

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **27.06.84**

(51) Int. Cl.³: **B 22 C 9/08**

(21) Application number: **80900722.2**

(22) Date of filing: **28.04.80**

(86) International application number:
PCT/GB80/00074

(87) International publication number:
WO 80/02658 11.12.80 Gazette 80/28

(54) **METHOD FOR THE PRODUCTION OF A METAL CASTING MOULD HAVING A RISER AND A CAVITY FORMER AND RISER SLEEVE FOR USE THEREIN.**

(30) Priority: **08.06.79 DE 2923393**

(43) Date of publication of application:
10.06.81 Bulletin 81/23

(45) Publication of the grant of the patent:
27.06.84 Bulletin 84/26

(84) Designated Contracting States:
FR

(56) References cited:
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FR - A - 2 382 292
GB - A - 1 319 799
US - A - 4 131 152

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Description

The present invention is concerned with a method for the production of a metal casting mould having a riser, and a cavity former and riser for use therein.

The use of riser sleeves in metal casting moulds is well known. Up to now, they have been located either by moulding directly on the pattern used to make the mould or subsequently by insertion into the top or cope part of the mould into a cavity formed by a loose pattern piece which has been removed from the top of the mould.

It has also been proposed to insert riser sleeves into open half moulds where the mould has a vertical parting line.

Because of the increasing automation of methods used for the production of casting moulds from moulding material such as sand, there is less access to the pattern plates at the moulding station, especially in the production of repetition castings. As a result, it is no longer possible to apply riser sleeves directly on the pattern plate, nor is it possible to locate a loose piece on the pattern plate to form a cavity into which is later inserted a riser sleeve.

When it is no longer possible to obtain access to the pattern plate an alternative procedure may be possible with automatic moulding plants which are equipped with a cope mould line which is synchronised with a drag line where cores are set into the drag. On the moving cope line, inverted cope moulds are accessible for additional work, so riser sleeves may be inserted in the inverted cope mould.

With riser sleeves which have been used hitherto this is either impossible or only partially successful. Known riser sleeves have a cylindrical or almost cylindrical outer surface for reasons partly concerned with their production technique and partly concerned with their function. Because of dimensional variations inherent in their method of production such riser sleeves cannot be inserted into a preformed cavity with sufficient confidence that they will remain in place securely.

Another group of riser sleeves, especially those which are closed by means of a cap at one end, have a positive taper from their base going up towards the cap i.e. the outside diameter becomes larger from bottom to top and therefore they cannot be used for the subsequent insertion into the inverted cope mould.

One object of this invention is the creation of a new method for the production of a metal casting mould made of finely divided moulding material such as moulding sand which makes it possible to insert a riser sleeve readily and so that the sleeve remains securely in a preformed cavity.

According to the invention there is provided a method for production of a metal casting mould having a riser, in which method a riser sleeve is inserted in a cavity in the mould, the

cavity being formed by locating a cavity former in a body of particulate moulding material, compacting the material about the former, and removing the former, characterised in that the former is made oversize relative to the sleeve to be received in the cavity and has one or more recesses therein whereby the cavity is formed with at least one inwardly projecting rib-like formation of moulded material for gripping the sleeve when received therein and the former has a taper so that the cavity has a wider mouth than inner end.

When objects such as riser sleeves are made in quantity to a predetermined nominal size i.e. height and diameter, in practice the sleeves deviate from that nominal size. Such sleeves can still be used provided that they can be inserted in the mould cavities which are to receive them, and that once inserted they will remain in place.

By checking and recording the actual height and diameter of a particular nominal size of sleeve during the course of production it is possible to calculate the standard deviation in height and diameter from the mean values for those parameters for that sleeve.

The invention also includes for carrying out the method a former characterised in that the tapered former has one or more recesses extending between the top and towards the bottom of the former. In this way the outside diameter of the former is larger than the outside diameter of the riser sleeves which are to be inserted in the cavities. Retention of the sleeves in the cavities results from the grip on the outside of the riser sleeve of the sand ribs which are moulded from the recesses in the former. This results in a clamping effect because according to the invention the circles which can be geometrically incised inside the base of the recesses have diameters which are smaller than the corresponding mean outside diameters less three times the standard deviation of the riser sleeves which are to be used.

According to a preferred feature of the invention the former has at its top end a raised rim which is so dimensioned that the total height of the former thus constituted is greater than the mean height plus three times the standard deviation of the actual riser sleeves which are to be used. Thus there remains after the insertion of the riser sleeve an annular cavity into which any sand which has been loosened during the insertion of the riser sleeve, may fall, without in any way hindering the desired depth of location of the riser sleeve.

According to another preferred feature of the invention the former has at its top end an annular depression which is so dimensioned that the height of the former up to the base of the annular depression is smaller than the mean height less three times the standard deviation of the actual riser sleeves which are to be used.

By using such a former there is formed after moulding an annular rib of moulding material.

This rib is of such depth that it touches even the lowest or shortest inserted sleeve at its top end and when longer riser sleeves are inserted the pad becomes partially compressed. A sealing means is achieved with this arrangement.

A further example of a former according to the invention is characterised in that the annular depression adjoins a surface lying above the level of the annular depression whereby the height of the former up to this surface is greater than the mean height plus three times the standard deviation of the actual riser sleeves which are to be used. By this means, using riser sleeves which are open at the top, an additional riser volume is achieved, while when using a riser sleeve with a closed top an air gap remains between the surface and the top of the cap of the riser sleeve.

The invention also includes a riser sleeve of exothermic, exothermic and heat-insulating or heat-insulating material. According to the invention such a riser sleeve is characterised in that its outer surface exhibits from its base to its top a negative taper having an angle from 2° to 20° with respect to the vertical. Preferably, the inner and outer surface of the tapered riser sleeve are parallel one with another. In another embodiment the sleeve also has a height to diameter ratio (with respect to the lowermost internal diameter) in the range 1:1 to 1.6:1.

According to a further embodiment a riser sleeve according to the invention is characterised in that it has a closed top in which a blind recess is provided which reduces the thickness of the top and which permits the controlled venting of the riser.

Because the cavity is oversized by a predetermined amount, when a riser sleeve is inserted, several air cavities are formed which are separated from each other by the vertical sand ribs and which are connected one with another by the gap at the bottom of the cavity. This has several advantages. Firstly, heat transfer to surrounding moulding material or moulding sand is reduced, and the modulus extension factor of the riser sleeve is increased. Secondly, the atmospheric oxygen contained in the air cavities can lead to a reduction in the necessary quantity of oxidising agents in the sleeve material or by retaining the same amount of oxidising agents the ignition and burning rates of the exothermic sleeves can be increased. Further, in the case of green sand moulds the transfer of moisture to the riser sleeve is reduced. Thereby the ignition and burning characteristics in the case of exothermic sleeves will become more consistent.

Preferably a breaker core is present at the lower end of the riser sleeve and the core has an outside diameter larger than that of the riser sleeve so that the cavity formed by the former can be sealed by the projecting edge of the breaker core. By choosing suitable dimensions for the breaker core the breaker core can be made to seal the cavity formed by the former.

The former of the invention may be made from any suitable material which will retain its shape during mould production.

The invention is illustrated with reference to the drawings in which

Figure 1 is a cross section through a closed tapered riser sleeve fitted with a breaker core.

Figure 2 is a section through a tapered open riser sleeve fitted with a breaker core.

Figure 3 is a top plan view of a former.

Figure 4 is a section along the line A—B of Figure 3.

Figure 5 shows schematically a riser sleeve fitted with a breaker core inserted into a casting mould.

Figure 6 shows schematically a riser sleeve without a breaker core inserted into a casting mould.

Figure 7 shows a cavity in a sand mould for the later insertion of a riser sleeve the cavity being formed by a former according to the invention.

Figure 8 is analogous to Figure 7 but shows a riser sleeve fitted with a breaker core inserted into the cavity in the sand mould.

In Figure 1 a riser sleeve 1 has a closed top 2 and a breaker core 4 fitted by glueing, whose outside diameter is larger than the outside diameter of the riser sleeve 1. As a result the breaker core 4 exhibits with respect to the riser sleeve 1 a projecting rim 4'.

In Figure 2 a riser sleeve 1a is shown which is open at the top and to which a breaker core 4 can be fitted as is indicated in the representation of Figure 2.

The riser sleeve 1 or 1a is made from exothermic, exothermic and heat-insulating or heat-insulating material. The breaker cores 4 are made of refractory material.

As can be seen from Figures 1 and 2 the outer surface of the respective riser sleeve has a negative taper from bottom to top having an angle of from 2° to 20° with respect to the vertical. Moreover the inner and outer surfaces of the tapered riser sleeve are parallel one to another.

The ratio of height to diameter of the riser sleeve 1 or 1a lies in the range of 1:1 to 1.6:1 with respect to the lowermost inside diameter.

In the example according to Figure 1 the riser sleeve 1 has a closed top 2 and in this closed top at least one blind recess 11 which reduces the thickness of the top 2 is provided. By means of one or more of such blank recesses a controlled venting of the riser is possible.

In Figures 3 and 4 a former 5 is shown whereby the left half of Figure 4 represents a sectioned view of line A—B in Figure 3 and the right half of Figure 4 represents the external view.

The former of Figures 3 and 4 has a tapered form corresponding to that of the riser sleeves 1 and 1a according to Figures 1 and 2, but, the outside diameters of the former 5 are larger than the respective mean outside diameters

plus three times the standard deviation of the riser sleeves which are to be used. By this means it is ensured that the former 5 has at any point on its height or length an outside diameter which is larger than the outside diameter of the riser sleeve which after moulding will be inserted or pushed into the cavity formed by the use of the former 5.

The outer surface of the former 5 has distributed around its circumference, several recesses 6 which extend from the top of the former towards the bottom. The recesses 6 form ribs from the moulding sand. The depth of the recesses 6 is chosen such that the circles which can be geometrically inscribed inside the base of the recesses have diameters smaller than the corresponding mean outside diameters less three times the standard deviation of the riser sleeves which are to be used. In this way the height of the sand ribs formed in the cavity by the recesses 6 is always such that a riser sleeve inserted into the cavity is gripped by the ribs. The riser sleeve is held fast by the sand ribs with sufficient force to withstand rough treatment likely to separate the sleeve from the cavity.

A raised rim 7 is present on top of the former 5 and is dimensioned so that the total height of the former 5 so formed is larger than the mean height plus three times the standard deviation of the riser sleeves which are to be used. By "mean height" of the riser sleeve the mean height of a particular type of riser sleeve is to be understood. Therefore the former 5 has an added length or is oversize with respect to the length or height of the riser sleeve which is to be inserted. As a result there remains after the insertion of the riser sleeve an empty annular cavity into which sand which is loosened during the insertion of the riser sleeve may fall. This ensures that the riser sleeve is always fixed at the desired depth.

An annular depression 7a is present within the rim 7 and is so dimensioned that the height of the former 5 up to the base of the annular depression 7a is smaller than the mean height less three times the standard deviation of the riser sleeves 1, 1a which are to be used. As a result an annular sand pad is formed in the cavity produced by the former 5 and the height of the pad is sufficient for the pad to contact the top of even the shortest or lowest riser sleeve. With this arrangement a seal is achieved especially in the case of open riser sleeves, or when using capped sleeves which have been vented in the foundry, so that when the sleeves are used and filled with metal, metal cannot flow from above, behind the sleeves.

The annular depression 7a on its inside adjoins a surface 8 which lies above the level of the annular depression the height of the former to this surface 8 is larger than the mean height plus three times the standard deviation of the riser sleeves 1, 1a which are to be used. By "mean height" here again the mean height of a

particular type of riser sleeve is to be understood. As a result, after a riser sleeve 1 or 1a has been inserted into the preformed cavity an air gap or a volume of air remains between the top end of the riser sleeve and the surface of the cavity opposite to the sleeve.

Figure 5 is a schematic representation showing a preformed cavity 9 formed by means of a former 5 according to the invention and in which cavity 9 has been inserted a riser sleeve 1. It is to be understood that the riser sleeve 1 is in close contact on its outer surface with the ribs which are formed on the inner surface of the preformed cavity 9 by means of the recesses 6 in the former. In addition the cap 2 of the riser sleeve 1 is in contact with the annular pad which has been formed by the annular depression 7a in the former 5. Between the outside of the inserted riser sleeve 1 and the wall of the preformed cavity 9 there are several air cavities separated from one another by the vertical ribs but which are all connected one with another by means of the annular air cavity which is formed in the preformed cavity 9 by the rim 7 on the former 5. In addition, an air cavity exists between the cap 2 of the riser sleeve 1 and the opposite end wall of the preformed cavity 9 and is also to be seen in Figure 5.

In the example according to Figure 5 a riser sleeve 1 with breaker core 4 is used. Since the diameter of the breaker core 4, already described above, is larger than the lowermost outside diameter of the riser sleeve 1 a seal is formed between the projecting rim 4' of the breaker core 4 and, according to Figure 5, the lower end of the wall of the preformed cavity 9 when the riser sleeve 1 is inserted into the preformed cavity 9.

Figure 6 is an analogous view to Figure 5 but where a riser sleeve 1, which has no breaker core, is inserted. In order to achieve a seal between the outside of the riser sleeve 1 and the lower end of the wall of the preformed cavity 9 by the use of such a riser sleeve the outside diameter at the lower end of the former 5 is so narrowly shaped that when a riser sleeve 1 is inserted a sealing contact results between the outside of the riser sleeve and the wall of the preformed cavity 9.

Figure 7 is a schematic view of a section of a sand mould with a preformed cavity 9 in compacted moulding sand 10 and having sand ribs 11 formed by the recesses 6 in the former 5. An annular rib 12 is formed by the rim 7, the cavity 7a and the surface 8 in the shape of the former 5.

Figure 8 is an analogous view to Figure 7 in which a riser sleeve 1 has been inserted into the preformed cavity 9. It may be seen that to a certain extent during insertion of the riser sleeve 1 the sand ribs 11 have been compressed or pinched together so that a secure fit is ensured between the outside of the riser sleeve 1 and the ribs 11. 13 indicates that part of the sand

ribs 11 with which the riser sleeve does not come into contact. Sand 14 loosened during the insertion of the riser sleeve 1 has fallen into the described annular cavity where it does no harm.

Figure 8 shows once again the seal at the wall of the preformed cavity 9 between the breaker core 4 and the compacted moulding sand 10.

As has been said, the riser sleeves may consist of exothermic, exothermic and heat-insulating or heat-insulating material. Examples of such materials are given below:—

Example 1

Exothermic riser sleeves were made having the following composition by weight:—

Silica sand	51.5%
Aluminium grindings	26.0%
Sodium cryolite	5.0%
Clay binder	2.0%
Resin binder	3.5%
Sodium nitrate	12.0%

The materials were mixed with 3—4% by weight water and compacted in core boxes by ramming by hand or using a core shooting machine. The "green" sleeves were stripped from the core boxes and dried at 180°C.

The sleeves had a density of 1.3 g/cm³.

Example 2

Exothermic and heat-insulating riser sleeves were made having the following composition by weight:—

Aluminium powder and grindings	24.0%
Boric acid	1.0%
Sodium cryolite	7.0%
Resin binder	6.9%
Iron oxide	11.0%
Silica sand	17.0%
Alumina	18.5%
Organic fibres	3.6%
Lightweight silica	11.0%

A slurry of the materials was produced in water. Formers for the sleeves were immersed in the slurry and the solid materials in the slurry were sucked on to the formers by means of pressure. The formers were removed and the "green" riser sleeves were dewatered. The sleeves were then stripped from the formers and dried at 180°C. The sleeves had a density of 0.85 g/cm³.

Example 3

Heat-insulating riser sleeves were made having the following composition by weight:—

Aluminium	5.5%
Alumina	13.0%
Resin binder	9.0%
Aluminium sulphate	1.0%

Colloidal silica sol	6.5%
Aluminium silicate fibres	6.0%
Silica fibres	55.0%
Organic fibres	4.0%

The sleeves were produced using the method described in Example 2.

The sleeves had a density of 0.45 g/cm³.

Claims

1. A method for the production of a metal casting mould having a riser, in which method a riser sleeve (1, 1a) is inserted in a cavity in the mould, the cavity (9) being formed by locating a cavity former (5) in a body of particulate moulding material, compacting the material about the former (5), and removing the former (5), characterised in that the former (5) is made oversize relative to the riser sleeve to be received in the cavity and has one or more recesses (6) therein whereby the cavity (9) is formed with at least one inwardly projecting rib-like formation of moulded material for gripping the riser sleeve (1, 1a) when received therein and the former (5) has a taper so that the cavity has a wider mouth than inner end.

2. A method according to claim 1 characterised in that the tapered former (5) has a plurality of radially spaced apart recesses (6) extending between the top and towards the bottom of the former (5) and the outside diameters of the tapered former (5) are larger than the corresponding mean outside diameters plus three times the standard deviation of the riser sleeve (1, 1a).

3. A method according to claim 2 characterised in that circles which can be geometrically inscribed inside the base of the recesses (6) have diameters smaller than the corresponding mean outside diameters less three times the standard deviation of the riser sleeve (1, 1a).

4. A method according to claim 2 or 3 characterised in that the former (5) possesses at its top end a raised rim which is so dimensioned that the total height of the former thus constituted is greater than the mean height plus three times the standard deviation of the riser sleeve (1, 1a).

5. A method according to claim 4 characterised in that the former possesses at its top end an annular depression (7a) which is so dimensioned that the height of the former (5) up to the base of the annular depression (7a) is smaller than the mean height less three times the standard deviation of the riser sleeve (1, 1a).

6. A method according to claim 5 characterised in that the annular depression (7a) adjoins a surface lying above the level of the annular depression whereby the height of the former (5) up to this surface is greater than the mean height plus three times the standard deviation of the riser sleeve (1, 1a).

7. A method according to one of the claims 2 to 6 characterised in that a riser sleeve without a breaker core is inserted in the cavity and the outside diameter of the former (5) towards its lower end is so formed that a sealing contact is achieved between the lower outside diameter of the inserted riser sleeve (1, 1a) and the lower diameter of the cavity.

8. A former for carrying out the method of claim 1 characterised in that the tapered former (5) has one or more recesses extending between the top and towards the bottom of the former (5).

9. A former (5) according to claim 8 characterised in that it possesses at its top end a raised rim (7).

10. A former (5) according to claim 9 characterised in that it possesses at its top end an annular depression (7a).

11. A riser sleeve (1, 1a) of exothermic, exothermic and heat-insulating or heat-insulating material for use in the method according to claim 1 characterised in that its outer surface exhibits from its base to its top a negative taper having an angle of from 2° to 20° with respect to the vertical.

12. A riser sleeve (1, 1a) according to claim 11 characterised in that the inner and outer surfaces of the tapered riser sleeve are parallel one with another.

13. A riser sleeve (1, 1a) according to claim 11 or 12 characterised in that the ratio of height to diameter with respect to the lowermost internal diameter lies in the range of 1:1 to 1.6:1.

14. A riser sleeve (1, 1a) according to one of the claims 11 to 13 characterised in that it has a closed top in which a blind recess is provided which reduces the thickness of the top and which permits the controlled venting of the riser.

15. A riser sleeve (1, 1a) according to one of the claims 11 to 14 characterised in that the sleeve has at its lower end a breaker core whose outside diameter is larger than that of the riser sleeve (1, 1a) so that the cavity formed by the former (5) can be sealed by the projecting edge (4') of the breaker core (4).

Patentansprüche

1. Verfahren zum Herstellen einer Form für Metallguß, die einen Steiger aufweist, bei welchem Verfahren eine Steigerhülse (1, 1a) in die Form in einen Hohlraum (9) eingesetzt wird, welcher geformt wird, in dem ein Hohlraum-former (5) in einen Körper aus partikelförmigem Formmaterial angeordnet wird, das Material um den Former (5) herum verdichtet wird und der Former (5) herausgenommen wird, dadurch gekennzeichnet, daß der Former (5) relativ zur in dem Hohlraum aufzunehmenden Steigerhülse überdimensioniert wird und eine oder mehrere Aussparungen (6) hat, wodurch der Hohlraum (9) mit wenigstens einem nach

innen vorspringenden, rippenartigen Gebilde aus Formmaterial geformt ist, um die Steigerhülse (1, 1a) zu ergreifen, wenn sie darin aufgenommen wird, und daß der Former (5) eine Verjüngung hat, so daß der Hohlraum eine Eingangsöffnung hat, die weiter als das innere Ende ist.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der sich verjüngende Former (5) einen Vielzahl von radial getrennten Aussparungen (6) hat, die sich zwischen der Oberseite und zu dem Boden des Formers (5) hin erstrecken, und daß die Außendurchmesser des sich verjüngenden Formers (5) größer sind als die entsprechenden mittleren Außendurchmesser zuzüglich dem Dreifachen der Standardabweichung der Steigerhülse (1, 1a).

3. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß Kreise, die geometrisch in die Basen der Aussparungen (6) gelegt werden können, Durchmesser haben, die kleiner sind als die mittleren Außendurchmesser weniger dem Dreifachen der Standardabweichung der Steigerhülse (1, 1a).

4. Verfahren nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß der Former (5) an seiner Oberseite einen erhöhten Rand besitzt, der derart bemessen ist, daß die Gesamthöhe des so gebildeten Formers größer ist als die mittlere Höhe zuzüglich dem Dreifachen der Standardabweichung der Steigerhülse (1, 1a).

5. Verfahren nach Anspruch 4, dadurch gekennzeichnet, daß der Former an seiner Oberseite eine ringförmige Vertiefung (7a) besitzt, die derart bemessen ist, daß die Höhe des Formers (5) bis zur Basis der ringförmigen Vertiefung (7a) kleiner ist als die mittlere Höhe weniger dem Dreifachen der Standardabweichung der Steigerhülse (1, 1a).

6. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß die ringförmige Vertiefung (7a) an eine Fläche anschließt, die über dem Niveau der ringförmigen Vertiefung liegt, wodurch die Höhe des Formers (5) bis zu dieser Fläche größer ist als die mittlere Höhe zuzüglich dem Dreifachen der Standardabweichung der Steigerhülse (1, 1a).

7. Verfahren nach einem der Ansprüche 2 bis 6, dadurch gekennzeichnet, daß eine Steigerhülse ohne Brecherkern in den Hohlraum eingesetzt ist, und daß der Außendurchmesser des Formers (5) zu seinem unteren Ende hin derart geformt ist, daß ein Dichtungskontakt zwischen dem unteren Außendurchmesser der eingesetzten Steigerhülse (1, 1a) und dem unteren Durchmesser des Hohlraums erzielt wird.

8. Former zum Ausführen des Verfahrens nach Anspruch 1, dadurch gekennzeichnet, daß der sich verjüngende Former (5) eine oder mehrere Aussparungen hat, die sich zwischen der Oberseite und zu dem Boden des Formers (5) hin erstrecken.

9. Former (5) nach Anspruch 8, dadurch gekennzeichnet, daß er an seinem oberen Ende einen erhöhten Rand (7) aufweist.

10. Former (5) nach Anspruch 9, dadurch gekennzeichnet, daß er an seinem oberen Ende eine ringförmige Vertiefung (7a) besitzt.

11. Steigerhülse (1, 1a) aus exothermischem, exothermischem und wärmeisolierendem oder wärmeisolierendem Material zur Verwendung in dem Verfahren gemäß Anspruch 1, dadurch gekennzeichnet, daß ihre äußere Fläche von ihrer Basis zu ihrer Oberseite eine negative Verjüngung zeigt, die einen Winkel von 2° bis 20° zur Vertikalen hat.

12. Steigerhülse (1, 1a) nach Anspruch 11, dadurch gekennzeichnet, daß die inneren und äußeren Flächen der sich verjüngenden Steigerhülse parallel zueinander sind.

13. Steigerhülse (1, 1a) nach Anspruch 11 oder 12, dadurch gekennzeichnet, daß das Verhältnis Höhe zu Durchmesser bezüglich des untersten inneren Durchmessers im Bereich von 1:1 bis 1,6:1 liegt.

14. Steigerhülse (1, 1a) nach einem der Ansprüche 11 bis 13, dadurch gekennzeichnet, daß sie eine geschlossene Oberseite hat, in welcher eine Blindaussparung vorgesehen ist, welche die Dicke der Oberseite vermindert und das kontrollierte Entlüften des Steigers erlaubt.

15. Steigerhülse (1, 1a) nach einem der Ansprüche 11 bis 14, dadurch gekennzeichnet, daß die Hülse an ihrem unteren Ende einen Brecherkern hat, dessen Außendurchmesser größer als der der Steigerhülse (1, 1a) ist, so daß der von dem Former (5) gebildete Hohlraum durch die vorspringende Kante (4') des Brecherkerns (4) abgedichtet werden kann.

Revendications

1. Procédé de fabrication d'un moule de coulée de métal comportant un conduit de coulée, procédé dans lequel un manchon de conduit de coulée (1, 1a) est inséré dans une cavité du moule, la cavité (9) étant formée par mise en place d'un élément de formage de cavité (5) dans un corps de matière de moulage en particules, par compactage de la matière autour de l'élément de formation (5) et par enlèvement de l'élément de formage (5), caractérisé en ce que l'élément de formage (5) est surdimensionné par rapport au manchon de conduit de coulée pour être reçu dans la cavité et comportant un ou plusieurs évidements (6) de façon que la cavité (9) soit formée avec au moins une partie de matière moulée en forme de nervure faisant saillie vers l'intérieur pour agripper le manchon de conduit de coulée (1, 1a) lorsqu'il est engagé dans celle-ci et en ce que l'élément de formage (5) comporte un profil effilé de manière que la cavité ait une embouchure plus large que l'extrémité inférieure.

2. Procédé selon la revendication 1, caractérisé en ce que l'élément de formage effilé (5) comporte une pluralité d'évidements (6) espacés radialement l'un de l'autre et s'étendant entre le haut et vers le fond de l'élément de formage (5)

et en ce que les diamètres extérieurs de l'élément de formage effilé (5) sont plus grands que les diamètres extérieurs moyens correspondants plus trois fois l'écart standard du manchon de conduit de coulée (1, 1a).

3. Procédé selon la revendication 2, caractérisé en ce que des cercles qui peuvent être géométriquement inscrits à l'intérieur de la base des évidements (6) ont des diamètres plus petits que les diamètres extérieurs moyens correspondants moins trois fois l'écart standard du manchon de conduit de coulée (1, 1a).

4. Procédé selon la revendication 2 ou 3, caractérisé en ce que l'élément de formage (5) comporte à son extrémité supérieure une nervure en saillie qui est dimensionnée de manière que la hauteur totale de l'élément de formage ainsi constitué soit supérieure à la hauteur moyenne plus trois fois l'écart standard du manchon de conduit de coulée (1, 1a).

5. Procédé selon la revendication 4, caractérisé en ce que l'élément de formage comporte à son extrémité supérieure un creux annulaire (7a) qui est dimensionné de façon que la hauteur de l'élément de formage (5) jusqu'à la base du creux annulaire (7a) soit plus petite que la hauteur moyenne moins trois fois l'écart standard du manchon de conduit de coulée (1, 1a).

6. Procédé selon la revendication 5, caractérisé en ce que le creux annulaire (7a) rejoint une surface placée au-dessus du niveau du creux annulaire de façon que la hauteur de l'élément de formage (6) jusqu'à cette surface soit supérieure à la hauteur moyenne plus trois fois l'écart standard du manchon de conduit de coulée (1, 1a).

7. Procédé selon l'une quelconque des revendications 2 à 6, caractérisé en ce qu'un manchon de conduit de coulée sans noyau de rupture est inséré dans la cavité et en ce que le diamètre extérieur de l'élément de formage (5) en direction de son extrémité inférieure est établi de façon qu'un contact de scellement soit créé entre le diamètre extérieur inférieur du manchon de conduit de coulée inséré (1, 1a) et le diamètre inférieur de la cavité.

8. Élément de formage pour la mise en oeuvre du procédé de la revendication 1, caractérisé en ce que l'élément de formage effilé (5) comporte un ou plusieurs évidements s'étendant entre le haut et en direction de la base de l'élément de formage (5).

9. Élément de formage (8) selon la revendication 8, caractérisé en ce qu'il comporte à son extrémité supérieure une nervure en saillie (7).

10. Élément de formage (8) selon la revendication 9, caractérisé en ce qu'il comporte à son extrémité supérieure un creux annulaire (7a).

11. Manchon de conduit de coulée (1, 1a) formé d'un matériau exothermique, exothermique et thermiquement isolant ou thermiquement isolant, utilisable dans le procédé con-

forme à la revendication 1, caractérisé en ce que sa surface extérieure présente depuis sa base jusqu'à sa partie supérieure une pente négative correspondant à un angle de 2 à 20° par rapport à la verticale.

12. Manchon de conduit de coulée (1, 1a) conforme à la revendication 11, caractérisé en ce que les surfaces intérieure et extérieure du manchon de conduit de coulée effilé sont parallèles entre elles.

13. Manchon de conduit de coulée (1, 1a) selon la revendication 11 ou 12, caractérisé en ce que le rapport de la hauteur au diamètre en ce qui concerne le diamètre intérieur le plus bas est compris dans la gamme allant de 1:1 à 1,6:1.

14. Manchon de conduit de coulée (1, 1a)

conforme à l'une quelconque des revendications 11 à 13, caractérisé en ce qu'il comporte une partie supérieure fermée dans laquelle est ménagé un évidement aveugle qui réduit l'épaisseur de la partie supérieure et qui permet la ventilation contrôlée du conduit de coulée.

15. Manchon de conduit de coulée (1, 1a) conforme à l'une quelconque des revendications 11 à 14, caractérisé en ce que le manchon comporte à son extrémité inférieure un noyau dont le diamètre extérieur est plus grand que celui du manchon de conduit de coulée (1, 1a) de façon que la cavité formée par l'élément de formage (5) puisse être scellée par le bord en saillie (4') du noyau de rupture (4).

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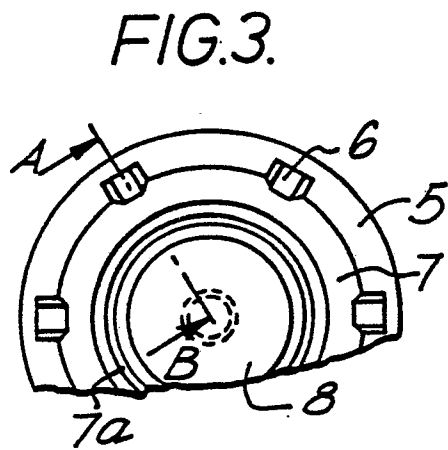
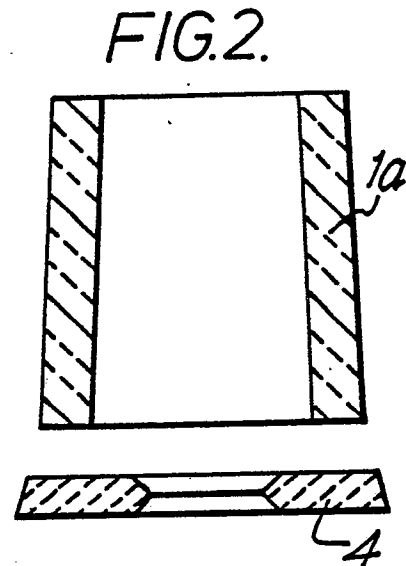
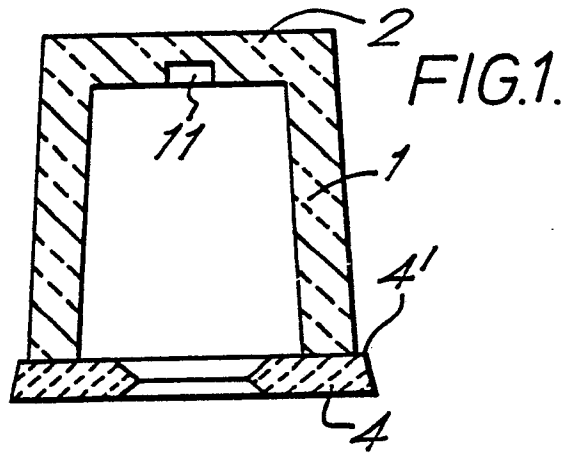
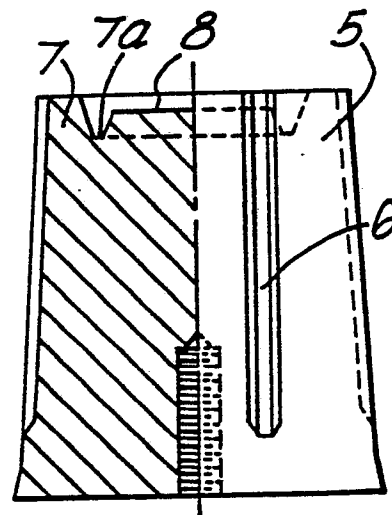


FIG.4.



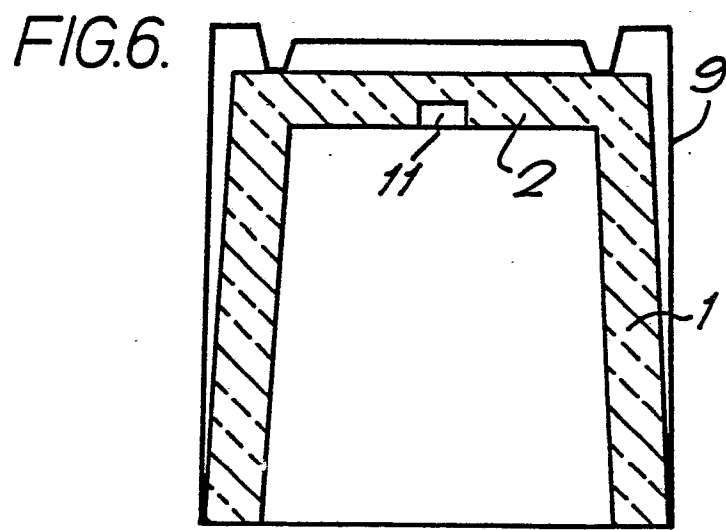
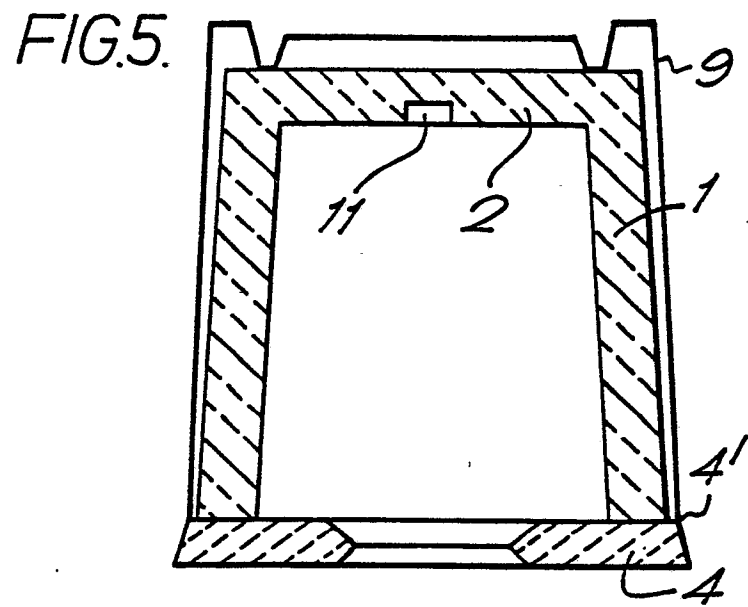


FIG.7.

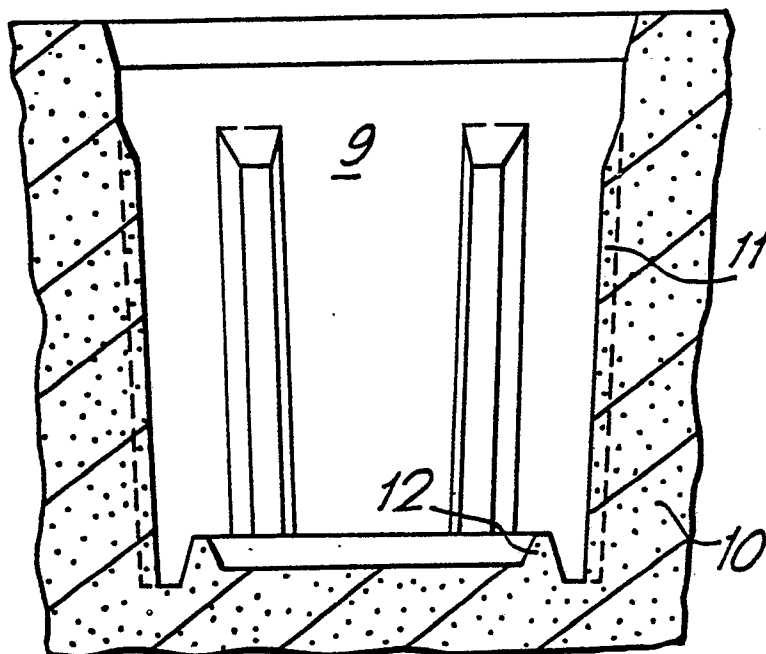


FIG.8.

