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(54) Method for adjusting the diameter of the winding body of a pre-unwinding device as well as such a pre-unwinding device

(57) The invention relates to a method and device for adjusting the diameter of the winding body (5) of a pre-unwinding device for feeding yarn to a weaving device, which device also comprises: a central, rotatable shaft (2) disposed in a housing; a winding body (5) surrounding said central shaft and having a yarn entry side and a yarn exit side, whose diameter is adjustable in a plane perpendicular to the central shaft (2), means for adjusting the diameter of the winding body, as well as a winding arm (1) connected to said central shaft for winding a yarn drawn off a supply spool onto the winding body in side-by-side, separated or unseparated windings during operation through rotation of the central shaft.

In accordance with the invention, the diameter of the winding body is adjusted through rotation of the central shaft.

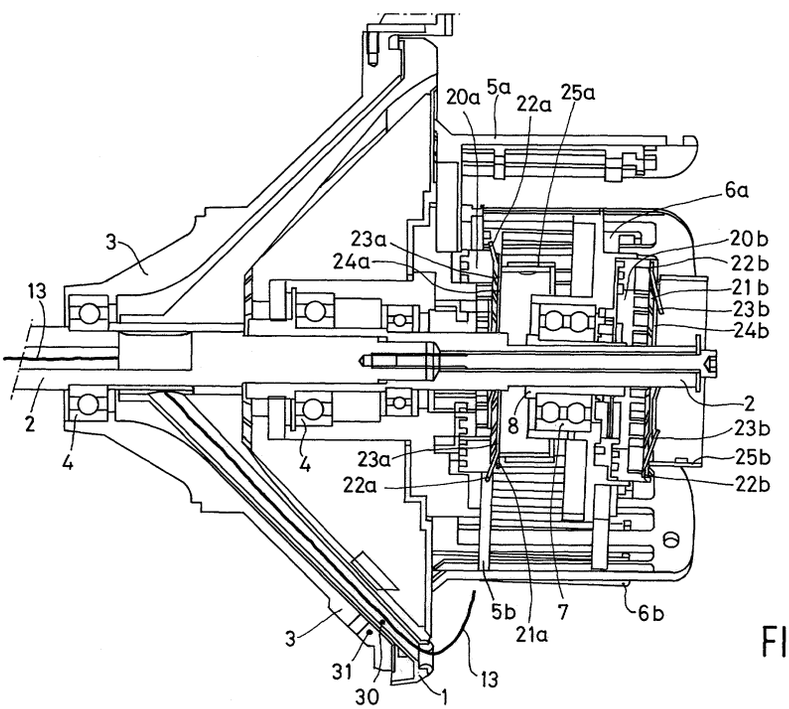

FIG. 2

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Description

[0001] The invention relates to a method for adjusting the diameter of the winding body of a pre-unwinding device for feeding yarn to a weaving device, which pre-unwinding device also comprises: a central, rotatable shaft disposed in a housing; a winding body surrounding said central shaft and having a yarn entry side and a yarn exit side, whose diameter is adjustable in a plane perpendicular to the central shaft, means for adjusting the diameter of the winding body, as well as a winding arm connected to said central shaft for winding a yarn drawn off a supply spool onto the winding body in side-by-side, separated or unseparated windings during operation through rotation of the central shaft.

[0002] The invention also relates to a pre-unwinding device for feeding yarn to a weaving device, which pre-unwinding device comprises: a central, rotatable shaft disposed in a housing, a winding body surrounding said central shaft and having a yarn entry side and a yarn exit side, whose diameter is adjustable in a plane perpendicular to the central shaft, means for adjusting the diameter of the winding body, as well as a winding arm connected to said central shaft for winding a yarn drawn off a supply spool onto the winding body in side-by-side, separated or unseparated windings during operation through rotation of the central shaft.

[0003] Such a pre-unwinding device is known, for example from Dutch patent application no. 94/00726 in the name of the present applicant, and it is generally used in industrial weaving devices. Pre-unwinding devices take up a supply of yarn, which supply of yarn is wound onto a fixed winding body in the form of one or more windings. The wound-up windings are moved from the entry side to the exit side of the winding body by so-called transport segments. The yarn supply is carried into the weaving device at high velocity by a yarn injector, using compressed air or a water jet, by unwinding the supply of windings at the exit side of the winding body.

[0004] The length L of the supply of windings of the winding body equals the length of the yarn required for each weaving stroke in the weaving device, and consequently the length L of this so-called weft yarn equals the width H of the product to be woven. In general:

$$L = H = n \times \pi \times D \qquad [m]$$

wherein:

n = the number of windings to be drawn off [-]
D = the diameter of the winding body [m]

[0005] The drawing off of the wound-up weft yarn is controlled by control means of the pre-unwinding device in that not only the number of wound-up windings "n" is counted, but also in that the weft yarn is decelerated or stopped in time by means of a braking unit during said drawing off of the supply of windings the moment the nth winding has been drawn off. In the meantime, a new supply of windings are been wound onto the winding body at the entry side and the next weaving stroke can be carried out.

[0006] If a yarn fabric having a different dimension H' is to be produced, it will be necessary to re-set the pre-unwinding device. The new length L' of the weft yarn can be wound onto the winding body, using the same number of windings n but with different diameter D', so that:

$$L' = H' = n \times \pi \times D' \qquad [m]$$

[0007] This makes it necessary to adapt the diameter D, to which end the winding segments and the transport segments forming the winding body are movable in radial direction with respect to the central shaft within the housing. It will be understood that the transport segments will have to be adjusted, too, upon adjustment of the winding segments, in order to make it possible to move the wound-up windings from the entry side to the exit side of the winding body with the newly adjusted diameter.

[0008] An example of a pre-unwinding device in which the diameter of the winding body can be adjusted by adjusting the winding segments and the transport segments is disclosed in the European patent publication no. 0 469 527. To this end, the winding segments and the transport segments are arranged on a toothed ring together with spiral grooves, which ring can be rotated by means of a driving gear and an auxiliary tool. Accordingly, the winding segments and the transport segments move to the desired diameter setting.

[0009] Another embodiment exhibiting an adjustable diameter is disclosed in the European patent publication no. 0 363 980, which likewise employs a gear transmission and auxiliary tools for adjusting the diameter of the winding body. On the other hand, EP 0 363 980 discloses a complex hinge construction for adjusting the diameter.

[0010] All the aforesaid patent publications disclose pre-unwinding devices comprising complicated means for adjusting the diameter of the winding body, which not only require additional parts and additional overall space, but also a greater number of adjusting operations.

[0011] The object of the invention is to provide a method and a pre-unwinding device in which the diameter of the winding body of the pre-unwinding device can be adjusted in a quicker, easy and more precise manner while using fewer adjusting operations, in which the construction of the pre-unwinding device is significantly simplified and in which the periods of standstill of the pre-unwinding device and of the weaving device in question are reduced to a minimum.

[0012] According to the invention, the method is characterized in that the diameter of the winding body is adjusted through rotation of the central shaft. This enables a fast, more direct and above all more precise adjustment of the diameter of the winding body.

[0013] More in particular, according to the invention the diameter adjusting means are brought into engagement with the central shaft in a first operating state, and in a special embodiment said engagement with the central shaft is effected by spring force. This enables a direct, fast and precise adjustment of the diameter without additional adjusting means being required, as is the case with the prior art.

[0014] In another embodiment, the first operating state is according to the invention effected by moving the diameter adjusting means and the central shaft relative to each other, and in a very specific embodiment the method according to the invention is characterized in that the diameter adjustment is carried out by the control means of the pre-unwinding device.

[0015] The pre-unwinding device according to the invention is characterized in that means are present for adjusting the diameter of the winding body through rotation of the central shaft. In a specific embodiment, said means are at least partially arranged around the central shaft or at least partially on the central shaft. This provides a compact construction which requires a minimum amount of overall space, whilst furthermore the adjustment can be effected directly and precisely through rotation of the central shaft.

[0016] More specifically, the diameter adjusting means and the central shaft are movable relative to each other.

[0017] In a specific embodiment, the pre-unwinding device according to the invention is characterized in that the winding body is built up of a number of winding segments arranged around the central shaft and a number of transport segments arranged between said winding segments, being movable with respect thereto, for moving the yarn windings from the entry side to the exit side in the direction in which the shaft extends, in which said means comprise at least one first ring having an inner edge and an outer edge, in which, in a first operating state, said inner edge mates with the central shaft and said outer edge mates with a rotatable disc surrounding the central shaft, which is provided with a number of spiral grooves, in which each groove engages with one of the winding segments and/or transport segments.

[0018] Said means may comprise at least one second ring having an inner edge and an outer edge, in which the second ring is fixedly connected to the central shaft in the direction of rotation, the outer edge mating with the inner edge of the first ring in the first operating state, which mating engagement between the inner edge of the first ring with the central shaft or with the outer edge of the second ring can be released in a second operating state.

[0019] During normal operation, i.e. the winding of the yarn onto the winding segments of the winding body in one or more windings, which windings are subsequently transported one by one to the exit side of the winding body (referred to as the second operating state) by the transport segments, the diameter adjusting means do not mate with the central driving shaft, so that no adjustment of the winding segments and/or the transport segments takes place.

[0020] In order to enable easy re-setting of the pre-unwinding device according to the invention to an operating state in which the diameter of the winding body can be varied, the device according to the invention is in particular characterized in that the first ring is provided with at least one projecting cam at its inner edge, which cam is in engagement with a corresponding recess formed in the outer edge of the second ring in the first operating state and which is out of engagement with the recess in question in the second operating state.

[0021] More in particular, the mating engagement with the central shaft for the purpose of adjusting the diameter of the winding body is effected in that the outer edge of the first ring is provided with at least one projecting cam, which is in engagement with a groove formed in the rotatable disc surrounding the central shaft in the first operating state.

[0022] In a specific embodiment, at least the projecting cams present on the inner edge of the first ring are made of a springing material.

[0023] Similarly, at least the projecting cams present on the outer edge of the first ring may likewise be made of a springing material. More in particular, the first ring is made of a springing material in its entirety.

[0024] In a specific embodiment, the pre-unwinding device according to the invention is characterized in that the device comprises a first assembly and a second assembly, each assembly consisting of a first ring, a second ring and a rotatable disc, the first assembly functioning to adjust the diameter of the winding segments and a second assembly functioning to adjust the diameter of the transport segments. This makes it possible to adjust the winding segments as well as the transport segments of the winding body via a separate connection to the central shaft.

[0025] The diameters both of the winding segments and of the transport segments can be jointly adjusted in that case.

[0026] More in particular, the adjusting means can be moved from the second operating state to the first operating state, and vice versa, by means of clamping elements present in the housing. This makes it possible to re-set the pre-unwinding device from the second (normal) operating state in the first (adjusting) operating state while using a minimum number of adjusting operations.

[0027] A very effective embodiment of the pre-unwinding device according to the invention is characterized in that the control means of the pre-unwinding device drive the adjusting means.

[0028] More in particular, feedback information with regard to the exact diameter setting of the winding body can be supplied to the control means and/or the user in a very quick and efficient manner in that, in accordance with the invention, the device comprises suitable means for providing a signal corresponding to the adjusted diameter of the winding body.

[0029] Said means may be comprised of co-acting sensors fitted on the winding arm and on a part of the housing directly adjacent to the winding arm, whilst on the other hand said means may comprise an angle encoder fitted on the central shaft for quickly obtaining a reliable signal.

[0030] In order to make it possible to obtain a direct indication as regards the setting of the pre-unwinding device according to the invention, said means comprise visual markings provided on the winding arm and on the housing for reading or adjusting the diameter setting.

[0031] The invention will now be explained in more detail with reference to a drawing, in which;

Figure 1 is a cross-sectional view of a pre-unwinding device according to the prior art;
Figure 2 is a cross-sectional view of an embodiment of a pre-unwinding device according to the invention;
Figures 3A and 3B are detail views of a part of the pre-unwinding device of Figure 2;
Figure 4 is another detail view of another part of the pre-unwinding device of Figure 2;
Figure 5 is yet another detail view of yet another part of the pre-unwinding device of Figure 2.

[0032] For the sake of clarity and a better understanding of the invention, like parts will be indicated by the same numerals hereinafter.

[0033] Figure 1 shows a device for feeding yarn to a weaving device, which device is also referred to as a pre-unwinding device. The prior art pre-unwinding device that is shown in Figure 1 comprises a winding body fitted round the central shaft 2 by means of bearings 4. The central shaft 2 can be rotated by driving means (not shown). Mounted on the central shaft 2 is a winding arm 1, through which a yarn 13 can be passed, which yarn is drawn off a supply spool (disposed at a location not included in the drawing). The drawn-off yarn 13 is wound onto the winding body 5a, 5b in a large number of windings 13a, 13b etc by the winding arm through rotation of the central shaft 2.

[0034] The winding body 5 surrounding the central shaft 2 via bearings 4 is preferably built up of winding segments 5a, 5b arranged around the central shaft 2 in circular symmetry, with so-called transport segments 6a, 6b being arranged therebetween. The transport segments 6a, 6b are supported on a bush 8 via a rotary bearing 7, which bush surrounds the central shaft 2. As Figure 1 shows, the central axis of the bush 8 exhibits a certain eccentricity with respect to the central axis of the central shaft 2; in fact, the central axis of the bush 8 crosses the central axis of the central shaft 2 at some distance therefrom and at an angle with respect thereto.

[0035] As a result, the transport segments 6a-6b make a so-called tumbling movement upon rotation of the central shaft 2, said movement having a component parallel to the central shaft and a component radial thereto. The transport segments extend outside the outer circumference of the winding body along a certain part of said outer circumference when this takes place and move the yarn windings 13a, 13b etc that are wound on the winding body at that location from the entry side 35a of the winding body 5 to the exit side 35b, where the yarn windings are carried to the shed of the weaving device (not shown) in the form of a weft yarn 13'.

[0036] The length of the supply of windings on the winding body 5 is greater than the length of the yarn 13' that is required for each weaving stroke in the weaving device. Means for introducing the weft yarn 13' into the weaving device are provided, which means release or draw off the number of windings required for every weft stroke from the winding body. If a yarn fabric having a different width dimension is to be produced, the pre-unwinding device will have to be re-set.

[0037] To this end, pre-unwinding devices have been developed whose winding body 5 has an adjustable diameter so as to make it possible to adapt the diameter of the pre-unwinding device to the width of the desired product that is to be woven. To this end, the stationary winding segments 5a, 5b and the transport segments 6a, 6b, which are movably disposed with respect to the central shaft 2, are adjustable (in radial direction) in a plane perpendicular to the central shaft 2. Thus the imaginary diameter of said winding segments and said transport segments can be increased or decreased without increasing the number of windings.

[0038] Figure 2 shows an embodiment of a pre-unwinding device, which is according to the invention provided with means for adjusting the diameter of the winding body 5a, 5b, 6a, 6b in a quick, accurate and effective manner.

[0039] In this embodiment, the adjusting means are made up of two discs 20a, 20b surrounding the central shaft 2, which are rotatable with respect to the central shaft 2. Each disk 20a, 20b is provided with a number of spiral grooves 31 (also refer to Figure 4), which spiral grooves 31 of the disk 20a each engage one of the winding segments 5a, 5b etc. Similarly, the spiral grooves 31 of the other disc 20b each engage one of the transport segments 6a, 6b etc.

[0040] During normal operation, i.e. during the winding of the yarn 13 onto the winding segments 5a, 5b etc in a number of windings 13a, 13b, 13c etc by the winding arm 1, the winding segments 5a, 5b and the transport segments 6a, 6b have a fixed diameter setting, which is locked with respect to the central shaft. During rotation of the central shaft 2, the two spiral discs 20a and 20b are stationary with respect to the housing 3 and the

winding body, respectively.

[0041] When the diameter of the winding body 5a, 5b, 6a, 6b is to be re-set, the pre-unwinding device must be stopped, after which the diameter adjusting means are set from one operating state to the other operating state for adjusting or varying the diameter of the winding body 5.

[0042] In accordance with the invention, the diameter adjusting means co-operate with the central shaft 2 of the pre-unwinding device during said adjustment. In order to effect said diameter adjustment, each spiral disk 20a, 20b mates with a respective first ring 21a, 21b, as is shown in Figure 3. Each first ring 21a, 21b surrounds the central shaft 2 and has an outer edge 30a and an inner edge 30b. Preferably, the entire ring 21a, 21b is made of a springing material, with a number of recesses 31 being present on the inner side 30b, and it has a pre-bent shape, as is shown in Figure 3b. Each first ring 21a, 21b is provided with two projecting cams 22a, 22b at its outer edge 30a, whilst it is furthermore provided with a number of inwardly projecting cams 23a, 23b, at its inner edge 30b.

[0043] As is shown in Figure 3b, the cams 22a, 22b and 23a, 23b project from the plane formed by the ring 21a, 21b due to the pre-bent shape of the first ring 21a, 21b.

[0044] As will be explained hereinafter, the outer cams 22a, 22b can mate with the spiral discs 20a, 20b for adjusting the diameter of the winding body 5a, 5b, 6a, 6b, and that in such a manner that the projecting cams 22a, 22b can engage in corresponding recesses 32 formed in the outer edge 33 of the spiral disc 20a, 20b.

[0045] According to the invention, the diameter adjusting means furthermore comprises a second ring, which is indicated by numerals 24a, 24b in Figure 2. Said second ring 24a, 24b is shown in more detail in Figure 5. The second ring 24a, 24b has an opening 32, via which each second ring 24a, 24b can be fixedly connected to the central shaft 2 in the direction of rotation. During operation, said second ring 24a, 24b will rotate jointly with the central shaft 2 in the housing 3, therefore. Each second ring 24a, 24b has an outer edge 35, in which two opposed recesses 34a, 34b are formed.

[0046] The recesses 34a, 34b of the second ring 24a, 24b are adapted to mate with the inwardly projecting cams 23a, 23b of each first ring 21a, 21b. The dimensions of the first ring and the second ring are geared to each other, which means that the internal diameter of the first ring 21a, 21b is slightly larger than the external diameter of the second ring 24a, 24b, which is fixedly connected to the central shaft 2 in the direction of rotation. The operation of the diameter adjusting means consisting of the spiral discs 2oa, 20b, the first rings 21a, 21b and the second rings 24a, 24b will now be explained below.

[0047] In the normal operating state, i.e. while the yarn 13 is being wound onto the winding body 15 by the winding arm 1 so as to make it possible to draw off said windings in the form of a weft yarn at the exit side of the winding body 5 and introduce it into the shed of a weaving device at high velocity by means of a yarn injector, the two spiral discs 20a, 20b are fixedly disposed in the housing 3 in the direction of rotation, thus rendering radial adjustment of the winding segments 5a, 5b and the transport segments 6a, 6b impossible. In this position, which is referred to as the second operating state in the present patent application, the clamping bushes 25a, 25b are clamped down by means of holding or clamping elements (such as screws, etc), thus forcing the pre-bent, springing first rings 21a, 21b into a flattened position, so that at least the inwardly projecting cams 23a, 23b no longer extend outside the plane formed by the first ring but lie within the plane formed by said ring. The second rings 24a, 24b, which are positioned directly beside the two first rings 21a, 21b and which are fixedly connected to the central shaft in the direction of rotation, rotate jointly with the central shaft 2 in this second operating state.

[0048] When the diameter of the winding body 5 is to be adapted or re-set, the pre-unwinding device is stopped and the clamping bushes 25a, 25b are loosened by unscrewing the screws (not shown), as a result of which the two first rings 21a, 21b, which are made of a springing material, spring back to their pre-bent shape as shown in Figure 3b. To this end, the inwardly projecting cams 23a, 23b extend outside the plane formed by the rings 21a, 21b and into the plane formed by the second rings 24a, 24b, which are fixedly connected to the central shaft 2 in the direction of rotation.

[0049] When the central shaft 2 is rotated to a small extent, for example by manually rotating the winding arm 1 forwards and backwards, the recesses 34a, 34b of the second rings 24a, 24b can be aligned with respect to the projecting cams 23a, 23b of each first ring 21a, 21b, in such a manner that said projecting cams 23a, 23b each engage in a corresponding recess 34a, 34b of each second ring 24a, 24b.

[0050] Thus, the first ring 21a, 21b, which is stationary (i.e. not capable of rotation) within the housing 3 in the normal (second) operating state, is now brought into engagement with the second ring 24a, 24b and thus with the central rotary shaft 2. Consequently, rotation of the central shaft 2 will be transmitted to the springing first ring 21a, 21b via the fixedly connected second ring 24a, 24b and the engagement between the recesses 34a, 34b and the corresponding internal cams 23a, 23b.

[0051] In said first operating state, the projecting cams 22a, 22b engage in the recesses 32 formed in the outer edge 33 of each spiral discs 20a, 20b in a corresponding manner. Accordingly, rotary movement of the central shaft 2 will be transmitted to the spiral disc 20a, 20b via the second disc 24a, 24b, the engagement between the recesses 34a, 34b and the cams 23a, 23b, via the first ring 21a, 21b, and via the engagement between the projecting cams 22a, 22b and the recesses

32. Rotation of each spiral disc 20a, 20b will result in a radial movement of the winding segments 5a, 5b together with the respective transport segments 6a, 6b, since these segments engage in the spiralling grooves 31 of each spiral disc 20a, 20b.

[0052] This makes it possible to adjust the diameter of the winding body 5 in a simple and accurate manner via this mechanical connection between the diameter adjusting means and the central shaft 2.

[0053] When the clamping elements or screws (not shown) are tightened, the two clamping bushes 25a, 25b will again force the two springing first rings 21a, 21b into a flattened position, as a result of which at least the inwardly projecting cams 23a, 23b will be moved out of engagement with the recesses 34a, 34b of the second ring 24a, 24b. It is not necessary, therefore, to move the projecting cams 22a, 22b of each first ring 21a, 21b out of engagement with the recesses 32 of each spiral disc 20a, 20b during the transition from the first operating state (in which adjustment of the diameter can take place) to the second operating state (the normal operating state of the pre-unwinding device).

[0054] In this embodiment of the diameter adjusting means, the inwardly extending cams 23a, 23b of each first ring 21a, 21b are caused to move into and out of engagement with the recesses 34a, 34b of each second ring 24a, 24b, which second rings are fixedly connected to the central shaft 2 in the direction of rotation, upon transition from the first operating state to the second operating state and vice versa.

[0055] It will be understood that a very reliable, simple, quick but above all precise adjustment of the diameter of the winding body can be obtained when this construction is used, and that not only a the number of parts but also the space required for said parts is minimised.

[0056] The moment the transition of the pre-unwinding device from the second operating state to the first operating state for adjusting the diameter of the winding body 5 is complete, the diameter adjustment can be carried out in a simple manner by the control means of the pre-unwinding device via the driving mechanism of the central shaft 2. Feedback information on the actual diameter adjustment can be supplied to the control means in that, in accordance with the invention, sensors 30, 31 are mounted on the winding arm and on at least a part of the housing 3 located directly beside the winding arm 1, which sensors generate a signal upon rotation of the winding arm 1, which signal can be used as a measure for the adjusted diameter. More in particular, said signal can be used as a feedback signal by the control means of the pre-unwinding device for setting the correct diameter.

[0057] On the other hand, the sensors may consist of an angle encoder fitted on the central shaft.

[0058] Markings may be provided on the winding arm and on the housing so as to enable the user to visually read the diameter setting or the length of the weft yarn.

Claims

1. A method for adjusting the diameter of the winding body of a pre-unwinding device for feeding yarn to a weaving device, which pre-unwinding device also comprises:

   - a central, rotatable shaft disposed in a housing;
   - a winding body surrounding said central shaft and having a yarn entry side and a yarn exit side, whose diameter is adjustable in a plane perpendicular to the central shaft,
   - means for adjusting the diameter of the winding body, as well as
   - a winding arm fixedly connected to said central shaft, at least in the direction of rotation, for winding a yarn drawn off a supply spool onto the winding body in side-by-side, separated or unseparated windings during operation through rotation of the central shaft, **characterized in that** the diameter of the winding body is adjusted through rotation of the central shaft.

2. A method according to claim 1, **characterized in that** the diameter adjusting means are moved into engagement with the central shaft in a first operating state.

3. A method according to claim 2, **characterized in that** said engagement with the central shaft is effected through spring force.

4. A method according to claim 2, **characterized in that** said first operating state is realised by moving the diameter adjusting means and the central shaft relative to each other.

5. A method according to any one or more of the preceding claims, **characterized in that** the diameter adjustment is carried out by the control means of the pre-unwinding device.

6. A pre-unwinding device for feeding yarn to a weaving device, comprising:

   - a central, rotatable shaft disposed in a housing;
   - a winding body surrounding said central shaft and having a yarn entry side and a yarn exit side, whose diameter is adjustable in a plane perpendicular to the central shaft,
   - means for adjusting the diameter of the winding body, as well as
   - a winding arm fixedly connected to said central shaft, at least in the direction of rotation, for winding a yarn drawn off a supply spool onto the winding body in side-by-side, separated or unseparated windings during operation through rotation of the central shaft, **character-**

ized in that means are present for adjusting the diameter of the winding body through rotation of the central shaft.

7. A pre-unwinding device according to claim 6, **characterized in that** said means are at least partially arranged around the central shaft.

8. A pre-unwinding device according to claim 6 or 7, **characterized in that** said means are at least partially arranged on the central shaft.

9. A pre-unwinding device according to any one or more of the preceding claims 6-8, **characterized in that** the diameter adjusting means and the central shaft are movable relative to each other.

10. A pre-unwinding device according to any one or more of the preceding claims 6-9, **characterized in that** the winding body is built up of a number of winding segments arranged around the central shaft and a number of transport segments arranged between said winding segments, being movable with respect thereto, for moving the yarn windings from the entry side to the exit side in the direction in which the shaft extends, in which said means comprise at least one first ring having an inner edge and an outer edge, in which, in a first operating state, said inner edge mates with the central shaft and said outer edge mates with a rotatable disc surrounding the central shaft, which is provided with a number of spiral grooves, in which each groove engages with one of the winding segments and/or transport segments.

11. A pre-unwinding device according to claim 10, **characterized in that** said means comprise at least one second ring having an inner edge and an outer edge, in which the second ring is fixedly connected to the central shaft in the direction of rotation, the outer edge mating with the inner edge of the first ring in the first operating state.

12. A pre-unwinding device according to claim 11, **characterized in that** , the mating engagement between the inner edge of the first ring with the central shaft or with the outer edge of the second ring can be released in a second operating state.

13. A pre-unwinding device according to claim 11 or 12, **characterized in that** the first ring is provided with at least one projecting cam at its inner edge, which cam is in engagement with a corresponding recess formed in the outer edge of the second ring in the first operating state and which is out of engagement with the recess in question in the second operating state.

14. A pre-unwinding device according to any one or more of the preceding claims 6-13, **characterized in that** the outer edge of the first ring is provided with at least one projecting cam, which is in engagement with a groove formed in the rotatable disc surrounding the central shaft in the first operating state.

15. A pre-unwinding device according to claim 13, **characterized in that** at least the projecting cams present on the inner edge of the first ring are made of a springing material.

16. A pre-unwinding device according to claim 14, **characterized in that** at least the projecting cams present on the outer edge of the first ring are made of a springing material.

17. A pre-unwinding device according to any one or more of the preceding claims 6-16, **characterized in that** the first ring is made of a springing material in its entirety.

18. A pre-unwinding device according to any one or more of the preceding claims 9-17, **characterized in that** the device comprises a first assembly and a second assembly, each assembly consisting of a first ring, a second ring and a rotatable disc, the first assembly functioning to adjust the diameter of the winding segments and a second assembly functioning to adjust the diameter of the transport segments.

19. A pre-unwinding device according to any one or more of the preceding claims 9-18, **characterized in that** the diameters both of the winding segments and of the transport segments can be jointly adjusted.

20. A pre-unwinding device according to any one or more of the preceding claims 6-10, **characterized in that** the adjusting means can be moved from the second operating state to the first operating state, and vice versa, by means of clamping elements present in the housing.

21. A pre-unwinding device according to any one or more of the preceding claims 6-20, **characterized in that** the control means of the pre-unwinding device drive the adjusting means.

22. A pre-unwinding device according to any one or more of the preceding claims 6-21, **characterized in that** the device comprises suitable means for providing a signal corresponding to the adjusted diameter of the winding body.

23. A pre-unwinding device according to claim 22, **characterized in that** means are comprised of coacting sensors fitted on the winding arm and on a

part of the housing directly adjacent to the winding arm

24. A pre-unwinding device according to claim 22, **characterized in that** said means comprise an angle encoder fitted on the central shaft.

25. A pre-unwinding device according to claim 22, **characterized in that** said means comprise visual markings provided on the winding arm and on the housing for reading and adjusting the diameter.

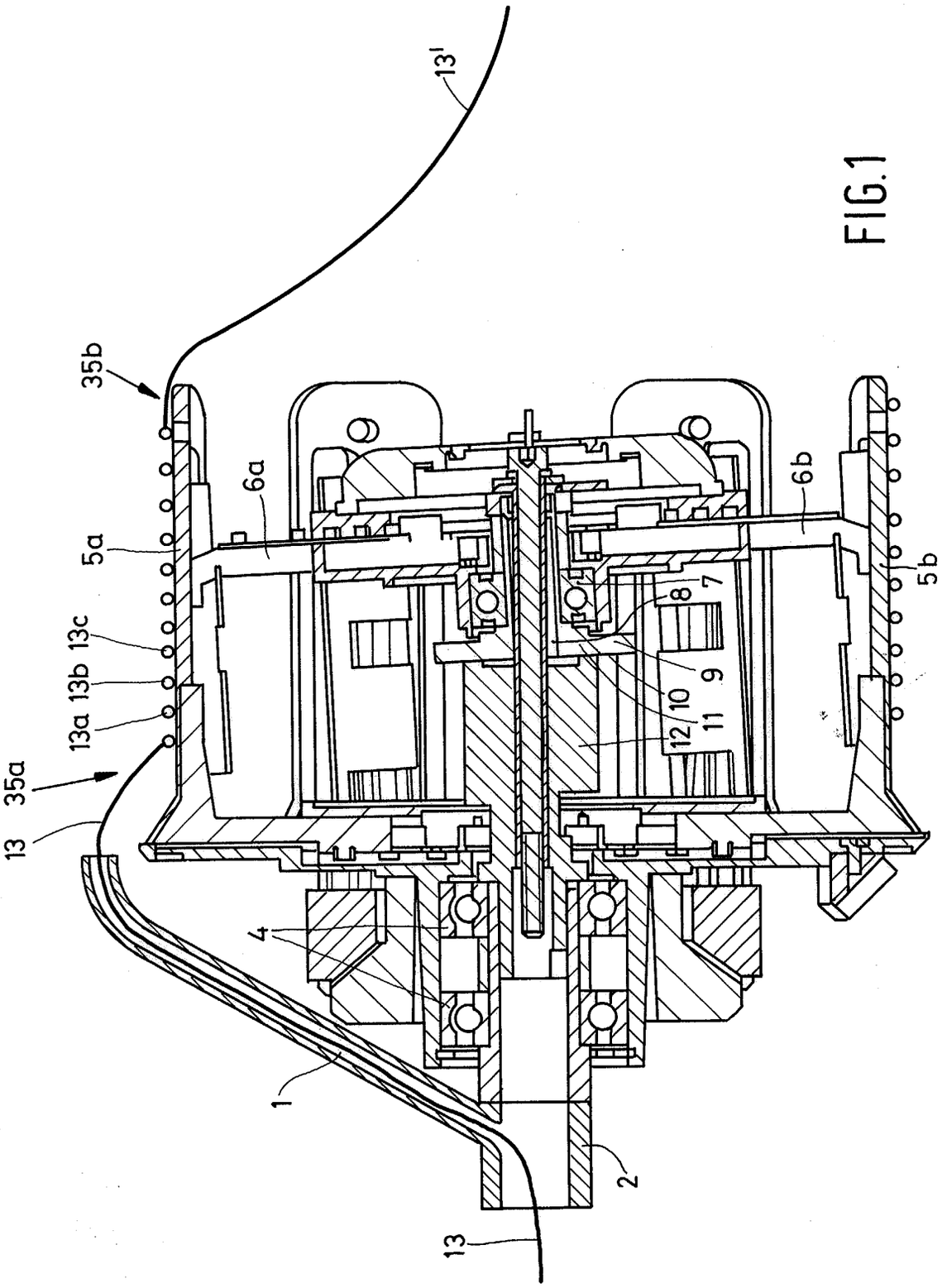

FIG.1

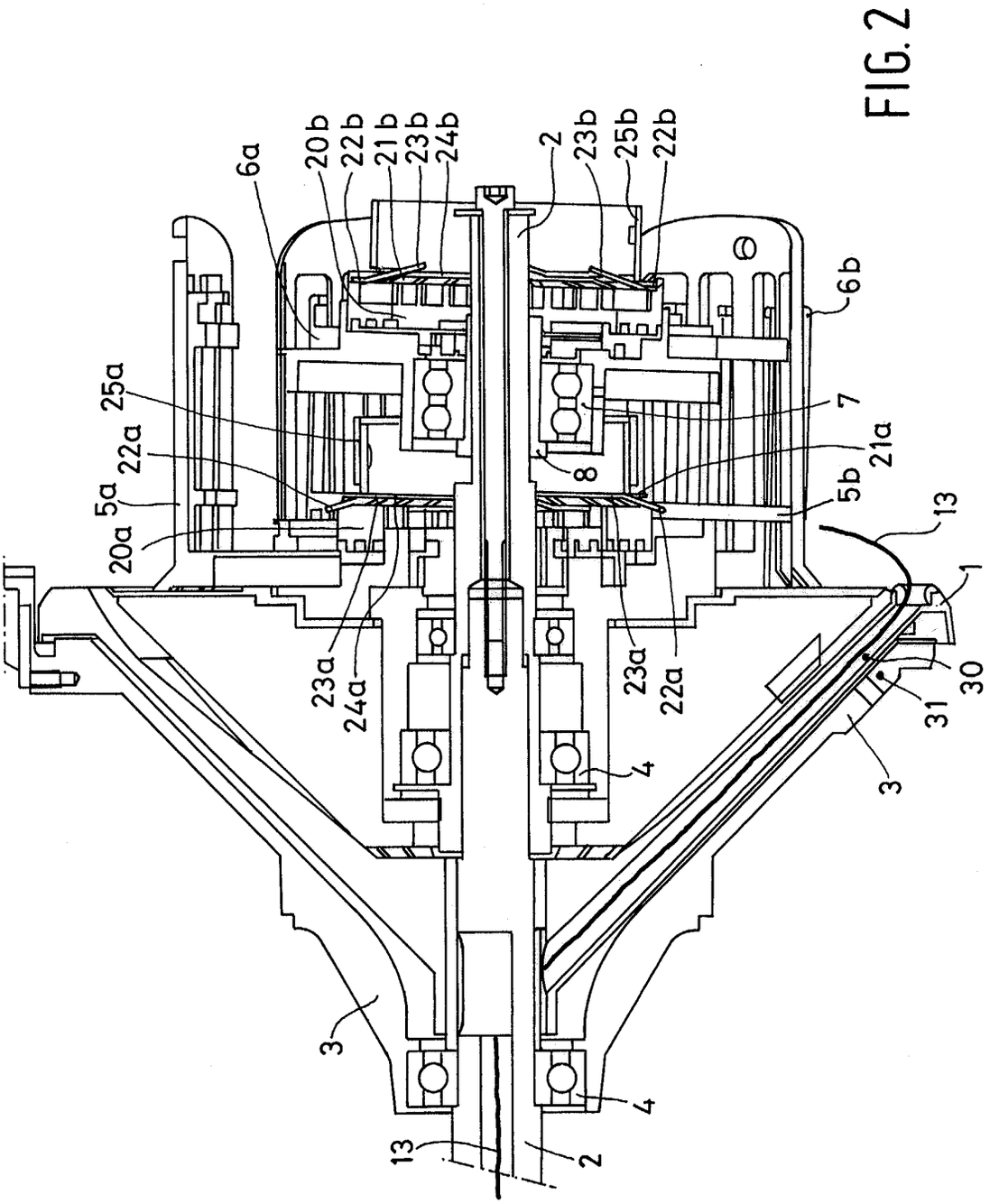
6a
20b
22b
21b
23b
24b
2
23b
25b
22b
6b
25a
22a
5a
20a
7
8
21a
5b
13
1
23a
24a
23a
22a
30
31
4
3
3
4
13
2

FIG. 2

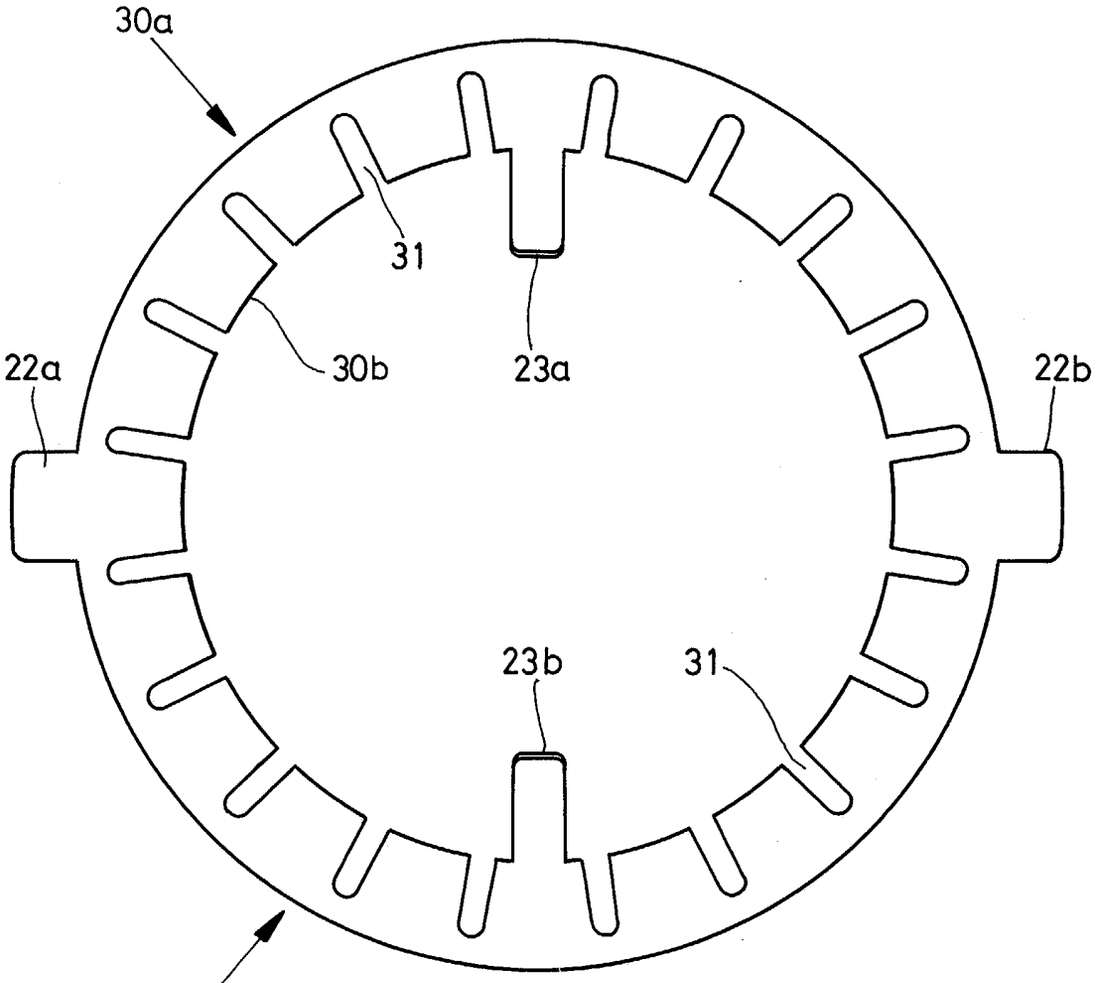

FIG. 3a

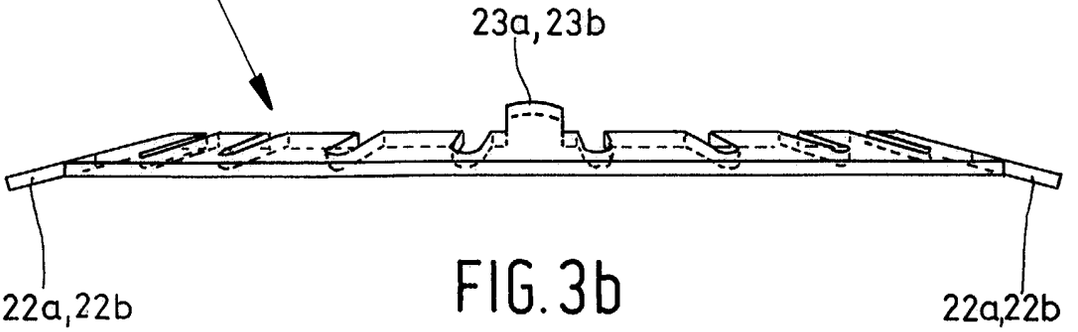

FIG. 3b

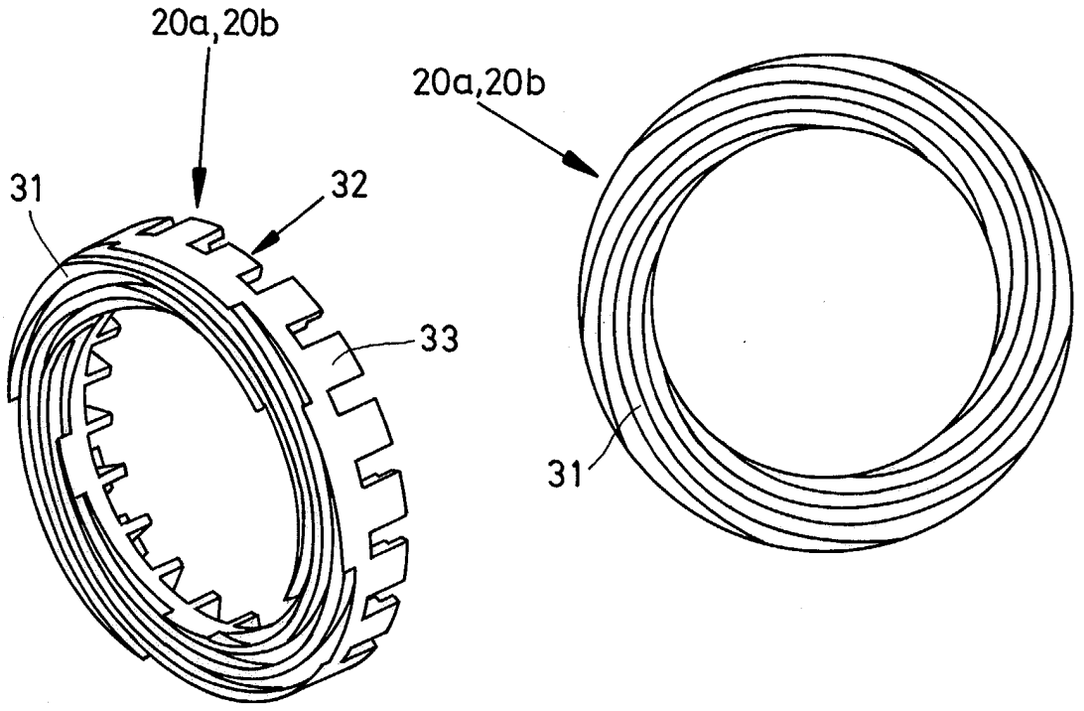

FIG. 4

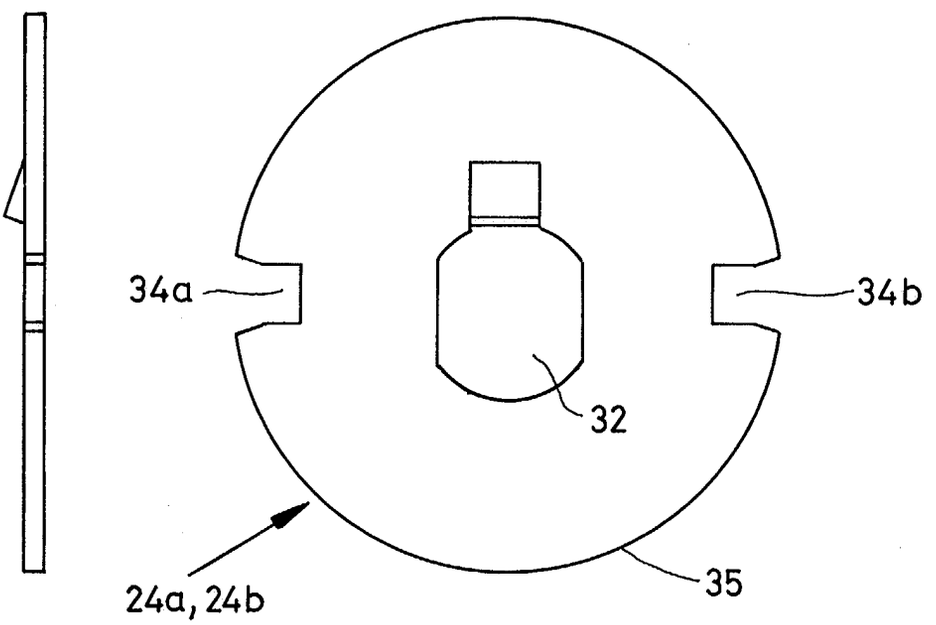

FIG. 5

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B65H
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Place of search	Date of completion of the search	Examiner
THE HAGUE	16 July 2003	Van Gelder, P

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