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

(11) EP 0 803 303 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.10.1997 Bulletin 1997/44

(51) Int. Cl.[6]: **B22C 15/02**, B22C 15/30

(21) Application number: **97106203.9**

(22) Date of filing: **15.04.1997**

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

(30) Priority: **24.04.1996 JP 129061/96**
10.05.1996 JP 140772/96

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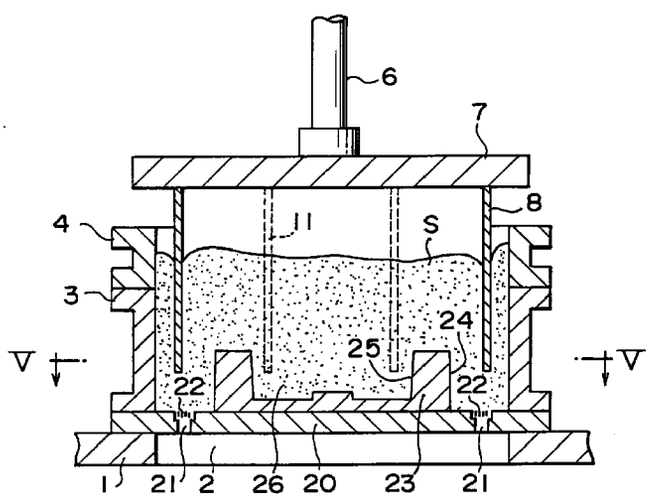
(54) Method for producing a mold

(57) The method of the present invention includes pre-compressing molding sand in a mold space at the lower part of it near the outer and inner side surfaces of a pattern and the inner side surfaces of a flask, where it tends to be not well consolidated, by inserting a thin-plate body into the molding sand. The method also includes pre-compacting the molding sand or consolidating all the molding sand.

FIG. 3



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Description

Field of the Invention

This invention relates to a method for producing a mold by pressing molding sand which is first put in a mold space defined by a pattern plate and a flask.

Description of the Prior Art

To produce a mold from molding sand, it must be compacted. However, molding sand tends not to be well compacted at the part near lower peripheral (i.e., lower inner and outer side) surfaces of the mold and the inner side surface of the flask.

This poor compacting is caused because a force to press the molding sand is not well transmitted to the lower part of it near these side surfaces due to frictional resistance by the side surfaces. A mold having a part or parts that are not dense tends to deform, particularly when it is filled with molten metal. Thus it fails to produce a good cast of accurate dimensions.

Conventionally, before pressing all the molding sand, pre-compacting it by the jolt process or by circulating compressed air through it has been tried. However, even by this pre-compaction the molding sand is insufficiently consolidated at the part near the inner or outer side surface of the pattern or the inner side surface of the flask. To sufficiently pre-compact molding sand by such methods, heavy and bulky equipment is required. This equipment causes serious vibrations and noises.

This invention is conceived in view of the above prior-art drawbacks. It aims to provide a method to sufficiently consolidate molding sand to produce a mold wherein the molding sand is also well consolidated at the lower part of it near the inner and outer side surfaces of a pattern and the inner side surface of the flask.

Summary of the Invention

The method of the present invention includes pre-compressing molding sand in a mold space at the lower part of it near the side surfaces of the pattern and flask, where it tends to be not well consolidated, by inserting a thin-plate body or rod into the molding sand at the lower part near the side surfaces. The method also includes pre-compacting the molding sand at the lower part of it (near the pattern plate) and/or consolidating all the molding sand. Below the details of the invention will be explained through embodiments by reference to the accompanying drawings.

Brief Description of the Drawings

Figs. 1 - 4 are vertical, sectional views of a molding machine to carry out a first embodiment of the method of the present invention.

Fig. 5 is a horizontal, sectional view taken along Arrow V-V in Fig. 3.

Fig. 6 is a horizontal, sectional view similar to Fig. 5, showing an alternative example of a thin-plate body.

Fig. 7 is a vertical, sectional view of a molding machine to carry out a second embodiment of the method of the present invention.

Fig. 8 is a horizontal, sectional view taken along Arrow VIII - VIII in Fig. 7.

Fig. 9 is a vertical, sectional view of a molding machine to carry out a third embodiment of the method of the present invention.

Fig. 10 is a horizontal, sectional view taken along Arrow X- X in Fig. 9.

Preferred Embodiments of the Invention

Now the embodiments of the present invention will be explained in detail by reference to the drawings.

In Figs. 1 - 5 a first embodiment of the method of the present invention is explained. In Fig. 1 a table 1 formed with a central opening 2 is disposed. A circular pattern 23 formed with a large, central depression or pocket 26 (Figs. 3 and 5) is mounted on a pattern plate 20. The pattern plate 20 is placed on the table 1 such that it bridges the opening 2 of the table 1. The pattern plate 20 has a plurality of vent holes 21 provided with vent plugs 22. These vent plugs 22 communicate with the opening 2 of the table 1. A flask 3 and a filling frame 4 are placed on the pattern plate 20. The pattern plate 20, flask 3, and filling frame 4 define a mold space. Molding sand S is then put into the mold space, and the surface of it is leveled.

In Fig. 2 the mold space is then sealingly covered with a covering member 5, which is connected by way of a valve 5A to a source P for supplying compressed air into the mold space. The valve 5A is opened for a while, so that compressed air is introduced into the mold space. The introduced air pre-compacts the molding sand S, especially its lower part close to the pattern plate 20, and is then evacuated from the vent plugs 22. Thus the lower part of the molding sand S has a high bulk density. The covering member 5 is then removed.

In Fig. 3 a pre-compressing device or means comprised of a tubular thin-plate body 8 attached to a rigid plate 7, which in turn is attached to a piston rod 6 of a cylinder (not shown), is moved to a position just above the mold space. The length of the thin-plate body 8 generally equals the total height of the flask 3 and filling frame 4. The diameter of the body 8 is slightly less than that of the mold space. The piston rod 6 is lowered so that the thin-plate body 8 is inserted into the molding sand S until the lower end of it reaches a part of the molding sand above the pattern plate 20. By this insertion the lower part of the molding sand near the inner side surface of the flask is well pre-compressed. The thin-plate body 8 is then withdrawn from the molding sand S and moved away from the mold space. The thin-plate body 8 is preferably 20 mm thick. If it were thicker, a void would be left in the surface of the molding sand S

when the thin-plate body 8 is withdrawn from it.

In Fig. 4 a press plate 10 attached to a piston rod 9 of a cylinder (not shown) is pressed against the entire surface of the molding sand to thereby compact all the molding sand. This completes the process of producing a mold.

Referring to Fig. 6, instead of using a single tubular thin-plate body such as the body 8 shown in Figs. 3 and 5, a thin-plate body 8A that has a plurality of metal strips and angles as in the drawing may be used.

Referring to Figs. 3 and 5, an additional tubular thin-plate body 11 (shown in dotted lines), which has a diameter slightly less than the inner side surface 25 of the pattern 20, may be attached to the rigid plate 7 such that the lower end of the thin-plate body 11 reaches the lower part of the molding sand S near the inner side surface 25 of the pattern 20 as in Fig. 3 when the piston rod 6 is lowered. The thin-plate body 11 well pre-compresses this part of the molding sand.

In Figs. 7 and 8 a second embodiment of the method of the present invention is explained. In this embodiment another method is used to pre-compress the lower part of the molding sand near the outer and inner side surfaces of a pattern and to consolidate all the molding sand. The same numbers and letters are used for the same elements of the first embodiment, and similar numbers and letters for similar elements.

As in Figs. 7 and 8, a pattern plate 20A (with no vent hole) is placed on a table 1A (with no opening). A pattern 23A is mounted on the pattern plate 20A. The pattern 23A is in the form of an almost square block and has a small, cylindrical central throughbore or pocket 26A. The pattern plate 20A, flask 3, and filling frame define a mold space. The device to pre-compact the molding sand includes a piston rod 6, a rigid plate 7 attached to it, and a thin-plate body 8 and a round bar or rod 11A, both attached to the rigid plate 7. The diameter of the round rod 11A is slightly less than that of the pocket 26A.

In operation, first, molding sand is fed into the mold space, and the side surface of the molding sand is leveled. The piston rod 6 is then lowered until the thin-plate body 8 and round rod 11A reach the lower part of the molding sand near the outer and inner side surfaces of the pattern 23A, respectively, as in Fig. 7. The molding sand is well pre-compressed at the part near the side surfaces by the thin-plate body 8 and rod 11A. After pre-compressing, the device is then moved away from the molding sand. A covering member, which is connected to means for supplying compressed air through a valve (such as the covering member 5, the valve 5A, and the means P of Fig. 2), is then sealingly attached to the top of the filling frame 4. The valve is opened to introduce compressed air into the mold space to consolidate all the molding sand. Thus a mold is produced.

In Figs. 9 and 10 a third embodiment of the method to pre-compress the molding sand is shown. This method is similar to that of the second embodiment. In this third embodiment a pattern 23B and a thin-plate body 8B are circular in plan, but the inner side surface of the flask 3 is square. Thus the distance between the inner side surface of the flask and outer side surface of the pattern is great at the inner corners of the flask 3. Molding sand tends to be not well consolidated at these corners. Thus in this embodiment four more thin-plate bodies or angle rods 12 are attached to comers of the rigid plate 7 so that the lower part of the molding sand S near the inner side surface of the flask 3 is well pre-compressed. When the central rod 11A, thin-plate body 8B, and angle rods 12, are inserted into the molding sand, it is well pre-compressed at the lower part near the inner and outer side surface of the pattern 23B and the inner side surface of the flask 3. After the molding is pre-compressed, compressed air is applied to the entire surface of it as in the second embodiment. Thus a mold is produced. If desired, all angle rods 12 may be wider than those shown in Fig. 10.

The foregoing embodiments are exemplary only. One or more of thin-plate bodies and/or rods may be selectively used depending on the part of the molding sand to be especially compressed and the shape of a pattern and a flask. Any other modification to or variation of the embodiments, or any combination of the embodiments, can be made within the scope of the appended claims. For example, the vent holes and vent plugs may be eliminated in the first embodiment. Further, in the first embodiment, instead of pre-compacting by compressed air, pre-compacting by the jolting process may be used. Although in the first embodiment molding sand is pre-compacted by compressed air before pre-compressing by a thin-plate body, this sequence may be changed. That is, the molding sand may be pre-compressed first by the thin-plate body and then be pre-compacted by compressed air. Further, although in the foregoing embodiments the thin-plate body and/or rod is inserted into molding sand in the mold space by lowering it, instead of this, by a conventional method the molding sand in the mold space may be lifted to the fixed thin-plate body and/or rod.

Claims

1. A method for producing a mold by compressing molding sand, comprising the steps of:

   introducing molding sand in a mold space defined by a pattern plate, which has a pattern, and a flask;

   pre-compacting the introduced molding sand at a part thereof near the pattern plate;

   moving the pattern plate and a means for pre-compressing the molding sand relatively close to each other, said means being disposed above the mold space, said means including at least one thin-plate body or rod that is laterally spaced apart from the inner side surface of the flask inwardly, and/or that is laterally spaced apart from the inner and outer side surfaces of

the pattern, so as to insert said at least one thin-plate or rod into the molding sand, thereby pre-compressing the molding sand at the part thereof that is near the pattern plate, and that is near at least one of the inner side surface of the flask and the inner and outer side surfaces of the pattern;

moving the pattern plate and said means relatively away from each other so as to withdraw said at least one thin-plate body or rod from the molding sand; and

after the withdrawal, pressing the entire surface of the molding sand.

2. A method for producing a mold by compressing molding sand, comprising the steps of:

introducing molding sand in a mold space defined by a pattern plate, which has a pattern, and a flask;

moving the pattern plate and a means for pre-compressing the molding sand relatively close to each other, said means being disposed above the mold space, said means including at least one thin-plate body or rod that is laterally spaced apart from the inner side surface of the flask inwardly, and/or that is laterally spaced apart from the inner and outer side surfaces of the pattern, so as to insert said at least one thin-plate or rod into the molding sand, thereby pre-compressing the molding sand at the part thereof that is near the pattern plate, and that is near at least one of the inner side surface of the flask and the inner and outer side surfaces of the pattern;

moving the pattern plate and said means relatively away from each other so as to withdraw said at least one thin-plate body or rod from the molding sand;

after the withdrawal, pre-compacting the molding sand at a part thereof near the pattern plate; and

pressing the entire surface of the molding sand.

3. The method of claim 1 or 2, wherein said step of pre-compacting includes applying compressed air to the molding sand in the mold space.

4. The method of claim 1 or 2, wherein said step of pre-compacting includes pre-compacting by the jolting process.

5. A method for producing a mold by compressing a molding sand, comprising the steps of:

introducing molding sand in a mold space defined by a pattern plate, which has a pattern, and a flask;

moving the pattern plate and a means for pre-compressing the molding sand relatively close to each other, said means being disposed above the mold space, said means including at least one thin-plate body or rod that is laterally spaced apart from the inner side surface of the flask inwardly, and/or that is laterally spaced apart from the inner and outer side surfaces of the pattern, so as to insert said at least one thin-plate or rod into the molding sand, thereby pre-compressing the molding sand at the part thereof that is near the pattern plate, and that is near at least one of the inner side surface of the flask and the inner and outer side surfaces of the pattern;

moving the pattern plate and said means relatively away from each other so as to withdraw said at least one thin-plate body or rod from the molding sand; and

applying compressed air to the surface of the molding sand to thereby compress all the molding sand.

FIG. 1

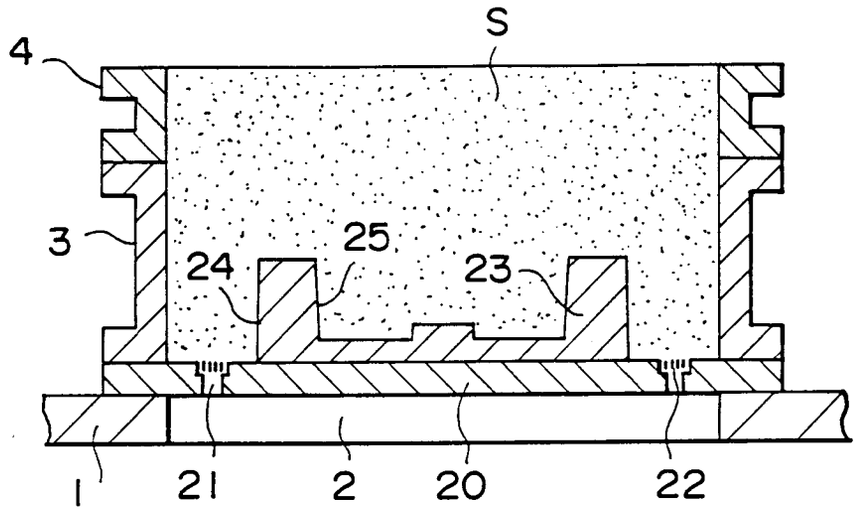


FIG. 2

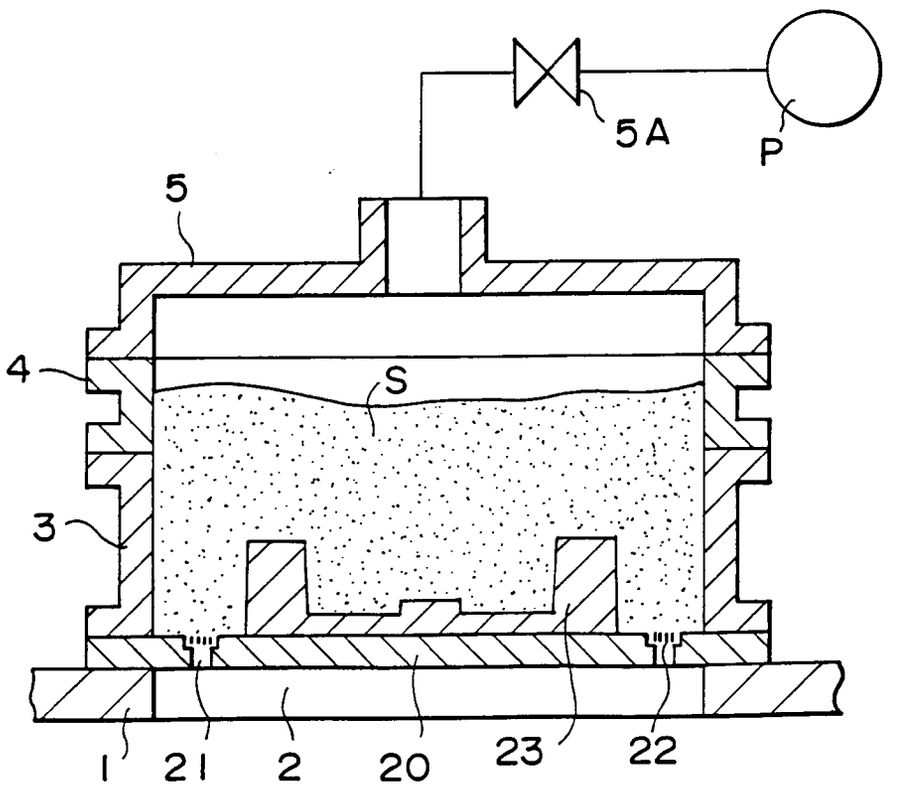


FIG. 3

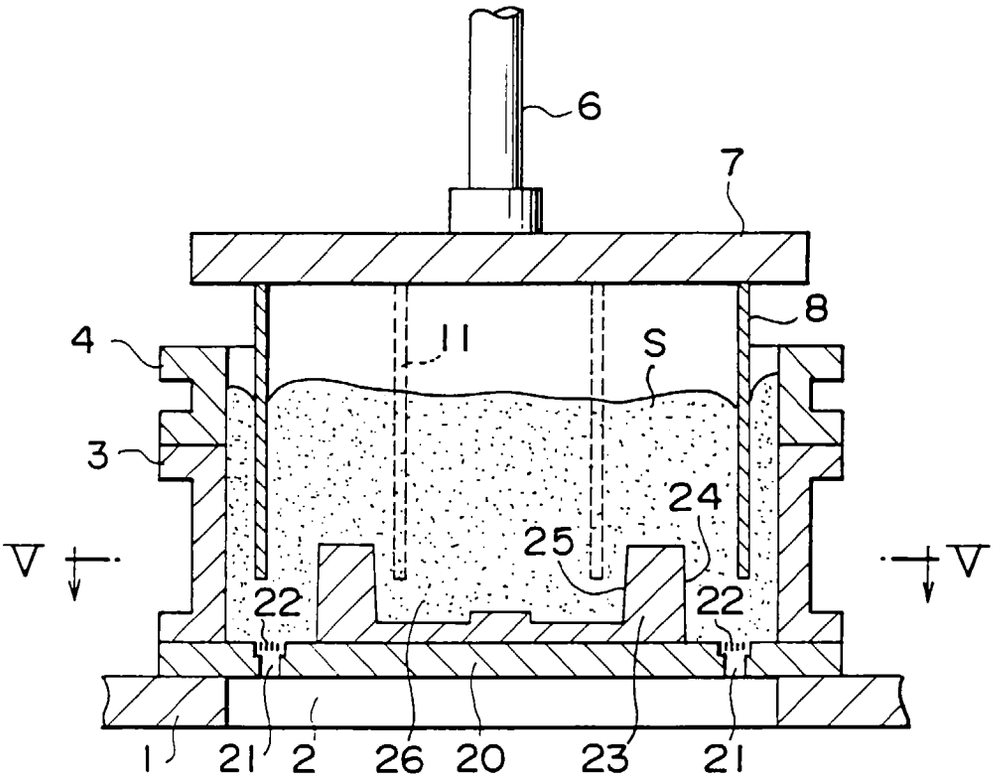


FIG. 4

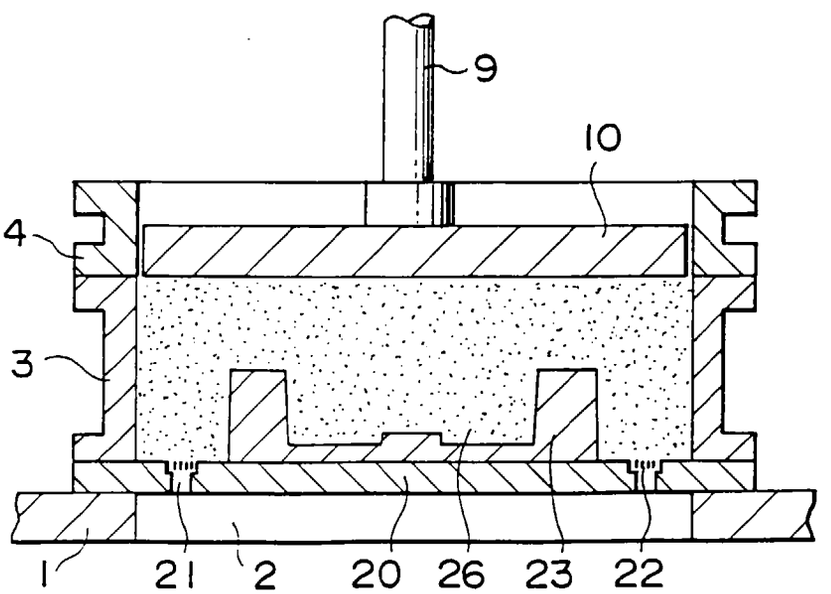


FIG. 5

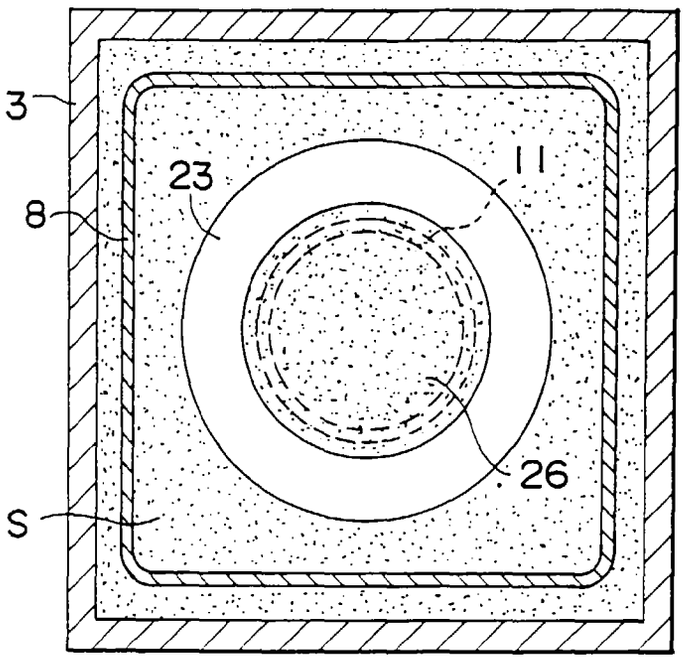


FIG. 6

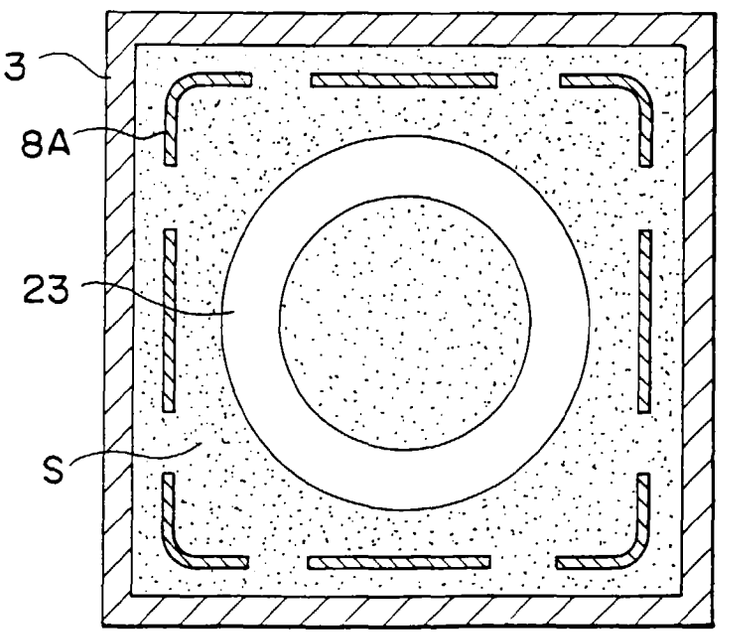


FIG. 7

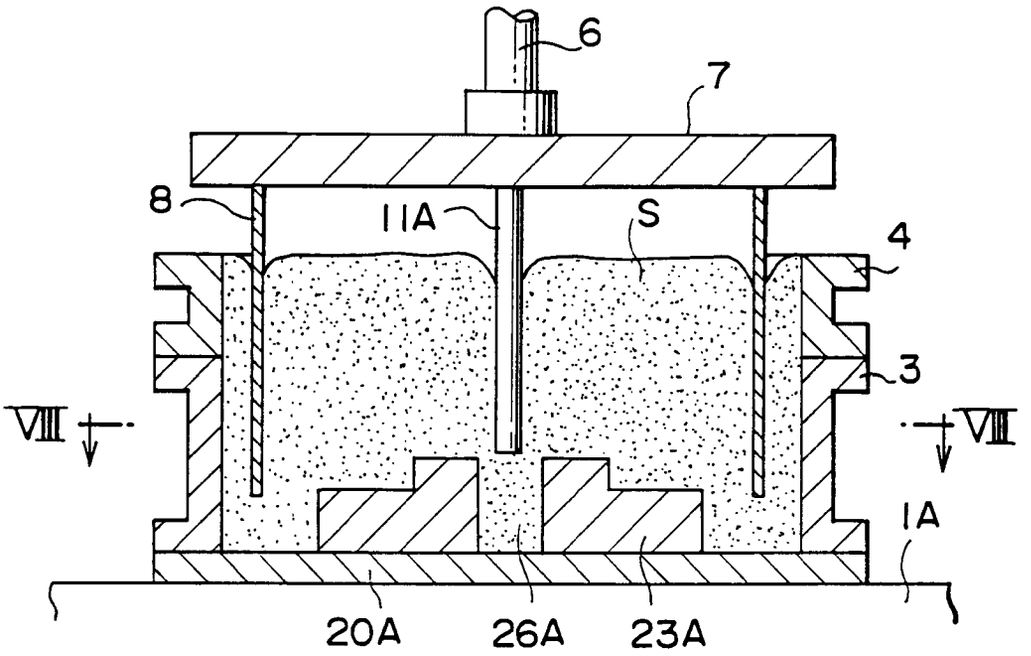


FIG. 8

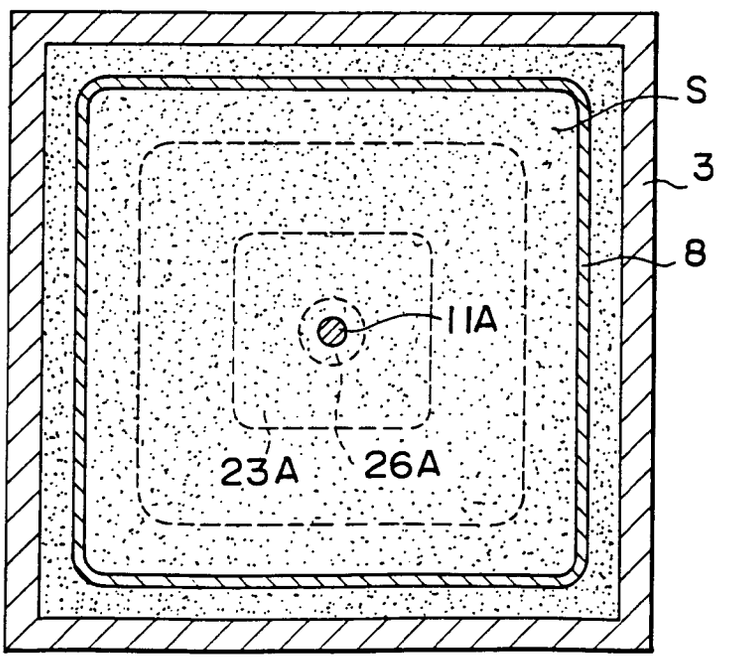


FIG. 9

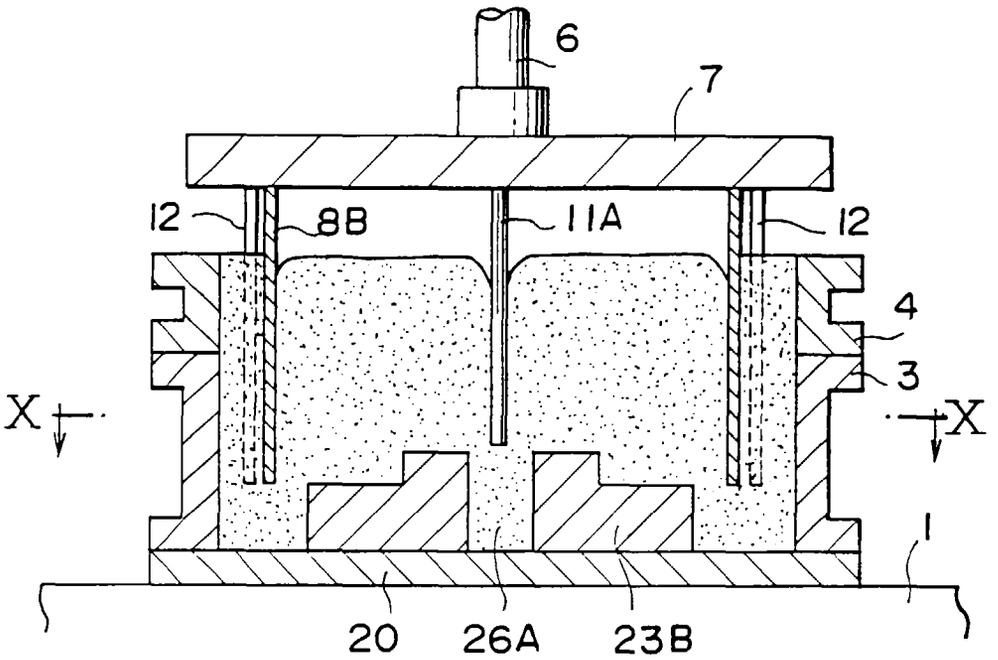
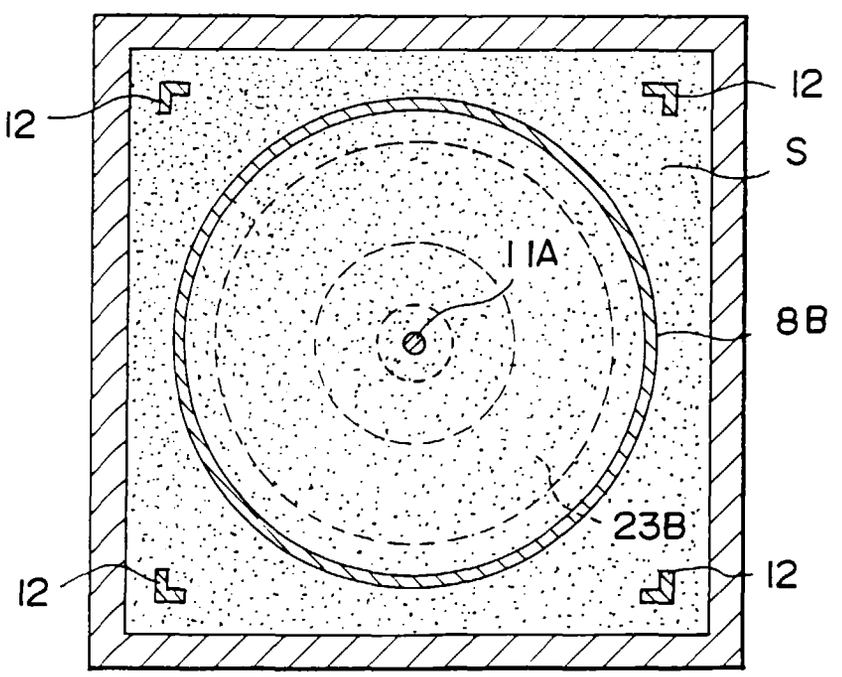


FIG. 10



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EUROPEAN SEARCH REPORT

Application Number
EP 97 10 6203

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.6)
P,X	EP 0 748 663 A (SINTOKOGIO LTD) 18 December 1996 * the whole document *	1,2	B22C15/02 B22C15/30
A	PATENT ABSTRACTS OF JAPAN vol. 016, no. 195 (M-1246), 12 May 1992 & JP 04 028453 A (SINTOKOGIO LTD), 31 January 1992, * abstract *	1-5	
A	EP 0 490 701 A (SINTOKOGIO LTD) 17 June 1992 * column 2, line 12 - line 15 *	3,5	
A	EP 0 299 941 A (HYBE MASKIN SYSTEM AB) 18 January 1989 * abstract *	4	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B22C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	6 August 1997	WOUDENBERG, S

CATEGORY OF CITED DOCUMENTS

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