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(54) Method of manufacturing core and mold

Verfahren zur Herstellung von Kernen und Gussformen

Procédé pour fabriquer des noyaux et des moules

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(73) Proprietors:
• **MITSUBISHI JUKOGYO KABUSHIKI KAISHA**
Tokyo (JP)
• **KAO QUAKER CO., LTD.**
Chuo-Ku, Tokyo (JP)

(72) Inventors:
• **Sano, Hiroaki**
5007 Itozaki-cho Mihara Hiroshima Pref. (JP)
• **Yasukuni, Takashi**
5007 Itozaki-cho Mihara Hiroshima Pref. (JP)
• **Ohata, Masaaki**
5007 Itozaki-cho Mihara Hiroshima Pref. (JP)

• **Nagai, Kiyotaka**
5007 Itozaki-cho Mihara Hiroshima Pref. (JP)
• **Matsuura, Hiroshi**
5007 Itozaki-cho Mihara Hiroshima Pref. (JP)
• **Koshiishi, Kunio**
Kayabacho 1-chome Chuo-ku Tokyo (JP)
• **Hirama, Yasuyoshi**
Kayabacho 1-chome Chuo-ku Tokyo (JP)
• **Ogawa, Kyozauro**
Aioi, Hyogo Pref. (JP)

(74) Representative: **W.P. Thompson & Co.**
Coopers Building,
Church Street
Liverpool L1 3AB (GB)

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Description

The present invention relates to a method of manufacturing a core and a mold, and more particularly to a method of manufacturing a core and a mold using self-hardening molding sand.

A core means a part which forms the shape of a hollow portion of a casting product, and is generally manufactured with a sandmold. The configuration of the core is multifarious depending on the casting product.

Manufacture of a core using self-hardening molding sand has been heretofore performed by, for example, hand molding, by a machine, such as a jolt machine and a two-dimensional jolt molding machine, and by filling a mold utilizing air (a blowing method).

The method of filling molding sand utilizing air is used widely in mass production foundries as a method of molding a core with comparatively medium and small sized mass products as its objects.

In the small quantity production of a variety of products in which self-hardening molding sand is used for the core, the core is generally manufactured by hand molding only or a joint operation of molding by a machine (such as a jolt machine and a two-dimensional jolt molding machine) and that by hand.

Fig. 7 shows a method of manufacturing a core by hand molding. In Fig. 7, reference numeral 1 denotes a core pattern, 2 denotes self-hardening molding sand, and 9 denotes a rammer or a sand rammer.

The self-hardening molding sand 2 is charged into the core pattern 1 in an appropriate quantity, rammed with the rammer or the sand rammer 9 and left as it is until it self-hardens.

Fig. 8 shows a method of manufacturing a core using a two-dimensional jolt molding machine, in which 1 denotes a core pattern, 2 denotes self-hardening molding sand and 6' denotes a two-dimensional jolt molding machine.

The core pattern 1 is placed on the two-dimensional jolt molding machine 6', the self-hardening molding sand 2 is charged in an appropriate quantity into the core pattern 1, and the two-dimensional jolt molding machine 6' is operated to shake the pattern, so as to improve the filling density of the self-hardening molding sand 2.

However, it is impossible to fill the self-hardening molding sand 2 to corner angle portions A₁, A₂, A₃, A₄, A₅, A₆ and others of the core pattern only with the shaking force of the two-dimensional jolt molding machine 6'. Therefore, supplementary hand molding for filling the self-hardening molding sand 2 to the corner angle portions A₁, A₂, A₃, A₄, A₅, A₆ and others of the core pattern 1 with a rammer or a sand rammer 9 becomes necessary.

After the core is manufactured, the core is taken out of the core pattern 1 after leaving it as it is until the self-hardening molding 2 hardens, similarly to hand molding shown in Fig. 7.

Such a method of manufacturing a core has problems as follows.

When a core having a complicated configuration is molded, it is required to ram the core by hand in order to realize the configuration of the core with certainty and to obtain a required core density.

Thus, in case of a core pattern having such a complicated configuration that ramming of the core by hand is difficult, the core is split. Therefore, after manufacture of the core is completed there occur such problems as that assembling the split cores is more time consuming, dimensional accuracy of the core deteriorates, and burrs occur on the cast product.

Further, it is necessary to leave the core as it is for a certain period of time until the self-hardening molding sand hardens in the core pattern after manufacture of the core is completed. As a result, there are such problems as increased core molding periods, variation in time between the hardening and ejection of cores, and deformation of cores at the time of ejection or after ejection (varying depending on ambient conditions).

A hand molding method and a molding method with a two-dimensional jolt molding machine are also adopted for the manufacture of a sandmold casting using self-hardening casting sand. In these manufacturing methods, the pattern is taken out of a flask after standing by for several tens of minutes to several hours until a chemical reaction between a resin for caking mixed in the molding sand and a hardening agent progresses and the mold hardens after the molding of the self-hardening mold is completed. Fig. 15 is a partial longitudinal sectional side view showing a method of manufacturing a self-hardening mold by hand molding, in which numeral 11 denotes a pattern, 12 a flask, 13 self-hardening molding sand, 17 a roller conveyor, 22 a sand rammer and 24 a surface plate.

In Fig. 15, the flask 12 is placed on the surface plate 24 on the roller conveyor 17, the pattern 11 is placed in the flask 12, and the self-hardening molding sand 13 is charged in an appropriate quantity in a void portion, formed with the pattern 11 and the flask 12 and is rammed with the sand rammer 22. After the mold is manufactured through repetitive operations of charging of the self-hardening molding sand 13 and ramming with the sand rammer 22, the mold is left as it is until it hardens.

Fig. 16 is a partial longitudinal sectional side view showing a method of manufacturing a self-hardening mold using a two-dimensional jolt molding machine, in which numeral 11 denotes a pattern, 12 denotes a flask, 13 denotes self-hardening molding sand, 14 denotes a vibrating table, 15 denotes air springs, 16 denotes shakers, 17 denotes a roller conveyor, 23 denotes a riser wood pattern and 24 denotes a surface plate. In Fig. 16, the flask 12 mounted on the surface plate 24 is placed on the vibrating table 14 of the two-dimensional jolt molding machine, the pattern 11 is placed in the flask 12, the self-hardening molding sand 13 is charged in the void portion formed with the pattern 11 and the flask 12, and it is intended to improve the filling density of the self-hardening molding sand 13 by shaking the two-dimen-

sional jolt molding machine.

In this case, filling at a root portion of the riser wood pattern 23 and the like is not sufficient only by molding with shaking on the two-dimensional jolt molding machine. Therefore, it is also required to perform supplementary hand molding operation with a sand rammer or a rammer. Further, in the event that there is an attachment on the pattern, filling at the lower part of the attachment is liable to be insufficient, and thus hand operation is necessary in a similar manner to the above-described case. After the mold is manufactured in such a manner, ejection is performed, that is, the pattern 11 and the riser wood pattern 23 are taken out after leaving the mold as it is until the self-hardening molding sand 13 hardens similarly to the case of hand molding.

According to the conventional methods of manufacturing a self-hardening mold shown in Fig. 9 and Fig. 10, there are such problems as follows.

First of all, it is required to increase the filling density of the self-hardening molding sand and to reduce the unevenness thereof in order to secure dimensional accuracy of a casting and to eliminate seizure, sand contamination and the like which are defects in casting complicating the fettling. However, it is insufficient by the conventional method, viz., the mold manufacturing method by hand molding or a two-dimensional jolt molding machine.

Further, the ejection time of the self-hardening mold depends on the atmospheric temperature, the sand temperature, the humidity, the quantity of resin added, the type of hardening agent, the quantity of a hardening agent added and the like. Therefore, it is difficult to control the ejection time, and such troubles as damage to the pattern and damage and deformation of the mold occur.

Furthermore, since the period for leaving the mold untouched in keeping with hardening from the completion of the molding to the ejection of the self-hardening mold is long, there is a drawback of obstructing productivity, too. On the other hand, if the hardening agent is adjusted so as to shorten the ejection time, the problem is caused that hardening starts before the molding operation, and the period during which the molding sand can be used, viz., the spendable period is reduced by a large margin, thus making it difficult to produce a good mold.

There is known from JP-A- 6210345 a vacuum molding and casting method wherein no-binder sand (i.e. plain sand without a binder or water) is introduced into a molding box over a pattern, with a heat film placed therebetween over the surface of the pattern. The interior of the box being connected to a vacuum so as to draw the film onto the pattern surface. The molding box and sand is then subjected to two-dimensional jolting/vibration at the same time as the interior space of the box is subjected to sub-atmospheric pressure. The difference in pressure between that of the atmosphere and said vacuum causes hardening of the sand in the mold. a molten metal is introduced to the mold while the mold is held in the hardened state by the differential pressure.

There is also known from JP-A- 630 52741 a method of forming a casting mold using a technique similar to that of JP-A- 6210345 described hereinbefore, wherein a differential pressure is applied across a mass of free-flowing, no binder sand whereby to ensure that this takes up the shape of a forming box and is held rigid in that condition. Two-dimensional jolting is again sufficient because of the free-flowing nature of this type of plain sand.

It is an object of the present invention to solve the above-described problems when a core and a mold are manufactured using self-hardening molding sand.

More particularly, it is an object of the present invention to provide a method of manufacturing a core in which problems in molding performance and in points of quality of the core and the casting have been solved.

Further, it is a second object of the present invention to provide a method of manufacturing a self-hardening mold in which molding workability and workmanship of a self-hardening mold are excellent and problems in point of quality of a cast casting product can be solved.

In accordance with a first aspect of the present invention, there is provided a method of manufacturing a cast core, comprising introducing self-hardening sand into a hollow core pattern, subjecting the core pattern and the self-hardening sand therein to three-dimensional jolting whereby to promote complete filling of the hollow core pattern with said sand, and removing air and moisture from the core pattern, and hence from said sand, by means of a suction apparatus to promote the hardening of the core.

In the method of manufacturing a core, the molding sand flows into every nook and corner of the mold and minute filling is performed by applying three-dimensional jolting to the pattern when the self-hardening molding sand is charged or after being charged in the core pattern. The moisture contained in the molding sand and the moisture generated by chemical reaction of the caking agent are removed by speeding up air flow by applying suction to the filled molding sand, thus accelerating hardening.

According to the above described method of manufacturing a core, it is possible to obtain the following effects:

- (1) The core molding period can be reduced to 1/3 to 1/5 of that by a conventional method.
- (2) A ramming operation on the core by hand can be discontinued completely.
- (3) The applicable range of molding the core as one body is enlarged considerably. As a result, assembly and dimension check operations of a core become no longer required.
- (4) Burrs on a casting disappear due to integration of the core, thus making it possible to reduce fettling periods sharply.

(5) Hardening period of the core is reduced to 1/2, and productivity of the core is improved.

(6) Hardening of the core being uniform and good, the accuracy of the core is improved and the dimensional accuracy of a casting is also improved. Further, reduction of finishing cost is also made possible.

In accordance with a second aspect of the invention, there is provided a method of manufacturing a cast mold, comprising introducing self-hardening sand into a hollow casting frame, subjecting the casting frame and self hardening sand therein to three-dimensional jolting whereby to promote filling of the hollow casting frame with said sand, and reducing the air pressure in the casting frame whereby to assist in removing moisture from the sand, generated during the hardening reaction, and to thereby promote the hardening of the casting mold.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a longitudinal sectional view of an apparatus according to a first embodiment of the present invention;

Fig. 2 is a longitudinal sectional view of an apparatus according to a second embodiment of the present invention;

Fig. 3 is a longitudinal sectional view of an apparatus according to a third embodiment of the present invention;

Fig. 4 is a longitudinal sectional view of an apparatus according to a fourth embodiment of the present invention;

Fig. 5 is a longitudinal sectional view of an apparatus according to a fifth embodiment of the present invention;

Fig. 6 is a partial longitudinal sectional side view of an apparatus according to sixth, seventh and eighth embodiments for executing a method of manufacturing a self-hardening mold of the present invention;

Fig. 7 is a longitudinal sectional view of an apparatus for executing a conventional method of manufacturing a core;

Fig. 8 is a longitudinal sectional view of another apparatus for executing a conventional method of manufacturing a core;

Fig. 9 is a partial longitudinal sectional side view of an apparatus for executing a conventional method of manufacturing a self-hardening mold;

Fig. 10 is a partial longitudinal sectional side view of another apparatus for executing a conventional method of manufacturing a self-hardening mold;

Examples of manufacturing a core using self-hardening molding sand

Embodiment - 1

In the first embodiment shown in Fig.1, a core pattern 1 provided with a reduced-pressure suction box 3 or reduced-pressure suction means for core hardening is installed on a vibrating table of a three-dimensional jolt molding machine 6. After self-hardening molding sand 2 mixed at a separate location is added into the core pattern 1 in an appropriate quantity (such as 1/2 of the total sand quantity), the three-dimensional jolt molding machine 6 is actuated and jolts are applied in three mutually perpendicular directions, i.e., X-axis, Y-axis and Z-axis, so as to fill the self-hardening molding sand 2 in the core pattern. The three-dimensional jolt molding machine 6 is then stopped, and an appropriate quantity (for example, 1/4 of the total sand quantity) of molding sand is charged in the core pattern, and the three-dimensional jolt molding machine 6 is re-actuated. The remaining quantity portion (for example, 1/4) of the self-hardening molding sand 2 is then charged in the core pattern 1, and jolt filling is performed again.

Immediately after core molding is completed, a reduced-pressure suction unit 8 is operated for several minutes, and the core is sucked via a suction pipe 7 and the reduced-pressure suction box 3 so as to cause an air flow in the mold, thereby to remove by dehydration the moisture in the self-hardening molding sand 2 and the moisture generated when a caking agent reacts chemically, thus promoting hardening.

Next, the particular operation of the present embodiment will be described.

The shaking forces (frequencies) along the X-, Y- and Z-axes of the three-dimensional jolt molding machine 6 were set at 50 hertz, respectively, a core pattern 1 having a core weight of 30 Kg was installed on the vibrating table, 1/2 of the total sand quantity of the furan molding sand 2 was charged in the core pattern 1, and jolting was applied for 10 seconds. Then 1/4 of the total sand quantity of the furan molding sand 2 was charged in the core pattern 1 and jolted for 20 seconds, and a little over 1/4 of the total sand quantity of the furan molding sand 2 was charged further in the core pattern 1 and jolted for 30 seconds. After the core pattern was completed, the reduced-pressure suction unit 8 was actuated (for 5 minutes) so as to harden the core by speeding up air flow in the mold by sucking the core.

As to the ejected core, even a projected core print approximately 100 mm long was filled completely, and a good core which had been hardened up to the central part uniformly was obtainable. Table 1 shows hardening characteristics when air flow rate in the mold was accelerated for hardening by sucking the furan self-hardening sand.

Table 1

Hardening Characteristics by Suction of Furan Self-Hardening Sand							
Resin		Hardening agent		Suction	Proof pressure		
Type	%	Type	%		after 0.5 Hr	after 1 Hr	after 24 Hr
340B	1	C-14	40	no	0	2.8	37.5
340B	1	C-14	40	yes	3.9	9.4	40.8
340B	1	TK-3	40	no	5.2	11.8	36.0
340B	1	TK-3	40	yes	13.6	28.2	39.5
Note) Tested sand: Kaketsu Fusen No. 5 Ambient temperature: 28°C Humidity: 90% RH Behavior of hardening: Uniform hardening to the depth							

Embodiment - 2

Fig. 2 shows a second embodiment.

A core pattern 1 provided with intercommunicating pores 4 for reduced-pressure suction at portions A_1 , A_2 , ..., A_6 where self-hardening molding sand 2 could not be filled in recessed portions of the core pattern 1 was installed on a three-dimensional jolt molding machine 6, the furan molding sand 2 was charged in the core pattern 1 while actuating a reduced-pressure suction unit 8, and the three-dimensional jolt molding machine 6 provided jolt for about 60 seconds keeping pace with the above, thus manufacturing the core. As the result of executing hardening by suction thereafter in a similar manner as the first embodiment, a good core was obtainable.

Embodiment - 3

Referring to Fig.3, after a core pattern 1 provided with holes 5 for sand replenishment each 15 mm square at recessed portions A_1 , A_2 , A_4 and A_5 of the core pattern 1 was installed on a three-dimensional jolt molding machine 6, 1/2 of the total sand quantity of furan molding sand 2 was charged in the core pattern 1 and jolted for about 20 seconds. Then, the furan molding sand was charged in a supplemental manner through an upper part and holes 5 for sand replenishment of the core pattern 1 with jolt by the three-dimensional jolt molding machine 6 and was jolted for about 40 seconds. As the result of actuating a reduced-pressure suction unit 8 so as to promote hardening by suction after molding of the core was completed, a good core was obtainable.

Embodiment - 4

Fig. 4 shows a fourth embodiment in which a core is hardened by sucking under reduced pressure from an upper part of a core pattern. A core pattern 1 provided with intercommunicating pores 4 for reduced-pressure suction and holes 5 for sand replenishment (omitted depending on the configuration of the core) is installed on a vibrating table of a three-dimensional jolt molding machine 6. A core is molded by shaking with the three-dimensional jolt molding machine 6 while charging self-hardening molding sand 2 mixed at a separate location in the core pattern 1 in parts by appropriate quantities.

As the result of operating a reduced-pressure suction unit not shown for several minutes after molding of the core was completed, accelerating air flow in the mold by sucking the core through a suction pipe 7 provided at the upper part of the core pattern 1, removing the moisture in the self-hardening molding sand 2 and the moisture generated at time of chemical reaction, and promoting hardening, the ejection period of the core could be reduced by half as compared with a conventional self-hardening method, and uniform hardening up to the depth of the core was realized.

Reference number 10 denotes a clamp in Fig.4.

Embodiment - 5

Fig. 5 shows a fifth embodiment in which hardening is made by sucking under reduced pressure from a side of a core pattern.

5 The adding method and the shaking point of self-hardening molding sand 2 are similar to those in the fourth embodiment.

Suction under reduced pressure was performed through the side portion of the core pattern 1, but satisfactory results similar to the fourth embodiment were obtainable in points of ejection period and hardened state.

10 Examples of manufacturing a mold using self-hardening molding sand

Fig. 6 shows an apparatus suitable for working of a method of manufacturing a self-hardening mold of the present invention.

15 Fig. 6 is a partial longitudinal sectional side view, in which 11 denotes a pattern, 12 denotes a flask and 13 denotes self-hardening molding sand, in which normal temperature self-hardening furan resin as a caking agent of the molding sand of a sandmold casting and a hardening agent are mixed. 14 denotes a vibrating table of a three-dimensional jolt molding machine, 15 denotes air springs, 16 denotes shakers, and 17 denotes a roller conveyor which conveys a surface plate 24 on which a flask 12 is placed. 18 denotes a vertical working cylinder, 19 denotes a surface plate for suction under reduced pressure, 20 denotes a suction pipe and 21 denotes a control board of a pressure reducing unit.

20 A method of manufacturing a self-hardening mold of the present invention using the apparatus of Fig.6 will now be described.

Embodiment - 6

25 A flask 12 placed on the surface plate 24 of Fig.6 was placed on the vibrating table 14 of the conventional two-dimensional jolt molding machine shown in Fig. 16, a pattern 11 was placed in the flask 12, furan self-hardening molding sand 13 was charged in a void portion formed by the pattern 11 and the flask 12, and the shakers 16 of the two-dimensional jolt molding machine were actuated thereby to fill the molding sand 13.

30 Then, this assembly was conveyed into a pressure reducing unit shown in Fig. 6, and was brought into a close contact with the upper surface of the flask 12 by lowering the surface plate 19 for reduced-pressure suction provided with a reduced-pressure suction mechanism by means of a vertical working cylinder 18. Thereafter, a pressure reducing pump (not shown) was operated for five minutes and the pressure inside the flask 12 was reduced down to 200 mmHg through suction pipes 20. After approximately 30 minutes had elapsed, the mold was ejected and the hardening state thereof was investigated. As a result, it was found that the ejection period could be reduced by half as compared with
35 that in which no pressure reduction was made, and a good mold which was hardened uniformly up to the depth of the mold and had no deformation was also obtainable.

Embodiment - 7

40 A flask 12 is placed via the surface plate 24 on the vibrating table 14 of the three-dimensional jolt molding machine shown in Fig. 6 and a pattern 11 to which a riser wood pattern 23 is fitted is installed therein. After charging an appropriate quantity (for example, 3/4 of the total sand quantity) of furan self-hardening molding sand 13 mixed by a sand mixer in a void portion formed by the pattern 11 and the flask 12, the shakers 16 of the three-dimensional jolt molding machine were actuated, jolt in three directions of X-axis, Y-axis and Z-axis was applied, and the furan self-hardening
45 molding sand 13 was charged in the flask 12. Then, an appropriate quantity (for example, 1/4 of the total sand quantity) of furan self-hardening molding sand 13 was charged in the flask 12, and jolt filling was performed. After molding of the mold was completed, the mold was conveyed into the pressure reducing unit through the roller conveyor 17.

Next, a surface plate 19 for reduced-pressure suction provided with a reduced-pressure suction mechanism was lowered by a vertical working cylinder 18 so as to be brought into close contact with the upper surface of the flask 12, a pressure reducing pump not shown was actuated for several minutes (for example, about 5 minutes) so as to reduce the pressure in the flask 12 (for example, 150 mmHg to 250 mmHg) through a suction pipe 20, and the moisture contained in the furan self-hardening molding sand 13 and the moisture generated at time of chemical reaction between furan resin which is a caking agent mixed with the molding sand and a hardening agent were evaporated thereby to be removed by dehydration through the suction pipe 20. Furthermore, the mold ejected after being left as it was for about
55 30 minutes showed a good mold having no deformation, and the hardening period was not only reduced by half, but also the filling density was high, and which was hardened uniformly up to the central part thereof, as compared with a conventional mold left as it was with no pressure reduction.

Table 2 shows reduced-pressure suction hardening characteristics of the furan self-hardening molding sand.

Table 2

Reduced-Pressure Suction Hardening Characteristics of Furan Self-Hardening Molding Sand							
Resin		Hardening agent		Reduced-pressure	Tensile strength (kg/cm ²)		
Type	wt%	Type	wt%		after 30 m.	1 Hr	24 Hr
340B	1.0	C-14	40	no	0	2.8	37.5
340B	1.0	C-14	40	yes	3.9	9.4	40.8
340B	1.0	TK-3	40	no	5.2	11.8	36.0
340B	1.0	TK-3	40	yes	13.6	28.2	39.5
Note) Wt% of hardening agent is shown with a ratio to resin. Tested sand: Kaketsu Fusen No. 5 Ambient temperature: 28°C Humidity: 90% RH Degree of pressure reduction: -150 mmHg Behavior of hardening: Uniform hardening to the depth of the mold (in case of reduced-pressure hardening)							

Claims

1. A method of manufacturing a cast core, comprising introducing self-hardening sand into a hollow core pattern, subjecting the core pattern and the self-hardening sand therein to three-dimensional jolting whereby to promote complete filling of the hollow core pattern with said sand, and removing air and moisture from the core pattern, and hence from said sand, by means of a suction apparatus to promote the hardening of the core.
2. A method of manufacturing a core according to claim 1, wherein small holes communicating with said suction apparatus are provided at corner portions within the core pattern so as to facilitate filling the molding sand within said corner portions.
3. A method of manufacturing a core according to claim 1, wherein holes for sand replenishment are provided at recessed portions of the core pattern where it is difficult to fill the molding sand so as to facilitate filling the molding within said recessed portions.
4. A method of manufacturing a core according to claim 3, wherein small holes communicating with said suction apparatus are provided at corner portions within the core pattern so as to facilitate filling the molding sand within said corner portions.
5. A method of manufacturing a cast mold, comprising introducing self-hardening sand into a hollow casting frame, subjecting the casting frame and self hardening sand therein to three-dimensional jolting whereby to promote filling of the hollow casting frame with said sand, and reducing the air pressure in the casting frame whereby to assist in removing moisture from the sand, generated during the hardening reaction, and to thereby promote the hardening of the casting mold.

Patentansprüche

1. Verfahren zur Herstellung eines Gießkerns, umfassend das Einleiten von selbsthärtendem Sand in eine hohle Kernform, Unterziehen der Kernform und des darin befindlichen selbsthärtenden Sandes einem dreidimensionalen Rüttelvorgang, um ein vollständiges Füllen der hohlen Kernform mit dem genannten Sand zu fördern, und Entfernen von Luft und Feuchtigkeit aus der Kernform, und somit aus dem Sand, mit Hilfe einer Absaugvorrichtung, um das Härten des Kerns zu begünstigen.
2. Verfahren zur Herstellung eines Kerns nach Anspruch 1, bei dem kleine, mit der genannten Absaugvorrichtung in

Verbindung stehende Löcher an Eckabschnitten in der Kernform vorgesehen sind, um das Füllen des Formsandes in den genannten Eckabschnitten zu erleichtern.

- 5 3. Verfahren zur Herstellung eines Kerns nach Anspruch 1, bei dem Löcher zum Nachfüllen von Sand in ausgekehrten Abschnitten der Kernform vorgesehen sind, wo das Einfüllen des Formsandes schwierig ist, um das Füllen der Form in den genannten ausgekehrten Abschnitten zu erleichtern.
- 10 4. Verfahren zur Herstellung eines Kerns nach Anspruch 3, bei dem kleine, mit der genannten Absaugvorrichtung in Verbindung stehende Löcher an Eckabschnitten in der Kernform vorgesehen sind, um das Einfüllen des Formsandes in die genannten Eckabschnitte zu erleichtern.
- 15 5. Verfahren zur Herstellung einer Gießform, umfassend das Einleiten von selbsthärtendem Sand in einen hohlen Gießrahmen, Unterziehen des Gießrahmens und des darin befindlichen selbsthärtenden Sandes einem dreidimensionalen Rüttelvorgang, um das Füllen des hohlen Gießrahmens mit dem genannten Sand zu begünstigen, und Reduzieren des Luftdruckes in dem Gießrahmen, um das Entfernen von während der Härungsreaktion erzeugten Feuchtigkeit aus dem Sand zu unterstützen und somit das Härten der Gußform zu begünstigen.

Revendications

- 20 1. Procédé pour fabriquer un noyau coulé, comprenant l'introduction de sable autodurcissant dans une forme de noyau creuse, la soumission de la forme de noyau et du sable autodurcissant qui se trouve à l'intérieur à des vibrations tridimensionnelles de manière à encourager le remplissage complet de la forme de noyau creuse avec ledit sable, et l'élimination de l'air et de l'humidité de la forme de noyau, et donc dudit sable, au moyen d'un appareil suceur pour encourager le durcissement du noyau.
- 25 2. Procédé pour fabriquer un noyau conformément à la revendication 1, dans lequel de petits trous communiquant avec ledit appareil suceur sont fournis au niveau de parties de coin au sein de la forme de noyau de manière à faciliter le remplissage du sable de fonderie à l'intérieur desdites parties de coin.
- 30 3. Procédé pour fabriquer un noyau conformément à la revendication 1, dans lequel des trous pour le réapprovisionnement en sable sont prévus au niveau de parties évidées de la forme de noyau où il est difficile de remplir le sable de fonderie de manière à faciliter le remplissage du moule à l'intérieur desdites parties évidées.
- 35 4. Procédé pour fabriquer un noyau conformément à la revendication 3, dans lequel de petits trous communiquant avec ledit appareil suceur sont fournis au niveau de parties de coin au sein de la forme de noyau de manière à faciliter le remplissage du sable de fonderie à l'intérieur desdites parties de coin.
- 40 5. Procédé pour fabriquer un noyau coulé, comprenant l'introduction de sable autodurcissant dans une carcasse de fonte creuse, la soumission de la carcasse de fonte et du sable autodurcissant qui se trouve à l'intérieur à des vibrations tridimensionnelles de manière à encourager le remplissage de la carcasse de fonte creuse avec ledit sable, et la réduction de la pression d'air dans la carcasse de fonte de manière à aider l'élimination de l'humidité du sable, générée durant la réaction de durcissement, et pour ainsi encourager le durcissement du moule de fonte.

FIG. 1

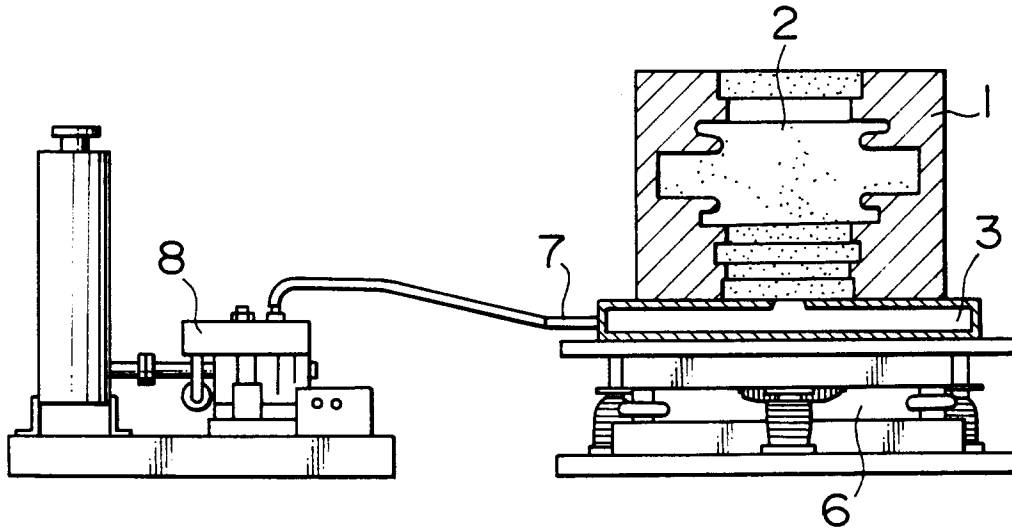


FIG. 2

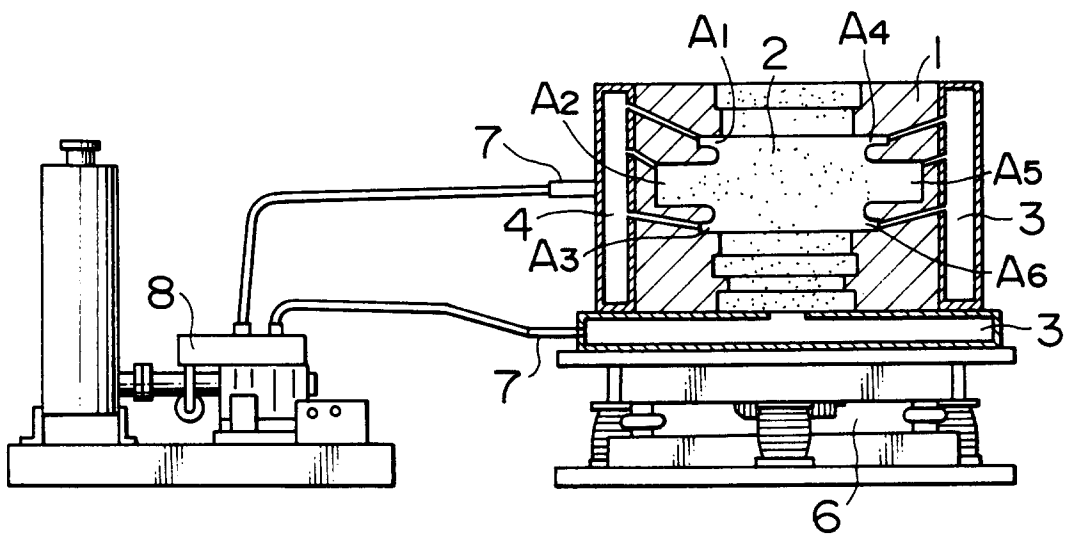


FIG. 3

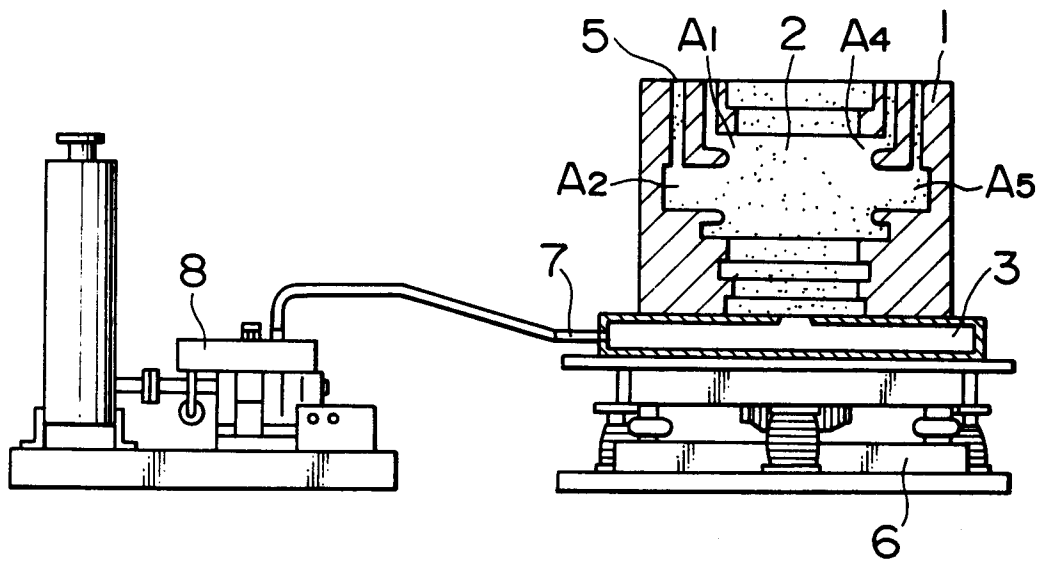


FIG. 4

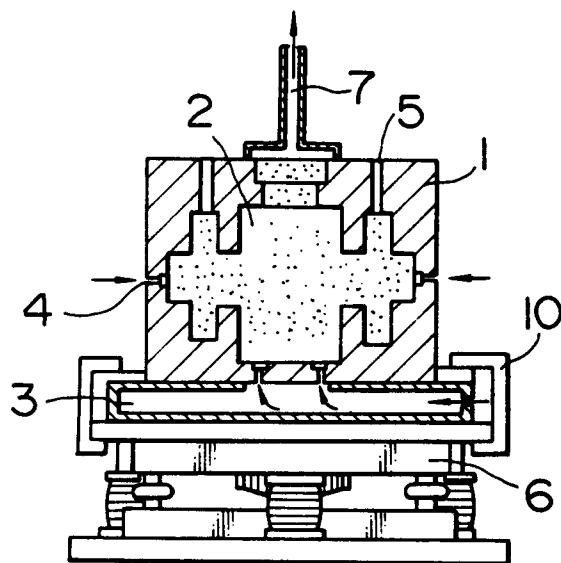


FIG. 5

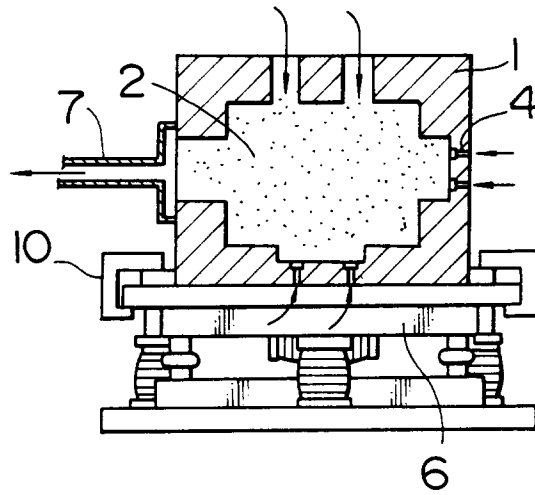


FIG. 6

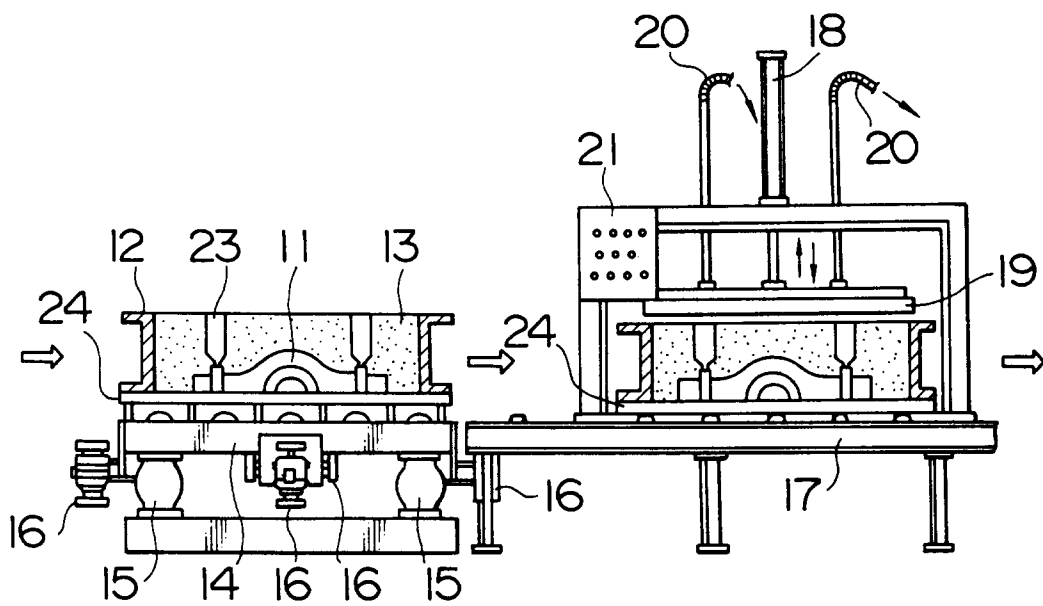


FIG. 7

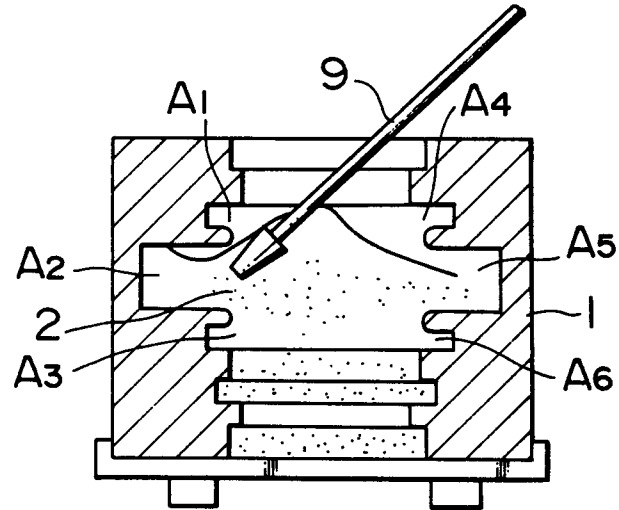


FIG. 8

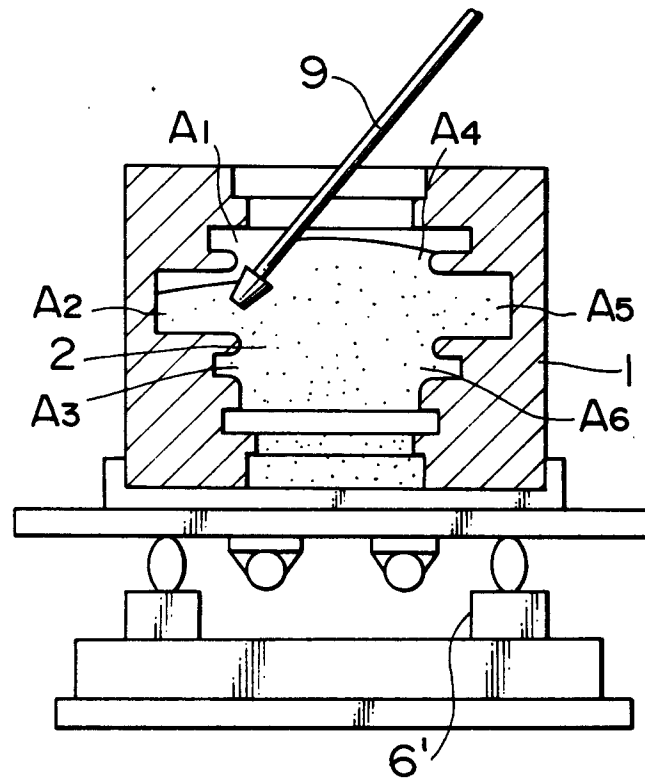


FIG. 9

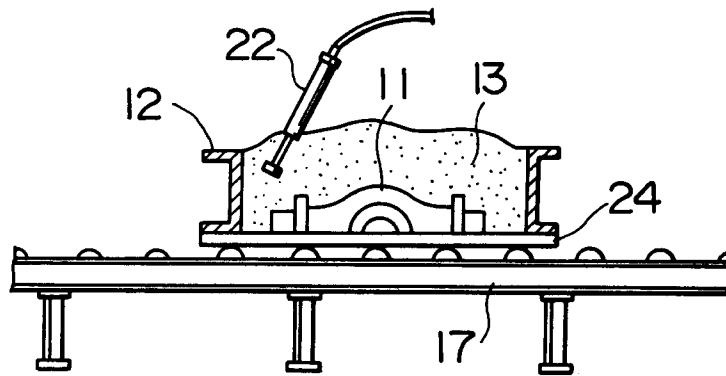


FIG. 10

