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(54) Mixer for manufacturing blocks of stone material

(57) In a mixer operating under vacuum for the preparation of a mixture for the production of blocks of stone material, for permitting the addition of additives, in particular colouring agents, during the mixing cycle without having to restore the atmospheric pressure in the mixture and then to add the additive and thereafter to provide again vacuum, there is mounted on the vacuum-tight cover (18) of the mixer at least one metering device (20), which is preferably also maintained under the same vacuum, comprising a hopper (30,32) which is closed at the bottom by an element or cylinder (42) which has a plurality of cavities (50) suitable for being filled with the additive or colouring agent contained in the hopper (30,32). The plurality of cavities (50) are arranged alternately with angular offsetting of 180° so that, by rotating the cylinder (42) through 180°, the cavities (50) filled with the additive are caused to be discharged into the mixing chamber (10) of the mixer without communication being established between the mixing chamber (10), which is under vacuum, and the outside, which is under atmospheric pressure.

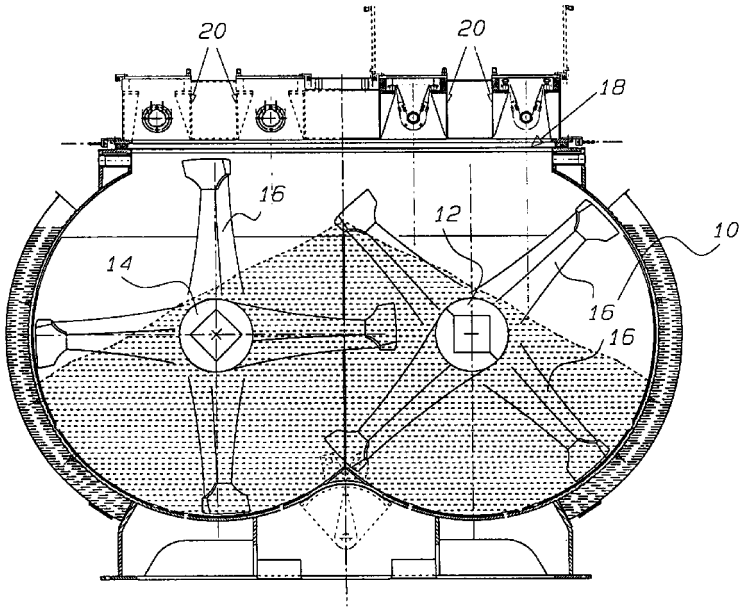

Fig. 1

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Description

[0001] The present invention relates to installations for the manufacture of blocks of stone material and more specifically to a device for supplying additives to the mixer used in those installations.

[0002] Italian Patent No. 1.181.570 describes and claims an improvement in the process and in the installation for manufacturing blocks of material in which a mineral, such as marble, natural stone and the like, in the form of granules or particles of a controlled and predetermined size is mixed with a binder, and the mixture, after an homogenisation stage, is loaded into a mould in which the mixture is subjected to a compacting action under vacuum accompanied by a vibrating movement of predetermined frequency.

[0003] The pre-formed material in the mould is then caused to harden thereby, forming a block capable of being sawn and converted into manufactured articles, such as slabs for paving, coverings etc., in the same manner as a block of natural stone.

[0004] This prior patent relates specifically to an improvement regarding the mixing stage and according thereto, not only the stage of compacting and applying a vibrating movement must take place under a predetermined vacuum, but also the mixing stage should be carried out likewise.

[0005] From the point of view of installation engineering, this means that the mixer from which the forming and hardening mould is supplied must also be under vacuum throughout the entire mixing stage.

[0006] The block so obtained is single-coloured and therefore, in the past, for trying to better imitate the natural stone and the aesthetic effects thereof, one or more colouring substances were added to the mixture.

[0007] The addition was carried out manually, which entailed various problems and disadvantages. Indeed,, in that case the cycle took place according to the following stages:

(1) loading the mixer with suitable amounts of sand and particles of an appropriate granulometry;
(2) creation of vacuum conditions;
(3) mixing while maintaining the mixer under vacuum;
(4) restoration of atmospheric pressure and interruption of the operation of the mixer;
(5) manual addition of the predetermined dose of a first colouring agent;
(6) rotation though 180° of the blades of the mixer (which in the case in point has two groups of blades mounted on a horizontal rotatable shaft, that are offset by 90° relative to one another);
(7) manual addition of a second metered amount of colouring agent (having the same or a different colour from the previous colouring agent);
(8) repetition of stages 6 and 7 several times according to the number of different colouring agents to be added;
(9) restoration of the vacuum;
(10) mixing and simultaneous start of the mixture unloading in order to avoid obtaining a single-coloured block because, by immediately discharging the mixture, blocks are obtained which, when sawn, have the characteristic veining of natural stone, in particular when cutting into slabs.

[0008] It will be appreciated that the stages of adding colouring agents manually, precisely because they are accompanied by a return to atmospheric pressure and by the subsequent restoration of the vacuum, involve a considerable increase in the production times and in the associated costs.

[0009] In addition, that same problem also arises when other additives or modifying agents have to be added to the starting mixture, or more generally when a process stage has to take place under vacuum with intermediate additions of ingredients or additives.

[0010] The principal object of the present invention is to solve that technical problem and in particular to provide a mixer and more specifically a device for loading additives, specifically colouring agents, to be added to the mixture when the latter is in the mixing stage under vacuum, in an automatic and controlled manner and without it being necessary to change the state of vacuum established in the mixer during the stage of preparing and discharging the mixture into the mould.

[0011] This object is achieved by a mixer of the type comprising a mixing chamber connected to vacuum-generating means, provided at the bottom with one or more openings for the controlled discharge of the mixture and with at least one agitator having blades and a horizontal rotating shaft, the chamber being provided with an upper opening for loading the ingredients to be mixed, characterised in that the upper opening is fixedly joined to a metering device for the automated and controlled charging of additives, in particular colouring agents, the metering device comprising a hopper component closed at the bottom by a cylinder or other element having at least one cavity for containing a predetermined amount of additive, the cylinder being movable between a first position in which the cavity is in communication with the hopper component and a second position in which it is in communication with the mixing chamber of the mixer, in such a manner that the inner chamber of the mixer can in no way be in communication with the outside in either the first or the second position of the cylinder.

[0012] Preferably, the metering device is also subjected to the same degree of vacuum as that acting in the mixing chamber, so that the colouring agent can fall on to the mixture without being spread by air currents.

[0013] In a preferred embodiment, the mixture according to the present invention comprises two horizontal bladed shafts mounted parallel to one another and each provided with eight blades offset by 90°, four metering

devices are fixedly applied to the cover which closes the loading aperture of the mixer, mounted symmetrically relative to the axes of the two bladed shafts, in such a manner that the hopper of each metering device is fixedly applied to the cover and is accessible individually by way of a suitable lid, the base or tapered end of each hopper being closed by the cylinder mounted in such a manner that, when the cover of the mixer is closed, its axis is parallel to the axis of the bladed shafts and is offset laterally, the cylinder being provided with a plurality of cavities arranged alternately with angular offsetting of 180°, so that, in each rotation position of the cylinder, half of the cavities are turned towards the hopper and the other half are turned towards the chamber of the mixer.

[0014] The features and the advantages of the present invention will appear more clearly from the following detailed description thereof, given in relation to the appended drawings wherein:

Figure 1 is a diagrammatic view of the mixer having a cover provided with metering devices according to the invention;
Figure 2 is a view in a direction perpendicular to that of Figure 1, which shows only a metering device, partially in section;
Figure 3 is a cross-sectional view of a metering device; and
Figure 4 is a representation of the relative arrangement of the cylinders of the metering devices relative to the bladed shafts of the mixer.

[0015] Referring first of all to Figure 1, it is possible to see a mixer of the conventional type for this kind of installation, so that it is therefore sufficient to mention that it comprises a mixing chamber 10 shaped in such a manner, as to accomodate and to allow the synchronous rotation of two parallel horizontal shafts 12 and 14 which are rotated by means not shown and which are each provided with eight mixing blades 16 offset by 90° relative to one another, as shown more especially in Figure 4.

[0016] The mixer is provided with the usual lower opening for discharging the mixture prepared in it towards a vacuum chamber, which opening is naturally closed by a suitable small door operated at the end of each mixing cycle, and with a vacuum-tight upper cover 18 for loading the ingredients to be mixed into the chamber 10.

[0017] As shown in Figure 1, four metering devices generally indicated 20 are fixed rigidly to the cover in such a manner that they move integrally therewith in its movements between the opening and closing positions.

[0018] Reference will now be made specifically to Figures 2 and 3 for the structure of each metering device.

[0019] The metering device comprises two upright side walls 22 and 24 anchored to the cover 18 of the mixer and an upper horizontal partition 26 having an opening 28 which is centred between the two side walls 22 and 24 and which accommodates the two downwardly converging sides 30 and 32 of a hopper, the upper edges thereof are anchored by means of bolts 34 to two bars 36 which are fixedly joined to the above-mentioned horizontal partition 26 parallel to the opening 28. Above the bolts 34, a vacuum-tight lid 38 hinged at 40 to the fixed structure of the mixer closes the inner space of the metering device.

[0020] The two sides 30 and 32 of the hopper terminate in a closing cylinder 42 which extends longitudinally over the entire length of the metering device and is supported at the two ends by suitable support brackets, being also connected to drive means (not shown) suitable for causing the cylinder to perform controlled rotations, usually of the order of 180°.

[0021] As is shown clearly in Figure 3, in order to ensure that the cylinder 42 can rotate and at the same time that there is a seal between the outer surface of the cylinder and the sides of the hopper, the end portion of the sides is produced in the form of two flexible sheets 46 secured to the sides by means of bolts 48.

[0022] Formed at regular intervals in the outer surface of each cylinder 42 are blind cavities 50 which are distributed along the length of the cylinder and are offset alternately by 180°.

[0023] Thus, the cavities 50 are alternately turned towards the inside of the hopper and towards the mixing chamber.

[0024] In the embodiment shown, the cover 18 of the mixer is associated with four metering devices 20 (cf. Figure 1) which are mounted in such a manner that the respective distributor cylinders 42 are parallel but offset laterally relative to the blade-carrying shafts 12 and 14 of the mixer.

[0025] Figure 4 shows separately the distributor cylinders 42 of the two metering devices to be associated with the shaft 14, and it is therefore possible to see the arrangement of the cavities 50 which are identified by the letters A, B, C, D, E, F, G, H.

[0026] The upper portion of Figure 4 shows the two shafts 12 and 14 of the mixer with the respective blades, identified by the Roman numerals from I to VIII.

[0027] In the same upper portion, shaded circles and the corresponding letters indicate the positions of the cavities 50 turned towards the mixing chamber when the two distributor cylinders 42 are in the position shown in the lower portion of the Figure.

[0028] It will be appreciated that, by previously filling the hoppers of the metering devices 20 with the additive, in particular the desired colouring agent, it is possible to achieve the main object set by the present invention, as can be seen from the following listing of the operating stages of the mixer according to the invention:

(1) loading the metering devices 20 with the required colouring agent and hermetic closing of

the respective lids 38;

(2) loading the mixing chamber with the ingredients of the mixture and closing the cover 18 so that the metering devices 20 adopt the operating position;

(3) creation of the vacuum inside both the mixer and the devices for metering the colouring agent, which are connected to the mixing chamber, with the same degree of vacuum in order to avoid currents of air which could spread the colouring agent in an uncontrolled manner;

(4) operation of the blade-carrying shafts for the necessary cycle duration (normally from 15 to 20 minutes for the mixtures to which the present invention specifically relates);

(5) stopping the blade-carrying shafts in the position shown in Figure 4 and rotating the metering cylinders 42 in such a manner that the pre-metered amounts of colouring agent contained in the cavities directed towards the mixing chamber, fall into the chamber and thus on to the mixture which the chamber contains, the cavities being identified by the letters B and D, E and G, looking at Figure 4, in the case of the blade-carrying shaft 14;

(6) rotation of 180° of the blade-carrying shafts and thus of the respective blades, and rotation through 180° of the cylinders 42 of the metering devices in order to discharge into the mixing chamber the colouring agent contained in cavities A and C, F and H in the case of the blade-carrying shaft 14;

(7) repetition of the operation mentioned under point (6) for the number of times necessary to discharge into the mixing chamber the required amount of colouring agent (usually four times);

(8) setting the mixer back in operation and immediate initiation of the discharge of the mixture into the mould in order to prevent the colouring agent from being distributed uniformly inside the mixture, which would again lead to a single-coloured mixture containing no veining.

[0029] As regards stage (6), it is important to observe that the synchronism between the axes of the bladed mixing shafts 12, 14 and the metering cylinders 42, and also the position of the cavity 50, are controlled in such a manner that the colouring agent does not fall on to the blades but on to the mixture.

[0030] It will be clear from the above description that the present invention achieves the aims initially set with other additional advantages, such as, for example, the fact that the initial charging of the metering devices 20 enables additives to be added to the mixtures of a number of blocks before they are re-filled or topped up.

[0031] Preferably, in order to prevent any colouring agent from adhering permanently to the walls of the containing cavities 50, the cylinder 42 may be associated with a mechanism suitable for applying periodically (for example each time discharge takes place from the cavity to the mixing chamber) a vibrating movement or a succession of gentle shakes.

[0032] With the metering device maintained under a vacuum in the preferred embodiment of the invention it is ensured, on the one hand, that doses of colouring agent are introduced in controlled positions for achieving controlled aesthetic effects, and the blocks obtained, once cut into slabs, have distinctly more pleasing aesthetic effects (colour veining and the like) without causing any drawbacks on the cycle time for the production of the blocks.

[0033] In the above description, reference has been made to a solution which consists in metering cylinders provided with cavities arranged according to a specific orientation.

[0034] It will be appreciated that other mechanisms may be adopted, such as, for example, a metering drawer mounted at the base of the hopper component of the metering device and movable between a position in which a cavity for receiving colouring agent is in communication with the base of the hopper, and a second position in which the cavity is in communication with the mixing chamber of the mixer. Such a drawer may, for example, comprise a parallelepipedal element provided with a cylindrical through hole and with two slidable covers, which close the two ends of the hole and which are openable alternately in accordance with the position occupied by the slide valve.

[0035] As already mentioned, the present invention has been described in relation to two specific elements, that is to say, the mixers used in installations for the production of blocks of stone material and the addition of colouring agents.

[0036] However, it will be appreciated that the invention can also be used in other cases wherein a process stage has to be carried out under vacuum with the concomitant discontinuous introduction of one or more additives.

Claims

1. A mixer of the type comprising a mixing chamber (10) connected to vacuum-generating means, provided at the bottom with one or more openings for the controlled discharge of a mixture, with at least one agitator having blades (16) and a horizontal rotating shaft (12, 14), at with an upper opening for loading the ingredients to be mixed, characterised in that the upper opening there is fixedly applied to at least one metering device (20) for the automated and controlled loading of additives, in particular colouring agents, the metering device comprising a hopper component (30, 32) which is closed at the bottom by a cylinder (42) or other element having at least one cavity (50) for containing a predetermined amount of additive, the cylinder being movable between a first position in which the cavity is in communication with the hopper component and a second position in which it is in communication with

the mixing chamber of the mixer, in such a manner that the inner chamber of the mixer can in no way be in communication with the outside in either the first or the second position of the cylinder.

2. A mixer according to claim 1, characterised in that the metering device also operates under vacuum.

3. A mixer according to claim 2, characterised in that the metering device operates under the same degree of vacuum as the mixing chamber.

4. A mixer according to claim 1, characterised in that on the cover (18) which closes vacuum-tight loading opening of the mixer there are applied fixedly four metering devices (20) which are mounted symmetrically relative to the axes of the two bladed shafts (12, 14) in such a manner that the hopper of each metering device is fixedly joined to the cover and is accessible individually by way of a suitable vacuum-tight lid (38), the base or tapered end of each hopper being closed by the cylinder (42) mounted in such a manner that, when the cover (18) of the mixer is closed, its axis is parallel to the axis of the bladed shafts (12, 14) and is offset laterally, the cylinder (42) being provided with a plurality of cavities (50) ranged alternately with angular offsetting of 180° so that, in each rotation position of the cylinder, half of the cavities are turned towards the hopper and the other half are turned towards the chamber of the mixer.

5. A mixer according to claim 1, characterised in that the hopper comprises two sides (30, 32) tapering towards the bottom and terminating in two flexible sheet elements (46) kept in contact against the outer surface of the cylinder (42).

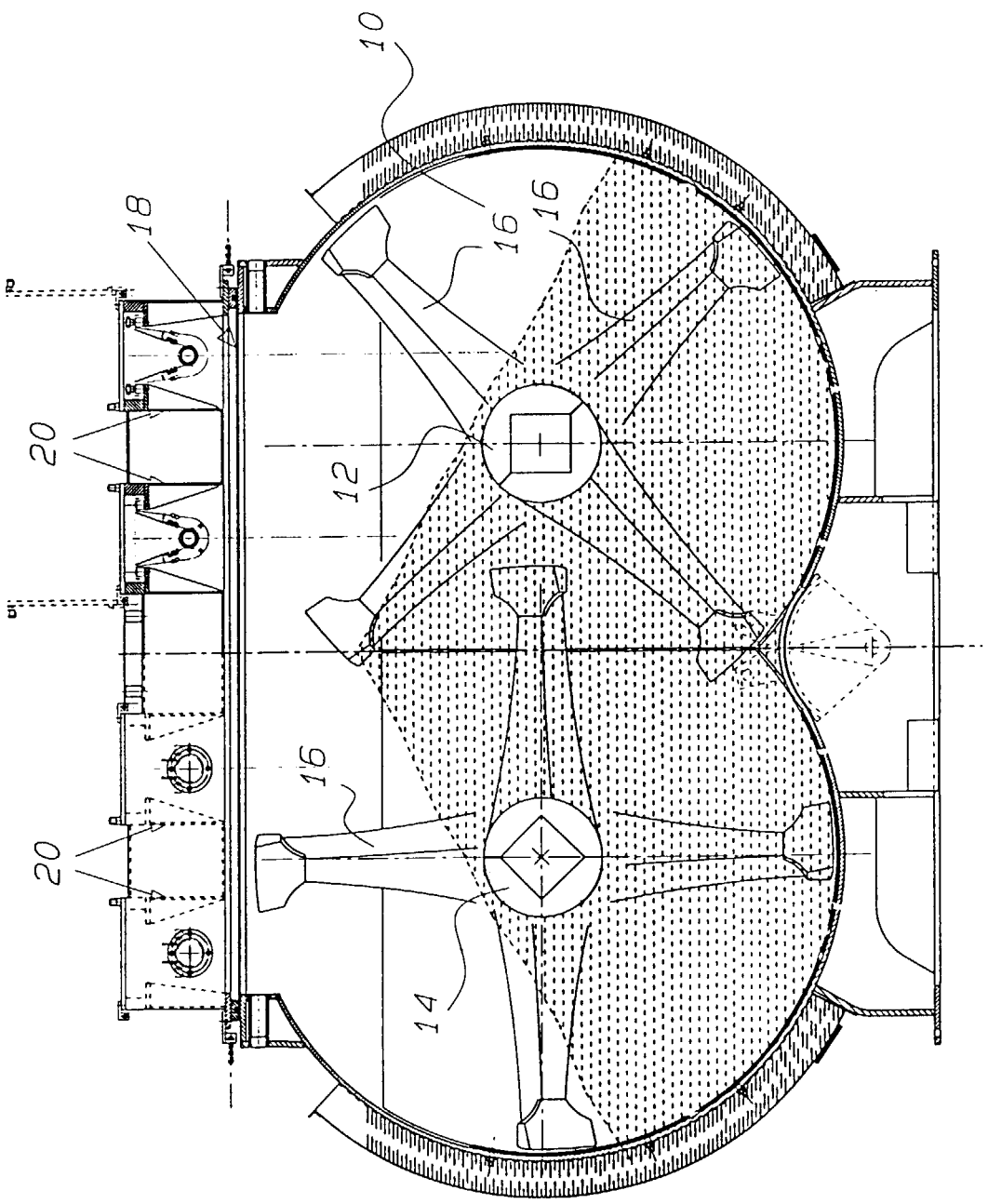


Fig. 1

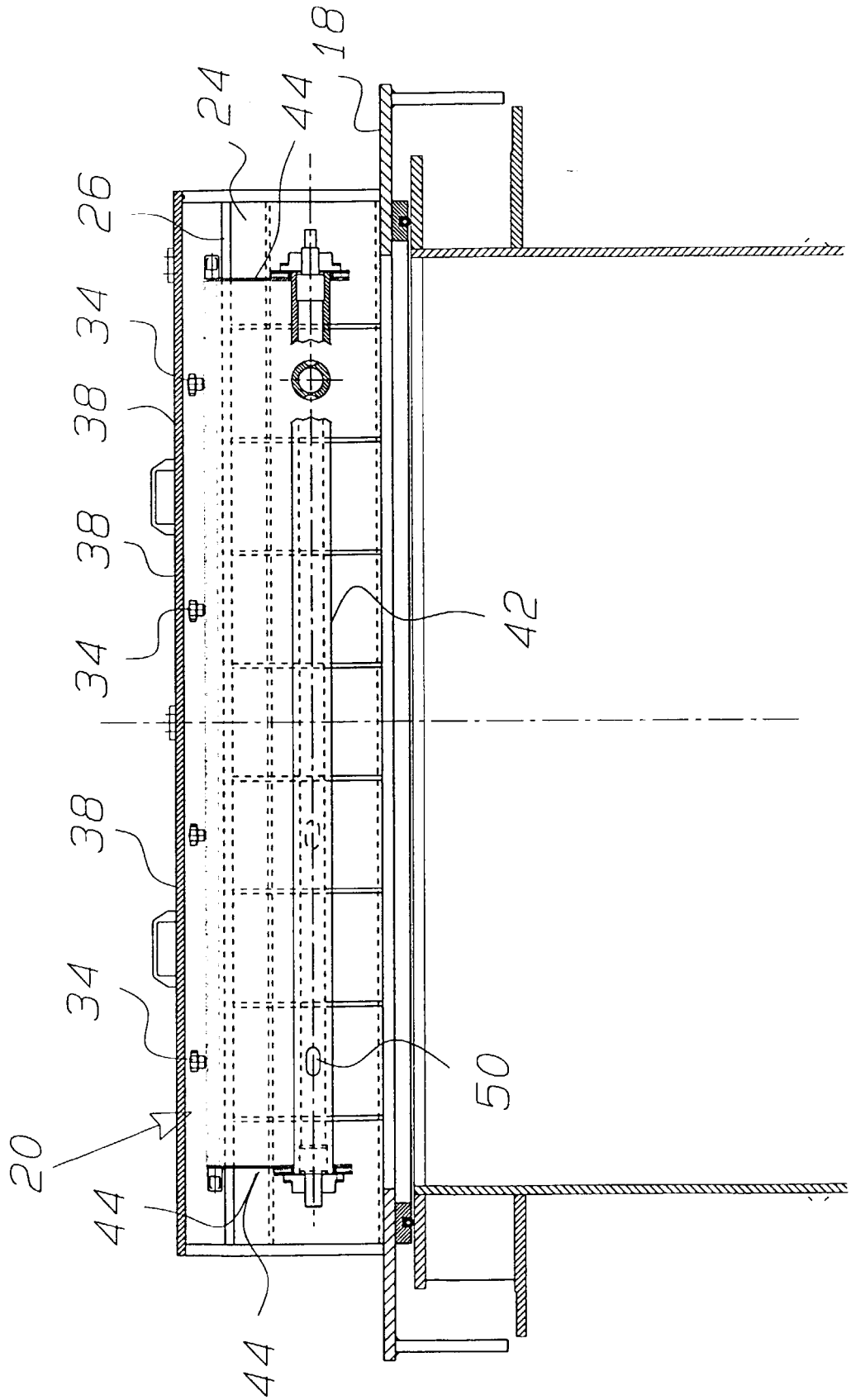


Fig. 2

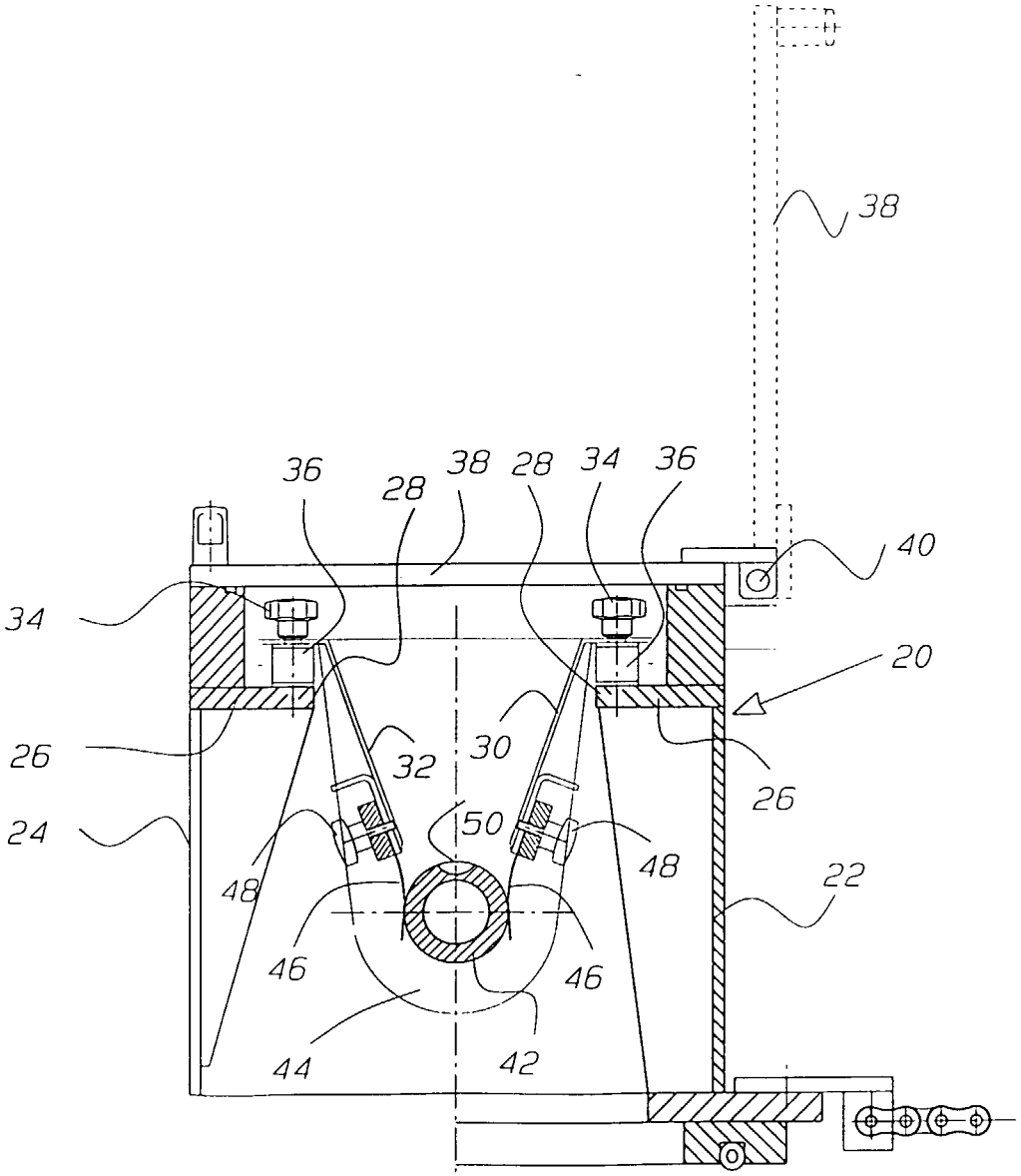
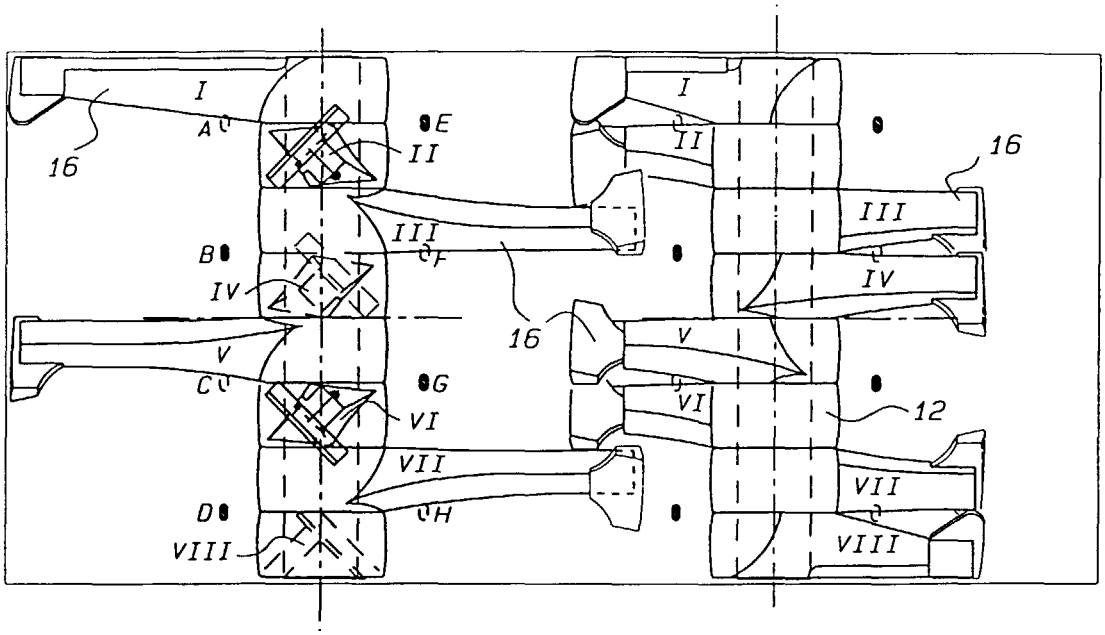


Fig. 3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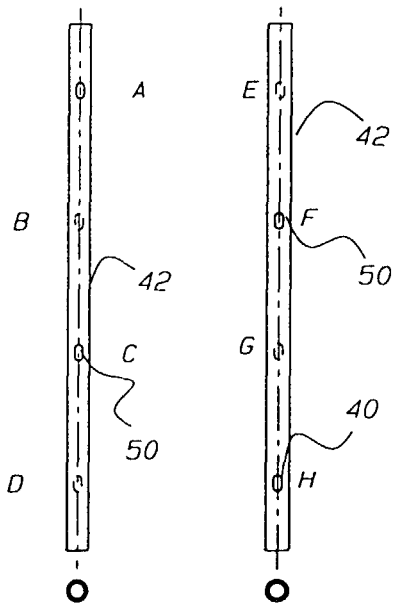
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Fig. 4