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(54) **Winding device for sails**

(57) A winding device for sails (1), of the type which can be associated with at least one winder (A) that can be coupled with parts of a boat and that can be actuated at discretion of the yachtsman, also comprises at least one stay comprising at least one rigid shaft (2) suitable for transferring the torque provided by the winder (A), said shaft (2) comprising at least one first shaped end (3) associated with the winder (A) and at least one second shaped end (4) removably coupled to respective locking members (5), said locking members (5) being associated in a rotating manner at least with parts of the mast of a boat, and being it foreseen for there to be means (6) for fixing at least one corner of at least one sail associated with said shaft (2), said fixing means (6) being controlled so as to be mobile from a disengagement configuration, in which they are associated at least with said shaft (2) in a freely rotating manner, to an engagement configuration, in which they are associated at least rotating as a unit at least with said shaft (2), for the selective and facilitated furling of the sail around at least said shaft (2) pulled in rotation by the winder (A) when said fixing means (6) are in said engagement configuration.

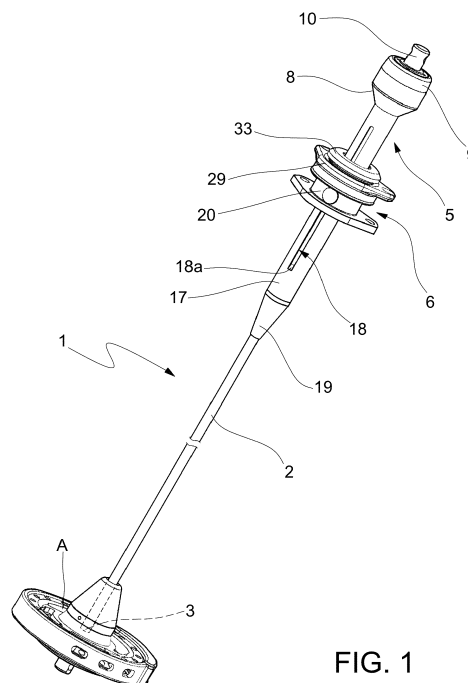


FIG. 1

Description

Technical field of the invention

[0001] The present invention concerns a winding device for sails.

[0002] In particular, the present invention concerns a winding device for sails that allows the sail to be rapidly furled around a stay, and to be simply and quickly replaced at discretion of the yachtsman.

State of the art

[0003] In the nautical field it is known for there to be furling devices that are normally used for winding up sails on boats, and in particular devices are known that are associated with winders for furling the sail (like for example a jib, or other types of sails), around a respective stay.

[0004] The devices of the type known by the name jib furler, for this purpose, comprise a tube that is associated with the drum of the winder; the stay passes inside the tube, said stay being a stranded metal or fabric cable that supports the mast. In these types of devices the winders only support the load of the halyard and of the sail.

[0005] The sail is continuously fixedly connected to the tube, so as to be able to wind it around the tube, and the stay, when the yachtsman actuates the winder.

[0006] Devices of this type have drawbacks also due to the fact that they are made up of a high number of components: for such a reason they are heavy, and also require complicated installation, removal and maintenance operations and require the intervention of specialised workers for many hours and moreover with the boat idle. This obviously leads to drawbacks in terms of both time and money.

[0007] Furthermore the stay housed inside the tube has a large profile that negatively affects the correct introduction of wind in the sail.

[0008] Moreover, devices of this type have a great bulk on deck to the detriment of the surface of the sail and of the consequent speed that can be obtained by the boat. In order to avoid such a drawback built-in below deck jib furlers have been devised, which however are very costly.

[0009] Other known devices more simply comprise a fabric or metal strand stay, which is associated on one side to the drum and on the other side to the head of the mast through a swivel joint, whereas the sail is fixedly connected with its head corner to the top of the stay. In such devices the winders also support the load of the mast. By actuating the winder, in one direction or the other, the sail is wound up or unwound around the stay.

[0010] Although these devices are lighter than the previous ones described and despite having small on-deck bulk, they still have drawbacks mainly due to the fact that the stranded cable that forms the stay tends to open up in one of the two rotation directions. Therefore, these types of devices do not always efficiently transmit the

torque provided by the winder and do not ensure an optimal winding/unwinding of the sail. Consequently their use in the field is limited (for example to small sail boats).

[0011] Moreover, the fabric stay of such devices is very costly, it requires suitable maintenance (at least once a year), and it is still affected by drawbacks like accidental cutting.

[0012] Furthermore, such devices do not allow the sail to be lowered and/or replaced easily due to how they are associated with the stay, and require specific and long operations for this, to be carried out with the boat idle, with losses, also in this case, in terms of time and money.

Purposes of the invention

[0013] The technical task of the present invention is therefore that of devising a winding device for sails that allows the sail to be wound up/unwound simply and rapidly around the stay, and that makes it possible to lower and replace it rapidly at the discretion of the yachtsman even when sailing.

[0014] In such a technical task, one particular purpose of the present invention is to make a winding device for sails that is lighter than that of known devices, and that has smaller bulk and a minimum profile going into the wind.

[0015] Another purpose of the present invention is that of making a winding device for sails that is made up of small number of components, so that it is simple and rapid to install, use and maintain.

[0016] Again, another purpose of the present invention is to provide a winding device for sails that is particularly practical and simple to actuate.

[0017] This task and this purpose are achieved with the winding device for sails according to the attached claim 1.

[0018] The winding device for sails is of the type that can be associated with at least one winder that can be coupled to parts of a boat and that can be actuated at discretion of the yachtsman, and it comprises at least one stay comprising at least one rigid shaft that is suitable for transferring the torque provided by the winder; such a shaft comprises at least one first shaped end that is associated with the winder and at least one second shaped end that is removably coupled to respective locking members; such locking members are rotatably associated at least to parts of the mast of a boat, and means are foreseen for fixing at least one corner of at least one sail that are associated at least with the shaft; the fixing means are controlled so as to be mobile from a disengaged configuration, in which they are associated freely able to rotate with the shaft, to an engagement configuration, in which they at least rotate as a unit at least with the shaft, for the facilitated selective furling of the sail around at least the shaft that is pulled in rotation by the winder when the fixing means are in the aforementioned engagement configuration.

[0019] Further advantageous characteristics are de-

scribed in the dependent claims.

Brief description of the drawings

[0020] The characteristics of the invention shall become clearer by a man skilled in the art from the following description and with the attached drawing tables, given as a non-limiting example, in which:

- figure 1 is a perspective view of the winding device, according to the present invention;
- figure 2 is a perspective exploded view of the locking members and of the shaft of the winding device according to the present invention;
- figure 3 is an enlarged detail view of the second end of the shaft of the device according to the embodiment of figure 2;
- figure 4 is an exploded perspective view of the locking members and of the shaft of the winding device, according to another embodiment of the present invention;
- figure 5 is an enlarged detail view of the second end of the shaft of the device according to the embodiment of figure 4;
- figure 6 is a diametrical-section perspective view of the device according to the invention, with the fixing means that are engaged on the locking members in turn coupled with the shaft;
- figure 7 is a perspective section view of the fixing means of the winding device, according to the present invention;
- figure 8 is an exploded perspective view of the same fixing means.

Embodiments of the invention

[0021] With reference to the attached figure 1, a winding device for sails according to the present invention is wholly indicated with reference numeral 1.

[0022] The winding device is of the type which can be associated with at least one winder A.

[0023] The winder A can be coupled to parts of a boat, and it can be actuated at discretion of the yachtsman.

[0024] The winder A comprises at least one stay, comprising at least one rigid shaft 2.

[0025] The shaft 2 is suitable for transferring the torque provided by the winder A.

[0026] Such a shaft 2 comprises at least one first shaped end 3, which is associated with the winder A.

[0027] The shaft 2 also comprises at least one second shaped end 4.

[0028] The device 1 moreover comprises locking members 5.

[0029] The second shaped end 4 is removably coupled to the locking members 5.

[0030] The locking members 5 are rotatably associated at least with parts of the mast of a boat.

[0031] The device 1 comprises means 6 for fixing at

least one corner of at least one sail.

[0032] The fixing means 6 are associated with the shaft 2; the fixing means 6 are controlled so as to be mobile from a disengagement configuration, in which they freely rotate with respect to the shaft 2, to an engagement configuration, in which, on the other hand, they rotate as a unit with the shaft 2.

[0033] When the fixing means 6 are in the aforementioned engagement configuration, as shall become clearer in the rest of the description, there is the facilitated selective furling of the sail around the shaft 2 pulled in rotation by the winder A.

[0034] As mentioned, the shaft 2 is rigid, adapted to suitably transfer the torque provided by the winder A.

[0035] In particular, the second shaped end 4 of the shaft 2 has a shape corresponding to a respective shaped seat 7 that is defined in the locking members 5 that are rotatably associated with the mast.

[0036] In such a way, the relative rotation between the two components is prevented in a constructively simple manner.

[0037] The shaft 2 can therefore be coupled in a removably firm manner with respect to the locking members 5, so as to allow the controlled rotation of the shaft 2 for transmitting the torque provided by the winder A.

[0038] For example, as visible in figure 5, the second shaped end 4 defines at least one abutment portion 4a and preferably two abutment portions 4a.

[0039] The second shaped end 4 has an elliptical cross-section, so as to be able to be engaged in the aforementioned seat 7 of the locking means 5.

[0040] Otherwise, as visible in figure 3, the second shaped end 4 defines, according to another embodiment of the invention, at least one abutment portion 4a and at least one flat surface 4b so as to be able to be engaged in the respective seat 7 of the locking means 5.

[0041] More in detail, in the embodiment of figures 2, 3, the second shaped end 4 defines two abutment portions 4a and two flat surfaces 4b for engaging the locking members 5 inside the seat 7.

[0042] The first end 3 and the second end 4 may or may not have an identical shape, in any case a shape that is suitable for transferring the torque provided by the winder A to the shaft 2.

[0043] The first end 3 and the second end 4 can be made through riveting, fusion, moulding, milling, or other mechanical processes that are suitable for the purpose.

[0044] In one different embodiment of the device 1 - not represented in the figures - the second shaped end 4 can comprise a hole for fixedly coupling to the locking members 5, through respective means of the screw or pin type.

[0045] Also the first shaped end 3 can comprise a hole for being fixedly attached to the drum of the winder A, through respective means of the screw or pin type.

[0046] The first shaped end 3 of the shaft 2 is coupled to the winder A with means of the screw type, pin type or other types of coupling means that are suitable for the

purpose, which make it possible to transfer the torque provided by the winder A to the shaft 2.

[0047] The mentioned shaft 2 can have a full cross-section, or it can have a tubular cross-section, in any case suitable for transmitting the torque provided by the winder A.

[0048] The cross-section of the shaft 2 can have a shape selected from the circular, elliptical, curvilinear, or polygonal shape.

[0049] Moreover, the shaft 2 can have a variable cross-section.

[0050] The materials, with which the shaft 2 is made, can be selected from metal, composite materials, or other materials with suitable mechanical characteristics.

[0051] The aforementioned locking members 5 comprise at least one main body 8.

[0052] The main body 8 defines the aforementioned shaped seat 7.

[0053] The main body 8 is associated to a head 9, which is provided with at least one swivel joint 10 for connecting to parts of the boat mast.

[0054] The swivel joint 10 is in turn associated with the head of the mast of the boat by means of connection elements of the known types such as textile rope rings, carabiners, shackles and more that are suitable for the purpose.

[0055] In particular, the main body 8 comprises the aforementioned seat 7 and at least one first housing 11 for at least one respective first insert 12.

[0056] Moreover, the main body 8 has a hole 13 for the insertion of a respective screw 14, which is suitable for thrust locking the first insert 12 against the second shaped end 4 of the shaft 2.

[0057] The main body 8 also comprises a second housing 15 for a respective second insert 16: the first insert 12, the second end 4 and the second insert 16 are forced to couple with one another by the screw 14.

[0058] The first insert 12, the second end 4 and the second insert 16 are closed at the top by the head 9 when it is coupled with the main body 8.

[0059] The main body 8 is associated with a tubular stem 17 for housing a section of the shaft 2.

[0060] The tubular stem 17, externally, comprises at least one groove 18.

[0061] The groove 18 is arranged longitudinally with respect to the axis of the tubular stem 17.

[0062] As shall become clearer in the rest of the description, the groove 18 makes it possible to obtain the removable coupling of the fixing means 6 in the aforementioned engagement configuration.

[0063] More in detail, at least the tubular stem 17 comprises two longitudinal grooves 18 for the removable coupling of the fixing means 6.

[0064] The longitudinal grooves 18 are foreseen, along the tubular stem 17, diametrically opposite with one another.

[0065] It is also foreseen for there to be an end post 19 that is associated with the stem 17 and that is perforated, for the shaft 2 to pass through it.

rated, for the shaft 2 to pass through it.

[0066] The grooves 18 can also extend along portions of the post 19.

[0067] The aforementioned fixing means 6 comprise at least one first element 20.

[0068] The first element 20 is substantially ring-shaped.

[0069] The first element 20 is slidingly associated with the shaft 2. The first element 20 comprises at least one protrusion 21, having at least one through hole 22 for the connection with one corner of the sail.

[0070] In particular the protrusion 21 of the first element 20 has two through holes 22 for the connection of the corner of the sail, for example through a top textile ring, or other suitable connection means.

[0071] More in detail, the first element 20 comprises at least one retractable element 23.

[0072] More in detail, in the embodiments of the figures, the retractable element 23 is made up of a retractable tooth.

[0073] The retractable tooth 23 can be engaged with a removable elastic snap-coupling inside a respective groove 18 of the tubular stem 17, so as to obtain the aforementioned engagement configuration of the fixing means 6.

[0074] In one embodiment of the invention of particular practical interest, the first element 20 comprises two retractable teeth 23 that can be engaged in the two respective longitudinal grooves 18 foreseen in the tubular stem 17.

[0075] The two grooves 18 can also extend, as mentioned, along the portions of the post 19.

[0076] The retractable teeth 23 are housed in respective hollow dowels 24.

[0077] The hollow dowels 24 are inserted in corresponding receptacles 25 of the first element 20.

[0078] The receptacles 25 are foreseen, in the first element 20, diametrically opposite one another.

[0079] The retractable teeth 23 are elastically pushed in engagement inside the grooves 18 by action of elastic means 26, like for example springs.

[0080] Such elastic means 26 are interposed between respective shoulders 27 of the teeth 23 and respective rear caps 28 of the dowels 24.

[0081] The aforementioned grooves 18 have their respective ends 18a facing towards the first shaped end 3 of the shaft 2.

[0082] The ends 18a are open or also suitably joined, so as to allow the respective teeth 23 to be disengaged in a controlled manner in the aforementioned disengagement configuration of the fixing means 6.

[0083] In another different embodiment of the device according to the invention - not represented in the figures - the shaft 2 can directly comprise, near to its second end 4, at least one shaped recess for the removable elastic coupling of at least one tooth 23 of the main body 20, so as to obtain said engagement configuration. More in detail, the shaft 2 can comprise two longitudinal recesses

for the removable elastic coupling of the two respective teeth 23 of the fixing means 6.

[0084] The ends of the recesses facing towards the first end 3 of the shaft 2 are suitably joined so as to allow the teeth 23 to be disengaged in a controlled manner.

[0085] The fixing means 6 also comprise a second element 29.

[0086] The second element 29 is substantially ring-shaped.

[0087] The second element 29 is slidingly associated with the shaft 2, and it is associated with the first element 20 in a rotating manner.

[0088] The second element 29 comprises a border 30, which has at least one through hole 31 for the connection to at least one halyard of the mast.

[0089] This makes it possible to easily lower the sail and allow it to be rapidly replaced at discretion of the yachtsman.

[0090] In particular the second element 29 comprises two through holes 31 for the connection of the halyard of the mast, for example through a top textile ring, or other suitable connection members, and as already mentioned, it makes it possible for the sail to be simply and rapidly replaced.

[0091] More in detail, the first element 20 is coupled with an inner bush 32.

[0092] The inner bush 32 can slide along the shaft 2 and the tubular stem 17.

[0093] Moreover, it is foreseen for there to be a closing ring nut 33, which can be engaged in the first element 20 for the respective rotatable coupling with the second element 29.

[0094] The inner bush 32 comprises two through slots 34 for the passage of the retractable teeth 23 of the first element 20.

[0095] The rotatable coupling between the second element 29, the first element 20 and the ring nut 33 is obtained through the interposition of balls - or bearings, and the like - that are distributed along respective annular throats 35.

[0096] The operation of the winding device for sails 1, according to the invention is, according to what has been described, completely intuitive.

[0097] As mentioned, the first end 3 of the shaft 2 is coupled to the winder A, which in turn is associated with parts of the boat, whereas the second end 4 is coupled with the locking members 5, in turn rotatably associated with the head of the mast. The fixing means 6, on the other hand, have the first element 20 that is connected to the sail, and the second element 29 that is connected to the halyard of the mast.

[0098] The fixing means 6, in the disengagement configuration, can slide along the shaft 2 and, as mentioned, can freely rotate with respect to the latter.

[0099] In order to bring the fixing means 6 into the engagement configuration, it is sufficient to act on the halyard of the mast connected to the second element 29, by suitably putting it under tension and by making the

fixing means 6 themselves rise back up along the shaft 2, until they reach the grooves 18 of the locking members 5 (or until they reach the recesses on the shaft 2, if present).

[0100] As soon as the first element 20, rotating together with the inner bush 32, is arranged with the retractable teeth 23 at the grooves 18 - or at the recesses - the retractable teeth 23 automatically engage in the respective grooves 18 pushed by action of the elastic means 26, thus making the fixing means 6 rotate as a unit with the shaft 2.

[0101] At this point the winder A, controlled in rotation by the yachtsman, pulls with it the shaft 2, which transmits the torque to the locking members 5 and to the fixing means 6, thus leading to the facilitated selective furling of the sail around the shaft 2 itself.

[0102] In order to open the sail again, it is sufficient for the yachtsman to control the rotation of the winder A and thus the shaft 2 in the opposite direction.

[0103] In order to bring the fixing means 6 again into the disengagement configuration, it is sufficient to act upon the halyard partially releasing it, so that the fixing means 6 come back down simply with their weight and pulled by action of the sail along the shaft 2: in such a way, the retractable teeth 23 of the first element 20 disengage from the respective grooves 18 having ends 18a that are open or suitably joined - or by the recesses having suitably joined ends - thus allowing the fixing means 6 to freely rotate again with respect to the shaft 2.

[0104] The yachtsman can decide if to rapidly lower the sail by simply releasing the halyard: in such a way the fixing elements 6, connected to it with the second element 29, slide along the entire shaft 2.

[0105] At this stage the yachtsman can decide whether to rapidly replace the sail, by simply and quickly acting upon the connection means between the same and the first element 20, with an obvious saving of time with respect to that necessary with devices of the known type, which can on the other hand require operations that can take even many hours and having the boat idle.

[0106] The invention, thus conceived, makes it possible to obtain important technical advantages.

[0107] One important technical advantage consists of the fact that the winding device 1, as described, makes it possible for there to be an optimal rapid winding/unwinding of the sail around the shaft 2 which is controlled in rotation - pulled by the winder A - fixedly attached to the locking members 5 and to the fixing means 6.

[0108] The winding device 1 also makes it possible, as described, to quickly and easily lower the sail, allowing it to be replaced rapidly at the discretion of the yachtsman, even while sailing: in order to replace the sail it is sufficient to simply act on the halyard that is connected to the second element 29 of the fixing means 6 to lower it and then the corner of the sail to be replaced is rapidly disconnected from the first element 20, so as to connect, just as rapidly, the corner of a new sail to it. The new sail is hoisted quickly by acting on the halyard again.

[0109] Moreover, the winding device described, boasting of a small number of components, is lighter with respect to known devices, and has small bulk and a minimum profile going into the wind.

[0110] The small number of components also makes it possible to have advantages also from an economic point of view.

[0111] For the same reason also installation, use and maintenance operations of the device are therefore simple and fast, with advantages in terms of both time and money.

[0112] As previously described, the passing from the engagement configuration to the disengagement configuration of the fixing means 6 is made particularly simple and practical, due to the fact that it occurs in a substantially automatic manner.

[0113] Indeed, such a passage occurs with a single action of the user (tightening or loosening the halyard of the sail), and not though sequential actuation of many commands as occurs in known devices, in which it may also be necessary to disconnect the halyard of the sail.

[0114] As mentioned, the halyard of the sail never requires to be disconnected and actually remains always in its place without risking to wind up around the sail itself or to interfere with any other operation, and facilitating the operations of both hoisting and lowering the sail.

[0115] It has thus been seen how the invention achieves the proposed purposes.

[0116] The present invention has been described according to preferred embodiments, but equivalent variants can be conceived without departing from the scope of protection offered by the following claims.

Claims

1. Winding device for sails (1), of the type which can be associated with at least one winder (A) that can be coupled with parts of a boat and that can be actuated at discretion of the yachtsman, comprising at least one stay provided with at least one rigid shaft (2) suitable for transferring the torque provided by the winder (A), said shaft (2) comprising at least one first shaped end (3) associated with the winder (A) and at least one second shaped end (4) removably coupled to respective locking members (5), said locking members (5) being at least associated with parts of the mast of a boat in a rotatable manner, and being it foreseen for there to be means (6) for fixing at least one corner of at least one sail associated at least with said shaft (2), **characterised in that** said fixing means (6) are controlled so as to be mobile from a disengagement configuration, in which they are associated in a freely rotating manner at least with said shaft (2), to an engagement configuration, in which they at least rotate as a unit with said shaft (2), for the selective and facilitated furling of the sail around at least said shaft (2) pulled in rotation

by the winder (A) when said fixing means (6) are in said engagement configuration.

2. Winding device, according to claim 1, wherein at least said second shaped end (4) has a shape corresponding to a respective shaped seat (7) defined in said locking members (5) that are associated in a rotary manner with the mast, for the mutual integral removable coupling, so as to allow the controlled rotation of said shaft (2) for transmitting the torque provided by the winder (A).
3. Winding device, according to claim 2, wherein at least said second shaped end (4) defines at least one abutment portion (4a) and has a substantially elliptical cross-section for coupling in said respective seat (7) of said locking means (5).
4. Winding device, according to claim 2, wherein said second shaped end (4) defines at least one abutment portion (4a) and at least one flat surface (4b) for coupling said locking means (5) inside said respective seat (7).
5. Winding device, according to any one of the previous claims, wherein at least said second shaped end (4) comprises at least one hole for the fixed coupling to said locking members (5) through respective means of the screw or pin type.
6. Winding device, according to any one of the previous claims, wherein said shaft (2) has a full or tubular cross-section, with a shape that is selected from circular, elliptical, curvilinear, or polygonal.
7. Winding device, according to any one of the previous claims, wherein said shaft (2) has a variable cross-section.
8. Winding device, according to any one of the previous claims, wherein said shaft (2) is made from materials selected from metals, composite material, and/or other materials having suitable mechanical characteristics.
9. Winding device, according to any one of the previous claims, wherein said locking members (5) comprise at least one main body (8) defining at least said shaped seat (7) and associated with a head (9) provided with at least one swivel joint (10) for connecting to parts of the boat mast.
10. Winding device, according to claim 9, wherein said main body (8) defines said seat (7) and at least one first housing (11) for at least a respective first insert (12), said main body having at least one hole (13) for the insertion of at least one respective screw (14) suitable for thrust locking at least said first insert (12)

against said second end (4).

11. Winding device, according to claim 10, wherein said main body (8) defines said seat (7) for said second end (4), said first housing (11) for said first insert (12) and a second housing (15) for a respective second insert (16), said first insert (12), said second head (4) and said second insert (16) being forcibly pushed to couple said screw (14).
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12. Winding device, according to any one of claims 9-11, wherein said main body (8) is associated with at least one tubular stem (17) for housing a segment of said shaft (2), said stem (17) defining on the outside at least one groove (18) for the removable coupling of said fixing means (6) in said engagement configuration.
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13. Winding device, according to claim 12, wherein said fixing means (6) comprise at least one first element (20) substantially in the shape of a ring slidingly associated on at least said shaft (2) and defining at least one protrusion (21) having at least one through hole (22) for connecting a corner of the sail.
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14. Winding device, according to claim 13, wherein said first element (20) comprises at least one retractable element (23) that can be fittingly snap-engaged, in a removable manner, inside at least said groove (18) of said stem (17), so as to achieve said engagement configuration in an automatic manner.
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15. Winding device, according to claim 14, wherein said stem (17) comprises two of said grooves (18) having the ends (18a) facing towards said first end (3) of said shaft (2) that are open or suitably joined, so as to allow the controlled decoupling of two of said respective retractable elements (23), in said disengagement configuration for said fixing means (6).
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16. Winding device, according to one of claims 14, 15, wherein said shaft (2) comprises, near to said second end (4), at least one shaped recess for the removable elastic coupling with said at least one retractable element (23) of said fixing means (6) so as to obtain said engagement configuration.
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17. Winding device, according to one of claims 13-16, wherein said fixing means (6) comprise at least one substantially ring-shaped second element (29) slidingly associated with at least said shaft (2) and associated in a rotating manner with said first element (20), said second element (29) defining at least one border (30) having at least one through opening (31) for connecting to at least one halyard of the mast, so as to easily lower the sail and allow it to be replaced rapidly at discretion of the yachtsman.
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18. Winding device, according to claim 17, wherein said first element (20) is associated with at least one internal bush (32) slidingly associated along said at least said shaft (2) and said stem (17), being it foreseen for there to be a closing ring nut (33) that can be engaged with at least said first element (20) for the respective rotary coupling with said second element (29).

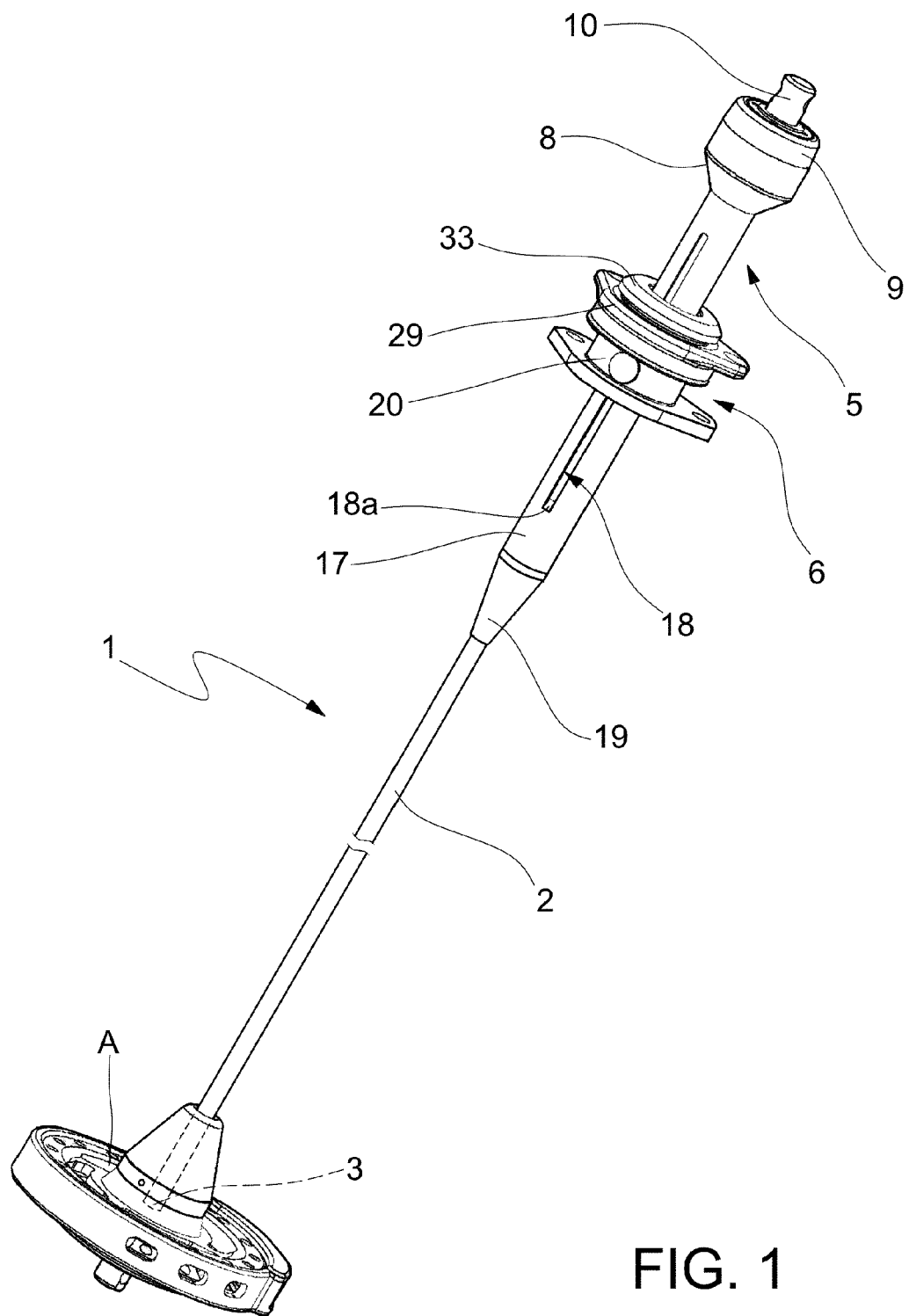


FIG. 1

FIG. 2

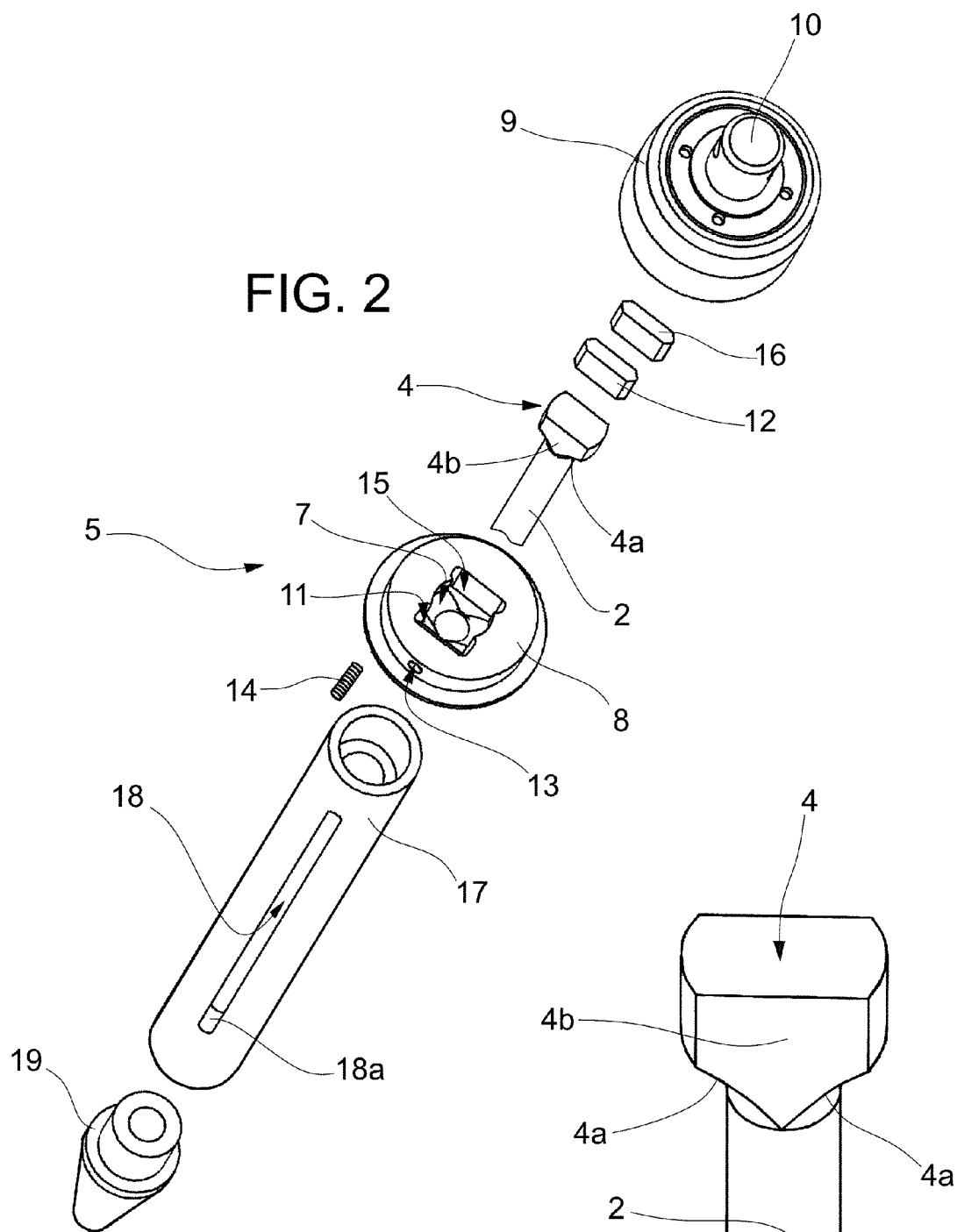
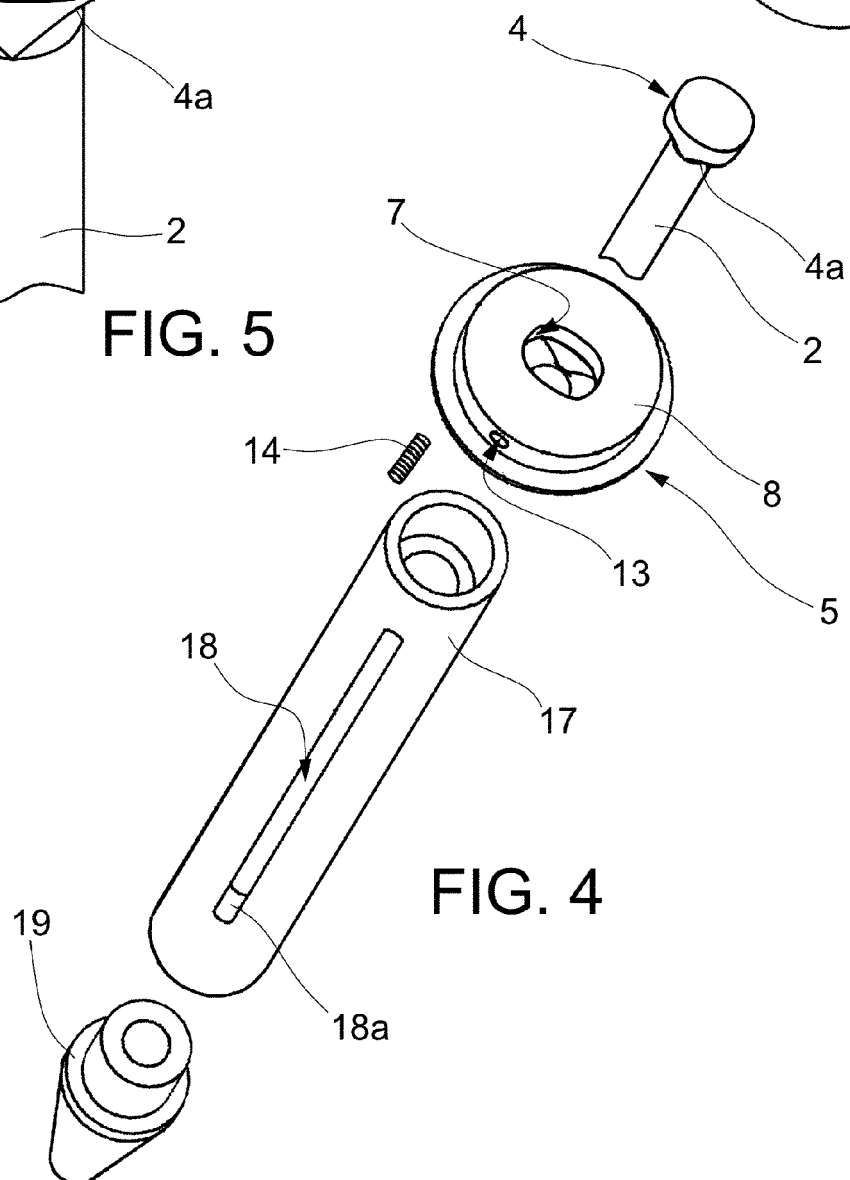
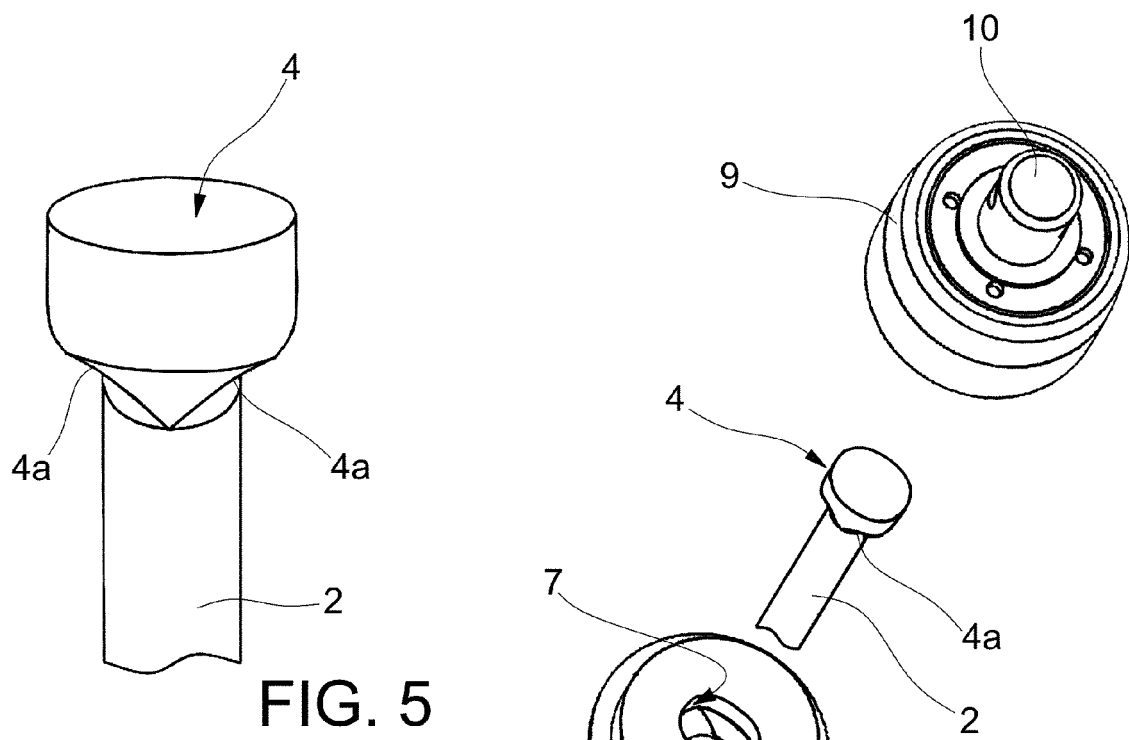
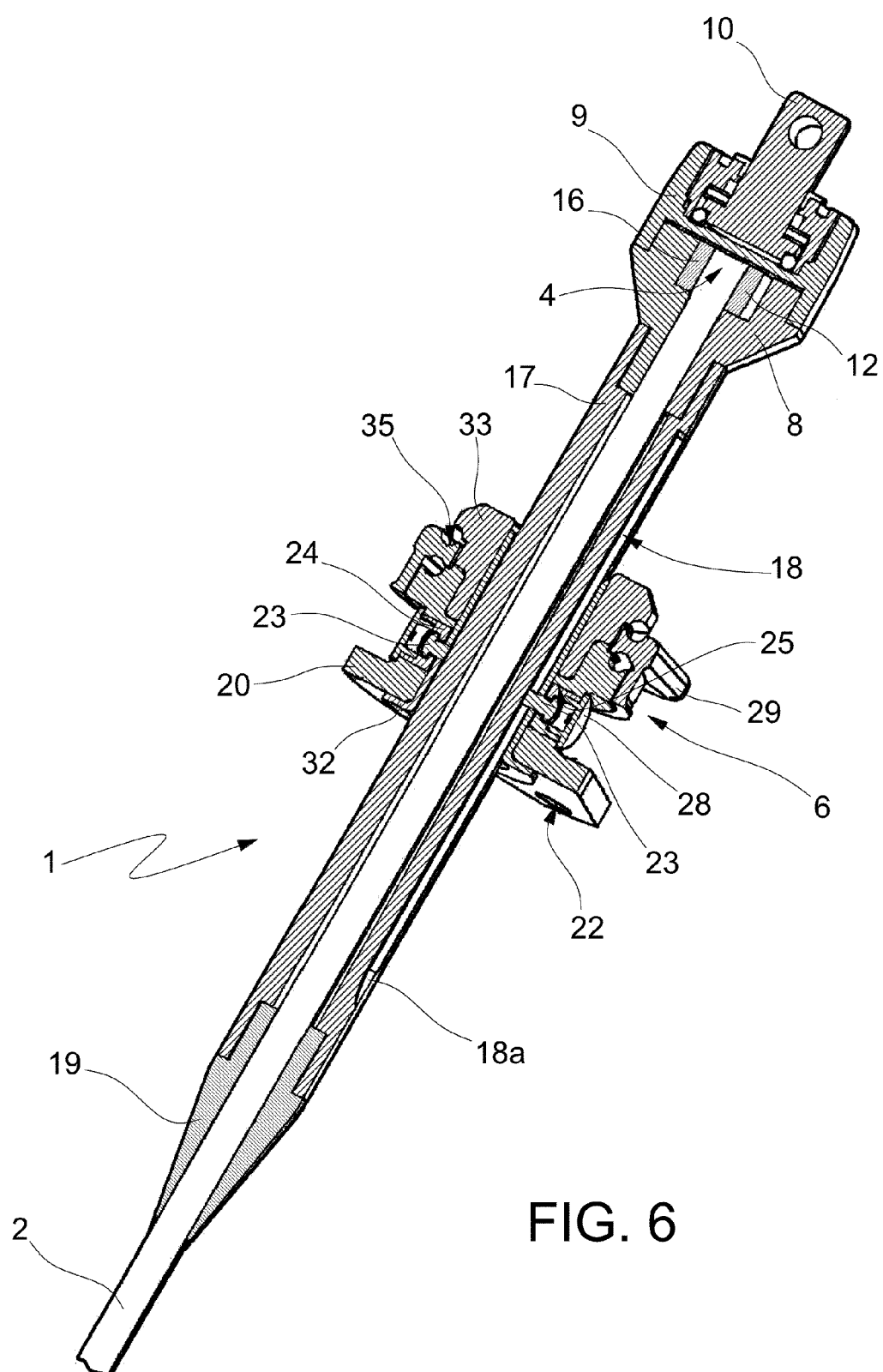


FIG. 3





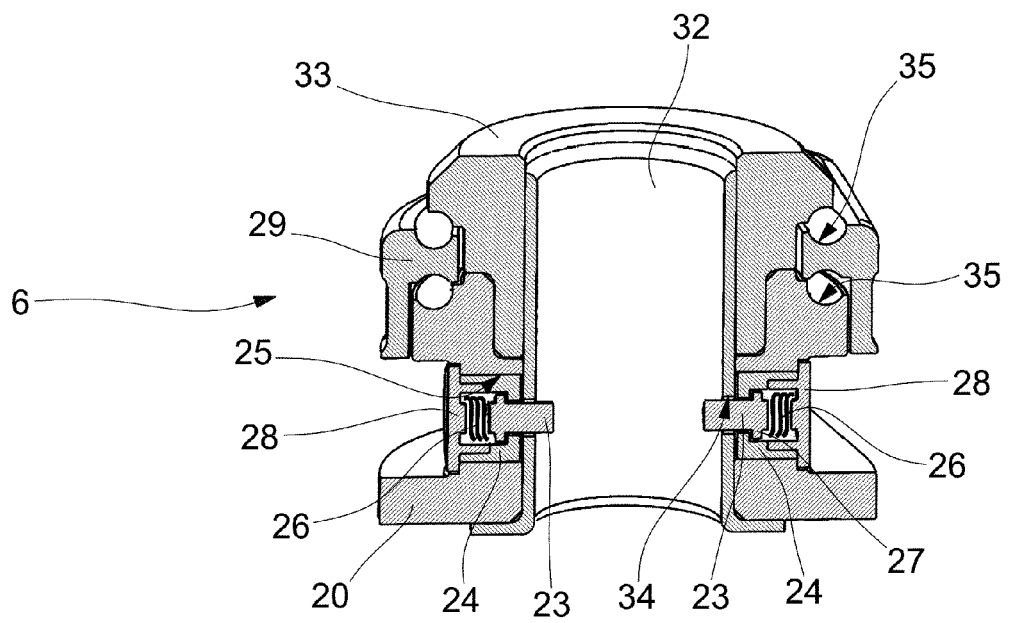


FIG. 7

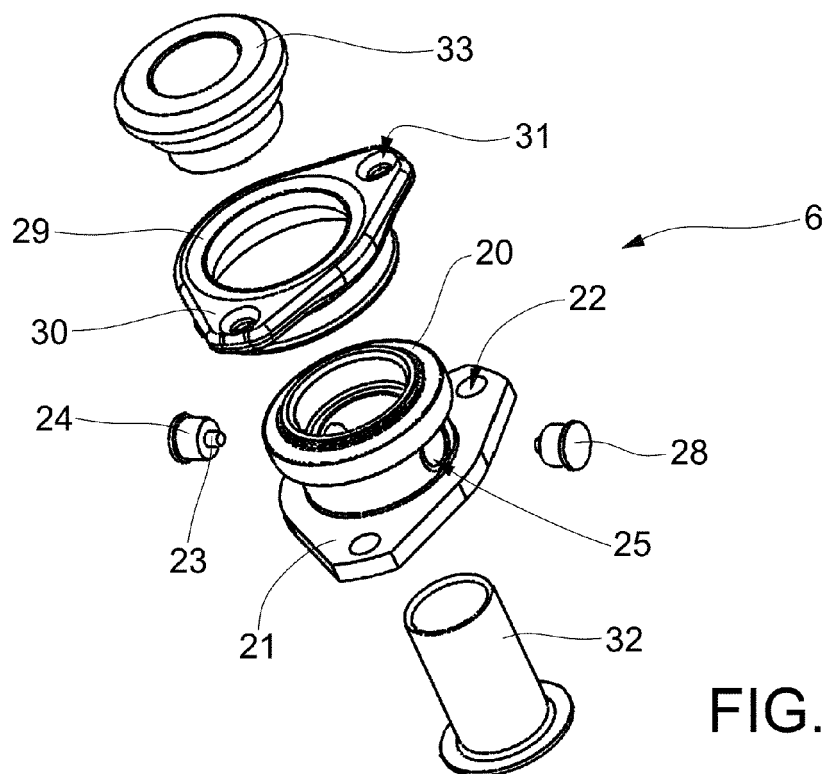


FIG. 8



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EP 14 18 7419

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