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(54) Title: DEVICE FOR ADDING FLUID TO A LIQUID

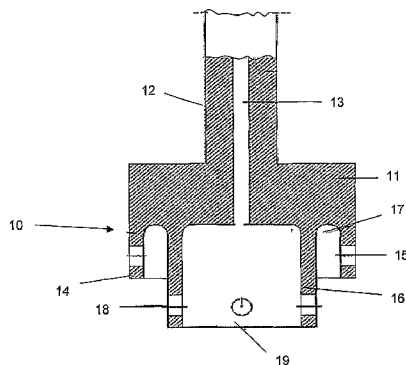


Fig. 1

(57) Abstract: Device for adding a fluid to a liquid, for example of gas and/or particles to liquid metal. A rotor is rotated immersed in the liquid, comprising a hollow rotational body 10 with a first inner annular wall 16 with at least one radial opening 18 from a central, cylindrical chamber 19 and with an opening directed downwards. The rotational body is carried by a generally vertical shaft 12 which is connected to a powering unit and which may be arranged to lift the rotational body out of, respectively lower it into the liquid. Outside the central annular wall 16 of the rotational body 10 a further annular wall 14 which forms an annular chamber 17 is arranged, which communicates with the central chamber through the one or more radial openings 18. Advantages are achieved by that the one or more of the radial openings 18 are arranged in the lower part of the inner annular wall 16 of the rotational body, in a area which projects down under the surrounding additional annular wall 14.

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Device for adding fluid to a liquid

The invention relates to a device as described in the introductory part of claim 1, for adding fluid to a liquid. The term "fluid" should here be understood as a gas, a liquid or a mix of these, possibly
5 with the addition of particles. Some particle masses may also be treated and transported as a fluid.

Background

For some purposes there is a need for treatment of liquids, such as melted metals, by addition of a fluid. Particularly actual fluids in connection with metal melting are a gas and/or a particular
10 material. For this purpose it is known to use a device with a rotor which is submerged in the liquid and where a fluid, that is gas and/or particles, is added through the inner part of the rotor.

Such a rotor may comprise a hollow rotational body with openings in the bottom and the side, which is mounted and driven via a shaft by a driving unit and that is arranged to be lifted out of
15 and lowered into the liquid. When a gas reacts with a liquid, the speed of the reaction will be a function of the surface of the gas bubbles that is in inverse ratio with the diameter of the gas bubbles. That is, gas bubbles with a small diameter are desired.

Generally there is a desire for rotors in treatment of liquid, in particular treatment of melted
20 metals, that the addition of gas or a particular material is effective. At the other side, there is also a desire not to create too much stirring or turbulence which causes a turbulent surface and whirls in the liquid and thereby causes an increased addition of undesirable gas from the environment (atmosphere).

It is previously known equipment for treatment and addition of a particular material in a liquid as
25 mentioned above. Thus it is known from the inventors Norwegian patent 155447 a rotor for treatment and addition of material in a liquid where the rotor is constituted by a symmetric rotational hollow body, and where the material is added to the liquid via a bore in the rotor shaft and further out through a hole in the side of the hollow body together with the liquid, which due
30 to the centripetal force is sucked in through an opening in the bottom and circulate through the body.

From the inventors own patent Norwegian patent application 19983142 it appears a solution by rotors for treatment of liquid where the efficiency when intermixing gas or particles into a liquid is
35 close to doubled, but where the stirring is maintained unchanged related to the design shown in

NO 155447. Further it is reached a solution by rotors where the use of gas/particles is less than the half.

From the Norwegian patent 307289 it is known a device for addition of a fluid to a liquid, for
5 example of gas and/or particles to a liquid metal, with a rotor which is driven immersed in the
liquid and which comprises a hollow rotational body with a first inner annular wall and at least one
radial opening from a centrally, cylinder shaped hollow room with an opening facing downwards,
as the rotational body is carried by a generally vertical shaft which is connected to a driving unit
and which may be arranged to lift the rotational body out, respectively lower it into the liquid,
10 where it outside the central annular wall of the rotational body is arranged an additional annular
wall which forms an annular chamber, which communicates with the central chamber through the
one or more radial openings.

A disadvantage of this design of the rotor is that liquid which contains bubbles or powder, and
15 which comes out of the central chamber, comes into an annular chamber with a narrow opening
and small volume for mixing the bubbles or powder into the liquid. What would have been
satisfactory in a liquid with low specific weight, for example water, does not work satisfactory in
liquid metal, for example aluminium.

20 **Purpose**

The main purpose of the invention is to create such a device in connection with a rotor used for
addition of a fluid, where the efficiency of the intermixture is further improved. It is particularly
desirable to increase the efficiency when adding gas or gas mixtures containing particles, where
big size of the bubbles reduces the efficiency.

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The invention

The invention is described in claim 1. The one or more radial openings is arranged in the lower part
of the inner annular wall of the rotational body, in an area which extends down under the
surrounding further annular wall.

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By the fact that the added fluid passes the annular wall inn this way, the intermixture becomes
more effective.

Particularly this is valid for gas, where more openings means smaller bubble diameter.

The rotor of the device according to the invention will, when gas bubbles are supplied, provides that the gas bubbles emerging from the inner row of holes will be sucked into the one or more other annular rooms so that the gas is treated several times. A corresponding increase of the intermixture will be achieved when supplying other fluids.

5

The dependant claims 2 – 5 describes advantageous features of the invention.

Example

The invention will in the following be described more closely by help of example and with
10 reference to the accompanying drawings where:

Fig. 1 shows an axial intersection through one embodiment of the invention with one extra annular wall, while

Fig. 2 shows a corresponding axial intersection through a further embodiment of a rotor according to the invention with more extra inner annular walls.

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Fig. 1 shows an example of a rotor 10 according to the invention. It comprises a rotational symmetrical main part 11, preferably cylindrical, which is carried by an upwards projecting driven rotor shaft 12 with vertical axis and with a central channel 13.

20 At the outer edge of the main part 11 there is an outer annular wall 14 which projects downwards with four evenly distributed side holes 15. Between the outer annular wall 14 and an inner concentric annular wall 16 an annular chamber 17 is arranged. The inner concentric annular wall 16 projects downwards below the outer annular wall 14 and has in the projecting area, four evenly distributed side holes 18. Thereby the side holes 18 will end below the mouth of the annular
25 chamber 17. The inner annular wall forms a cylindrical chamber 19 which is supplied with fluid through the central channel 13. The fluid may be a gas and/or particle formed material.

The rotor 10 operates in the following way: It is lowered into a liquid, for example a liquid metal, and is rotated. The liquid will then, due to the rotation of the rotor and thereby the centripetal
30 force which is generated in the fluid, be sucked up in the inner chamber 19 and the annular chamber 17. Gas and/or particles which are supplied through the channel 13 in the rotor shaft 12 will be pressed through the holes 18 out in the surrounding liquid. At the same time, due to the buoyancy and suction, a large part of gas and particles will enter into the annular chamber 17 and emerge through the side holes 15.

Moreover the invention is not limited to one extra annular wall, but may be provided with two or more additional annular walls. Fig. 2 shows an example of a rotor 20 where it is used one outer annular wall 21 and three stepped downwards projecting additional annular walls 22, 23, 24. Between these annular walls three annular chambers are formed, an inner annular chamber 25, an
5 intermediate chamber 26 and an outer chamber 27.

The annular walls 22 – 24 have four side holes 18 in the lower part, in a similar way as in the example embodiment in Fig. 1.

Claims

1. Device for adding a fluid to a liquid, for example of gas and/or particles to liquid metal, with a rotor which is driven immersed in the liquid and which comprises a hollow rotational body (10) with a first, inner annular wall (16) with at least one radial opening (18) from a central, cylindrical shaped hollow room (19) with an opening directed downwards, as the rotational body is carried by a generally vertical shaft (12) and is connected to a driving unit and which may be arranged to lift the rotational body out, respectively lower it into the liquid, where it outside the central annular wall (16) of the rotational body (10) is arranged a further annular wall (14) which forms an annular chamber (17), which communicates with the central room through the one or more radial openings (18), **characterized in** that the one or more radial openings (18) are arranged in the lower part of the inner annular wall (16) of the rotational body, in an area projecting below the surrounding additional annular wall (14).
2. Device according to claim 1, **characterized in** that the hollow rotational body (10) comprises more than two generally concentric annular walls (21 – 24), providing two or more annular rooms (25, 26, 27) outside the central hollow room, whereby the fluid is supplied to the central hollow room (19) and further to the annular rooms (21 – 24) and to the liquid via at least one opening (18) in each annular wall (21 – 24), as the radial openings (18) are arranged in the lower part of each annular wall.
3. Device according to claim 1, **characterized in** that the openings (18) in the annular walls (21 – 24) are placed mutually displaced in the peripheral direction and/or axially related to each other.
4. Device according to one of the claims 1 to 3, **characterized in** that four openings (18) are arranged in each annular wall.
5. Device according to one of the claims 1 to 4, **characterized in** that it comprises four annular walls (21 – 24, Fig. 2).

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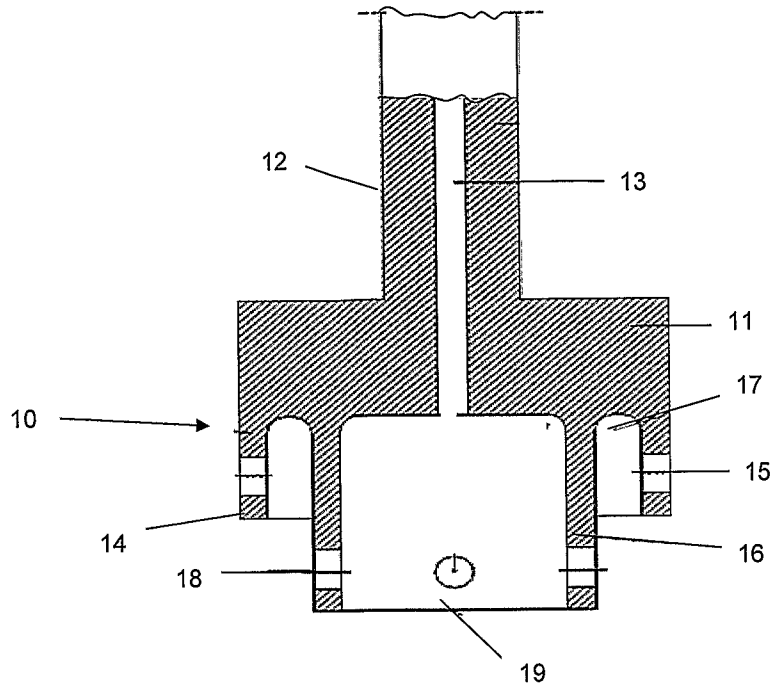


Fig. 1

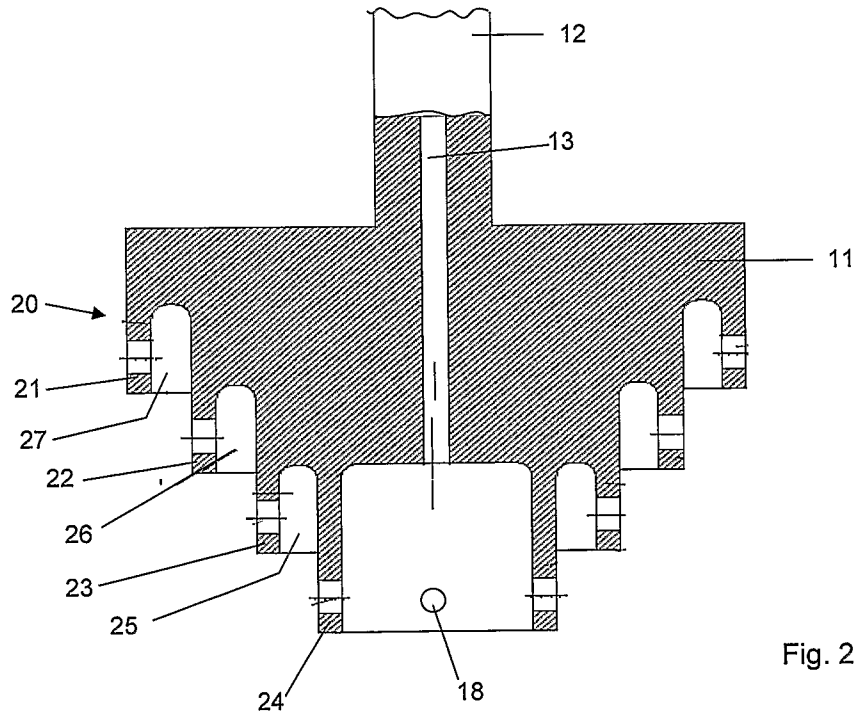


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 2009/000089

A. CLASSIFICATION OF SUBJECT MATTER

IPC 8 B01F3/04 (2006.01), F27D23/04 (2006.01), C22B9/05 (2006.01), C21C7/072 (2006.01)

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 B01F, F27D, C22B, C21C

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

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

EPODOC, WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0970740 B1 (INGENIOR KARL VENAS AS) 12 January 2000 see whole document	1-5
Y	US 3972709 A (SOUTHWIRE COMPANY) 3 August 1976 see whole document	1-5

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

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"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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INTERNATIONAL SEARCH REPORT
Information on patent family members

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PCT/NO 2009/000089

Patent document cited in search report		Publication date	Patent family member (s)	Publication date
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