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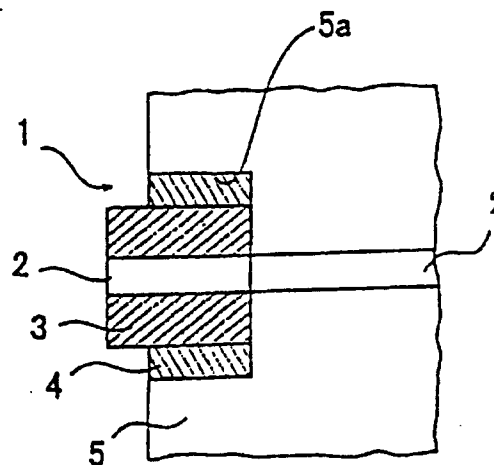
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(54) **SLEEVE FOR SLAG OUTLET, WASTE GASIFYING MELTING FURNACE WITH THE SLEEVE,
AND METHOD OF REPLACING THE SLEEVE**

(57) The present invention relates to a sleeve for tap hole of a waste gasifying and melting furnace which is formed with an internal sleeve made of a refractory material less liable to be melted by molten slag and an external sleeve made of a refractory material capable of being cut easily by boring, the external sleeve being provided on the external surface of the internal sleeve. The sleeve for tap hole in accordance with the present invention can be exchanged easily without much labor and time.

FIG. 2B



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Description

TECHNICAL FIELD

[0001] The present invention relates to a sleeve for tap hole in a waste gasifying and melting furnace, a waste gasifying and melting furnace mounted with the sleeve, and a method for exchanging the sleeve.

BACKGROUND ART

[0002] A waste gasifying and melting furnace is a melting furnace in which wastes are heat decomposed and gasified, and the residue is melted. The produced combustible gas is burned by blowing air in a secondary combustion chamber, and the exhaust gas generated at this time is sent to a boiler, where heat recovery is effected. On the other hand, the molten slag generated by melting the residue is discharged out of the furnace and solidified, the solidified slag being used as a road bed material, a back filling material, and the like.

[0003] FIG. 1 is a longitudinal sectional view of a shaft type melting furnace, which is an example of a conventional waste gasifying and melting furnace.

[0004] Wastes 31 and coke 32 are charged into a melting furnace 33 separately through a furnace top 33a. The charged coke 32 deposits in the furnace and is burned by oxygen-enriched air, which is blown through a main tuyere 34, together with fixed carbon in the wastes 31. The charged wastes 31 are heat decomposed and gasified in a high-temperature reducing atmosphere on the deposited layer of coke 32. At this time, the residue is melted and falls down toward a furnace bottom 33b. Generated combustible gas 37 is sent to a secondary combustion chamber through a duct 38. Molten slag 39 having fallen down to the furnace bottom 33b is discharged through tap holes 2 continuously or intermittently. Such tap holes 2 are usually provided at least at two places. When one tap hole 2 is used for maintenance such as replacement, the other tap hole 2 is used to discharge the molten slag 39.

[0005] As an example of tap hole, JP-A-7-316615 has disclosed a sleeve for blast furnace tap hole which is made of a refractory material that is less liable to be melted by high-temperature iron and molten slag.

[0006] However, this sleeve for blast furnace tap hole cannot be broken easily because it is made of a hard refractory material, so that it takes much labor and time to exchange the sleeve.

DISCLOSURE OF THE INVENTION

[0007] An object of the present invention is to provide a sleeve for tap hole in a waste gasifying and melting furnace, which can be exchanged without much labor and time, a waste gasifying and melting furnace which is equipped with the sleeve, and a method for exchanging the sleeve.

[0008] The above object is achieved by a sleeve for tap hole comprising: an internal sleeve made of a refractory material which is less liable to be melted by molten slag; and an external sleeve made of a refractory material which is capable of being cut easily by boring, the external sleeve being provided on the external surface of the internal sleeve.

[0009] Also, the sleeve for tap hole can be exchanged easily by a method for exchanging a sleeve for tap hole comprising the steps of: closing a tap hole of a waste gasifying and melting furnace which is equipped with the above sleeve for tap hole by using a mud gun; cutting the external sleeve of the sleeve for tap hole by boring; taking out the sleeve for tap hole; and mounting a new sleeve for tap hole similar to the taken out sleeve in the portion from which the sleeve for tap hole has been taken out after mortar is applied to the external surface of the new sleeve for tap hole.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 is a longitudinal sectional view of a shaft type melting furnace, which is an example of a conventional waste gasifying and melting furnace;

FIGS. 2A and 2B are views showing an example of a sleeve for tap hole in accordance with the present invention;

FIGS. 3A and 3B are views showing another example of a sleeve for tap hole in accordance with the present invention;

FIGS. 4A and 4B are views showing still another example of a sleeve for tap hole in accordance with the present invention;

FIG. 5 is a view showing still another example of a sleeve for tap hole in accordance with the present invention;

FIGS. 6A and 6B are views showing an example of a core bit which is used for boring;

FIGS. 7A to 7F are views showing a method for exchanging a sleeve for tap hole in accordance with the present invention;

FIG. 8 is a view showing still another example of a sleeve for tap hole in accordance with the present invention; and

FIGS. 9A and 9B are views showing still another example of a sleeve for tap hole in accordance with the present invention.

EMBODIMENTS OF THE INVENTION

[0011] FIGS. 2A and 2B show an example of a sleeve for tap hole in accordance with the present invention. FIG. 2A is a front view of the sleeve for tap hole, and FIG. 2B is a sectional view taken along the line A-A of FIG. 2A.

[0012] A sleeve for tap hole 1 has a double structure

comprising an internal sleeve 3 which is made of a refractory material less liable to be melted by molten slag and an external sleeve 4 which is made of a refractory material capable of being cut easily by boring, the external sleeve 4 being provided on the external surface of the internal sleeve 3. The sleeve for tap hole 1 is mounted in a mount hole 5a with a fixed depth, which is drilled in a furnace body refractory 5 of a waste gasifying and melting furnace, with mortar etc. being applied on the external surface thereof. At this time, the tap hole 2 of the sleeve for tap hole 1 and the tap hole 2 of the furnace body refractory 5 have an approximately equal opening diameter and are disposed so as to coincide with each other.

[0013] The sleeve for tap hole 1 mounted as described above can be exchanged without much labor and time by boring the external sleeve 4 capable of being cut easily using a core bit or the like.

[0014] As a refractory material for the internal sleeve 3, silicon carbide brick or the like is used.

[0015] As a refractory material for the external sleeve 4, a chamotte castable (SiO_2 , Al_2O_3), an alumina castable (SiO_2 , Al_2O_3), or the like that has a thermal conductivity of $2 \text{ W/m} \cdot \text{K}$ or lower at about 1400°C is used. The reason why the thermal conductivity is set at $2 \text{ W/m} \cdot \text{K}$ or lower is that a heat insulating effect is given to the external sleeve 4 to prevent a phenomenon that molten slag flowing through the tap hole 2 of the internal sleeve 3 is cooled, and thus the flowability thereof decreases, or the molten slag solidifies. Also, thereby, heating means such as a burner and an induction heating device need not be provided.

[0016] The external sleeve 4 should preferably have a thickness of 10 mm or larger so that when it is cut by boring, the internal sleeve 3 and the furnace body refractory 5, which are made of a hard material and provided around the external sleeve 4, are prevented from being cut. Also, to lessen the cutting residue at the time of cutting, the thickness of the external sleeve 4 should preferably be 50 mm or smaller.

[0017] The internal sleeve 3 projects from the furnace wall as shown in FIG. 2 in order to make easy the alignment of core bit. Therefore, the internal sleeve 3 need not necessarily be projected from the furnace wall. The same is true in the following figures.

[0018] FIGS. 3A and 3B show another example of a sleeve for tap hole in accordance with the present invention. FIG. 3A is a front view of the sleeve for tap hole, and FIG. 3B is a sectional view taken along the line B-B of FIG. 3A.

[0019] In this sleeve for tap hole 1, a notch is provided at a lower part of a portion facing the furnace outside of the external sleeve 4, and a refractory 6 having melting resistance equivalent to that of the internal sleeve 3 is mounted in this notch with an adhesive or the like. This structure can prevent the external sleeve 4 with relatively low melting resistance from being melted because even if molten slag coming out of the tap hole 2 of the

internal sleeve 3 runs down, the refractory 6 having melting resistance exists there.

[0020] If the refractory 6 is formed into a wedge shape so as to be attached and detached easily to and from the notch of the external sleeve 4, the replacement of this refractory 6 only is made easy.

[0021] FIGS. 4A and 4B show still another example of a sleeve for tap hole in accordance with the present invention. FIG. 4A is a front view of the sleeve for tap hole, and FIG. 4B is a sectional view taken along the line C-C of FIG. 4A.

[0022] In this sleeve for tap hole 1, a lower part 3b of the internal sleeve 3 is made of a refractory material less liable to be melted by molten slag, and an upper part 3a of the internal sleeve 3 is made of a refractory material less liable to be damaged by high-temperature gas. This structure can further improve the durability of the internal sleeve 3.

[0023] As a refractory material for the upper part 3a of the internal sleeve 3, an oxide-based refractory material containing at least one of alumina, magnesia, and chromia should preferably be used.

[0024] In the internal sleeve 3, the occupying ratio of the lower part 3b to the upper part 3a depends on the height of slag surface in the tap hole 2 of the internal sleeve 3. If the height of slag surface is located in the center of the tap hole 2, the lower part 3b occupies the lower half of the internal sleeve 3, that is, the occupying cross-sectional area of the lower part 3b being 50% of the total cross-sectional area of the internal sleeve 3. As the height of slag surface decreases, the occupying ratio of the lower part 3b to the upper part 3a decreases.

[0025] In place of the internal sleeve 3 shown in FIGS. 4A and 4B, an internal sleeve 3 as shown in FIG. 5, which is integrally molded so that the upper part 3a is covered with the lower part 3b, can be used.

[0026] The length in the furnace wall thickness direction of the upper part 3a need not be equal to the length of the lower part 3b. The upper part 3a can be limited to a tip end portion facing the furnace outside of the sleeve for tap hole 1, which is liable to be damaged by an oxidizing atmosphere.

[0027] FIGS. 6A and 6B show an example of a core bit which is used for cutting the external sleeve 4 by boring. FIG. 6A is a front view of the core bit, and FIG. 6B is a side view thereof.

[0028] A bottom plate 12 is provided at one end of a cylindrical body 11, and a plurality of bits 13 are provided on the other end thereof at equal intervals around the circumference of the cylindrical body 11. Cutting by boring can be performed by applying a striking rotation by using a rock drill with a rotating shaft 14 connected to the bottom plate 12 or by rotating the rotating shaft 14 by using a rotating machine.

[0029] FIGS. 7A to 7F show a method for exchanging a sleeve for tap hole in accordance with the present invention.

1) 7A: The tap hole 2 of the waste gasifying and melting furnace is closed with a mud material 15 by using a mud gun.

2) 7B: A guide hole 16 is drilled in the closed tap hole 2 in the internal sleeve 3 by using a drill so as to serve as a guide for a boring center. When a guide for boring is provided by another method, this process can be omitted.

3) 7C: The external sleeve 4 is cut by boring by using a core bit 10 shown in FIGS. 6A and 6B.

4) 7D: After the external sleeve 4 is cut until the core bit 10 reaches the furnace body refractory 5, the internal sleeve 3 is pulled out.

5) 7E: After the internal sleeve 3 is removed, the cutting residue 4a of the external sleeve 4 attaching to a mount hole in the furnace body refractory 5 is removed by using a dresser 17 or the like, and the internal surface of the mount hole in the furnace body refractory 5, which comes into contact with the external sleeve 4, is smooth finished. When the cutting residue 4a of the external sleeve 4 scarcely exists in the mount hole, this process can be omitted.

6) 7F: Mortar is applied to the external surface of the external sleeve 4 of a new sleeve for tap hole 1, and the sleeve for tap hole 1 is inserted into the mount hole in the furnace body refractory 5 by using a sleeve mounting machine 18.

[0030] The sleeve for tap hole in accordance with the present invention can be exchanged as described above. Therefore, the work for exchanging a sleeve for tap hole, which has conventionally required much time, can be performed in a short period of time.

[0031] As shown in FIG. 8, the center A of the internal sleeve 3 of the sleeve for tap hole 1, the center B of the external sleeve 4, and the center C of the tap hole 2 need not necessarily be concentric. The center of the external sleeve 4 can be shifted through a distance of L1 with respect to the internal sleeve 3 so that the thickness of the external sleeve 4 changes along the circumferential direction so as to match with the heat distribution in the circumferential direction, or the center of the tap hole 2 can be shifted upward or downward through a distance of L2 with respect to the internal sleeve 3 depending on whether the melting direction of the tap hole 2 is downward or upward.

[0032] FIGS. 9A and 9B show still another example of a sleeve for tap hole in accordance with the present invention. FIG. 9A is a front view of the sleeve for tap hole, and FIG. 9B is a sectional view taken along the line D-D of FIG. 9A.

[0033] This sleeve for tap hole 1 is an example of a sleeve which is provided so as to penetrate the furnace body refractory 5 in the thickness direction. Like the above-described sleeve for tap hole, this sleeve for tap hole 1 is made up of the internal sleeve 3 which is made of a refractory material less liable to be melted by molten slag and the external sleeve 4 which is made of a re-

fractory material capable of being cut by boring. In a portion facing the furnace inside of the sleeve for tap hole 1, the external sleeve 4 does not exist over a fixed length (a length of about 50 to 100 mm in the case where the thickness T of the furnace body refractory 5 is 400 mm), and a portion 3a of the internal sleeve 3 is only provided. According to the structure as described above, molten slag does not come into direct contact with the furnace body refractory 5. Therefore, the repair of the furnace body refractory 5 is not needed, and the sleeve for tap hole 1 has only to be replaced.

[0034] Conventionally, when the furnace body refractory 5 is repaired, the repair work must be performed in a state in which the furnace operation is suspended and the furnace is made empty, which requires a troublesome operation and a long period of time. By the use of this sleeve for tap hole 1, the sleeve can be exchanged easily as described above, so that furnace operation can be performed continuously for a long period of time.

[0035] The sleeve for tap hole 1 is exchanged by the following procedure of 1) to 4).

1) The supply of coke and wastes into the furnace is stopped, the slag surface is lowered below the sleeve for tap hole 1, and the blowing of oxygen-enriched gas through a main tuyere is stopped.

2) The external sleeve 4 is cut by boring by using a core bit or the like.

3) After the external sleeve 4 is cut and removed, the internal sleeve 3 is taken out.

4) A new sleeve for tap hole 1 is mounted in a mount hole 5a in the furnace body refractory 5 after mortar is applied to the external surface of the sleeve for tap hole 1.

[0036] In this case, the sleeve for tap hole 1 must be provided at a position slightly above the furnace bottom, not at the furnace bottom as shown in FIG. 1. Also, the portion 3a of the internal sleeve 3 facing the furnace inside of the sleeve for tap hole 1 appears to be difficult to cut by boring. However, the portion 3a is in contact with molten slag in the furnace and thus melting proceeds easily in the portion 3a, and therefore the remaining length of the portion 3a is short at the time of exchanging the sleeve for tap hole 1. Therefore, the exchange is not so difficult to perform.

[0037] The above-described sleeve for tap hole in accordance with the present invention can be applied to an ash melting furnace and a sludge melting furnace as well as a wastes melting furnace.

Claims

1. A sleeve for tap hole comprising:

an internal sleeve made of a refractory material which is less liable to be melted by molten slag;

- and
 an external sleeve made of a refractory material
 which is capable of being cut easily by boring,
 the external sleeve being provided on the ex-
 ternal surface of the internal sleeve. 5
2. The sleeve for tap hole according to claim 1, where-
 in the external sleeve has a thickness such that the
 external sleeve can be cut easily by boring. 10
3. The sleeve for tap hole according to claim 1, where-
 in a lower part of a portion facing the furnace outside
 of the external sleeve is made of a refractory mate-
 rial which has melting resistance equivalent to that
 of the internal sleeve. 15
4. The sleeve for tap hole according to claim 2, where-
 in a lower part of a portion facing the furnace outside
 of the external sleeve is made of a refractory mate-
 rial which has melting resistance equivalent to that 20
 of the internal sleeve.
5. The sleeve for tap hole according to claim 1, where-
 in an upper part of the internal sleeve is made of a
 refractory material which is less liable to be dam- 25
 aged by high-temperature gas in place of the refrac-
 tory material which is less liable to be melted by mol-
 ten slag.
6. The sleeve for tap hole according to claim 2, where- 30
 in an upper part of the internal sleeve is made of a
 refractory material which is less liable to be dam-
 aged by high-temperature gas in place of the refrac-
 tory material which is less liable to be melted by mol-
 ten slag. 35
7. The sleeve for tap hole according to claim 3, where-
 in an upper part of the internal sleeve is made of a
 refractory material which is less liable to be dam- 40
 aged by high-temperature gas in place of the refrac-
 tory material which is less liable to be melted by mol-
 ten slag.
8. The sleeve for tap hole according to claim 4, where- 45
 in an upper part of the internal sleeve is made of a
 refractory material which is less liable to be dam-
 aged by high-temperature gas in place of the refrac-
 tory material which is less liable to be melted by mol-
 ten slag. 50
9. A waste gasifying and melting furnace which is
 equipped with the sleeve for tap hole according to
 any one of claims 1 to 8.
10. The waste gasifying and melting furnace according 55
 to claim 9, wherein the sleeve for tap hole according
 to any one of claims 1 to 8 is equipped so as to pen-
 etrate a furnace body refractory.
11. A method for exchanging a sleeve for tap hole com-
 prising the steps of:
 closing a tap hole of a waste gasifying and melt-
 ing furnace which is equipped with the sleeve
 for tap hole according to any one of claims 1 to
 8 by using a mud gun;
 cutting the external sleeve of the sleeve for tap
 hole by boring;
 taking out the sleeve for tap hole; and
 mounting a new sleeve for tap hole similar to
 the taken out sleeve in the portion from which
 the sleeve for tap hole has been taken out after
 mortar is applied to the external surface of the
 new sleeve for tap hole.
12. The method for exchanging a sleeve for tap hole
 according to claim 11, further comprising a step of
 lowering a slag surface below the position of the
 sleeve for tap hole by stopping the supply of coke
 and wastes and the blowing of oxygen-enriched gas
 through a main tuyere.

FIG. 1

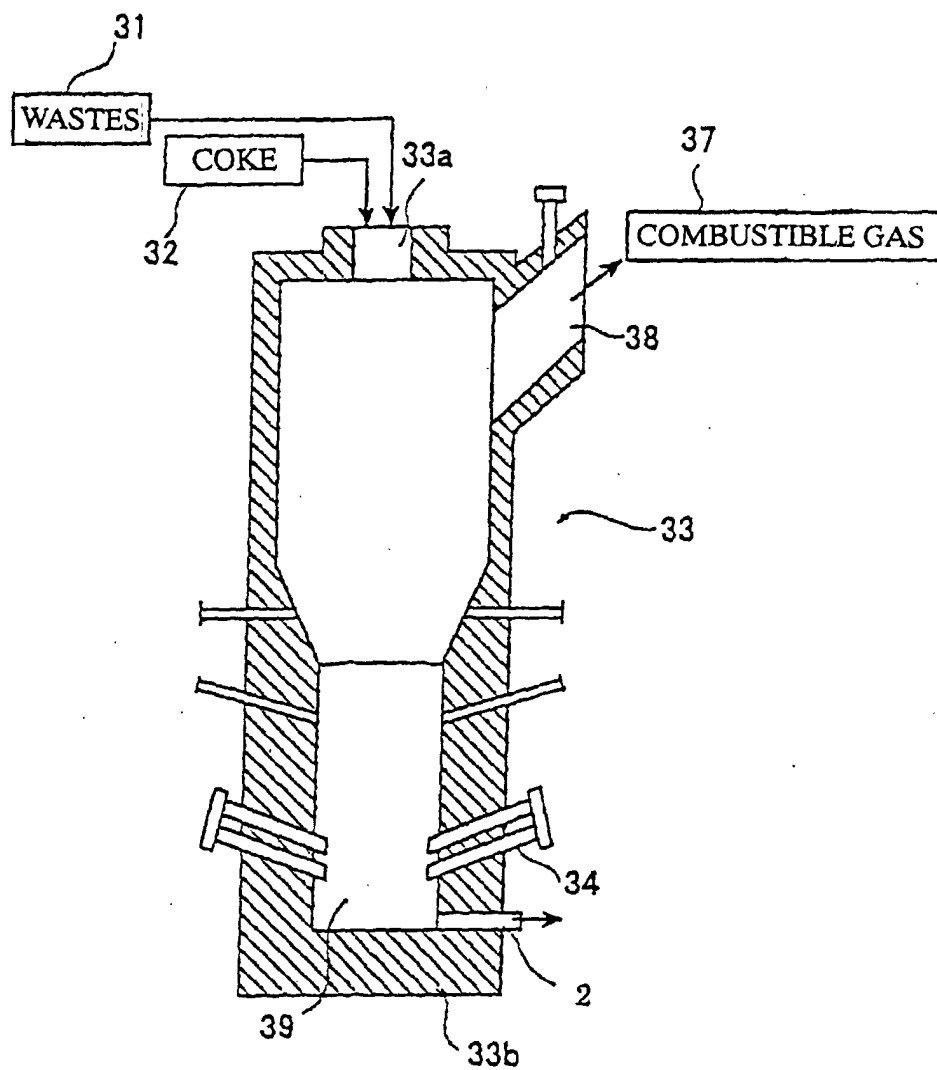


FIG. 2A

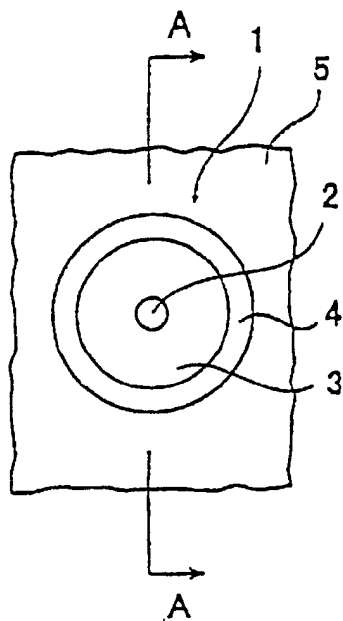


FIG. 2B

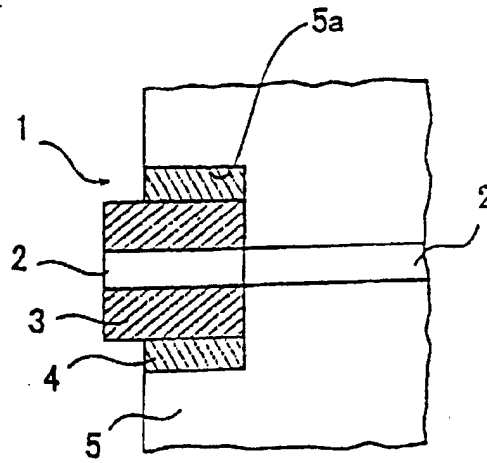


FIG. 3A

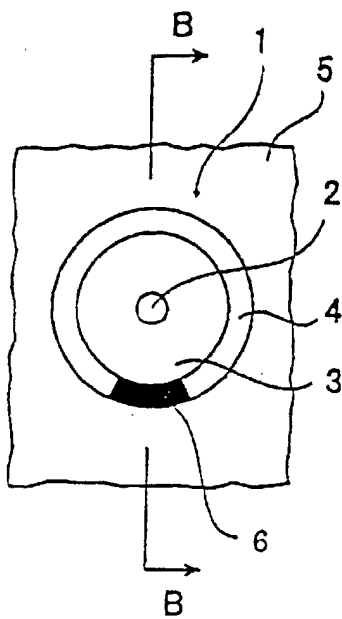


FIG. 3B

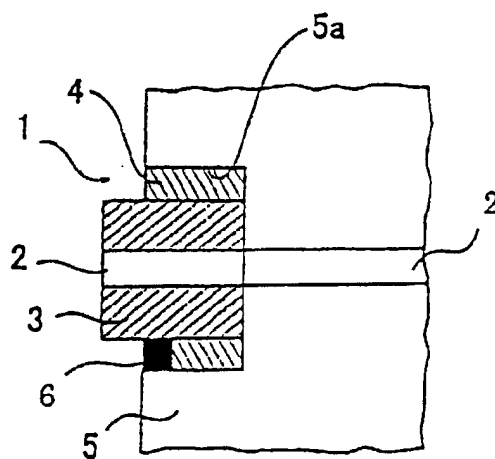


FIG. 4A

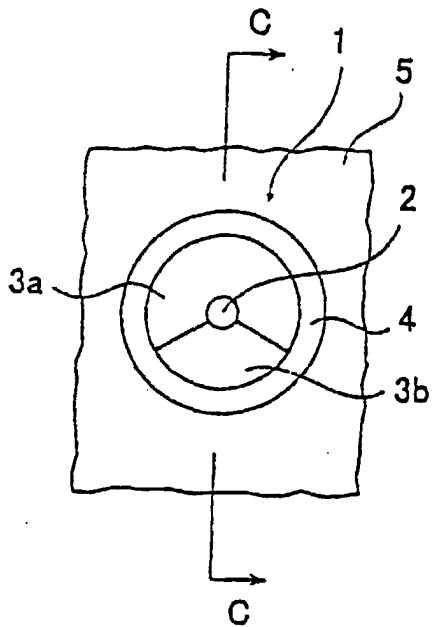


FIG. 4B

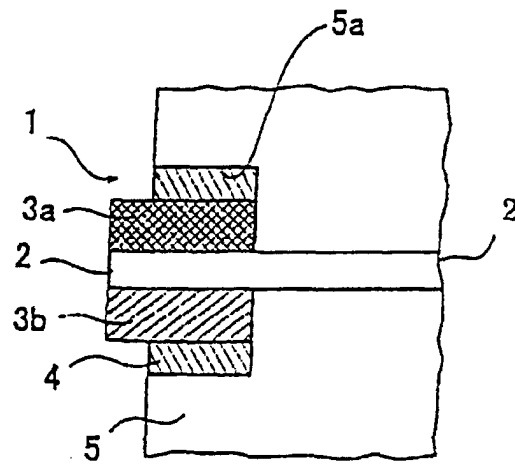


FIG. 5

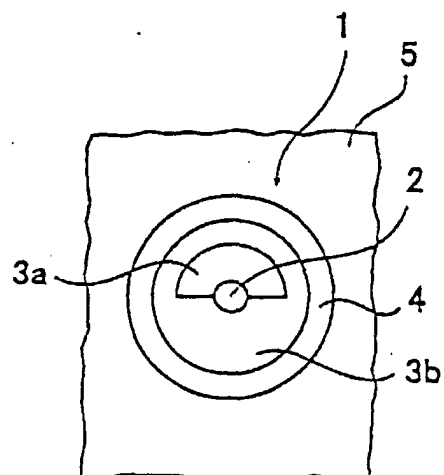


FIG. 6A

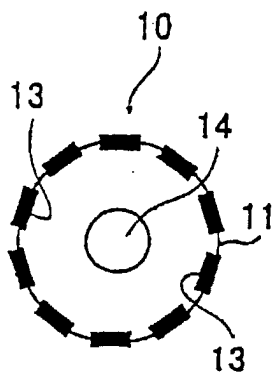


FIG. 6B

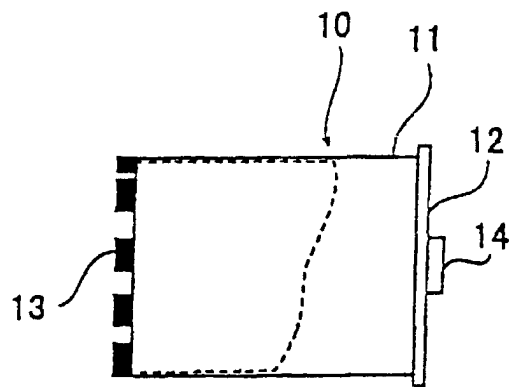


FIG. 7A

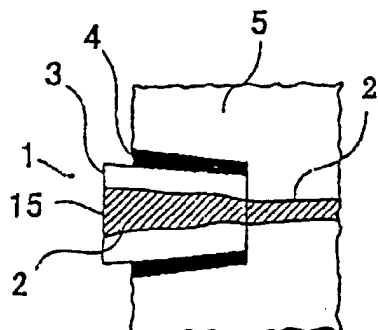


FIG. 7B

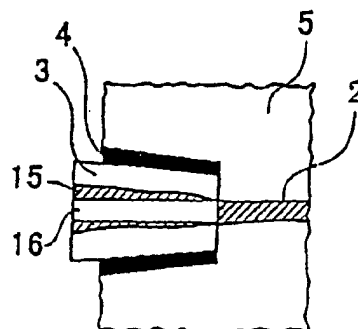


FIG. 7C

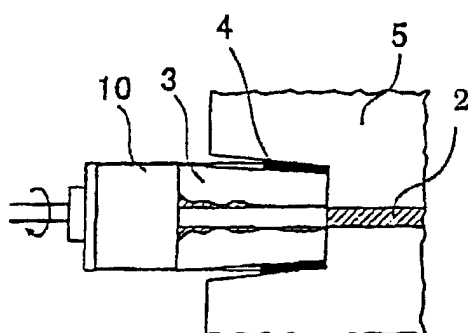


FIG. 7D

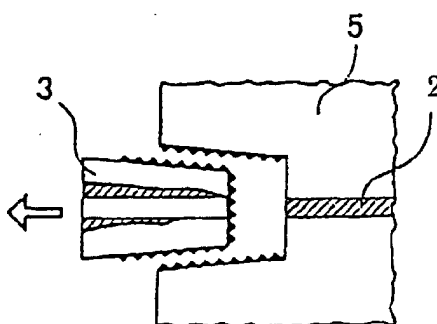


FIG. 7E

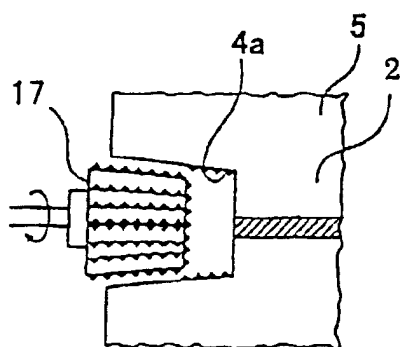


FIG. 7F

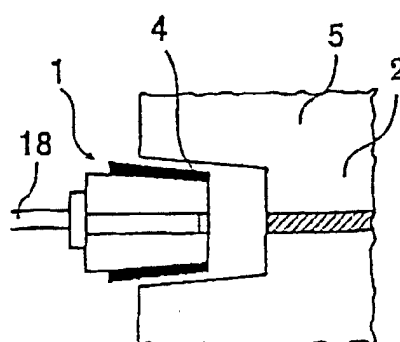


FIG. 8

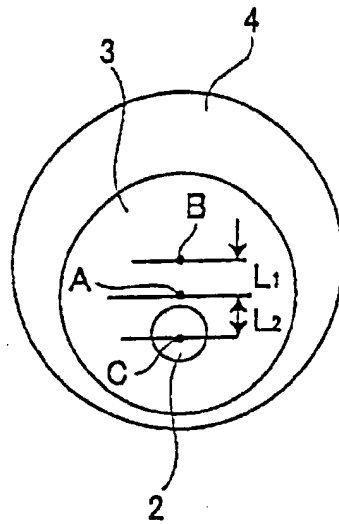


FIG. 9A

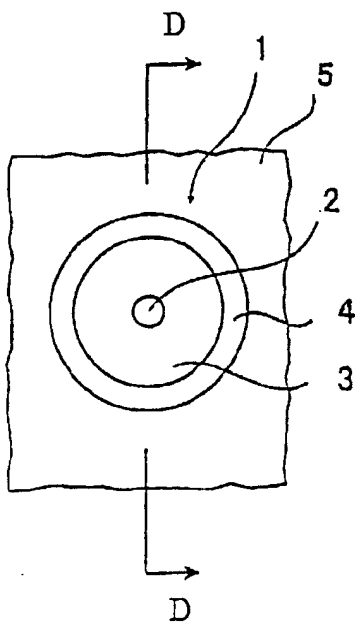
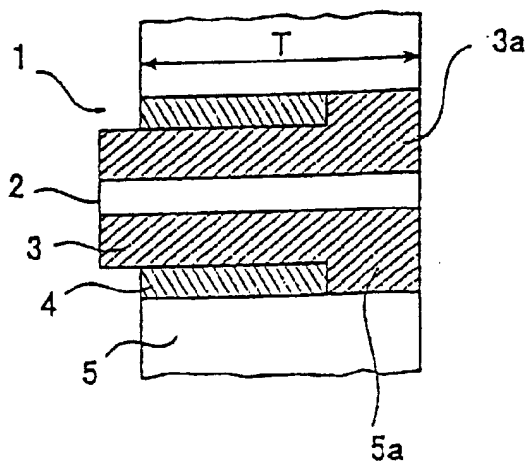


FIG. 9B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/05472

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ F27D3/14, F23J1/00, F23G5/24				
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) Int.Cl. ⁷ F27D3/14, F27B1/00-3/28, F23J1/00, F23G5/24				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2002 Kokai Jitsuyo Shinan Koho 1971-2002 Jitsuyo Shinan Toroku Koho 1996-2002				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
A	JP 63-30016 Y2 (Osaka Gas Co., Ltd.), 11 August, 1988 (11.08.88), (Family: none)	1-12		
A	JP 2000-283447 A (NKK Corp.), 13 October, 2000 (13.10.00), (Family: none)	1-12		
A	JP 2000-283448 A (NKK Corp.), 13 October, 2000 (13.10.00), (Family: none)	1-12		
A	JP 2000-28127 A (Hitachi Zosen Corp.), 25 January, 2000 (25.01.00), (Family: none)	1-12		
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.				
<table border="0"> <tr> <td style="vertical-align: top;"> * Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td style="vertical-align: top;"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family </td> </tr> </table>			* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
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Date of the actual completion of the international search 13 August, 2002 (13.08.02)		Date of mailing of the international search report 27 August, 2002 (27.08.02)		
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Facsimile No.		Telephone No.		

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/05472

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 9-178349 A (Shinagawa Refractories Co., Ltd.), 11 July, 1997 (11.07.97), (Family: none)	1-12
A	JP 7-62168 B2 (Nisshin Steel Co., Ltd.), 05 July, 1995 (05.07.95), (Family: none)	1-12
A	JP 4-325618 A (Tokyo Yogyo Kabushiki Kaisha), 16 November, 1992 (16.11.92), (Family: none)	1-12
A	JP 11-36011 A (Akechi Ceramics Co., Ltd.), 09 February, 1999 (09.02.99), (Family: none)	1-12

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