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(54) **Papermaking screen apparatus**

(57) A screen apparatus includes a tank receiving a papermaking raw material; a screen partitioning the tank into a primary chamber and a secondary chamber; a papermaking raw material supply passage for supplying a papermaking raw material to the tank; a foreign material discharge passage for discharges the papermaking raw material containing a foreign material that does not pass through the screen to the outside of the tank; a papermaking raw material discharge passage communicating

with the secondary chamber, and discharging the papermaking raw material passing through the screen to the outside of the tank; a cylindrical rotor body rotatably provided inside the screen, and stirs the papermaking raw material in the primary chamber; and a stepped stirring member provided on the side surface except for both end surfaces of the rotor body. The stepped stirring member is formed at a falling gradient with respect to a papermaking raw material flow.

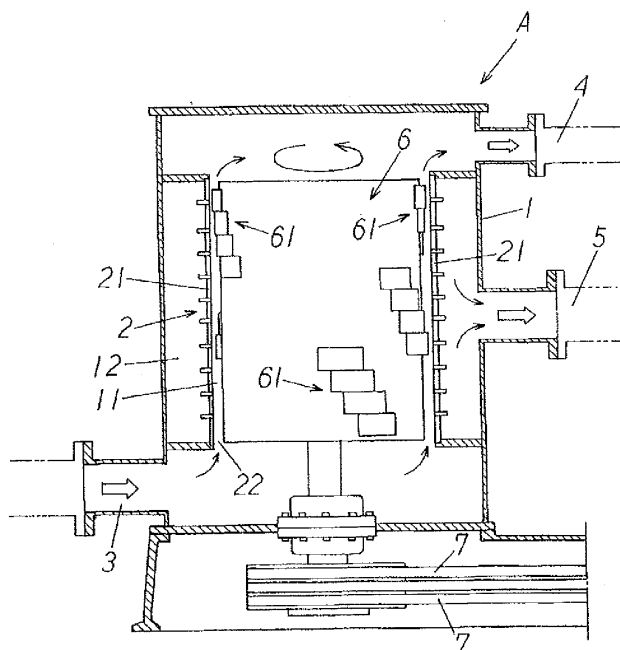


Fig. 1

Description

Background of the Invention

Technical Field

[0001] The present invention relates to a papermaking screen apparatus, in particular, to a papermaking screen apparatus that is capable of achieving energy saving and careful selection effect in a well-balanced manner.

Related Art

[0002] Conventionally, there has been a papermaking screen apparatus in which a stirring member is provided in parallel to a side surface except for both end surfaces of a cylindrical papermaking rotor, a compression is generated at the front of the stirring member and a negative pressure is generated at the rear of the stirring member with respect to the flow of a papermaking raw material, and a washing action of a basket is caused, thereby making an effective selection (see JP 2005-171449 A).

[0003] In the papermaking screen apparatus, although the effective selection is satisfactory, since the papermaking raw material receives the resistance of papermaking raw material flow at a right angle and longitudinally to the stirring member, there is a problem in that the power is required.

[0004] As an improvement of the problem, there has been a papermaking screen apparatus in which a linear stirring member having a falling gradient with respect to the papermaking raw material flow is provided on a side surface except for both end surfaces of a cylindrical papermaking rotor, a compression is generated at the front of the stirring member and a negative pressure is generated at the rear of the stirring member with respect to the flow of the papermaking raw material, and the washing action of a screen is caused, thereby making an effective selection (see JP 2008-223151 A). In the papermaking screen apparatus, since the stirring member inclines, and the papermaking raw material flow has a form that carries the resistance in accordance with the inclination of the stirring member, the apparatus is improved in terms of the power.

[0005] However, since the stirring member of the latter papermaking screen apparatus is formed at a falling gradient with respect to the flow of the papermaking raw material, that is, linearly in an oblique direction, the papermaking raw material which collides with the stirring member is linearly guided in the oblique direction. Accordingly, the flow to the downstream side becomes stronger, and the papermaking raw material that does not pass through the screen is forcibly sent to a reject side. However, since the flow rate of the reject side is limited by a flow rate control valve, a phenomenon in which the raw material flow returns to the upstream side occurs. For that reason, since the foreign materials which cannot pass through the screen also return to the up-

stream side again and pass through the screen, there has been a problem in that the careful selection force is not sufficient.

[0006] The invention has been made in consideration of the above problems, and an object thereof is to provide a papermaking screen apparatus that is capable of achieving the energy saving and the careful selection effect in a well-balanced manner.

10 Summary of the Invention

[0007] According to a first aspect of the invention, a papermaking screen apparatus includes a tank configured to accept a papermaking raw material, a screen configured to partition the tank into a primary chamber and a secondary chamber, a papermaking raw material supply passage that communicates with the primary chamber of the tank, and supplies the papermaking raw material to the tank, a foreign material discharge passage that communicates with the primary chamber, and discharges the papermaking raw material containing a foreign material that does not pass through the screen to the outside of the tank, a papermaking raw material discharge passage that communicates with the secondary chamber, and discharges the papermaking raw material that passed through the screen to the outside of the tank, a cylindrical rotor body that is rotatably provided in the primary chamber as the inside of the screen, and stirs the papermaking raw material in the primary chamber, and a stepped stirring member provided on the side surface except for both end surfaces of the rotor body, wherein the stepped stirring member is formed at a falling gradient, i.e. extending downwardly and backwardly, with respect to the papermaking raw material flow.

[0008] Further, according to a second aspect of the invention, in a papermaking screen apparatus of the first aspect, the stepped stirring member includes a plurality of single stirring members, the single stirring member is a substantially crescent-shaped member in which a width of an intermediate portion is wider than both ends in the longitudinal direction, the longitudinal direction of the single stirring member is substantially parallel to both end surfaces of the cylindrical rotor body, the plurality of the single stirring members is adjacently formed stepwise, and the adjacent single stirring members are provided so that a leading end portion of an upstream single stirring member with respect to the papermaking raw material flow relative to a rotational direction of the rotor body is located before a leading end portion of a downstream single stirring member relative to the rotational direction of the rotor body, and a male screw provided in the single stirring member passes through a hole of the cylindrical rotor body, and is tightened and fixed by being screwed into a female screw located in the cylindrical rotor body.

[0009] Further, according to a third aspect of the invention, in a papermaking screen apparatus of the first aspect, the stepped stirring member includes a plurality of single stirring members, the single stirring member is

a substantially crescent-shaped member in which a width of an intermediate portion is wider than both ends in the longitudinal direction, the longitudinal direction of the single stirring member is substantially parallel to both end surfaces of the cylindrical rotor body, the plurality of the single stirring members is adjacently formed stepwise, and the adjacent single stirring members are provided so that a leading end portion of an upstream single stirring member with respect to the papermaking raw material flow relative to a rotational direction of the rotor body is located before a leading end portion of a downstream single stirring member relative to the rotational direction of the rotor body, and a male screw provided in the cylindrical rotor body passes through a hole of the cylindrical rotor body, and is tightened and fixed by being screwed into a female screw located in the single stirring member.

[0010] Further, according to a fourth aspect of the invention, in a papermaking screen apparatus of the first aspect, the stepped stirring member includes a plurality of single stirring members, the single stirring member is a substantially crescent-shaped member in which a width of an intermediate portion is wider than both ends in the longitudinal direction, the longitudinal direction of the single stirring member is substantially parallel to both end surfaces of the cylindrical rotor body, the plurality of the single stirring members is adjacently formed stepwise, and the adjacent single stirring members are provided so that a leading end portion of an upstream single stirring member with respect to the papermaking raw material flow relative to a rotational direction of the rotor body is located before a leading end portion of a downstream single stirring member relative to the rotational direction of the rotor body.

[0011] According to the screen apparatus of the first aspect, there is provided the papermaking rotor including the cylindrical rotor body, and the stirring member provided on a side surface other than both end surfaces of the rotor body and having a step shape as viewed in a side view. Since the stepped stirring member is formed at the falling gradient with respect to the papermaking raw material flow, the papermaking raw material stirred with the stepped stirring member becomes a form that parries a collision resistance to some extent, and suppresses the power. The forced flow to the downstream side is suppressed by the stirring member of the inclined shape, the precise selection action is caused on small blocks, and at the first stage (front stage), the papermaking raw material that is not precisely selected is guided to the adjacent stirring member of the downstream side. Accordingly, it can effectively perform the careful selection between the adjacent stirring member of downstream side and a portion of the screen facing the stirring member, so that the screen apparatus that is also capable of expecting the energy-saving effect can be obtained.

[0012] Furthermore, according to the screen apparatus of the second aspect, in addition to the effect of the

first aspect described above, the adjacent single stirring members are provided so that a leading end portion of an upstream single stirring member with respect to a papermaking raw material flow relative to a rotational direction of the rotor body is located before a leading end portion of a downstream single stirring member relative to the rotational direction of the rotor body, and a male screw provided in the single stirring member passes through a hole of the cylindrical rotor body, and is tightened and fixed by being screwed into a female screw located in the cylindrical rotor body. Accordingly, as compared to the attachment by welding, there is no deformation of the cylindrical rotor body, and when the stepped stirring member is damaged, the damaged single stirring member can only be quickly and easily replaced without replacing the entire stepped stirring members.

[0013] Furthermore, according to the screen apparatus of the third aspect, in addition to the effect of the first aspect described above, the adjacent single stirring members are provided so that a leading end portion of the upstream single stirring member with respect to the papermaking raw material flow relative to the rotational direction of the rotor body is located before a leading end portion of the downstream single stirring member relative to the rotational direction of the rotor body, and a male screw provided in the cylindrical rotor body passes through a hole of the cylindrical rotor body, and is tightened and fixed by being screwed into a female screw located in the single stirring member. Accordingly, as compared to the attachment by welding, there is no deformation of the cylindrical rotor body, and when the stepped stirring member is damaged, the damaged single stirring member can only be quickly and easily replaced without replacing the entire stepped stirring members.

[0014] Furthermore, according to the screen apparatus of the fourth aspect, in addition to the effect of the first aspect described above, the adjacent single stirring members are provided so that a leading end portion of an upstream single stirring member with respect to the papermaking raw material flow relative to a rotational direction of the rotor body is located before a leading end portion of a downstream single stirring member relative to the rotational direction of the rotor body. Accordingly, when the stepped stirring member is damaged, the damaged single stirring member can only be effectively replaced without replacing the entire stepped stirring members.

Brief Description of the Drawings

[0015]

FIG. 1 is a schematic cross-sectional view of a screen apparatus of an embodiment of the invention; FIG. 2 is a schematic front view of a papermaking rotor of FIG. 1; FIG. 3 is a schematic plan view of the papermaking

rotor of FIG. 2;

FIG. 4 is a schematic front view of a papermaking rotor of another embodiment different from the papermaking rotor of FIG. 2;

FIG. 5 is a schematic front view of a papermaking rotor of another embodiment different from the papermaking rotor of FIG. 4;

FIG. 6 is a schematic cross-sectional view of a screen apparatus of another embodiment different from the screen apparatus of FIG. 1;

FIG. 7 is a schematic front view of a papermaking rotor of another embodiment different from the papermaking rotor of FIG. 5;

FIG. 8 is a schematic plan view of the papermaking rotor of FIG. 7;

FIG. 9 is a schematic cross-sectional view taken along line 9-9 of FIG. 7;

FIG. 10 is a schematic partial front view illustrating an enlarged part of FIG. 7;

FIG. 11(a) is an exploded schematic cross-sectional view illustrating a portion in FIG. 9, and FIG. 11(b) is an exploded schematic cross-sectional view in a case where a thin plate is interposed between a single stirring member and a rotor body of FIG. 11A; and FIG. 12 is an exploded schematic cross-sectional view of another embodiment different from FIG. 11A.

Detailed Description of Embodiments

[0016] A papermaking screen apparatus and a papermaking rotor according to an embodiment of the invention will be described with reference to the drawings.

[0017] A screen apparatus A has a tank 1 configured to accept a papermaking raw material, a screen 2 configured to partition the tank 1 into a primary chamber 11 and a secondary chamber 12, and a cylindrical papermaking rotor 6 that is rotatably provided in the primary chamber 11 as the inside of the screen 2 and stirs the papermaking raw material within the primary chamber 11.

[0018] For example, the screen 2 has a plurality of opening portions 21, for example, the opening portions 21 are gaps in the case of annularly arranging rod-shaped longitudinal members with gaps (longitudinal gaps), round holes provided on the cylindrical side surface, and slits (e.g., elongated rectangular gaps), through which the papermaking raw material passes to the cylindrical side surface, and the screen is secured uprightly to the tank 1 by opening a bottom portion 22.

[0019] Furthermore, as illustrated in FIGS. 1 to 3, the papermaking rotor 6 is provided with a cylindrical rotor body 60, and a stirring member 61 having a step shape as viewed in the side view provided so as to protrude to the side surface 60a except for both end surfaces of the rotor body 60.

[0020] For example, four stepped stirring members 61 may be integrated with the rotor body 60 by being welded to the side surface 60a for each member, or the stirring

member 61 formed in one member by integrating the four members may be integrated with the rotor body 60 by being welded to the side surface 60a.

[0021] The stepped stirring member 61 is formed at a falling gradient with respect to a papermaking raw material flow X. The single stirring member (each stirring member) of the stepped stirring member 61 is a substantially crescent-shaped member in which the width of the intermediate portion is wider than both ends in the longitudinal direction, and includes, for example, four stages 61a, 61b, 61c, and 61d.

[0022] The stepped stirring member 61 includes, for example, the plurality of single stirring members (respective stirring members 61a, 61b, 61c, and 61d), the longitudinal direction of the single stirring member is substantially parallel to both end surfaces of the cylindrical rotor body 60, the plurality of the single stirring members is adjacently formed stepwise, and the adjacent single stirring members 61a and 61b are provided so that a leading end portion (a collision surface) A of the upstream single stirring member 61a with respect to the papermaking raw material flow relative to a rotational direction Y of the rotor body 60 is located before a leading end portion (a collision surface) B of the downstream single stirring member 61b relative to the rotational direction Y of the rotor body 60.

[0023] Furthermore, similarly, the adjacent single stirring members 61b and 61c are provided so that the leading end portion (the collision surface) B of the upstream single stirring member 61b with respect to the papermaking raw material flow X relative to the rotational direction Y of the rotor body 60 is located before a leading end portion (a collision surface) C of the downstream single stirring member 61c relative to the rotational direction Y of the rotor body 60.

[0024] Furthermore, similarly, the adjacent single stirring members 61c and 61d are provided so that the leading end portion (the collision surface) C of the upstream single stirring member 61c with respect to the papermaking raw material flow X relative to the rotational direction Y of the rotor body 60 is located before a leading end portion (a collision surface) D of the downstream single stirring member 61d relative to the rotational direction Y of the rotor body 60.

[0025] In addition, the number of the stages of the stepped stirring member 61 is not limited to four stages, and the number may be two stages, three stages, five stages, six-stage or the like. Furthermore, as illustrated in FIG. 2, the collision surfaces A, B, C, and D of the respective stirring members 61a, 61b, 61c, and 61d are parallel to the side surface 60a except for both end surfaces of the rotor body 60, but may be formed so as to incline as illustrated in FIGS. 4 and 5.

[0026] Furthermore, the papermaking rotor 6 rotates from a motor which is not illustrated via a power transmission member 7 (for example, a belt).

[0027] A papermaking raw material supply passage 3 communicates with the primary chamber 11 of the tank 1 and supplies the papermaking raw material to the tank

1. A foreign material discharge passage 4 communicates with the primary chamber 11, and discharges the papermaking raw material containing foreign materials that do not pass through the screen 2 to the outside of the tank 1. A papermaking raw material discharge passage 5

[0028] Therefore, the papermaking raw material is supplied into the primary chamber 11. As the papermaking raw material within the primary chamber 11 goes toward the downstream side, the papermaking raw material collides with the stepped stirring member 61. The papermaking raw material that collided with the stirring member 61 successively collides with the respective stirring members 61a, 61b, 61c, and 61d constituting the stepped stirring member 61, becomes a form that parries the collision resistance to some extent, and suppresses the power. The forced flow to the downstream side is suppressed by the inclined stirring member, and a careful selection action is caused on small blocks. At the first stage (front stage), the papermaking raw material that is not properly selected is guided to the adjacent stirring member of the downstream side, and it can effectively performs the effective selection between the adjacent stirring member of the downstream side and a portion of the screen facing the stirring member.

[0029] As a result, the papermaking raw material effectively selected by the screen 2 by increasing the selection efficiency is discharged to the outside of the tank 1 via the papermaking raw material discharge passage 5, and the papermaking raw material containing the foreign material that cannot pass through the screen 2 is discharged to the outside of the tank 1 via the foreign material discharge passage 4.

[0030] In addition, the respective stirring members 61a, 61b, 61c, and 61d also rotate with the rotation of the papermaking rotor 6, the papermaking raw material causes the compression to the screen 2 at the front of the respective stirring members 61a, 61b, 61c, and 61d, and causes the negative pressure to the screen 2 at the rear of the respective stirring members 61a, 61b, 61c, and 61d, and the papermaking raw material is effectively selected by performing the action of the washing on the screen 2.

[0031] The screen apparatus A of the embodiment described above is the screen of the type that allows the papermaking raw material to flow in from below. However, the invention is not limited thereto, and a screen apparatus illustrated in FIG. 6 that allows the papermaking raw material to flow in from above can also be similarly applied (the same parts of FIG. 6 as in the above-mentioned embodiment are denoted by the same reference numerals and the description thereof will not be provided). Furthermore, the tank 1 of the screen apparatus A of the above-mentioned embodiment is erected, but the invention is not limited thereto, and although not illustrated, the tank 1 of the screen apparatus A can also be

similarly applied to a lying type screen.

[0032] According to the stepped stirring member 61 of the embodiment described above, for example, the four members are integrated with the rotor body 60 by being welded to the side surface 60a for each member, but the invention is not limited thereto, and the stepped stirring member 61 may also be fixed by a male screw and a female screw (FIGS. 7 to 12).

[0033] That is, as in the embodiment described above, the stepped stirring member 61 is formed at the falling gradient with respect to the papermaking raw material flow X, the single stirring member of the stepped stirring member 61 (each stirring member) is a substantially crescent-shaped member in which the width of the intermediate portion is wider than both end portions in the longitudinal direction, and includes, for example, four stages of 61a, 61b, 61c, and 61d.

[0034] The stepped stirring member 61 includes a plurality of single stirring members (the respective stirring members, for example, 61a, 61b, 61c, and 61d), the longitudinal direction of the single stirring member is substantially parallel to both end surfaces of the cylindrical rotor body 60, the plurality of the single stirring members is adjacently formed stepwise, and the adjacent stirring members 61a and 61b are provided so that a leading end portion (a collision surface) A of the upstream single stirring member 61a with respect to the papermaking raw material flow X relative to a rotational direction Y of the rotor body 60 is located before a leading end portion (a collision surface) B of the downstream stirring member 61b relative to the rotational direction Y of the rotor body 60.

[0035] Furthermore, similarly, the adjacent single stirring members 61b and 61c are provided so that the leading end portion (the collision surface) B of the upstream single stirring member 61b with respect to the papermaking raw material flow X relative to the rotational direction Y of the rotor body 60 is located before a leading end portion (a collision surface) C of the downstream single stirring member 61c relative to the rotational direction Y of the rotor body 50.

[0036] Furthermore, similarly, the adjacent single stirring members 61c and 61d are provided so that the leading end portion (the collision surface) C of the upstream single stirring member 61c with respect to the papermaking raw material flow X relative to the rotational direction Y of the rotor body 60 is located before a leading end portion (a collision surface) D of the downstream single stirring member 61d relative to the rotational direction Y of the rotor body 60.

[0037] Moreover, as illustrated in FIGS. 9, 10, and 11(a), a male screw 61dA provided in the single stirring member 61d passes through a hole 60h of the cylindrical rotor body 60, and is tightened and fixed by being screwed into a female screw Ma positioned in the cylindrical rotor body 60.

[0038] Similarly to the single stirring member 61d, the single stirring members 61a, 61b, and 61c are provided

so that male screws (although not illustrated, the male screws are the same as the male screw 61dA) each provided in the single stirring members 61a, 61b, and 61c pass through the holes 60h (although not illustrated, the holes are the same as the holes 60h) of the cylindrical rotor body 60, and are tightened and fixed by being screwed into female screws (although not illustrated, the female screws are the same as the female screws Ma) located in the cylindrical rotor body 60. A washer W is illustrated in FIGS. 9 to 12.

[0039] In addition, in the embodiments illustrated in FIGS. 7 to 11(a), the same portions as the above-mentioned embodiments (FIGS. 1 to 6) are denoted by the same reference numerals, and the description thereof will not be provided.

[0040] In regard to fixing of the stepped stirring member 61 of FIGS. 7 to 11(a), compared to the attachment by welding, there is no deformation of the cylindrical rotor body 60, and when the stepped stirring member 61 is damaged, it can be quickly and easily replaced by only changing the damaged single stirring member, without replacing the entire stepped stirring members 61. Furthermore, as illustrated in FIG. 11(b), the clearance adjustment of the screen 2 can be made by interposing a thin plate T between the single stirring member 61d and the rotor body 60.

[0041] Furthermore, as illustrated in FIG. 11(a), the male screw 61dA provided in the single stirring member 61d passes through the hole 60h of the cylindrical rotor body 60, and is tightened and fixed by being screwed into the female screw Md positioned in the cylindrical rotor body 60. However, the invention is not limited thereto, and as illustrated in FIG. 12, a male screw V provided within the cylindrical rotor body 60 may pass through the hole 60h of the cylindrical rotor body 60, and may be tightened and fixed by being screwed into the female screw Mb provided in the single stirring member 61d.

Claims

1. A screen apparatus comprising:

a tank configured to accept a papermaking raw material;
 a screen configured to partition the tank into a primary chamber and a secondary chamber;
 a papermaking raw material supply passage that communicates with the primary chamber of the tank, and supplies the papermaking raw material to the tank;
 a foreign material discharge passage that communicates with the primary chamber, and discharges the papermaking raw material containing a foreign material that does not pass through the screen to outside of the tank;
 a papermaking raw material discharge passage that communicates with the secondary cham-

ber, and discharges the papermaking raw material that passed through the screen to the outside of the tank;

a cylindrical rotor body that is rotatably provided in the primary chamber as the inside of the screen, and stirs the papermaking raw material in the primary chamber; and

a stepped stirring member provided on a side surface of the rotor body except for two end surfaces thereof,

wherein the stepped stirring member is formed to have a downward gradient with respect to a papermaking raw material flow.

2. The screen apparatus according to claim 1, wherein the stepped stirring member includes a plurality of single stirring members, the single stirring member is a substantially crescent-shaped member in which a width of an intermediate portion is wider than two ends in a longitudinal direction thereof, the longitudinal direction of the single stirring member is substantially parallel to two end surfaces of the cylindrical rotor body, the plurality of the single stirring members is adjacently formed stepwise, and the adjacent single stirring members are provided so that a leading end portion of an upstream single stirring member with respect to a papermaking raw material flow relative to a rotational direction of the rotor body is located before a leading end portion of a downstream single stirring member relative to the rotational direction of the rotor body, and a male screw is provided in the single stirring member, passes through a hole of the cylindrical rotor body, and is tightened and fixed by being screwed into a female screw located in the cylindrical rotor body.
3. The screen apparatus according to claim 1, wherein the stepped stirring member includes a plurality of single stirring members, the single stirring member is a substantially crescent-shaped member in which a width of an intermediate portion is wider than two ends in a longitudinal direction, the longitudinal direction of the single stirring member is substantially parallel to two end surfaces of the cylindrical rotor body, the plurality of the single stirring members is adjacently formed stepwise, and the adjacent single stirring members are provided so that a leading end portion of an upstream single stirring member with respect to a papermaking raw material flow relative to a rotational direction of the rotor body is located before a leading end portion of a downstream single stirring member relative to the rotational direction of the rotor body, and a male screw is provided in the cylindrical rotor body, passes through a hole of the cylindrical rotor body, and is tightened and fixed by being screwed into a female screw located in the single stirring member.

4. The screen apparatus according to claim 1, wherein the stepped stirring member includes a plurality of single stirring members, the single stirring member is a substantially crescent-shaped member in which a width of an intermediate portion is wider than two ends in a longitudinal direction, the longitudinal direction of the single stirring member is substantially parallel to two end surfaces of the cylindrical rotor body, the plurality of the single stirring members is adjacently formed stepwise, and the adjacent single stirring members are provided so that a leading end portion of an upstream single stirring member with respect to a papermaking raw material flow relative to a rotational direction of the rotor body is located before a leading end portion of a downstream single stirring member relative to the rotational direction of the rotor body.

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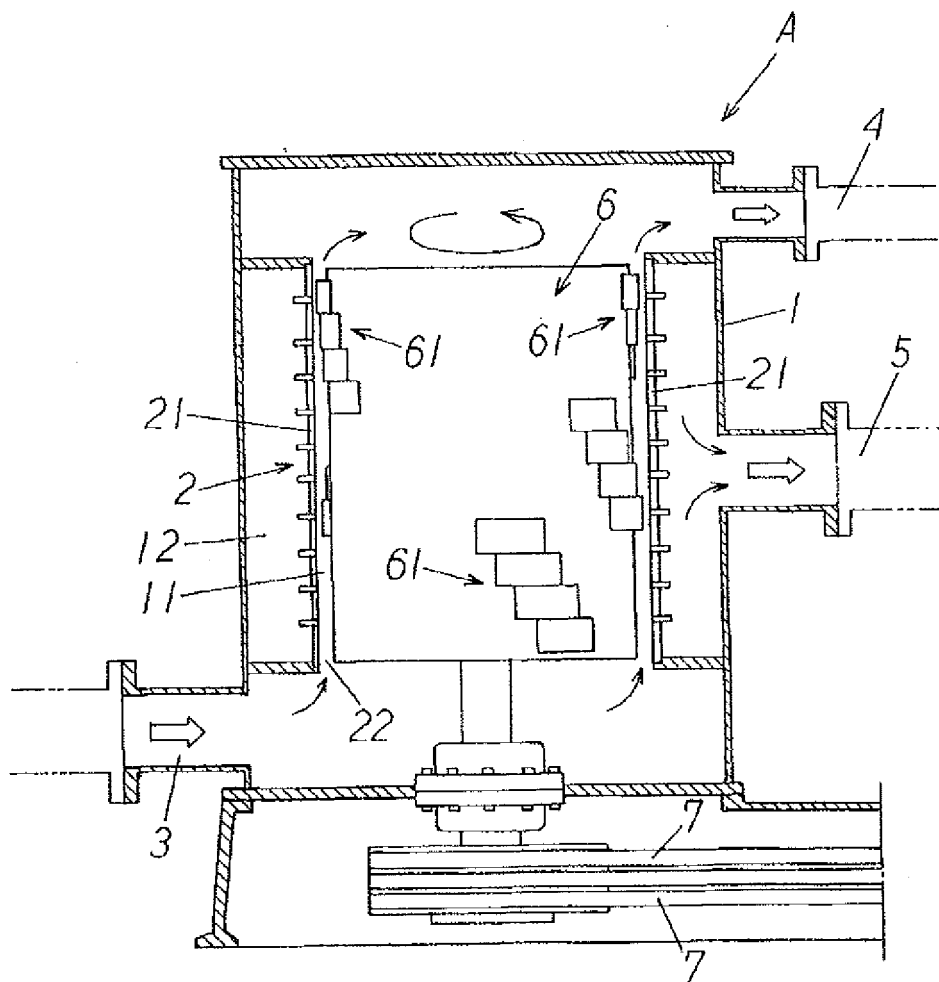


Fig. 1

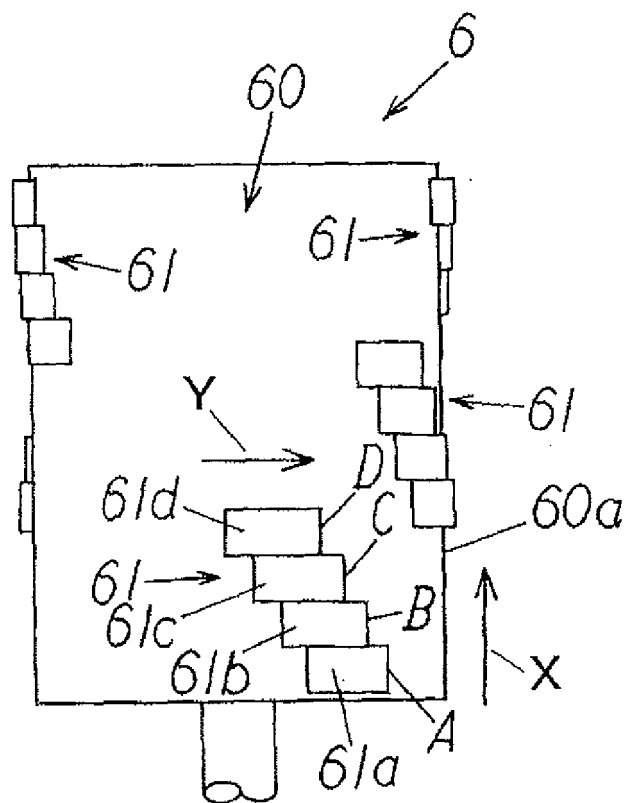


Fig. 2

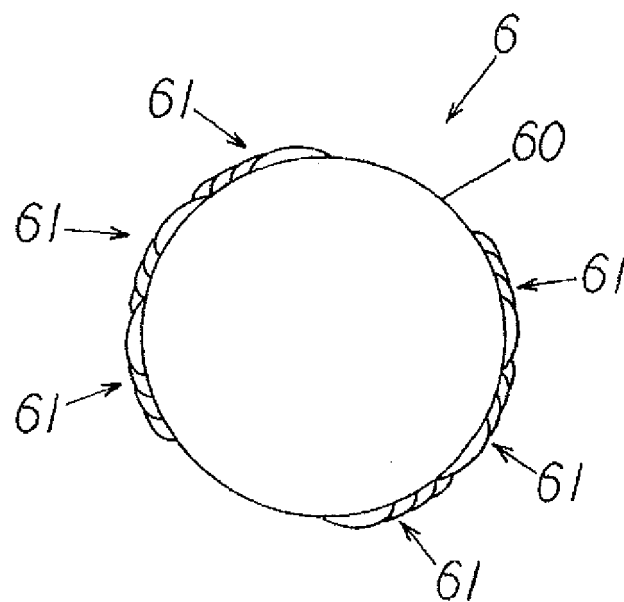


Fig. 3

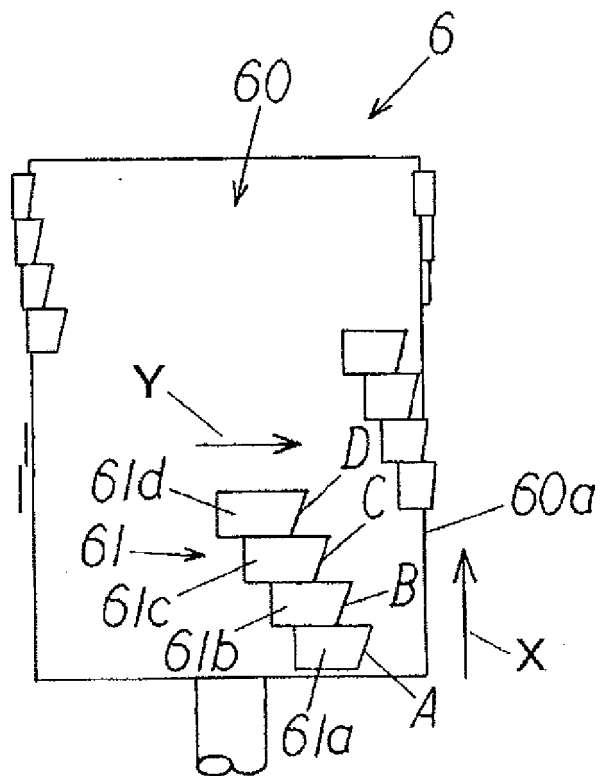


Fig. 4

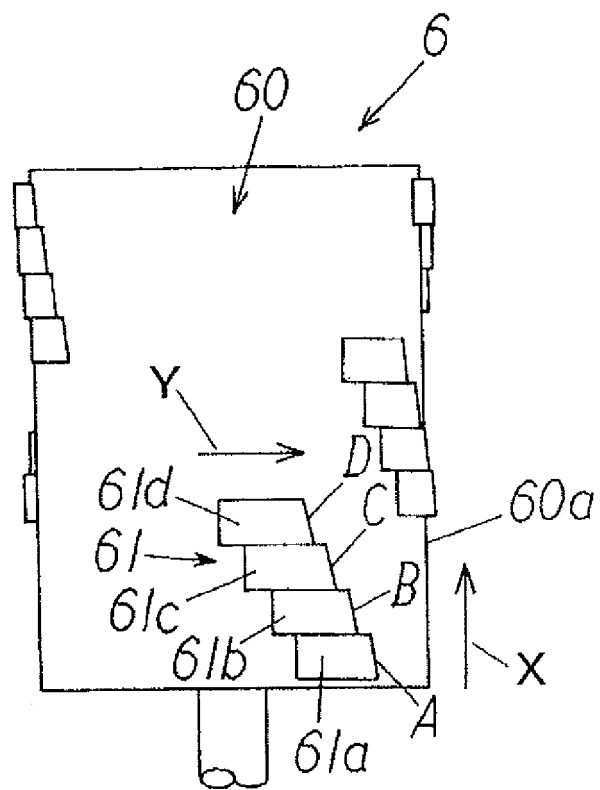


Fig. 5

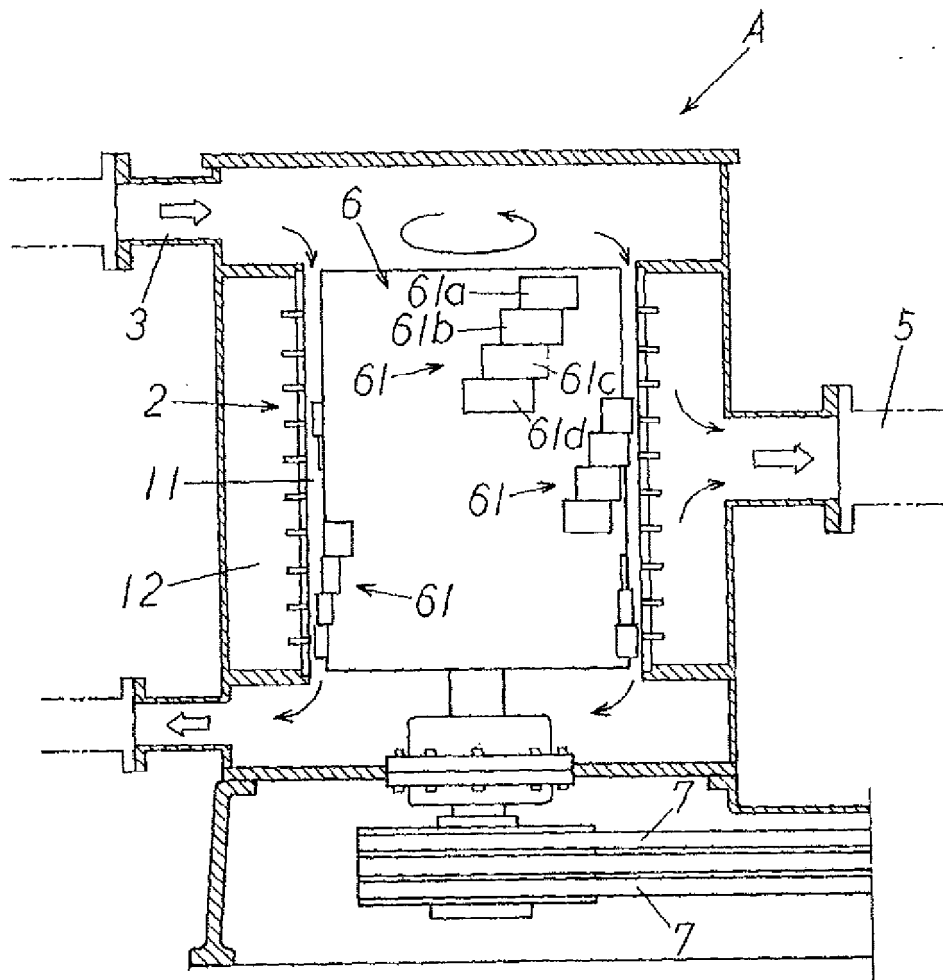


Fig. 6

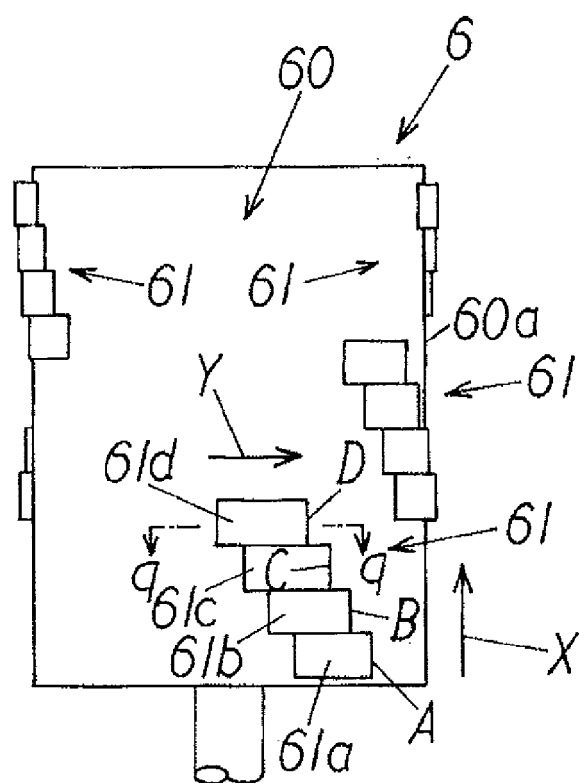


Fig. 7

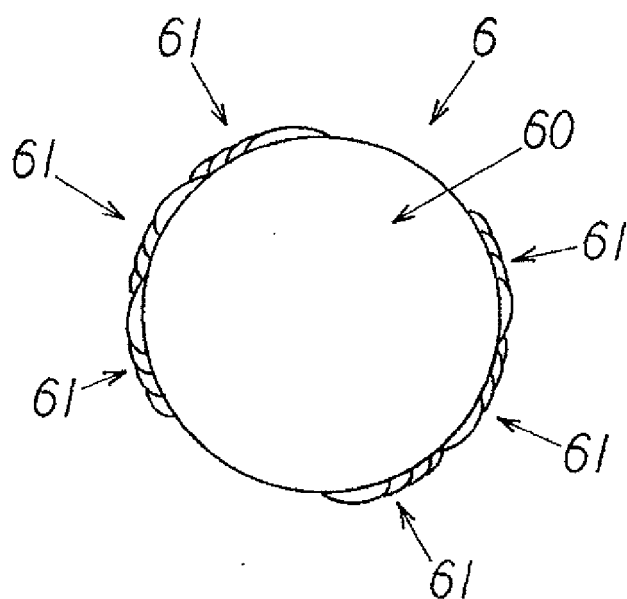


Fig. 8

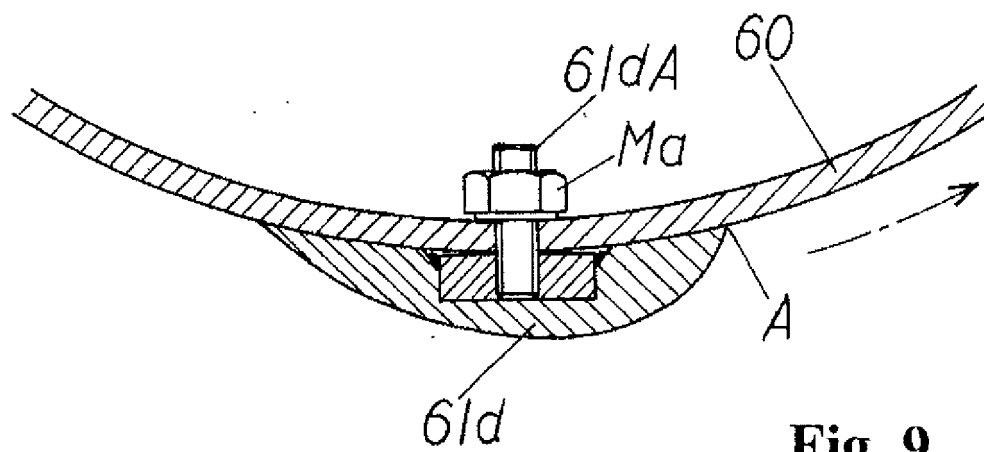


Fig. 9

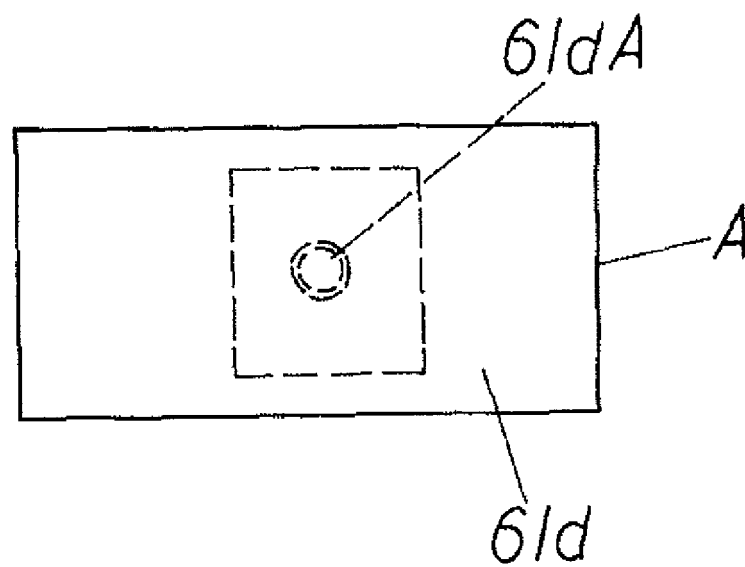


Fig. 10

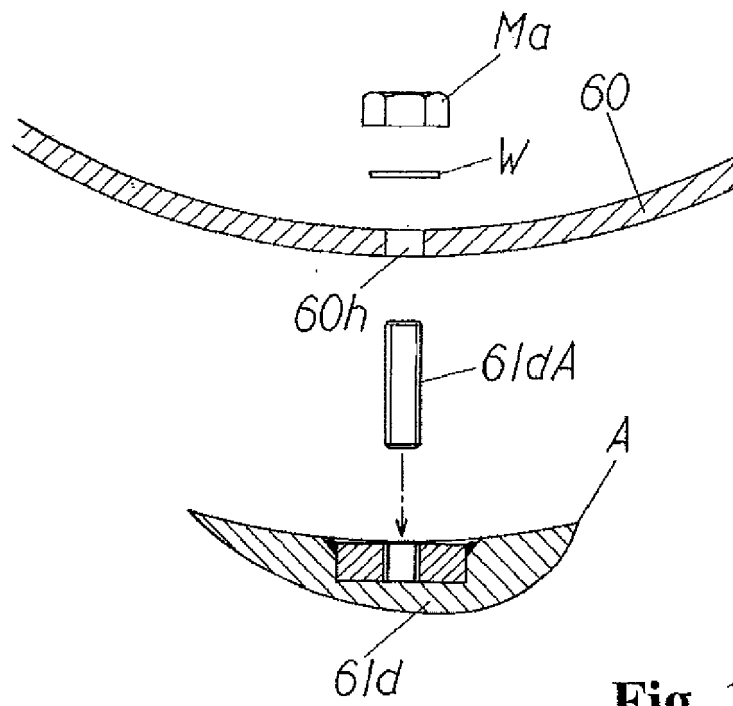


Fig. 11(a)

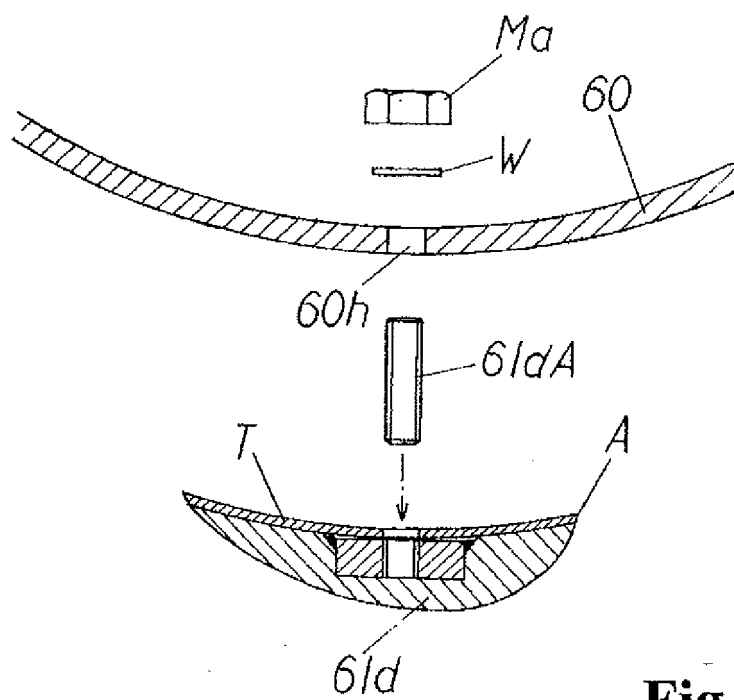


Fig. 11(b)

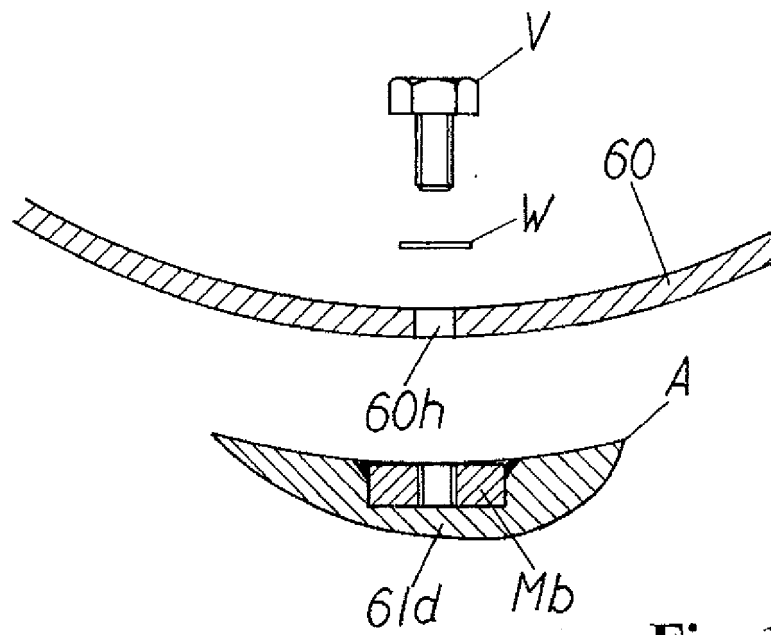


Fig. 12



EUROPEAN SEARCH REPORT

 Application Number
EP 14 15 0389

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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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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 March 2014	Examiner Pregetter, Mario
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