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(54) **RISER SLEEVE WITH AIR GAP**

STEIGERHÜLSE MIT LUFTSPALT

MANCHON DE MASSELOTTE AVEC LAME D'AIR

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Description

Technical Field

[0001] The disclosed embodiments of the present invention relate to a riser sleeve for use in the casting of molten metal, and, in particular, to a riser sleeve that is shaped around an exterior surface thereof to provide closed cavities when the riser sleeve is inserted into a riser cavity of a foundry mold. In an even more particular embodiment, the cavities are positioned in the sleeve to run as generally vertical depressions along the sleeve exterior when the riser sleeve is operationally positioned in the foundry mold.

Background of the Art

[0002] As described in US Patent 6,640,874, among other prior art references, riser sleeves and their use are well known in the prior art. A riser sleeve operates in a foundry mold as a conduit and as a reservoir. When molten metal is poured into a preformed cavity shaped in the nature of the product being formed, a portion of the poured metal flows into and accumulates in the riser. As the metal in the cavity solidifies, shrinkage of the solidified metal in the mold would result in dimensional changes and possibly internal cavities, in the absence of a riser.

[0003] The loss of heat from the metal in the riser cavity primarily occurs at the interface of the metal with the mold. By strategically placing one or more riser sleeves in the foundry mold, with each riser sleeve in gravity-feed liquid communication with the cavity, and by maintaining the molten metal in the sleeve in its molten state, at least preferentially to the metal in the casting, molten metal is available after the pour to flow from the sleeve into the mold, offsetting the shrinkage. If this objective is not achieved, the metal in the riser sleeve simply solidifies and becomes another appurtenance to the casting that needs to be removed in finishing the product.

[0004] The riser sleeves themselves are not a part of the finished casting. Once the casting has properly cooled, the risers are removed as a part of the foundry mold.

[0005] It has been an ongoing effort in the casting industry to provide riser sleeves that achieve their objective in an effective manner. The continuing nature of this effort speaks loudly about the need for additional improvement.

[0006] Thus, there exists a need in the prior art for an improved riser sleeve.

Summary of the Invention

[0007] This and other unmet advantages are provided by a riser sleeve for use in a foundry molding operation. The sleeve has a body with an outside wall that extends from a bottom to a top of the body. The riser sleeve is characterized by a plurality of cavities that are formed on the side wall, extending from the top in an axial direction

of the body.

[0008] In some instances, the body is cylindrical. In other instances, the body is frustoconical, preferably with a diameter that decreases uniformly from the bottom to the top.

[0009] In some instances, each of the plurality of cavities is preferably substantially semi-cylindrical, each cavity having an axis that is preferably aligned along a virtual circumferential area of the outside side wall that does not comprise the cavities. In some of these instances, each cavity is characterized by a radius, such that the axes of adjacent cavities are spaced apart by a distance of at least four radii around the circumference of the riser sleeve. In some of these, each cavity preferably subtends an angle in the range of from about 120° to about 180°, as measured from the axis of the cavity.

[0010] In some instances, each cavity extends along the outside wall over a majority of a distance from the top towards the bottom, but each cavity terminates above the bottom.

[0011] In some instances, the plurality of cavities are substantially uniformly spaced around a circumference of the body.

[0012] In some instances, the body is substantially hollow, with an interior wall or surface that is cylindrical or that tapers from bottom to top in a manner that corresponds to the side wall.

Brief Description of the Drawings

[0013] A better understanding of the disclosed embodiments will be obtained from a reading of the following detailed description and the accompanying drawings wherein identical reference characters refer to identical parts and in which:

FIG. 1 is a perspective view of a formed riser sleeve as known in the prior art before imparting the air gaps of the claimed invention;

FIG. 2 is a perspective view of the formed riser sleeve of Fig. 1, after the air gaps have been formed thereon; and

FIG. 3 is a perspective view of a riser sleeve of the claimed invention, shown in partial sectional view on a mold pattern.

Detailed Description

[0014] In general, riser sleeves are one of two types. Blind riser sleeves comprise a hollow dome-shaped riser sleeve, which is open at the bottom. Open-top riser sleeves are generally annular shaped, that is, open at both top and bottom. Blind riser sleeves are more expensive to manufacture. Their use is typically reserved to special applications. Open-top riser sleeves, on the other hand, allow the casting operator to see the progress of the cast by visualizing the level of the molten metal in the riser sleeve. For purposes of this patent specification,

the term "riser sleeve" is used generically to apply to both types, unless there is specific reference to one of the types.

[0015] The riser sleeves may be inserted into the mold cavity after the mold is formed. This is generally referred to as an insertable sleeve. The riser sleeve may also be placed on the pattern and the mold formed around the sleeve to create the riser cavity. This is generally referred to as a "ram-up" sleeve). Generally in the prior art, the wall of the sleeve will have a uniform thickness and fit tightly into the mold with negligible gap between the sleeve and the mold.

[0016] Again, speaking still in a general manner, riser sleeves are manufactured from heat insulating materials, with the intent of slowing the solidification of the molten metal contained within the riser sleeve before it passes to the cavity in the foundry mold. Alternatively or additionally, the riser sleeves may be made from exothermic materials intended to generate heat to maintain fluidity of the molten metal. Typical riser sleeves are manufactured from refractory materials, including man-made fibers. They may include fuels such as aluminum or silicon which are used to produce their respective heat insulating oxides during an exothermic reaction within the riser sleeve. Properties sought to be optimized in riser design include low density and high porosity, as these facilitate the heat insulating properties.

[0017] Feeding aids are used to slow and control the solidification of the riser. These may be insulating or exothermic sleeves or "hot topping". A sleeve consists of material that lines at least part of the riser cavity, to slow the heat loss from the riser by providing insulation or additional heat input from an exothermic material or both. Hot toppings are insulating or exothermic material used to cover the top of the riser after pouring where the riser is open through the top of the mold.

[0018] Sleeves can be manufactured from a variety of different materials including refractory fibers, sand, hollow refractory spheres, as well as other refractory materials. Refractory fiber sleeves are typically formed by depositing the fiber and other ingredients onto a wire mesh form that creates the internal dimensions of the sleeve. The fiber and other ingredients are in a water-based slurry and are deposited on the form by drawing a vacuum on the interior of the form. This creates a sleeve with a somewhat rough external surface. Sleeves made from sand or from hollow spheres plus other ingredients can be formed by blowing a mixture of the dry ingredients and a liquid foundry binder into a mold/corebox and curing the binder in the mold to create a solid sleeve with both internal and external shapes formed by the mold. The walls of a riser sleeve made from sand or hollow spheres will tend to be more uniform than those made from fibrous materials and this may make the sand/hollow sphere riser sleeves more amenable to the implementation of the inventive concept.

[0019] The insulating or exothermic properties of a riser sleeve is predominantly determined by the material

used to create the sleeve. For instance, a fiber refractory sleeve will typically have a lower density than the mold material and provide insulation because of lower heat capacity and thermal conductivity. A sand exothermic sleeve may contain a relatively high percentage of exothermic material, typically thermite of a mixture of metallic aluminum powder and iron oxide. When the riser is filled with molten metal the thermite ignites and provides a secondary heat source for the riser.

[0020] Turning attention now to **FIG. 1**, a perspective view of a riser sleeve blank **10** is shown. This sleeve blank **10** is shown as being slightly frusto-conate, with a diameter that decreases uniformly and monotonically from a bottom or base to a top **12**. Both the top **12** and the base are depicted as being normal to a central axis of the blank **10**. Depending upon the application, it may be desirable in some applications to round off the top surface into more of a bullet point shape, especially when the riser sleeve will be of the blind type that will be inserted in a "ram up" manner. Although riser sleeve blank **10** is of the blind-type, it has the flattened top **12**.

[0021] It should be clear from the depicted embodiment that the sleeve blank **10** could easily be cylindrical, with a consistent diameter from top to base. The sleeve blank **10** shows a smooth and consistent texture to the outside walls **14** and can be produced from a variety of different materials.

[0022] A perspective view of an embodiment **100** of a riser sleeve having the inventive concept is provided in **FIG. 2**. In the specific embodiment **100**, which is also depicted as being of the blind-type, there are ten depressions or cavities **102** formed on the outside wall **14**. This plurality of cavities **102** is depicted as arranged in a substantially uniform spacing around the circumference of the outside wall **14**, although the uniform spacing is not considered critical to the efficacy of the riser sleeve being formed. While the body of the embodiment **100** is depicted as cylindrical, it will be known to those of skill that some casting situations will require other shapes, such as an oval or flat-faced shape, but that these shapes can also be formed with a plurality of cavities in the same manner as is depicted with the cylindrical embodiment.

[0023] The depressions or cavities **102** on the embodiment **100** are depicted as being substantially semi-cylindrical. An axis of each semi-cylindrical cavity **102** is generally aligned along the outside wall **14**, with the effect being that the respective axes reflect the slightly conate or generally cylindrical nature of the overall riser sleeve **100**. A top end of each cavity **102** is open and provides a "scalloped" circumference to the top **12**. The cavities **102** are depicted as extending a substantial portion of the height of the riser sleeve **100** from the top of the sleeve in an axial direction of the sleeve, but each cavity clearly terminates above the base. This results in a cylindrical ring around the base of the riser sleeve, with the intent of forming a tight seal with the mold, preventing liquid metal from flowing into the cavities during the pour.

[0024] With regard to the size and number of the cav-

ities **102**, it may be expected that, in the case of semi-cylindrical cavities having a radius R , the axes of adjacent cavities will be spaced apart by a distance of at least $4R$ around the circumference of the riser sleeve **100**. Worded somewhat differently, at least one-half of the original surface of the outside walls **14** will be preserved for contact with the mold, although it may prove to be desirable to have about 40% of the side wall removed in the creation of the cavities.

[0025] As depicted, the cavities **102** are semi-cylindrical, that is, the axis of the cavity is effectively located along the surface or outside wall **14**, and an angle of approximately 180° is subtended between adjacent edges of a given cavity. In general, it may be more preferred to include less than 180° , that is, to position the axis outside of surface **14**, than to have more than 180° of the cylinder subtended, which would result when the axis would be positioned inside of surface **14**. This would prevent forming a thin reentrant surface along the edges of the cavity that would be subject to breakage. In any case, the subtended portion of the cylinder would be at least 120° and in almost all cases will be less than 180° .

[0026] By imposing these cavities **102**, a corresponding number of closed air gaps are formed between the sleeve and the mold when the sleeve is inserted into the mold. These cavities **102** will trap air in them. The air-filled cavities **102** would have very low heat capacity and thermal conductivity compared to both the mold material and the sleeve. They will further reduce the contact area between the mold and the sleeve, reducing conductive heat loss. The cavities **102** also provide additional insulation. This could result in better performance by the sleeve and would also result in lower sleeve weight and material cost, as the primary thickness of the riser sleeve blank would not be increased in order to impose the cavities.

[0027] While not fully tested, it is expected that the sleeve **100** can improve feeding efficiency and allow the use of smaller risers and sleeves for improved casting yield.

[0028] The use of the riser sleeve **100** is shown in a perspective schematic manner in **FIG 3**, in which the riser sleeve is shown mounted on a mold pattern **40**, and, more particularly, on a mounting plug **42** of the mold pattern. For "ram-up" applications where the riser sleeve is placed directly on the pattern and molding sand is compacted around the sleeve to form the sleeved riser, a paper, cardboard, plastic film, or similar material covering can be placed over the sleeve, with the paper or similar material forming the outside surface of the air filled cavity and preventing infiltration by the molding sand as the mold is rammed into position.

[0029] As clearly shown in Fig 3, the riser sleeve **100** will be significantly hollow, either due to the process by which it is initially formed or from the removal of material. The interior surface **104** will have preferably have a taper from bottom to top **12** that will correspond to that of outer surface **14**, except for the cavities, which are found only

on the outer surface.

[0030] The depicted riser sleeve having the inventive features is a so-called "blind" riser sleeve as described above. However, it is well within the skill of one of ordinary skill in the art to apply the teachings of the present specification to provide the same inventive features on an open-top riser sleeve.

[0031] Having shown and described a preferred embodiment of the invention, those skilled in the art will realize that many variations and modifications may be made to affect the described invention and still be within the scope of the claimed invention. Thus, many of the elements indicated above may be altered or replaced by different elements which will provide the same result and fall within the spirit of the claimed invention.

Claims

1. A foundry mold comprising a riser sleeve (100) inserted into the foundry mold, the riser sleeve (100) being a body, the body having a side wall (14) that extends from a bottom to a top (12) of the body and the side wall (14) having a plurality of cavities where the plurality of cavities (102) are formed on the side wall and extend from the top in an axial direction of the body, **characterized in that** the cavities are closed and provide closed air gaps between the riser sleeve and the foundry mold.
2. The foundry mold according to claim 1, wherein the body of the riser sleeve (100) is cylindrical.
3. The foundry mold according to claim 1, wherein the body of the riser sleeve (100) is frustoconical, preferably with a diameter that decreases uniformly from the bottom to the top.
4. The foundry mold according to any one of claims 1 to 3, wherein each of the plurality of cavities is substantially semi-cylindrical, each cavity having an axis that is aligned along the side wall.
5. The foundry mold according to claim 4, wherein each cavity is **characterized by** a radius, such that the axes of adjacent cavities are spaced apart by a distance of at least four radii around the circumference of the riser sleeve (100).
6. The foundry mold according to claim 4, wherein each cavity subtends an angle in the range of from 120° to 180° , as measured from the axis of the cavity.
7. The foundry mold according to any one of the preceding claims, wherein each cavity extends along the side wall over at least a majority of a distance from the top towards the bottom, terminating above

the bottom.

8. The foundry mold according to any one of the preceding claims, wherein the plurality of cavities are substantially uniformly spaced around a circumference of the body.
9. The foundry mold according to any one of claims 1 to 5, wherein the body of the riser sleeve (100) is substantially hollow, with an interior wall or surface that corresponds in shape to the side wall, less the plurality of cavities.

Patentansprüche

1. Gießform, umfassend einen Speisereinsatz (100), eingefügt in die Gießform, wobei der Speisereinsatz (100) ein Körper ist, wobei der Körper eine Seitenwandung (14), die sich von einem unteren Teil zu einem oberen Teil (12) erstreckt, aufweist und wobei die Seitenwandung (14) eine Mehrzahl von Aushöhlungen aufweist, wobei die Mehrzahl von Aushöhlungen (102) auf der Seitenwandung ausgebildet sind und sich von dem oberen Teil aus in eine axiale Richtung des Körpers erstrecken,
dadurch gekennzeichnet, dass die Aushöhlungen abgeschlossen sind und abgeschlossene Luftspalte zwischen dem Speisereinsatz und der Gießform bereitstellen.
2. Gießform nach Anspruch 1, wobei der Körper des Speisereinsatzes (100) zylinderförmig ist.
3. Gießform nach Anspruch 1, wobei der Körper des Speisereinsatzes (100) kegelförmig ist, vorzugsweise mit einem Durchmesser, der von dem unteren Teil zu dem oberen Teil gleichmäßig abnimmt.
4. Gießform nach einem der Ansprüche 1 bis 3, wobei jede der Mehrzahl von Aushöhlungen im Wesentlichen halbzylindrisch ist, wobei jede Aushöhlung eine Achse, die entlang der Seitenwandung ausgerichtet ist, aufweist.
5. Gießform nach Anspruch 4, wobei jede Aushöhlung so durch einen Radius gekennzeichnet ist, dass die Achsen von benachbarten Aushöhlungen mit einem Abstand von mindestens vier Radien um den Umfang des Speisereinsatzes (100) herum beabstandet sind.
6. Gießform nach Anspruch 4, wobei jede Aushöhlung einen Winkel im Bereich von 120° bis 180°, gemessen von der Achse der Aushöhlung aus, überstreicht.
7. Gießform nach einem der vorangehenden Ansprü-

che, wobei sich jede Aushöhlung entlang der Seitenwandung über zumindest einen Großteil einer Strecke von dem oberen Teil aus in Richtung des unteren Teils, dabei endend oberhalb des unteren Teils, erstreckt.

8. Gießform nach einem der vorangehenden Ansprüche, wobei die Mehrzahl von Aushöhlungen um einen Umfang des Körpers im Wesentlichen gleichmäßig beabstandet sind.
9. Gießform nach einem der Ansprüche 1 bis 5, wobei der Körper des Speisereinsatzes (100) im Wesentlichen hohl ist, mit einer Innenwandung oder Innenfläche, die in der Form der Seitenwandung, abzüglich der Mehrzahl von Aushöhlungen, entspricht.

Revendications

1. Moule de fonderie comprenant un manchon de masselotte (100) inséré dans le moule de fonderie, le manchon de masselotte (100) étant un corps, le corps ayant une paroi latérale (14) qui s'étend depuis un bas jusqu'à un haut (12) du corps et la paroi latérale (14) ayant une pluralité de cavités où la pluralité de cavités (102) est formée sur la paroi latérale et s'étend depuis le haut dans une direction axiale du corps,
caractérisé en ce que les cavités sont fermées et fournissent des lames d'air fermées entre le manchon de masselotte et le moule de fonderie.
2. Moule de fonderie selon la revendication 1, dans lequel le corps du manchon de masselotte (100) est cylindrique.
3. Moule de fonderie selon la revendication 1, dans lequel le corps du manchon de masselotte (100) est tronconique, de préférence avec un diamètre qui diminue uniformément depuis le bas vers le haut.
4. Moule de fonderie selon l'une quelconque des revendications 1 à 3, dans lequel chacune de la pluralité de cavités est sensiblement semi-cylindrique, chaque cavité ayant un axe qui est aligné le long de la paroi latérale.
5. Moule de fonderie selon la revendication 4, dans lequel chaque cavité est **caractérisée par** un rayon de telle sorte que les axes des cavités adjacentes sont espacés d'une distance d'au moins quatre rayons autour de la circonférence du manchon de masselotte (100).
6. Moule de fonderie selon la revendication 4, dans lequel chaque cavité sous-tend un angle dans la plage de 120° à 180°, mesuré à partir de l'axe de la cavité.

7. Moule de fonderie selon l'une quelconque des revendications précédentes, dans lequel chaque cavité s'étend le long de la paroi latérale sur au moins une majorité d'une distance depuis le haut vers le bas, se terminant au-delà du bas. 5
8. Moule de fonderie selon l'une quelconque des revendications précédentes, dans lequel la pluralité de cavités est sensiblement uniformément espacée autour d'une circonférence du corps. 10
9. Moule de fonderie selon l'une quelconque des revendications 1 à 5, dans lequel le corps du manchon de masselotte (100) est sensiblement creux, avec une paroi ou surface intérieure qui correspond au niveau de la forme à la paroi latérale, moins la pluralité de cavités. 15

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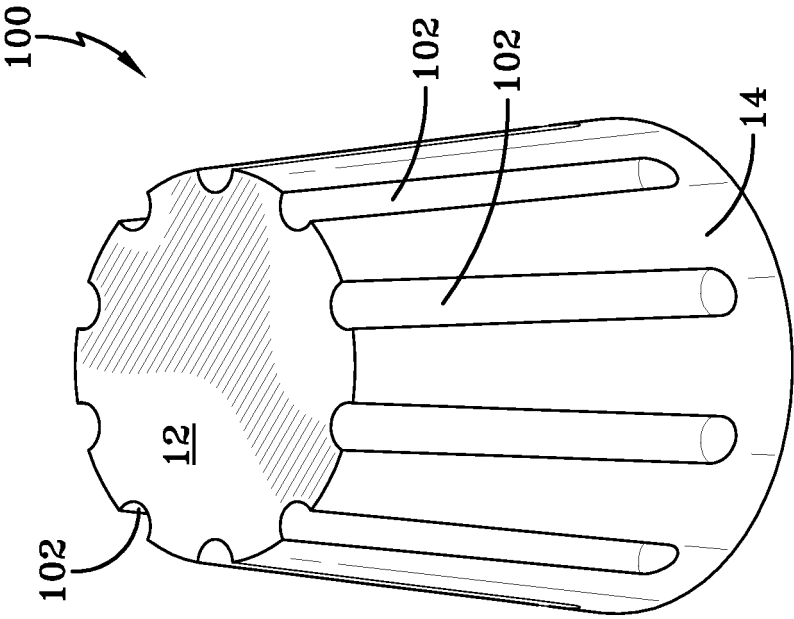


FIG-2

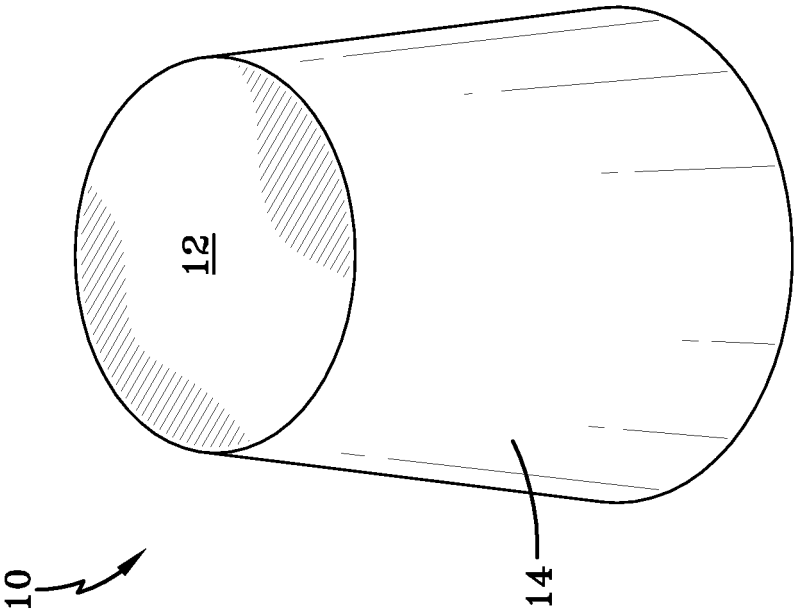


FIG-1

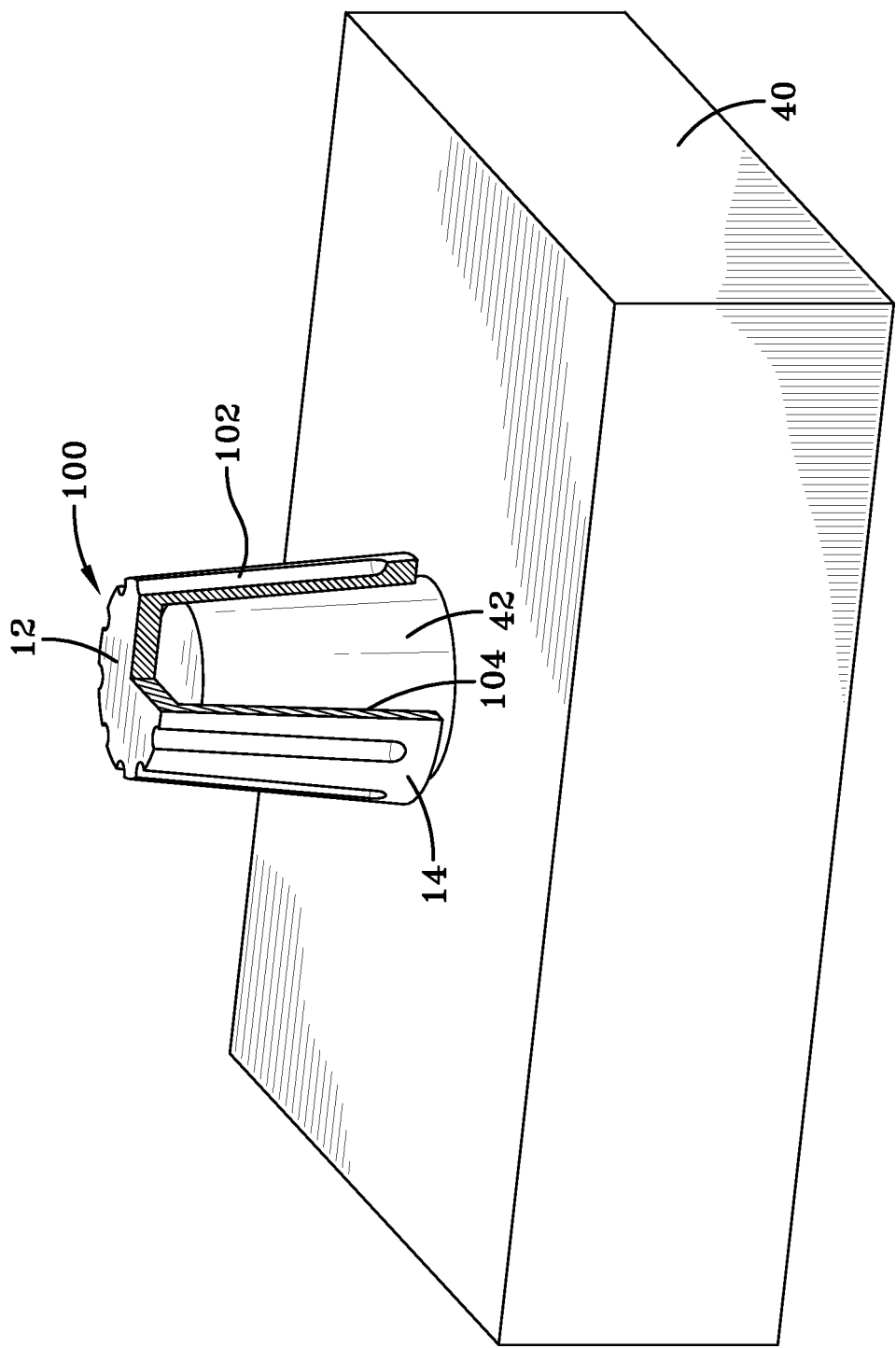


FIG-3

REFERENCES CITED IN THE DESCRIPTION

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