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(54) HOPPER OF A SAND CORE MAKING MACHINE

(57) The invention relates to a hopper of a sand core making machine, comprising a hollow body (1) with an inner surface (1.0) delimiting a passage for a material used in the manufacture of the sand core. The hopper (100) further comprises a plurality of breaker assemblies (3), each breaker assembly (3) comprising at least one thread (3.0) and each end of a thread (3.0) being attached to a corresponding attachment point (1.1) of the inner surface (1.0) of the body (1), such that the threads (3.0) are arranged in the passage for the material. Two contiguous breaker assemblies (3) are spaced apart such that said two breaker assemblies (3) interact with each other to break lumps of the material supplied to the hopper (100) when the body (1) is shaken.

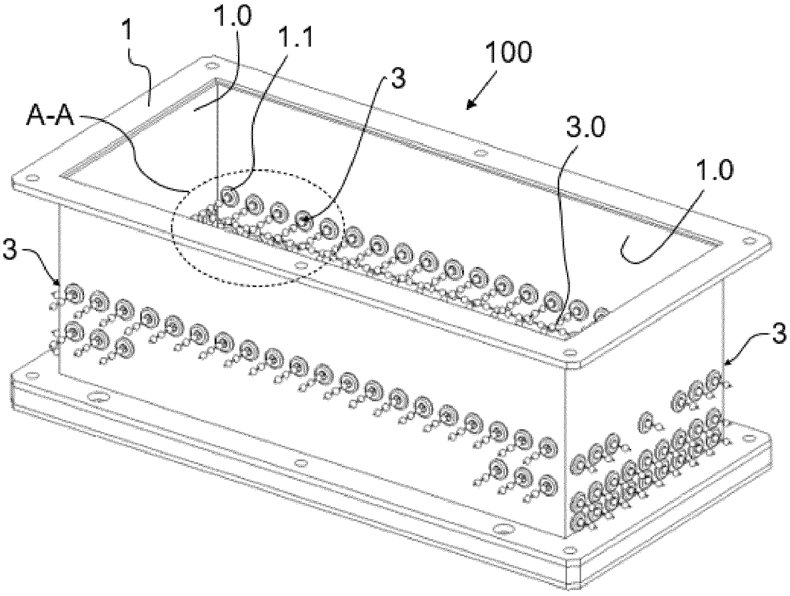

Fig. 1a

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Description

TECHNICAL FIELD

[0001] The present invention relates to hoppers of sand core making machines, which are used to supply at least one of the materials required for the manufacture of sand cores.

PRIOR ART

[0002] Sand cores manufactured on sand core making machines are composed of a mixture of sand with a binder and/or additives. The main function of the binder and/or additive is to harden the sand, giving the sand core the required rigidity or solidity.

[0003] These machines comprise a hopper to supply the sand and another hopper to supply the binder and/or additive. These materials usually comprise hygroscopic properties, so that due to humidity, lumps may be generated during (or before) the supply. In addition, electrostatic energy is also generated in this type of machine, which can also influence the generation of lumps.

[0004] If lumps get into the final mixture, the resulting sand core may not be suitable due to the presence of such lumps. Therefore, it is important to ensure as much as possible that no lumps reach the final mixture, or that the size of the lumps that reach the final mixture is small enough so that they do not adversely affect the resulting sand core.

[0005] CN218319151U discloses a hopper with a filter mesh through which the material to be delivered passes. A filter mesh comprises a plurality of holes of a certain size, whereby lumps larger than this size cannot pass through, thereby limiting the size of the lumps that can reach the final mixture. The hopper further comprises an actuator for causing vibration of the filter mesh, and such vibration causes at least the material on the filter mesh to move, such movement being capable of causing any lumps on the filter mesh to break.

DISCLOSURE OF THE INVENTION

[0006] The object of the invention is to provide a hopper of a sand core making machine, as defined in the claims.

[0007] The hopper comprises a hollow main body with an inner surface delimiting a passage for a material used in the manufacture of the sand core, and a plurality of breaker assemblies arranged inside the main body. Each breaker assembly comprises at least one thread, each end of a thread being attached to a corresponding attachment point of the inner surface of the main body, such that the thread is arranged in the passage delimited by the inner surface of the main body.

[0008] The main body comprises at least two contiguous breaker assemblies which are spaced apart such that, if the main body is shaken, the threads of the two breaker assemblies vibrate and the breaker assemblies interact with each other to break up the lumps of material supplied to the hopper.

[0009] Thus, when a material is fed through the hopper, if unwanted lumps of the material are generated, when shaking of the main body is generated, the threads of the breaker assemblies vibrate and this vibration causes the breaker assemblies to tend to strike or interact with each other, so that the breaker assemblies strike the lumps during this tendency, breaking them. This ensures that lumps larger than the distance between the two breaker assemblies do not pass through the breaker assemblies, so that the material passing through the breaker assemblies comprises no lumps or lumps smaller than the initial size, and the sand core produced from such material comprises no imperfections due to the presence of unwanted lumps.

[0010] These and other advantages and features of the invention will become apparent in view of the figures and the detailed description of the invention.

DESCRIPTION OF THE DRAWINGS

[0011]

Figure 1a shows a perspective view of an embodiment of a hopper according to the invention.

Figure 1b partially shows the hopper in figure 1a.

Figure 2 shows the hopper of figure 1a, arranged in a sand core making machine.

Figure 3a shows a detail A-A of the hopper of figure 1a, without the main body of the hopper being subjected to shaking.

Figure 3b shows the detail of figure 3a, with the breaker assemblies in one position as a result of the shaking of the main body.

Figure 4 shows a cutaway side view of the hopper of figure 1a.

Figure 5 shows a filtering assembly of the hopper of figure 1a, without a first filter mesh.

DETAILED DISCLOSURE OF THE INVENTION

[0012] Figure 1a shows an embodiment of a hopper 100 of a sand core making machine 1000 as shown by way of example in figure 2. The hopper 100 comprises a hollow main body 1 with an inner surface 1.0 delimiting a passage for a material used in the manufacture of the sand core. The machine 1000 comprises a mould not shown in the figures, adapted to receive the material from said hopper 100, such that the sand core is generated in said mould.

[0013] The material supplied to the hopper 100 falls in a supply direction through the hopper 100, which generally coincides with a longitudinal axis of said hopper 100. Said material may comprise lumps, or even lumps may be generated during its supply, and said lumps may adversely affect the manufactured sand core if said lumps reach the mould. Therefore, the hopper 100 comprises a plurality of breaker assemblies 3 arranged, at least partially, inside the main body 1, such that when the material is supplied to said hopper 100, said breaker assemblies 3 can break said lumps and eliminate them or at least reduce their size. Preferably the hopper 100 comprises as many breaker assemblies 3 as are necessary so that all the material supplied to the hopper 100 passes through some breaker assembly 3, thus ensuring that no unwanted lumps reach the mould without first having been contacted by any breaker assembly 3. The plurality of breaker assemblies 3 may form a lattice as partially shown in figure 1b.

[0014] Each breaker assembly 3 comprises at least one thread 3.0, and each end of a thread 3.0 is attached to a corresponding attachment point 1.1 of the inner surface 1.0 of the main body 1 such that said thread 3.0 is arranged in the passage delimited by said inner surface 1.0. Two attachment points 1.1 associated with the same thread 3.0 are arranged in such a way that they can be joined together with a straight line passing through the passage delimited by the inner surface 1.0. Depending on the tension of the thread 3.0 between said attachment points 1.1 said thread 3.0 will be more or less slack, but preferably said thread 3.0 will be sufficiently taut to form a line. The thread 3.0 is preferably made by a rigid material such as plastic or metal, and, preferably, said material is stainless.

[0015] In some embodiments, as in the embodiment shown in the figures for example, the hopper 100 is rectangular (although it could have other shapes, if required, such as a cylindrical shape for example). In these embodiments the attachment points 1.1 associated with the same thread 3.0 are on different walls. In the case of the embodiment shown in the figures, the attachment points 1.1 associated with the same thread 3.0 are on opposite walls.

[0016] The main body 1 is configured to be shaken during use, and when shaking of the main body 1 is generated, said threads 3 3 vibrate (as depicted in figure 3b, as compared to figure 3a where threads 3.0 are shown without the main body 1 being shaken), and the breaker assemblies 3 are spaced apart such that, with said shaking, said breaker assemblies 3 interact with each other and break up any lumps that are present in the material supplied to the hopper 100. How they vibrate will depend on the frequency and amplitude at which the main body 1 is shaken, and the required frequency and/or amplitude will be applied in each case, depending on the design of the breaker assemblies 3 and the material supplied to the hopper 100 in each case, for example, and may even be varied throughout the same supply of material, to further refine the filtrate carried out in the hopper 100 for example.

[0017] Preferably, each breaker assembly 3 comprises a plurality of breaker elements 3.3 distributed in series, associated with the corresponding thread 3.0, and attached to said thread 3.0. Each breaking element 3.3 may have any desired shape, but protrudes from the thread 3.0 to which it is attached. Thus, it may have a spike shape, a cube shape or a ball shape, for example. In the embodiment shown in the figures, the breaker elements 3.3 are balls. The material of the breaker elements 3.3 is, preferably, the same material of the thread 3.0.

[0018] By protruding from the thread 3.0 to which it is attached, the breaker elements 3.3 strike against the material delivered to the hopper 100, generating a more effective strike which ensures that any lumps are broken to a greater extent. As the breaker elements 3.3 are arranged in series, the positive effect of the breaker elements 3.3 covers the largest possible area of the passage for the material supplied to the hopper 100.

[0019] During vibration of a thread 3.0, the amplitude of such vibration in the thread 3.0 is smaller the closer it is to the end which is attached to an attachment point 1.1, and it has been detected that this may result in a greater risk of accumulation of material at the ends of said thread 3.0, despite the vibrations generated. Thus, in order to avoid this possible negative effect, the hopper 100 comprises a thread 3.0 of one breaker assembly 3 which intersects an end of another thread 3.0 of another (contiguous) breaker assembly 3, at a different height, i.e. a thread 3.0 of one breaker assembly 3 extends in a first direction at a different height from the end of another thread 3.0 of another breaker assembly 3 which extends in a second direction different from the first direction (see figure 4). Preferably the first direction and the second direction are perpendicular to each other. The separation distance between said two breaker assemblies 3 is such that said breaker assemblies 3 interact with each other when the main body 1 is shaken, in order to break possible lumps of the material supplied to the hopper 100.

[0020] Additionally, or alternatively, in the case where a breaker assembly 3 has a plurality of the breaker elements 3.3, the size of said breaker elements 3 is larger the closer it is to an end of the corresponding thread3.0.

[0021] The threads 3.0 of the breaker assemblies 3 may be extended transversely (in a plane transverse to the material supply direction), or inclined with respect to that transverse plane, and may be arranged as required. This may depend, for example, on the ease of mounting the breaker assemblies 3 in the hopper 100 and/or the required specifications for the material. The more breaker assemblies 3 there are, the greater the lump-breaking capacity of the hopper 100 will generally be.

[0022] In some embodiments, the attachment points 1.1 associated with a plurality of breaker assemblies 3 are distributed in a same plane, said plane being preferably transverse to the material supply direction, the breaker assemblies 3 whose attachment points 1.1 are in a same plane forming a breaker group. In such cases, preferably, all the breaker assemblies 3 of a breaker group are parallel to each other and comprise an equal distance therebetween. The hopper 100 may comprise a single breaker group or a plurality of breaker groups, each breaker group being associated with a different plane and all planes being spaced apart from each other (preferably in the supply direction). This distance between planes is such as to allow the breaker assemblies 3 of one breaker group to interact with the breaker assemblies 3 of another breaker group when the main body 1 is shaken, in order to break possible lumps in the material supplied to the hopper 100. The more breaker groups one has, the greater the lump breaking capacity of the hopper 100 will generally be. Preferably, moreover, the breaker assemblies 3 of one breaker group extend in a different direction from the breaker assemblies 3 of the breaker group of an adjoining plane, as can be seen in the embodiment of the figures (see figures 1b and 4), such directions being preferably perpendicular to each other.

[0023] When there is a plurality of breaker groups, furthermore, the distance between the breaker assemblies 3 of one breaker group may be different from the distance between the breaker assemblies 3 of another breaker group, the distance between the breaker assemblies 3 of another breaker group decreasing from top to bottom. Thus, the distance between the breaker assemblies 3 of a breaker group distributed in a first plane is greater than the distance between the breaker assemblies 3 of a breaker group distributed in a second breaker plane downstream of the first plane. This is advantageous since as the lumps of material are broken up, the resulting lumps or particles become smaller and smaller, leaving less space between the breaker assemblies 3 of the next breaker assembly 3 for the material to pass through. It is the distance between breaker assemblies 3 that determines what size of lump or particle can pass between two adjacent or contiguous breaker assemblies 3.

[0024] The hopper 100 may further comprise a filtering assembly 4 arranged downstream of the breaker assemblies 3 (in the supply direction). The hopper 100 comprises an inlet opening 101 through which material is supplied and an outlet opening 102 through which material exits the hopper 100, said filtering assembly 4 being preferably arranged at said outlet opening 102 and in a way that all material exiting the hopper 100 has passed through the filtering assembly 4.

[0025] The filtering assembly 4 comprises at least one filtering mesh 4.1, such that only material comprising a size smaller than that defined by the size of the holes of the filtering mesh 4.1 can exit said hopper 100 and can be used for the manufacture of sand cores. In this way, the action of the breaker assemblies 3 and the filtering assembly 4 results in the utilisation of all, or at least to a greater extent, of the material supplied to the hopper 100, and in a manner which ensures the manufacture of acceptable sand cores which are free from lumps of such material. For the sake of clarity such a filter mesh 4.1 is not shown in figure 1b.

[0026] Preferably, as in the embodiment shown in the figures, the filtering assembly 4 comprises a first filtering mesh 4.1 and a second filtering mesh 4.2 spaced apart in height (longitudinally, in the supply direction), and a plurality of elements 4.3 (preferably balls) arranged between both filtering meshes 4.1 and 4.2 with freedom of movement. The distance between both filter meshes 4.1 and 4.2 is larger than the size of these elements 4.3, so that when the main body 1 is shaken, these elements 4.3 move or jump between the two filter meshes 4.1 and 4.2, hitting the material between both filter meshes 4.1 and 4.2 and reducing the size of the lumps which may have reached therein after passing through the breaker assemblies 3. The first filter mesh 4.1 is arranged upstream of the second filter mesh 4.2 and comprises holes for the passage of material larger than the holes of the second filter mesh 4.2, so that some lumps that have passed through the first filter mesh 4.1 cannot pass through the second filter mesh 4.2 until they have been hit and broken by the elements 4.3.

[0027] Preferably, in addition, the space between the two filter meshes 4.1 and 4.2 of the filtering assembly 4 is divided into a plurality of compartments 4.4, as shown in figures 4 and 5 by way of example, by walls 4.5 extending partially, preferably from the first filter mesh 4.1 towards the second filter mesh 4.2. In each compartment 4.4, the hopper 100 comprises a plurality of elements 4.3. Due to the shaking supported by the main body 1 of the hopper 100, it is possible for the elements 4.3 to concentrate in the same area over time in absence of sad compartments 4.4, and the fact of compartmentalising the space between the two filtering meshes 4.1 and 4.2 avoids this possibility and ensures the presence of elements 4.3 throughout this space, providing homogeneity in the filtering performed by the filtering assembly 4. The compartments 4.4 are distributed transversally to the material supply direction.

[0028] Preferably the walls 4.5 do not reach the second filter mesh 4.2, leaving a gap 4.6 between it and said filter mesh 4.2. This gap 4.6 is used to allow the supplied material to move through the entire filtering assembly 4 and not only through the interior of a compartment 4.4, but said gap 4.6 is such that it does not allow the passage of an element 4.3 between a compartment 4.4 and an adjacent compartment 4.4, so that the elements 4.3 which are in a compartment 4.4 always remain in said compartment 4.4.

[0029] In some embodiments, the hopper 100 comprises an actuator attached to the main body 1 and configured to shake the main body 1 in a controlled manner. The actuator is adapted to be able to apply a frequency of vibration to shake the main body 1, and to control said frequency, and to vary said frequency when required if so required. Furthermore, said actuator could also control the amplitude of said frequency, thus having total control over the shaking of the main body 1. Depending on the value of the frequency the vibration generated from the breaker bodies 3 will be greater or lesser, and depending on the amplitude the shock exerted by the breaker assemblies 3 will be greater or lesser.

[0030] A sand core making machine 1000 may comprise a hopper 100 as previously described, in any of the embodiments and/or configurations. In the case of comprising a hopper 100 without an actuator attached to the main body 1, said machine 1000 may comprise an actuator 2 associated with said hopper 100 as shown in figure 2, for causing the shaking of said hopper 100. In any embodiment, a machine 1000 may further comprise a control unit 1001 such as a microprocessor or other computationally capable device, communicated with the actuator 2, to be able to cause the actuator 2 to actuate in a controlled manner.

Claims

1. Hopper of a sand core making machine, comprising a hollow main body (1) with an inner surface (1.0) delimiting a passage for a material used in the manufacture of the sand core, **characterised in that** the hopper (100) further comprises a plurality of breaker assemblies (3) and each breaker assembly (3) comprises at least one thread (3.0), each end of a thread (3.0) being attached to a corresponding attachment point (1.1) of the inner surface (1.0) of the main body (1) such that the threads (3.0) are arranged in the passage for the material independently of each other, two breaker assemblies (3) being spaced apart from each other such that said two breaker assemblies (3) interact with each other to break lumps of the material supplied to the hopper (100) when the main body (1) is shaken.

2. Hopper of a sand core making machine according to claim 1, wherein each breaker assembly (3) comprises a plurality of breaker elements (3.3) attached to the corresponding thread (3.0) and distributed in series.

3. Hopper of a sand core making machine according to claim 1 or 2, comprising a breaker assembly (3) with a thread (3.0) extending in a first direction at a different height from another thread (3.0) of another breaker assembly (3) with which it interacts when the main body (1) is shaken and which extends in a second direction different from the first direction, said directions being preferably perpendicular to each other.

4. Hopper of a sand core making machine according to any of claims 1 to 3, wherein the attachment points (1.1) associated with a plurality of breaker assemblies (3) are distributed in the same plane, said breaker assemblies (3) forming a breaker group and said plane being preferably transversal.

5. Hopper of a sand core making machine according to claim 4, comprising a first breaker group with a plurality of breaker assemblies (3) distributed in a first plane, and a second breaker group with a plurality of breaker assemblies (3) distributed in a second plane spaced apart from the first plane, such that the breaker assemblies (3) of the first breaker group interact with the breaker assemblies (3) of the second breaker group to break the lumps of the material supplied to the hopper (100) when the main body (1) is shaken, the first plane and the second plane being preferably parallel to each other.

6. Hopper of a sand core making machine according to claim 4 or 5, wherein the threads (3.0) of the breaker assemblies (3) of the first breaker group extend in a first direction and the threads (3.0) of the breaker assemblies (3) of the second breaker group extend in a second direction different from the first direction, the first direction preferably being perpendicular to the second direction and the threads (3.0) of the breaker assemblies (3) of the same breaker group being preferably arranged parallel to each other.

7. Hopper of a sand core making machine according to any of claims 1 to 6, comprising a filtering assembly (4) arranged downstream of the breaker assemblies (3), the filtering assembly (4) comprising at least one filter mesh (4.1).

8. Hopper of a sand core making machine according to claim 7, wherein the filtering assembly (4) comprises a first filter mesh (4.1) and a second filter mesh (4.2) spaced apart from the first filter mesh (4.1) and arranged downstream of said first filter mesh (4.1), and a plurality of elements (4.3) arranged between both filter meshes (4.1, 4.2), the distance between both filter meshes (4.1, 4.2) being greater than the size of the elements (4.3) arranged between both filter meshes (4.1, 4.2), such that said elements (4.3) are arranged between both filter meshes (4.1, 4.2) with freedom of movement.

9. Hopper of a sand core making machine to claim 8, wherein the space between the two filter meshes (4.1, 4.2) of the filtering assembly (4) is divided into a plurality of compartments (4.4), each compartment (4.4) comprising a plurality of elements (4.3).

10. Hopper of a sand core making machine according to claim 9, wherein the compartments (4.4) are communicated with each other through passages which are smaller than the size of the elements (4.3) arranged between both filtering meshes (4.1, 4.2), making it impossible for said elements (4.3) to move between the different compartments (4.4) but allow-

ing the passage of material between said compartments (4.4), the filtering assembly (4) preferably comprising walls (4.5) extending from the first filtering mesh (4.1) towards the second filtering mesh (4.2) to delimit the compartments (4.4).

11. Hopper of a sand core making machine according to any of claims 8 to 10, wherein the first filter mesh (4.1) comprises holes with a first size and the second filter mesh (4.2) comprises holes with a second size smaller than the first size.

12. Hopper of a sand core making machine according to any of claims 1 to 11, comprising an actuator (2) attached to the main body (1) and configured to agitate said main body (1).

13. Sand core making machine, **characterised in that** it comprises a hopper (100) according to any of claims 1 to 12.

14. Sand core making machine, **characterised in that** it comprises a hopper (100) according to any of claims 1 to 11, and an actuator (2) configured to generate a shaking and associated with the main body (1) of the hopper (100), such that, when it generates said shaking, said actuator (2) causes the shaking of the said main body (1).

15. Control method for a sand core making machine according to claim 13 or 14, wherein a material is supplied through the hopper (100) and a shaking of the main body (1) is generated.

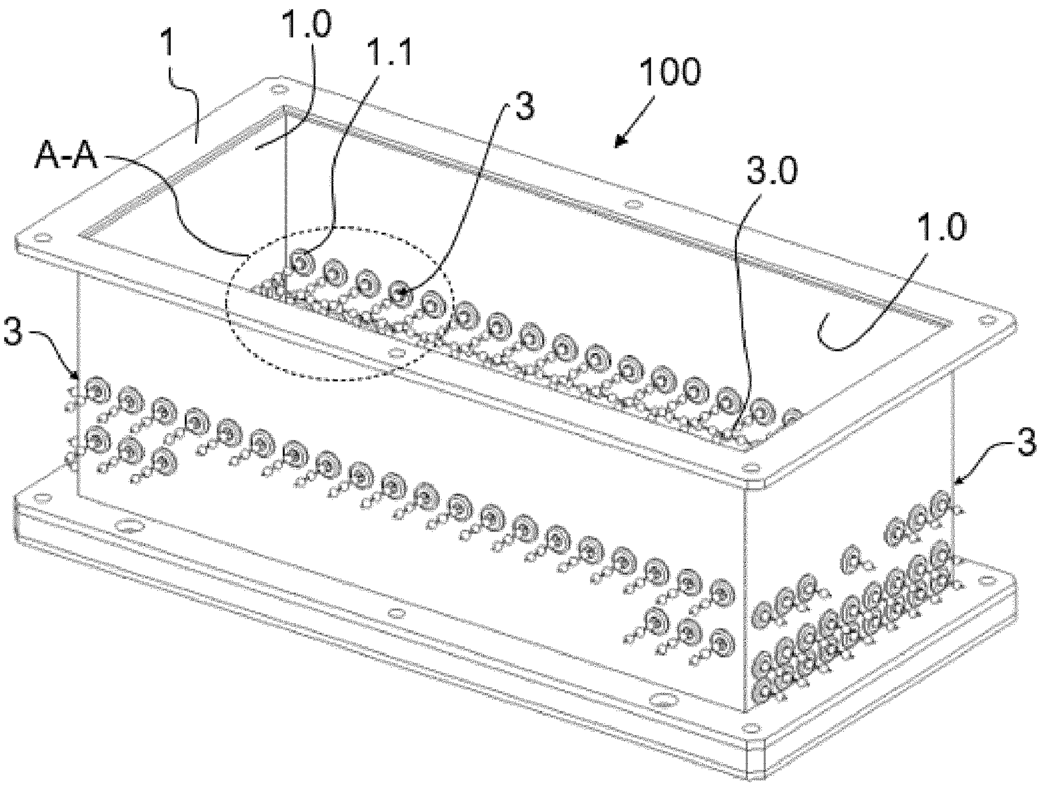

Fig. 1a

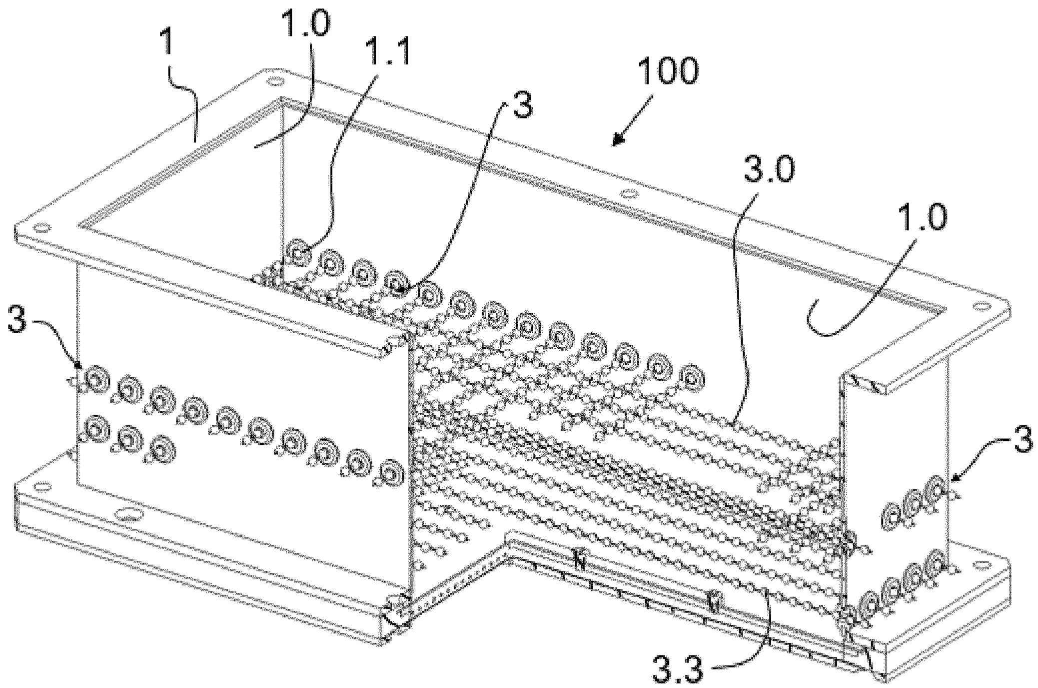

Fig. 1b

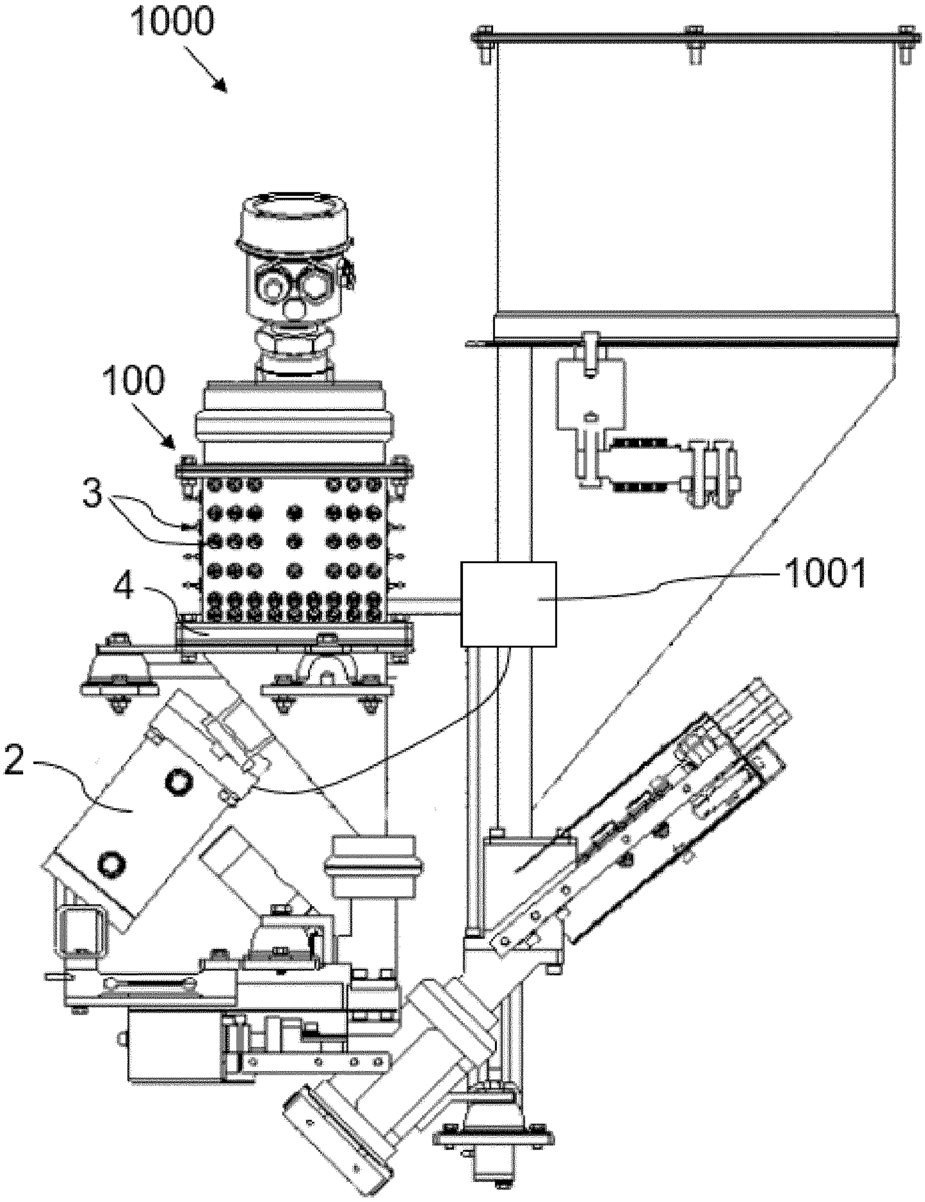

Fig. 2

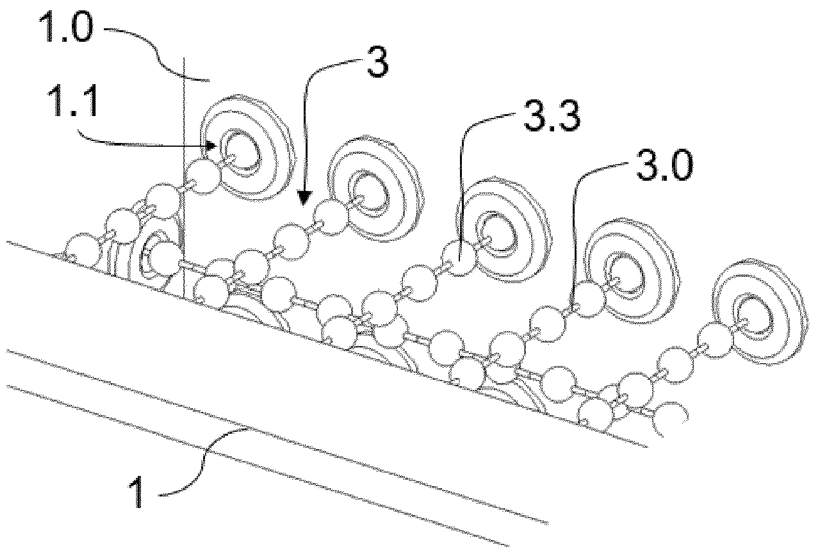

Fig. 3a

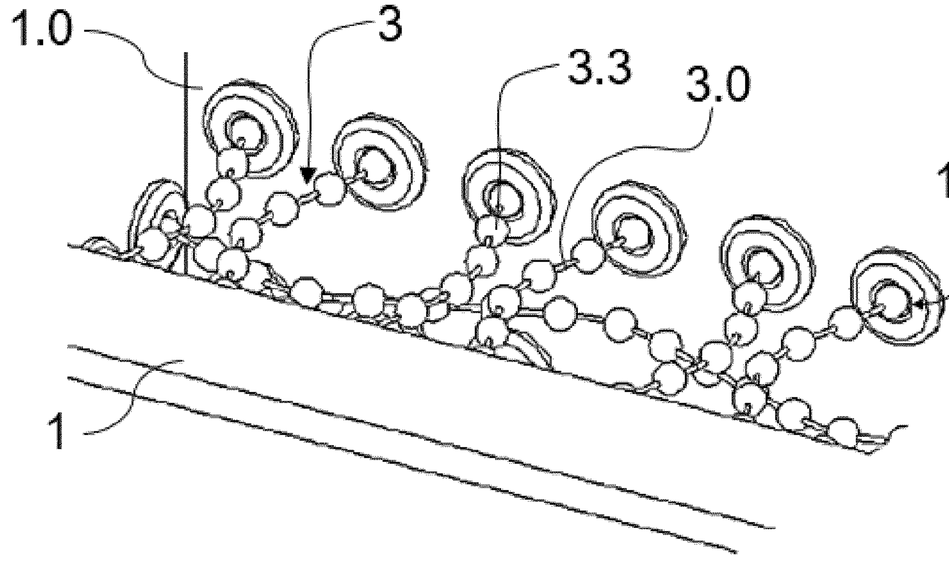

Fig. 3b

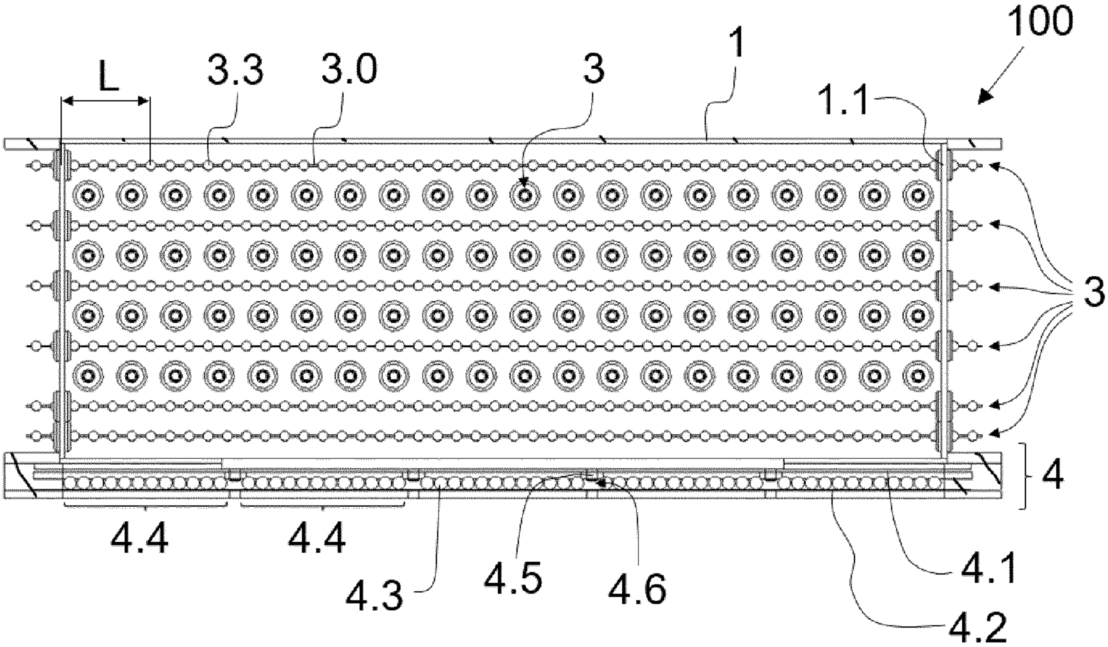

Fig. 4

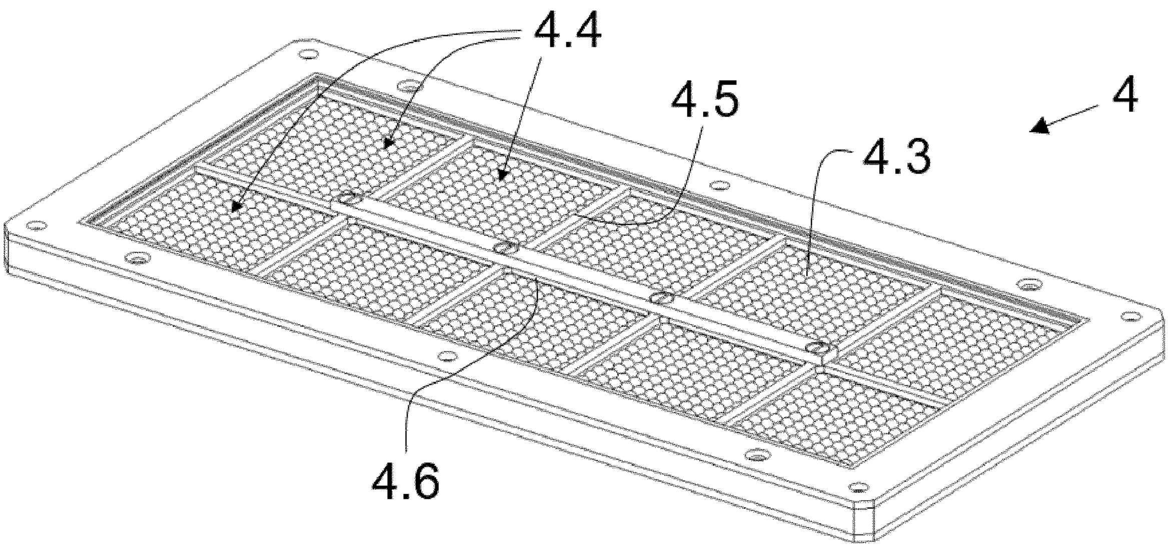

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 23 38 2235

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	CN 107 457 353 A (FOSHAN HENGXUE TECH SERVICE CO LTD) 12 December 2017 (2017-12-12) * claim 1; figure 2 * -----	1-15	TECHNICAL FIELDS SEARCHED (IPC) B22C F27D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 July 2023	Momeni, Mohammad

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CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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