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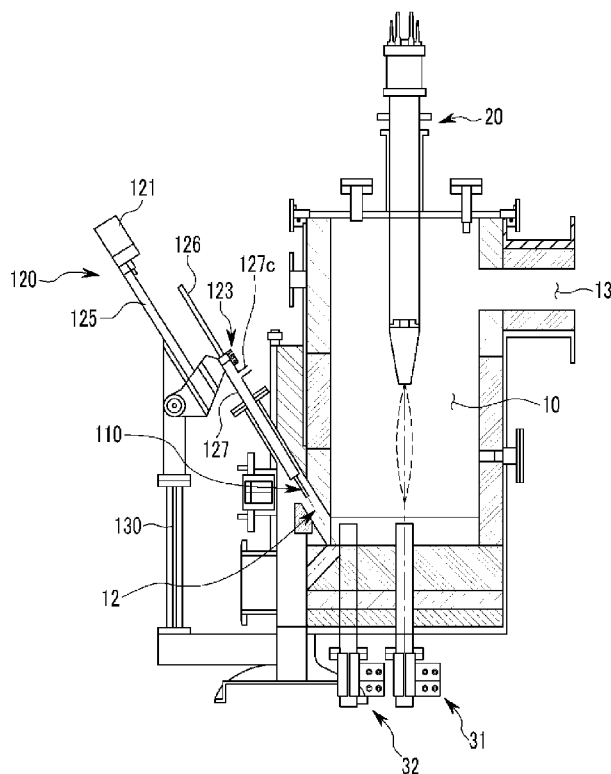
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(54) Title: APPARATUS AND METHOD FOR TAPPING MELTS IN PLASMA TORCH MELTER

[Fig. 1]



(57) Abstract: The present invention relates to an apparatus for tapping melts, the apparatus being used for a plasma torch melter including a tapping tunnel disposed to be sloped on an area of the inner wall of a melter, a plasma torch disposed on the upper part of the melter and a main electrode disposed on the lower part of the melter to be electrically coupled with an anode of the plasma torch, the apparatus comprising: a tapping-inducing electrode electrically coupled with the main electrode in parallel, the tapping-inducing electrode being moved adjacent to the melts in the tapping tunnel, thereby being electrically coupled with the anode of the plasma torch, heating and melting the melts which remain in the tapping tunnel; a controller electrically decoupling the anode of the plasma torch with the main electrode, the controller electrically coupling the anode of the plasma torch with the tapping-inducing electrode; and a transporting device moving the tapping-inducing electrode in the tapping tunnel, thereby controlling the distance between the tapping-inducing electrode and the melts.



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GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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APPARATUS AND METHOD FOR TAPPING MELTS IN PLASMA TORCH MELTER

BACKGROUND OF THE INVENTION

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Field of the Invention

The present invention relates to an apparatus and method for tapping melts from a plasma torch melter, and particularly an apparatus and method for tapping melts from a plasma torch melter to safely and easily melt the melts which remain in a blocked tapping tunnel by using a tapping-inducing electrode.

Description of the Related Art

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A tapping tunnel of a plasma torch melter may be blocked due to the low temperature of the outer wall of the tapping tunnel or the solidified melts. Additionally, the slag which grows up during the tapping process may block the tapping tunnel. If the tapping tunnel is blocked by the melts, it is very difficult to clean out the tapping tunnel since the melts which block the tapping tunnel cannot be easily removed by conventional mechanical methods (e.g., drills, hammers, mud guns and oxygen torches). Sometimes the refractory layer which covers the melter must be disassembled to remove the melts in the tapping tunnel.

Furthermore, the conventional mechanical methods for removing the melts in the tapping tunnel are not ideal for swift use in melting systems which repeat the intermittent tapping processes. They are particularly inappropriate for handling radioactive wastes.

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SUMMARY OF THE INVENTION

The present invention is invented to resolve the above conventional problems.

10 The first purpose of the present invention is to provide an apparatus and method for tapping melts from a plasma torch melter that can easily melt the melts which block a tapping tunnel and clean out the tapping tunnel by placing a tapping-inducing electrode in the tapping tunnel.

15 The second purpose of the present invention is to provide an apparatus and method for tapping melts from a plasma torch melter which can safely remove the remaining melts from the tapping tunnel at a remote place by installing the tapping-inducing electrode on a transporting device having a remote control device even if the melts which block the tapping tunnel are dangerous substances (e.g., radioactive wastes).

20 The third purpose of the present invention is to provide a method for tapping melts from a plasma torch melter that can easily heat the melts, which are disposed adjacent to the tapping tunnel in the melter, by Joule-heat that is generated by placing an auxiliary electrode as well as the tapping-inducing electrode adjacent to the tapping tunnel in the melter, and electrically
25 coupling an anode of a plasma torch with an auxiliary electrode.

The present invention relates to an apparatus for tapping melts, the apparatus being used for a plasma torch melter including a tapping tunnel disposed to be sloped on an area of an inner wall of a melter, a plasma torch
5 disposed on an upper part of the melter and a main electrode disposed on a lower part of the melter to be electrically coupled with an anode of the plasma torch, the apparatus comprising: a tapping-inducing electrode which is electrically coupled with the main electrode in parallel and is moved adjacent to the melts in the tapping tunnel, thereby being electrically coupled with the
10 anode of the plasma torch, heating and melting the melts which remain in the tapping tunnel; a controller which electrically decouples the anode of the plasma torch with the main electrode and electrically couples the anode of the plasma torch with the tapping-inducing electrode; and a transporting device which moves the tapping-inducing electrode in the tapping tunnel, thereby
15 controlling the distance between the tapping-inducing electrode and the melts.

The apparatus according to the present invention further comprises an auxiliary electrode which is electrically coupled with the main electrode and the tapping-inducing electrode in parallel and is disposed adjacent to the
20 tapping tunnel on the lower part of the melter, thereby being electrically coupled with the anode of the plasma torch and heating the melts which remain adjacent to the tapping tunnel of the melter, wherein the controller electrically couples the anode of the plasma torch with the main electrode, the auxiliary electrode or tapping-inducing electrode.

The apparatus according to the present invention further comprises a protection gas guider which has a pipe shape, a first end of the protection gas guider being opened, a second end of the protection gas guider being closed, the protection gas guider surrounding the tapping-inducing electrode to prevent the tapping-inducing electrode from being oxidized by flowing a protection gas into the protection gas guider; and an electrode holder which is disposed on the second end of the protection gas guider to be coupled with the tapping-inducing electrode, which is disposed in the protection gas guider, to be moved up and down, wherein the transporting device comprises a linear-driving guider coupled with the protection gas guider to guide the tapping-inducing electrode to place the tapping-inducing electrode in the center of the tapping tunnel; and a servo motor which is installed on the linear-driving guider to drive the linear-driving guider in a linear-driving method.

The present invention relates to a method for tapping melts remaining adjacent to a tapping tunnel of a plasma torch melter, the method comprising the steps of: (a) electrically coupling an anode of a plasma torch, which is disposed on the upper part of the melter, with a main electrode which is disposed on the lower part of the melter; (b) electrically decoupling the anode of the plasma torch with the main electrode after step (a), and electrically coupling the anode of the plasma torch with a tapping-inducing electrode moved adjacent to the melts which remain around the tapping tunnel; (c) melting the melts in the tapping tunnel by electrically coupling the plasma torch with the tapping-inducing electrode; and (d) tapping the melts which are melted in the tapping tunnel to the outside of the melter.

The method according to the present invention further comprises the step of (e) electrically coupling the anode of the plasma torch with an auxiliary electrode after the anode of the plasma torch is electrically decoupled from the main electrode, wherein the auxiliary electrode is electrically coupled with the main electrode and the tapping-inducing electrode in parallel and is disposed adjacent to the tapping tunnel on the lower part of the melter.

The effects of the present invention are as follows.

The first effect is to easily melt the melts which block the tapping tunnel by placing the tapping-inducing electrode in the tapping tunnel, thereby easily cleaning out the tapping tunnel.

The second effect is to safely remove the remaining melts from the tapping tunnel at a remote place by installing the tapping-inducing electrode on the transporting device having the remote control device even if the melts which block the tapping tunnel are dangerous substances (e.g., radioactive wastes).

The third effect is to easily heat the melts, which are adjacent to the tapping tunnel in the melter, by Joule-heat which is generated by electrically coupling the anode of the plasma torch with the auxiliary electrode, thereby preventing the temperature of the melts from decreasing during the tapping process and facilitating the tapping process.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view illustrating the apparatus for tapping melts from a plasma torch melter according to the preferred embodiment of the present invention.

Fig. 2 is an electric circuit for illustrating electrically coupling and
5 decoupling an electrode of a plasma torch with a main electrode, an auxiliary electrode or a tapping-inducing electrode according to the preferred embodiment of the present invention.

Fig. 3 is a schematic view illustrating the tapping-inducing electrode and the transporting device thereof according to the preferred embodiment of
10 the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, a preferred embodiment of the present invention will be
15 explained in more detail with reference to the accompanying drawings.

Fig. 1 is a schematic view illustrating the apparatus for tapping melts from a plasma torch melter according to the preferred embodiment of the present invention. Fig. 2 is an electric circuit for illustrating electrically coupling and decoupling an electrode of a plasma torch with a main electrode,
20 an auxiliary electrode or a tapping-inducing electrode according to the preferred embodiment of the present invention. Fig. 3 is a schematic view illustrating the tapping-inducing electrode and the transporting device thereof.

As shown in Figs. 1 to 3, the present invention comprises a melter 10, a plasma torch 20, a main electrode 31, an auxiliary electrode 32, a controller 90, a tapping-inducing electrode 110 and a transporting device 120.

The upper part and lower part of the melter 10 are closed. A tapping
5 tunnel 12, which is a sloped tunnel, is disposed on an area of the inner wall of the melter 10. The melts 1 which are contained in the melter 10 are tapped through the tapping tunnel 12. Preferably, the inner wall and bottom surface of the melter 10 are made of the refractory substance which can endure high temperature. Non-combustible wastes such as iron, concrete, sand and
10 asbestos, combustible wastes such as wood, vinyl and paper, or the combinations thereof are melted ("melts," below) in the melter 10. While the melts 1 are melted in the melter 10, the nonmetals having a low specific gravity come to be placed in the upper space of the melter 10, and the metals having a high specific gravity come to be placed in the lower space of the
15 melter 10. When the melts 1 are tapped through the tapping tunnel 12 after completion of the melting process in the melter 10, due to the difference of the specific gravity of the melts 1 and the shape of the tapping tunnel 12, the melts 1 remain in the tapping tunnel 10, thereby blocking the tapping tunnel 12 due to the low temperature of the outer wall of the tapping tunnel.

20 The plasma torch 20 is installed on the upper part of the melter 10. As shown in Fig. 2, an anode 22 and cathode 23 are installed in the plasma torch 20. When power is applied to the plasma torch 20, the electric current flows between the anode 22 and the cathode 23, whereby the temperature of the plasma gas passing between the anode 22 and cathode 23 becomes high,
25 and then the high-temperature plasma gas flows into the melter 10. The

wastes which are contained in the melter 10 are melted by the high-temperature plasma gas and become conductive, whereby the electric current can flow between the anode 22 and the main electrode 31.

The main electrode 31 is installed on the center surface of the lower
5 part of the melter 10. As shown in Fig. 2, the main electrode 31 is electrically coupled with the auxiliary electrode 32 and the tapping-inducing electrode 110 in parallel, and then is grounded. Also, the main electrode 31 is electrically coupled with the controller 90 by the first switch 91 which is electrically coupled with the main electrode 31. If the first switch turns on
10 the main electrode 31, the electric current flows between the main electrode 31 and the anode 31 through the melts.

The auxiliary electrode 32 is installed adjacent to the tapping tunnel 12 in the lower part of the melter 10. As shown in Fig. 2, the auxiliary electrode 32 is electrically coupled with the main electrode 31 and the
15 tapping-inducing electrode 110 in parallel, and then is grounded. Also, the auxiliary electrode 32 is electrically coupled with a power device 70 by the second switch 92 which is electrically coupled with the auxiliary electrode 32. If the second switch turns on the auxiliary electrode 32, the electric current flows between the auxiliary electrode 32 and the anode 22 through the
20 melts.

As shown in Fig. 2, the tapping-inducing electrode 110 is electrically coupled with the main electrode 31 and the auxiliary electrode 32 in parallel, is grounded, and then disposed in the tapping tunnel 12 as shown in Fig. 3. The tapping-inducing electrode 110 is electrically coupled with a power
25 device 70 by the third switch 93 which is electrically coupled with the

tapping-inducing electrode 110. If the third switch turns on the tapping-inducing electrode 110, the electric current flows between the tapping-inducing electrode 110 and the anode 22 through the melts.

As shown in Fig. 2, the power device 70 comprises a switching module 71. The controller 90 comprises the first switch 91 which is electrically connected with the main electrode 31, the second switch 92 which is electrically connected with the auxiliary electrode 32 and the third switch 93 which is electrically connected with the tapping-inducing electrode 110, and selectively turns on one of them.

As shown in Fig. 3, the present invention further comprises a servo motor 121, a power-connecting terminal 123, a linear-driving guider 125, an electrode holder 126 and a protection gas guider 127. The transporting device 120 comprises the servo motor 121 and the linear-driving guider 125, and moves the tapping-inducing electrode 110 through the tapping tunnel 12, thereby being able to control the distance between the tapping-inducing electrode 110 and the melts 1 which remain in the tapping tunnel 12. The transporting device 120 is supported by a supporter 130 which is installed on the structure of the melter 10.

As shown in Fig. 3, the protection gas guider 127 surrounds the tapping-inducing electrode 110 and has a pipe shape. The first end 127a of the protection gas guider is opened and the second end 127b of the protection gas guider is closed. A protection gas hole 127c is formed on the protection gas guider 127, through which the protection gas flows into the protection gas guider 127. Argon gas may be typically used as the protection gas which

prevents the tapping-inducing electrode 110 from being oxidized and extends the life of the tapping-inducing electrode 110.

The electrode holder 126 can be moved in the direction of the arrow illustrated in Fig. 3. The power-connecting terminal 123 applies electric
5 current to the tapping-inducing electrode 110 when the power is on.

The linear-driving guider 125 is coupled with the protection gas guider 127 and guides the tapping-inducing electrode 110, which moves in the protection gas guider 127, to be placed in the center of the tapping tunnel 12.

The servo motor 121 is coupled with the linear-driving guider 125.
10 The servo motor 121 linearly drives the linear-driving guider 125 up and down to control the distance between the tapping-inducing electrode 110 and the melts in the tapping tunnel 12.

Hereinafter, the method for tapping melts from the plasma torch melter, using the apparatus for tapping melts according to the present
15 invention will be explained with reference to Figs. 1 to 3.

The method for tapping melts from the plasma torch melter according to the present invention taps the melts 1 using the operation characteristic of the plasma torch 20. The operation types of the plasma torch 20 are divided into a non-transferred operation, a transferred operation and a mixed
20 operation in which the non-transferred operation and the transferred operation are performed simultaneously.

The non-transferred operation is the operation that generates an electric arc between the anode and cathode which are installed in the plasma torch, passes the plasma gas between the anode and cathode, changes the
25 plasma gas passing between the anode and cathode to the high-temperature

plasma gas, heats the surface of the melts with the high-temperature plasma gas and melts the melts.

The transferred operation is the operation that passes high-temperature plasma gas between the anode which is installed in the plasma torch and the
5 cathode (e.g., the main electrode 31, the auxiliary electrode 32 or the tapping-inducing electrode 110) which is installed outside of the plasma torch, heats the inside of the melts and melts the melts.

The mixed operation is the operation that performs the non-transferred operation and the transferred operation simultaneously. The mixed
10 operation can control the output ratio of the non-transferred operation and transferred operation automatically or manually according to the change of electrical conductivity of the melts.

In order to melt the melts 1 which remain in the melter 10 adjacent to the tapping tunnel 12, the controller 90 electrically decouples the anode 22 of
15 the plasma torch 20 from the main electrode 31, and electrically couples the anode 22 with the auxiliary electrode 32. The controller 90 can electrically couple the anode 22 of the plasma torch 20 with the main electrode 31, the auxiliary electrode 32 which is installed adjacent to the tapping tunnel 12 in the lower part of the melter 10 or the tapping-inducing electrode 110 which is
20 disposed in the tapping tunnel 12.

If the controller 90 electrically couples the anode 22 with the auxiliary electrode 32, the melts 1 are heated and melted.

In order to melt the melts 1 which remain in the tapping tunnel 12, the tapping-inducing electrode 110 is moved adjacent to the melts 1 which remain
25 in the tapping tunnel 12, and then the controller 90 electrically couples the

anode 22 with the tapping-inducing electrode 110. The transferred electric current flows to the melts 1 which remain in the tapping tunnel 12 through the tapping-inducing electrode 110, thereby heating and melting the melts 1. Then, if the tapping tunnel 12 is cleaned out, the controller 90 electrically
5 decouples the anode 22 from the tapping-inducing electrode 110. After the tapping-inducing electrode 110 is electrically decoupled from the anode 22, the tapping-inducing electrode 110 is moved back from the tapping tunnel 12 along the linear-driving guider 125.

After the above process, if the melts 1 which exist in the melter 10
10 and the tapping tunnel 12 are completely melted, they are tapped to the outside of the melter 10 through the tapping tunnel 12. The protection gas which is filled in the protection gas guider 127 of the transporting device 120 is discharged through a waste gas outlet 13.

15 From the above embodiment for the present invention, it is noted that modifications and variations could be made by a person skilled in the art in light of the above teachings. Therefore, it should be understood that changes may be made for a particular embodiment of the present invention within its scope and spirit outlined by the appended claims.

20

WHAT IS CLAIMED IS:

1. An apparatus for tapping melts, the apparatus being used for a plasma torch melter including a tapping tunnel disposed to be sloped on an area of an inner wall of a melter, a plasma torch disposed on an upper part of the melter and a main electrode disposed on a lower part of the melter to be electrically coupled with an anode of the plasma torch, the apparatus comprising:

a tapping-inducing electrode electrically coupled with the main electrode in parallel, the tapping-inducing electrode being moved adjacent to the melts in the tapping tunnel, thereby being electrically coupled with the anode of the plasma torch, heating and melting the melts remaining in the tapping tunnel;

a controller electrically decoupling the anode of the plasma torch from the main electrode, the controller electrically coupling the anode of the plasma torch with the tapping-inducing electrode; and

a transporting device moving the tapping-inducing electrode in the tapping tunnel, thereby controlling a distance between the tapping-inducing electrode and the melts.

2. The apparatus according to claim 1, further comprising:

an auxiliary electrode electrically coupled with the main electrode and the tapping-inducing electrode in parallel, the auxiliary electrode being disposed adjacent to the tapping tunnel on the lower part of the melter, thereby being electrically coupled with the anode of the plasma torch and heating the melts remaining adjacent to the tapping tunnel of the melter,

wherein the controller electrically couples the anode of the plasma torch with the main electrode, the auxiliary electrode or tapping-inducing electrode.

- 5 3. An apparatus for tapping melts in a plasma torch melter, the apparatus comprising:

 a melter having a tapping tunnel for tapping the melts, the tapping tunnel being disposed to be sloped on an area of an inner wall of the melter;

 a plasma torch disposed on an upper part of the melter;

- 10 a main electrode disposed on a lower part of the melter to be electrically coupled with an anode of the plasma torch, thereby melting the melts;

 an auxiliary electrode electrically coupled with the main electrode and a tapping-inducing electrode in parallel, the auxiliary electrode being
15 disposed adjacent to the tapping tunnel on the lower part of the melter, thereby being electrically coupled with the anode of the plasma torch and heating the melts remaining adjacent to the tapping tunnel of the melter;

 the tapping-inducing electrode electrically coupled with the main electrode and the auxiliary electrode in parallel, the tapping-inducing
20 electrode being moved adjacent to the melts through the tapping tunnel, thereby being electrically coupled with the anode of the plasma torch, heating and melting the melts remaining in the tapping tunnel;

 a controller electrically coupling the anode of the plasma torch with the main electrode, the auxiliary electrode or the tapping-inducing electrode;
25 and

a transporting device moving the tapping-inducing electrode through the tapping tunnel, thereby controlling a distance between the tapping-inducing electrode and the melts.

5 4. The apparatus according to claim 1 or claim 3, further comprising:

a protection gas guider having a pipe shape, a first end of the protection gas guider being opened, a second end of the protection gas guider being closed, the protection gas guider surrounding the tapping-inducing electrode to prevent the tapping-inducing electrode from being oxidized by
10 flowing a protection gas into the protection gas guider; and

an electrode holder disposed on the second end of the protection gas guider to be coupled with the tapping-inducing electrode disposed in the protection gas guider to be moved up and down,

wherein the transporting device comprises:

15 a linear-driving guider coupled with the protection gas guider to guide the tapping-inducing electrode to place the tapping-inducing electrode in a center of the tapping tunnel; and

a servo motor installed on the linear-driving guider to drive the linear-driving guider in a linear-driving method.

20

5. A method for tapping melts remaining adjacent to a tapping tunnel of a plasma torch melter, the method comprising the steps of:

(a) electrically coupling an anode of a plasma torch disposed on an upper part of the melter with a main electrode disposed on a lower part of the
25 melter;

(b) electrically decoupling the anode of the plasma torch from the main electrode after the step (a), and electrically coupling the anode of the plasma torch with a tapping-inducing electrode moved adjacent to the melts remaining around the tapping tunnel;

5 (c) melting the melts in the tapping tunnel by electrically coupling the plasma torch with the tapping-inducing electrode; and

(d) tapping the melts melted in the tapping tunnel to an outside of the melter.

10 6. The method according to claim 5, further comprising the step of:

(e) electrically coupling the anode of the plasma torch with an auxiliary electrode after the anode of the plasma torch is electrically decoupled from the main electrode, wherein the auxiliary electrode is electrically coupled with the main electrode and the tapping-inducing
15 electrode in parallel, and is disposed adjacent to the tapping tunnel on the lower part of the melter.

Fig. 1

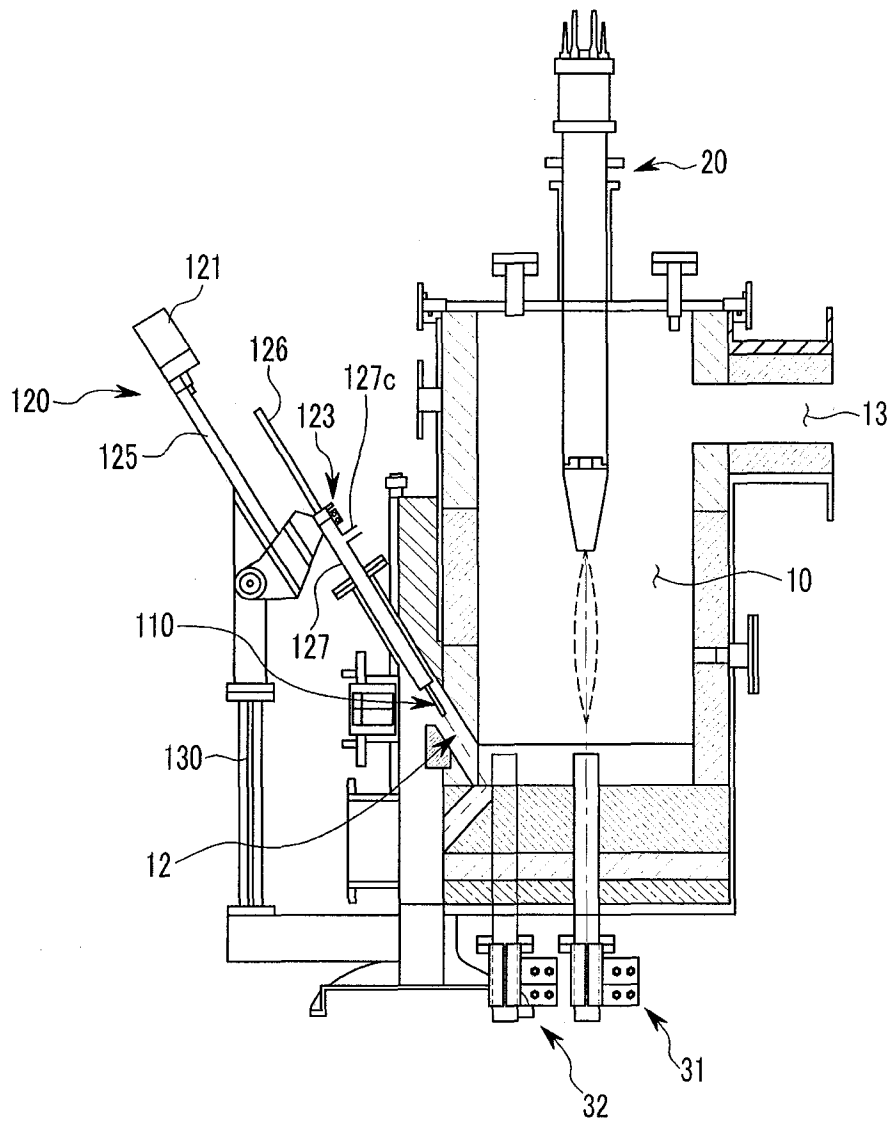


Fig. 2

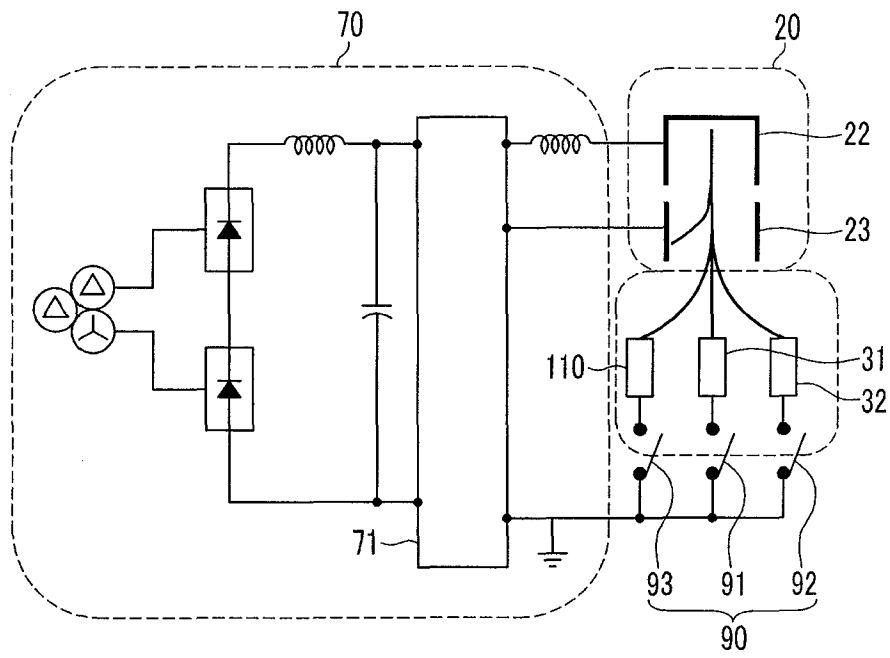
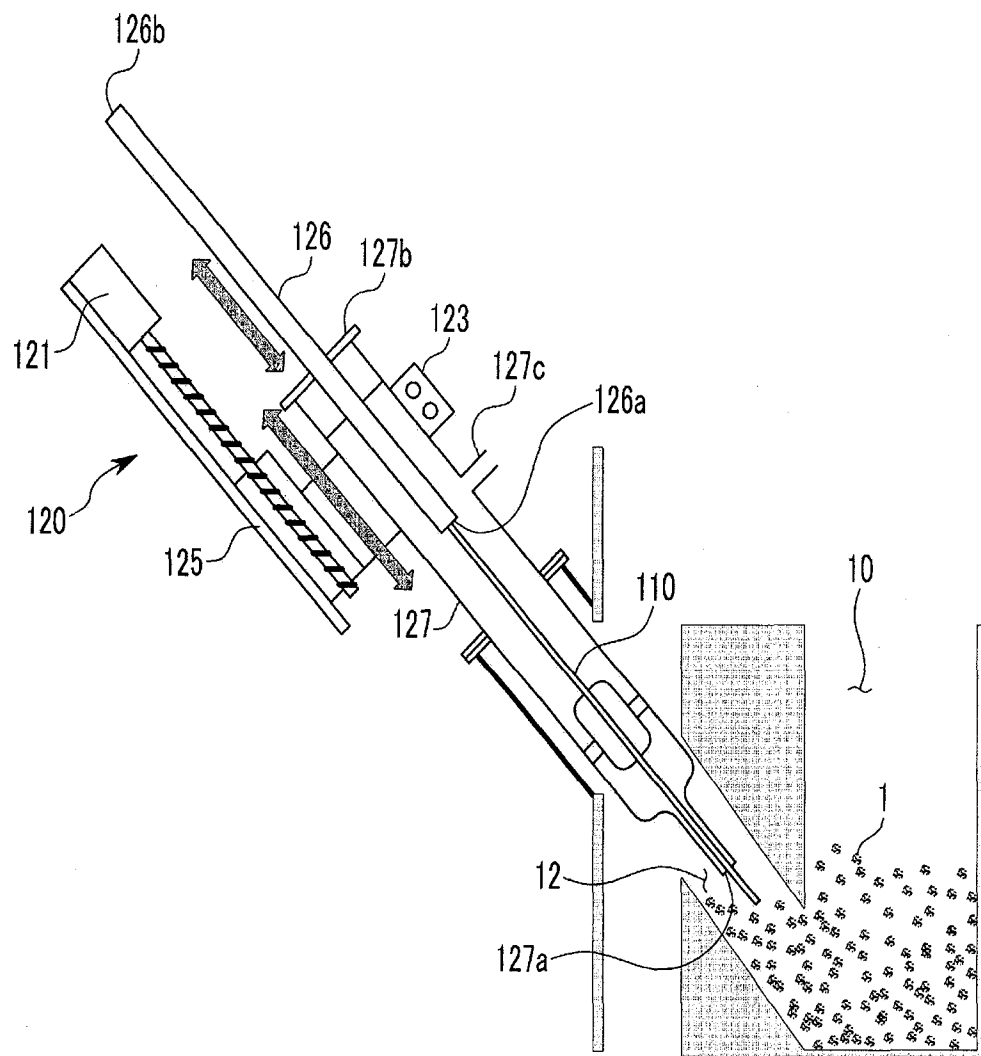


Fig. 3



A. CLASSIFICATION OF SUBJECT MATTER***F27D 15/00(2006.01)i***

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC F23G 5/00, F23J1/00, F27D 3/14, F27B 3/19

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models since 1975.

Japanese Utility models and applications for Utility models since 1975.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO INTERNAL) "plasma", "electrode", "tapping"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 11-230518 A (TAKUMA CO., LTD.) 27 August 1999 See paragraphs [0021]-[0028] and figure 1.	1 - 6
Y	JP 2005-030605 A (NISSEI CO., LTD.) 3 February 2005 See paragraphs [0058]-[0063] and figures 10-11.	1 - 6
A	JP 09-210339 A (DAIDO STEEL CO., LTD.) 12 August 1997 See the abstract and claim 1.	1 - 6
A	JP 07-248188 A (MITSUBISHI HEAVY IND. CO., LTD.) 26 September 1995 See the abstract and claim 1.	1 - 6



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2008/007101

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 11-230518 A	27.08.1999	NONE	
JP 2005-030605 A	03.02.2005	KR 10-2004-0010397 A TW 271500 A	31.01.2004 21.01.2007
JP 09-210339 A	12.08.1997	NONE	
JP 07-248188 A	26.09.1995	NONE	