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[54] ELECTRICAL TRANSFER TYPE PLASMA ARC MELTING FURNACE

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[58] **Field of Search**.....13/1, 9; 219/121 P; 313/231

[56] **References Cited**

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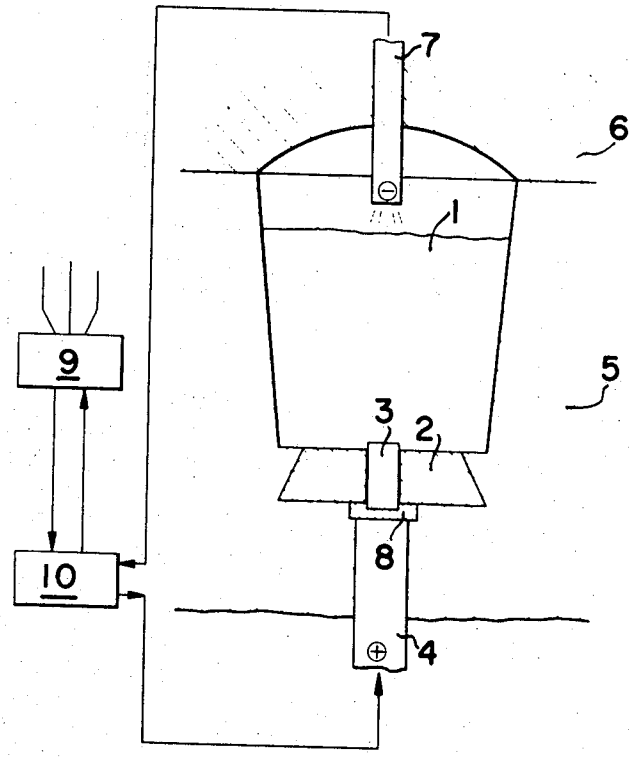
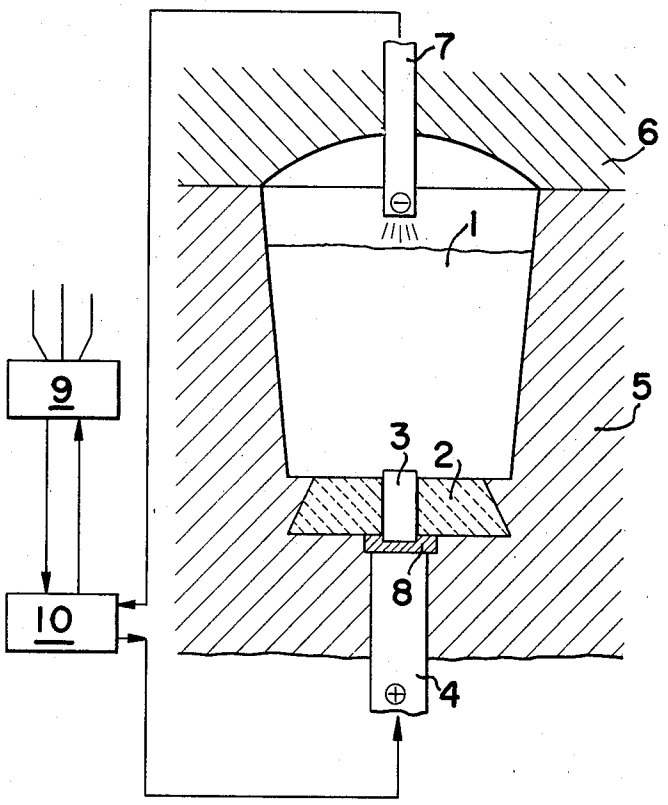
[57] **ABSTRACT**

An electrical transfer type plasma arc melting furnace with one or more combined electrodes composed of a metal electrode having direct contact with the scrap or molten metal, a electric carbon electrode directly connected with the source and baked or unbaked electrically conductive compounded refractory which is inserted between the metal bar and the said carbon electrode arranged either in the furnace hearth or in the furnace wall.

2 Claims, 1 Drawing Figure

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ELECTRICAL TRANSFER TYPE PLASMA ARC MELTING FURNACE

This invention relates to a combined electrode in a plasma arc melting furnace operated by an electrical transfer type plasma torch.

In a conventional transfer type plasma arc furnace, the cathode is placed in the center of a plasma jet torch and molten metal functions as the anode.

The plasma arc current flows between the plasma jet torch and molten metal; therefore, the molten metal must be contacted to a bottom electrode connected with an electrical source.

The said bottom electrode (ordinally made of graphite) which is usually placed in the furnace hearth, is often broken by the erosion caused by chemical reaction between the electrode and molten metal, overheating of molten metal or electrical joule heat. As, the said damage often appears at the early stage just after the charge of scraps, a stable plasma arc cannot be maintained and the plasma arc melting cannot be actually continued.

This invention may be fully understood by referring the attached drawing, which shows a vertical section of a typical furnace according to the present invention.

A metal electrode **3** is fixed in the cone shaped refractory **2** which, for example, is made of baked or unbaked magnesia, and contacts directly with scraps or molten metal **1**.

Electrically conductive materials **8** comprising refractory and carbon powder properly kneaded together are inserted between the said metal electrode **3** and the graphite electrode **4**.

According to the present invention, the above described defects can be avoided and suitable electric conductivity can also be maintained by preparing the combined electrode composed of the metal electrode **3**, compounded refractory **8** and the carbon electrode **4**. This furnace, as shown in the drawing, has a furnace body **5**, a furnace cover **6**, a plasma jet torch **7**, a

rectifier **9** and a transformer **10**, all of which are suitably arranged.

As described before, this furnace will not have such a direct contact between the molten metal and the carbon electrode as seen in any conventional transfer type plasma arc melting furnace. Therefore, no increase of carbon content in the molten metal results. Moreover, a relatively small power loss caused by possible electric resistance of the metal electrode is incurred.

At the earlier stage of melting, plasma arc current can be stabilized and also plasma arc melting can be smoothly carried out.

These advantages accomplish a considerable reduction in melting time and provides for suitable melting of ultra low carbon steel.

Results shown in Table 1 indicate operational conditions between a furnace of the present invention and a conventional furnace. The data in the table highlights the advantages of the present invention.

The metal electrode **3** keeps a solid form with its one part in contact to the kneaded refractory **8** and semi-molten form with the other part in contact to the molten metal **1**.

TABLE 1

Type of furnace used	Assured plasma arc currents (A)	Carbon content in the molten metal	Electrode consumption (kg./charge)	Melting time (h./r.)
This invention	<3,000	0.001	<0.001	1.5
Others which have a direct contact between the molten metal and the electrode	650–900	0.15–0.30	<0.75–1.50	2.4

Though the metal electrode **3** which is in semi-molten form will be a little lost after tapping, quicker melting operation can be obtained by only exchanging the used metal electrode with a new one.

What we claim is as follows:

1. An electrical transfer type plasma arc melting furnace with an upper cathode and a lower anode characterized in that said anode is a combined electrode composed of a metallic portion which directly contacts the scrap or molten metal in said furnace, a carbon portion which is connected to the electric source and an intermediate portion which comprises a blend of refractory material and carbon.

2. An electrical transfer type plasma arc melting furnace according to claim **1** wherein said carbon portion is arranged either in the furnace hearth or in the furnace wall.

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