Aug. 21, 1934. G. L. WALKER 1,971,287

TORCH TIP

Filed Oct. 2, 1930

Fig.1.

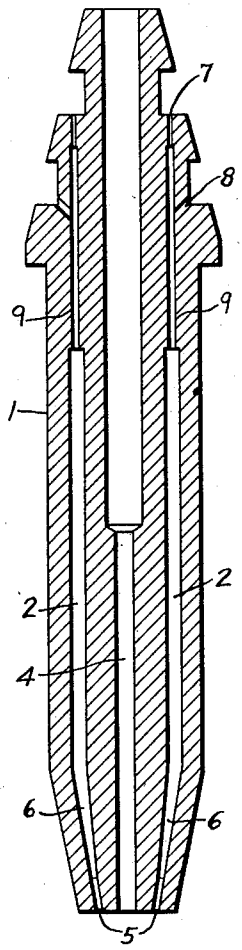


Fig.3.

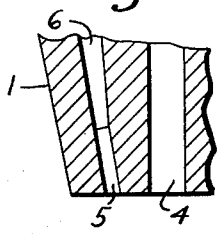
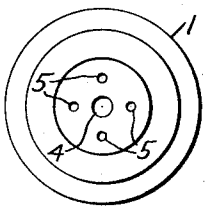


Fig.2.



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1,971,287

TORCH TIP

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Application October 2, 1930, Serial No. 485,971

8 Claims. (Cl. 158—27.4)

This invention relates to one-piece cutting tips having, in each, a plurality of preheating gas passages grouped about a central cutting oxygen passage. The object of the invention is to provide cutting tips which are superior in general performance and with which the preheat, before starting a cut, is very quick. More specific objects are to secure high exit velocity through the preheating flame orifices, with comparatively low operating pressures, and still to maintain stable flames, to obtain higher flows of preheating mixture through a given orifice at given pressure, to cause the preheating flames to be long and pointed rather than short and bulbous, to concentrate the preheating of the metal by the numerous flames, and to overcome a tendency of a powerful cutting jet, when turned on, to extinguish the flames by entrainment.

In a specific aspect, the invention comprises an improvement in cutting tips in which the gases for the preheating flames are admitted to separate large passages or chambers in the tip through relatively small inlets in the rear portion of the tip. The particular tip herein illustrated and constituting the preferred and complete embodiment of the invention is of the type in which the mixture of fuel gas and oxygen is formed in the tip, and in which the several mixing and preheating provisions, which cooperate with the cutting jet, are separate from each other. It is an object of the invention to secure the advantages of a one-piece construction as well as functional advantages, some of which have been indicated, and a further object is to provide a tip which is susceptible of being manufactured economically.

In tips of this nature, the passages for conducting and delivering the preheating mixture have been small bores of the same diameter as the flame orifices, these bores receiving the two gases through restricted inlet or metering ports at the rear end of the tip and extending from the port region uninterruptedly to the orifice face at the front end of the tip. The production of such preheating passages was difficult and expensive, particularly in the tips of lower powers requiring the smaller flame orifices, and in the use of the tips mixing was imperfect and the preheating flames tended to be short and bulbous, with attendant disadvantages. In order to secure better results, or to avoid manufacturing difficulties, various multiple-piece tip constructions have been used, but the joints in such tips often leak and make the tips unserviceable. Integral tips are much to be desired, but heretofore integral cutting tips, which mix the preheating gases in the tip, have not been capable of delivering preheating flames of the best characteristics.

A tip embodying the present invention is a one-piece article and has, in addition to the central cutting jet passage, a plurality of mixing passages, enlarged with respect to the flame orifices and provided at the rear end with restricted ports for admitting the respective gases, so that the two preheating gases enter the tip separately through small openings, commingle and complete their mixing in large passages, and issue through relatively small orifices. As the result of this, the character of the flames is markedly improved. Furthermore, the flame orifices are made with straight or parallel walls of substantial length, and the cross-sections of the streams are gradually reduced from the areas of the large mixing chambers to the areas of the orifices by the provision of tapered approach passages. Each of these features contributes to the improvement of the flames, and the entire combination gives very excellent results.

In the previously known one-piece, internal-mixing tips, the one-diameter mixing and flame orifice passages have been straight, either parallel with the cutting jet passage or else inclined throughout their length. In the tip of the present invention the preheating passages contain a bend toward the front, that is to say the flame orifices, and also the tapered approach passages, are inclined inward from the major portions of the mixing passages. This, also, is beneficial.

It will be understood that the invention is not limited to cutting tips which mix the preheating oxygen and fuel for the first time in the tip itself. There is another well-known type of tip which receives a mixture of oxygen and fuel gas which has been formed by a mixer in the body or handle of the torch. The invention includes a beneficial combination which is applicable generally to one-piece cutting tips which deliver numerous preheating flames grouped about a central cutting jet. This combination comprises the large preheating mixture passages or chambers which reduce resistance to the flow of the gases, give large gas flows, permit relatively low operating pressures to be used, insure more thorough mixing, and thereby permit lower oxygen to fuel ratios to be used and increase the thermal efficiency, the small parallel-walled exit orifices of substantial length, the tapered approach passages, which reduce the restrictive effect and cooperate with the reduced parallel-walled exit orifices in forming

the advantageous long, pointed, high-velocity preheating flames, and the inward convergence of the tapered approach passages and the exit orifices at an inclination from the axes of the large preheating mixture chambers. This last concentrates the preheat of the long, pointed, high-velocity flames so that the preheating time, before cutting is begun, is very brief. With such convergence the concentration of preheat is secured without having the outlet ends of the flame orifices so close to the cutting jet orifice that the oxygen stream would be able to pull the flames away from the tip. It is known to incline preheating passages throughout the length of a tip, but in such a case, unless the tip is unduly short or becomes very broad at the rear end, requiring a large torch head, convergence can not be as satisfactory as it is in tips embodying this invention, in which the chambers are approximately parallel with the cutting oxygen passage, or slightly inclined, and the tapered approach passages and the parallel-walled exit orifices incline inward at an angular relation to the length of the chambers.

In the accompanying drawing, forming part hereof:

Fig. 1 is a longitudinal section through a cutting tip embodying the invention;

Fig. 2 is an end view thereof; and

Fig. 3 is a fragmentary section, showing a flame jet orifice and its tapered approach passage on a larger scale.

The tip 1 has a suitable rear end for seating in a torch head. 4 is a cutting oxygen passage drilled through the tip and preferably counterbored. One or more drilled passages 2 of comparatively large size constitute the mixing chambers for the preheating jets, these chambers having metering ports 7 and 8 at the rear end for admission of oxygen and a fuel gas respectively.

Each passage for combustible mixture terminates in a reduced, parallel-walled exit orifice 5. The length of this orifice should be greater than the diameter, and the ratio may range from two to one to eight to one, or even greater, depending to some extent on the nature of the fuel gas that is to be used and the precise form of flame that is desired. A ratio of about four to one is satisfactory for most purposes.

The exit orifice does not immediately adjoin the mixing chamber, however, but the gases are led to it through a long, gently tapering approach passage 6. The orifice passages 5 and the approach passages 6 are inclined inward relatively to the passages 2, so that flame convergence is pronounced, ample metal is left between the passages 2 and 4, and the tip is kept narrow and may be of any length desired.

In tips of this construction the oxygen and fuel gas coming through the ports 7 and 8 at high velocity are admitted to the relatively large chamber 2, where there is an intimate commingling of the component gases and a reduction in velocity. After traversing the long chamber, the gases again have their velocity gradually increased as they enter and pass through the approach passages 6, and issue from the tip at relatively high velocity. This is desirable in that it tends to prevent flashbacks and also gives a longer flame, which is beneficial for many classes of cutting. The advantage of obtaining a more thorough mixing of the gases in the enlarged chamber is to reduce the ratio of oxygen to fuel gas, since better combustion is obtained with the more intimate mixture and a less amount of oxygen is required for the complete combustion of the acetylene.

The tip is preferably made by swaging the forward end of the tip with mandrels in the outlet parts of the mixed gas passages, as described in my copending application Serial No. 485,972, filed October 2, 1930.

The mixing chamber passages 2 may be drilled full width back to the metering ports 7, but for most purposes it is preferable to make the rear portions 9 of these passages with drills of smaller size than the drills used for the enlarged chambers 2, such narrower rear portions extending for a distance in front of the metering ports 8. These reduced throats 9 have a useful function, more particularly in the tips of larger powers, having relatively large preheating orifices and large flows. They cause a relatively high velocity in the gases at and beyond the inlet ports and aid in preventing flashbacks.

The long or pointed preheating flames obtainable with tips of this invention have numerous advantages. Short and bulbous preheating flames, such as have characterized former one-piece, internal-mixing cutting tips, often cause the tips to overheat, especially when they are operated at low gas flows or have a considerable number of preheating flames. Furthermore, those tips have to be held so close to the work to start the cutting that a clear view of the operation can not be had. With long or pointed flames the region of highest flame temperature is farther away from the tip, the flames are more separated, there is materially less radiation of heat back to the tip, the tip can be kept at a greater distance from the work, and there is more visibility. These flames effect a much quicker preheat. Tips such as disclosed herein may have smaller preheating orifices than the former tips, the flame velocity may be greater, and a larger number of preheating orifices may be provided, securing increased efficiency for the preheating and cutting. The gas flows may be increased, when desirable, greatly beyond that permissible in former practice. On the other hand, the gas flows may be reduced much below that practice. Thus, the flows can be increased from two to four times the gas flows for ordinary preheating passages, or they can be decreased to about one-half the flows suitable in former tips, and still give stable, efficient preheating flames without excessive overheating. In general, a tip embodying my invention has the advantage of being able to cover a range of work that would ordinarily require several types of tips giving various amounts of preheat. At any flow, the flame velocity is greater than for ordinary tips operating at the same gas flows.

I claim:

1. A cutting tip having a cutting oxygen passage and a group of separate mixing and preheating means, said tip consisting of a single piece in the rear portion of which there are small inlet ports controlling the admission of oxygen and fuel gas, respectively, to the several preheating means, the preheating means terminating in relatively small flame orifices at the forward end of the tip and including individual enlarged mixing chamber passages extending lengthwise in the tip between the reduced flame orifices and the inlet ports.

2. A cutting tip having a cutting oxygen passage and a group of separate mixing and preheating means, said tip consisting of a single piece in the rear portion of which there are small inlet ports controlling the admission of oxygen and fuel

gas, respectively, to the several preheating means, the preheating means terminating in relatively small flame orifices at the forward end of the tip and including individual enlarged mixing chamber passages extending lengthwise in the tip between the reduced flame orifices and the inlet ports, the preheating means also including tapering approach passages through which the gases are conducted from the mixing chambers to the flame orifices.

3. A cutting tip having a cutting oxygen passage and a group of separate mixing and preheating means, said tip consisting of a single piece in the rear portion of which there are small inlet ports controlling the admission of oxygen and fuel gas, respectively, to the several preheating means, the preheating means including parallel-walled flame orifices at the forward end of the tip, and enlarged mixing chamber passages extending lengthwise between the relatively reduced flame orifices and the inlet ports.

4. A cutting tip having a cutting oxygen passage and a group of separate mixing and preheating means, said tip consisting of a single piece in the rear portion of which there are small inlet ports controlling the admission of oxygen and fuel gas, respectively, to the several preheating means, the preheating means including parallel-walled flame orifices at the forward end of the tip, enlarged mixing chamber passages extending lengthwise between the relatively reduced flame orifices and the inlet ports, and tapered approach passages connecting the mixing chambers with the parallel-walled orifices.

5. A cutting tip having a cutting oxygen passage and a group of separate mixing and preheating means, said tip consisting of a single piece in the rear portion of which there are small inlet ports controlling the admission of oxygen and fuel gas, respectively, to the several preheating means, the preheating means including parallel-walled flame orifices at the forward end of the tip, enlarged mixing chamber passages extending lengthwise between the relatively reduced flame orifices and the inlet ports, and tapered approach passages connecting the mixing chambers with the parallel-walled orifices, said flame orifices and approach passages being inwardly inclined with respect to the mixing passages and the cutting oxygen passage.

6. A cutting tip having a cutting oxygen passage and a plurality of separate mixing and preheating means, said tip consisting of a single piece in the rear portion of which there are small inlet ports controlling the admission of oxygen and fuel gas, respectively, to form the preheating mixtures, the preheating means terminating in relatively small flame orifices at the forward end of the tip and including individual enlarged mixing chamber passages extending lengthwise in the tip, together with reduced throat passages into which said ports open and which pass the commingling gases at relatively high velocity to the enlarged mixing chambers.

7. A cutting tip having a cutting oxygen passage and a plurality of separate mixing and preheating means, said tip consisting of a single piece in the rear portion of which there are small inlet ports controlling the admission of oxygen and fuel gas, respectively, to form the preheating mixtures, the preheating means including parallel-walled flame orifices at the forward end of the tip, enlarged mixing chamber passages, tapered approach passages connecting the mixing chambers with the parallel-walled orifices, and reduced throat passages into which said ports open and which pass the commingling gases at high velocity to the enlarged mixing chambers.

8. A one-piece cutting tip containing a cutting oxygen passage and a group of separate preheating means, said preheating means comprising large preheating mixture chambers extending lengthwise within the tip, restricted parallel-walled flame orifices of substantial length, and tapering approach passages each of which merges with a separate one of said mixture chambers and connects the same with a separate one of said orifices, said tapering approach passages and said parallel-walled flame orifices being inclined inward toward the axis of the cutting jet passage and in angular relation to the axes of the large preheating mixture chambers.

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