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(54) **Belt clamping device**

(57) A belt clamping device which comprises, in order to clamp a belt (1) around the circumference of a roll shell, the first clamping piece (2, 3, 6) and the second clamping piece (10) to be installed at the ends of a belt roll. The invention is characterized in that the first clamping piece (2, 3, 6) forms the inner clamp ring and the second clamping piece forms the outer clamp ring (10,

11), and that the outer clamp ring is a one-piece or two-piece ring-like band element having the shape of a cut or closed circle, where the band element having the shape of a cut circle is equipped with jointing devices (13, 14) in order to form the outer clamp ring having the shape of a closed circle around the inner clamp ring and hence in order to clamp the belt between the clamp rings.

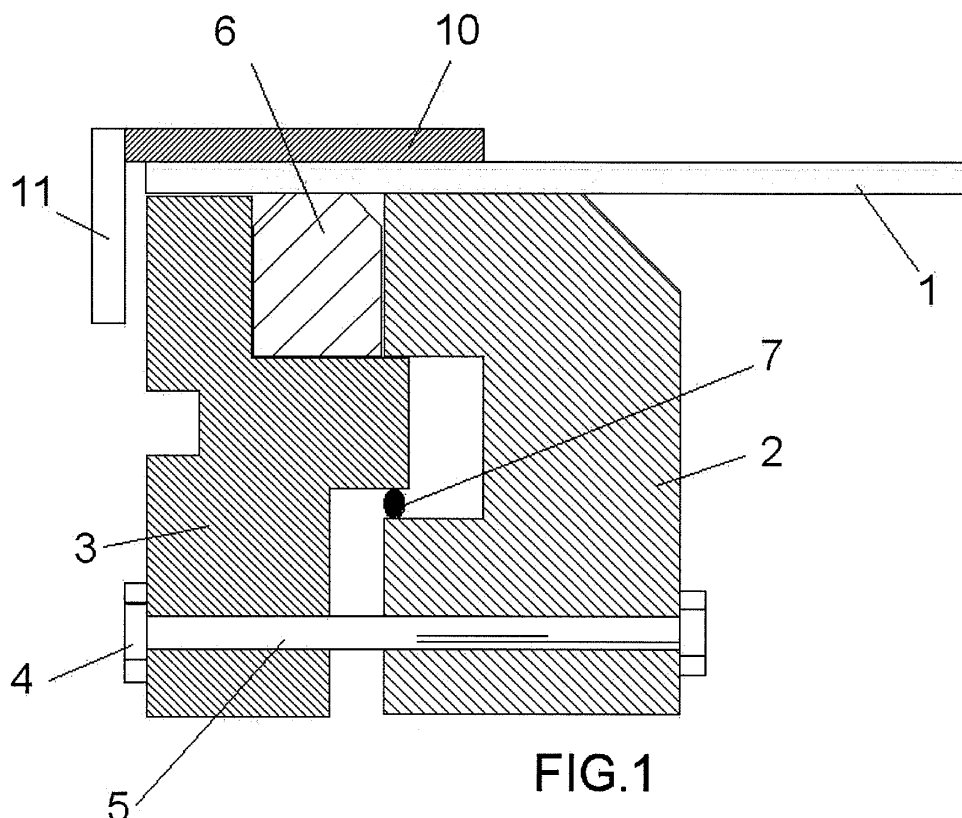


FIG.1

Description

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

[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 method. Another goal of the present invention is to accomplish a new and inventive 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] This goal can be accomplished generally by means of a belt clamping device in accordance with the present invention, where the belt clamping device comprises, in order to clamp a belt around the circumference of a roll shell, the first clamping piece and the second clamping piece to be installed at the ends of the belt roll, for example so that the first clamping piece forms the inner clamp ring and the second clamping piece forms the outer clamp ring, and that the outer clamp ring is a one-piece or two-piece ring-like band element having the shape of a cut or closed circle, where the band element having the shape of a cut circle is equipped with jointing devices in order to form the outer clamp ring having the

shape of a closed circle around the inner clamp ring and hence in order to clamp the belt between the clamp rings.

[0006] In accordance with the invention, the belt to be clamped can be fitted between the inner clamp ring and the outer clamp ring, and it can hence be locked between the inner circumference of the outer clamp ring and the intermediate element. According to the invention, the clamping pieces of the clamping device comprise, in the axial direction of the belt roll, inner ends which are directed towards each other and radially outside these outer ends so that the clamping device comprises an inner clamp ring and outer clamp ring which are fitted concentrically over each other, where the inner clamp ring comprises two concentric ring elements, which are tightened against each other axially, and an intermediate element, which is located between the ring elements and which is of a flexible material and which is pressed, when the ring elements are tightened towards or against each other, radially outwards towards the inner circumference of the outer clamp ring.

[0007] According to the invention, it is recommended that the band element having the shape of a cut circle has as many jointing devices as there are cut-off points in order to join together the band element ends which border the cut-off area. In a preferred embodiment example, the band element comprises 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 in order to form a band element having the shape of a closed circle around the inner clamp ring. In another embodiment example, the band element is of a single piece and has the shape of a cut circle, and the band element can be fitted as a single piece around the inner clamp ring and the band element can be formed into a band element having the shape of a closed circle around the inner clamp ring by joining the ends bordering the cut-off area by means of at least one jointing device. In a third embodiment example, the band element is of a single piece and is equipped with an articulation device, and the band element can be fitted as a single piece around the inner clamp ring and the band element can be formed into a band element having the shape of a closed circle around the inner clamp ring by joining the ends bordering the cut-off area by means of at least one jointing device.

[0008] According to a fourth embodiment example of the present invention, a tight fit and a single-piece, closed circle can be used. However, the usability of such an uncut circle is not equal to that of a band element where a cut circle is used. According to a fifth embodiment example of the present invention, it is possible to use a solution where the belt is only locked by tightening the outer clamp ring, i.e. the band tightening devices.

[0009] According to one example of the present invention, there are projections at a distance from each other in the band element on the side of the outer end of the clamping piece, with the projections being directed towards the center of symmetry of the band element at an

angle which corresponds, on the side of the outer end of the clamping piece, essentially to the angle between the end face and the outer circumferential face of the inner clamp ring. These projections serve as the positioning projections of the band element, in other words as its positioning claws. The angle between the positioning claws and the circumferential face of the band element is preferably a right angle. Furthermore, it is preferable according to the invention that the positioning claw is, at the outer end of the clamping device, located at a distance from the end of the inner clamp ring and extends at least partly over the end of the inner clamp ring or always over the lower end of the inner clamp ring. Moreover, the slots formed in the positioning claws also enable the positioning of a new installed belt with respect to the end. The positioned belt can be locked by the holes in its projections by means of a locking device arranged in conjunction with the clamping device located in conjunction with the positioning claws. The locking device, which extends at least partly over the slot, can be slightly conical so that the fitting of the locking device into the belt holes would be easy. Such locking devices can be at least in some of the positioning claws, and they can be removed easily after the installation of the belt so that the projections constitute no disturbance during operation.

[0010] The claw elements, the quantity of which should preferably be the same as the quantity of the positioning projections of the belt, can be fastened on the band structure during winding. Another application is to wind the entire structure as a single piece using a uniform 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. It is preferable to also arrange the positioning and fastening of the ring element close to the slots in the positioning claws, preferably using positioning and fastening devices of the ring element. In locations where the positioning claws are susceptible to wear, such as in conjunction with the fastening holes of the slots, reinforcements or a stronger material can be used in the structure against mechanical wear. In order to ensure the balance of the rotating roll, the band element equipped with tightening devices is preferably equipped with counter weights. Moreover, it is preferable that all protrusions beyond the outer circumference of the band element are rounded off and/or covered in order to prevent all types of entanglement and harmful flows.

[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, that the outer clamp ring included in the clamping device can be made of a single piece, in which case it can extend uniformly around the outer circumference of the inner counter face, and that the outer clamp ring can be equipped with positioning devices in order to ensure easier installation. The outer clamp ring of the clamping device can preferably also be 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 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. 10 to 20 kilograms at belt roll diameters corresponding to the construction of a single uniform piece of the most preferred application and at the 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 can be used for receiving the radial outward load of the inner clamping element. 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 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 patent drawings, where:

FIG. 1 is a schematic cross-section of the clamp rings of the band-like 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.

FIG.3 is a schematic view of another outer clamping ring of the clamping device according to the invention, seen from the outer end of the belt roll.

[0014] With reference to FIG.1, FIG.2 and FIG.3, in order to clamp the belt 1 onto the circumference of the roll shell of a belt roll, the clamping device comprises the first and the second clamping piece 2, 3, 6, 10 to be fitted at the ends of the belt roll. The clamping pieces have inner ends directed towards each other, and outer ends which are located radially outside the inner ends. Each clamping piece has concentric and superimposed inner clamp ring 2, 3, 6 and outer clamp ring 10. The inner clamp ring is composed of concentric ring elements 2, 3, which are tightened towards and/or against 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] When the clamping device 2, 3, 6, 10 is made of a reinforced fiber material, the weight of the clamping device is only approx. 10 to 20 kilograms at a uniform single-piece construction and at 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 present solutions, because the orientation of the fibers in the longitudinal direction of the band can be used for receiving the radial outward load of the inner clamping element. 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.

[0016] In the embodiment example shown in the figures, the outer clamp ring 10 of the clamping device 2, 3, 6, 10 has the shape of a cut circle and is a single-piece ring-like band element, which is equipped with jointing devices 13, 14 in order to form an outer clamp ring having the shape of a closed circle around the inner clamp ring 2, 3, 6 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 a band element 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.

[0017] The jointing device can be 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, 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.

[0018] The band element 10 can also have several pieces, and preferably it has two pieces.

[0019] The two-piece band element 10 can comprise two segments, which can be fitted in parts around the inner clamp ring 2, 3, 6 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 etc. The segments joined together by the jointing devices form a band element 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 a band element having the shape of a closed circle around the inner clamp ring 2, 3, 6.

[0020] In the embodiment shown in the figures, the ring-like band element 10 on the side of the outer end of the clamping piece 2, 3, 6, 10 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 piece, this angle corresponds essentially to the angle between the axial end face of the inner clamp ring 2, 3, 6 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 2, 3, 6.

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

[0022] The claw elements, the quantity of which should preferably be the same as the quantity of the projections 11 for the positioning of the belt 1, 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] It is preferable to also arrange the positioning and fastening of the ring element close to the slots 15 in the projections 11 or positioning claws using the positioning and fastening devices 18 of the ring element. In locations where the projections or positioning claws are susceptible to wear, such as in conjunction with the fastening holes of 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, 11 equipped with tightening devices 13, 14 is preferably equipped with counter weights 16. Moreover, it is preferable that all protrusions, such as tightening devices and/or counter weights, beyond the outer circumference of the band element are rounded off and/or covered 17 in order to prevent all types of entanglement and harmful flows.

[0025] With reference to FIG.3, the band element 10, 11 is a uniform composite structure, where the positioned belt can be locked by the holes in its projections by means of a locking device 19 arranged in conjunction with the clamping device 18 located in conjunction with the positioning claws 11 before the actual locking by means of the band element 10, 11. The locking device 19, which extends at least partly over the slot 15, can be slightly conical so that the fitting of the locking device 19 into the belt holes would be easy. Such locking devices 19 can be at least in some of the positioning claws 11, and they can be removed easily after the installation of the belt so that the said projections constitute no disturbance during operation.

[0026] 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 straight angle and the projection extends, at the outer end of the clamping piece 2, 3, 6, 10, at a distance from the end of the inner clamp ring 2, 3, 6 at least partly over the end of the inner clamp ring.

[0027] The invention is described above only using examples of a preferred embodiment. However, the invention is in no way confined to only concern such an individual embodiment example, but many alternative solutions and modifications as well as functionally equivalent alternatives are possible within the scope of protection of the inventive idea specified by the accompanying claims.

[0028] Therefore, for example 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 a band element 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 etc.

[0029] A single-piece band element having the shape of a closed circle can also be used to implement the

present invention. However, the usability of such an uncut circle is not necessarily equal to that of a band element where a cut circle is used. When using a single-piece, in other words uncut, band element, it is essential that the fit between the band element and the inner clamp ring is a tight fit, because there is no possibility to tighten the band element.

[0030] 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 tightening devices of the band element, over the inner clamp ring, in other words between the outer clamp ring and the inner clamp ring.

Claims

1. A belt clamping device which comprises, in order to clamp a belt (1) around the circumference of a roll shell, the first clamping piece (2, 3, 6) and the second clamping piece (10) to be installed at the ends of the belt roll, **characterized in that** the first clamping piece (2, 3, 6) forms the inner clamp ring and the second clamping piece forms the outer clamp ring (10, 11), and that the outer clamp ring is a one-piece or two-piece ring-like band element having the shape of a cut or closed circle, where the band element having the shape of a cut circle is equipped with jointing devices (13, 14) in order to form the outer clamp ring having the shape of a closed circle around the inner clamp ring and hence in order to clamp the belt between the clamp rings.
2. A belt clamping device according to claim 1, **characterized in that** the belt (1) to be clamped is fitted between the inner clamp ring (2, 3, 6) and the outer clamp ring (10) so that the belt (1) can be locked between the inner circumference of the outer clamp ring and the intermediate element (6).
3. A belt clamping device according to claim 1 and/or 2, **characterized in that** the clamping pieces (2, 3, 6, 10) of the clamping device comprise, in the axial direction of the belt roll, inner ends which are directed towards each other and radially outside these outer ends so that the clamping device comprises an inner clamp ring (2, 3, 6) and outer clamp ring (10) which are fitted concentrically over each other, where the inner clamp ring comprises two concentric ring elements (2, 3), which are tightened against each other axially, and an intermediate element (6), which is located between the ring elements and which is of a flexible material and which is pressed, when the ring elements are tightened towards or against each other, radially outwards towards the inner circumference of the outer clamp ring (10).
4. A belt clamping device according to any of the above

claims, **characterized in that** the band element (10) having the shape of a cut circle has as many jointing devices (13, 14) as there are cut-off points (12) in order to join together the band element ends which border the cut-off area.

5. A belt clamping device according to claim 4, **characterized in that** the band element (10) comprises two segments, which can be fitted in parts around the inner clamp ring (2, 3, 6) and which can be joined together in the circumferential direction of the band element by means of jointing devices (13, 14), such as screw and/or latch devices, in order to form a band element having the shape of a closed circle around the inner clamp ring.
6. A belt clamping device according to claim 4, **characterized in that** the outer clamp ring (10) is of a single piece and has the shape of a cut circle, that the band element can be fitted as a single piece around the inner clamp ring (2, 3, 6), and that the band element can be formed into a band having the shape of a closed circle around the inner clamp ring by joining together the ends bordering the cut-off area (12) by means of at least one jointing device (13, 14), such as a screw and/or latch device etc.
7. A belt clamping device according to claim 4, **characterized in that** the outer clamp ring (10) is of a single piece and equipped with an articulation device, that the band element can be fitted as a single piece around the inner clamp ring (2, 3, 6), and that the outer clamp ring can be formed into a band having the shape of a closed circle around the inner clamp ring by joining together the ends bordering the cut-off area (12) by means of at least one jointing device, such as a screw and/or latch device etc.
8. A belt clamping device according to claim 4, **characterized in that** the outer clamp ring (10) is of a single piece and has the shape of a closed circle, and that the outer clamp ring can be fitted as a single piece around the inner clamp ring (2, 3, 6).
9. A belt clamping device according to claim 8, **characterized in that** the outer clamp ring (10) is of a single piece, in other words uncut, and that the fit between the outer clamp ring and the inner clamp ring (2, 3, 6) is a tight fit.
10. A belt clamping device according to claim 4, **characterized in that** the belt is locked around the inner clamp ring (2, 3, 6) by tightening the outer clamp ring (10), i.e. the band tightening devices.
11. A belt clamping device according to any of the above claims, **characterized in that** on the side of the outer end of the clamping piece (2, 3, 6, 10), the ring-like

band element (10) or the outer clamp ring is equipped with projections (11), which are located at a distance from each other and which are essentially directed towards the center of symmetry of the ring-like band element or the outer clamp ring at an angle which corresponds, on the side of the outer end of the clamping piece, essentially to the angle between the end face and the outer circumferential face of the inner clamp ring (2, 3, 6).

12. A belt clamping device according to claim 11, **characterized in that** the projections (11) serve as positioning claws in the outer clamp ring (10), and that the angle between the positioning claws and the circumferential face of the outer clamp ring is preferably a straight angle.
13. A belt clamping device according to claim 11 and/or 12, **characterized in that** the projection (11) located at the edge of the outer clamp ring (10), preferably a positioning claw, is located on the side of the outer end of the clamping piece (2, 3, 6, 10) at a distance from the end of the inner clamp ring (2, 3, 6) and extends at least partly over the end of the inner clamp ring.
14. A belt clamping device according to any of the above claims, **characterized in that** there are slots (15) in the projections (11) in the outer clamp ring (10) for receiving the belt (1) drawn over the end of the roll when locating and/or positioning the belt.
15. A belt clamping device according to claim 14, **characterized in that** the projection (11) in the outer clamp ring (10) has positioning and fastening devices (18) for positioning the band element.
16. A belt clamping device according to claim 15, **characterized in that** the quantity of the positioning claws for the positioning of the belt (1) is equal to the quantity of the projections (11), and that each claw element is attached or fastened to the outer clamp ring (10) for the duration of winding.
17. A belt clamping device according to any of the above claims, **characterized in that** the clamping device (2, 3, 6, 10) is made of a fiber-reinforced plastic material.
18. A belt clamping device according to claim 17, **characterized in that** the fibers in the outer clamp ring (10) are oriented longitudinally in order to receive the radial outward load of the inner clamping element.
19. A belt clamping device according to claim 17, **characterized in that** the fibers/fiber bundles/woven fiber ribbon are wound in the direction of the outer

clamp ring (10) or at a small angle to it.

20. A belt clamping device according to any of the above claims 17, 18 or 19, **characterized in that** the reinforced plastic material is composed of the mold casting of a fiber-reinforced plastic material. 5

21. A belt clamping device according to any of the above claims, **characterized in that** in locations where the projections (11) or positioning claws are susceptible to wear, such as in conjunction with the fastening holes of the slots (15), reinforcements or a stronger material can be used in the structure against mechanical wear. 10

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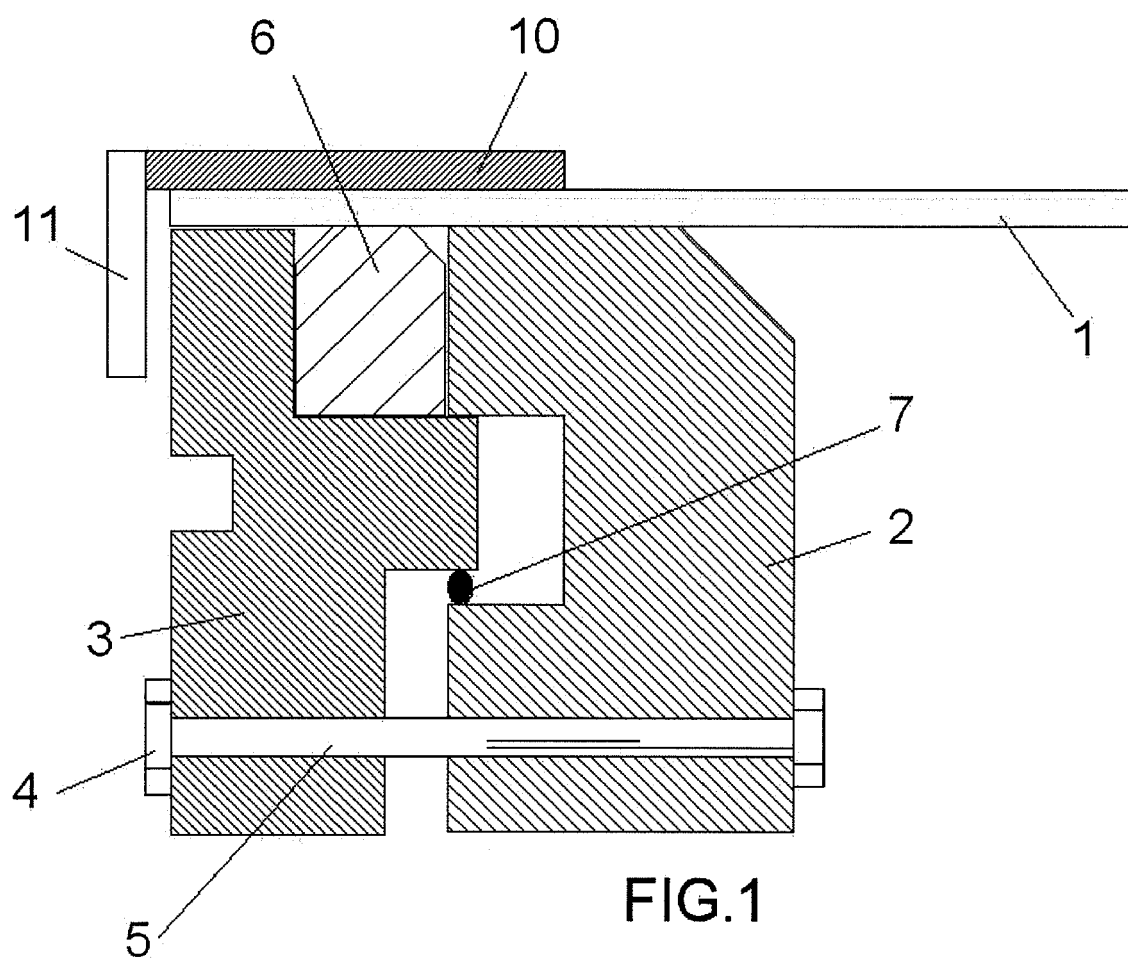
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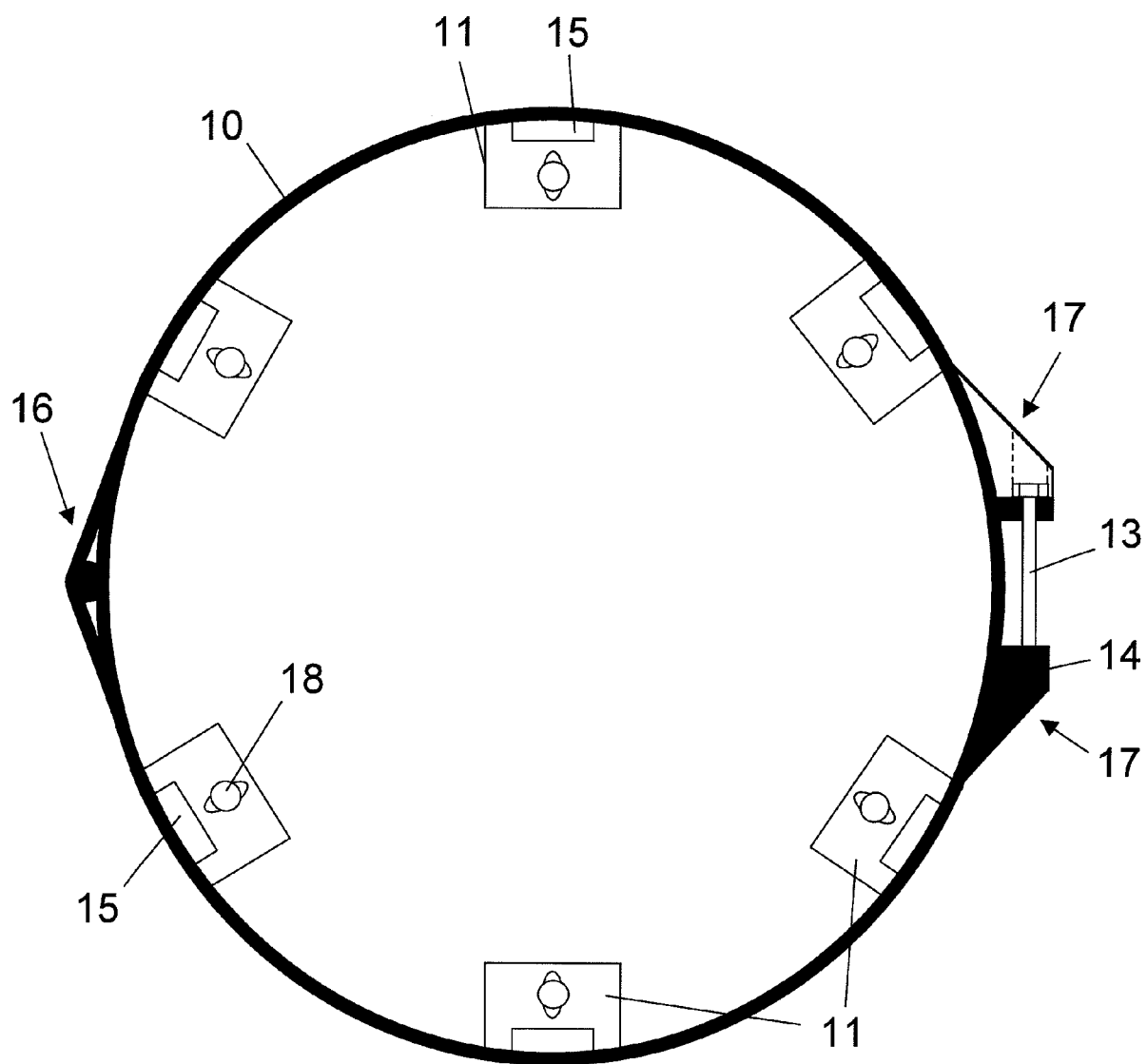


FIG.2

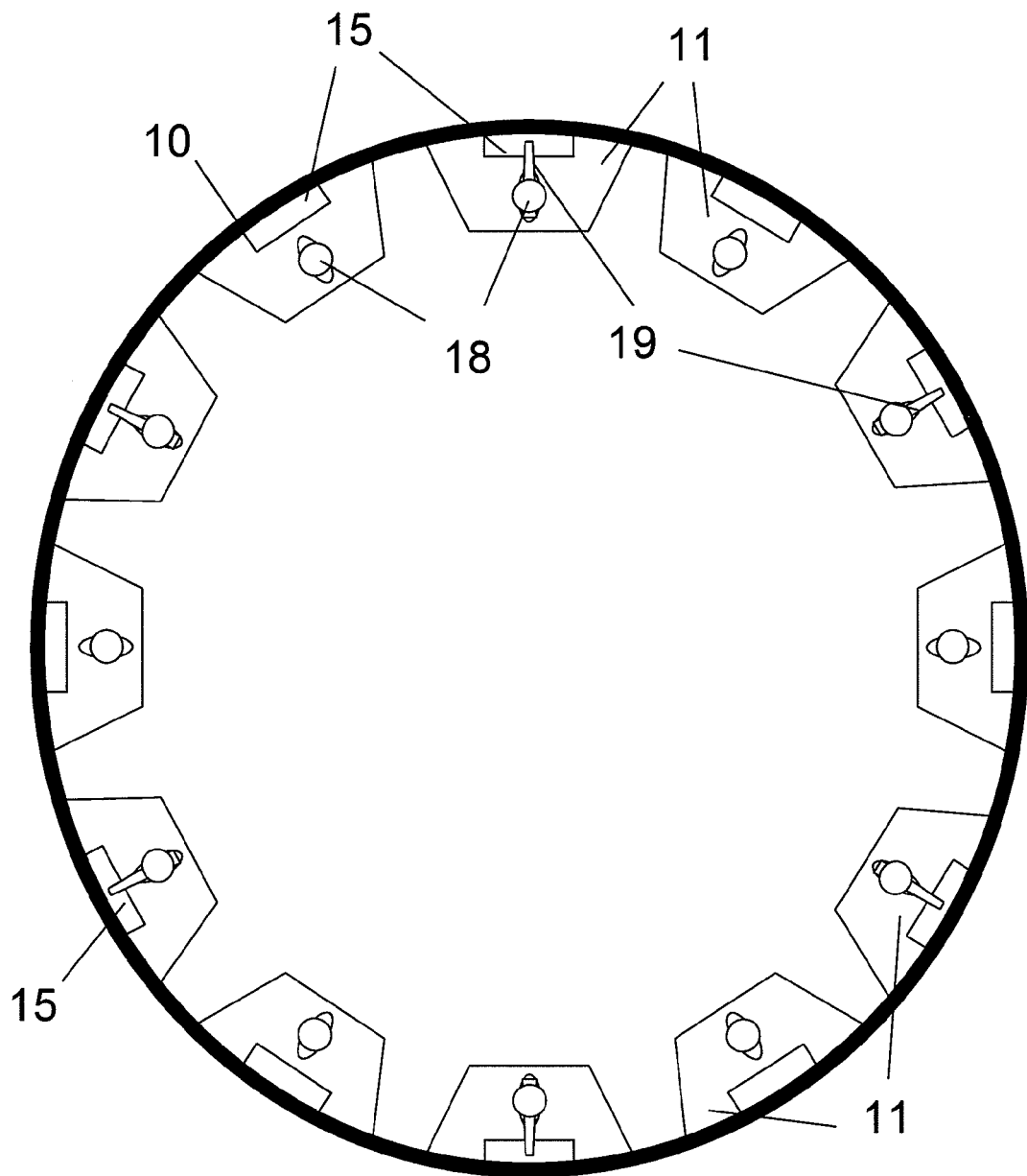


FIG.3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 12 1272

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Place of search Munich		Date of completion of the search 27 March 2008	Examiner Maisonnier, Claire
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 12 1272

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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