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

(11) Publication number: **0 409 805 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **90830318.3**

(51) Int. Cl.5: **B22D 27/15**, B22D 21/00

(22) Date of filing: **10.07.90**

(30) Priority: **18.07.89 IT 4819989**

(43) Date of publication of application:
23.01.91 Bulletin 91/04

(84) Designated Contracting States:
CH DE ES FR GB IT LI SE

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(54) A device for the decontamination of a casting mould, particularly for castings of titanium and the like.

(57) A device (1) for decontaminating casting moulds, particularly for castings of titanium and the like, comprising a sealed chamber (2), at the interior of which the casting mould is placed, said chamber (2) being endowed at the upper side of an opening and closing valve (4) for the connection with an inert gas reservoir, and at the lower side with a thin sheet or foil (6) of a material which doesn't pollute or contaminate the metal to be cast and has a thickness that allows it to withstand the vacuum made at the interior of the sealed chamber (2) and that is porportional to the mass of the casting metal, said sealed chamber (2) having at least one extremity (6, 8) which is removable to allow the casting cylinder to be introduced and, subsequently, to be taken out and to allow a subsequent casting to be performed.

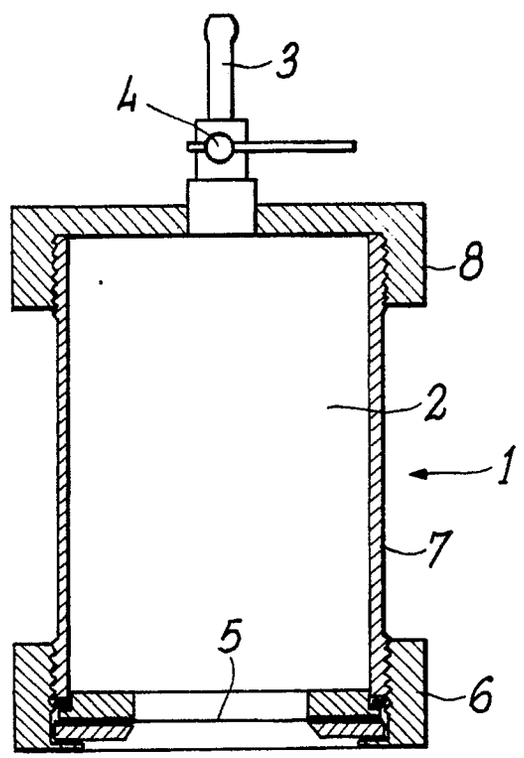

FIG. 2

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A DEVICE FOR THE DECONTAMINATION OF A CASTING MOULD, PARTICULARLY FOR CASTINGS OF TITANIUM AND THE LIKE

The present invention relates to a device for decontaminating casting moulds, particularly for titanium castings and the like.

More particularly, the present invention relates to a device of the said type, particularly suitable for titanium castings, which device allows the decontamination of the casting mould or cylinder to be realized before the latter is inserted into the casting machine, which greatly simplifies the realization and the operation of said castings, and allows casting articles with optimum characteristics to be obtained.

As is well known, investment castings are realized by making a wax model of the article to be obtained, which model is then recovered with a coating of a refractory material.

After the refractory material has hardened, the whole is subjected to a furnace heat treatement, during which the wax sublimes leaving a cavity corresponding to the piece to be obtained at the interior of the coating.

The casting cylinder so obtained is placed at the interior of the casting machine.

The main problem met with in such type of operations, particularly when working titanium, is that due to the contamination by substances, or gases such as O_2, H, N that are contained in the casting chamber or are trapped within the pores of the coating, which takes place in the casting.

The problems of the contamination of the metal due to external elements during the casting are felt particularly when working titanium, as mentioned above, so that we are not yet able to obtain titanium castings with optimum quality characteristics at the present day.

Two main groups of titanium casting machines are pre sently employed.

The first one has a centrifugal system and works on the basis of argon saturation without vacuum.

The second kind of machine is based on argon saturation and it works under vacuum but without any centrifugal system.

It is well known to those skilled in the art that melted metal must not be contaminated from the surrounding atmosphere and the investment material.

Moreover, castings must have accurate fit, with very thin and strong margins.

The first kind of casting machines (centrifugal casting machines) work by argon saturation of the casting chamber and the castings have thin margins and accurate fit, but metal will be contaminated because of absence of vacuum.

The main problem for this kind of machines is that of obtaining the vacuum by sealing the centrifugal system. It is technically very difficult and, mainly, very much expensive.

On the other side, the second kind of machines (vacuum machines), not having the centrifugal system, allows to obtain castings without contamination, but it is impossible to get multiple castings with good thin margins.

The Applicant of the present invention, being well aware of the problems and needs mentioned above, has realized a device which allows all the drawbacks to be obviated, allowing a casting, particularly a titanium casting, to be realized, in a fully decontaminated environment and so an optimum quality article to be obtained.

Moreover, the device according to the present invention does not require the realization of complex sealing systems in the casting chamber of the casting machine, because in said chamber neither the inlet of the inert gases, nor, least of all, a vacuum are to be realized.

In this way it is possible to perform castings with a centrifugal casting machine without the needing of the sealing of the centrifugal system.

In fact, the device according to the invention is used with a centrifugal system and provides an adequate vacuum with helium as the only residual gas.

These and other results are obtained, according to the present invention, by realizing a device which provides a sealed chamber, at the interior of which the casting mould or cylinder, according to the more used casting techniques, particularly the investment casting technique, is placed, said sealed chamber being endowed with opening and closing valves, for the connection with a source of inert gases, preferably of helium or argon, and with the vacuum source, and with a wall made up of a thin sheet of a material, preferably a titanium foil, and of a thickness proportional to the casting mass and to the vacuum that has been made, and such as to become melted into the casting chamber when the molten metal comes into contact with the foil or thin sheet from the crucible and such as not to contaminate the casting itself.

In this way, the decontamination is realized outside of the casting chamber, in an environment of a reduced size as compared to that of the casting chamber, and the device so prepared is directly placed into the chamber. The molten metal flow from the crucible onto the foil and melts it, and is kept in a decontaminated environment, under a vacuum, at the interior of which it is sucked off

realizing an impurity-free casting.

It is therefore a specific object of the present invention a device for decontamination the casting mould, particularly for titanium castings and the like, which device comprises a sealed chamber, at the interior of which the casting cylinder is placed, said device being also endowed on its upper side with a means for the connection to an inert gas reservoir and with a vacuum source, and on the lower side with a thin sheet of a material that doesn't contaminate the metal to be cast, and having a thickness that allows it to withstand the vacuum made at the interior of the sealed chamber, and proportional to the mass of the casting metal, said sealed chamber having at least one removable extremity for allowing the casting cylinder to be introduced and, subsequently, to be taken out, and for allowing the next casting to be prepared.

Said means for the connection to the inert gas reservoir and to the vacuum source may consist, according to the present invention, of a closing and opening valve or of a copper pipe, arranged between an opening made in the sealed chamber and the inert gas reservoir and the vacuum source, which pipe is cut, by crushing its extremities, after having realized the decontamination, so hermetically closing the device itself.

Preferably, said sealed chamber has an upper portion which is removable by threading or other analogous systems.

Moreover, the sealed chamber may have the lower portion as the only removable portion, or both portions may be removable, with systems analogous to those mentioned above.

In a preferred embodiment of the device according to the present invention, said thin sheet is made up of a titanium foil. Said thin sheet may also be made up of a plastic material.

Preferably, the inert gas employed is helium or argon, particularly helium.

The present invention will be now disclosed according to its preferred embodiments with reference particularly to the figures of the enclosed drawings, in which:

Figure 1 is a side view of the device according to the present invention;

Figure 2 is a view of a vertical section of the device of Figure 1;

Figure 3 is a view of a detail of the device of Figure 2, and

Figure 4 shows the device according to the present invetion connected to the source of the inert gases and to the vacuum source.

With reference now to Figures 1 to 3, the device 1 according to this invention provides a cylindrical chamber 2, at the interior of which the casting cylinder is placed, which chamber is hermetically closed and endowed on the upper side with a small connection tube 3 endowed with an opening and closing valve 4.

The lower wall of the chamber 2 consists of a thin sheet 5 of titanium, or of an other non-contaminating plastic or metallic material, of such a thickness as to melt, at the interior of the casting chamber of the casting machine, owing to the metal poured from the crucible, and, moreover, as to withstand the vacuum made at the interior of the chamber 2.

In the embodiment depicted in the figures, the device 1 is realized with the lower portion 6 which is unscrewable with respect to the main body 7, so that the foil 5 may be replaced and the device reemployed.

The upper portion 8 is also unscrewable with respect to the main body 7.

Obviously, the device 1 may be also realized with the body 7 and the lower portion 6 which are integral to each other. In this case, the whole assembly body 7, the lower portion 6, and the thin sheet or foil 5 must be replaced to employ the device itself again.

The matings between the body 7 and the lower portion 6 and the upper portion 8, realized in such a way, as to insure an absolute seal, may also be realized in a different way with respect to the interthreading system shown in the figure.

From Figure 4, an application of the device 1, connected to a tube 9 which is in turn connected to the vacuum source (not shown) by the offtake 10 and to the inert gas source by the offtake 11, can be observed.

On the offtakes 10 and 11 valves 12 and 13 are provided for excluding either or both of them during the preparation cycle. A pressure gauge 14 is provided on the tube 9.

After having prepared the device 1 with the casting cylinder, the small tube 4 is attached to the tube 9 and the valve 4 is opened. Then an inert gas, preferably helium, is let into chamber 2, and then a vacuum is made.

In order to obtain an optimum situation, the same cycle is operated a second time, and then valve 4 is closed.

The chamber 2, with the casting cylinder, is now in a decontaminated environment under vacuum, at the interior of which an optimum casting is obtained.

The device 1 is then ready for being placed into the casting machines.

The use of helium is recommended with respect to other inert gases because it realizes an atmosphere with a better flowing.

As already said, the device 1 according to the present invention may be connected to the inert gas reservoir and to the vacuum source by means

of a copper tube provided on an opening of chamber 2 (which opening is realized in place of valve 4).

In this case, the closing and opening valve will be provided on the inert gas delivering and vacuum-making facility.

Once the decontamination has been performed, it suffices to cut the copper tube by pliers, and to crush its cut extremity so that the necessary seal is obtained.

The present invention has been disclosed with the specific reference to some of its preferred embodiments, but it is to be understood that variations and/or modifications may be made by those who are skilled in the art, without so departing from the scope of the enclosed claims.

Claims

1. A device for decontaminating a casting mould, particularly for titanium castings and the like, characterized in that it comprises a sealed chamber, at the interior of which the casting cylinder is placed, said chamber being endowed at the upper side with means for the connection with an inert gas reservoir and with a vacuum source, and at the lower side with a thin sheet of a material wich doesn't contaminate the metal to be cast and having a thickness that allows it to withstand the vacuum made at the interior of the sealed chamber and that is proportional to the mass of the metal of the casting, said sealed chamber having at least one extremity which is removable to allow the casting cylinder to be introduced and, successively, the same to be taken off and to allow a successive casting to be prepared.

2. A device according to Claim 1, characterized in that said means for the connection with the inert gas reservoir and with the vacuum source consists of an opening and closing valve.

3. A device according to Claim 1, characterized in that said means for the connection with the inert gas reservoir and with the vacuum source consists of a copper tube, having one extremity arranged on an opening provided on said sealed chamber and the other connected to the inert gas reservoir and with the vacuum source, the copper tube being cut, so hermetically closing the sealed chamber, after having performed the decontamination.

4. A device according to any one of Claims 1-3, characterized in that said sealed chamber has its upper portion removable.

5. A device according to any one of Claims 1-3, characterized in that said sealed chamber has its lower portion removable.

6. A device according to any one of Claims 1-3, characterized in that both the upper and the lower portion of the sealed chamber are removable.

7. A device according to any one of Claims 2 to 6, in which said upper and/or lower portion mate with the sealed chamber by threading.

8. A device according to any one of Claims 2 to 6, in which said upper and lower portions mate with said sealed chamber by means of a seal quick-joint.

9. A device according to any one of the preceding claims, characterized in that said thin sheet is made up of a titanium foil.

10. A device according to any one of Claims 1 to 8, characterized in that said thin sheet is made up of a plastic material.

11. A device according to any one of the preceding claims, characterized in that said inert gas is helium.

12. A device according to any one of Claims 1 to 10, characterized in that said inert gas is argon.

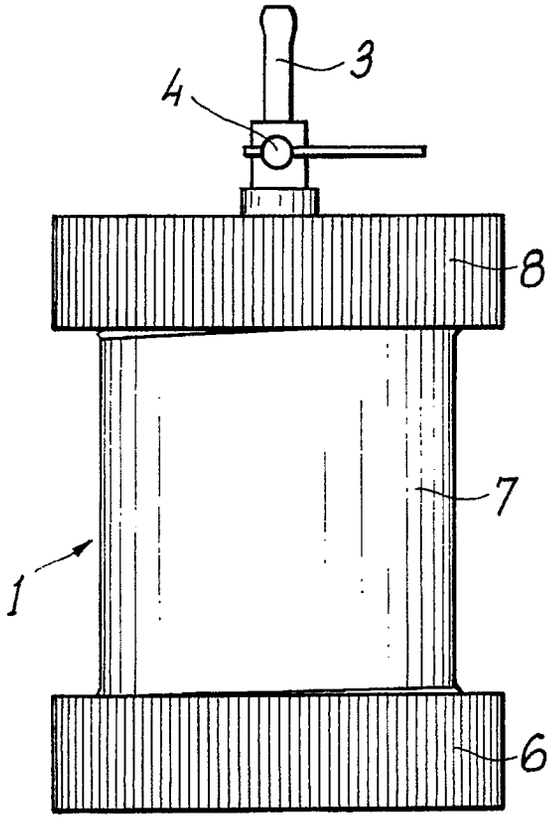

FIG. 1

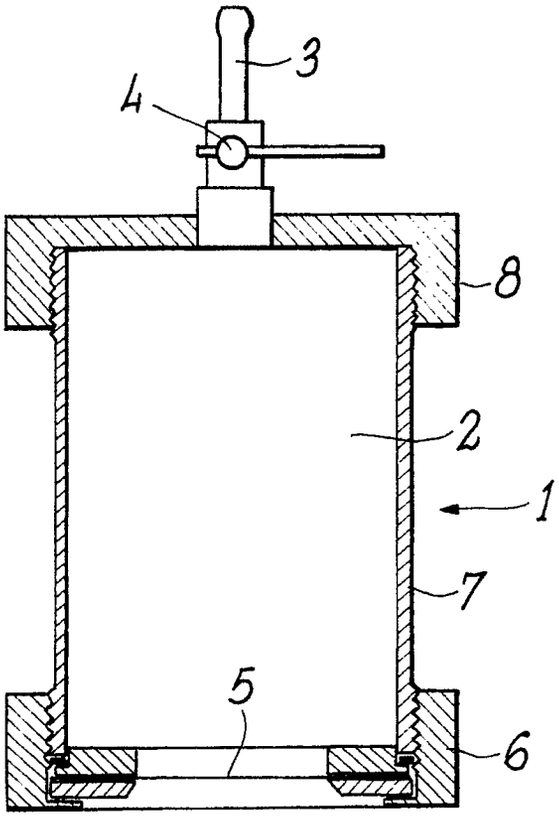

FIG. 2

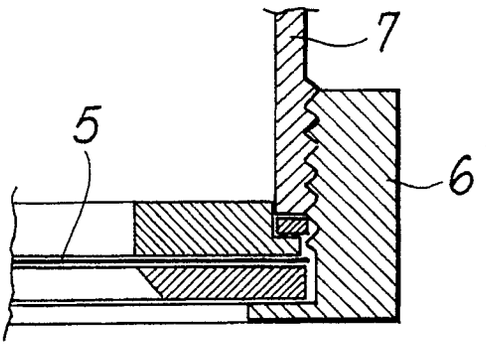

FIG. 3

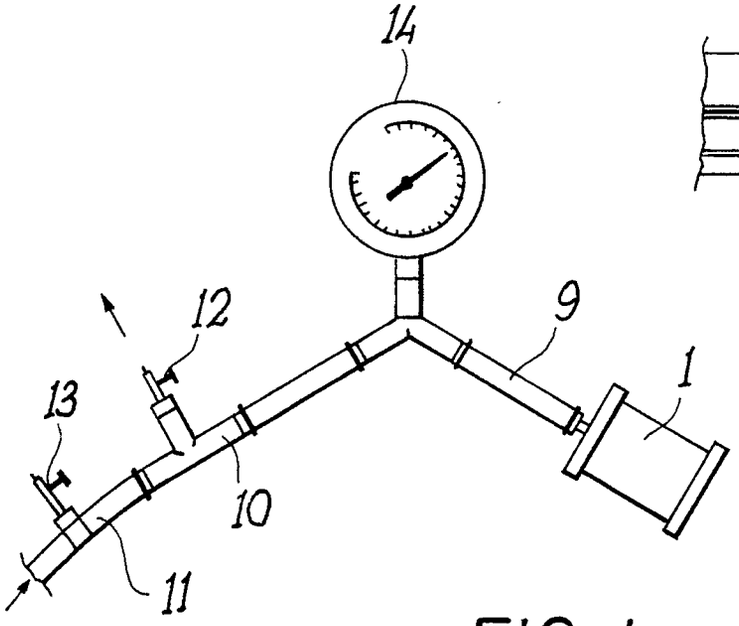

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number

EP 90 83 0318

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-3 682 458 (PIWONKA et al.) ---		B 22 D 27/15 B 22 D 21/00
A	PATENT ABSTRACTS OF JAPAN, vol. 9, no. 18 (M-353), 25th January 1985; & JP-A-59 166 340 (OHARA) 19-09-1984 ---		
A	US-A-4 007 772 (LAEDTKE et al.) ---		
A	GB-A-2 170 742 (MARIO DI MAIO) ---		
A	FOUNDRY TRADE JOURNAL, vol. 162, no. 3373, 7th July 1988, pages 568,570,572; F. HAUZEUR et al.: "Advances in titanium casting" -----		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 22 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17-10-1990	OBERWALLENEY R.P.L.I.

CATEGORY OF CITED DOCUMENTS

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