Aug. 7, 1928. 1,679,586

G. C. QUELCH

TIP FOR CUTTING TORCHES

Filed Dec. 21, 1926

Fig. 1.

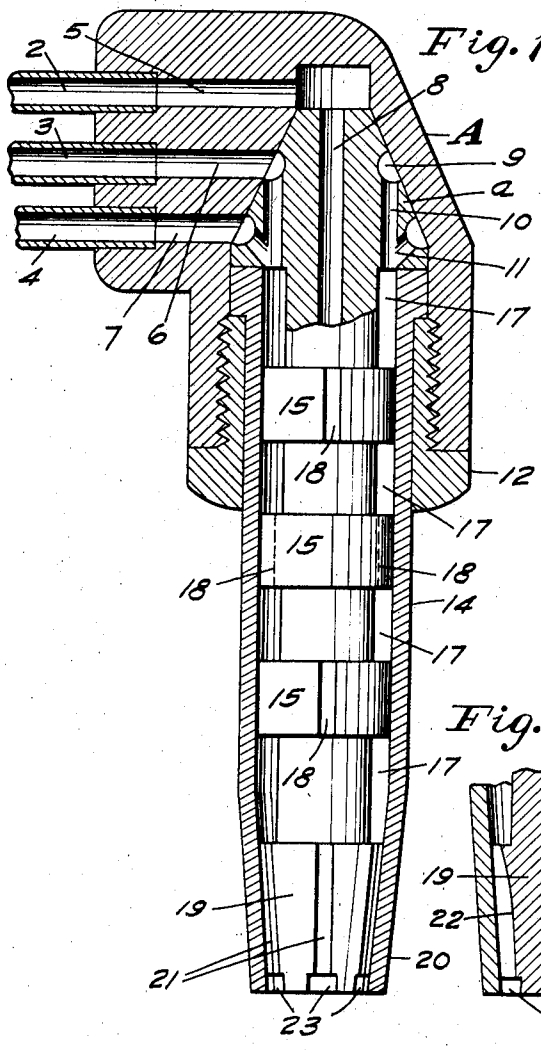


Fig. 2.

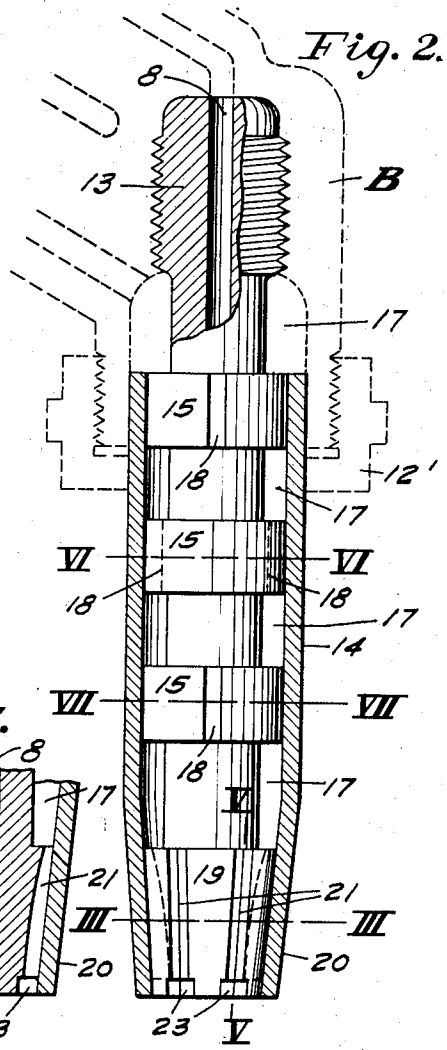


Fig. 5.

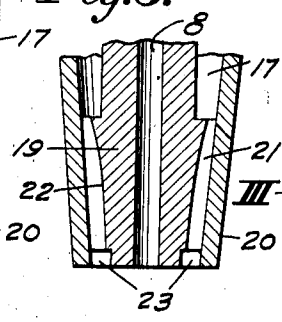


Fig. 3.

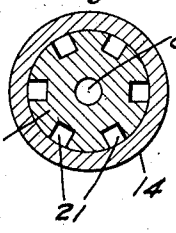


Fig. 4.

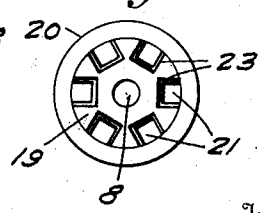


Fig. 6.

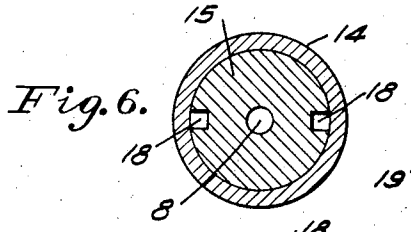
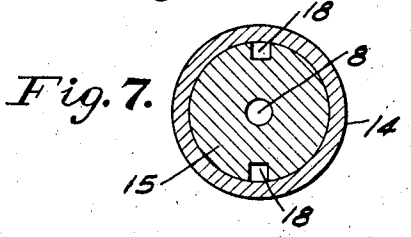


Fig. 7.



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Patented Aug. 7, 1928. 1,679,586

UNITED STATES PATENT OFFICE.

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TIP FOR CUTTING TORCHES.

Application filed December 21, 1926. Serial No. 156,210.

My invention refers to an improvement in the class of cutting tips for torches for the cutting of ferrous metals.

In such torches, which are now in large and common use, a preheating flame of high temperature is first directed against the metal to be cut, and, when the combustible temperature of the metal is reached, a jet of pure oxygen under pressure is directed against the heated portion, with a corresponding cessation of the preheating flame.

Combustion of the metal, under the oxygen jet, then occurs, reducing the metal to magnetic oxide of iron, the pressure jet of oxygen forcing the oxide through and away from the narrow kerf made in the metal as the cutting action proceeds along a given line.

In torches of this general class, the device is usually provided with three supply pipes or conduits, leading to the terminal head embodying the tip, providing for the supply of high pressure oxygen for cutting, low pressure oxygen, and a combustible gas for burning therewith for preheating.

In general practice, there are two main classes or types of tips utilized; first, where the combustible mixture of oxygen and fuel gas, for preheating, is formed or combined within the torch proper or within its head; second, where the combustible mixture is formed between balanced gases, or by proper relation of the conducting orifices, or by injector action within the torch tip itself, mounted in the surrounding head.

There are also variations in the terminal construction of the tip, which may be either plane across the delivery end with all of the jet openings emerging on the same plane, or with the tip of the jet recessed, providing a forwardly extending tubular shell for protection of the preheating flame.

The plain end tips are ordinarily used for fuel gases having a kindling or igniting point below 600° C., such as hydrogen, igniting with an igniting point of 580° C., or acetylene at 480° C.

The recessed tips are ordinarily used for fuel gases having a kindling or igniting point above 600° C., as in the case of hydrocarbon gases, which liquefy within a container at or below the pressures usually considered standard for low or high pressure containers.

In the use of such gases for metal cutting with torches of the class involved, it has been necessary, and the practice is common in the industry, to use a tip designated as a recessed or cup tip.

The object of my present invention is to provide a cutting torch tip for the purpose of securing a more stable preheating flame with a gaseous mixture of high kindling or igniting point, as above 600° C.

Also, to provide a cutting torch tip for use with natural gas or other gases of similar high kindling quality adapted for use, with oxygen, in cutting and like operations.

One of the objects accomplished by the construction shown is to provide for an alternating path for gas circulation, or for gas and a small oxygen content, through an alternating course, with channels and mixing cavities so arranged as to effect a complete and thorough mixture of the gaseous body, in such alternating or tortuous path.

Also, to provide beyond such zone of uniform density, contracted outlet ports which are then enlarged to increase the area of the outlet ports for expansion of the gases before emission; and enlarged final emission areas at the tip terminal, surrounding the main oxygen supply port, and on the same transverse plane therewith.

By the construction involved, I effect a desirable uniformity of density of the gaseous mixture, at the point of combustion. I also avoid the necessity of recessing the tip or its casing, thereby preventing burning, and lengthening its available time of use.

These objects are secured by providing the individual preheating gas delivery passages, with alternating or intervening communicating admixture pockets and final terminal delivery channels adapted to conduct the gaseous mixture under uniform pressure and with such accelerated terminal delivery. In the construction shown, these features are embodied in both of the main classes of tips above identified, and as hereinafter more fully described.

In the accompanying drawings, showing certain preferred embodiments of the invention:

Fig. 1 is a sectional view of the head of a

cutting torch, of the first class, provided with one form of my improved tip;

Fig. 2 is a similar sectional view of another construction of tip and its mounting, of the second class, partly in elevation;

Fig. 3 is a cross-section on the line III—III of Fig. 2;

Fig. 4 is an end view of the tip of Fig. 2;

Fig. 5 is a partial longitudinal sectional view on the line V—V of Fig. 2;

Fig. 6 is a cross-section on the line VI—VI of Fig. 2; and

Fig. 7 is a similar view on the line VII—VII of Fig. 2.

Referring to the drawings, A is the head of a standard torch having the usual high pressure oxygen pipe 2, a low pressure oxygen pipe 3, and a gas supply pipe 4 communicating with the several corresponding passages 5, 6 and 7.

As is generally understood in the art, the preheating mixture is effected by mixing the low pressure oxygen from port 6 with the preheating gas, as acetylene, hydrocarbon, etc., of passage 7.

The jet member of the present invention, for such construction, is adapted to be mounted in head A in connection with its integral inner distributing head or member *a*, of well known construction, and usually forming a portion of the entire tip member. Such section *a* is provided with the central high pressure oxygen passage 8, communicating with passage 5.

Low pressure oxygen port 6 and gas port 7 communicate by annular channels 9 with branched ports 10 and 11, leading to common exit openings. Socket member *a* forms the inner end of my improved tip member.

Such tip, with either construction of distributing head, is generally of the same form as similar tips, having a central opening from one end to the other for the passage and terminal emission of the high pressure oxygen supply, with outer terminal surrounding emission jets for the preheating gas.

In the form shown in both cases, Figs. 1 and 2, such tip is enclosed within an outer surrounding shell or enclosing tube 14 fixedly held in contact with the confronting flange of member *a* by a threaded fitting 12. Otherwise, as in Fig. 2, the tip is provided with a terminal threaded inner end 13, for insertion within the head B.

Shell 14 in such case is co-operatively mounted with any suitable similar fitting 12'.

With either construction, I provide a series of annular abutments 15, with alternating reduced connecting neck portions 16 of the tip member, providing annular mixing chambers 17, between the several abutments. The abutments 15 are provided with longitudinal circulating ports 18, said ports preferably alternating in longitudinal arrangement, as shown, whereby to provide a tortuous progressive path for the combustion mixture from its introduction into the initial annular mixing space 17, to the final emission terminal portion. Any suitable number of such abutments and intervening admixture chambers may be provided, dependent on the conditions, kind of gas used, etc.

The outer end of the tip is tapered, as at 19, for interfitting connection within the outer tapered portion 20 of shell 14. Such tapered portion of the tip is longitudinally grooved as at 21. Any suitable number of such grooves may be provided, preferably six, equally spaced around the central oxygen outlet opening 8, providing an enveloping or surrounding sheath of preliminary heating gas.

Each of such channels 20 is enlarged at its middle portion, as by a milling cutter or other suitable tool, so as to increase the depth of the groove, as indicated at 22. The cross sectional area of the groove is maintained uniform from such deeper portion toward the end, however, whereby to provide open unrestricted delivery ports for the gas with decreased velocity, as it nears the exit opening.

The ends of the channels 20 are finally materially enlarged, as indicated at 23, as by an end milling cutter or drill, adapted to enlarge the cross sectional emission opening for the combustion mixture. Any suitable formation may be utilized, as by flaring the walls of the channels 21, so as to deliver the combustible mixture outwardly at further decreased velocity through the end of the tip on the same transverse plane as the high pressure oxygen hole 8.

The shell 14 fits tightly around the circular exterior of the tip, as in Figs. 1 and 2, making close contact with the several enlarged abutment portions 15, and with the tapered terminal 19, thereby providing closed interior passageways for the gas.

The purpose of interposing the several abutments 15 between the alternating annular spaces 17, and especially with the offset or non-registering channels 18 through the abutments, is to provide for thorough admixture of the gaseous mixture, and to promote and ensure a common and continuous degree of density throughout, with uniform pressure, from one end of the tip toward the outlet end.

At such outlet end the volume of gaseous mixture in the final chamber 17 passes outwardly through channels 21, with such uniform pressure, in passing therefrom into the laterally enlarged emission apertures 23. There is, as a result, an ample supply of gaseous mixture, with no tendency for the flame to blow away from the end of the tip when a given quantity of gases are passing through the preheating holes, as would be

the case if the passages 21 were continued uniform through to the end, as is the common practice.

I am, therefore, able to deliver the preheating gases through the end of the tip on the same plane as the emission jet of the high pressure cutting oxygen, without the necessity of any shrouding or protecting tubular extension beyond the passage terminals. As a result, there is no tendency for the preheating flame to be disturbed when the cutting jet of oxygen is operating, as is the case when such recessed tip is used.

My experiments with hydrocarbon gases, and particularly natural gas, having a high kindling or igniting temperature, have shown that with a cutting equipment designed for gases of low kindling point, a flame cannot be held at the end of a plain tip, unless the flame were highly oxidized. Such over-oxidation is objectionable because it materially reduces the flame temperature.

When a hydrocarbon gas is mixed with a proper proportion of oxygen, to secure maximum flame temperature, the flame will not burn continuously at the end of the tip, unless the volume is decreased to a fraction of the volume for which a given size tip was designed. Such decrease of volume is effected by lowering of pressure, so that a hydrocarbon gas of high ignition point will burn at the end of the tip if the pressure or velocity of the mixture at the point where the gases leave the tip, is thus lowered.

It is well understood that it is necessary to burn a comparatively large volume of combustible gas mixture in a small area in order to raise the temperature of the metal locally to the combustion point in the shortest possible time. The lowering of pressure at the end of the tip when effected only by a lowering in volume necessarily decreases the capacity of a given size tip, with a consequent increase in preheating time.

In my invention I secure the desired lowering in pressure, without any decrease in volume of the hydrocarbon fuel gas mixed with the proper proportion of oxygen, and secure the maximum flame temperature obtainable. This result is directly due to the preliminary complete admixture of the combustible gas elements in the alternating channels, and to the zonal enlargement of the individual jet passages themselves, and the final enlarged discharge orifices for a short distance backwardly of the tip terminal, in either of the constructions shown, and as above described.

It will be understood, of course, that the number and arrangement of the surrounding mixture passages may be changed or varied within the judgment of the designer or skilled mechanic, and with regard to the kind of work to be performed and the gaseous mixture employed. I, therefore, do not desire to be limited to the particular construction shown, but to include such variations within the scope of the following claims.

What I claim is:

1. In a cutting torch, the combination with an enclosing shell having a central high pressure oxygen supply port and laterally arranged low pressure oxygen and gas supply ports respectively, and an enclosing shell connected with said head, of a cutting tip having a central oxygen conduit communicating with the central port and an inner reduced neck providing an annular chamber with ports leading therefrom to the laterally arranged low pressure oxygen and gas supply ports, a plurality of annular abutments and reduced neck portions alternately located beyond said annular chamber, each of said abutments having a pair of oppositely located longitudinal ports arranged alternatingly between similar ports of an adjacent abutment, with a final terminal abutment within the endmost portion of the casing having an annular series of final delivery channels leading from the endmost annular chamber to the end of the cutting tip, said delivery channels being outwardly enlarged towards their middle portion without subsequent diminution and having further enlarged outlet terminals ending on the plane of the end of the shell.

2. A cutting tip of the class described having a central oxygen conduit adapted to communicate with a central supply port, a tapering head having ports adapted to communicate with low pressure oxygen and gas supply conduits respectively, and having an annular reduced neck portion beyond the tapering head, a plurality of annular abutments and reduced neck portions alternately located beyond said annular chamber, each of said abutments having a pair of oppositely located longitudinal ports arranged alternatingly between similar ports of an adjacent abutment, with a final terminal tapered abutment having an annular series of final delivery channels leading from the endmost annular chamber to the end of the cutting tip, said delivery channels being outwardly enlarged towards their middle portion without subsequent diminution and having further enlarged outlet terminals ending on the plane of the end of the tip.

In testimony whereof I hereunto affix my signature.

GEORGE C. QUELCH.