

United States Patent [19]

Mosiashvili et al.

[11] 3,825,718

[45] July 23, 1974

[54] PLASMATRON

[76] Inventors: **Otari Yakovlevich Mosiashvili**, ulitsa Perovskoi, 15; **Robert Nikolaevich Suladze**, ulitsa Barnova, 112; **Ivan Isidorovich Navdarashvili**, ulitsa Imgvsky Tupik 14; **Mikhail Georgievich Devdariani**, 4 Barnova, 20, all of Tbilisi, U.S.S.R.

3,567,898 3/1971 Fein..... 219/121 P
3,575,568 4/1971 Tateno..... 219/75
3,641,308 2/1972 Couch, Jr. et al..... 219/121 P

Primary Examiner—J. V. Truhe
Assistant Examiner—G. R. Peterson
Attorney, Agent, or Firm—Eric H. Waters

[22] Filed: Dec. 8, 1971

[21] Appl. No.: 205,975

[52] U.S. Cl..... 219/121 P, 219/75

[51] Int. Cl..... B23k 9/00

[58] Field of Search..... 219/121 P, 74, 75, 76, 219/130, 137

[56] References Cited

UNITED STATES PATENTS

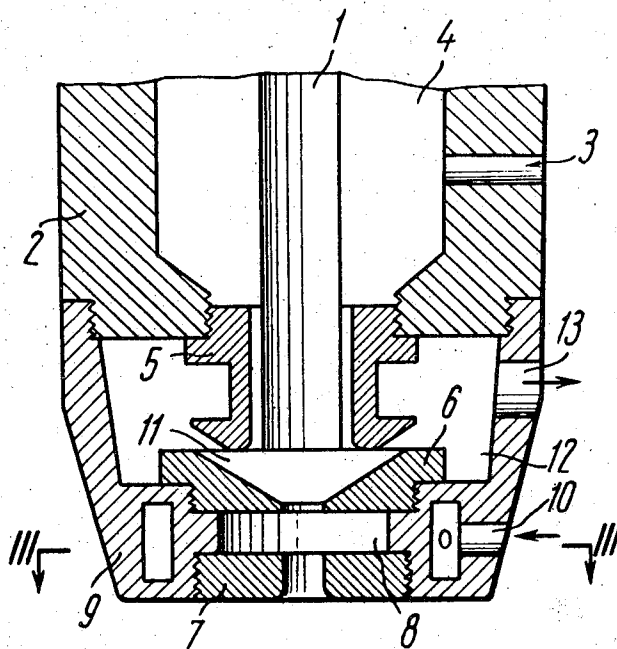
3,097,292 7/1963 Kugler et al..... 219/121 P
3,344,256 9/1967 Anderson..... 219/121 P
3,553,422 1/1971 McCoy..... 219/121 P

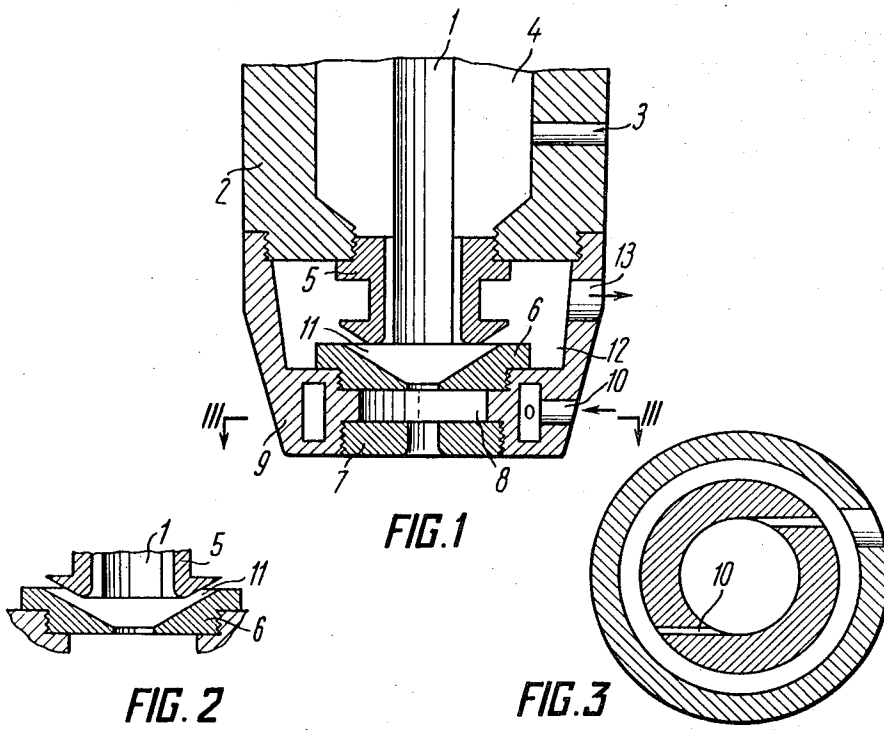
[57]

ABSTRACT

A consumable cathode plasma arc torch for working metals with a water-stabilized plasma arc in which a tubular nozzle is mounted in co-axial relationship to the cathode with the lower lateral surface thereof in coplanar relationship with an upper lateral surface of one of two tandemly mounted arc forming nozzles. This relationship increases the reliability and efficiency of the plasma arc torch by decreasing the possibility of cooling liquid getting into the arc-forming nozzles and by decreasing the distance between the lower end of the cathode and the inner arc-forming nozzle.

3 Claims, 3 Drawing Figures





1 PLASMATRON

The present invention relates to an improvement in plasmatrons and, more particularly, in the plasmatrons used for working metals with a water-stabilized plasma arc, and can be utilized for cutting, welding, depositing of metals and dressing of the finished articles.

Widely known in the art are various types of plasmatrons with a water-stabilized arc. Such plasmatrons have a consumable cylindrical cathode whose active section extends inside the tubular nozzle communicating with a cooling liquid supply chamber. The liquid supply channels ensure tangential delivery of the water into the chamber and tubular nozzle.

The inner and other nozzles are installed in tandem before the active end of the cathode.

A chamber formed between the walls of these nozzles serves for the delivery of water which stabilizes the plasma arc.

The tubular nozzle is arranged so that the surface of its lower end is somewhat higher than the end of the inner nozzle facing the cathode. In such a relative arrangement of the nozzles a part of the cooling water passes in a turbulent flow through the tubular nozzle and enters the inner nozzle and then the water collector. However, part of the cooling water gets into the orifices of the arc-forming nozzles which cools down the arc and impairs the stability of its burning. Besides, such an arrangement of the nozzles increases the distance between the working end of the cathode and the inner arc-forming nozzle, thereby reducing the efficient length of the plasma flame. All these factors reduce the reliability and efficiency of the plasmatron.

An object of the present invention lies in improving the reliability and efficiency of the plasmatron.

The invention aims at arranging the tubular and arc-forming nozzles in such a manner as to decrease considerably the possibility of the cooling liquid getting into the orifices of the arc-forming nozzles and to provide conditions for decreasing the distance between the lower end of the cathode and the inner arc-forming nozzle.

This aim is achieved by providing a plasmatron for working metals with a water-stabilized plasma arc comprising a cathode, a tubular nozzle and two arc-forming nozzles, the inner and outer ones, in which, according to the invention, the section of the tubular nozzle facing the inner nozzle is located in the space of the latter.

The end of the tubular nozzle can be installed flush with the surface of the end of the inner nozzle which faces the end of the cathode or enters the inner nozzle.

Now the invention will be described in detail by way of examples with reference to the accompanying drawings in which:

FIG. 1 illustrates a part of the plasmatron wherein the tubular nozzle is installed flush with the surface of the inner nozzle facing the end of the cathode;

FIG. 2 is another relative arrangement of the inner and tubular nozzles;

FIG. 3 is a section taken along line III-III of FIG. 1.

In the metal-cutting plasmatron a consumable graphite cathode 1 is installed in a body 2 whose wall is provided with a tangential channel 3 for the delivery of cooling liquid, e.g. water, into a chamber 4 formed by

2

the wall of the body 2 and cathode 1. Closely adjoining this chamber 4 is a tubular nozzle 5 whose space communicates with said chamber 4. The active section of the cathode 1 passes through this nozzle.

The tubular nozzle 5 has a rounded section at the point where the inner wall merges into the end portion.

Mounted in tandem, one after the other, before the end of the cathode, are two arc-forming nozzles 6 and 7, inner and outer ones, respectively. These nozzles deliver water which stabilizes the plasma arc.

Between these nozzles there is a chamber 8 closed at the sides by the projections of a part 9 which strengthens the arc-forming nozzles and is fastened to the body 1. The walls of the part 9 are provided with tangential channels 10 (see also FIG. 3) through which stabilizing water is delivered into the chamber at a pressure of 1 - 2 atm.

The section of the tubular nozzle 5 facing the inner nozzle 6 should be within the space of the latter.

As can be seen in FIG. 1, the end of the nozzle 5 is installed flush with the outer surface of the inner nozzle. A circular gap 11 formed by such an installation communicates the nozzle 6 with the water collector, the water from which is discharged outside through a channel 13.

The tubular nozzle 5 can be installed with its end entering the nozzle 6 (as shown in FIG. 2).

In this case the cooling liquid is also discharged through the circular gap 11. The size of this gap depends on the velocity of the cooling liquid flowing out of the tubular nozzle 5 and ranges from 2 to 5 mm to obtain the best results when the water is delivered at a pressure of 3 to 4 atm.

The plasmatron functions as follows.

The chambers 4 and 8 are filled with stabilizing and cooling liquids, respectively. Then an arc is excited between the cathode 1 and a work (not shown in the drawings) by any known method.

The cooling water delivered tangentially into the chamber 4 forms a turbulent stream washing the electrode 1 for cooling it. Acted upon by the centrifugal forces, the water spreads over the shaped part of the tubular nozzle 5, passes into the circular gap 11 and into the water collector 12 it is discharged outside.

The water stabilizing the plasma arc is delivered tangentially into the chamber 8, is swirled there and passes in the form of a thin film through the orifices of the nozzles 6 and 7. Part of this water turns into steam which, dissociating and ionizing, contributes to the formation of plasma.

The present arrangement of the tubular and inner nozzles makes it possible to locate the cathode considerably nearer to the arc-forming nozzles which increases the effective length of the plasma flame.

What we claim is:

1. A plasmatron for working metals with a water-stabilized plasma arc, comprising a consumable cathode; two arc-forming nozzles, a first one of said nozzles axially inside the plasmatron being positioned in front of the consumable end of said cathode and a second of said nozzles being spaced downstream of the first, adjacent the axial end of the plasmatron; means for delivering water intermediate said nozzles to stabilize the plasma arc; and a tubular nozzle surrounding said consumable end and having a laterally extending channel co-axial with said consumable end for tangential deliv-

3

ery into it of a cooling liquid, said tubular nozzle having a lower end surface thereof being in at least axially coplanar relationship with an upper lateral surface plane of the first one of said arc-forming nozzles so as to form an annular passageway therebetween for egress of said plasma arc-stabilizing water.

2. A plasmatron according to claim 1 wherein said

4

lower end surface of the tubular nozzle terminates so as to be coplanar with the upper lateral surface of said first arc-forming nozzle.

3. A plasmatron according to claim 1 wherein said lower end surface of the tubular nozzle extends into said first arc-forming nozzle.

* * * * *

10

15

20

25

30

35

40

45

50

55

60

65