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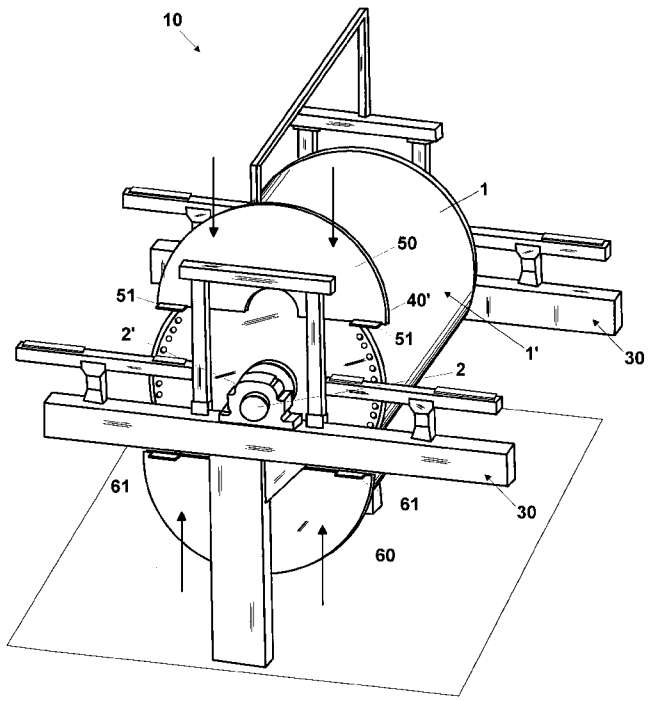
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[Continued on next page]

(54) Title: A PROTECTING STRUCTURE FOR HEAD WALLS OF A CONTINUOUS PAPER WEB DRYING CYLINDER

Fig. 2



(57) Abstract: A paper drying cylinder or roller (1) for paper mills, said cylinder or roller rotating about a rotating shaft (2) on bearing elements (2') of a framework (30) that holds at opposite sides the rotating shaft (2). In particular, the paper drying cylinder (1) rotates within the structure of two drying hoods (4, 5) that remove the moist air stream that forms while the continuous paper web is dried. The active surface of the Yankee cylinder (1) is cylindrical surfaces (1'), whereas the head walls (3) does not have any function related to paper drying but, on the contrary, are heat loss surfaces. According to the invention, a protection carter (40) is provided arranged about the rotating shaft (2) proximate to one of the head walls (3) that are connected to the framework (30) in such a way that the carter (40) during the rotation of the paper drying cylinder (1) stays motionless and faces the head wall (3) carrying out a thermal insulating function. This way, heat loss towards the environment and the steam consumption to heat cylinder 1 is reduced.

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TITLE

A PROTECTION STRUCTURE FOR HEAD WALLS OF A PAPER DRYING CYLINDER

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DESCRIPTION

Field of the invention

The present invention relates to machines for paper mills and, in particular, it relates to a protecting and thermally insulating structure a head wall of a paper drying cylinder, in particular a Yankee cylinder.

Background of the invention

In the production of most paper products that are currently on the market, for example toilet paper rolls, paper tissues, paper towels, etc., a "converting" step is provided of large size paper rolls, which are produced in paper mills by means of a so-called "continuous machine".

The operation of the continuous paper making machine comprises receiving a pulp slurry as a feed material, which is then distributed on a formation cloth conveyor by a headbox. A wet continuous sheet is then obtained which is conveyed to a felt web that is adapted to absorb moisture from the sheet, then the still wet sheet is conveyed by a series of roll presses to the surface of a paper drying cylinder, i.e. a Yankee cylinder or also Yankee drier.

The Yankee paper drying cylinder is a relatively large size cylinder, whose diameter normally ranges from about 2 m to 5,5 m and is 2 to 6 metres large; it hollow inside and is maintained at the saturation temperature of a steam flow that is conveyed inside, at a pressure that is set between 1 and 10 bar. The Yankee paper drying cylinder rotates on bearings that

rest on a structure. Two drying hoods are provided about each Yankee cylinder, each of them supplied by a respective gas burner, or by a respective heat exchanger that uses steam or diathermic oil as a heating means, and heats up an air stream to remove the residual humidity from it. The air that leaves the paper forms a humid current that is sucked away by the drying hoods and then is released into atmosphere. The dried paper has an average moisture content of about 5% and is therefore ready to be wound into rolls.

The active surface of the Yankee paper drying cylinder is its side cylindrical surface, which is lapped by the paper. Instead, the two bases of the Yankee cylinder, or head walls, do not have any function related to paper drying. The two head walls are therefore heated surfaces that causes a huge heat loss, which remarkably increases the amount of steam needed to heat the Yankee cylinder and therefore increases the paper mill energy consumption.

The need is felt of designing a Yankee paper drying cylinder that minimizes energy losses and requires a lower consumption of steam flowing inside them.

A system has been adopted to insulate the cylinder head walls, which comprises covering the whole head wall surface by arranging an aluminium sheet cover on it, to which an insulating material is glued. In particular, the cover is made in the form of boards which have the shape of circular sectors, to obtain a full coverage of the wall surfaces. However, this is not a satisfactory solution, since the insulating layer tends to detach from the cover, with time. This is mainly due to combined moisture and temperature effects on the glue which steadily deteriorates and looses its adhesive properties; it also depends upon

the centrifugal force acting on the head walls that rotate together with the cylinder. In fact, the linear speed of the Yankee cylinder can achieve 2000 metres/min, therefore the head walls may rotate at beyond 200 RPM.

A further problem is providing a protection for the operators, so that they are prevented from getting into contact with the head walls while the cylinder is rotating.

A fixed cover can be also provided, as described in US4878299, which is arranged at each head wall, connected to a fixed frame in order to cover all the surface of the relative head wall even if it remains still. This solution is advantageous, because there is not risk that the cover detaches by the centrifugal force, since it is fixed.

However, problems arise of tightness between the fixed cover and the head wall, and between the fixed cover and the rotating shaft of the cylinder. In the first case, a sliding lip seal element is provided between cover and head, which however is subject to wear with time. In the latter case, no heat insulations are provided between the fixed cover and the rotating shaft of the cylinder.

A further problem is a not easy assembling process of the fixed cover to the head wall, in particular where the covering has to be applied as retro-fit to a pre-existing cylinder.

Still a further problem is the mechanical resistance of the fixed cover, which has to be light, and at the same time resistant.

A further problem is the maintenance of the tight joint both against the head wall and against the rotating shaft.

Summary of the invention

It is a feature of the present invention to provide a protecting and thermally insulating structure for the head walls of a paper drying cylinder for paper mills, in particular of a Yankee cylinder, which reduces the steam leakage and allows an energy saving, and that works in a steady condition without any risk of detaching even if solved the above described problems.

It is another feature of the present invention to provide a protecting and thermally insulating structure for the head wall of a paper drying cylinder for paper mills, in particular of a Yankee cylinder, which can be mounted as a retrofit to both new cylinders and existing plants.

It is also a feature of the invention to provide a protecting and thermally insulating structure for the head wall of a paper drying cylinder for paper mills, in particular of a Yankee cylinder, which is easy and cheap to make.

These and other objects are achieved by a protection structure for a head wall of a paper drying cylinder, in particular a Yankee cylinder, said paper drying cylinder rotating about a rotating shaft and being supported by a framework, said protection structure comprising:

- a protection carter that is arranged about said rotating shaft close to a head wall of said cylinder;
- a fixing means for fixing said carter to said framework, such that said carter during the rotation of the paper drying cylinder stays motionless with respect to the framework and faces said head wall carrying out a thermal insulating function,

wherein said protection carter is a disc and comprises

at least a first and a second carter portion that are mutually engageable with each other and that are arranged, in use, bridging said rotating shaft, and wherein a means is provided for fixing said first and said second carter portions to each other, in such a way that an air tight connection between said first and said second carter portions is obtained.

This way, even if the carter consists of two disc portions, these portions form a single integral body without that there is leakage through the junction line between the two portions. It is therefore much easier to assemble the carter, without dismantling the cylinder.

Advantageously, the first and the second carter portion are in turn split as two sub-portions, such that said carter is obtained from the union of four disc sub-portions, in particular each subportion is made as a circular sector 90°. Alternatively, the carter is formed by three disc portions that are 120° angularly spaced apart from each other.

In an advantageous exemplary embodiment, the fixing means for fixing the carter to the framework also fixes said disc portions to each other. In particular, a mutual engagement means is provided on each portion of the carter between the fixing means and said carter portions, such that the fixing means fastens the carter portions to each other and provides a tight joint between the carter portions when the carter portions are fixed to the fixing means.

Preferably, said fixing means extends along the whole length of the junction line between two adjacent carter portions, such that the tight joint is ensured between said adjacent carter portions. In particular, said fixing means are T-shaped fixing means, and engage with respective protrusions or recesses that

are made on the surface of said carter portions, wherein, in particular, said carter portions are L-shaped carter portions.

In particular, said fixing means of said first and said second carter portions comprises at least a first and a second bracket that are arranged at opposite sides with respect to said rotating shaft and in such a way that they protrude in use from said disc towards an opposite side with respect to the head. In particular, the brackets are orthogonal to the surface of the disc and are fixed to the framework by means of a releasable lock means, for example by means of screws.

The brackets are preferably located on said first and said second carter portions at such a distance from the axis of the cylinder that they can be fixed to the framework laterally at the sides of a bearing for the rotation of the cylinder. In particular, the brackets are made starting from the inner edge of the disc.

In other words, the carter is integral to the framework and is fixed with respect to the paper drying cylinder and faces the head wall while the latter rotates, protecting at the same time the head wall such that the heat dispersions towards into the environment are reduced.

Advantageously, a sealing means is provided between said carter and said head wall, such that any air leakage is prevented between said carter and said head. This way, both irradiation heat losses, which are due to the presence of the carter, and convection heat losses are prevented, since the sealing means does not allow warm air to leave a space between the fixed carter and the rotatable head wall, and fresh air from the environment is prevented to enter either.

In particular, said sealing means provides a lip seal element that is arranged proximate to said head wall and, in particular, a lip seal element that remains in a close proximity of said head wall or a strip with a minimum friction on said head wall.

In particular, said lip seal element forms a labyrinth with said head, to minimize steam leakage.

Advantageously, said lip seal element comprises a plurality of sealing flexible strips that are arranged parallel and adjacent to each other, in particular said flexible strips are Teflon® strips. In particular, the flexible strips of a first carter portion are arranged offset with respect to one another, such that a fixed joint is formed with the flexible strips of a second carter portion proximate to said first carter portion. This way, the fixed joint ensures a tight joint also between the lip seal element and two adjacent portions.

Preferably, said carter portions are mounted on said fixing means in such a way that a sliding interference engagement is created between said flexible strips and said head walls, such that they quickly wear and leave a material residue on the surface of said head walls, such that the material residue provides a seal joint between them.

Preferably said carter portions are adapted to slide along the rotating shaft of said cylinder, such that a tight connection is obtained between the carter and the rotating shaft. In particular, each carter portion has an antifriction material sliding zone, for example said antifriction material is Teflon®. In particular, said carter portions are mounted on said fixing means in such a way that a sliding interference engagement is created between said sliding zone and the rotating shaft of the cylinder, such that they

quickly wear and leave a material residue on the surface of the rotating shaft, such that the material residue provides a seal joint between them.

Advantageously, said carter is made of a fiberglass shell that is internally filled with an insulating material, like high density mineral wool or a foam material, for example a polyurethane foam. This way, the carter is extremely tough and at the same time light, and has a high insulation capability.

Alternatively, said carter has an engagement groove for engaging a seal element that is made of a sealing material, for example a plastic sealing material or aluminium, such that said seal element slides on the head wall in a minimum friction engagement or in a minimum distance contactless engagement.

Advantageously, said carter has a plurality of grooves at the side that, in use, faces said head wall, said plurality of grooves adapted to hinder the convective motion of warm air that is present in an inner space between the head wall and the carter. In particular, said grooves are concentrically arranged with respect to the axis of the cylinder. This way, the heat losses towards the environment are reduced to a minimum and therefore the steam production energy costs are reduced.

Preferably, said carter has a peripheral bead that is arranged parallel to the side surface of the paper drying cylinder, along a portion of the cylinder that is not covered by the continuous paper web that passes on said cylinder. This way, the bead can further reduce the heat loss along the two side zones of the Yankee cylinder on which the paper does not pass, thus increasing the energy saving, which is already high due to the carter. In addition, the bead has the

object of preventing paper fragments, dissolved fibres and particulate from entering in a space between the carter and the head, where the sealing means are provided. In particular, the bead has a seal edge that slidingly engages with the side surface of the Yankee paper drying cylinder, a minimum friction or a minimum distance being created between said edge and said side surface.

Brief Description of the drawings

Further characteristic and advantages of the apparatus, according to the invention, will be made clearer with the following description of an exemplary embodiment thereof, exemplifying but not limitative, with reference to the attached drawings, in which like reference characters designate the same or similar parts, throughout the figures of which:

- figure 1 shows a perspective view of a Yankee paper drying cylinder and of the framework that supports it, according to the prior art;
- figure 2 shows a perspective view of the Yankee paper drying cylinder Fig. 1, in a step of assembling a protection carter, according to the invention;
- figure 3 shows a perspective view of the protection carter, according to the invention;
- figure 4 shows a cross sectional view of the protection carter of Fig. 2, according to the invention, which is arranged on the head wall of the Yankee paper drying cylinder;
- figure 5 is an enlarged view of Fig. 4 in a seal zone of the protection carter with the head wall of the Yankee paper drying cylinder;
- figures 6 and 7 show two exemplary embodiments of the lip seal element arranged at the head wall of

the cylinder;

- figure 8 shows a perspective view of the Yankee paper drying cylinder equipped with the protection carter of the head, according to the invention;
- figure 9 shows a perspective view of a Yankee paper drying cylinder that is provided with a different exemplary embodiment of the protection carter of the head, according to the invention;
- figure 10 shows an elevational front view of the Yankee paper drying cylinder that is equipped with the protection carter of the head wall of Fig. 9 consisting of four disc sectors connected to each other in such a way that a thermally relevant tight connection is obtained both with the head wall of the cylinder and with the rotating shaft and between the above described disc sectors;
- figure 11 shows an enlarged view of a disc sector of the protection carter of the head wall where a plurality of seal rings are depicted that are arranged overlapping each other and have a thermally sliding contact engagement with the head wall of the cylinder;
- figure 12 shows a further enlarged view of the series of seal rings that depicts the positive engagement between two adjacent ring sectors; Fig. 12 shows furthermore, a connection groove that is adapted to receive the connecting element of two disc sectors;
- figure 13 shows an elevational cross sectional side view of the protection carter that consists of four disc sectors connected to each other; the view shows the end element of the carter which ensures a tight joint at the rotating shaft of the cylinder.

Detailed description of the invention

With reference to Fig. 1, a paper drying cylinder or Yankee drying roller 1 for paper mills is diagrammatically shown, which rotates about a rotating shaft 2 on bearing elements 2' of a framework 30 that holds the rotating shaft 2 at own opposite sides.

In particular, paper drying cylinder 1 rotates within the structure of two drying hoods 4 and 5, which are shown in thin lines and remove the moist air stream that is formed during the continuous paper web drying step.

The active surface of Yankee cylinder 1 is a side surface 1', i.e. so-called "Yankee drier surface", that is lapped by the wet paper web (not shown) by means of a pressing cylinder 20. In addition, Yankee cylinder 1 comprises two bases or head walls 3 that do not have any function in drying the paper but, on the contrary, cause heat loss surfaces that remarkably increase the amount of steam needed to heat Yankee cylinder 1 and therefore increase the energy consumption in the paper mill.

As shown in Fig. 2 a protection carter 40 is provided, according to the invention, which is arranged about rotating shaft 2 near one of the head walls 3, and is connected to framework 30 in such a way that carter 40, during the rotation of paper drying cylinder 1, stays motionless and faces head wall 3 and thermally insulates it. In other words, carter 40 remains integral to framework 30 in order to protect head wall 3 of the Yankee cylinder and to reduce the heat loss towards the environment. The latter aspect will be described in detail below, with reference to the following figures.

As shown in Fig. 2 and in Fig. 5, protection carter 40 is a disc and comprises a first and a second disc portion 50, 60, that are mutually engageable with

each other and that are arranged, in use, bridging rotating shaft 2. In particular, a means is provided for fixing first disc portion 50 and second disc portion 60 to each other, in such a way that an air tight connection is obtained between them, as described below with reference to Figs. 9 to 11.

This way, even if carter 40 consists of two disc portions, they form a single integral body without any leakage through the junction line between the two portions. Therefore, it is much easier to assemble the carter, without dismantling the cylinder.

In particular, the disc 40 is made of a material that is adapted to resist high temperatures and, according to a preferred exemplary embodiment, is made of fiberglass or of carbon fibre or even of a fiberglass shell that is internally filled with an insulating material, such as high density mineral wool or foam material, for example a polyurethane foam. This way, the carter is at the same time extremely tough and light, and has a high insulation capacity.

In particular, the step of assembling provides that such portions 50 and 60 are introduced between Yankee paper drying cylinder 1 and framework 30 respectively from above and from below, such that they can be coupled to each other bridging rotating shaft 2.

If, for any structural reasons, it were impossible to introduce the two parts of the carter from above and from below, the carter might be split into more that two parts, in order to assist the introduction. Once the carter is positioned, the protection disc 40 is connected to an upright 31 by means of a first bracket 51 and of a second bracket 61, such brackets arranged at opposite sides with respect to rotating shaft 2, in such a way that they protrude from an

opposite side with respect to head wall 3. In particular, brackets 51 and 61 are orthogonal to the surface of disc 40 and are connected to upright 31 by means of screws, for instance. At any rate, the connection system of the above described disc may be adjusted according to the different structures of the existing continuous machines.

As shown in Fig. 3, in an enlarged view of protection carter 40, brackets 51 and opposite brackets 61 are located at such a distance suitable for the rotation axis 2 of Yankee cylinder 1, such that they can be fixed to framework 30 at the sides of rolling element bearing 2' (Fig. 2). More precisely, brackets 51 and 61 are made starting from the edge 40' of the disc towards the inside.

The releasable connection between two disc portions 50 and 60, instead, comprises a fixed joint between a profile 62 made on portion 60 that is inserted in a groove 52 of portion 50. This way, it is possible to remove the protection carter from Yankee cylinder 1, for example, to allow maintenance work to be carried out and for other purposes. Furthermore, such embodiment is advantageous in that protection carter 40 can be mounted as a retrofit to existing drying cylinders, since no modifications need to be made to the head wall of the Yankee paper drying cylinder 3 or to framework 30.

Figure 4 shows a cross sectional view of a portion of the protection disc 40 that faces head wall 3 of Yankee paper drying cylinder 1. In particular, this drawing shows how a lip seal element 43 works between carter 40 and head wall 3 that prevents both radiation heat losses, due to carter 40, and convection heat losses, since lip seal element 43 prevents the exit of warm air 41 which flows between the fixed carter 40

and rotatable head wall 3 of cylinder 1. A more detailed view of lip seal element 43 is shown in the enlarged view of Fig. 5, which highlights how lip seal element 43 is located very close to or in minimum friction contact with head wall 3 of Yankee paper drying cylinder 1.

In an exemplary embodiment shown in Fig. 6, carter 40 has a engagement groove 45 for a gasket 46 that is made of a sealing material, for example a plastic material or aluminium, such that gasket 46 remains in minimum friction sliding contact with head wall 3 or remains very close to the head wall without being brought into contact with it.

In another exemplary embodiment, shown in Fig. 7, a seal 47 is provided, instead, that has two parallel wings, and is mounted within a groove 47', such that thermally insulating labyrinth is formed with head wall 3 that reduces, also in this case, the leakage of warm air towards the environment and therefore energy consumption.

With reference to Fig. 4, carter 40 has, furthermore, a plurality of grooves 80 on the side that, in use, faces head wall 3; grooves 80 are adapted to hinder the convective motion of warm air within the space between head wall 3 and carter 40. In particular, grooves 80 are concentrically arranged with respect to the axis of cylinder 1 (Fig. 3). This way, the warm air leakage towards the environment is reduced to a minimum and therefore energy costs are lowered, since a lower amount of steam is produced.

Furthermore, carter 40 has a peripheral bead 70 that arranges itself parallel to the side surface 1' of paper drying cylinder 1, for a portion that is not covered by the continuous paper web that passes on the Yankee cylinder. In particular, bead 70 has a seal

edge 72 that slidingly engages with side surface 5 of said paper drying cylinder 1, with the object of reducing the heat loss along two belts side 74 of Yankee cylinder 1, on which the paper does not pass, thus increasing the energy saving that is already high due to the carter 40. In addition, bead 70 has the object of preventing paper fragments or fibres or various particulate from accumulating between the carter and the head in zone 71 of lip seal element 43.

Figure 8 shows the above mentioned drying disc 1 that is provided with protection carter 40 according to the invention.

Figures 9 to 13 show a further exemplary embodiment of carter 40. In this case, first and second disc portion 50 and 60 are in turn split into two sub-portions, 50a/50b and 60a/60b, such that carter 40 is obtained as the union of four disc sub-portions, in particular each subportion is made as a 90° circle sector. Alternatively, carter 40 is formed by three disc portions that are spaced apart 120° from one another.

In an advantageous exemplary embodiment, the fixing means 41 of carter 40 to the framework, shown in Figs. 9 and 10, also has the function of a means for fixing disc portions 50a/50b and 60a/60b to each other. In particular, on each portion 50a/50b and 60a/60b of the carter mutual engagement means are provided between fixing means 41 of carter 40 to framework 30 and carter portions 50a/50b and 60a/60b, such that, when carter portions 50a/50b and 60a/60b are fixed to fixing means 41, fixing means 41 fastens the carter portions together and provides a tight joint between the carter portions.

In particular, fixing means 41 extend along the whole length of the junction line between two adjacent

carter portions 50a/50b and 60a/60b, such that the tight joint between the adjacent carter portions is ensured.

In particular, fixing means 41 are T-shaped fixing means, and engages with respective inserts 42 that engage with corresponding recesses 42a that are made on the surface of carter portions 50a/50b and 60a/60b, shown in Fig. 12.

With reference to Figs. 11 and 12, an exemplary embodiment of a lip seal element 90 is shown, in particular, which consists of a plurality of strips 91 of a flexible seal material; the strips are arranged parallel and adjacent to each other. In particular, strips 91 are made of Teflon.

More in detail, as shown in Fig. 12, flexible strips 91 of first carter portion 50b are arranged offset with respect to one another, such that a fixed joint is formed with the flexible strips of second carter portion 50a, (Fig. 10), which is adjacent to the first carter portion. This way, the fixed joint ensures a tight joint also between the lip seal element and two adjacent portions.

Advantageously, the carter portions are mounted on fixing means 41 in such a way that a sliding interference engagement is created between flexible strips 91 and head wall 3 of the cylinder, such that they quickly wear, and a material residue 90' is left adherent on the surface of head wall/s 3. Material residue 90' deposited on the face of head wall 3 improves joint tightness, since a sliding engagement is provided between Teflon® 90' and Teflon® 90.

Carter portions 50a/50b and 60a/60b are adapted to slide even with the rotating shaft of the cylinder, such that an air tight connection is obtained between the carter and rotating shaft 2. In particular, each

carter portion 50a/50b and 60a/60b has a sliding zone 95 that is made of an antifriction material, for example of Teflon®. In particular, carter portions 50a/50b and 60a/60b are mounted on fixing means 41 in such a way that a sliding interference engagement is created between sliding zone 95 and rotating shaft 2 of the cylinder, such that they quickly wear, and a material residue 95' is left adherent on the surface of rotating shaft 2, so that adherent material residue 95' and sliding zone 95 provide a seal joint between them.

It must be pointed out how such a protection structure allows relevant energy savings to produce the steam needed to dry a continuous paper web. This savings allow to obtain an energy loss reduction of 10-15%, which allows a fuel gas saving from 10 Nm^3/h to 40 Nm^3/h, depending upon the size of Yankee paper drying cylinder 1.

The foregoing description of specific embodiments will so fully reveal the invention according to the conceptual point of view, so that others, by applying current knowledge, will be able to modify and/or adapt for various applications such embodiments without further research and without parting from the invention, and it is therefore to be understood that such adaptations and modifications will have to be considered as equivalent to the specific embodiments. The means and the materials to realise the different functions described herein could have a different nature without, for this reason, departing from the field of the invention. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

CLAIMS

1. A protection structure for a head wall of a paper drying cylinder, in particular a Yankee cylinder, said paper drying cylinder rotating about a rotating shaft and supported by a framework, said protection structure comprising:
   - a protection carter that is arranged about said rotating shaft close to a head wall of said cylinder;
   - a fixing means for fixing said carter to said framework, such that said carter during the rotation of said paper drying cylinder stays motionless with respect to said framework and faces said head wall carrying out a thermal insulating function,

   wherein said protection carter is a disc and comprises at least a first and a second carter portion that are mutually engageable with each other and that are arranged, in use, bridging said rotating shaft, and wherein a means is provided for fixing said first and said second carter portions to each other, in such a way that an air tight connection between said first and said second carter portions is obtained.

2. A protection structure, according to claim 1, wherein the first and the second carter portions are in turn split as two sub-portions, such that said carter is obtained from the union of four disc sub-portions, in particular each subportion is made as a 90°circular sector.

3. A protection structure, according to claim 1, wherein said carter is formed by three disc portions that are angularly spaced 120° apart from each other.

4. A protection structure, according to claim 1, wherein the fixing means for fixing the carter to the framework also fixes said disc portions to each other.

5. A protection structure, according to claim 4, wherein a mutual engagement means is provided on each portion of the carter between the fixing means and said carter portions, such that the fixing means fastens the carter portions together and provides a tight joint between the carter portions when the carter portions are fixed to the fixing means.

6. A protection structure, according to claim 1, wherein said fixing means extends along the whole length of the junction line between two adjacent carter portions, such that an air tight joint is ensured between said adjacent carter portions, in particular said fixing means are T-shaped fixing means, and engage with respective protrusions or recesses that are made on the surface of said carter portions, wherein, in particular, said carter portions are L-shaped carter portions.

7. A protection structure, according to claim 1, wherein a sealing means is provided between said carter and said head wall, such that any air leakage is prevented between said carter and said head.

8. A protection structure, according to claim 1, wherein said sealing means provides a lip seal element that is arranged proximate to said head wall and, in particular, a lip seal element that remains in a close proximity of said head wall or strip with a minimum friction on said head wall.

9. A protection structure, according to claim 8,

wherein said lip seal element comprises a plurality of sealing flexible strips that are arranged parallel and adjacent to each other, in particular said flexible strips are Teflon® strips.

10. A protection structure, according to claim 9, where the flexible strips of a first carter portion are arranged offset with respect to one another, such that a fixed joint is formed with the flexible strips of a second carter portion proximate to said first carter portion, whereby the fixed joint ensures a tight joint also between the lip seal element and two adjacent portions.

11. A protection structure, according to claim 9, wherein said carter portions are mounted on said fixing means in such a way that a sliding interference engagement is created between said flexible strips and said head walls, such that they quickly wear and leaves a material residue on the surface of said head walls, such that the material residue provides a seal joint between them.

12. A protection structure, according to claim 1, wherein said carter portions are adapted to slide along the rotating shaft of said cylinder, such that a tight connection is obtained between the carter and the rotating shaft, in particular each carter portion having an antifriction material sliding zone, wherein in particular said antifriction material is Teflon®, in particular said carter portions are mounted on said fixing means in such a way that a sliding interference engagement is created between said sliding zone and the rotating shaft of the cylinder, such that they quickly wear and leaves a material residue on the surface of the rotating shaft a material trace,

such that the material residue provides a seal joint between them.

13. A protection structure, according to claim 3, wherein said lip seal element forms a labyrinth with said head, to minimize air leakage.

14. A protection structure, according to claim 1, wherein said carter has a plurality of grooves at the side that, in use, faces said head wall, said plurality of grooves adapted to hinder the convective motion of warm air that is present in an inner space between the head wall and the carter, in particular said grooves are concentrically arranged with respect to the axis of said paper drying cylinder.

15. A protection structure, according to claim 1, wherein said carter has a peripheral bead that arranges itself parallel to the side surface of said paper drying cylinder along a portion of said cylinder that is not covered by the continuous paper web that passes on said cylinder, in particular, said bead has a seal edge that slidingly engages with the side surface of said paper drying cylinder, a minimum friction or a minimum distance being created between said edge and said side surface.

p.p. Fomat S.r.l.

Fig. 1

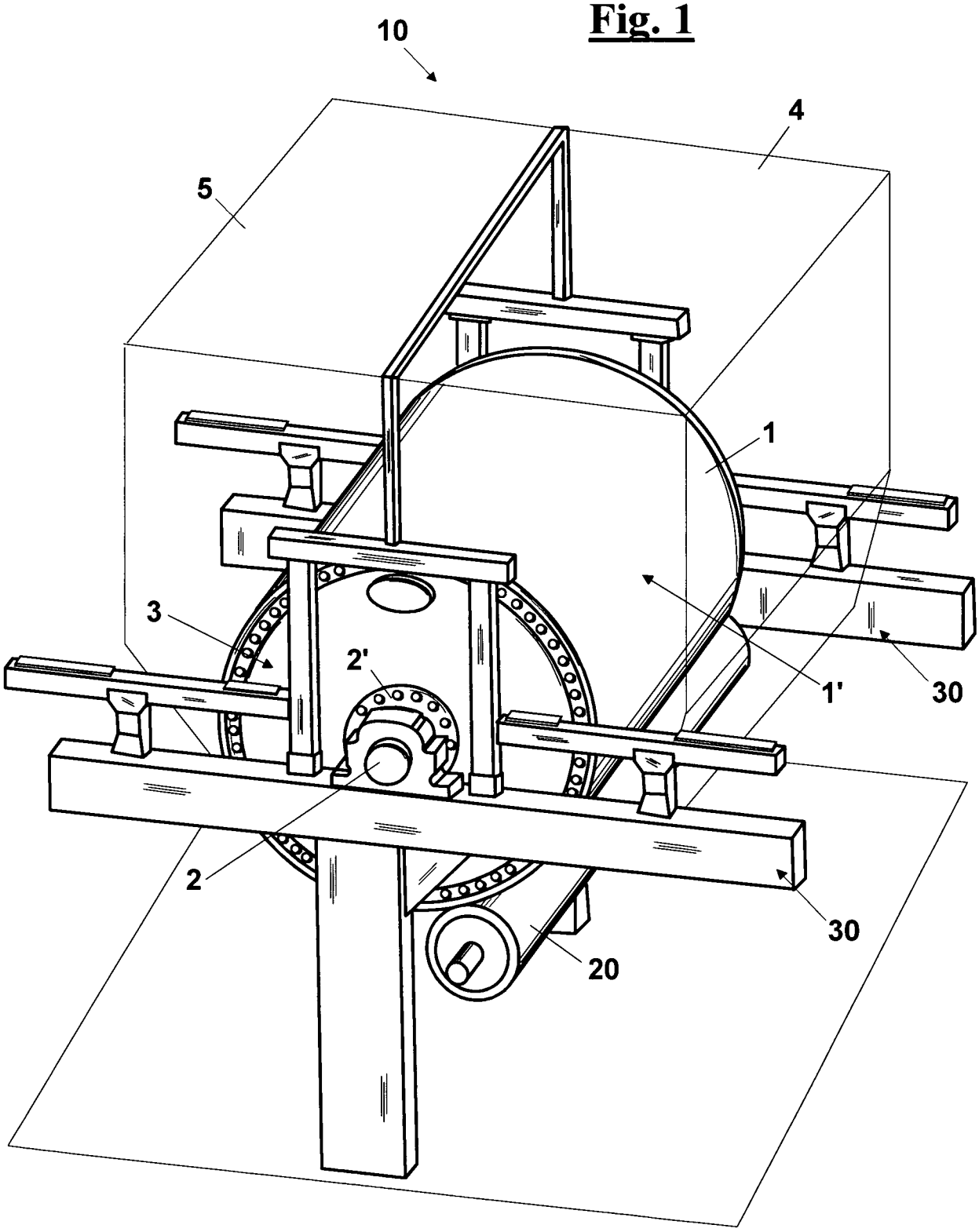


Fig. 2

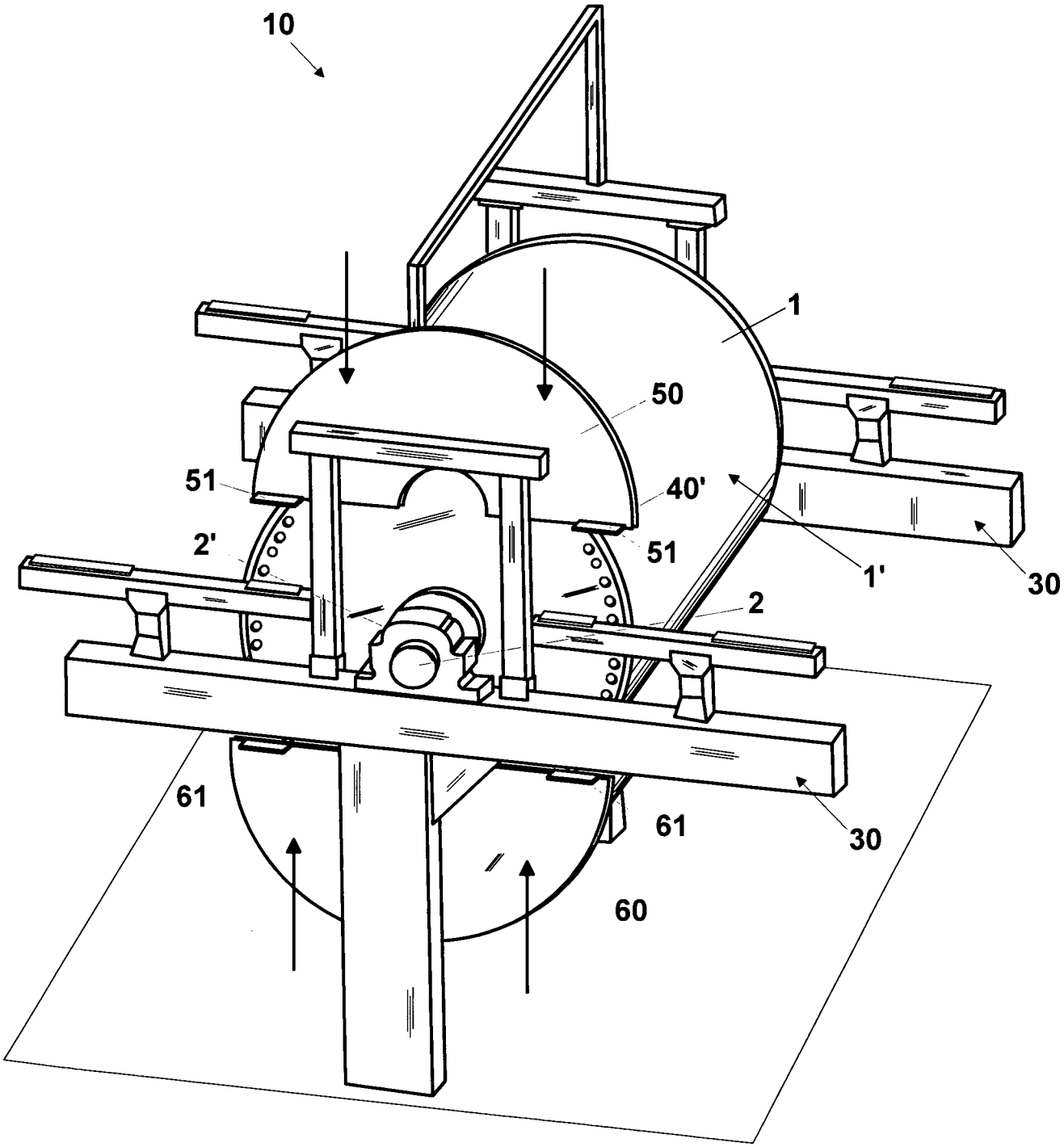
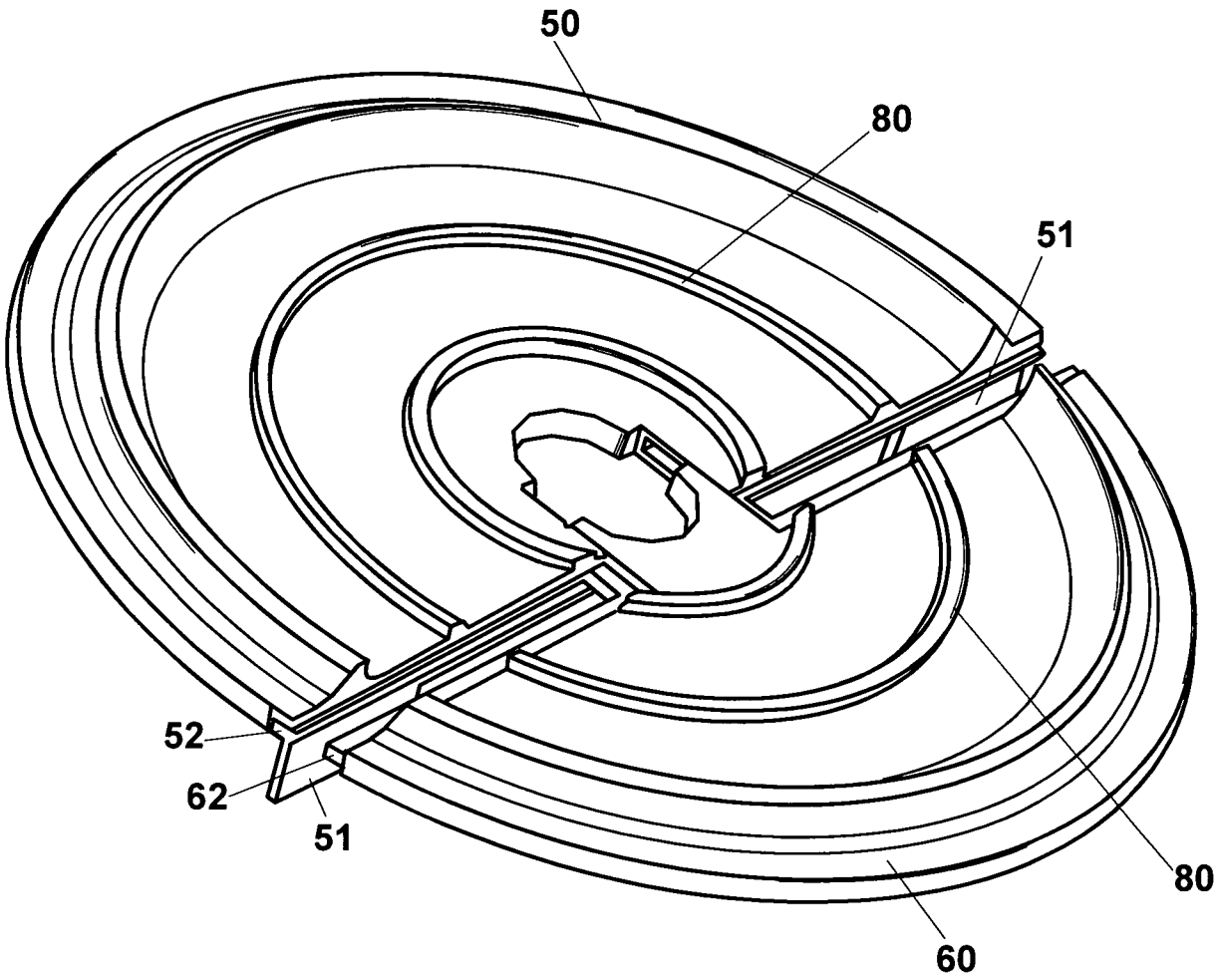


Fig. 3



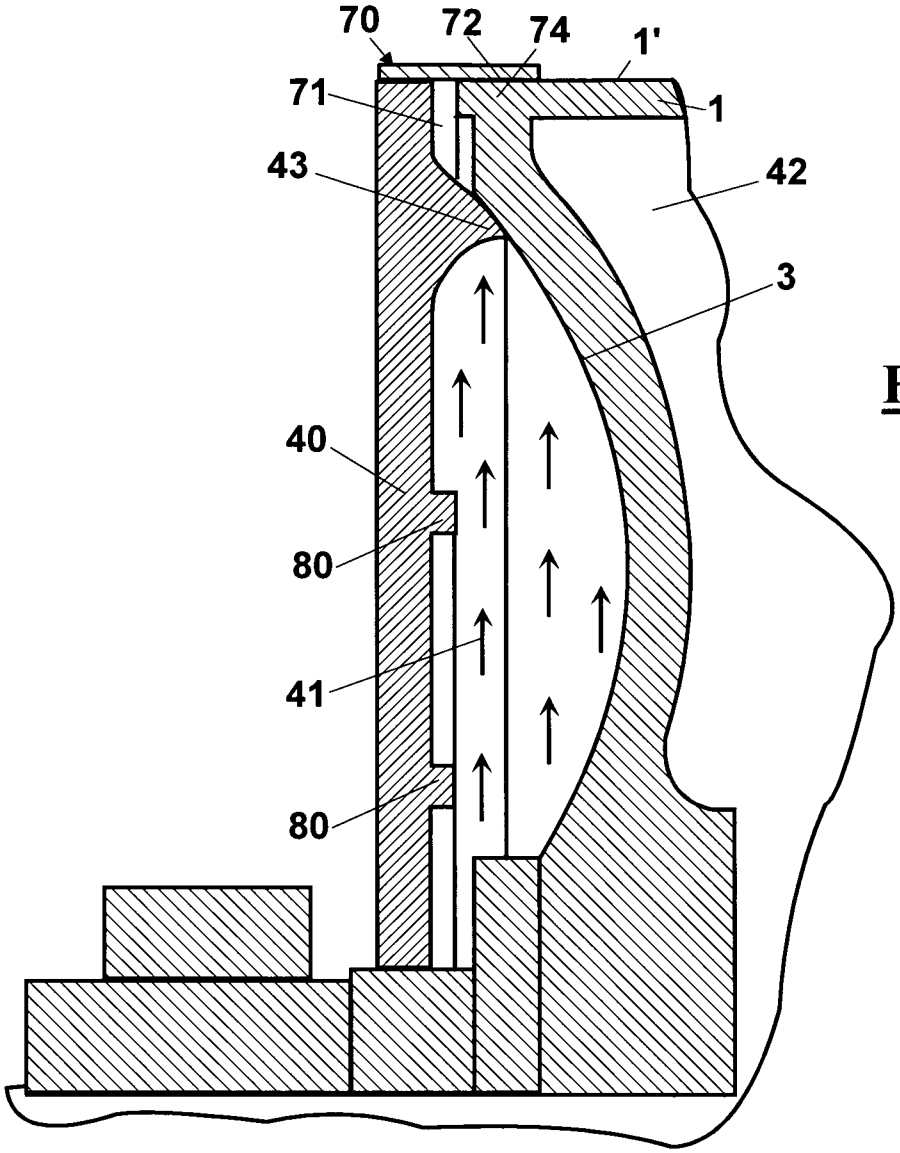


Fig. 4

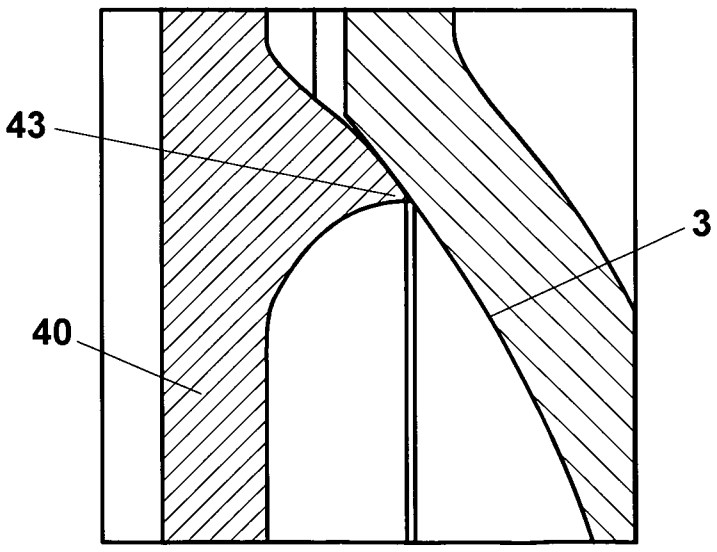


Fig. 5

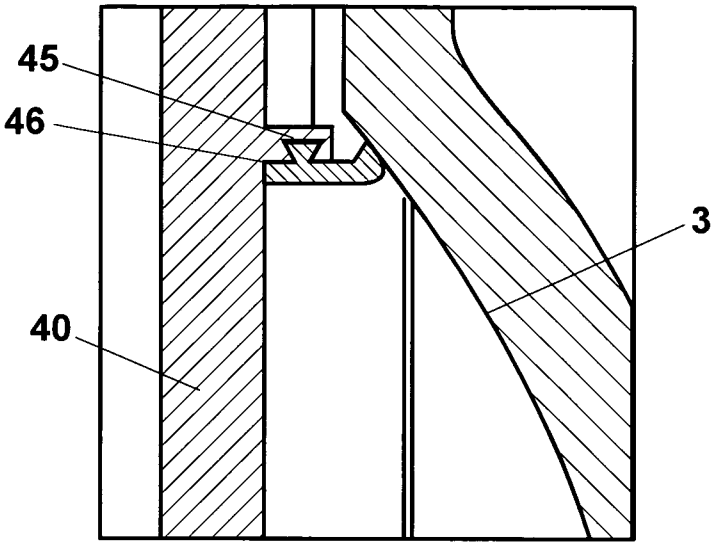


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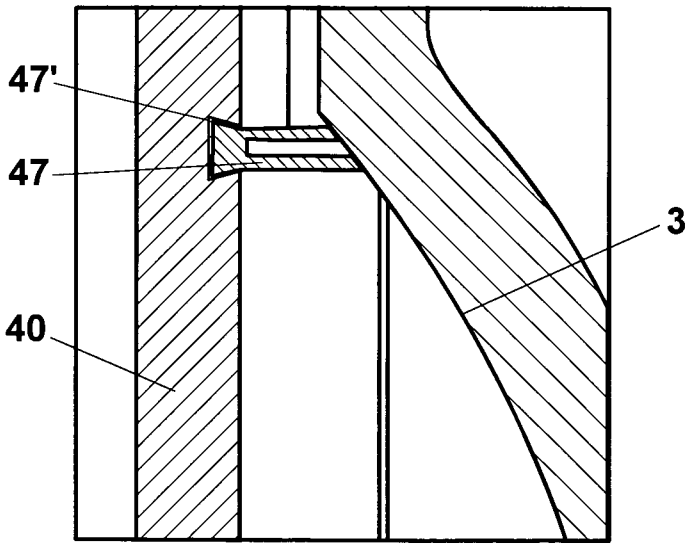


Fig. 7

Fig. 8

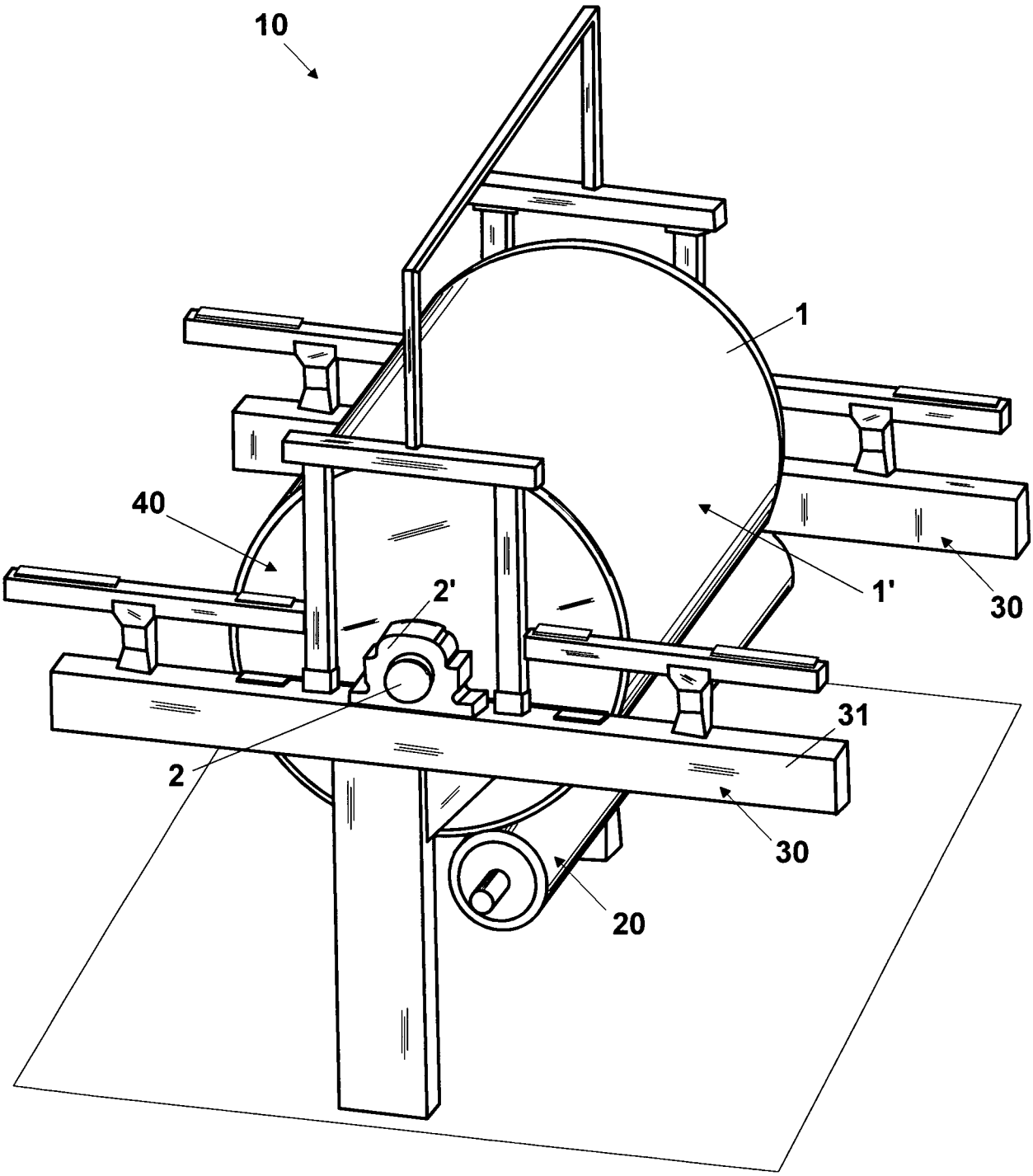


Fig. 9

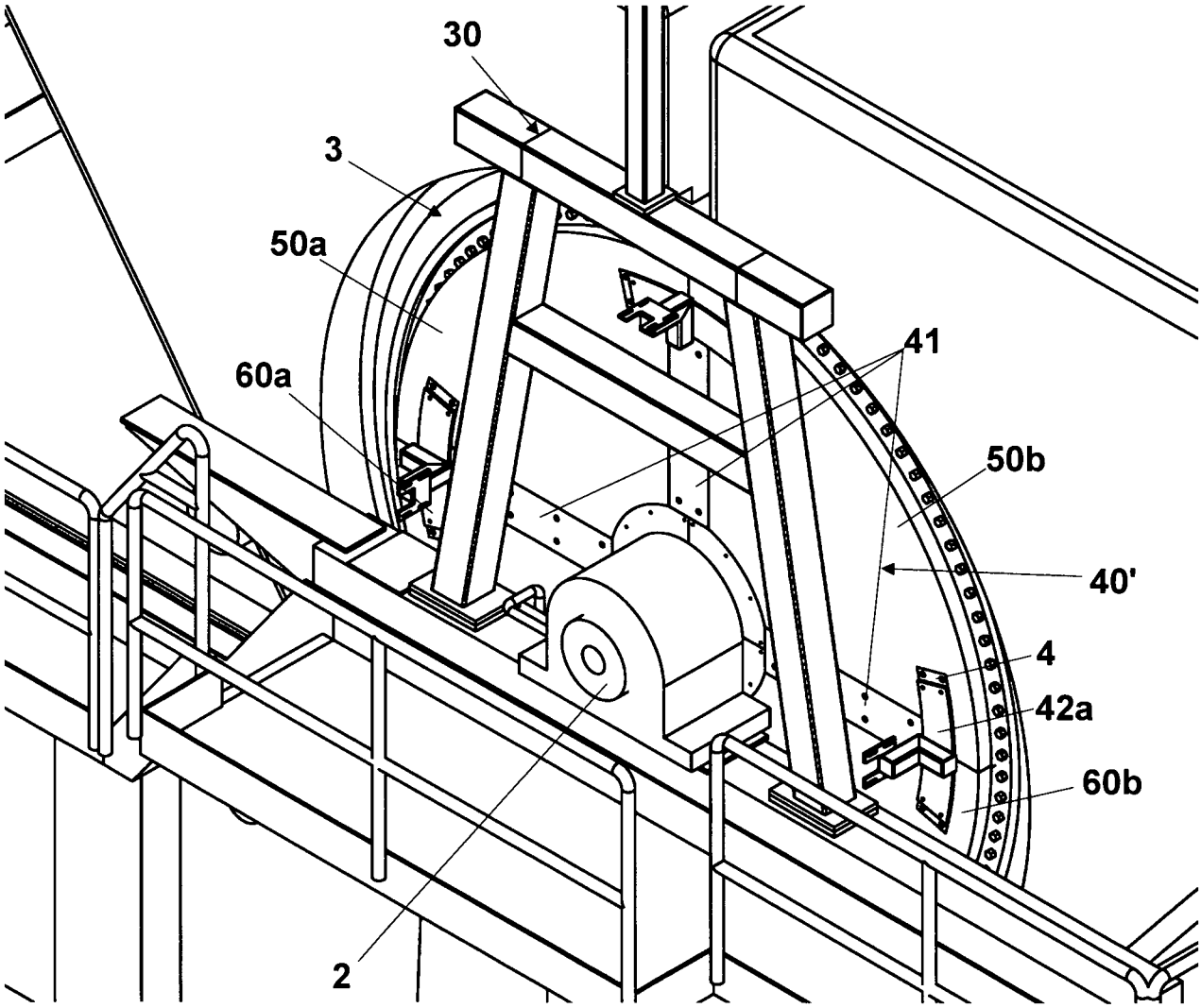


Fig. 10

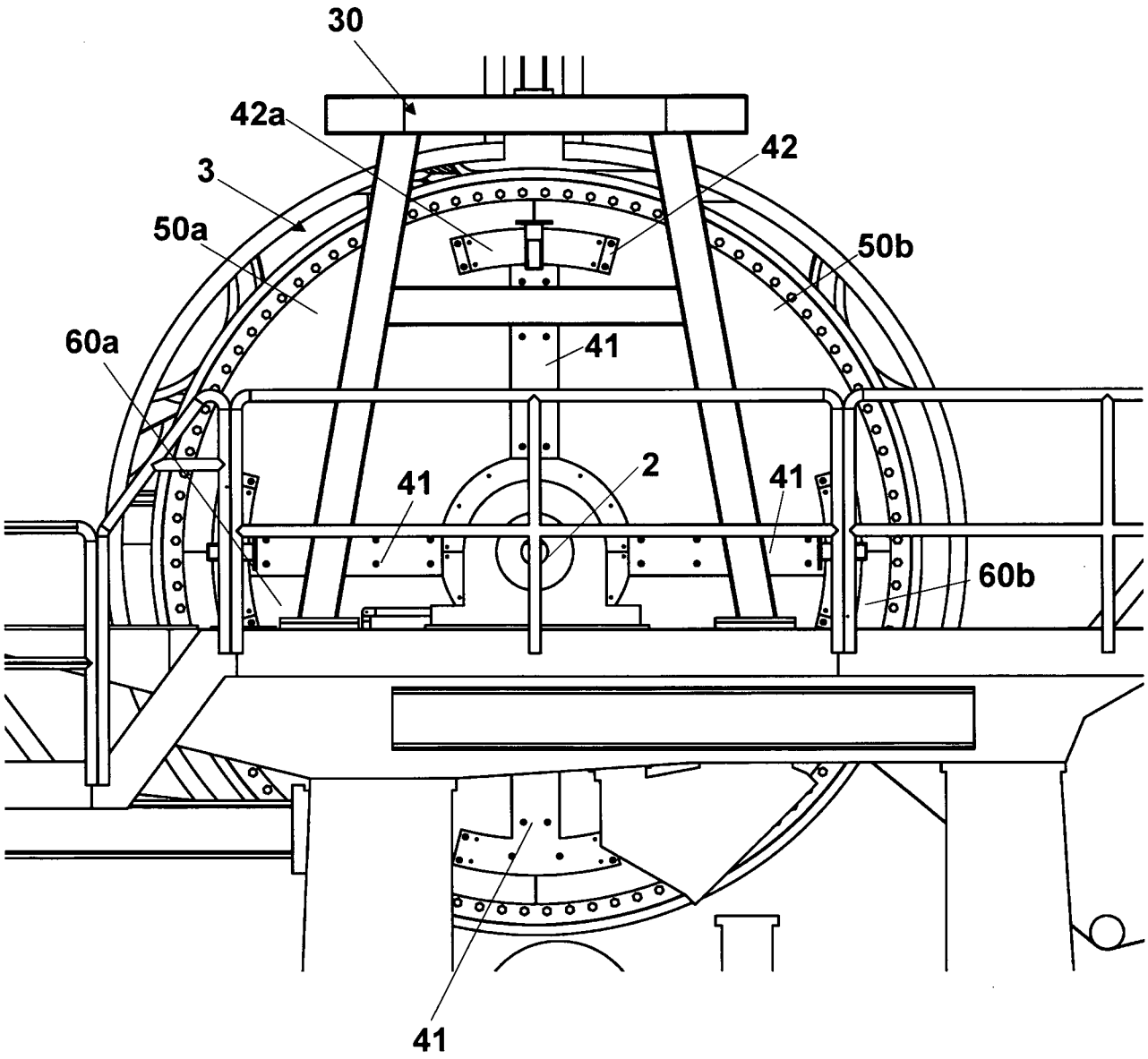


Fig. 11

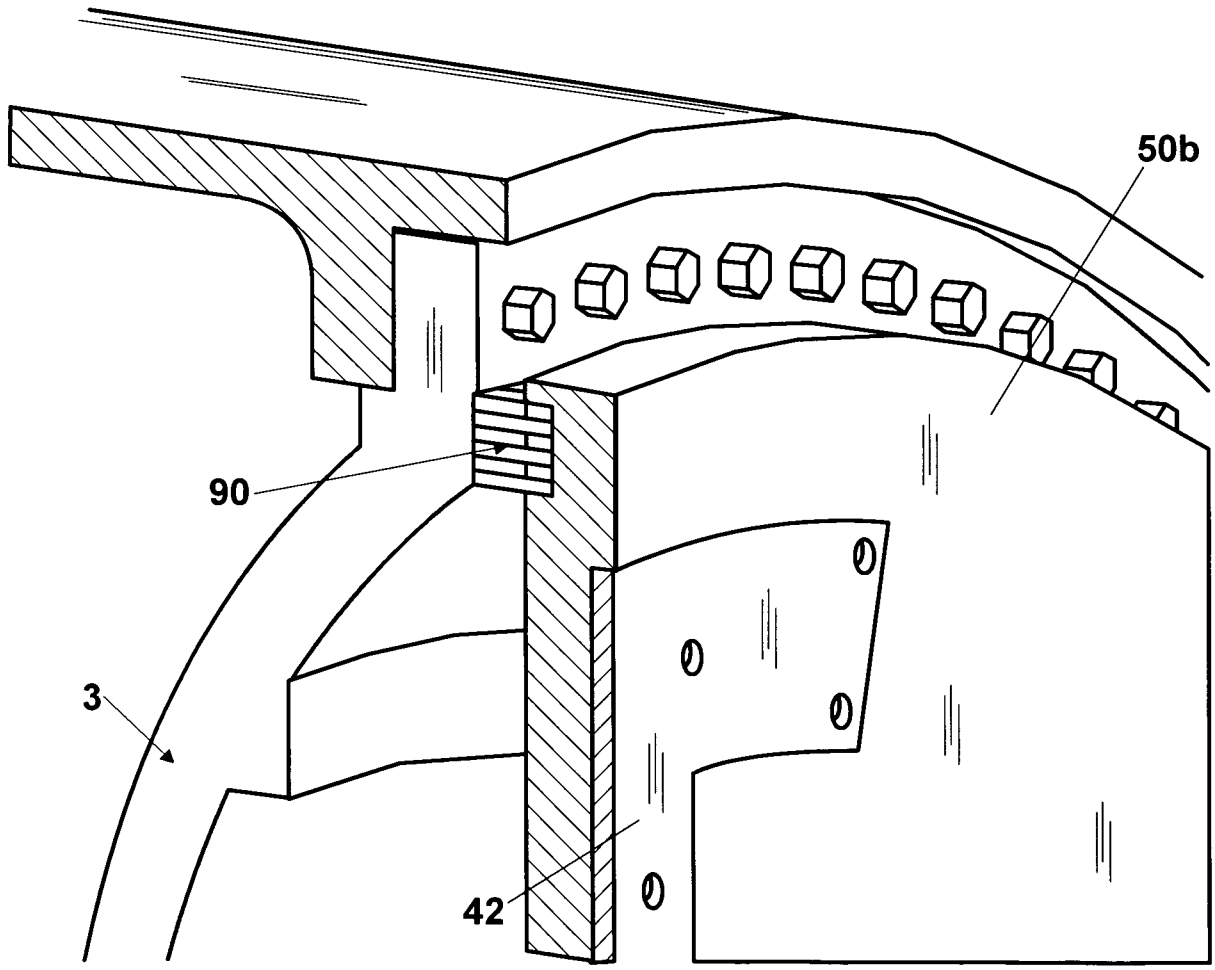
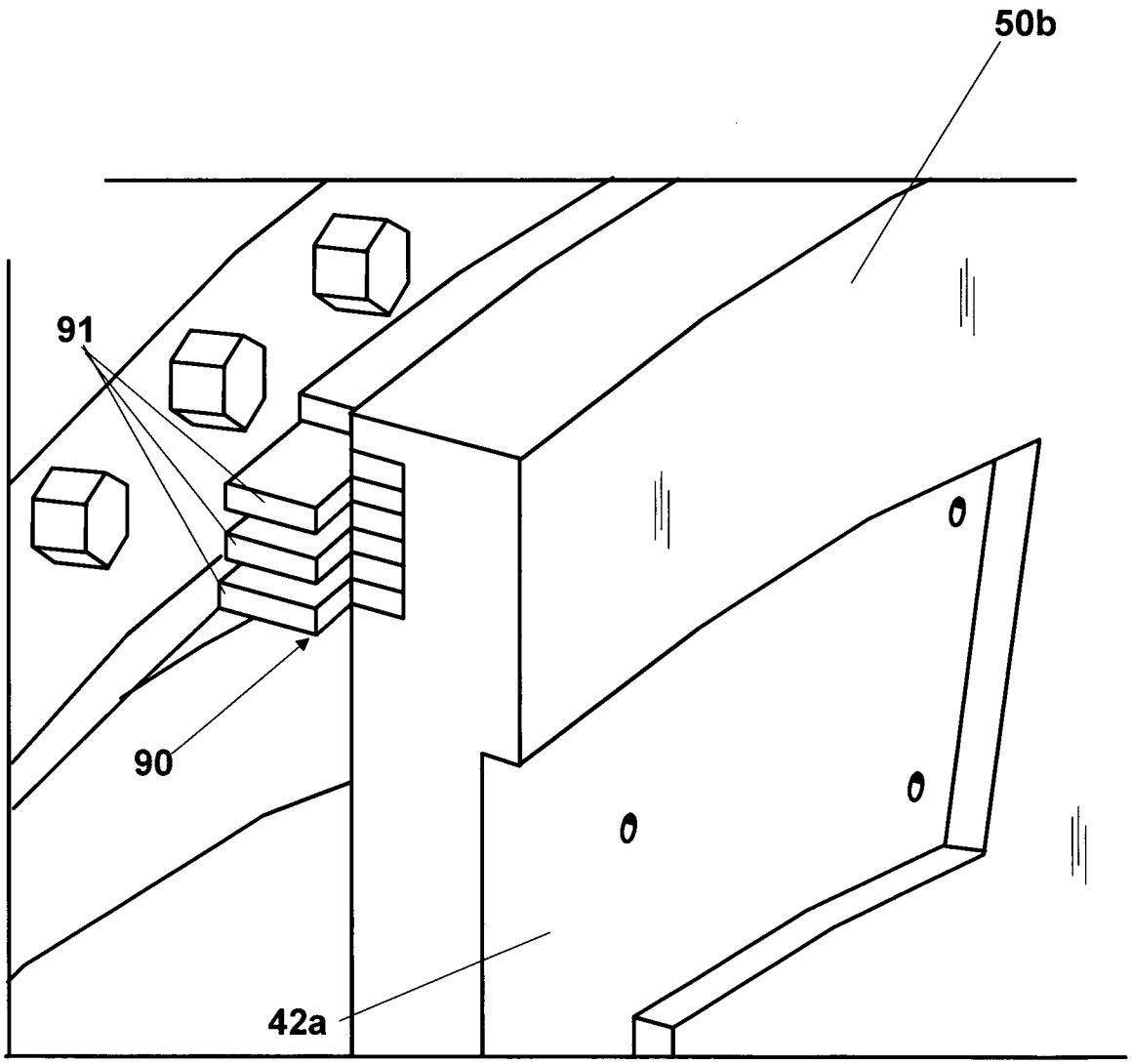


Fig. 12



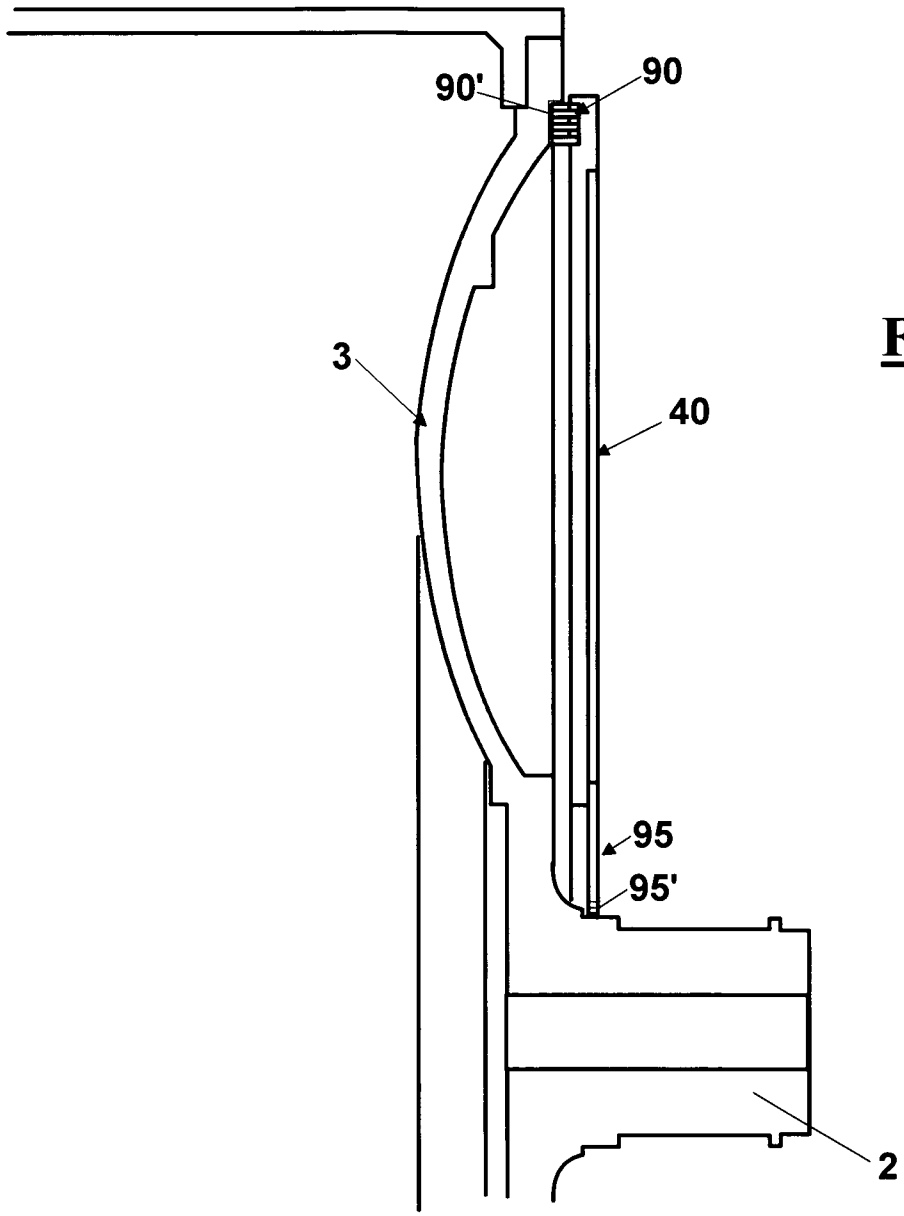


Fig. 13