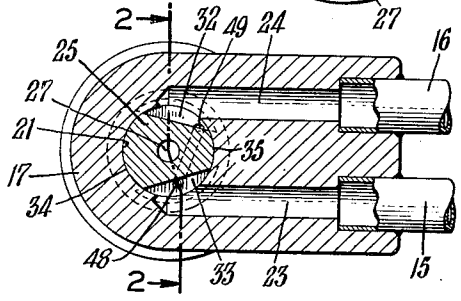
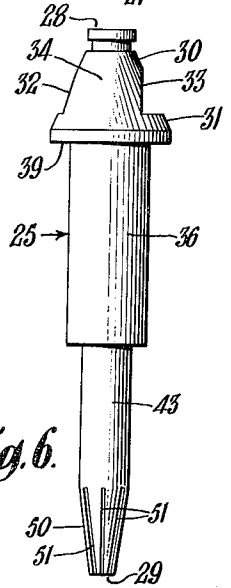


Fig. 6.



INVENTOR
ROGER S. BABCOCK
BY
ATTORNEY

Patented July 31, 1945 2,380,570

UNITED STATES PATENT OFFICE

2,380,570

BLOWPIPE NOZZLE

Roger S. Babcock, Plainfield, N. J., assignor to Union Carbide and Carbon Corporation, a corporation of New York

Application June 21, 1941, Serial No. 399,074

6 Claims. (Cl. 158—27.4)

This invention relates to blowpipes and more particularly to self-mixing cutting nozzles.

In general, cutting nozzles are provided with a central passage for discharging a stream of oxidizing gas, such as oxygen, for thermochemical reaction with ferrous metal. Self-mixing cutting nozzles are also provided with internal passages for mixing a combustible gas, such as acetylene, and a combustion-supporting gas, such as oxygen, and for discharging the mixed gas as jets through a plurality of outlet ports surrounding the central passage. The jets, when ignited, produce flames for preheating the work at a starting point before the cutting oxygen is applied against such point to start the thermochemical reaction, as well as for locally heating the work during the actual cutting operation.

In the past, it has been customary to provide separate mixers or separate mixing arrangements of the oxygen and acetylene passages for each of the mixed-gas outlet ports or passages. Unless such passages were very accurately dimensioned, the resulting preheating flames had non-uniform chemical characteristics. From a practical standpoint, therefore, known self-mixing nozzles are very difficult and expensive to manufacture and when the cutting oxygen is turned on the preheat flames are undesirably affected. For example, some of the flames would be carburizing, others neutral, and still others would be oxidizing, in the same nozzle. This is very undesirable because the ferrous metal adjacent the cut is adversely or non-uniformly affected by the different chemical characteristics of the several preheating flames. Furthermore, in usual cutting operations the nozzles become unevenly heated, or several of the orifices become partially clogged with foreign bodies and the effect of either or both of these conditions various the characteristics of each flame to produce a non-uniform condition.

The main object of this invention, therefore, is to provide a self-mixing cutting nozzle of simple and inexpensive construction having improved and uniform operating characteristics. Another object is to provide a blowpipe nozzle having high flashback resistant properties. A further object is to provide a very compact combined nozzle and blowpipe of comparatively few and inexpensive parts. Other objects are to provide an improved cutting nozzle for severing steel and other ferrous metal bodies; to obtain uniform preheat flames without the measure of accuracy previously required; and to produce a nozzle at a cost below that of known nozzles having integral mixers.

A particular problem solved by the invention is the elimination of an expensive blowpipe with a tube carrying premixed gases to the nozzle and the production of a self-mixing nozzle particularly adaptable to but not limited to plate edge preparation. The use of a tube for conveying premixed gases is undesirable because of the explosion hazard.

In accordance with the invention there is provided a self-mixing nozzle wherein the preheating gases are mixed by a single mixing device and then distributed equally and uniformly to a plurality of preheating flame ports. The single mixer, acting in conjunction with a suitable distribution chamber, uniformly supplies all of the ports with mixed gas having identical chemical characteristics.

Referring to the drawing:

Fig. 1 is a view mainly in side elevation with parts shown in section of a blowpipe embodying features of the invention;

Fig. 2 is an enlarged view in cross-section of the forward end of the blowpipe taken on line 2—2 of Fig. 1;

Fig. 3 is an enlarged view in bottom plan looking into the discharge end of the nozzle;

Figs. 4 and 5 are enlarged fragmentary views in section taken on line 4—4 and line 5—5, respectively, of Fig. 1;

Fig. 6 is a view in side elevation of the inner part of the nozzle;

Fig. 7 is a top plan view of the inner part of the nozzle; and

Fig. 8 is a view in vertical section of the outer part of the nozzle.

In Figs. 1 through 8 of the drawing, there is shown one form of the invention comprising a blowpipe B having an oxygen inlet nipple O and an acetylene inlet nipple A connected to a valve block 10 provided with an oxygen valve 11 and an acetylene valve 12. The valve block 10 is also provided with a cutting oxygen valve having a control lever L which is swung toward handle H to open the cutting oxygen valve and may be locked in this position by a slide S having a catch 13 which engages a part of the handle H. Connected to the corresponding valves in the block 10 and extending through the handle H are a cutting oxygen pipe 14, a preheating oxygen pipe 15 and an acetylene pipe 16. The forward ends of these pipes are connected to a head 17 having therein a generally conical socket 18 comprising a central bore 19 connected to the cutting oxygen pipe 14 by a passage 20, a conical opening 21, and an internally threaded bore 22.

Opposite sides of the conical opening 21 are connected to the preheating oxygen and acetylene pipes 15 and 16, respectively, by passages 23 and 24 in the head 17.

Connected to the head 17 by a nut 41 is a self-mixing cutting nozzle N comprising a generally tubular body of metal, such as copper, the exposed external surface of which preferably is chromium plated. The nozzle N consists of an elongated tubular inner core part or internal member 25 telescoped within a casing such as an outer cylindrical part or external member 26. The inner core part 25 is provided with an axial oxidizing gas passage 27 extending from the inlet end 28 to the outlet end 29 of the nozzle. The one-piece member 25 is shaped at the inlet end 28 to provide an annular seat 30 surrounding the central passage and another annular seat 31 longitudinally and radially spaced therefrom. Between the annular seats 30 and 31 the part 25 is provided with a pair of eccentric preheating-gas inlets or recesses 32 and 33 separated by a pair of lateral seats 34 and 35. The seats 30 and 31 and seats 34 and 35, as shown, constitute portions of the lateral surface of a frustum of a cone corresponding to the conical socket 21 in the head 17, so that such seats are adapted to fit and form gas-tight seals with the wall of the socket 21, thus preventing any leakage between the oxidizing-gas and preheating-gas chambers 19, 32 and 33. Each of the recesses has a lateral wall extending parallel to the longitudinal axis of the nozzle and a bottom surface. The lateral walls of the two recesses form an included angle with each other which is less than 90° while the bottom surfaces are positioned in the same transverse plane.

The inner part 25 of the nozzle N has a cylindrical portion 36 adapted to fit a corresponding portion 37 of the outer part 26, with the inner end 38 of the latter engaging an annular shoulder 39 provided on the inner part 25. The outer part 26 is also provided with an annular shoulder 40 adapted to be engaged by the inner end of the nut 41 sleeved over the outer part 26 and having externally threaded portion 42 adapted to cooperate with the internally threaded portion 22 of the head 17. Thus, when the nut 41 is screwed home the nozzle parts 25 and 26 and the nozzle N and head 17 are held in assembled relation.

The inner part 25 of the nozzle N is provided along a zone intermediate of its length with a cylindrical portion 43 of reduced diameter opposite a conically tapered socket 44 within the outer part 26 to form therewith an internal annular mixed preheating-gas chamber 45 located between the opposite ends of the nozzle N. The inner part 25 is also provided with a substantially long longitudinal preheating-gas mixing passage 46 of substantially uniform cross-sectional area from end to end, which discharges into the annular chamber 45. The inlet end 47 of the preheating-gas mixing passage 46 is spaced from the inlet end 28 of the nozzle N and the nozzle part 25 has one preheating-gas passage 48 connecting the preheating-gas chamber or inlet 33 to the inlet end 47 of the mixing passage 46, and another preheating-gas passage 49 also connecting the other preheating-gas chamber or inlet 32 to the inlet end 47 of the gas mixing passage 46. The preheating-gas passage 48 is axially in line with the gas mixing passage 46 and is of substantially smaller cross section, while the preheating gas passage 49 is inclined at an acute angle with respect to the passage 48. The annular distributing chamber surface 43 of the body 25, being of reduced diameter, is offset with respect to the outlet end of the preheating-gas mixing passage 46 whereby, upon the body 25 being separated from the casing 26, a cleaning tool can have ready access either when applied to the outlet end of the preheating-gas mixing passage or when a cleaning tool is thrust in the opposite direction through the aligned preheating-gas passage 48 and preheating-gas mixing passage 46. In order that the cross passage 49, upon being drilled, may more easily miss the oxidizing gas passage 27, the centers of the inlets 32 and 33 are disposed in a common plane and form with the longitudinal axis of the nozzle an included angle of less than 180°.

The inner part 25 of the nozzle N is conically tapered at 50 to fit the conical socket 44 in the outer part 26 and is provided with a plurality of grooves 51 to form substantially long mixed preheating-gas discharge passages extending from the annular chamber 45 to the outlet end 29 of the nozzle N when the parts 25 and 26 are in assembled relation.

In the operation of the blowpipe B shown in Figs. 1 through 8, the nipples O and A are connected to a suitable source of oxygen and to a suitable source of acetylene, respectively, and the valve 11 and 12 are opened. This causes preheating oxygen and acetylene to flow through the pipes 15 and 16 to the head 17. In the head 17 the preheating oxygen flows through the passage 23 to the preheating oxygen inlet 33 of the nozzle N, then through the small passage 48 from which it is discharged into the inlet end 47 of the preheating gas-mixing passage 46, aspirating acetylene into said inlet end 47 through passage 49 to which it is supplied through acetylene inlet 32 and passage 24. The preheating oxygen and acetylene are then thoroughly mixed as they flow through the relatively long passage 46, being discharged thereby into the annular chamber or recess 45 which distributes the gas mixture uniformly to the several relatively long outlet passages 51. The resulting jets of mixed gas issuing from the passages 51 are ignited, forming generally converging preheating flames which may be applied to the ferrous metal work after the valves 11 and 12 have been adjusted to obtain the desired type of preheating flame. As the work reaches its ignition temperature, the lever L is depressed to cause cutting oxygen to be supplied to and discharged by the central passage 27 in the nozzle N, the cutting oxygen flowing thereto through the pipe 14 and then through passages 20 and 19 in the head 17. The stream of cutting oxygen discharged by nozzle N thermochemically reacts with the hot work and the cutting operation thereupon is carried out in the usual well-known manner.

The nozzle of the present invention has a particular advantage over self-mixing nozzles known and used in the past because most of such nozzles include separate mixers or separate mixing arrangements of the oxygen and acetylene passages for each preheat passage in the nozzle. Consequently the preheat flames of such nozzles are not uniform and part of the flames are carburizing, part of the flames are neutral and part of the flames are oxidizing. The nozzle of the present invention avoids such difficulties and provides preheat flames which are always entirely uniform in character. The use of a single mixer produces flames uniform as to size as well as character.

Self-mixing cutting nozzles of this invention

have excellent flashback resistance in addition to uniform preheating-flame properties by virtue of their unique construction, with the result that cutting operations involving preheating may be performed more efficiently and effectively than with any known cutting nozzles which have been used in the past for similar operations.

While the invention has been shown in a type of nozzle adapted to discharge a plurality of gas jets forming flames around the cutting oxygen stream it will be understood that the invention also may be applied to that type of nozzle employing a ring of flame around the cutting oxygen stream.

It will also be understood that the disclosure herein is merely for the purpose of illustration and that the invention is not limited to cutting nozzles alone, but can be embodied in nozzles for other metal removing operations such, for example, as deseaming and desurfacing.

What is claimed is:

1. A blowpipe nozzle comprising a generally tubular body having an axial oxidizing-gas passage extending from the inlet end to the outlet end of the nozzle; said tubular body being provided on its inlet end with a circumferential engaging portion having one annular seat surrounding said oxidizing-gas passage, another annular seat axially spaced from said first annular seat and also surrounding said oxidizing gas passage, and a pair of eccentrically arranged preheating-gas inlets at the same transverse level about said portion and between said annular seats, said preheating-gas inlets being angularly separated from each other by laterally disposed seats; said body having a mixed preheating-gas chamber located between the ends of the nozzle, and mixed preheating-gas discharge passage means extending from said chamber to said outlet end of the nozzle; said body also having a preheating-gas mixing passage discharging into said chamber, with the inlet end of said mixing passage spaced from said preheating-gas inlets; and said body having one preheating-gas passage connecting one preheating-gas inlet to the inlet end of said preheating-gas mixing passage, and another preheating-gas passage connecting the other preheating-gas inlet to said inlet end of the preheating-gas mixing passage, at least one of said preheating-gas passages being inclined with respect to said mixing passage.

2. A blowpipe nozzle as claimed in claim 1, with one preheating-gas passage in axial alignment with said preheating-gas mixing passage and opening into the one preheating-gas inlet.

3. A blowpipe nozzle as claimed in claim 1, with the centers of the preheating-gas inlets in a common plane and forming with the longitudinal axis of the nozzle an included angle of less than 180°.

4. In a self-mixing blowpipe nozzle, an elongated body provided with a circumferential engaging portion adjacent the inlet end having a pair of axially spaced conical seat portions, a pair of preheating-gas inlets located in the same transverse plane about said end portion and between the conical seat portions, and lateral seat portions angularly separating said inlets from one another; said body also having a mixed preheating-gas recess located between the opposite ends of the nozzle, and mixed preheating-gas discharge passage means extending from said recess to the outlet end of the nozzle; said body also having a preheating-gas mixing passage discharging into said recess, the inlet end of said preheating-gas mixing passage being spaced from the inlet end of the nozzle; and said body also having one preheating-gas passage connecting one preheating-gas inlet to the inlet end of said preheating-gas mixing passage, and another preheating-gas passage connecting the other preheating-gas inlet to said inlet end of the preheating-gas mixing passage, at least one of said preheating-gas passages being inclined with respect to said mixing passage.

5. A self-mixing blowpipe nozzle comprising a casing, and an elongated body detachably telescopable within and cooperable with said casing to form a distributing chamber for mixed preheating-gas and discharge passage means extending from said chamber to the outlet end of the nozzle; said body having a circumferential inlet end portion provided with axially spaced annular seat portions, a pair of preheating-gas inlets located in a common plane between said annular seat portions, and a pair of lateral seat portions angularly spacing the inlets from one another, a preheating-gas mixing passage discharging into said chamber, the inlet end of said preheating-gas mixing passage being spaced from said inlet end of the nozzle and in axial alignment with one of the preheating-gas inlets, and said body also having one preheating-gas passage in axial alignment with the preheating-gas mixing passage and with the one preheating-gas inlet for connecting the latter with the inlet end of said preheating-gas mixing passage, and another preheating-gas passage connecting the other preheating-gas recess with the inlet end of said preheating-gas mixing passage and extending at an angle with respect to said one preheating-gas passage, the distributing chamber surface and discharge passage surface of the body being of reduced diameter and inwardly offset with respect to the outlet end of the preheating-gas mixing passage.

6. A blowpipe nozzle having passage means including a gas mixing passage within the nozzle for mixing a combustible gas and a combustion-supporting gas to form a gas mixture which subsequently is discharged from the tip of the nozzle to produce a flame, said nozzle being generally in the shape of a tube the central opening of which constitutes a passage for oxidizing gas to be discharged from the tip adjacent such flame, the end of said nozzle opposite such tip having a frusto-conical surface portion provided with a recess on each side of the nozzle, each recess having a lateral wall and a bottom surface, one recess constituting a combustible gas inlet and the other recess a combustion-supporting gas inlet, the bottom surfaces of such two recesses being positioned in the same transverse plane, a gas passage disposed in parallel relation to the longitudinal axis of the nozzle opening to the bottom of one of said recesses, and a gas passage disposed in angular relation to such axis opening to the bottom of the other recess, said gas passages being arranged to conduct the different gases to the inlet end of said gas mixing passage, the lateral walls of said recesses being disposed in planes which are parallel to the longitudinal axis of the nozzle and form an included angle with each other which is less than 90°.

ROGER S. BABCOCK.