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F. DOMBRUCH ET AL

3,484,044

CUTTING TORCH NOZZLE AND METHOD

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Fig. 1.

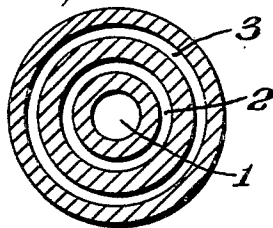


Fig. 2.

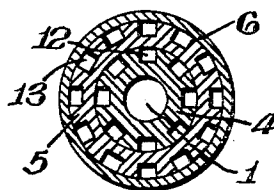


Fig. 3.

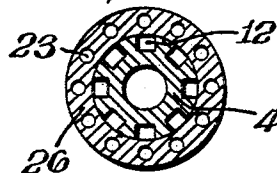
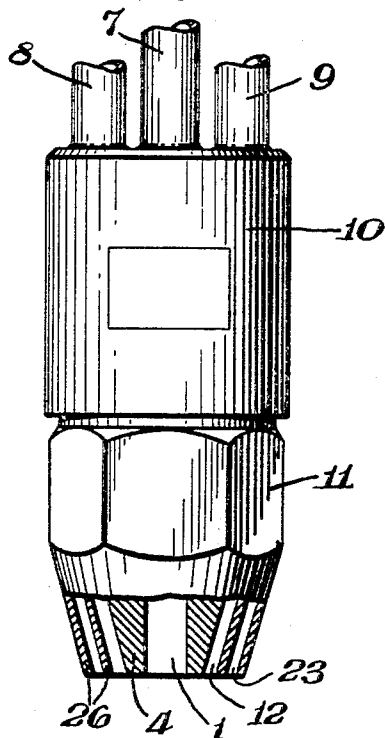


Fig. 4.



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CUTTING TORCH NOZZLE AND METHOD

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Continuation of application Ser. No. 389,859, Aug. 17, 1964. This application Mar. 31, 1967, Ser. No. 627,471
Claims priority, application Germany, Aug. 17, 1963, K 50,559

The portion of the term of the patent subsequent to Jan. 23, 1985, has been disclaimed

Int. Cl. F23d 15/00, 21/00

U.S. Cl. 239—8

8 Claims

ABSTRACT OF THE DISCLOSURE

A cutting torch nozzle includes a central stream of cutting oxygen, an intermediate annular stream of fuel gas surrounding the cutting oxygen, and an outer annular stream of additional oxygen surrounding the fuel gas. The fuel gas mixes externally with the oxygen supplied from both the central cutting stream and the outer additional stream. The outer stream also acts as a shield for the fuel gas to assure its complete combustion and minimize mixture with the air which would result in undesired carbon deposits or soot.

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of copending application Ser. No. 389, 859, filed Aug. 17, 1964, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a nozzle for a metal cutting torch, and more particularly to such a cutting torch which externally mixes oxygen with its fuel.

In cutting and flame torches it is often customary to use an oxygen stream and post-mixed preheating flames, that is flames formed by the combustion fuel gas and oxidizing gas mixed externally of the nozzle, in order to avoid the formation of an inflammable gas mixture within the torch, and hence undesirable reactions in the torch such as backfiring. Some torches do not add a special heating oxygen stream to the fuel but instead construct the nozzle head in such a manner that the fuel obtains the oxygen necessary for orderly combustion, from the actual cutting or flame oxygen stream. This is achieved in a simple manner in that the fuel as well as the cutting or flame oxygen stream openings are situated so close to each other that the flames are formed immediately at the edge area of the oxygen stream.

The use of this principle of outside mixture has very good results in working with an oxygen stream having slight exhaust speed, as is often used in flame torches for instance, particularly in the use of acetylene or gases burning slower than acetylene, such as coal gas, propane, or the like. There are difficulties, however, in cases where a high heat tolerance and heat concentration and where a sufficient combustion of the gas is not too great a distance from the work piece, are required with the oxygen streams having high velocity as is the case, for example, in torch cutting.

An object of this invention is to provide a nozzle for effectively mixing fuel with oxygen streams outside a metal cutting torch.

SUMMARY OF THE INVENTION

In accordance with this invention a constantly satisfactory flame formation is achieved, irrespective of the

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fuel used, in cutting torches by means of a nozzle having one or more further oxygen exhaust openings closely arranged to the fuel exhaust openings with correspondingly the fuel exhaust openings surrounding the central cutting oxygen passage. In other words the fuel is concentrically arranged between two streams of oxygen. Thus correlation is brought about in that the areas of the emerging fuel gases which are diverted from the central cutting oxygen stream also come in contact with the additional oxygen stream to thereby achieve by a double outer mixture a satisfactory intermixture fuel gas and oxygen.

Stated in another manner the intermediate fuel stream mixes with oxygen from the central cutting stream as well as with oxygen from the outer annular stream. The outer stream of oxygen has the added function of shielding the fuel from the air which assures a complete combustion or mixing of the fuel while preventing the formation of carbon deposits or soot. For example arrangements which contain outer streams of fuel gas or of premixed gases (such as disclosed in U.S. Patents 2,407,972 and 2,243,184) permit a mixture of the air and fuel gas. Since air contains over 70% nitrogen and other inert gases there is an incomplete combustion in that the fuel gas is not fully oxidized. This in turn results in carbon formations or soot on the workpiece which increases the strength of the workpiece rendering it more difficult to cut or work with at some subsequent time. Additionally the type of cut achieved with such prior devices would be "wavy" and of varying thickness or non-uniform due to the instable fluttering of the pre-heat mixture. With the shielded fuel stream of this invention there is complete combustion which enables a smooth, sharp, uniform, narrow cut to be obtained from the more concentrated cutting stream.

In one form of this invention the nozzle top for the cutting torch is constructed by providing the additional oxygen exhaust openings concentrically around the round fuel gas exhaust slot or the ring of individual openings for fuel gas exhaust, either in the form of an annular passage or a number of individual passages of any diameter desired. When the fuel gas exhaust is made up of a ring of individual openings or passages, the additional oxygen exhaust openings may be arranged in the ring area of the fuel gas openings in an alternating manner. In other words all of the additional oxygen exhaust openings are not radially aligned with the fuel openings. In all of these arrangements of the additional oxygen exhaust openings and the fuel gas opening there results in an especially effective manner a double outer mixture, irrespective of the central cutting oxygen passageway.

This double outer mixture may also be accomplished by constructing the nozzle tip for the cutting torch with the additional oxygen exhaust openings concentrically surrounding the round fuel gas exhaust slot or the ring of individual openings for the fuel gas exhaust, either in the form of an annular opening or a number of individual openings of any cross section desired.

Other objects and many attendant advantages of this invention will be readily appreciated as the same become better understood by reference to the following detailed description when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWING

FIGS. 1-3 are cross-sectional views of three embodiments of this invention; and

FIG. 4 is a side view partially broken away and in section of the nozzle shown in FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 4 shows the general arrangement of a cutting torch head 10 incorporating one of the nozzles 1 of this

invention. As shown in FIG. 4 cutting oxygen is supplied through conduit 7 into central bore 1 of torch head 10 and nozzle 11. Conduit 8 conducts the gaseous fuel through a number of apertures or spaced coarcuate passageways 12 which are concentric with central oxygen cutting passageway 1. Additional oxygen is supplied through conduit 9 into spaced passages 23 in jacket 26 concentrically arranged about passages 12.

FIG. 1 shows one form of a nozzle where there are arranged around the central cutting oxygen bore or passage 1, an annular or ring-like passage or slot 2 for fuel gas in place of individual passages. Surrounding passage 2 is another annular channel 3 for supplying the additional heating oxygen.

The nozzle tip represented in FIG. 2 is constructed in two parts. The actual cutting nozzle 4, which contains the central cutting oxygen bore 1, is provided with slots or grooves 12 on its outer surface. Heating cap 5 is secured to and surrounds nozzle 4 to thus transform slots or grooves 12 into closed canals or passages for the fuel gas. Cap 5 also has a plurality of grooves or slots 13 on its outer surface which, in turn become canals or passages for the additional oxygen when jacket 6 is screwed on or otherwise secured on or otherwise secured to cap 5.

FIG. 3 is a cross-sectional view of the nozzle 11 shown in FIG. 4 and includes a sleeve 26 surrounding cutting nozzle 4 which contains central oxygen passage 1. Nozzle 4 is provided with spaced longitudinal grooves 12 which form fuel passages when jacket 26 is secured to nozzle 4. Sleeve or jacket 26 has a series of spaced longitudinal passages 23 which conduct the additional oxygen. In this arrangement the need for a special heating cap such as cap 5 of FIG. 2, is eliminated.

By means of the nozzles shown, there is achieved in an especially advantageous manner a double outer mixture of the fuel gas. The pure fuel gas, leaving slot or annular passage 2 or canals 12, obtains its heating oxygen in the usual manner from the edge area of the central cutting oxygen stream, which streams through bore 1. Additionally, however, for the obtainment of a sufficient mixture, there is mixed to the fuel gas additional oxygen which passes through annular passageway 3, or canals 13, or bores 23. This additional oxygen not only provides an added supply of oxygen to the fuel but also shields the fuel from the surrounding air.

The invention can be effected in various ways and is not limited to the examples shown. Thus, the arrangement and diameter size of the exhaust canals or passages for the actual cutting oxygen, fuel gas, as well as additional oxygen are entirely arbitrary and depend on the requirements and circumstances of a particular case. For example, the exhaust openings for the additional oxygen can be installed in the same exhaust ring or annular member as the fuel gas, particularly in such a manner that the gas and oxygen exhaust openings are alternatively arranged. For example as shown in FIGS. 2-3 all of the additional oxygen passageways 13 or 23 are not radially aligned with fuel passageways 12. In all cases it is also essential that the nozzle tip—next to the cutting oxygen exhaust—is at a suitable place, or in the corresponding area of the further oxygen exhaust openings, to enable a double outer mixture of the fuel gas.

Similarly, the principle of the double outer mixture can be used for torches of other types and nature, e.g. for flame torches or the like. This concept can thus be used in cases where any other cross-section forms for the gas and oxygen exhaust are present, such as elongated exhaust slots for the oxygen with heating gas exhaust openings in the form of bores or slots mounted above and/or below the oxygen exhaust openings.

The nozzle of this invention which enables such double outer mixture is not only of importance in the use of gases with more slight exhaust velocity as acetylene; but

also in the use of acetylene, since despite its comparatively high oxidation velocity there results in the outer zone of the flame opening, and incomplete oxidation which forms undesired carbon deposits or soot on the workpiece. This soot has a detrimental affect on the strength of the workpiece. This carbon deposit is avoided, however, in the use of an outer oxygen sheet around the acetylene, and there occurs, furthermore, because of the additional oxygen an intensive burning and thus makes a better utilization (i.e. complete combustion) of the acetylene. The nozzle of this invention is, of course, not limited to a particular type of fuel gas.

Finally, by means of correspondingly logical arrangement of the further fuel gas, and oxygen exhaust openings adjacent thereto, the double outer mixture can be extended to a multiple outer mixture, as it is considered for example in preheating torches with large effective surfaces.

What is claimed is:

1. A nozzle for a torch operated by the external mixing of its gases comprising a central cutting oxygen stream outlet, a plurality of gas passageways concentrically arranged about said central outlet for conducting a corresponding number of unmixed gases from the torch, said outlet and said passageways being coterminous whereby internal mixing is avoided, said central outlet having a feed end and a discharge end, means connected to said feed end for feeding cutting oxygen gas through said outlet, said plurality of passageways comprising a pair of passageways, one of said passageways being an intermediate passageway concentrically arranged between one of the said passageways and said central outlet, the other of said passageways being an outer passageway, means connected to the feed end of said intermediate passageway for feeding fuel gas therethrough, and means connected to the feed end of said outer passageway for feeding additional oxygen therethrough.

2. A nozzle as set forth in claim 1 wherein said intermediate passageway is a continuous annular passageway.

3. A nozzle as set forth in claim 1 wherein said outer additional oxygen passageway is a continuous annular passageway.

4. A nozzle as set forth in claim 1 wherein said cutting oxygen outlet is a bore in a central member, a plurality of longitudinal grooves being in the external surface of said central member, a sleeve fitting over said central member to form a top wall for said grooves, and said plurality of grooves being said intermediate passageway for said fuel gas.

5. A nozzle as set forth in claim 4 wherein a second plurality of grooves are in the external surface of said sleeve, an outer member fitting over said sleeve to form a top wall for said second plurality of grooves, and said second plurality of grooves being said outer passageway for additional oxygen.

6. A nozzle as set forth in claim 1 wherein said intermediate fuel passageway is a set of spaced coarcuate passageways, said outer additional oxygen passageway being a set of spaced coarcuate passageways, and at least some of said additional oxygen passageways being radially non-aligned with corresponding fuel passageways.

7. In a process for externally mixing gases from a torch nozzle comprising supplying a cutting stream of oxygen through a central outlet in the nozzle, supplying an intermediate annular stream of pure fuel gas through a passageway around said central outlet, supplying an outer annular stream of additional oxygen through a passageway around said fuel gas passageway, mixing said fuel gas externally of said nozzle with oxygen from both said central stream and said outer stream, and shielding said fuel gas from the atmosphere by said outer stream of additional oxygen.

8. In a process as set forth in claim 7 wherein only unmixed gases are emitted from said nozzle.

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