Arc Torch

**JTST Historical Patent #33**

**UNITED STATES PATENT OFFICE**

2,858,412

*John S. Kane, Watchung, and Clifford W. Hill, Mountainside, N.J., assignors to Union Carbide Corporation, a corporation of New York*

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19 Claims. (Cl. 219-75)

This invention relates to arc torches of the character disclosed in the copending application of R.M. Gage, U. S. Serial No. 524,353, and has for its principal object to provide an improved torch for carrying out the process disclosed therein.

This is a transferred type high pressure electric arc torch provided with a nozzle having a non-consumable solid walled passage for laterally constricting the arc and gases and then discharging the resultant current-carrying event which is stable, directional and shaped to follow a well-defined path corresponding to the geometry of such passage.

Other objects of the present invention are to provide effective insulation between the nozzle and the electrode holder, and between the nozzle and electrode to prevent the pilot arc from passing other than between the electrode and the orifice wall, to provide a cooling jacket for the orifice wall, to provide cooling fluid passage means inside the torch body and nozzle for supplying cooling fluid to said cooling jacket, and to positively center the electrode with respect to the outlet orifice of said wall in order to obtain the desired high quality cuts.

The gas shielded arc cutting torch comprises a torch body, an electrode holder carried by said torch body, a gas directing nozzle carried by said torch body but insulated therefrom and extending below said electrode holder, a replaceable orifice wall in said nozzle having an orifice small enough to constrict the arc and gases and then discharging the resultant current-carrying event which is stable, directional and shaped to follow a well-defined path corresponding to the geometry of such passage.

According to the present invention a water jacket is provided for the orifice wall, and an annular refractory ceramic liner is provided inside the nozzle below the electrode holder to prevent the pilot arc from passing other than between the orifice wall and the electrode. Preferably the ceramic insert is provided with internal bearings to center the electrode. The nozzle preferably forms a water jacket outside of the electrode holder and above the ceramic liner, and the nozzle has passages therebelow communicating with the water jacket for the orifice wall.

In the drawings:

Fig. 1 is a vertical cross section through an arc torch according to the preferred embodiment of the present invention; and

Fig. 2 is a plan of the electrode centering ceramic liner.

The torch comprises a body B having a bore the lower end of which is threaded to receive an electrode holder or collet body H. A collet C inside the holder H bears against an abutment in the top of the torch body R, and the holder H has a conical inner bottom surface to constrict the collet C when the holder H is screwed into the body B. An insulating ring I is screwed onto the outside of the bottom of the torch body B and a nozzle or orifice wall holder N is screwed onto the outside of the insulation I.

The torch body B is of the type shown in Behnke et al. U.S. Patent No. 2,685,632, and has an inlet 12 for shielding gas which opens into an annular chamber between the collet head and the top of the electrode holder H, from which the gas flows down inside the holder and outside the collet, then in through the collet slots on through the bottom of the holder. The torch body B also has an inlet 12, for cooling water from which passages not shown lead to an annular groove 14 in the torch body. The lead-in conduit for the welding current is extended through the water outlet hose, as shown in said patent.

The electrode holder or collet body H comprises an upper tubular portion 16 substantially coextensive with the collet, and a collar portion 18 below the bottom of the torch body B and larger than the bore therein. Longitudinal grooves 22 formed in the tubular portion 16 and the collar portion 18 connect the torch body groove 14 with the space below the torch body B. In assembly, after the collet C is screwed into the body B, baffe plugs 17 are inserted in selected grooves 22 to locate the plugs 17 to form baffles between the inlet 12 and the outgoing water.

The nozzle or orifice wall support N comprises an upper outer sleeve portion 24 which is screwed onto the insulating ring I and extends therebelow for the depth of the collar portion 18 to enclose a water jacket 26. Below the water jacket the nozzle comprises a thick walled body portion 28 having a central bore of upper larger and lower smaller diameter to receive a refractory ceramic insulating liner 30. The liner 30 comprises an upper portion 32 underlying the collar 18 and having a conical entrance top, and a lower sleeve portion 34 of substantially the same inner diameter as the collar 18 and aligned therewith. The larger size of the ceramic head portion 32 decreases the air gap, and provides an extended insulation against the pilot arc current to insure discharge only at the wall member 42. The conical top facilitates entrance of the electrode and also the shielding gas.

The head portion 32 has bearings 20 projecting inwardly in the bore of the holder N for centering and guiding the electrode. The bearings 20 preferably have approximately three thousandths of an inch clearance around the electrode, and extend only about half way down the length of the insulating liner bore in order to

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provide additional gap to prevent internal arcing of both high frequency and pilot arc current between the electrode and insert holder assembly. This insures pilot arc discharge in close proximity to the end of the electrode to initiate the constricted cutting arc.

The water jacket 26 is sealed by a compressible gasket 36 fitted onto an annular shoulder formed by the top of the thick walled portion 28. The gasket 36 is of insulating material, and extends inwardly over the top at the head portion 32, to cover the entire lower surface of the collar 18 and eliminate any tendency for the high frequency current to arc therefrom to the insert holder portion 28. The gasket 36 is compressed against the bottom of the collar portion 18 when the nozzle sleeve portion 24 is screwed onto the insulation ring I.

Below the nozzle portion 28 is a smaller portion or orifice wall holder 38, which is smaller for visibility purposes in using the torch. This smaller portion has a bore aligned with the holder collar portion 18 and which receives the ceramic sleeve 34.

The nozzle N, preferably the portion 38, is provided with a replaceable orifice wall 40. The pilot arc is struck between this wall 40 and the electrode. The wall 40 may be electrically conductive, or it may be of heat resisting insulating material when a suitable probe is provided to pass the pilot arc from the nozzle portion 38 through the wall 40 to the electrode.

In the embodiment shown, the wall 40 constitutes a removable insert in the lower end of the bore in the portion 38, and comprises an upper tubular portion and a lower tapered portion terminating in a head or rim 42. For larger sizes of electrode, the taper may be omitted to provide an entirely tubular bore.

The thick walled nozzle portion 28 is drilled to form passages 44 leading from the water jacket 26, and the insert, holder portion 38 is drilled to form passages 46 registering with the passage 44 when the holder portion 38 is secured to the thick walled portion 25 as by means of silver solder. The parts 28 and 38 are made separately only to facilitate machining. These passages 46 communicate with the water jacket 48 which surrounds the orifice wall 40. In the form shown the water jacket is formed between the tapered portion of the insert 40 and the inside of the bore in the insert holder.

An insert retaining cap nut 50 is screwed onto the outside of the insert holder 38 and has an inturned rim underlyng the insert head 42. The bore of the insert holder 38 is provided with a groove to receive an “O” ring 51 through which the upper tubular portion of the insert 40 passes when the insert enters the bore. A heat resistant gasket 52 is compressed against the bottom of the insert holder 38 by the insert head 42 when the nut 50 is tightened. The outside rim of the nut 50 is provided with a ring 54 of insulating material to prevent arcing therefrom to the work.

A lead-in ring 56 of conductive material is clamped between the nozzle sleeve portion 24 and the insulating ring I, and carries a binding post for connection thereto of a conduit 58 for high frequency starting current. By virtue of the ceramic liner 30, the nozzle portions 24 and 28 are insulated from the electrode holder H, and a pilot arc is established between the insert 40 and the tip of the electrode E.

The outside of the nozzle N is covered by a flexible rubber sheath or boot 60 which covers the lead in ring 56, and which can be rolled up for access to the cap nut 50 for replacing the insert 40.

This application is in part a continuation of our copending application Serial No. 540,927, filed October 17, 1955.

What is claimed is:

1. Gas shielded arc torch comprising a torch body, an electrode holder carried by said torch body, an annular refractory member below said electrode holder having a central bore through which the electrode depends, a gas directing nozzle surrounding said annular refractory member having therebelow a solid walled arc shaping and directing passage aligned with the electrode, gas passage means extending to said nozzle passage, and an electrical conductor connected to said nozzle whereby an arc may be struck between the tip of said electrode and the portion of said nozzle below said annular refractory member.

2. Gas shielded arc torch comprising a torch body, an electrode holder carried by said torch body, a gas directing nozzle carried by said torch body and extending therebelow to an orifice aligned with the electrode and located below the tip thereof and small enough to constrict the arc therefrom, a cooling jacket inside said nozzle aligned with said orifice and said electrode, and cooling fluid passage means entirely inside the confines of said torch.