



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
07.09.2016 Bulletin 2016/36

(51) Int Cl.:
B22C 13/08 (2006.01)

(21) Application number: **14857419.7**

(86) International application number:
PCT/JP2014/074549

(22) Date of filing: **17.09.2014**

(87) International publication number:
WO 2015/064236 (07.05.2015 Gazette 2015/18)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **30.10.2013 JP 2013225382**

(71) Applicants:
• **TOYOTA JIDOSHA KABUSHIKI KAISHA**
Toyota-shi, Aichi-ken 471-8571 (JP)
• **Sintokogio, Ltd.**
Nagoya-shi, Aichi 460-0003 (JP)

(72) Inventors:
• **MAEGAWA, Takumi**
Toyota-shi
Aichi 471-8571 (JP)

• **WATANABE, Hirotsune**
Toyota-shi
Aichi 471-8571 (JP)
• **MITSUTAKE, Masaomi**
Toyota-shi
Aichi 471-8571 (JP)
• **KANNO, Toshio**
Toyokawa-shi
Aichi 442-8505 (JP)
• **KURITA, Hiroataka**
Toyokawa-shi
Aichi 442-8505 (JP)
• **KATO, Yusuke**
Toyokawa-shi
Aichi 442-8505 (JP)

(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

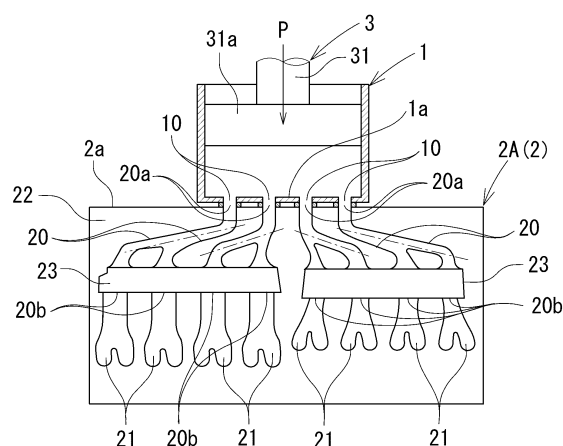
(54) **MOLD SHAPING DEVICE**

(57) [TASK] To provide a mold forming apparatus capable of reliably causing a foamed mixture to appropriately fill a cavity of a forming mold by a simple configuration, and capable of achieving reduction in size.

[MEANS OF SOLVING THE PROBLEM] The mold forming apparatus includes: a storage tank 1 that has in its bottom 1a a plurality of injection ports 10 capable of being opened and closed, and that stores a foamed mixture; a forming mold 2 that has a plurality of runners 20, corresponding to the injection ports 10, into which the foamed mixture is introduced through the injection ports 10 of the storage tank 1, and that has cavities 21 for forming the introduced foamed mixture into a mold in a predetermined shape; and pressing means 3 that is disposed so as to correspond to the forming mold 2 and that presses the foamed mixture stored in the storage tank 1 to inject the foamed mixture into the cavities 21 through the runners 20 of the forming mold 2, wherein a parting surface 22 of the forming mold 2 is formed parallel to a pressing direction P of the pressing means 3, and the runners 20 of the forming mold 2 are formed in the parting surface 22 and are tilted with respect to the pressing di-

rection P of the pressing means 3 so as to spread apart from inlets 20a toward outlets 20b guided to the cavities.

F I G . 3



Description

TECHNICAL FIELD

[0001] The present invention relates to a mold forming apparatus, and more particularly to a mold forming apparatus including: a storage tank that has in its bottom an injection port capable of being opened and closed and that stores a foamed mixture formed by agitating a granular aggregate and an additive; a forming mold that has a runner into which the foamed mixture is introduced through the injection port of the storage tank and that has a cavity for forming the introduced foamed mixture into a mold in a predetermined shape; and pressing means that is disposed so as to correspond to the forming mold and that presses the foamed mixture stored in the storage tank to inject the foamed mixture into the cavity through the runner of the forming mold.

BACKGROUND ART

[0002] Patent Document 1 is known as related art of a mold forming apparatus. Patent Document 1 describes a mold forming apparatus that forms a mold by filling a cavity of a heated mold with a foamed mixture formed by agitating a granular aggregate, a water soluble binder, and water by an injection method, characterized by including: mixture storage means that has a hollow rectangular parallelepiped body having the shape of a rectangular parallelepiped and having a space extending in the vertical direction, that has a bottom plate closing an opening at the lower end of the hollow rectangular parallelepiped body and having injection holes for injecting the foamed mixture, and that has both a function as an agitation tank in which the granular aggregate, the water soluble binder, and the water are agitated, and a function as an injection cylinder that stores the foamed mixture in order to inject the foamed mixture; and plug means capable of closing the injection holes.

[0003] In such a mold forming apparatus, in general, in order to cause the foamed mixture to entirely fill the cavity of the forming mold, a plurality of runners are formed in the forming mold according to the size, shape, etc. of a mold to be formed, and a plurality of injection holes are formed in the bottom plate of the hollow rectangular parallelepiped body (hereinafter referred to as a "bottom of the storage tank") so as to correspond to inlets of the runners. In order for the foamed mixture to be reliably injected into the cavity with minimum resistance, the runners are typically formed linearly and parallel to the direction in which the foamed mixture stored in the storage tank is injected.

[0004] The forming mold is typically formed by a pair of forming molds that can be opened and closed, and is often formed such that abutting surfaces (parting surface) of both the forming molds extend in a direction perpendicular to the direction in which the pressing means presses the foamed mixture, that is, such that the runners

are formed in one of the forming molds and the direction in which the forming molds are opened and closed is parallel to the direction in which the pressing means presses the foamed mixture.

Prior Art Documents

Patent Documents

[0005] Patent Document: International Publication No. WO 2005/089984

SUMMARY OF THE INVENTION

15 Problem to be Solved by the Invention

[0006] However, in the case where a plurality of runners are formed according to the size, shape, etc. of a mold to be formed such that the runners extend linearly and parallel to the direction in which the foamed mixture is injected as in the related art, injection ports are formed in the bottom of the storage tank so as to correspond to the inlets of the runners. The bottom of the storage tank therefore needs to have substantially the same size as the maximum width of the surface of the forming mold in which the inlets of the runners are formed. In particular, in the case where the storage tank is formed in a cylindrical shape in order to agitate the granular aggregate and the additive to form the foamed mixture by rotating agitating blades in the storage tank, the storage tank is formed such that the diameter of the bottom of the cylindrical storage tank is substantially the same as the maximum width of the surface of the forming mold in which the inlets of the runners are formed. Accordingly, in the case where the cavity of the forming mold is large or has a complex shape etc., the diameter of the storage tank is increased accordingly, which increases the overall size of the mold forming apparatus and the space required to install the mold forming apparatus.

[0007] In the case where the direction in which the forming molds are opened and closed is parallel to the direction in which the pressing means presses the foamed mixture, a large distance is required between the forming mold and the pressing means so that the forming mold does not interfere with the pressing means when opened. This increases the overall size of the mold forming apparatus and the space required to install the mold forming apparatus. Moreover, in the case where the direction in which the forming molds are opened and closed is parallel to the direction in which the pressing means presses the foamed mixture, the runners are formed in one of the forming molds. In this case, the solidified foamed mixture remains in the runners after a mold is formed, and it is difficult to remove this solidified foamed mixture.

[0008] The present invention was developed in view of the above problems, and it is an object of the present invention to provide a mold forming apparatus capable

of accurately forming a mold by reliably causing a foamed mixture to appropriately fill a cavity of a forming mold by a simple configuration, and capable of achieving reduction in size.

Means for Solving the Problem

[0009] In order to achieve the above object, the invention according to a mold forming apparatus of claim 1 is a mold forming apparatus including a storage tank that has in its bottom a plurality of injection ports capable of being opened and closed, and that stores a foamed mixture formed by agitating a granular aggregate and an additive, a forming mold that has a plurality of runners into which the foamed mixture is introduced through their inlets formed so as to correspond to the respective injection ports of the storage tank, and that has a cavity for forming the introduced foamed mixture into a mold with a predetermined shape, and pressing means that is disposed so as to correspond to the forming mold and that presses the foamed mixture stored in the storage tank to inject the foamed mixture into the cavity through the runners of the forming mold, characterized in that a parting surface of the forming mold is formed parallel to a pressing direction of the pressing means, and each of the runners of the forming mold is formed in the parting surface and is tilted with respect to the pressing direction of the pressing means so as to spread apart from the inlet toward its outlet guided to the cavity.

[0010] In order to achieve the above object, in the invention of claim 1, the invention of the mold forming apparatus of claim 2 is characterized in that the runners extend from the inlets and branch off in an intermediate portion on a downstream side being allowed to obtain the plurality of outlets guided to the cavities.

Effects of the Invention

[0011] According to the invention of claim 1, the parting surface of the forming mold is formed parallel to the pressing direction of the pressing means, and each of the runners of the forming mold is formed in the parting surface of the forming mold and is tilted with respect to the pressing direction of the pressing means so as to spread apart from other runners from the inlet toward its outlet to the cavity. With this simple configuration, the bottom of the storage tank can be made smaller than the maximum width of the surface of the forming mold in which the inlets of the runners are formed. The storage tank therefore need not have a size according to the size of the forming mold, and can thus be reduced in size. Moreover, the forming mold does not interfere with the pressing means when opened. The mold forming apparatus can thus be reduced in size. Since the runners are formed in the parting surface of the forming mold, any solidified foamed mixture remaining inside the runners can be easily removed by opening the forming mold.

[0012] According to the invention of claim 2, the run-

ners extend from the inlets and branch off in an intermediate portion on the downstream side, and have the plurality of the outlets, which guide to the cavities. The inlets of the runners therefore need not be formed so as to correspond to the number of cavities, and the foamed mixture can be reliably caused to appropriately fill the cavities of the forming mold.

(Exemplary Forms of the Invention)

[0013] Some forms of the invention that is recognized as being able to be claimed in the present application (hereinafter sometimes referred to as the "invention that can be claimed"; the invention that can be claimed includes at least the "invention" or "present invention" that is the invention described in the claims, but may include an invention having a narrower concept than the present invention or an invention having a broader concept or a different concept than the present invention) will be shown and described below. As in the claims, the forms are divided into items, the items are numbered, and the number(s) of other item(s) is cited as necessary. This is merely for facilitating understanding of the invention that can be claimed, and is not intended to limit the combination of constituent elements forming the invention that can be claimed to the combinations described in the items shown below. That is, the invention that can be claimed should be interpreted in view of the description associated with each item, the description of the embodiment, etc., and any form in which other constituent element(s) is added to the form of each item or any form in which the constituent element(s) is eliminated from the form of each item may be one form of the invention that can be claimed, as long as these forms are consistent with the interpretation. In the following items, items (1), (2) correspond to claims 1, 2, respectively.

(1) A mold forming apparatus including
a storage tank that has in its bottom a plurality of injection ports capable of being opened and closed, and that stores a foamed mixture formed by agitating a granular aggregate and an additive;
a forming mold that has a plurality of runners into which the foamed mixture is introduced through their inlets formed so as to correspond to the respective injection ports of the storage tank, and that has a cavity for forming the introduced foamed mixture into a mold with a predetermined shape; and
pressing means that is disposed so as to correspond to the forming mold and that presses the foamed mixture stored in the storage tank to inject the foamed mixture into the cavity through the runners of the forming mold, characterized in that
a parting surface of the forming mold is formed parallel to a pressing direction of the pressing means, and
each of the runners of the forming mold is formed in the parting surface and is tilted with respect to the

pressing direction of the pressing means so as to spread apart from the inlet toward its outlet guided to the cavity.

(2) The mold forming apparatus according to item (1), characterized in that the runners extend from the inlets and branch off in an intermediate portion on a downstream side being allowed to obtain the plurality of the outlets guided to the cavity.

(3) The mold forming apparatus according to item (1) or (2), characterized in that an area of the bottom of the storage tank is 70% to 30% of that of a surface of the forming mold in which the inlets of the runners are formed.

Setting the area of the bottom of the tank to 70% to 30%, more preferably 50% to 30%, of that of the surface of the forming mold in which the inlets of the runners are formed makes it possible to make the diameter of the bottom of the cylindrical storage tank smaller than a maximum width of the surface of the forming mold in which the inlets of the runners are formed.

(4) The mold forming apparatus according to any one of items (1) to (3), characterized in that the storage tank is formed in a cylindrical shape and the bottom has a diameter smaller than a maximum width of the surface of the forming mold in which the inlets of the runners are formed.

Making the diameter of the bottom of the cylindrical storage tank smaller than the maximum width of the surface of the forming mold in which the inlets of the runners are formed makes it possible to make the bottom of the storage tank smaller than the maximum width of the surface of the forming mold in which the inlets of the runners are formed.

(5) The mold forming apparatus according to any one of items (1) to (4), characterized by further including agitating means including an agitating member that rotates inside the storage tank to agitate the granular aggregate and the additive, which have been put in the storage tank, to form the foamed mixture.

With the agitating means, the storage tank can function both as an agitation tank in which the granular aggregate and the additive are agitated and as an injection cylinder that injects the foamed mixture stored therein into the forming mold.

(6) The mold forming apparatus according to item (5), characterized by further including moving means for relatively moving the storage tank and the agitating member between an agitating position where the agitating member is located inside the storage tank and a withdrawn position where the agitating member is located outside the storage tank and for relatively moving the storage tank between the withdrawn position and a position between the forming mold and the pressing means where the injection ports are connected to the inlets of the runners of the forming mold.

[0014] After the granular aggregate and the additive which have been put in the storage tank are agitated by the agitating member to form the foamed mixture, the agitating member is immediately moved relative to the storage tank to the withdrawn position by the moving means, and the storage tank is relatively moved to the position between the forming mold and the pressing means to connect the injection ports to the inlets of the runners of the forming mold. The cavities of the forming mold can thus be reliably and quickly filled with the foamed mixture in a satisfactory state.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

[FIG. 1] FIG. 1 is a schematic front view illustrating an embodiment of an entire mold forming apparatus of the present invention.

[FIG. 2] FIG. 2 is a plan view illustrating a storage tank and a forming mold of the present invention.

[FIG. 3] FIG. 3 is a front view of FIG. 2.

MODES FOR CARRYING OUT THE INVENTION

[0016] An embodiment of a mold forming apparatus of the present invention will be described in detail based on FIGS. 1 to 3. The same reference numerals and characters are used throughout the figures to denote similar or corresponding portions.

[0017] The mold forming apparatus of the present invention generally includes: a storage tank 1 that has in its bottom 1a a plurality of injection ports 10 capable of being opened and closed, and that stores a foamed mixture formed by agitating a granular aggregate and an additive; a forming mold 2 that has a plurality of runners 20 into which the foamed mixture is introduced through their inlets 20a formed so as to correspond to the respective injection ports 10 of the storage tank 1, and that has cavities 21 for forming the introduced foamed mixture into a mold with a predetermined shape; and pressing means 3 that is disposed so as to correspond to the forming mold 2 and that presses the foamed mixture stored in the storage tank 1 to inject the foamed mixture into the cavities 21 through the runners 20 of the forming mold 2. A parting surface 22 of the forming mold 2 is formed parallel to a pressing direction P of the pressing means 3. Each of the runners 20 of the forming mold 2 is formed in the parting surface 22 and is tilted with respect to the pressing direction P of the pressing means 3 so as to spread apart from other runners in a direction from the inlet toward its outlet guided to the cavity.

[0018] In the mold forming apparatus of the present invention, the runners 20 extend from the inlets 20a and branch off in an intermediate portion on a downstream side being allowed to obtain the plurality of the outlets 20b guided to the cavities 21.

[0019] In the mold forming apparatus of the present

embodiment, the storage tank 1 is formed in a cylindrical shape (hereinafter referred to as the "cylindrical tank 1"), and the bottom 1a has a diameter D smaller than the maximum width W of a surface 2a of the forming mold 2 in which the inlets 20a of the runners 20 are formed. The mold forming apparatus of the present embodiment further includes agitating means 4 including an agitating member 40 that rotates inside the cylindrical tank 1 to agitate the granular aggregate and the additive, which have been put in the cylindrical tank 1, to form the foamed mixture. The mold forming apparatus of the present embodiment further includes moving means (described later) for relatively moving the cylindrical tank 1 and the agitating member 40 between an agitating position where the agitating member 40 is located inside the cylindrical tank 1 and a withdrawn position where the agitating member 40 is located outside the cylindrical tank 1 and for relatively moving the cylindrical tank 1 between the withdrawn position and a position between the forming mold 2 and the pressing means 3 where the injection ports 10 are connected to the inlets 20a of the runners 20 of the forming mold 2.

[0020] The cylindrical tank 1 is open in its upper part and has the plurality of injection ports 10 in the bottom 1a. The bottom 1a therefore has a circular shape as shown in FIG. 2. The bottom 1a is provided with opening/closing means such as a plug member or a shutter which controllably opens and closes the injection ports 10.

[0021] In the present embodiment, the forming mold 2 is formed by a pair of forming molds 2A, 2B so that the parting surface 22 of the forming molds 2A, 2B extends vertically. The forming molds 2A, 2B are therefore opened and closed along the vertical direction on the paper of FIG. 2 showing a plan view. The runners 20 for introducing the foamed mixture and the cavities 21 for forming a mold with a predetermined shape are formed in abutting surfaces of the forming molds 2A, 2B. In the present embodiment, the inlets 20a of the runners 20 are open at the upper surface of the forming mold 2 in FIG. 3. The inlets 20a of the runners 20 are disposed so as to be aligned with the injection ports 10 when the cylindrical tank 1 is located on the surface 2a of the forming mold 2 in which the inlets 20a of the runners 20 are formed. In the embodiment shown in FIG. 3, the runners 20 are formed such that small parts of their upstream portions which extend from the inlets 20a to be connected to the injection ports 10 are parallel to the pressing direction P of the pressing means 3. The runners 20 are bent at an intermediate position, and their intermediate portions forming large parts of the runners 20 are tilted with respect to the pressing direction P of the pressing means 3 so as to spread apart from each other. In the present embodiment, each of the runners 20 branches into two in its downstream portion, and the outlets 20b are respectively open to a plurality of the cavities 21 via a core print part 23 provided in the forming mold 2. The angle at which the runners 20 are tilted with respect to

the pressing direction P of the pressing means 3 can be set as appropriate in view of the shape and size of a mold to be formed, the positions of the cavities 21 that are formed in the forming mold 2, fluidity of the foamed mixture, etc.

[0022] In the present embodiment, the pressing means 3 has a cylinder 30 provided above the forming mold 2, and a piston 31 fittingly inserted in the cylinder 30 and provided with a pressing portion 31a that enters the cylindrical tank 1 through an opening in the upper part of the cylindrical tank 1 to press the foamed mixture. In the present embodiment, the pressing direction P of the pressing means 3 is downward in the vertical direction in FIG. 3. With the bottom 1a of the cylindrical tank 1 being placed on the upper surface 2a of the forming mold 2 such that the injection ports 10 are aligned with the inlets 20a of the runners 20 and are opened, the piston 31 in the cylinder 30 is driven to extend. The pressing portion 31a at the tip end of the piston 31 can thus enter the cylindrical tank 1 through the opening in the upper part of the cylindrical tank 1 and press the foamed mixture to inject the foamed mixture through the injection ports 10 to fill the cavities 21 with the foamed mixture through the runners 20 of the forming mold 2. That is, the cylindrical tank 1 functions as an injection cylinder that injects the foamed mixture stored therein to fill the cavities 21 of the forming mold 2 with the foamed mixture. The parting surface 22 of the forming molds 2A, 2B extends vertically, and the forming molds 2A, 2B are opened and closed along the lateral direction or in the front-back direction in the plane of the paper of FIG. 3. As described below, the cylinder 30 can therefore be disposed at about such a height that, with the piston 31 in the cylinder 30 being in a retracted state, the pressing portion 31a does not interfere with the cylindrical tank 1 when the cylindrical tank 1 is moved to the left from the withdrawn position of agitating blades 40a as indicated by an arrow S in FIG. 1.

[0023] In the present embodiment, the agitating member 40 of the agitating means 4 has a plurality of agitating blades 40a around a rotary shaft 40b. The rotary shaft 40b for the agitating blades 40a is connected to a rotary drive shaft of a motor 41. The motor 41 is supported by a support member 42. With the injection ports 10 of the cylindrical tank 1 being closed, the granular aggregate and the additive are put in the cylindrical tank 1. The agitating blades 40a are moved into the cylindrical tank 1, and the motor 41 is driven to rotate, whereby the granular aggregate and the additive can be agitated to form the foamed mixture in the cylindrical tank 1. That is, the cylindrical tank 1 can function not only as the injection cylinder described above but also as an agitation tank in which the granular aggregate and the additive are agitated to form the foamed mixture. In the present invention, since the diameter D of the bottom 1a of the cylindrical tank 1 is smaller than the maximum width W of the surface 2a of the forming mold 2 in which the inlets 20a of the runners 20 are formed, the agitating blades 40a can also

be reduced in size. The load on the motor 41 that drivingly rotates the agitating blades 40a is therefore reduced accordingly, whereby the motor 41 can also be reduced in size.

[0024] In the present embodiment, the moving means includes: agitating blade moving means 5 that moves the agitating blades 40a of the agitating means 4 between the agitating position where the agitating blades 40a having been moved into the cylindrical tank 1 through the opening in the upper part of the cylindrical tank 1 can agitate the granular aggregate and the additive, and the withdrawn position where the agitating blades 40a are withdrawn out of the cylindrical tank 1 through the opening in the upper part of the cylindrical tank 1 (see an arrow V in FIG. 1); and moving the cylindrical tank 1 to the position between the pressing portion 31a and the forming mold 2 with the agitating blades 40a being located at the withdrawn position and the piston 31 of the pressing means 3 being in the retracted state (see the arrow S in FIG. 1). In the present embodiment, the agitating blade moving means 5 includes a cylinder 50 disposed at a predetermined height and having the support member 42 bonded to the tip end of a piston rod 51. In the present embodiment, after the granular aggregate and the additive which have been put in the cylindrical tank 1 are agitated by the agitating blades 40a to form the foamed mixture, the piston rod 51 of the cylinder 50 is immediately driven to retract so that the agitating blades 40a are moved to withdraw, and the cylindrical tank 1 is moved in the direction indicated by the arrow S in FIG. 1 to the position between the upper surface 2a of the forming mold 2 and the pressing portion 31a of the pressing means 3. The bottom 1a is placed on the upper surface 2a of the forming mold 2 such that the injection ports 10 are aligned with the inlets 20a of the runners 20. The cavities 21 of the forming mold 2 are thus filled with the foamed mixture in a satisfactory state, and a mold having satisfactory shape accuracy etc. can be formed.

[0025] The outlets 20b of the runners 20 which open to the cavities 21 in the forming mold 2 are disposed according to the size or shape of a mold to be formed. The runners 20 are formed in the parting surface 22 of the forming mold 2 and are tilted with respect to the pressing direction P of the pressing means 3 so as to spread apart from each other from the inlets 20a toward the outlets 20b. The inlets 20a of the runners 20 are formed in the upper surface 2a of the forming mold 2 which is to be contacted by the cylindrical tank 1, and are open to the parting surface 22 of the forming molds 2A, 2B. The injection ports 10 of the cylindrical tank 1 are disposed in the bottom 1a such that the injection ports 10 can be aligned with the inlets 20a of the runners 20 so as to communicate with the inlets 20a of the runners 20. The cylindrical tank 1 is therefore formed such that its diameter D is smaller than the maximum width W of the forming mold 2. The diameter D of the cylindrical tank 1 can be set such that the area of the bottom 1a is 70% to 30%, more preferably 50% to 30%, of that of the upper surface

2a of the forming mold 2 in which the inlets 20a of the runners 20 are open. This can reliably make the bottom 1a of the cylindrical tank 1 smaller than the maximum width W of the upper surface 2a of the forming mold 2 in which the inlets 20a of the runners 20 are formed. The mold forming apparatus can therefore be reduced in size. Since the parting surface 22 of the forming mold 2 is parallel to the pressing direction P of the pressing means 3, the pressing means 3 does not interfere with the forming mold 2 when the forming mold is opened. The mold forming apparatus can therefore be reduced in size. Any solidified foamed mixture remaining in the runners 20 can be easily removed by opening the forming mold 2.

[0026] The present invention is not limited to the above embodiment in which the bottom 1a of the cylindrical tank 1 is positioned on the lower side in the figure and the pressing means 3 presses the foamed mixture from above. For example, the present invention may include a configuration in which the bottom 1a of the cylindrical tank 1 is disposed laterally, the forming mold 2 is disposed laterally on the bottom 1a of the cylindrical tank 1, and the pressing means 3 laterally presses the foamed mixture to fill the cavities of the forming mold 2 with the foamed mixture. The present invention may also include a configuration in which the bottom 1a of the cylindrical tank 1 is positioned on the upper side upward, the forming mold 2 is disposed on the bottom 1a of the cylindrical tank 1, and the pressing means 3 presses the foamed mixture from below to fill the cavities of the forming mold 2 with the foamed mixture, etc.

[0027] The present invention can be applied to any apparatus that forms a mold in a predetermined shape by storing in a storage tank a foamed mixture formed by agitating a granular aggregate and an additive, and pressing the foamed mixture by pressing means to inject the foamed mixture from the storage tank through an injection port to fill a cavity with the foamed mixture through a runner of a forming mold.

40 Description of the Reference Numerals

[0028]

- 1: Cylindrical Tank (Storage Tank)
- 1a: Bottom
- 2: Forming Mold
- 3: Pressing Means
- 4: Agitating Means
- 10: Injection Port
- 20: Runner
- 20a: Inlet
- 20b: Outlet
- 21: Cavity
- 22: Parting Surface
- 40: Agitating Member
- D: Diameter of Cylindrical Tank
- W: Maximum Width of Forming Mold

Claims**1.** A mold forming apparatus including:

a storage tank that has in its bottom a plurality of injection ports capable of being opened and closed, and that stores a foamed mixture formed by agitating a granular aggregate and an additive, 5

a forming mold that has a plurality of runners into which the foamed mixture is introduced through their inlets formed so as to correspond to the respective injection ports of the storage tank, and that has a cavity for forming the introduced foamed mixture into a mold with a predetermined shape, and 10

a pressing means that is disposed so as to correspond to the forming mold and that presses the foamed mixture stored in the storage tank to inject the foamed mixture into the cavity through the runners of the forming mold, wherein a parting surface of the forming mold is formed parallel to a pressing direction of the pressing means, and 15

each of the runners of the forming mold is formed in the parting surface and is tilted with respect to the pressing direction of the pressing means so as to spread apart from the inlet toward its outlet guided to the cavity. 20

2. The mold forming apparatus according to claim 1, wherein the runners extend from the inlets and branch off in an intermediate portion on a downstream side being allowed to obtain the plurality of the outlets guided to the cavity. 25

30

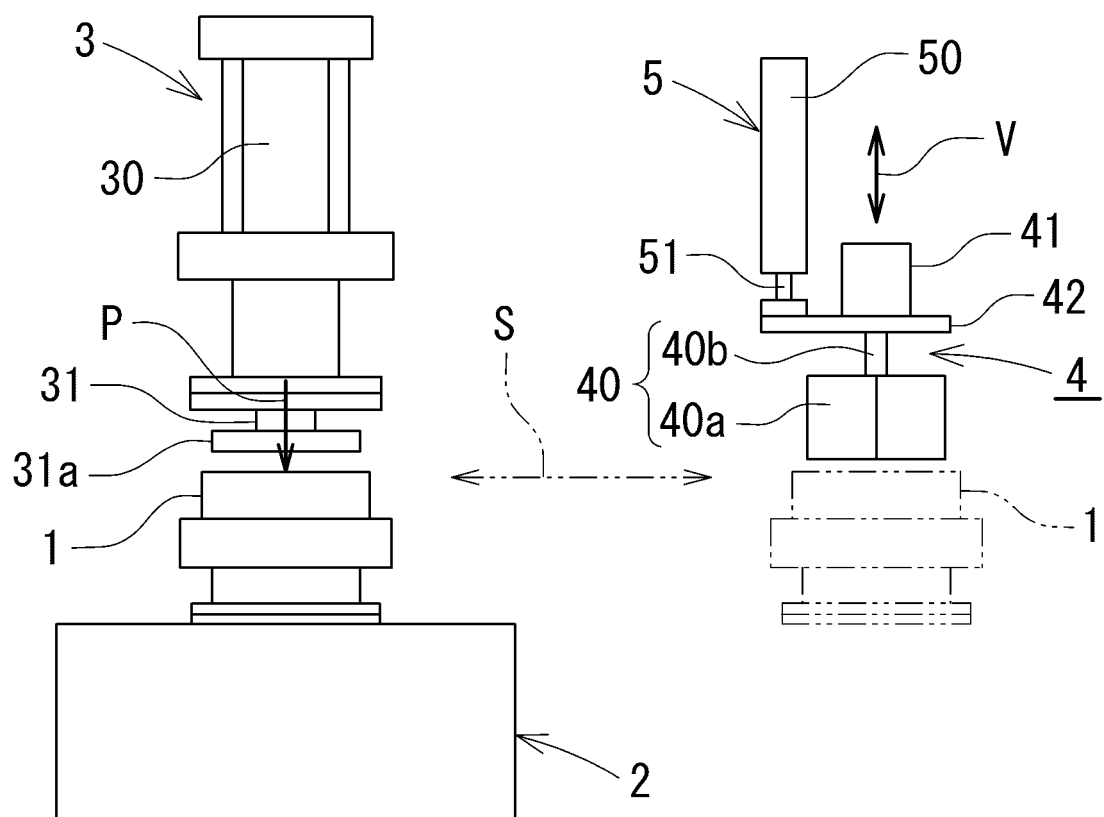
40

45

50

55

F I G. 1



F I G. 2

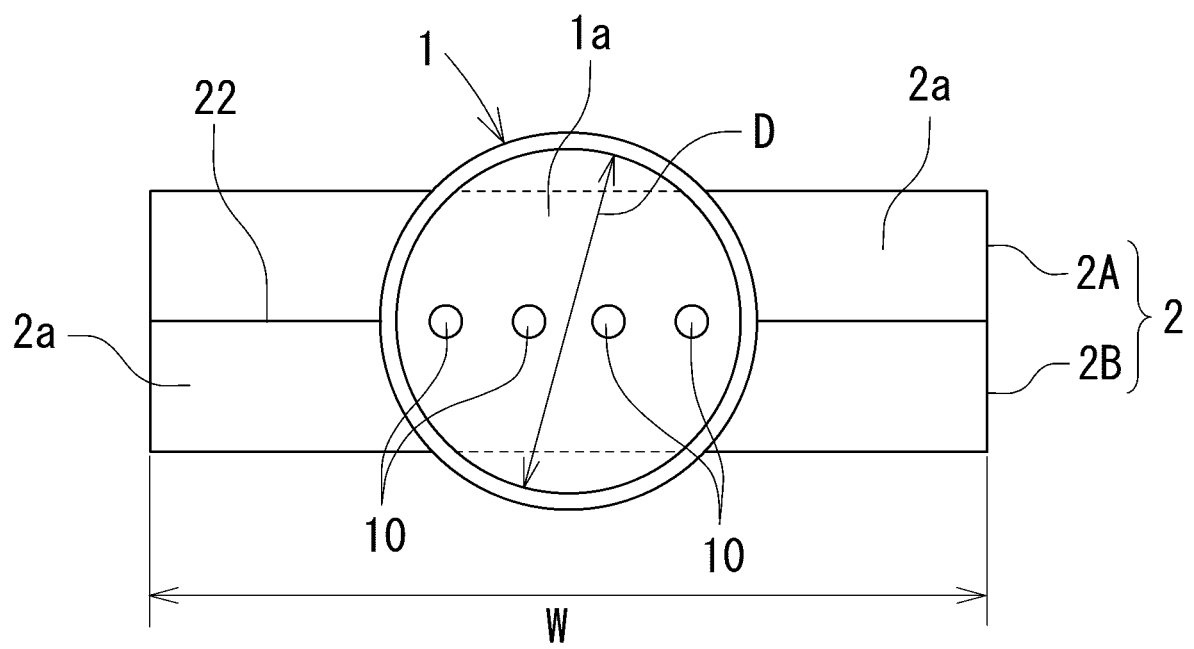
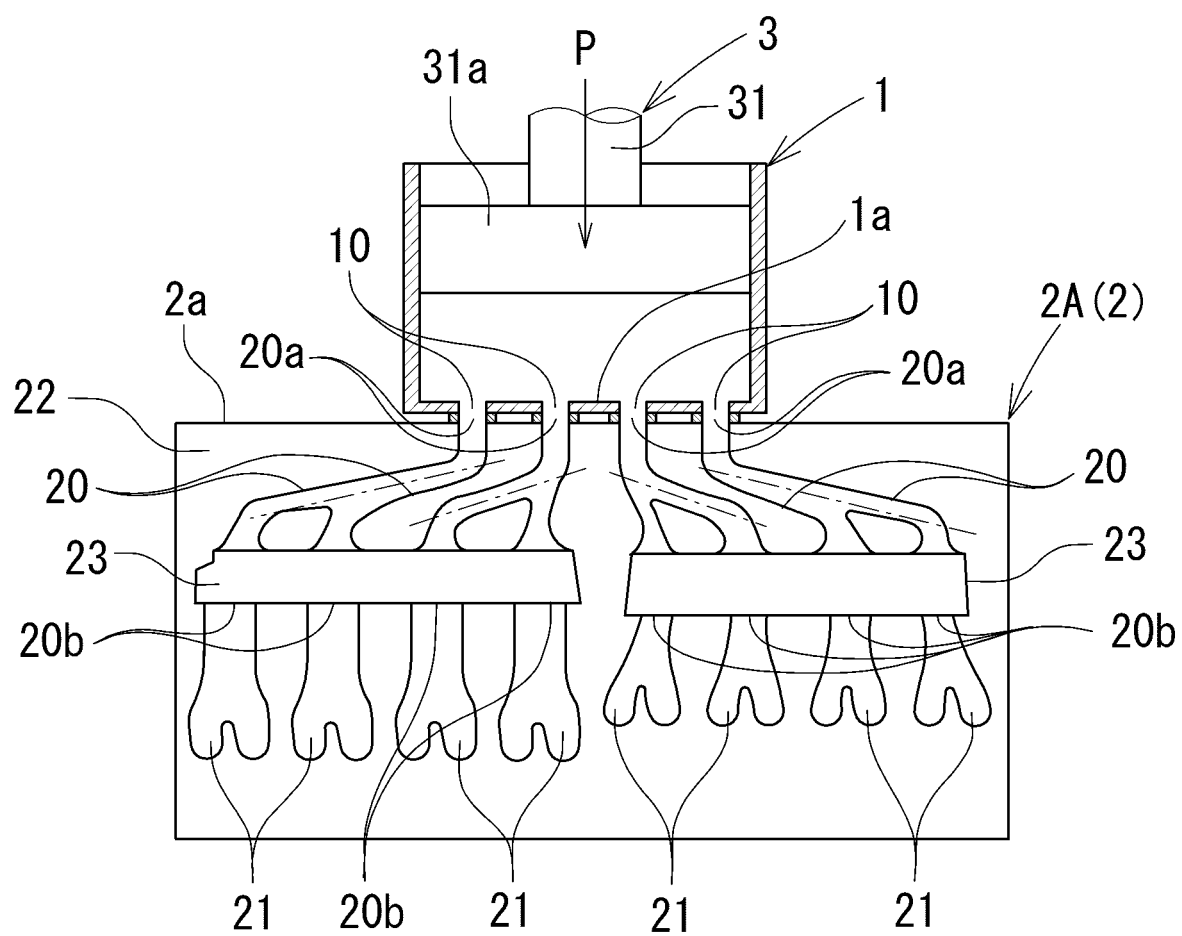


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/074549

A. CLASSIFICATION OF SUBJECT MATTER
B22C13/08(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B22C13/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014
Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 9-29387 A (Aisin Takaoka Co., Ltd.), 04 February 1997 (04.02.1997), entire text (Family: none)	1, 2
A	JP 3407877 B2 (Sinto Kogyo Ltd.), 19 May 2003 (19.05.2003), entire text & JP 2001-259794 A & US 2002/0157804 A1 & WO 2001/070433 A1 & CN 1366475 A & CN 1618546 A	1, 2
A	JP 4-127936 A (Yugen Kaisha San'yu), 28 April 1992 (28.04.1992), entire text (Family: none)	1, 2

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
 "A" document defining the general state of the art which is not considered to be of particular relevance
 "E" earlier application or patent but published on or after the international filing date
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
 "O" document referring to an oral disclosure, use, exhibition or other means
 "P" document published prior to the international filing date but later than the priority date claimed
 "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
 "&" document member of the same patent family

Date of the actual completion of the international search
06 October, 2014 (06.10.14)

Date of mailing of the international search report
14 October, 2014 (14.10.14)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/074549

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2013-188768 A (Ryobi Ltd.), 26 September 2013 (26.09.2013), entire text (Family: none)	1, 2

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2005089984 A [0005]