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BLOWPIPE

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This invention relates to blowpipes and more particularly to high capacity blowpipes wherein are mixed relatively large volumes of a combustible gas of high calorific value, such as acetylene, and a combustion-supporting gas, such as oxygen, to produce a gas mixture suitable for the production of a large amount of heat for flame treatment, welding, desurfacing, cutting, and other analogous operations on iron, steel, or other materials.

The invention is specifically concerned with a blowpipe in which large volumes of oxygen and acetylene, at relatively low velocities, may be mixed without undue danger of flashback or of the other usual attending complications involved in mixing large volumes of such gases.

The conventional oxy-acetylene blowpipe is provided with a simple injector for mixing the oxygen and acetylene, and coils or pockets in the oxygene or acetylene lines to improve flashback resistance. Such coils or pockets are usually located in the passages between the mixer and the adjustable inlet valves.

Considerable difficulty is encountered in the construction of a mixing device of conventional type capable of supplying large volumes of gas. Large mixing orifices are required which, in turn, require a blowpipe of decidedly ungainly proportions. Furthermore, to construct a large capacity blowpipe with good flashback resistance, the aforementioned conventional coils and pockets need to be very large, not only adding materially to the size of the blowpipe but also considerably increasing its cost.

Among the objects of this invention, therefore, are to provide a mixing device capable of mixing large volumes of gas, such as oxygen and acetylene, which device possesses good flashback resistance at large flows, as well as at the smaller flows of gas; means for mixing a combustible gas and a combustion-supporting gas wherein the diameter of the passage at the point of mixing said gases is held to a dimension which avoids adverse effects of preceding and proceeding connecting passages; means for eliminating the need for coils or pockets ordinarily used in oxygen and acetylene lines; and a mixing device wherein an annular passage is used to obtain a large area at the mixing point with but a small distance between the opposite walls, said mixing device being simple, sturdy and compact, although of high capacity.

In accordance with the invention there is provided improved means for mixing heating gases, such as oxygene and acetylene, in quantities far

in excess of those attainable with conventional mixing devices, yet retaining good flashback resistance. This is accomplished by the employment of a ring-type mixer whereby the area at the mixing point is increased without increasing the width of the passage. Since flashback resistance is generally increased with a reduction in the width of the mixing passage, good flashback resistance is obtained with substantially increased flows.

Referring to the drawing:

Fig. 1 is a longitudinal partial cross section of a blowpipe provided with a mixer embodying features of the invention;

Fig. 2 is a view in side elevation of a mixer plug forming a part of the mixer of Fig. 1;

Fig. 3 is a view in front elevation of the inlet end of the mixer plug of Fig. 2;

Fig. 4 is a view in cross section taken on line 4—4 of Fig. 1; and

Fig. 5 is a view in cross section taken on line 5—5 of Fig. 1.

The blowpipe illustrated in Figs. 1 to 5 comprises a gas inlet member I, a gas outlet member O, an internal mixer plug P disposed between the inlet and outlet members, and a coupling nut N connecting said members I and O with the plug P in assembled relation. The gas inlet member I consists of an outer pipe 10, an inner pipe 11, and a nipple 12. One end of the outer pipe 10 is sleeved over one end of the nipple 12 and secured thereto, preferably by an annular weld 13. The corresponding end of the inner pipe 11 projects into a central passage 14 in the nipple 12 and is secured to the nipple, preferably by an annular weld 15. The inner pipe 11 may be used to supply one of the gases, such as acetylene, to the mixer while the annular passage 16 surrounding the inner pipe 11 within the outer pipe 10 is used to supply the other gas, such as oxygen, to the mixer. Surrounding the central acetylene passage 14 in the nipple 12 are a series of annularly disposed longitudinal oxygene passages 17 which register with the oxygen annular passage 16. The outlet end of the nipple 12 is provided with a conical recess having an inner conical seating surface 18 and an outer conical seating surface 19 separated by an annular groove 20 into which the oxygen passages 17 open. The nipple 12 is also provided with external threads 21 to engage an internally threaded portion of the coupling nut N.

The outlet member O, which is preferably of metal, has an axial passage 23, ordinarily cylin-

drical, terminating with a frusto-conical recess 22. The outlet member O may be provided with external threads 24 to receive means for conducting the mixed gases to a conventional blowpipe head or tip (not illustrated). At the outer end of frusto-conical recess 22 in the outlet member O is a cylindrical socket 25 for receiving a corresponding cylindrical portion of the mixer plug P. The outlet member O is also provided with an external annular shoulder 26 for cooperation with a corresponding internal shoulder on the coupling nut N.

The mixer plug P, which is disposed between the inlet member I and outlet member O preferably comprises, in axial alignment, a conduit portion 27 provided with internal passages 31 and 32, a sharply tapered center portion 28 providing a frusto-conical mixer surface, and a gradually tapered terminal portion 29 having a rounded end. The conduit portion 27 has a core 30 surrounded by a plurality of longitudinal acetylene passages 31 and in radially and outwardly spaced relation thereto a plurality of longitudinal oxygen passages 32. The inlet end of the plug P is preferably of generally cylindrical shape and is provided with conical seating surfaces 33 and 34 separated by a cylindrical portion 35 adapted to cooperate, in an assembled blowpipe, with the seating surfaces 18 and 19 and annular groove 20 in the nipple 12 to form a gas-tight first annular oxygen distributing chamber 36. An annular flange 38 is provided to engage the end of the outlet member O. In an assembled blowpipe, as the nut N is tightened, the outlet member O is urged against the flange 38, and the plug P is thereby brought into engagement with the seating surfaces 18 and 19 of the nipple 12.

An annular groove 39 at the discharge end of the oxygen passages 32 is adapted to form with the cylindrical recess 25 of the outlet member O an annular second oxygen distributing chamber 40. The forward end of the conduit portion 27 is also provided with a frusto-conical outer surface 41 which, in an assembled blowpipe, is uniformly spaced from the frusto-conical recess 22 of the outlet member O to form an oxygen injector orifice 42 connected throughout to the oxygen distributing chamber 40. Between the forward end of the surface 41 and the rear end of the frusto-conical mixer surface 28 is an annular axially narrow outlet passage 43, surrounding the core 30. The ends of the acetylene passages 31 discharge into the annular outlet passage 43 at right angles thereto and acetylene is caused to flow radially outwardly through such passage 43 into a mixing chamber 44. The radial width of the gas mixing chamber 44 is substantially greater than that of the injector orifice 42, as shown in Fig. 1. The frusto-conical mixer surface 28 of the plug is uniformly spaced from the frusto-conical recess 22 of the outlet member O to form the relatively long frusto-conical gas mixing chamber 44 into which the oxygen is discharged by the orifice 42 in the form of a frusto-conical injector stream or jet.

The gradually tapered terminal 29 of the plug P extends centrally into the cylindrical passage 23 of the outlet member O to form a relatively long annular discharge chamber 45 of gradually increasing cross section for the unrestricted flow and further mixing of the mixed gases discharged from the frusto-conical mixing chamber 44. The cross section of the annular discharge chamber 45 preferably increases from the outlet of the gas mixing chamber 44 to the end of the discharge

chamber 45. Thus, the flow of mixed gases from the mixing chamber 44 is entirely unobstructed by any restriction in the discharge chamber 45 itself or between such chamber and the mixing chamber 44.

In considering the operation of the blowpipe shown in the drawing, oxygen upon entering the mixer through passages 16 and 17 proceeds into the first annular oxygen distributing chamber 36 from whence it is distributed uniformly among the several annularly disposed passages 32 which terminate in the second annular distributing chamber 40 and then proceeds into the frusto-conical injector orifice 42. Acetylene enters the mixer through the inner pipe 11 and central passage 14, and is distributed uniformly about core 30 among the several annularly disposed passages 31 which terminate in the laterally disposed annular outlet passage 43. The initial mixing of the two gases, therefore, occurs at the intersection of the injector orifice 42 and the outlet passage 43. The oxygen, being under higher pressure than the acetylene, aspirates the acetylene and the two gases continue on through the frusto-conical mixing chamber 44 and the discharge chamber 45.

With the employment of an annular or ring-type mixer of the character described, much greater quantities of gas can be mixed at relatively low velocities than in previously known types of mixers. Furthermore, it has been found that the device of this invention possesses excellent flashback resistance through its entire range of flow, permitting its use with a great variety of blowpipes and heating heads. Its compactness and simplicity, in view of the aforementioned qualities, add greatly to its usefulness and desirability because of the elimination of cumbersome, complicated equipment ordinarily required in large heating and welding installations. The actual capacity of a mixer of the type herein described has been found to be approximately 2000 cubic feet per hour.

The capacity at the annular line of mixing is increased without increasing the restriction of the passage at that point. Furthermore, the mass of metal surrounding the mixer is increased considerably above that of conventional devices without an undue increase in size, and the restriction of the passage at the annular line of mixing is reduced to a value where the lengths of the adjacent passages are no longer critical.

In the following claims the term "oxygen" includes any combustion-supporting gas, and the term "acetylene" includes any combustible gas.

What is claimed is:

1. An injector type blowpipe mixer provided with means having a frusto-conical passage terminating in an annular injector orifice for one gas, an annular axially narrow outlet passage from which another gas is caused to flow radially toward said annular injector orifice, a relatively long frusto-conical gas mixing chamber into which a frusto-conical jet of gas is adapted to be discharged by said annular injector orifice, the radial width of said gas mixing chamber being substantially greater than that of said injector orifice, and a relatively long annular discharge chamber into which said gas mixing chamber merges for the flow and further mixing of gases discharged from said mixing chamber, the connection between said mixing chamber and said discharge chamber being entirely unrestricted.

2. An injector type blowpipe mixer provided

with means having a plurality of longitudinal passages for acetylene, and, in radially and outwardly spaced relation thereto, a plurality of longitudinal passages for oxygen, an annular oxygen distributing chamber at the discharge end of said oxygen passages, said means also having a frusto-conical passage terminating in an annular oxygen injector orifice and connected throughout to said distributing chamber, an annular axially narrow outlet passage at which the discharge ends of said acetylene passages terminate at right angles and from which acetylene is caused to flow radially outwardly toward said annular injector orifice, a relatively long frusto-conical gas mixing chamber into which a frusto-conical jet of oxygen is adapted to be discharged by said annular injector orifice, and a relatively long annular discharge chamber into which said gas mixing chamber merges for the flow and further mixing of mixed gases discharged from said mixing chamber, the cross section of said annular discharge chamber increasing from the outlet of said gas mixing chamber to the end of said discharge chamber.

3. An injector type mixer plug comprising, in axial alignment, a conduit portion and a portion having a frusto-conical mixer surface, and a gradually tapered terminal, said conduit portion having a core surrounded by a plurality of longitudinal passages for acetylene, and, in radially and outwardly spaced relation thereto, a plurality of longitudinal passages for oxygen, said conduit portion having an annular groove at the discharge end of said oxygen passages, the forward end of said conduit portion having a frusto-conical injector surface extending from said groove and being separated from the rear end of said conical mixer surface around said core by an annular axially narrow outlet passage at which the discharge ends of said acetylene passages terminate at right angles and from which acetylene is caused to flow radially outwardly toward said frusto-conical injector surface, said gradually tapered terminal extending from said conical mixer surface.

4. A metal injector type mixer plug comprising, in axial alignment, a conduit portion, a portion having a conical mixer surface and a gradually tapered terminal, said conduit portion having a plurality of longitudinal passages for acetylene, and, in radially and outwardly spaced relation thereto, a plurality of longitudinal passages for oxygen, said conduit portion having an annular groove at the discharge end of said oxygen passages, the forward end of said conduit portion having a frusto-conical injector surface extending from said groove and being separated from the rear end of said conical mixer surface by an annular axially narrow outlet passage at which the discharge ends of said acetylene passages terminate at right angles and from which acetylene is caused to flow radially outwardly toward said frusto-conical injector surface, and said gradually tapered terminal extending from said conical mixer surface and having a rounded end.

5. In an oxy-acetylene injector type blowpipe mixer provided with an outlet member having a frusto-conical recess terminating in a cylindrical passage, a plug adapted to cooperate with said outlet member and comprising, in axial alignment, a conduit portion, a frusto-conical mixer

surface and a tapered terminal, said conduit portion having a core surrounded by a plurality of longitudinal passages for acetylene, and, in radially and outwardly spaced relation thereto, a plu-

5 rality of longitudinal passages for oxygen, said conduit portion having an annular groove at the discharge end of said oxygen passages which is adapted to form with said conical recess an annular oxygen distributing chamber, the forward end of said conduit portion having a frusto-conical outer surface adapted to form with said frusto-conical recess a frusto-conical oxygen passage terminating in an annular injector orifice connected throughout to said distributing chamber, 10 the forward end of said conduit portion being separated from the rear end of said frusto-conical mixer surface around said core by an annular axially narrow outlet passage at which the discharge ends of said acetylene passages terminate at right angles and from which acetylene is 20 caused to flow radially outwardly, said frusto-conical mixer surface being adapted to form with said frusto-conical recess a relatively long frusto-conical gas mixing chamber into which the oxygen is discharged by said annular injector orifice, and said tapered terminal being adapted to extend centrally into said cylindrical passage to form a discharge chamber of increasing cross section for the flow and further mixing of mixed 30 gases discharged from said frusto-conical gas mixing chamber.

6. In an oxy-acetylene injector type blowpipe mixer provided with a metal outlet member having a frusto-conical recess terminating in a cylindrical passage, a metal plug adapted to cooperate with said outlet member and comprising, in axial alignment, a conduit portion, a frusto-conical mixer surface and a gradually tapered terminal, said conduit portion having a core surrounded by a plurality of longitudinal passages 40 for acetylene, and, in radially and outwardly spaced relation thereto, a plurality of longitudinal passages for oxygen, said conduit portion having an annular groove at the discharge end of said oxygen passages which is adapted to form with said conical recess an annular oxygen distributing chamber, the forward end of said conduit portion having a frusto-conical outer surface adapted to form with said frusto-conical recess a frusto-conical oxygen passage terminating in an annular injector orifice connected throughout to said distributing chamber, the forward end of said conduit portion being separated from the rear end of said frusto-conical mixer surface 45 around said core by an annular axially narrow outlet passage at which the discharge ends of said acetylene passages terminate at right angles and from which acetylene is caused to flow radially outwardly, said frusto-conical mixer surface being adapted to form with said frusto-conical recess a relatively long frusto-conical gas mixing chamber into which the oxygen is discharged by said annular injector orifice, and said gradually tapered terminal being adapted to extend 50 centrally into said cylindrical passage to form a relatively long annular discharge chamber of increasing cross section for the flow and further mixing of mixed gases discharged from said frusto-conical gas mixing chamber.

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