(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 290 532 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
07.03.2018 Bulletin 2018/10

(21) Application number: **15910651.7**

(22) Date of filing: **17.12.2015**

(51) Int Cl.:
C21C 5/48 *(2006.01)* ***C21C 7/072*** *(2006.01)*

(86) International application number:
PCT/JP2015/006284

(87) International publication number:
WO 2017/103959 (22.06.2017 Gazette 2017/25)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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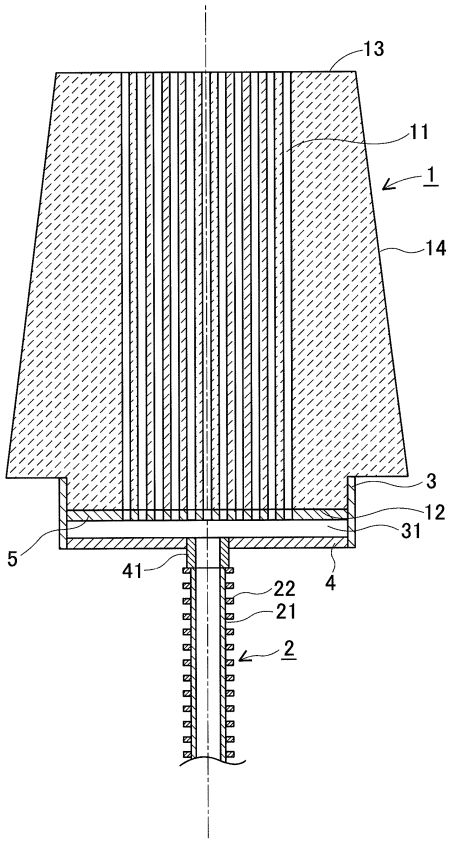
(54) **BOTTOM-BLOWING PLUG WITH IMPROVED WORKABILITY**

(57) Providing a bottom-blowing plug, which can be easily or readily built in into the bottom of a furnace, such as a converter furnace. Some or all of a gas supply conduit 2, which sends a gas to a plug body 1, includes a bending/folding-free conduit.

Fig. 1



EP 3 290 532 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a gas-injecting plug for molten metal. Specifically, it relates to a bottom-blowing plug that is aimed at injecting a gas into a metallic molten metal in a converter furnace, and the like, and which is to be built in into a bottom wall of the converter furnace, and so forth.

BACKGROUND ART

[0002] In converter furnaces, it has been heretofore carried out conventionally to inject a gas from a bottom-blowing plug, which is buried in the bottom portion of a converter furnace, in order to facilitate refining or stir molten steel, and the like.

[0003] The bottom portion of a converter furnace makes such a rough or simplified structure as illustrated in a vertical end-face diagram shown in Fig. 4. 10 designates an iron cladding of the bottom part of a furnace, and 20 designates a tuyere for injecting a gas. A permanent brick 9 is lined on the iron cladding 10 of the furnace-bottom part, and then a working brick 5 is laminated on this permanent brick 9. Moreover, the above-mentioned working brick 5 is available in such an instance that it makes a double-layer lining by a lower-layer brick 5b and an upper-layer brick 5a, as shown in Fig. 4; or in such another instance that it makes a one-layer lining by employing a long-length brick having a layer thickness to an extent of the upper and lower two layers. In the drawing, 6 designates a long-length integrated brick forming the tuyere, 7 designates a trunk portion of the furnace, and 8 designates a tapping port (see Patent Literature No. 1, for instance).

Related Technical Literature

Patent Literature

[0004] Patent Literature No. 1: Japanese Unexamined Patent Publication (KOKAI) Gazette No. 5-70819

SUMMARY OF THE INVENTION

Assignment to be Solved by the Invention

[0005] Since a refractory brick for converter furnace is exposed to high-temperature molten metals to be corroded, it needs to undergo relining regularly. When relining the converter-furnace bricks, it has been carried out to line bricks in the vertical direction and horizontal direction from a predetermined positon in the iron cladding; or, in a certain case, they are lined concentrically about the predetermined position serving as the center.

[0006] With regard to a bottom-blowing plug as well, the bottom-blowing plug is built in at a location, which is close to a position disposed, depending on the lining order of the refractory bricks, in the iron cladding, to let a gas supply conduit of the bottom-blowing plug pass through it.

[0007] There might possibly occur a case where such an inconvenience arises that the gas supply conduit of the bottom-blowing plug does not come into a hole for the gas-supply conduit in the iron cladding because of errors occurring at the time of lining and sticking the refractory bricks. In particular, when working with multiple plugs in the case where they are an interpolation (or inner-insertion) type bottom-blowing plug, respectively, the inconvenience might possibly arise so that the gas supply conduit of the bottom-blowing plugs does not come into the hole in the iron cladding because the hole in the iron cladding is small at the tuyere (see Fig. 4). If such is the case, the refractory bricks are exchanged for the other refractory bricks, or operations are done to adjust the position of the bottom-blowing plugs by scraping or grinding off some of the refractory bricks. However, such operations require a considerable time, so that such another inconvenience might possibly arise that the time for maintaining or repairing a converter furnace has become longer.

[0008] The present invention has been made in view of the above-mentioned problems. Hence, it is an assignment to the present invention to provide a bottom-blowing plug, which can be easily or readily built in into the bottom of a furnace, such as a converter furnace.

Means for Solving the Assignment

[0009] A bottom-blowing plug according to the present invention, which is made to solve the assignment, comprises: a plug body for spouting a gas, the plug body disposed in a furnace-bottom refractory for the bottom of a furnace, such as a converter furnace; and a gas supply conduit for supplying the gas to the plug body, some or all of the gas supply conduit including a bending/folding-free conduit.

[0010] Since some or all of the gas supply conduit includes a bending/folding-free conduit, it is possible to insert the gas supply conduit easily or readily into a hole in an iron cladding into which the gas supply conduit is to be inserted. As a result, it is possible to build in the bottom-blowing plug easily or readily into the furnace bottom.

[0011] In the aforementioned bottom-blowing plug, the bending/folding-free conduit can preferably include a flexible hose and/or a bellows. Note that the bending/folding-free conduit needs to exhibit heat resistance, pressure resistance, and airtightness.

[0012] Moreover, the plug body can preferably have a sector-type horizontal cross-sectional configuration. Thus, it becomes easy or ready to build in the bottom-blowing plug so as to enclose a furnace core while making the furnace core serve as the center.

[0013] In addition, the plug body can preferably be

equipped with multiple through bores. Thus, the bores, through which a gas is to be injected, come not to be clogged or blocked by a molten metal.

Effect of the Invention

[0014] Since some or all of the gas supply conduit includes a bending/folding-free conduit, it is possible to insert the gas supply conduit easily or readily into a hole, into which the gas supply conduit is to be inserted, in an iron cladding of a converter furnace.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a vertical cross-sectional diagram of a bottom-blowing plug according to an embodiment of the present invention;

Fig. 2 is a horizontal cross-sectional diagram of the bottom-blowing plug according to the embodiment of the present invention;

Fig. 3 is a partial end-face view diagram illustrating a modified embodiment of a bending/folding-free conduit; and

Fig. 4 is a vertical cross-sectional diagram illustrating a rough or simplified structure of a converter furnace at the bottom.

MODE FOR CARRYING OUT THE INVENTION

[0016] Hereinafter, an embodiment according to the present invention, a bottom-blowing plug that is disposed in a furnace-bottom refractory for the bottom of a furnace, such as a converter furnace, will be described concretely with reference to Figs. 1 and 2.

[0017] As illustrated in Fig. 1, a bottom-blowing plug according to the embodiment is constituted of a plug body 1 provided with multiple through bores 11, and a bending/folding-free conduit 2 installed to a downside of the plug body 1.

[0018] The plug body 1 is formed as a trapezoidal shape whose upper side is made smaller and lower side is made larger in the vertical cross section, and comprises a flat upper face 13, which faces opposite to a molten metal in the converter furnace, a lower face 12, and an outer peripheral face 14. As illustrated in Fig. 2, the outer peripheral face 14 of the plug body 1 includes two flat faces 14a, and curved faces (14b, 14c). The curved face 14b makes an arc of a circle whose center is a furnace-core center "O" of the converter furnace and which has a radius "R_0," whereas the curved face 14c makes an arc of another circle whose center is the furnace-core center "O" and which has a radius "R_1" (> "R_0").

[0019] Abase 3, which forms a gas chamber 31, is attached onto the lower face 12 of the plug body 1. The gas chamber 31, to which the lower portion of the through bores 11 opens, is disposed in the downside of the plug body 1, and the bending/folding-free conduit 2 communicates with the gas chamber 31.

[0020] For a refractory material quality of the plug body 1, a long-service-life or highly-durable magnesia/carbonaceous material is desirable.

[0021] As illustrated in Fig. 2, the through bores 11 have a horizontal cross-sectional configuration formed as a circular shape, and are additionally disposed to elongate along the axial center line of the plug body 1. Moreover, the respective bores 11 open not only in the top face 13 of the plug body 11 but also in the bottom face 12, and accordingly make it possible to inject a gas into a molten metal. In the plug body 1 according to the present embodiment, 90 pieces of the through bores 11 are arranged at equal intervals on 6 pieces of imaginary concentric regular hexagons.

[0022] (> The gas chamber 31 is formed by plugging the cylinder-shaped base 3 at the downside with a disk 4. An installation port 41, which is arranged concentrically with the plug body 1, is disposed fixedly onto the disk 4 at the center. Note that 5 designates a metallic disk coming in contact with the lower face 12 of the plug body 1.

[0023] Onto the installation port 41, one of the opposite ends of the bending/folding-free conduit 2 is connected in series. The bending/folding-free conduit 2, which is made of metal, comprises a thin-thickness pipe 21, and a member 22 wound spirally around the pipe 21 on the outer periphery; and excels in the heat resistance, pressure resistance and airtightness. The spirally-wound member 22 operates to retain a circular cross section even when the thin-thickness pipe 21 bends.

[0024] The bending/folding-free conduit 2 can also be a flexible hose 2A shown in Fig. 3. The flexible hose 2A is made by covering the outer periphery of a core tube $2A_1$, which is made of stainless steel, with an over braid $2A_2$, which is made of stainless steel. Note that $2A_3$ designates an end connection made of stainless steel. The core tube $2A_1$ is a kind of bellows, and the over braid $2A_2$ is a fabric made of stainless-steel wire.

[0025] The flexible hose 2A is superior to the bending/holding-free conduit 2 in the bending/folding property, heat resistance, pressure resistance, and airtightness.

[0026] (> The bending/folding-free conduit 2 can even be a bellows.

[0027] In the bottom-blowing plug according to the present embodiment, although all of the gas supply conduit 2, which communicates with the gas chamber 31, includes a bending/folding-free conduit, some of it can also include the bending/folding-free conduit partially.

[0028] In an injection plug according to the embodiment, since a gas supply conduit, which supplies a gas to the through bores 11 in the plug body 1, comprises the bending/folding-free conduit 2, the gas supply conduit can be inserted easily or readily into a hole in a converter furnace's iron cladding into which the gas supply conduit is to be inserted.

[0029] Moreover, since the injection plug according to the embodiment comprises: the curved face 14b making

an arc of a circle whose center is the furnace-core center "O" of a converter furnace and which has a radius "R_0"; and the curved face 14c making an arc of another circle whose center is the furnace-core center "O" and which has a radius "R_1" (> "R_0"), it becomes easy or ready to build in a bottom-blowing plug so as to enclose a furnace core while making the furnace core serve as the center.

Explanation on Reference Numerals

[0030]

1: Plug Body;
2: Bending/folding-free Conduit;
2A: Flexible Hose

Claims

1. A bottom-blowing plug comprising: a plug body for spouting a gas, the plug body disposed in a furnace-bottom refractory for the bottom of a furnace, such as a converter furnace; and a gas supply conduit for supplying the gas to the plug body, some or all of the gas supply conduit including a bending/folding-free conduit.

2. The bottom-blowing plug as set forth in claim 1, wherein the bending/folding-free conduit includes a flexible hose and/or a bellows.

Fig. 1

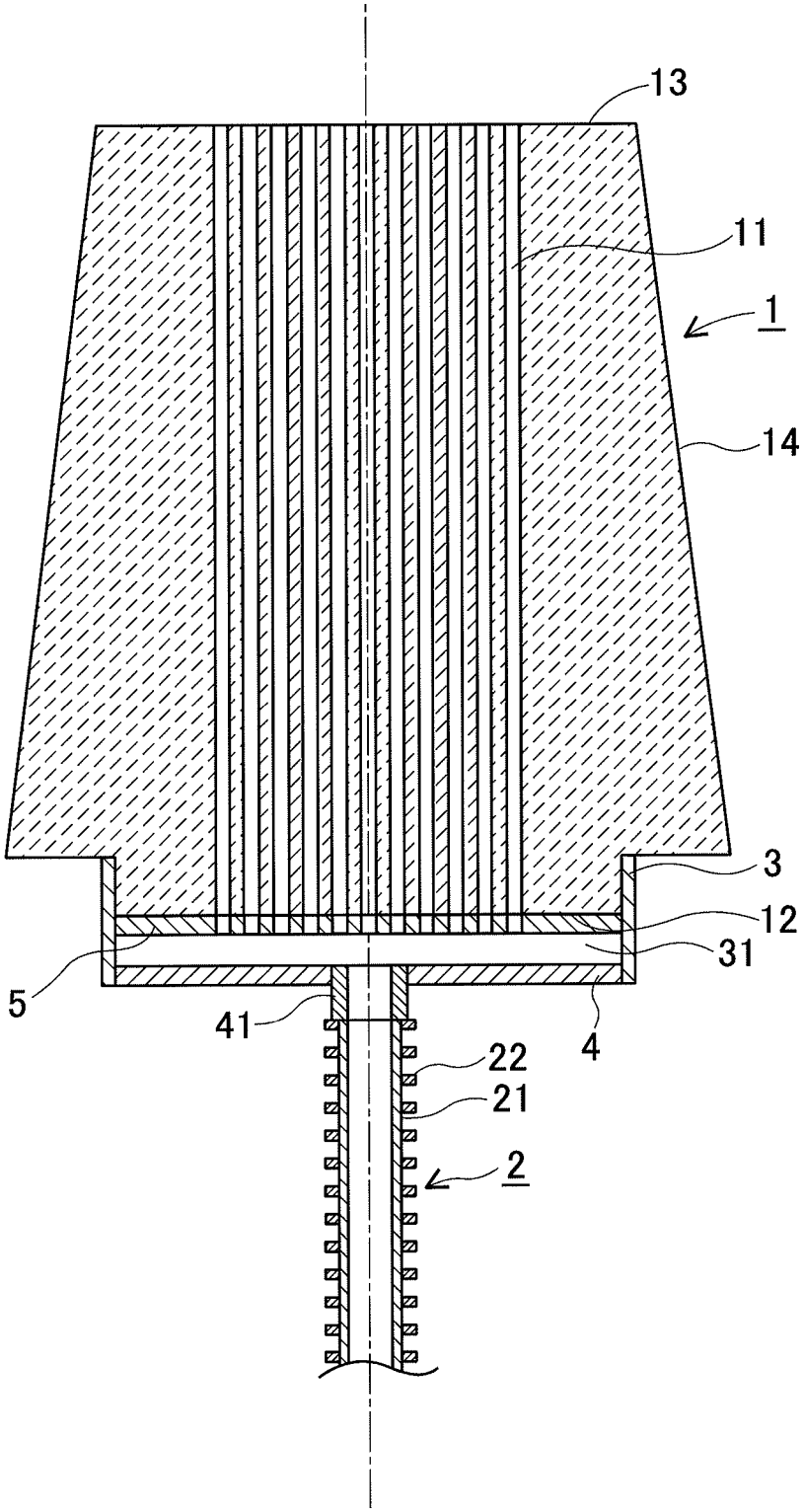


Fig. 2

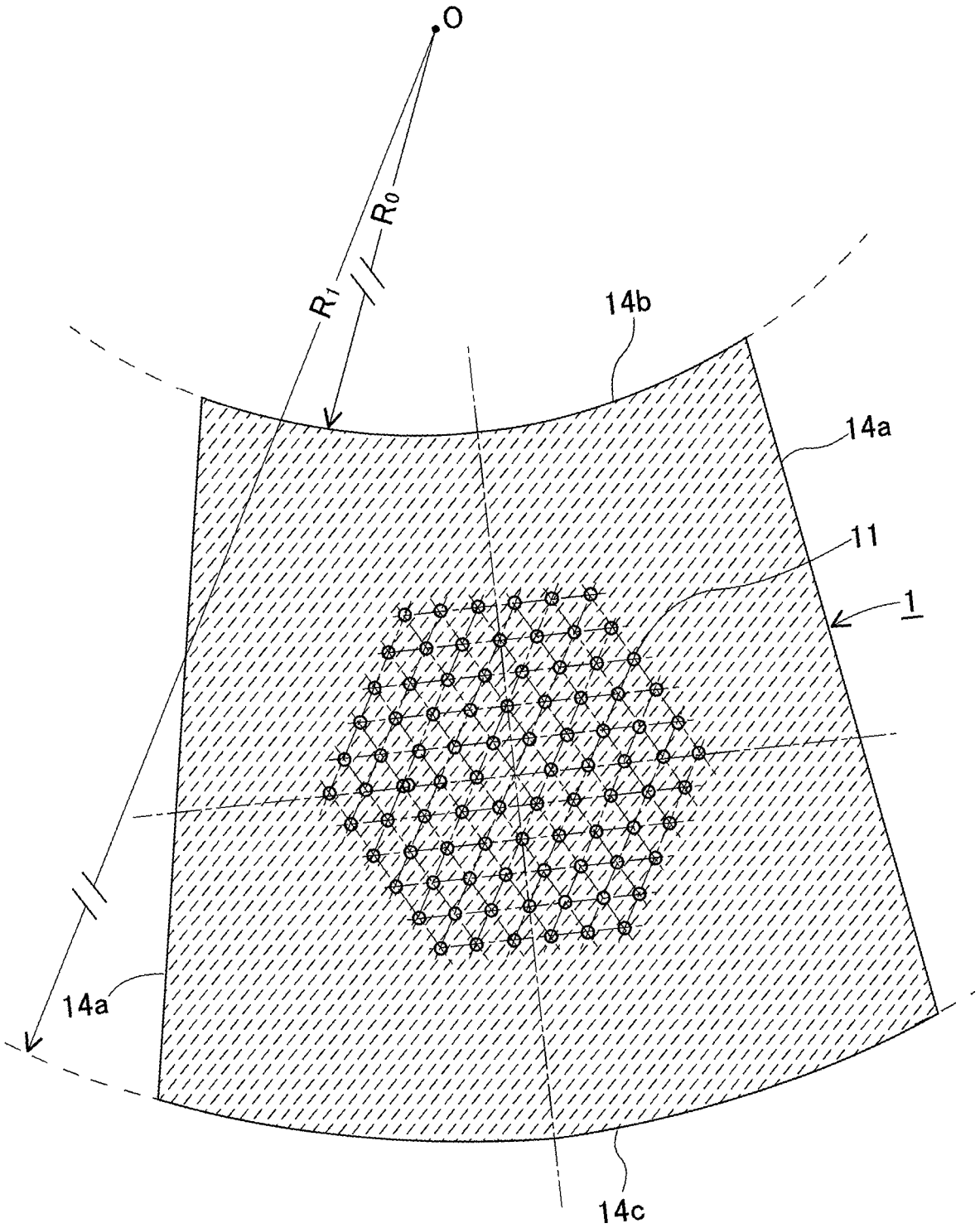


Fig. 3

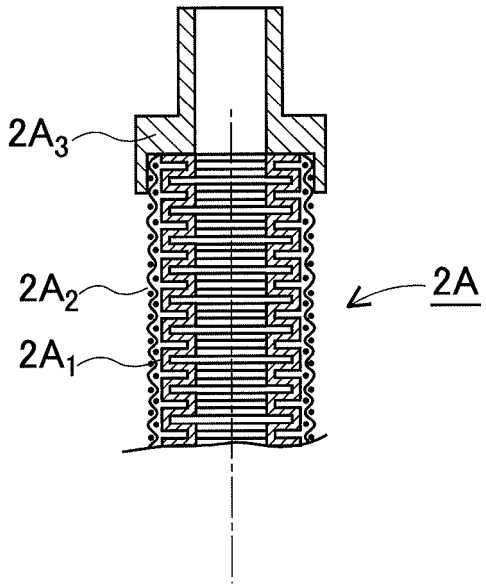
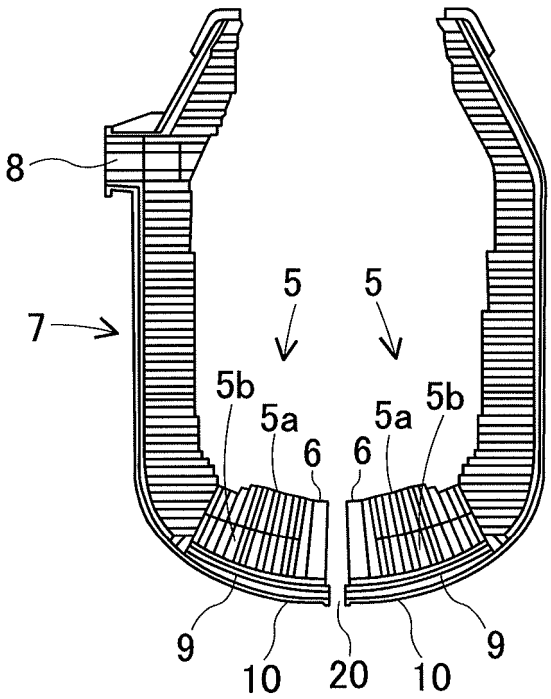


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/006284

A. CLASSIFICATION OF SUBJECT MATTER
C21C5/48(2006.01)i, *C21C7/072*(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)
C21C5/48, C21C7/072

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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.
X	JP 57-85940 A (Sumitomo Metal Industries, Ltd.), 28 May 1982 (28.05.1982), page 2, upper right column, line 12 to lower left column, line 5; fig. 1 (Family: none)	1,2
X	US 4502670 A (GOEBEL,R.Gunther), 05 May 1985 (05.05.1985), column 3, lines 55, 56; fig. 2 (Family: none)	1,2

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
01 March 2016 (01.03.16)	15 March 2016 (15.03.16)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/006284

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 2612676 Y (VANADIUM-EXTRACTING AND STEEL-MAKING PLANT OF PANZHIHUA NEW STEEL & VANADIUM CO., LTD.), 21 April 2004 (21.04.2004), claims; page 4, lines 14 to 22; fig. 3 (Family: none)	1,2
A	JP 2007-262471 A (TYK Corp.), 11 October 2007 (11.10.2007), entire text (Family: none)	1,2

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 5070819 A **[0004]**