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Averyanov et al.

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[54] **PLASMATRONS OF STEEL-MELTING PLASMAARC FURNACES**

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

[58] **Field of Search** ..... 219/121 R, 121 P, 74, 75, 219/138, 139, 144; 313/231

[56] **References Cited**

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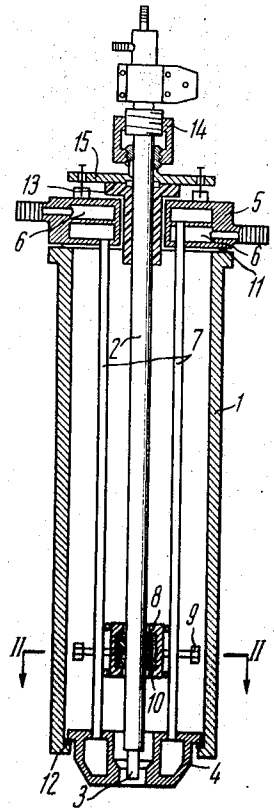
[57] **ABSTRACT**

The plasmatron has a device used for supplying coolant to the nozzle, which device is essentially a flange with ducts, secured in the upper portion of the plasmatron, the ducts communicating with an interior space in the nozzle by means of pipes passed inside the housing of the plasmatron and rigidly connected by their end portions to the flange and to the nozzle. The plasmatron is provided with a device for radial adjustment of the cathode relative to the nozzle, the adjustment device being mounted on the pipes inside the housing.

3 Claims, 2 Drawing Figures



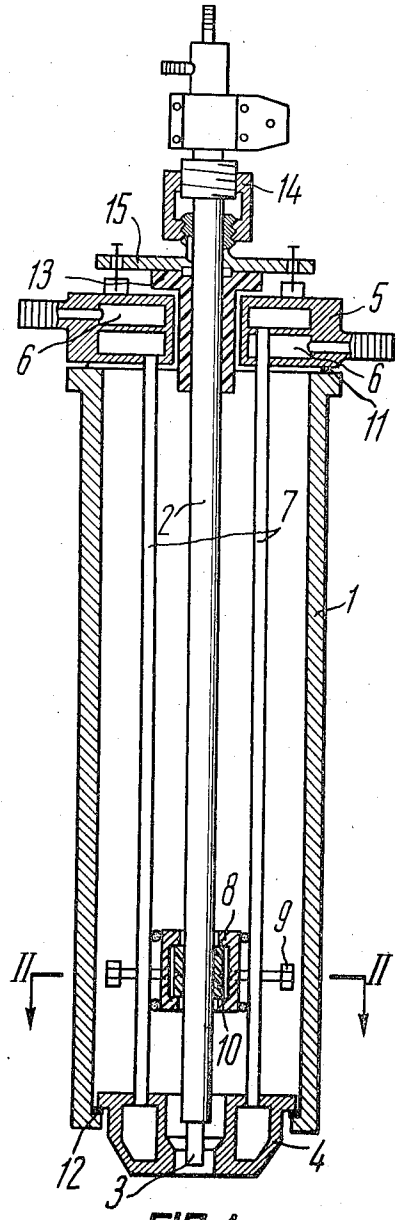


FIG. 1

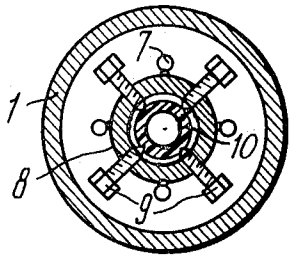


FIG. 2

PLASMATRONS OF STEEL-MELTING PLASMAARC FURNACES

The present invention relates to electrothermal equipment, and, more particularly, to plasmatrons of steel-melting plasma-arc furnaces with a ceramic crucible.

At present, for carrying out plasma-arc melting use is made of devices comprising an electric holder with a tungsten cathode and means for its axial displacement, a housing, a nozzle, members used for their electrical insulation and fastening, operating on a.c. and using argon or other flame-forming gases. Such devices have various different designs, such as, for example, disclosed in U.S. Pat. Nos. 2,960,594; 2,944,140; 2,951,143, but these have not found wide use because of their complexity and low reliability in operation. Also known in the art is an analogous device designed for industrial metallurgical furnaces (U.S. Pat. No. 3,130,292). This device comprises a housing consisting of three coaxially arranged pipes whose lower portion is tightly connected with a copper nozzle and has narrow ducts intercommunicating cooling spaces of the housing and nozzle. The copper water-cooled electric holder with a cathode is introduced inside the housing by means of electrically insulating bushes which simultaneously serve as a means for centering the cathode with respect to the nozzle. The position of the electric holder is fixed by a pressure ring disposed at the point at which the electric holder comes out of the housing. A disadvantage of the design lies in the complexity of manufacture of coupled housings of the nozzle, great resistance offered to the coolant flow at the point of their coupling, difficult repair, and absence of means for correcting the position of the cathode relative to the nozzle, which results in a low efficiency of the device when it is used in powerful metallurgical furnaces, especially in furnaces with a ceramic crucible (a rather great heat flow, splashing and amount of deposit separated from the metal).

An object of the present invention is to provide a plasmatron which is simple both in manufacture and use.

Another object of the present invention is to provide a plasmatron that is reliable in operation.

Still another object of the present invention is to provide a plasmatron that has a long service life.

In accordance with the afore-said and other objects in a plasmatron for melting metal, comprising a housing accomodating an electric holder with a cathode, capable of displacement in the axial direction, a cooled nozzle with a through hole adapted for the cathode to pass therethrough and disposed in the lower portion of the housing, and a device for supplying coolant to said nozzle, in which plasmatron, according to the present invention, the device for supplying coolant has a flange with ducts, mounted in the upper portion of the housing and having at least two pipes passed inside the housing and secured to the flange with their end portions, their other end portions being rigidly secured to the nozzle, the ducts of the flange being communicated with the space of the nozzle via the tubes, and means adapted for radial adjustment of the cathode with respect to the through hole of the nozzle secured to the tubes inside the housing.

This design of the plasmatron is simple in manufacture, increases the reliability and service life of the cathode and nozzle due to their precise coaxial adjustment, and makes it possible to build powerful plasmatrons.

The following description of an exemplary embodiment of the present invention is given with reference to the accompanying drawings, in which:

FIG. 1 is a longitudinal section of a device in accordance with the present invention; and

FIG. 2 is a section taken along line II—II in FIG. 1.

The plasmatron comprises a metal housing 1 made as a cooled tube. Disposed inside the housing 1 is an electric holder 2 which is essentially a cooled rod having a cathode 3 made from activated tungsten and secured to the lower end thereof by means of soldering, threading or in other suitable way.

The cathode 3 is disposed in a through hole of a nozzle 4.

Plasma-forming gas is delivered from the internal space of the plasmatron through an annular gap formed by the walls of said hole and the surface of the cathode 3, said gas being supplied into the plasmatron, for example, through a hole made in a flange (not shown in the drawing) of the housing 1 of the plasmatron.

Mounted on the upper portion of the housing 1 is a device used for supplying coolant and constructed as a flange 5 with ducts 6 through which the coolant is passed.

The coolant is supplied through the ducts of the flange 5 to the nozzle 4 along four pipes 7 which are welded at one of their end portions to the flange 5 and at their other end portions to the nozzle 4.

Welded to the pipes 7 is a metal ring 8 with threaded holes into which four adjusting screws 9 are screwed. In order to make it more rigid, the ring 8 may be extended to the flange 5 and welded thereto. Suspended from the adjusting screws 9 is an electric insulator 10 having a central through hole adapted for the electric holder 2 to pass therethrough. The afore-described adjusting means is disposed with respect to the nozzle 4 at a distance that is sufficient to prevent the arc at the end of the cathode 3 of the plasmatron from thermally effecting the nozzle 4.

The flange 5, pipes 7, adjusting means and nozzle 4 form a single unit providing for cooling of the nozzle 4 independently of the housing. This unit is simple in manufacture even when it is to be used in plasmatrons that are more than three metres long. This unit is secured by the flange 5 to the upper portion of the housing 1 through a packing ring 11, the nozzle 4 being mounted in the lower portion of the housing 1 against a compensating packing 12 which seals the gap between the housing 1 and the nozzle 4 to preclude gas leakage.

Mounted in the central hole of the flange 5 is an electric insulating bush 13 through which the electric holder 2 is passed. Secured to the upper portion of the electric holder 2 is a means used for axial displacement of the latter and provided, for instance, with a nut 14 which has right-hand and left-hand threadings and is engaged at one side with the electric holder 2 and at its other other side — with a flange 15 secured to flange 5 through the intermediary of electric insulators (not shown in the drawing).

The device operates as follows:

The electric holder 2 having the cathode 3 screwed therein is passed through the bush 13 and electric insu-

lator 10 of the adjusting means, and is secured to the flange 5. Then, the electric holder 2 is displaced by means of the adjusting screws 9 and the nut 14 of the displacing means until the cathode occupies the required position with respect to the through hole of the nozzle 4.

Thereafter, the assembled unit is introduced into the housing 1, and is mounted by its flange 5 on the upper portion of the housing 1 and is fastened, this being preceded by placing the packing ring 11 on the flange at the top of the housing and the packing ring 12 at the bottom of the housing. The packings can be made, for instance, from one or several layers of asbestos cord.

The plasmatron is mounted on a furnace or some other operating device, is connected with the supply systems of electric power, gas and coolant, and the latter are switched on. Thereafter, by means of an oscillator, the auxiliary arc disposed between the cathode 3 and the nozzle 4 is striken first and, then, the operating arc disposed between the cathode 3 and the material being treated is striken, this being simultaneously accompanied by effecting control over the power, and consumption of gas and coolant.

In the case of wear of the cathode 3, the electric holder 2 is displaced by means of the nut 14 to the required position in the hole of the nozzle 4, or the cathode 3 is replaced either by being either removed through the hole of the nozzle 4, or extracted together with the electric holder 2.

This device is very simple in manufacture, and makes it possible to increase the reliability and service life of the cathode and nozzle due to their precise coaxial disposition, as well as to build powerful plasmatrons.

What is claimed is:

1. A plasmatron for melting metal, comprising a housing, an elongated electric holder supported in the housing so that it can be displaced in axial direction inside said housing, a cathode secured to said electric holder at one end thereof, a nozzle inserted in said housing and having a through hole for receiving the cathode therein, means for supplying cooland to said nozzle to cool the same and including a flange mounted on said housing and having ducts for flow of coolant therein, and at least two pipes extending freely inside said housing and having one end portion rigidly secured to said flange and an opposite end portion rigidly secured to said nozzle, said ducts of the flange being in communication with said nozzle via said pipes, and means mounted on said pipes and engaging said holder for radially adjusting said holder relative to said pipes and thereby said cathode relative to the hole in said nozzle including a ring secured to said pipes, said holder extending freely in said housing and said ring surrounding said holder, and adjustment means engaging said ring and said holder for adjusting the radial position of the cathode.

2. A plasmatron as claimed in claim 1 wherein said flange, said pipes, said adjusting means and said nozzle form a single unit, said adjusting means being located at that end of the holder adjacent said nozzle.

3. A plasmatron as claimed in claim 1 wherein said adjustment means comprises screws threaded in said ring.

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