March 14, 1944. J. J. CROWE 2,343,958

CUTTING TIP WITH DIVERGING OUTLET

Filed Dec. 7, 1940

Fig. 1.

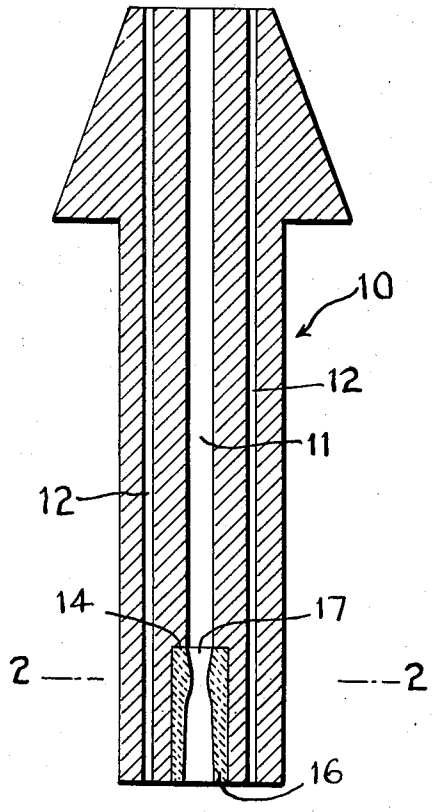


Fig. 5.

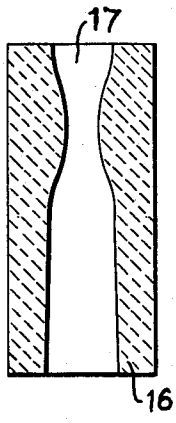


Fig. 2.

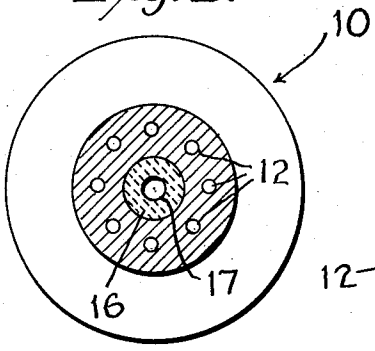


Fig. 3.

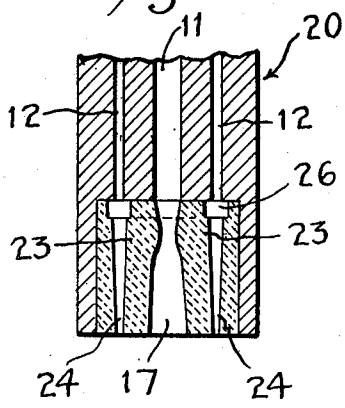
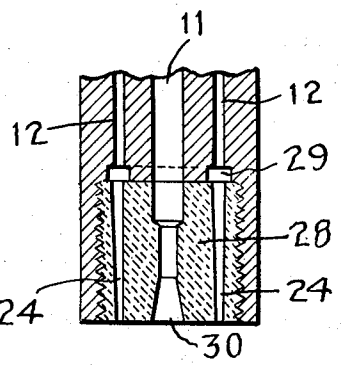


Fig. 4.



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CUTTING TIP WITH DIVERGING OUTLET

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2 Claims. (Cl. 158—27.4)

This invention relates to tips for oxygen cutting torches, and more particularly to improvements in the construction and methods of constructing such tips.

Improved cutting results are obtained with oxygen jets having velocities greater than the velocity of sound, provided that such jets can be prevented from expanding laterally after their discharge from the tip. A jet that remains cylindrical, or approximately so, can be obtained by using an oxygen passage diverging toward its outlet end with a change in cross-section that converts the gas pressure to gas velocity by the time the gas is discharged through the face of the tip.

By shaping the oxygen passage so that it decreases in cross-section to a constricted throat beyond which the passage diverges toward its outlet end with a given longitudinal curvature, the radius of which increases progressively toward the outlet end of the passage, the cutting results are not only improved, but the same tip can be used with a wide variety of oxygen pressures and the number of tips required for cutting the entire range of work thicknesses is greatly reduced. Because of the change in curvature, from convex at the throat to concave where the walls diverge beyond the throat, the passages cannot be drilled. They are made by rolling or drawing with suitable mandrels.

It is an object of this invention to provide an improved divergent tip construction in which the part of the tip containing the diverging jet passage is a different piece from the rest of the tip and preferably a molded piece inserted into a recess in the end face of the tip. The insert may be made of glass, or a ceramic material, or a powdered metal treated by a sintering process. Any desired curvature and variation in curvature can be economically obtained in molding.

Although the invention is particularly advantageous for the construction of cutting tips in which the diverging passage has a longitudinal curvature and a reverse in its curvature, it is not limited to such constructions and can be employed to advantage in making tips that have jet passages that vary in cross-section with a straight taper.

The invention can also be employed in the construction of tips having converging passages for the preheating jet passages. In its broadest aspects, therefore, it may be said to be an object of the invention to provide an improved composite tip structure, and method of making such a structure, in which one or more of the jet passages is of progressively changing cross-section along a portion of its length.

Other objects, features, and advantages of the invention will appear or be pointed out as the description proceeds.

In the accompanying drawing, forming a part hereof:

Fig. 1 is a vertical sectional view taken on a diametral plane through a cutting tip embodying this invention;

Fig. 2 is a sectional view on the line 2—2 of Fig. 1;

Figs. 3 and 4 are sectional views similar to the lower portion of Fig. 1, but showing modified forms of the invention; and

Fig. 5 is an enlarged view of the insert of Fig. 1.

In Fig. 1 a tip 10 has a body or body portion with drillings including a central jet passage 11 for the cutting oxygen, and a number of smaller jet passages 12 in a circle around the central jet passage for supplying gas for preheating flames. The upper end of the body portion has a conical seat of conventional construction.

The preheating jet passages 12 are cylindrical, that is, they are of uniform circular cross-section throughout their length. The cutting jet passage 11 is of uniform diameter down to a shoulder 14 that comprises the end of a cylindrical recess in the face of the tip body 10. A molded insert 16 fits the recess and is cemented into the body portion of the tip in the relation shown in Fig. 1, and forms a terminal portion of the tip.

The molded insert 16 has a central passage 17 that varies in cross-section with a fair curve and registers with the cutting oxygen passage 11 and forms the discharge end of the oxygen passage. The passage 17 has a diameter at its upper end substantially equal to the diameter of the passage 11. From its upper end the passage 17 decreases in diameter progressively to a throat, at the section line 2—2, and then increases in diameter to provide the diverging discharge that converts the gas pressure to velocity and prevents lateral expansion of the jet beyond the face of the tip.

The variation in diameter is not at a constant rate in the passage 17 shown in Fig. 1. With respect to the axis of the passage 17, the longitudinal curvature of the side wall is first concave, then convex at the throat region, and then concave with the radius of curvature increasing until the side wall has a substantially straight taper to the outlet end of the passage. The con-

cave section of the passage below the throat is a section of progressively decreasing angle of divergence.

Fig. 3 shows a modified form of the invention in which the insert or terminal portion is large enough to include the preheating jet passages. A tip body 20 has a central cutting oxygen passage 11 and a circle of preheating passages 12. The recess in the face of the tip body 20 is of considerably larger diameter than in the tip body 10 of Fig. 1, and a molded insert 23 is cemented into the recess and extends across the ends of the passages 12 where they open through the end wall of the recess.

The central passage 17 through the molded insert 23 is the same as the passage through the insert 16 of Fig. 1 and therefore designated by the same reference character. There is a circle of preheating jet passages 24 in the insert 23, and these passages 24 are at the same distance from the axis of the tip as are the passages 12. In order to avoid the necessity of having to register the passages 24 with their corresponding passages 12 in the body portion of the tip, an annular groove 26 is formed in the top side of the insert 23 in position to serve as a distributing chamber for gas to the passages 24 if they do not register with the passages 12.

It is advantageous for the preheating jet passages to have a slight inward taper toward their discharge ends, that is, to decrease in diameter toward the tip face. The passages 24 have such converging side walls, there being no difficulty in obtaining this convergence in a molded piece, though the taper is in the wrong direction to be made by reaming a metal tip through its face.

In Fig. 4 the recess in the face of the tip body portion is threaded and an insert 28 is threaded into the recess. Cement may be used in addition to the threads to retain the insert 28 in place. When the insert is threaded, an annular recess at the upper end of the preheating jet passages 24 is more important because the preheating jet passages 24 and 12 may not register when the insert 28 has turned into a tight position. Fig. 4 shows an annular groove 29 formed in the metal of the tip body instead of in the insert as in Fig. 3. Either construction can be used, though the annular groove formed in the top of the insert is the more economical expedient. The insert 28 has a central cutting oxygen passage 30 that differs from the passage 17 of Figs. 1–3 in that its changes in cross-section are obtained by tapered side walls that have no longitudinal curvature.

The inserts 16, 23, and 28 can be made of glass, ceramic material, such as porcelain, or a powdered metal. Although the use of molded inserts is a feature of the invention and a particularly advantageous feature because of the ease with which undrillable shapes can be obtained by molding, the invention is not limited to molded inserts. Even if the inserts or terminal portions of the tips of this invention are not molded, the fact that they are short pieces, separate from the tip body when constructed, makes less difficult the construction of special-shape passages.

Several embodiments of the invention have been illustrated, but changes and modifications can be made, and some features of the invention can be used without others. Terms of orientation are, of course, relative.

I claim:

1. A composite cutting tip comprising a body portion having a longitudinally-extending cylindrical passage through which cutting oxygen may pass and a plurality of smaller, longitudinally-extending passages around the cutting-oxygen passage through which oxygen for preheating flames may pass, a recess in the discharge end of the body portion extending coaxially with the cutting-oxygen passage, said recess terminating at a shoulder where the recess meets the cutting-oxygen passage, an insert secured within said recess and against said shoulder, said insert having a passage extending coaxially with the cutting-oxygen passage and forming a continuation thereof, the passage in the insert varying in cross-section with a fair curve and being restricted intermediate its ends to form a throat, the walls of the passage of the insert inwardly of the throat diverging and having their ends aligning substantially with the walls of the cutting-oxygen passage, and the walls of the passage of the insert outwardly of the throat diverging continuously to the outer end of the insert, the walls of the passage of the insert being inwardly convex at the throat and inwardly concave adjacent the throat at opposite sides thereof, whereby cutting-oxygen discharged from the end of the insert will not expand laterally substantially.

2. A composite cutting tip comprising a body portion having a longitudinally-extending cylindrical passage through which cutting-oxygen may pass, a recess in the discharge end of the body portion extending coaxially with the cutting-oxygen passage, said recess terminating at a shoulder where the recess meets the cutting-oxygen passage, an insert secured within said recess and against said shoulder, said insert having a passage extending coaxially with the cutting-oxygen passage and forming a continuation thereof, the passage in the insert varying in cross-section with a fair curve and being restricted intermediate its ends to form a throat, the walls of the passage of the insert inwardly of the throat diverging and having their ends aligning substantially with the walls of the cutting-oxygen passage, and the walls of the passage of the insert outwardly of the throat diverging continuously to the outer end of the insert, the walls of the passage of the insert being inwardly convex at the throat and inwardly concave adjacent the throat at opposite sides thereof, whereby cutting-oxygen discharged from the end of the insert will not expand laterally substantially.

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