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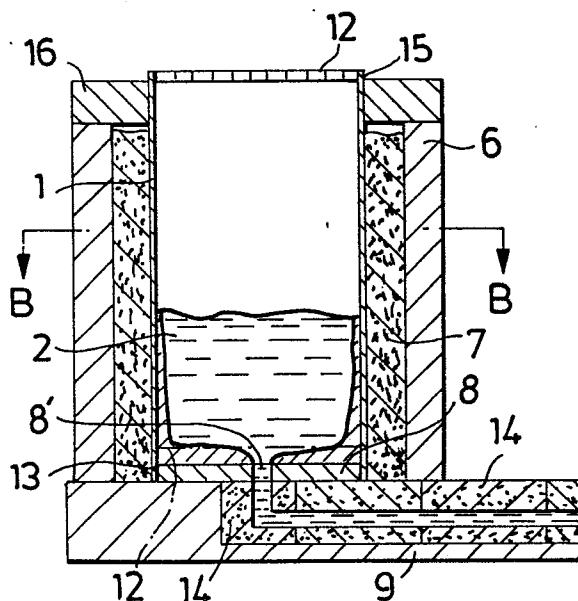
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Method for casting ingots and apparatus for carrying out the method.

A method of casting a metal bath (2) to single ingots, where the bath is supplied into a preferably vertically positioned mould (1), in which the bath solidifies and is moulded to an ingot with a cross-sectional geometry substantially in agreement with the cross-sectional geometry of the mould, and where the bath is supplied, moulded and caused to solidify in a substantially tubular and thin-walled metal casing (1) constituting or comprised by said mould, which casing (1) is caused to follow along with the ingot in process steps subsequent to the casting, which casting is carried out intermittently as down-hill casting where bath in known manner is supplied at an upper portion of the mould, casing, or intermittently as up-hill casting where bath in known manner is supplied at a lower portion of the mould, casing.

The method according to the invention is characterized especially in that said casing in process steps subsequent to the casting in a manner known per se is caused to be consumed and in a suitable process phase finally removed so as not to be included in products manufactured of the ingot, and the casing (1) is caused to be consumed instead of the ingot material inside thereof in order to increase the yield of the ingot material, and that a hot top (16) is provided externally against an upper portion (5, 15) of said casing (1).

The invention also relates to an apparatus for carrying out the method.



Method at casting a molten bath and apparatus for
carrying out the method

This invention relates to a method at the casting of
a molten bath intermittently to so-called ingots. The
5 invention also relates to an apparatus for carrying
out the method.

Industrial manufacture of metal products comprises in
most cases the production of ingots to be worked sub-
sequently, in such a manner, that a metal bath in a
10 cooling mould, an ingot mould, is cast either inter-
mittently to what usually is called an ingot, or
is continuously extruded. The ingot mould has the ob-
ject to mould the bath to desired geometry and to maint-
ain this bath geometry during an initial solidifying
15 phase. The heat excess of the bath is hereby conducted
away both via the ingot mould and directly to the
surrounding. As a result of the direct ingot mould
contact, in combination with the relatively shorter
thermal conduction distance within the ingot, the
20 crystals in the surface zone of the ingot are much finer
than the crystals formed later on at a greater depth
in the ingot. When a shell of sufficient thickness has
been formed against the inner surface of the ingot
mould in order to withstand the internal metallostatic
25 pressure from the bath, the ingot mould has served its
moulding function. In this phase the ingot disengages
from the inner walls of the ingot mould, due to solid-
ification shrinkage and thermal contraction in the
growing shell. The heat flow from the ingot mould is
30 hereby reduced considerably, because the thermal con-
duction substantially has come to an end. Thereafter,
the continued heat emission takes place substantially
by free convection and radiation.

Permanent ingot moulds for intermittent casting require a high degree of maintenance and, in addition, good planning and much space, because otherwise interruptions of work will occur and ingot surfaces of low
5 quality are obtained, which latter directly result in reduced yield.

The ingots, after having been cast, are transported either hot or substantially cold for being worked. Prior to their working, the ingots are heated, usually in a
10 furnace. This implies additional material losses and, consequently, decrease in yield, which are caused by so-called scaling, i.e. oxidation of the surface layer of the ingot, and in certain cases by decarburization in a layer beneath the oxidized one. The decarburized
15 layer normally must be removed later on in the manufacturing process, for example by descaling. Intermittently cast alloyed carbon steels of certain grades can lose up to 5% of the ingot weight by rough turning.

The present invention has the object to provide a method
20 and an apparatus for use at the casting of a metal bath intermittently in ingot moulds to single ingots, by which method and apparatus the aforesaid problems and disadvantages of known art are reduced substantially. The invention also comprises a hot top arrangement,
25 which facilitates a.o. the handling of the top.

The invention, thus, relates to a method of casting a metal bath to single ingots, at which the bath is supplied to a mould preferably of vertical position, in which the bath solidifies and is moulded to an ingot
30 with a cross-sectional geometry substantially in agreement with the cross-sectional geometry of the mould, and the bath is supplied into and moulded and caused to solidify in a substantially tubular and thin-walled

metal casing constituting or comprising said mould,
which casing is caused to follow along with the ingot
through process steps subsequent to the casting, which
is carried out intermittently as down-hill casting, at
5 which the bath in known manner is supplied at an upper
portion of the mould, casing, or intermittently as
bottom casting, at which the bath in known manner is
supplied at a lower portion of the mould, casing.

The method is characterized especially in that said
10 casing in process steps subsequent to casting is caused
in a manner known per se to be consumed, and in a suit-
able process phase finally is removed so as not to be
included in products made of the ingot, that the casing
is caused to be consumed instead of the ingot material
15 inside thereof in order to increase the yield of the
ingot material, and that a hot top is provided outwardly
against an upper portion of said casing.

The invention also relates to an apparatus at the cast-
ing of a metal bath to single ingots, where a mould is
20 provided, which preferably is positioned vertically, and
into which the bath is intended to be supplied and to
solidify and be moulded therein to an ingot with a cross-
-sectional geometry substantially in agreement with the
cross-sectional geometry of the mould, which mould com-
25 prises or constitutes a substantially tubular and thin-
-walled metal casing, into which the bath is intended
to be supplied, and which is intended to follow along
with the ingot through process steps subsequent to cast-
ing, which is intended to be carried out intermittently
30 as down-hill or up-hill casting.

The apparatus is characterized especially in that said
casing is intended, in a way substantially known per se,
in process steps subsequent to casting to be consumed
and in a suitable process step finally to be removed so
35 as not to be included in products made of the ingot,

which casing is consumed instead of the ingot material inside thereof in order to increase the yield of the ingot material, and that a hot top arrangement is located outwardly against an upper portion of said casing.

5 The invention is described in greater detail in the following, with reference to embodiments and to the accompanying drawings, in which Fig. 1 is a schematically shown vertical central section through an apparatus according to the invention applied to down-hill casting, Fig. 2 is a section A-A according to Fig. 1, Fig. 3 is a schematically shown vertical central section through an apparatus according to the invention applied to bottom casting, Fig. 4 is a section B-B according to Fig. 3, Fig. 5 is a schematically shown vertical central section through an apparatus according to the invention, with a first preferred embodiment of a hot top according to the invention, Fig. 6 is a schematically shown vertical central section through an apparatus according to the invention, with a second preferred embodiment of a hot top according to the invention, Fig. 7 is a schematically shown vertical central section through an apparatus according to the invention, where an external downward directed and insulating layer is provided for obtaining a directional solidification of the ingot, Fig. 8 is a schematically shown vertical central section through an apparatus according to the invention, where a divided support for the casing is provided, and Fig. 9 is a section C-C according to Fig. 8.

In Fig. 1 the numeral 1 designates a substantially tubular and preferably thin-walled metal casing according to the invention which is positioned substantially vertically. The casing 1 is intended to constitute or be comprised in the mould, into which a metal bath 2 is intended to be supplied and to solidify therein and thereby be moulded to an ingot. At the embodiment according to Fig. 1, the bath 2 is intended in a way substantially known per se to be supplied intermittently at the upper

portion 5 of the casing 1 as down-hill casting with a tapping jet 3 from a ladle 4 or corresponding device. The casing material, of course, is to be adapted to the ingot material at least so that the fusion point of the casing is higher than the casting temperature.

The cross-sectional geometry of the casing 1, Fig. 2, agrees substantially with the cross-sectional geometry of the ingot to be. In Fig. 2 a square cross-section is shown, but the cross-section, of course, can be chosen at option and, for example, may be rectangular or circular.

6 designates an outer pipe with the necessary well-defined wall thickness, an ingot mould or corresponding device, which is located about the casing 1 to support the same when there is risk for the casing to buckle at the supply of the bath. 7 designates a layer of steel sand, olivine sand or corresponding material located between the casing 1 and support 6 with the object of adjusting when the casing 1 does not abut perfectly the support 6. The thickness of the layer 7 in the Figures is slightly exaggerated for the sake of clearness.

Especially at high requirements on the purity of the metal, a bottom 8 preferably of metal suitably is joined to the casing 1, for example by welding.

9 designates a base, for example a casting plane. A casting protection 10, indicated in Fig. 1, can be inserted between the portion 5 and the nozzle 11 of the ladle 4, and a plastic cover 12, cardboard cover 12 or corresponding cover can be provided at the portion 5.

In Figs. 3 and 4 a second embodiment is shown, where the casting is carried out intermittently as bottom casting, and the bath 2 is supplied at the lower portion 13 of the casing 1 via channel bricks 14. The base 9 in this case is a bottom casting platform 9, on which

several ingots can be cast simultaneously in known manner. In the case of bottom casting, preferably a bottom 8 with a hole 8' is provided at the lower portion 13 of the casing, and a cover 12 of plastic, cardboard or corresponding material is provided at the portion 15 opposite to the portion 13 of the casing, as shown in Fig. 3. It may also be suitable to provide a cover 12 adjacent said bottom 8 with a hole, as shown by dashed line in Fig. 3. The support 6 and layer 7 are arranged in a way and have a function corresponding to down-hill casting, and the cross-sectional geometry of the casing 1 can be chosen correspondingly. The cover and bottom are used primarily at high material purity requirements.

Space is preferably to be left for a hot top 16, which is shown schematically in Figs. 1 and 3. The space is to be left in connection to the upper portion of the casing 1, Figs. 1 and 3, in which case the support 6 preferably is a support also for the hot top 16. The support 6 and layer 7 terminate slightly beneath the uppermost portion 1' of the casing 1.

In Figs. 5-7 different embodiments of hot top arrangements are shown in greater detail.

At the embodiment shown in Fig. 5 a top holder 17 is provided extending in the circumferential direction of the casing, by means of which holder plates 18 or the like are held. The plates 18 may project upward above the casing 1, whereby bath can be permitted to rise over the casing. The plates normally cannot be re-used. 19 designates a plate-shaped cover intended to cover the upper portion of the casing. It is, of course, also possible to establish a cover by powdered material.

At the embodiment shown in Fig. 6 also a top holder 17

is provided, with a space formed between the holder 17 and the casing 1, in which space powdered material 20 is located. In this case the bath preferably is not intended to rise above the casing, and the powdered material is intended to be re-used.

According to a preferred embodiment, the hot top is designed with downward decreasing wall thickness, at least at the lower portion 21 of the top, as shown in Figs. 5 and 6, whereby a directional solidification is intended to be obtained.

In Fig. 7 an embodiment is shown schematically, at which an insulating layer 22 is comprised by the hot top, as in Fig. 7, or in connection to the lower portion of the hot top, which layer extends downward from the upper portion of the casing along a substantial part of the casing height. The layer preferably has a downward decreasing wall thickness. By means of said layer a directional solidification is intended to be obtained, and a possible demand of conicity of the casing is intended to be reduced or entirely eliminated. In Fig. 7 a layer of powdered material 20 is shown located in a downward extending top holder 17. A corresponding layer, of course, can be obtained by means of plates or the like.

In Figs. 8 and 9 a further embodiment of a support for the casing 1 is shown. Supporting plates 23 or the like are arranged to the side of each other in the circumferential direction of the casing and abut the holder. Support beams 24 or the like preferably are provided for supporting and strutting the plates 23. At the embodiment shown, four plates 23 are provided for the square casing cross-section, one plate for each side of the casing where the plates can be moved to and from the casing. At the casting operation, the plates 23 can be retained in place, for example, by clamping

members 25 extending in the circumferential direction, as indicated schematically in Figs. 8 and 9, or they may be arranged so as via the beams to rest against an outer mould 6, indicated by dashed line. It also can
5 be imagined that the support plates preferably via the beams are arranged so as to run on rails or the like in the floor, on which the casing etc. are erected. This can be arranged in an obvious manner (not shown).

At the lower casing portion adjoining the floor or
10 corresponding support, preferably a sealing 26 by powdered material is provided, as in Figs. 8 and 9.

At the arrangement comprising an outer mould 6, Figs. 8 and 9, supporting members 24' suitably are provided, preferably between the beams 24 and outer mould, which
15 supporting members 24' are adjustable to the geometry of the casing 1, so that adjustment can be made a.o. to the distance between the casing and outer mould 26.

The method according to the invention and the mode of operation of the apparatus according to the invention
20 substantially should have become apparent from the above description.

The casing 1, thus, is positioned on a casting plane 9 with or without supports 6,7, whereafter the bath 2 is supplied by down-hill or up-hill casting. The bath
25 is protected against impurities by the bottom and cover 8 and, respectively, 12. The bath also is protected by the casting protection 10. It also can be imagined that air is evacuated from the casing 1 and inert gas, for example argon, is filled into the casing 1 by
30 expedient means prior to the casting. Supports are applied when there is buckling risk of the casing. Such risk arises, for example, when a casing 1 of low-carbon steel sheet metal of a few millimeters thickness is filled with a steel bath of a heat exceeding about 351500°C and the casing cross-section is not circular.

A possible support can be removed when a self-supporting solidified shell has been developed adjacent the casing 1.

At the embodiment according to Figs. 8 and 9 where the support is divided and consists of plates 23 or the like, the removal of the support is facilitated.

By means of a hot top according to the invention, the top handling is facilitated considerably. When the hot top is provided externally in relation to the casing 1, good ingot surfaces are obtained even at its top end. The design with downward decreasing wall thickness yields a directional or accentuated directional solidification. Due to the fact that the layer 22 extends a substantial distance downward on the ingot, a more extensive directional solidification can be obtained, whereby the demand of conicity of the casing can be eliminated, which facilitates considerably the manufacture of the casing. This facilitates also the hot working of the ingot.

The casing 1 is permitted to unite with the solidified bath and to follow along with the ingot thus moulded during the continued manufacturing process. The casing 1 is hereby diminished in thickness during the continued process steps by scaling etc. The remaining casing is removed by machining in a process step deemed suitable. The casing 1 thus prevents losses of ingot material due to scaling, decarburization etc. The casing, of course, is made of a simple and inexpensive material.

As should have become apparent from above, the invention renders possible large savings as a result of reduced material losses. The invention specifies a particularly simple arrangement for achieving these savings. Of essential importance is also that the hot top handling is simplified considerably and that good surfaces are obtained even in connection to the top.

The invention has been described above with reference to some embodiments. More embodiments and minor alterations, of course, can be imagined without therefore abandoning the invention idea. The cross-sectional geometry of the casing-ingot, as mentioned, can be chosen at option. .

The method and apparatus according to the invention can also be applied to casting processes other than those referred to above, for example to casting according to SE-PS 7706696-7 where a gas-powder mixture is injected into a casting jet, a jet of molten metal. As casting protection is used here preferably a collar between the outlet opening for the molten metal and the casing 1, which collar preferably opens inside the casing. The said method can be used at intermittent casting, but per se also at continuous casting.

At divided supports in the form of plates 23 or the like, of course, several embodiments can be imagined. The support, for example, can be made only as a two-piece support.

The invention, thus, must not be regarded restricted to the embodiments set forth above, but can be varied within the scope of the attached claims. .

Claims

1. A method of casting a metal bath to single ingots, where the bath is supplied into a preferably vertically positioned mould, in which the bath solidifies and is
5 moulded to an ingot with a cross-sectional geometry substantially in agreement with the cross-sectional geometry of the mould, and where the bath is supplied, moulded and caused to solidify in a substantially tubular and thin-walled metal casing constituting or
10 comprised by said mould, and which casing is caused to follow along with the ingot through process steps subsequent to the casting, which casting is carried out intermittently as down-hill casting where bath in known manner is supplied at an upper portion of the mould,
15 casing, or intermittently as up-hill casting where bath in known manner is supplied at a lower portion of the mould, casing, c h a r a c t e r i z e d i n that said casing (1) in process steps subsequent to the casting is caused in a manner known per se to be con-
20 sumed and in a suitable process step finally is removed so as not to be included in products manufactured of the ingot, that the casing (1) is caused to be consumed instead of the ingot material inside thereof in order to increase the yield of the ingot material,
25 and that a hot top (16) is provided externally against an upper portion (5,15) of said casing (1).

2. A method as defined in claim 1, c h a r a c t e r - i z e d i n that the casing (1) is supported by an outer pipe (6) provided about the casing and having
30 the necessary wall thickness, an ingot mould (6) or another support.

3. A method as defined in claim 2, c h a r a t e r - i z e d i n that the casing (1) is supported by means of supporting plates (23) or the like, which are
35 provided to the side of each other in the circumferent-

ial direction of the casing and abut the casing at least during an initial phase of the casting.

4. A method as defined in claim 3, characterized in that said supporting plates (23) are supported by means of an outer pipe (6), outer mould (6) or the like, and that means (24,24') are provided between the plates (23) and outer mould (6) for such adjustment to the casing geometry that a support is achieved.
- 10 5. A method as defined in claim 2, characterized in that a layer (7) of sand or corresponding material is provided between the casing (1) and said outer pipe (6), said ingot mould (6) or corresponding device, for adjustment purpose.
- 15 6. A method as defined in claim 2,3,4 or 5, characterized in that said outer pipe (6), ingot mould (6), supporting plates (23) or corresponding means are removed after a self-supporting solidified shell has been developed adjacent the casing (1).
- 20 7. A method as defined in claim 2,3,4,5 or 6, characterized in that the hot top (16) is caused to rest against said outer pipe (6) or corresponding device, and the casing (1) projects above the outer pipe or corresponding device.
- 25 8. A method as defined in claim 2,3,4,5,6 or 7, characterized in that a directional solidification at the upper portion of the casing (1) is caused to take place by means of a hot top (16) with downward decreasing wall thickness at least at
30 the lower portion of the hot top.
9. A method as defined in claim 2,3,4,5,6,7 or 8, characterized in that a directional solidification is caused to take place by means of

an insulating layer (22) comprised in the hot top (16) or connected to the lower portion of the hot top, which layer preferably has a downward decreasing wall thickness and extends downward from the upper portion of the casing along a substantial part of the total casing height, whereby a possible demand of conicity of the casing can be reduced or entirely eliminated.

10. A method as defined in any one of the preceding claims, characterized in that the hot top (16) is caused to be formed by means of a powdered material (20), which is caused to fill a space formed between the casing (1) and a top holder (17), and said material preferably is re-used.

11. A method as defined in any one of the preceding claims, characterized in that a bottom (8) preferably of metal is provided at the lower portion (13) of the casing (1), whereby the risk of impurities to be admixed to the bath is reduced considerably.

12. A method as defined in claim 11, where the casting is carried out as bottom casting, characterized in that a centering of the inflow of the bath into the casing (1) is obtained by co-action between said bottom (8), which for this purpose is provided with an inlet hole, and the up-hill casting platform used at the casting.

13. A method as defined in any one of the preceding claims, characterized in that a casting protection (10) is used, and that the casing (1) is filled with inert gas, for example argon gas, prior to the casting, preferably after evacuation of air.

14. An apparatus at the casting of a metal bath to single ingots, comprising a mould intended to be posit-

ioned preferably vertically, into which mould the bath is intended to be supplied and to solidify and be moulded therein to ingots with a cross-sectional geometry substantially in agreement with the cross-
5 -sectional geometry of the mould, which mould comprises or consists of a substantially tubular and thin-walled metal casing, into which the bath is intended to be supplied, and which mould is intended to follow along with the ingot in process steps subsequent to the
10 casting, which casting is intended to be carried out intermittently as down-hill or up-hill casting, characterized in that said casing (1) in a manner substantially known per se is caused in process steps subsequent to the casting to be
15 consumed and in a suitable process step finally to be removed so as not to be included in products manufactured of the ingot, and the casing (1) is consumed instead of the ingot material inside thereof in order to increase the yield of the ingot material, and that
20 a hot top (16) is located externally against an upper portion (5,15) of said casing (1).

15. An apparatus as defined in claim 14, characterized in that an outer pipe (6) with necessary wall thickness, an ingot mould (6)
25 or the like (23) is located about the casing (1) as a support.

16. An apparatus as defined in claim 15, characterized in that supporting plates (23) or the like are located removably to the
30 side of each other in the circumferential direction of the casing and abut the casing, and that preferably supporting beams (24) or the like serve as support and strutting for the plates (23).

17. An apparatus as defined in claim 16,
35 characterized in that supporting

members (24') are located between the supporting plates (23) and an outer pipe (6), outer mould (6) or the like, which supporting members (24') are adjustable to the geometry of the casing (1) so that
5 adjustment can be made a.o. to the distance between casing and outer mould.

18. An apparatus as defined in claims 15,16 or 17, characterized in that a layer (7) of sand or corresponding material is located between
10 the casing (1) and outer pipe (6), ingot mould (6) or corresponding device for adjusting purpose.

19. An apparatus as defined in claim 15,16,17 or 18, characterized in that the hot top (16) rests against said outer pipe (6) or corresponding
15 device, and the casing (1) projects upward above the outer pipe (6) or corresponding device.

20. An apparatus as defined in claim 14,15,16,17,18 or 19, characterized in that the hot top (16) at least at its lower portion has a downward
20 decreasing wall thickness whereby a directional solidification is intended to be obtained.

21. An apparatus as defined in claim 14,15,16,17,18, 19 or 20, characterized in that an insulating layer (22) is comprised in the hot top (16) or
25 connected to the lower portion of the hot top, which layer (22) extends downward from the upper portion of the casing (1) along a substantial part of the height of the casing (1), and said layer (22) has a preferably downward decreasing wall thickness, by means of which
30 layer a directional solidification is intended to be obtained.

22. An apparatus as defined in claim 14,15,16,17,18, 19,20 or 21, characterized in that the

hot top (16) consists of a powdered material (20) located between the casing (1) and a top holder (17), which powdered material (20) preferably is intended to be re-used.

5 23. An apparatus as defined in claim 14,15,16,17,18, 19,20,21 or 22, characterized in that a bottom (8) preferably of metal is located at the lower portion (13) of the casing (1), whereby the risk of admixture of impurities into the bath is reduced considerably.
10 ably.

24. An apparatus as defined in claim 23 where the casting is carried out as up-hill casting, characterized in that said bottom (8) is capable to co-act with the up-hill casting platform used at the
15 casting so that the inflow of the bath is centered via an inlet hole comprised in the bottom (8).

25. An apparatus as defined in claim 14,15,16,17,18, 19,20, 21,22,23 or 24, characterized in that a casting protection (10) is comprised therein,
20 and that it comprises means for filling inert gas, for example argon gas, into the casing (1), and preferably also means for evacuating air from the casing (1).

Fig. 1

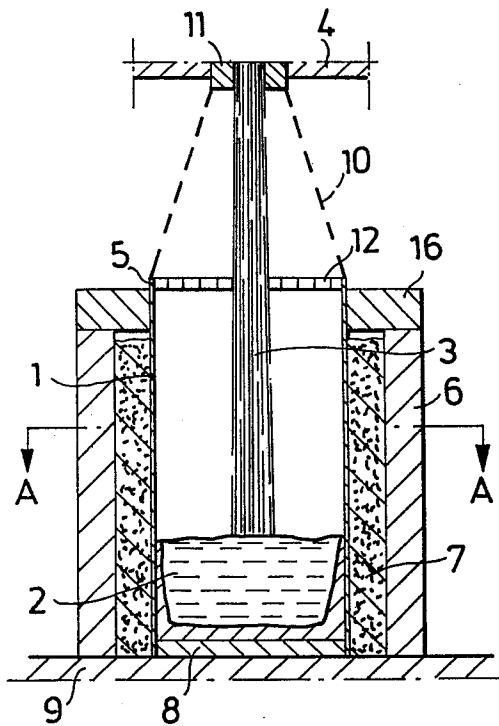


Fig. 2

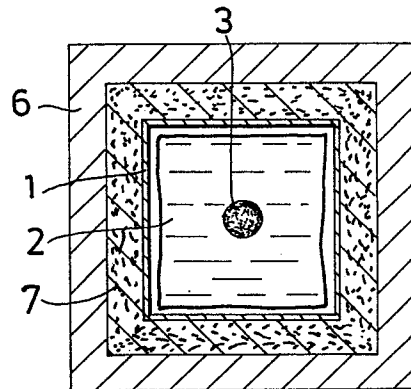


Fig. 3

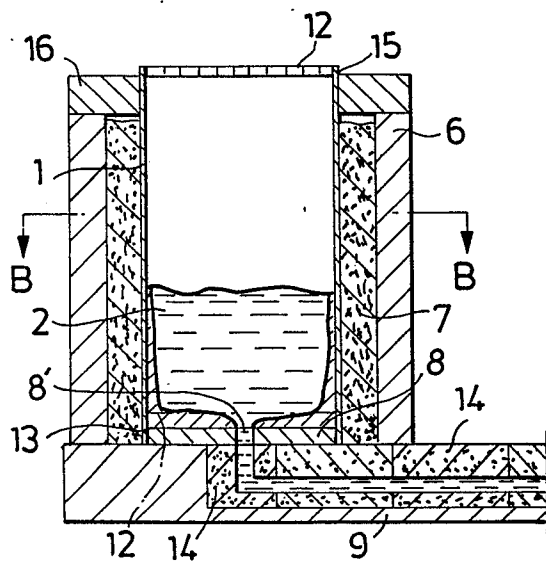


Fig. 4

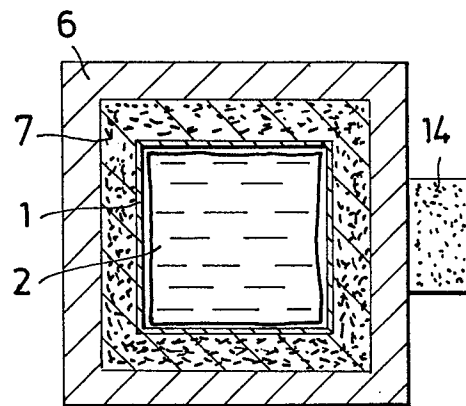


Fig. 5

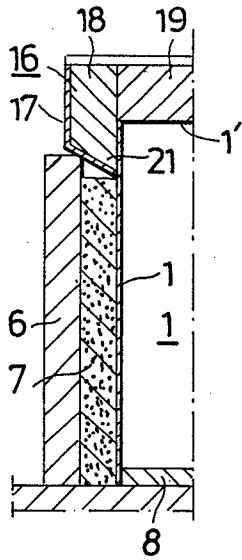


Fig. 6

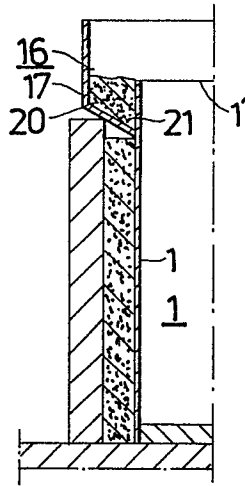


Fig. 7

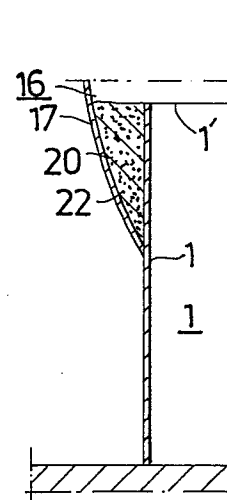


Fig. 8

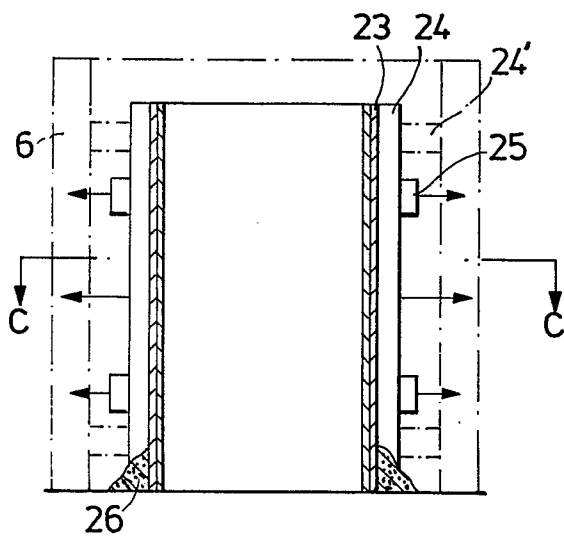
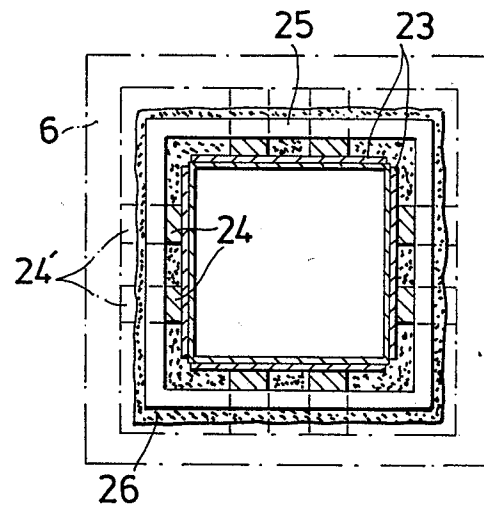


Fig. 9





European Patent
Office

EUROPEAN SEARCH REPORT

0110854

Application number

EP 83 85 0312

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. ³)
X	FR-A-1 037 319 (BOCHUMER VEREIN FÜR GUSSEFABRIKATION AG) * Page 1, left-hand column, lines 29-38; page 1, right-hand column, lines 7-21 *	1,2,5 14,15 18	B 22 D 7/00 B 22 D 7/06
X	FR-A-1 583 710 (DAUSSAN) * Page 3, left-hand column, lines 34-58; page 3, right-hand column, lines 1-40; page 4, left-hand column, lines 21-57 *	1,2,5 7,8,11 14,15 18,19 23	
X	US-A-4 111 254 (THE KANTHAL CORP.) * Column 1, line 31 - column 2, line 2 *	1,2,5 14,15 18	TECHNICAL FIELDS SEARCHED (Int. Cl. ³) B 22 D 7/00 B 22 D 7/06 B 22 D 9/00 B 22 D 7/10
X	DE-C-3 109 589 (KLÖCKNER WERKE) * Column 9, line 14 - column 10, line 16 *	1,2,5 11,14 15,23	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 02-03-1984	Examiner SCHIMBERG J.F.M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



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EUROPEAN SEARCH REPORT

0110854

Application number

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DOCUMENTS CONSIDERED TO BE RELEVANT			Page 2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	DE-B-1 089 933 (DEGERFORS JÄRNVERKS) * Column 3, line 50 - column 4, line 2 *	8-10, 20,21, 22	
A	DE-B-1 297 826 (SUMITOMO METAL) * Column 2, lines 34-39 * -----	13,25	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
Place of search THE HAGUE		Date of completion of the search 02-03-1984	Examiner SCHIMBERG J.F.M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			