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(54) **Belt clamping device**

Walzenmantelklemmvorrichtung

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(56) References cited:
EP-A- 0 838 549 EP-A- 1 273 701
DE-A1- 10 319 668 DE-A1- 19 703 218
DE-U1- 29 701 002 US-A- 5 700 357

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Description

[0001] The present invention is related to fiber web machines. More precisely, the invention concerns a belt clamping device for clamping a belt around the circumference of a belt roll.

[0002] Presently, a belt is clamped and/or locked on the roll by means of a ring-like clamping device, which comprises an inner clamp ring and an outer clamp ring in the radial direction. The inner clamp ring typically comprises in the axial direction two concentric ring elements, which are tightened against each other, and an intermediate element, which is located between the ring elements and which is typically made of a flexible material. When the ring elements are tightened towards each other in the axial direction, the intermediate element between them is pressed outwards towards the inner circumference of the outer clamp ring. The outer clamp ring comprises several, typically 12, clamp segments of the clamp ring, which are assembled end-on-end, in order to accomplish a uniform ring structure, i.e. the outer clamp ring. The belt, which is to be fastened and/or locked, is placed between the inner and the outer clamp ring, and it remains pressed and becomes locked between the inner circumference of the outer clamp ring and the intermediate element of the inner clamp ring, which is pressed towards the inner circumference of the outer clamp ring by tightening the ring elements of the inner clamp ring.

[0003] Among the problems and/or shortcomings of this type of a known device is that the clamp segments of the clamp ring are made of metal, which makes them heavy and difficult to handle in confined spaces. This essentially complicates and especially slows down service and/or reconditioning work. Because of their weight, there are several clamp segments in manual installation, because larger cast items would require the use of hoisting devices.

[0004] One of the goals of the present invention is to reduce the problems and shortcomings associated with the traditional clamping devices. Another goal of the present invention is to accomplish a new clamping device which can be used in fiber web machines for the clamping of the belt of a belt press or calender, such as the belt of a roll with the trade name SymBelt roll marketed by the applicant.

[0005] A belt clamping device comprising the features summarized in the preamble of claim 1 is known from document US-A-5 700 357. This known belt clamping device comprises an outer clamp ring having a radially extending flange as well as a ring-like band element constituted by a cylindrical portion of the outer clamp ring. The ring-like band element of the outer clamp ring is uninterrupted in its circumferential direction and thus has the shape of a closed circle. The belt is clamped between the inner circumferential surface of the ring-like band element and an inner clamp ring constituted by a one-piece cylindrical clamp ring and a plurality of clamp wedge segments.

[0006] A belt clamping device comprising the features summarized in the preamble of claim 1 is also known from document DE 297 01 002 U1. An outer clamp ring of this known belt clamping device comprises a ring-like band element constituted by an essentially cylindrical portion of the outer clamp ring. This ring-like band element has the shape of a close circle. The belt is clamped between the outer clamp ring and an inner clamp ring constituted by a first ring element and a second ring element which can be composed of a plurality of segments.

[0007] Document DE 103 19 668 A1 discloses a belt clamping device comprising an inner and an outer clamp ring, wherein the outer clamp ring can be composed of plural segments made of a fiber-reinforced plastic material.

[0008] It is an object of the present invention to provide a belt clamping device which is light and therefore easy to handle, thus facilitating service and/or reconditioning work.

[0009] This object is achieved by the belt clamping device defined in claim 1.

[0010] Advantageous developments of the belt clamping device according to the invention are defined in the dependent claims.

[0011] Among the advantages of the invention are that the clamping device according to the invention is light and therefore easy to handle, which facilitates service and/or reconditioning work, and that the outer clamp ring can be equipped with positioning claws in order to ensure easier installation. The band element of the outer clamp ring of the clamping device is made of a fiber-reinforced plastic material so that the resulting element is essentially lighter than the previously used cast metal clamp segments. As an example, the fiber material can be carbon fiber, glass fiber, Kevlar fiber or aramid fiber, and the polymer in the plastic material can be of thermosetting plastic, such as epoxy or polyurethane. Due to the simplified construction, the clamping device according to the invention is also more economical.

[0012] The benefits of the construction according to the present invention over a corresponding steel structure are described below. Depending on the diameter of the roll and the structural strength of the clamping device, the manufacture of the clamping device to have a single ring of steel for a typical belt roll diameter of approx. 1.2 to 1.7 meters gives the construction a weight of 490 to 688 N (50 to 70 kilograms). It is difficult to handle and position a heavy item such as this, which is why hoisting devices and several members of the installation team are needed in the replacement of the belt clamping device. On the other hand, when using a clamping device made of several cast metal pieces divided into segments, the weight of the individual narrow segments is smaller, but the total weight of the segments is higher, because it is necessary to use a thicker material in such smaller segments than in a uniform device. On the other hand, the quantity of the segments also increases the quantity of the fastening and positioning devices needed in each

segment, which slows down the progress of work. The weight of the clamping device according to the invention, made of a reinforced fiber material, is only approx. 98 to 196 N (10 to 20 kilograms) at typical belt roll diameters and at the typical structural thickness of the clamping device. This weight can be handled by a single mechanic and can be installed more quickly than applications presently in use. In practice, the material thickness of the solution according to the invention can be reduced, because the orientation of the fibers in the longitudinal direction of the band element can be used for receiving the radial outward load of the inner clamp ring. Preferably, the winding of fibers/fiber bundles/woven fiber ribbon in the ring direction or at a small angle to the ring can be used. It is also possible to use mold casting of a fiber-reinforced plastic material, but in this case the material thickness is higher and the achieved reduction in weight is smaller than in a wound structure, where the weight can be for example below 98 N (10 kilograms).

[0013] In what follows, the invention is described by means of one preferred embodiment of the invention and by making reference to the accompanying drawings, where:

FIG.1 is a schematic cross-section of the clamp rings of the clamping device according to the invention, and

FIG.2 is a schematic view of the outer clamp ring of the clamping device according to the invention, seen from the outer end of the belt roll.

[0014] With reference to FIG.1 and FIG.2 in order to clamp the belt 1 onto the circumference of the roll shell of a belt roll, the clamping device comprises concentric and superimposed inner and outer clamp rings to be fitted at the ends of the belt roll. The inner clamp ring is composed of concentric ring elements 2, 3, which are tightened towards each other in the axial direction, and of an intermediate element 6, which is made of a flexible material and which is located between the ring elements so that the intermediate element is pressed when the ring elements are tightened towards each other, radially outwards towards the inner circumference of the outer clamp ring. The clamped belt, which is located between the inner clamp ring and the outer clamp ring, hence becomes locked between the inner circumference of the outer clamp ring and the intermediate element.

[0015] In the embodiment example shown in the figures, the outer clamp ring of the clamping device comprises a single-piece ring-like band element 10, which has the shape of a cut circle and is equipped with a jointing device 13, 14 in order to form an outer clamp ring having the shape of a closed circle around the inner clamp ring and hence to lock/clamp the belt 1 between the clamp rings. Such a band element of a single piece and having the shape of a cut circle can be fitted as a single piece around the inner clamp ring, and the band element can be formed into the outer clamp ring having

the shape of a closed circle around the inner clamp ring by joining the band element ends bordering the cut-off area 12 by means of jointing device or devices 13, 14, which extend beyond the cut-off area.

[0016] The jointing device can comprise a screw 13, which is arranged to be turned into one end of the band element 10 bordering the cut-off area 12, and a screw counterpart 14 which has a counter thread for the screw and which is fitted at the other band element end bordering the cut-off area. Other jointing devices can also be used instead of the screw device, such as a latch and its counterpart, which are fitted at the band element ends bordering the cut-off area. The jointing devices are preferably located on the outer circumference of the band element.

[0017] The band element 10 can also have several pieces, and preferably it has two pieces.

[0018] The two-piece band element 10 can comprise two segments, which can be fitted in parts around the inner clamp ring and which can be joined together in the circumferential direction of the band element by means of jointing devices 13, 14. In this case, preferred jointing devices include screw and/or latch devices. The segments joined together by the jointing devices form an outer clamp ring having the shape of a closed circle around the inner clamp ring. In this conjunction, it can be stated that the band element 10 having the shape of a cut circle has always, i.e. irrespective of the quantity of the cut-off areas 12, a corresponding quantity of jointing devices 13, 14 so that the band element ends bordering the cut-off area can be joined together in order to form an outer clamp ring having the shape of a closed circle around the inner clamp ring.

[0019] When the element 2,3,10 of the clamping device are made of a reinforced fiber material, the weight of the clamping device is only approx. 98 to 196N (10 to 20 kilograms) at a typical structural thickness as well as at belt roll diameters of 1.2 to 1.7 meters. In practice, the material thickness of the clamping device can also be reduced as compared to a steel structure of known solutions, because the orientation of the fibers in the longitudinal direction of the band element can be used for receiving the radial outward load of the inner clamping. The winding of fibers/fiber bundles/woven fiber ribbon in the ring direction or at a small angle to the ring can also be used. Furthermore, it is possible to use mold casting of a fiber-reinforced plastic material, but in this case the material thickness is higher and the achieved reduction in weight is smaller than in a wound structure, where the weight can be for example below 10 kilograms.

[0020] In the embodiment shown in the figures, the ring-like band element 10 on the side of the outer end of the clamping device is equipped with projections 11. These projections are located at a distance from each other and are essentially directed towards the center of symmetry of the band element at an angle. On the side of the outer end of the clamping device, this angle corresponds essentially to the angle between the axial end

face of the inner clamp ring and the outer circumferential face of the inner clamp ring. The primary function of the projections 11 is that they serve as the positioning claws of the band element 10 when the band element is fitted around the inner clamp ring.

[0021] With reference to FIG.2, slots 15 formed in the projections 11 facilitate the positioning of a new belt 1, which is drawn over the end, when projections of the belt are drawn through the slots 15 in the projections 11 and locked for the duration of clamping through a hole in the belt projection for example by means of a taper pin. The projections 11 of the band element 10 can also contain positioning and fastening devices 18 for positioning the band element.

[0022] The positioning claws can be fastened on the band element 10 structure during winding. Another application is to wind the entire structure as a single piece using a uniform projection, i.e. positioning claw, having the same size as the entire ring. Mold casting can be carried out as a single piece irrespective of the quantity of positioning claws.

[0023] In locations where the projections or positioning claws are susceptible to wear, such as in conjunction with the slots, reinforcements or a stronger material can be used in the structure against mechanical wear.

[0024] In order to ensure the balance of the rotating roll, the band element 10 equipped with jointing devices 13, 14 is preferably equipped with counter weights 16. Moreover, it is preferable that all protrusions, such as jointing devices and/or counter weights, beyond the outer circumference of the band element are rounded off and/or covered as at 17 in FIG. 2 in order to prevent all types of entanglement and harmful flows.

[0025] In the example of the figures, the angle between the projections 11 serving as positioning claws and the circumferential face of the band element 10 is essentially a right angle and the projection extend, at the outer end of the clamping device, at a distance from the end of the inner clamp ring at least partly over the end of the inner clamp ring.

[0026] The single-piece band element having the shape of a cut circle may include an articulation device so that the fitting of the band element as a single piece around the inner clamp ring would be as easy as possible. In this case, the band element can be formed into an outer clamp ring having the shape of a closed circle around the inner clamp ring by joining the ends bordering one cut-off area together by means of at least one jointing device, such as a screw and/or latch device.

[0027] In order to implement the invention, it is also possible to use a solution where the belt is only locked by tightening the outer clamp ring, i.e. the jointing devices of the band element, over the inner clamp ring.

Claims

1. A belt clamping device for clamping a belt (1) around

the circumference of a belt roll, the belt clamping device comprising
an inner and an outer clamp ring (2, 3, 6; 10, 13, 14)
to be installed at one end of the belt roll for clamping
the belt (1) between them,
wherein the outer clamp ring (10, 13, 14) has the
shape of a closed circle and comprises a ring-like
band element (10),

characterized

in that the band element (10) is made of a fiber-reinforced plastic material,

in that the band element (10) has the shape of a cut circle having at least one cut-off area (12), and

in that the band element (10) is equipped with a jointing device (13, 14) at each of the cut-off areas (12) for joining the band element ends bordering the cut-off area (12) in order to form the outer clamp ring (10, 13, 14).

2. The belt clamping device according to claim 1, **characterized in that** the inner clamp ring (2, 3, 6) comprises two concentric ring elements (2, 3) which can be tightened towards each other axially, and an intermediate element (6) made of a flexible material, which is located between the ring elements (2, 3) and which is pressed, when the ring elements (2, 3) are tightened towards each other, radially outwards towards the inner circumference of the outer clamp ring (10, 13, 14).

3. The belt clamping device according to claim 1 or 2, **characterized in that** the band element (10) is a single-piece band element having a single cut-off area (12).

4. The belt clamping device according to claim 3, **characterized in that** the band element is equipped with an articulation device.

5. The belt clamping device according to claim 1 or 2, **characterized in that** the band element is a two-piece band element having two cut-off areas.

6. The belt clamping device according to one of claims 3 to 5, **characterized in that** the jointing device (13, 14) is a screw device.

7. The belt clamping device according to one of claims 3 to 5, **characterized in that** the jointing device is a latch device.

8. The belt clamping device according to one of claims 1 to 7, **characterized in that** the band element (10) is equipped with projections (11), which are located at a distance from each other in the circumferential direction of the outer clamp ring (10, 13, 14) and which are essentially directed towards the center of symmetry of the band element (10).

9. The belt clamping device according to claim 8, **characterized in that** the projections (11) serve as positioning claws for positioning the band element (10) on the inner clamp ring (2, 3, 6).

10. The belt clamping device according to claim 8 or 9, **characterized in that** slots (15) are formed in the projections (11), the slots (15) serving for receiving projections of the belt (1) when this is drawn over the end the belt roll.

11. The belt clamping device according to claim 10, **characterized in that** the projections (11) are provided with positioning and fastening devices (18) for positioning the band element (10).

12. The belt clamping device according to one of claims 1 to 11, **characterized in that** the fibers of the fiber-reinforced plastic material of the band element (10) are oriented in the longitudinal direction of the band element (10), in order to receive a radial outward load of the inner clamp ring (2, 3, 6).

13. The belt clamping device according to one of claims 1 to 12, **characterized in that** the fiber-reinforced plastic material is a mold-cast fiber-reinforced material.

Patentansprüche

1. Riemenklemmvorrichtung zum Klemmen eines Riemens (1) um den Umfang einer Riemenwalze, wobei die Riemenklemmvorrichtung folgendes aufweist:

einen inneren und einen äußeren Klemmring (2, 3, 6; 10, 13, 14), die an einem Ende der Riemenwalze einzubauen sind, um den Riemen (1) zwischen ihnen zu klemmen,

wobei der äußere Klemmring (10, 13, 14) die Form eines geschlossenen Kreises hat und ein ringartiges Bandedelement (10) aufweist,

dadurch gekennzeichnet, dass

das Bandedelement (10) aus faserverstärktem Kunststoffmaterial hergestellt ist,

dass das Bandedelement (10) die Form eines geschnittenen Kreises hat, der zumindest einen Wegschneidbereich (12) hat, und

dass das Bandedelement (10) mit einer Verbindungsvorrichtung (13, 14) an jedem der Wegschneidbereiche (12) ausgestattet ist, um die Bandedelementen, die an den Wegschneidbereich (12) angrenzen, zu verbinden, um den äußeren Klemmring (10, 13, 14) auszubilden.

2. Riemenklemmvorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, dass**

der innere Klemmring (2, 3, 6) zwei konzentrische Ringelemente (2, 3), die zueinander hin axial gespannt werden können, und ein Zwischenelement (6) aufweist, das aus einem flexiblen Material hergestellt ist, das zwischen den Ringelementen (2, 3) angeordnet ist und das, wenn die Ringelemente (2, 3) zueinander hin gespannt werden, radial nach außen zu dem Innenumfang des äußeren Klemmrings (10, 13, 14) gepresst wird.

3. Riemenklemmvorrichtung gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Bandedelement (10) ein aus einem einzelnen Stück bestehendes Bandedelement ist, das einen einzelnen Wegschneidbereich (12) hat.

4. Riemenklemmvorrichtung gemäß Anspruch 3, **dadurch gekennzeichnet, dass** das Bandedelement mit einer Gelenkvorrichtung ausgestattet ist.

5. Riemenklemmvorrichtung gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Bandedelement ein aus zwei Stücken bestehendes Bandedelement ist, das zwei Wegschneidbereiche hat.

6. Riemenklemmvorrichtung gemäß einem der Ansprüche 3 bis 5, **dadurch gekennzeichnet, dass** die Verbindungsvorrichtung (13, 14) eine Schraubvorrichtung ist.

7. Riemenklemmvorrichtung gemäß einem der Ansprüche 3 bis 5, **dadurch gekennzeichnet, dass** die Verbindungsvorrichtung eine Einrastvorrichtung ist.

8. Riemenklemmvorrichtung gemäß einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** das Bandedelement (10) mit Vorsprüngen (11) ausgestattet ist, die bei einem Abstand voneinander in der Umfangsrichtung des äußeren Klemmrings (10, 13, 14) angeordnet sind und die im Wesentlichen zu der Symmetriemitte des Bandedelementes (10) hin gerichtet sind.

9. Riemenklemmvorrichtung gemäß Anspruch 8, **dadurch gekennzeichnet, dass** die Vorsprünge (11) als Positionierklauen dienen zum Positionieren des Bandedelementes (10) an dem inneren Klemmring (2, 3, 6).

10. Riemenklemmvorrichtung gemäß Anspruch 8 oder

9,

dadurch gekennzeichnet, dass

Schlitze (15) in den Vorsprüngen (11) ausgebildet sind, wobei die Schlitze (15) zum Aufnehmen der Vorsprünge des Riemen (1) dienen, wenn dieser über das Ende der Riemenwalze gezogen wird.

11. Riemenklemmvorrichtung gemäß Anspruch 10,

dadurch gekennzeichnet, dass

die Vorsprünge (11) mit Positionier- und Befestigungsvorrichtungen (18) versehen sind zum Positionieren des Bandedementes (10).

12. Riemenklemmvorrichtung gemäß einem der Ansprüche 1 bis 11,

dadurch gekennzeichnet, dass

die Fasern des faserverstärkten Kunststoffmaterials des Bandedementes (10) in der Längsrichtung des Bandedementes (10) ausgerichtet sind, um eine radial nach außen wirkende Last des inneren Klemmrings (2, 3, 6) aufzunehmen.

13. Riemenklemmvorrichtung gemäß einem der Ansprüche 1 bis 12,

dadurch gekennzeichnet, dass

das faserverstärkte Kunststoffmaterial ein formgeossenes faserverstärktes Material ist.

Revendications

1. Dispositif de serrage de courroie pour serrer une courroie (1) autour de la circonférence d'un rouleau à courroie, le dispositif de serrage de courroie comprenant

une bague de serrage interne et une bague de serrage externe (2, 3, 6; 10, 13, 14) à installer au niveau d'une extrémité du rouleau à courroie pour serrer la courroie (1) entre elles,

où la bague de serrage externe (10, 13, 14) a la forme d'un cercle fermé et comprend un élément à bande (10) en forme d'anneau, **caractérisé**

en ce que l'élément à bande (10) est fait d'une matière plastique renforcée avec des fibres,

en ce que l'élément à bande (10) a la forme d'un cercle découpé ayant au moins une zone découpée (12), et

en ce que l'élément à bande (10) est équipé d'un dispositif de jonction (13, 14) au niveau de chacune des zones découpées (12) pour relier les extrémités de l'élément à bande venant en bordure de la zone découpée (12) afin de former la bague de serrage externe (10, 13, 14).

2. Dispositif de serrage de courroie selon la revendication 1, caractérisé en ce que la bague de serrage interne (2, 3, 6) comprend deux éléments de bagues concentriques (2, 3) qui peuvent être resserrés l'un

vers l'autre de manière axiale, et un élément intermédiaire (6) fait d'une matière flexible, qui est placé entre les éléments de bagues (2, 3) et qui est pressé, lorsque les éléments de bagues (2, 3) sont resserrés l'un vers l'autre, radialement vers l'extérieur vers la circonférence interne de la bague de serrage externe (10, 13, 14).

3. Dispositif de serrage de courroie selon la revendication 1 ou 2, caractérisé en ce que l'élément à bande (10) est un élément à bande monobloc ayant une seule zone découpée (12).

4. Dispositif de serrage de courroie selon la revendication 3, caractérisé en ce que l'élément à bande est équipé d'un dispositif d'articulation.

5. Dispositif de serrage de courroie selon la revendication 1 ou 2, caractérisé en ce que l'élément à bande est un élément à bande à deux pièces ayant deux zones découpées.

6. Dispositif de serrage de courroie selon l'une des revendications 3 à 5, caractérisé en ce que le dispositif de jonction (13, 14) est un dispositif à vis.

7. Dispositif de serrage de courroie selon l'une des revendications 3 à 5, caractérisé en ce que le dispositif de jonction est un dispositif de verrouillage.

8. Dispositif de serrage de courroie selon l'une des revendications 1 à 7, caractérisé en ce que l'élément à bande (10) est équipé de projections (11), qui sont situées à une distance l'une de l'autre dans la direction circonférentielle de la bague de serrage externe (10, 13, 14) et qui sont essentiellement dirigées vers le centre de symétrie de l'élément à bande (10).

9. Dispositif de serrage de courroie selon la revendication 8, caractérisé en ce que les projections (11) font office de mâchoires de positionnement pour positionner l'élément à bande (10) sur la bague de serrage interne (2, 3, 6).

10. Dispositif de serrage de courroie selon la revendication 8 ou 9, caractérisé en ce que des fentes (15) sont formées dans les projections (11), les fentes (15) servent à recevoir les projections de la courroie (1) lorsque celle-ci est tirée sur l'extrémité du rouleau à courroie.

11. Dispositif de serrage de courroie selon la revendication 10, caractérisé en ce que les projections (11) sont dotées de dispositifs (18) de positionnement et de fixation pour positionner l'élément à bande (10).

12. Dispositif de serrage de courroie selon l'une des revendications 1 à 11, caractérisé en ce que les fibres

de la matière plastique renforcée avec des fibres de l'élément à bande (10) sont orientées dans la direction longitudinale de l'élément à bande (10), afin de recevoir une charge externe radiale de la bague de serrage interne (2, 3, 6).

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13. Dispositif de serrage de courroie selon l'une des revendications 1 à 12, **caractérisé en ce que** la matière plastique renforcée avec des fibres est une matière renforcée avec des fibres par coulée en moule.

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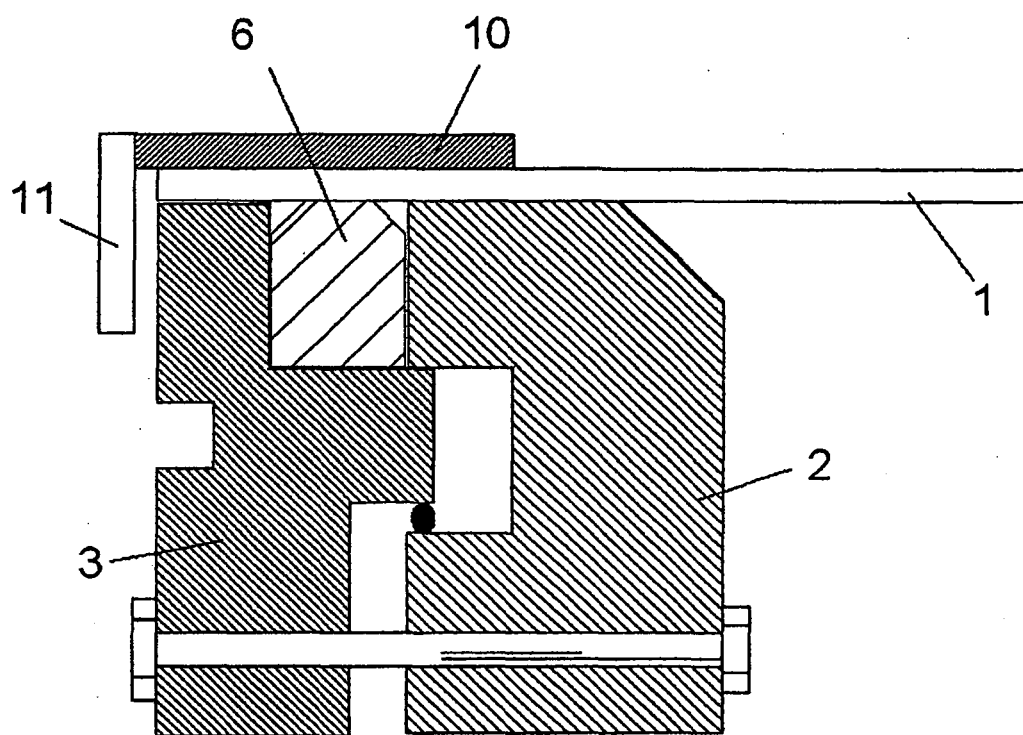


FIG.1

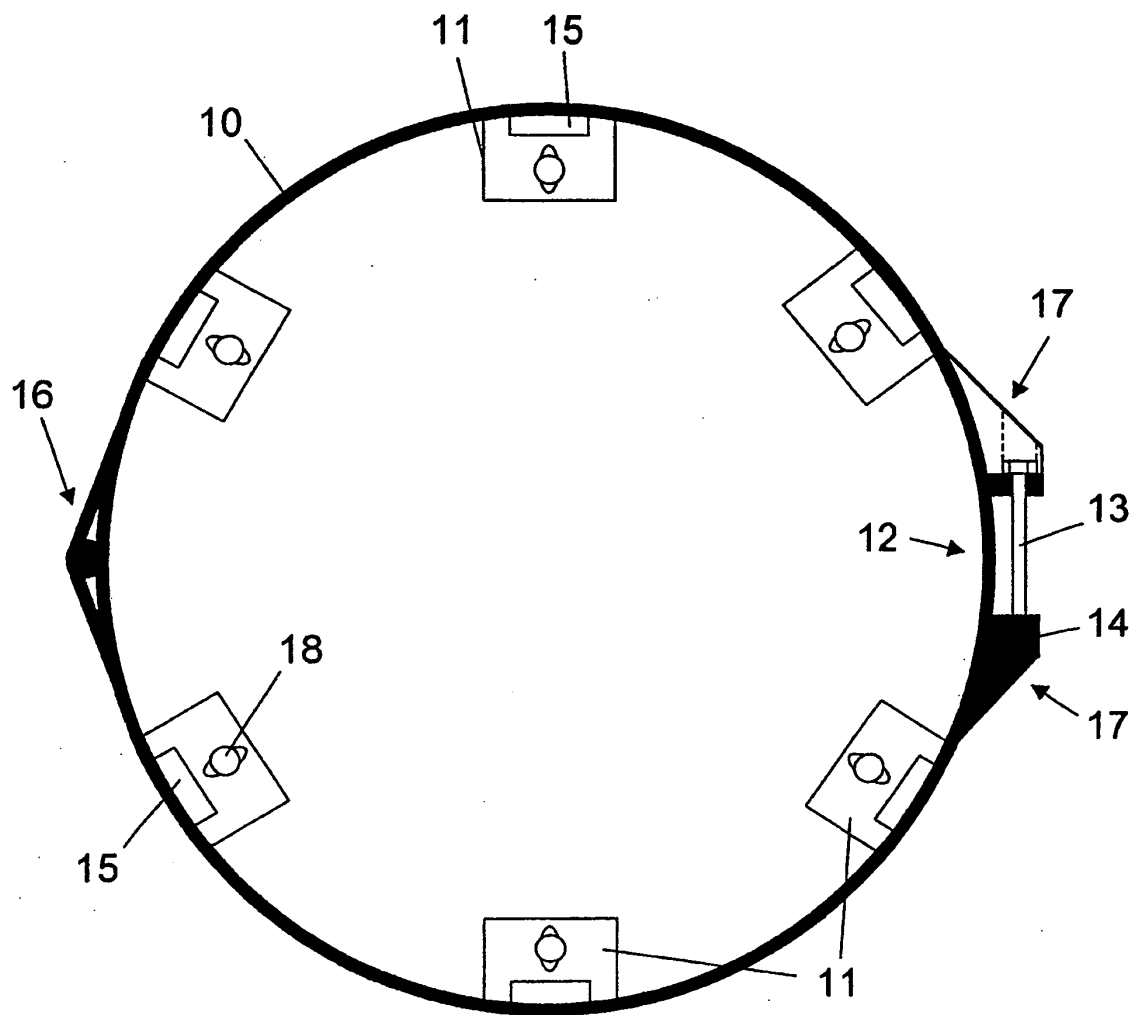


FIG.2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5700357 A [0005]
- DE 29701002 U1 [0006]
- DE 10319668 A1 [0007]