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(54) **Submersible centrifugal pump**

Zentrifugaltauchpumpe

Pompe centrifuge submersible

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(56) References cited:
EP-A- 0 267 445 **EP-A- 0 774 584**
US-A- 3 521 970 **US-A- 4 523 899**

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Description

[0001] The present invention relates to a submersible centrifugal pump.

[0002] In particular, the present invention is applied in the sector of extraction of a liquid, usually water, from a well or a tank.

[0003] As is known, the pumps currently used generally consist of a cylindrical containment jacket inside which there extends a shaft which can be connected to a motor (normally electric), and at least one stage comprising an impeller and a diffuser. A delivery body and an intake body are located respectively downstream and upstream of the jacket with reference to the direction of the fluid pumped.

[0004] The jacket, the delivery body and the intake body have threads on their side surfaces necessary for fixing these components to one another and clamping the hydraulic stages.

[0005] A tube is connected to the pump by securely screwing the tube to the delivery body.

[0006] In some cases, the delivery body has a non-return valve with the dual purpose of preventing the tube connected to the pump from emptying when the pump is not switched on and of protecting the impellers and the diffusers from possible pressure blowbacks. It is also known that, when pumps operate with a low head, the impellers tend to lift up, carrying the shaft with them. To overcome this disadvantage and, therefore, to prevent the shaft from being subject to excessive axial movements, there are thrust bearing means positioned at the end of the shaft close to the delivery body, so that the resulting forces are discharged mainly on the diffusers.

[0007] It is also known from document EP-A-0267445 a multistage pump for submersible electric pumps in which the axial anchoring and the centering of the stage body assembly are achieved by means of anchoring and centering elements consisting of projections provided in the outer casing of the pump. This allows a more solid and economical construction and a simplification of the assembly and disassembly of the pump, with a reduction of the number of inner structural locking elements.

[0008] Moreover, it is known from document EP-A-0774584 a device for mounting and keeping together parts in a submersible pump unit. Two groups of screw joints are alternatively arranged around the periphery of the pump unit, the first group of said joints connecting the stator housing and the seal housing via a ring, while the other group of joints connect said ring, said pump housing and a cooling jacket surrounding said stator housing.

[0009] It is also known from document US-A-4523899 a submergible motor pump assembly which is arranged to be easy to access to any part of the assembly with dismantling minimum elements, without requiring disassembly of the whole and without requiring discharging lubricating oil for a mechanical seal. Also, plural balance holes are provided in the main plate of the impeller and

a liner ring is disposed between the main plate and the top wall of the impeller chamber to establish the flow passage from the tip of the impeller blades through the gap between the main plate and the top wall of the chamber to the balance holes with flow restricted zones by the liner ring.

[0010] However, the known submersible centrifugal pumps have significant disadvantages.

[0011] Firstly, disadvantageously, the known type of pumps are unable to guarantee suitable internal stiffness due to the screw connection between the jacket and the delivery and intake bodies. With this type of connection adequate clamping of the stages is impossible, and, either the stages can move relative to one another, damaging pump operation, or they are overtightened, with the risk of damaging internal components. Moreover, the threads hydraulic seal and reducing its efficiency.

[0012] Secondly, in pumps fitted with a non-return valve, if the valve needs removing (normally during pump installation), the delivery body has to be removed from the containment jacket and this operation is complicated by the fact that subsequent reassembly of the delivery body must be performed in such a way as to guarantee the compactness of the stages and the hydraulic seal again.

[0013] Moreover, the shaft thrust bearing means, discharging the forces mainly on the diffusers, may damage the diffusers.

[0014] In addition, in the known pumps the tube connected to the delivery body may become unscrewed either during pump use due to the vibrations produced or due to incorrect revolutions by the motor connected to the pump.

[0015] Also, for correct pump operation, it is important to maintain the relative position of the various pump components, and in particular the stages, which must not move either longitudinally or transversally, and cannot tolerate relative rotations.

[0016] The Applicant has found that several aspects of the pumps of the type described above can be improved, in particular with regard to their stiffness and hydraulic seal.

[0017] The aim of the present invention is therefore to propose a pump which can overcome the above-mentioned disadvantages.

[0018] In particular the aim of the present invention is to propose a pump which can guarantee optimum compactness of the hydraulic stages and eliminate leaks between the jacket and the intake and delivery bodies.

[0019] Another aim of the present invention is to provide a pump which allows the elimination of possible damage to the diffusers caused by the thrust bearing means mounted on the shaft and/or facilitates the removal and refitting of the non-return valve.

[0020] These aims and others which are more apparent in the description that follows are achieved by a submersible centrifugal pump with the characteristics described in claim 1 and in the dependent claims.

[0021] Further features and the advantages of the present invention are more clearly illustrated in the detailed description which follows of a preferred, non-limiting embodiment of a submersible centrifugal pump according to the present invention.

[0022] The description refers to the accompanying drawings, provided by way of example only, without limiting the scope of the inventive concept, in which:

- Figure 1 is a plan view of a pump made in accordance with the present invention;
- Figure 2 is a first longitudinal section of the pump according to the line II - II illustrated in Figure 1;
- Figure 3 is a second longitudinal section of the pump according to the line III - III illustrated in Figure 1;
- Figure 4 is an exploded top view of an alternative embodiment of the pump, with some parts cut away to better illustrate others;
- Figure 5 is an exploded bottom view of the alternative embodiment illustrated in Figure 4;
- Figure 6 is a detail of the pump illustrated in Figure 2 relative to the clamping means; and
- Figure 7 is a detail of the pump illustrated in Figure 2 relative to the thrust bearing means.

[0023] With reference to the accompanying drawings, the numeral 1 denotes as a whole a submersible centrifugal pump according to the present invention. By way of example, the accompanying drawings illustrate a pump with a diameter of approximately 15 cm, or 6 inches.

[0024] The pump 1 comprises a containment jacket 2, preferably cylindrical, a shaft 3 with a hexagonal cross-section (usually polygonal so that the various components can be keyed to it) extending inside the containment jacket 2 along a longitudinal axis "X", and which can be connected to a motor, for example an electric motor (not illustrated).

[0025] The pump 1 also comprises a delivery body 4 connected to the containment jacket 2 at its outfeed 2b (with reference to the direction in which the fluid flows) and an intake body 5 which supports a first end 3a of the shaft 3, connected to a jacket 2 infeed 2a.

[0026] Inside the jacket 2 close to its outfeed 2b, there is an outfeed sector 6 designed to support a second end 3b of the shaft 3. The sector 6 consists of a tube 7 in contact with the internal walls of the jacket 2 and a domed structure 8 inside the tube 7 to which it is connected by a plurality of tabs 9. The domed structure 8 houses the second end 3b of the shaft 3.

[0027] The jacket 2 houses at least one hydraulic stage 10 comprising an impeller 11 keyed to the shaft 3 and a fixed diffuser 12 contained in a supporting tube 13 to which it is attached by tabs 14.

[0028] The delivery body 4 is a tubular structure located at the jacket 2 outfeed 2b and is connected to the latter by a circumferential weld. A sleeve 15, which forms a pump 1 outfeed pipe 46 and allows the connection of a threaded tube (not illustrated) to the pump 1, is also

present at the top of the delivery body 4 (although in the embodiment illustrated the sleeve 15 is an integral part of the delivery body 4, in other embodiments it may be a separate element). For this reason there is a thread on the inner side surface 16 of the sleeve 15. There is also an opening 17 in the sleeve 15 for a grub screw 17a which prevents the pump 1 from rotating relative to the tube, coming unscrewed and detaching.

[0029] Inside the delivery body 4 there is a non-return valve 22 smaller than the outfeed pipe 46 so that it can be inserted in the delivery body 4 through said pipe 46. The non-return valve 22 is then held in position by a supporting element 47 removably attached to the delivery body 4. Moreover, there is preferably a helical spring (not illustrated) acting on the non-return valve to guarantee that it closes with a predetermined force. In the embodiment illustrated (Figures 2 and 3) the supporting element comprises a diffuser 18, having a central hole, which is connected to the delivery body 4 by a plurality of tabs 19 which are connected to a ring nut 20 secured to the delivery body 4 by an elastic stop ring 21 (alternatively, it may be secured by screwing, although this solution is not illustrated). The non-return valve in turn comprises a cylindrical support 23 slidably inserted in the central hole in the diffuser 18, and a closing plate 24 whose centre is fixed to the cylindrical support 23. The plate 24 with the cylindrical support 23 is mobile between an open position, in which the plate 24 is raised and allows the liquid to pass (not illustrated), and a closed position, in which the plate 24 is resting on a projection 25 inside the delivery body 4 (Figures 2 and 3). Said projection 25 is preferably fitted with a seal 26 which, in the valve 22 closed position, is between the projection 25 and the plate 24, guaranteeing the hydraulic seal.

[0030] The intake body 5 consists of a tube with, at its first end, a flange 27a needed to connect the pump 1 to a motor and, at its second end, opposite the first, a flange 27b needed to connect the intake body 5 to the jacket 2. The tube also has lateral slits 5a allowing the liquid to enter the pump 1. The intake body 5 is connected to the jacket 2 by clamping means 28 located between the intake body 5 and the jacket 2 which, as well as connecting the two parts, are essential for compressing the hydraulic stages 10 between the intake body 5 and the delivery body 4, thus preventing longitudinal movements by the diffusers 12. Said clamping means 28 comprise at least one screw 29 or one tie rod (not illustrated).

[0031] In the embodiment illustrated, there are four screws 29 located around the circumference in a cross shape, having the longitudinal axis "Y" parallel with the axis "X" of the shaft 3. The screws, in particular, are tightened in a ring-shaped structure 30 in turn fixed to the jacket 2. In the embodiment illustrated, (Figure 6), the ring-shaped structure 30 is inserted in the jacket 2 and is held in it by a stop ring 31 inserted in a groove 48 made in the lower end 2a of the jacket 2.

[0032] A cup-shaped body 32 covers the lower part of each stage 10, and comprises a tubular structure 33 en-

compassing the impeller 11 and having an upper edge connected to the diffuser 12, and a ring-shaped surface 34 forming the bottom of the cup-shaped body 32. The ring-shaped surface 34 connects, along its inner edge 49, with the relative impeller 11 to guarantee the hydraulic seal.

[0033] The tubular structure 33 guarantees that the hydraulic stages 10 are contained as a pack in the pump 1, whilst the ring-shaped surface 34 prevents the stages 10 from moving transversally and rotating relative to one another. The ring-shaped surface is modelled in such a way that it has on its base three equidistant circular arc protrusions 35 on the same circle, between them delimiting the three seats 36 designed to hold projections 37, 39 on the upstream element (diffuser 12 or closing ring 38). Two hydraulic stages 10 are connected by placing at least one extension 37 of at least one tab 14 in the seats 36 of the next stage. The first stage 10 is connected to the closing ring 38 at the intake body (in particular between the cup-shaped body 32 of the first stage 10 and the flange 27b of the intake body 5) by positioning three of the ring 38 teeth 39 in the seats 36 in the cup-shaped body 32 of the first stage 10.

[0034] The outfeed sector 6 also has similar seats 6a delimited by similar protrusions 6b, and designed to receive the extensions 37 of the diffuser 12 of the last stage 10. On the delivery body 4 there is at least one tooth 4a which rests in a seat not illustrated in the accompanying drawings.

[0035] Correct positioning of each diffuser 12 relative to the cup-shaped body 32 of the relative hydraulic stage 10 is guaranteed by three small teeth 50 on the inside made in the tubular structure 33 of the cup-shaped body 32 and designed to connect with three recesses 51 made in the diffuser 12 (in particular in the tube 13 which houses it).

[0036] The seats 36, 6a, the recesses 51, the extensions 37, the teeth 39, 4a, and the small teeth 50 constitute means designed to prevent the delivery body 4, the outfeed sector 6, the stages 10, the closing ring and the intake body 5 from moving transversally and rotating relative to one another. Tightening the screws 29 brings the intake body 5 and the ring-shaped structure closer together and the latter transfers the action exerted by the screws 29 to the jacket 2 thanks to a shear action applied to the elastic stop ring 31. Moreover, the intake body 5 flange 27b pushes the closing ring 38 against the cup-shaped body 32 (Figure 6) which, by means of its tubular structure 33, transfers the axial action to the relative diffuser, which then transmits it to the subsequent stages as far as the sector 6. In this way, the hydraulic stages 10 are compressed between the intake body 5 and the delivery body 4, eliminating any longitudinal play possible. Finally, thanks to the fact that the extensions 37 and the teeth 39 snap into the seats 36, 6a, immobilisation of the stages in the direction transversal to the axis "X" and prevention of their rotation are also guaranteed.

[0037] Advantageously, in the preferred embodiment,

the individual parts may be sized in such a way as to guarantee optimum calibrated clamping when the intake body 5 rests against the jacket 2 as illustrated in Figure 6. In this way, the pump can be disassembled and reassembled several times without altering the compactness of the stages 10 which is always kept at the ideal level.

[0038] On the first end 3a of the shaft 3 there is a hollow coupling 40 with teeth inside (Figure 7) designed to allow connection of the motor shaft (not illustrated) and the pump 1 shaft 3. Around the coupling 40 there is a thrust bearing washer 41 (advantageously made of anti-friction material) and a support 42 for the washer, both held in place by a metal stop ring 43. These thrust bearing means are inactive and separated from the intake body 5 when the pump 1 operates with a high head (Figure 7), whilst they rest on the intake body 5 when the pump 1 head is low and the shaft 3 with the impellers 11 is raised. In this way, the thrust bearing means prevent excessive axial movements by both the shaft 3 and the impellers 11. The water infeed is at the intake body 5 and is protected by a filter 44 consisting of a cylindrical surface encompassing the side of the intake body and which has many holes in it. Finally, on the outer surface of the delivery body 4, of the jacket 6 and of the intake body 5 there extends a closed channel 45 which houses the motor power cables.

[0039] Figures 4 and 5 illustrate an exploded view of several details of an alternative embodiment of the pump 1 with the presence of a single hydraulic stage 10. The delivery body 4, the outfeed sector 6, the diffuser 12, the impeller 11, the cup-shaped structure 32, the ring 38 and the intake body 5 are all visible.

[0040] Assembly of the pump 1 involves firstly connection of the delivery body 4 to the jacket 2 by welding. Then, all of the internal parts are assembled on the intake body 5 and all inserted together in the jacket 2. At this point the intake body 5 is removed and the ring-shaped structure 30 and relative elastic stop ring 31 are inserted in the jacket. Then the intake body 5 is fitted again and the first end 3a of the shaft 3, with the coupling 40, is inserted in the body 5. Then the screws 29 are positioned and the entire structure is closed, clamping and compressing the hydraulic stages 10. Finally, the thrust bearing washer 41 and the relative ring-shaped support 42 are placed on the coupling 40 and secured with the elastic ring 43.

[0041] The pump 1 is connected to the tube by screwing together a threaded end of the tube with the sleeve 15 and locking the connection with the grub screw 17a positioned in the opening 17.

[0042] The non-return valve 22 can be removed by simply removing the supporting element 47, unscrewing the ring nut 20 and taking out the valve 22.

[0043] The present invention achieves the preset aims and brings important advantages.

[0044] Firstly, the advantages of a pump configured in this way are basically linked to the compactness guaranteed by tightening the four screws which push the intake body 5 against the hydraulic stages, holding them

firmly against the delivery body 4. This eliminates the diffuser 12 play, preventing possible faulty operations and vibrations. Moreover, where necessary, the clamping can be given a predetermined optimum intensity.

[0045] In the embodiment illustrated, special means prevent unwanted relative transversal movements and relative rotations by the pump 1 components, giving the pump 1 a high level of stiffness.

[0046] In addition, the absence of threads on the jacket prevents liquid leaks, avoiding deterioration of pump operation. Moreover, since the delivery body 4 is welded on the pump 1, the connection between the tube and the pump 1 is simply guaranteed by the sleeve 15 thread and the grub screw 17a: this guarantees more simple assembly and does not have a negative affect on the delivery body 4 seal. Another advantage is the simple extraction of the non-return valve 22, which can even be removed by unskilled personnel.

[0047] Finally, a significant advantage is provided thanks to the absence of threads on the delivery body 4, on the jacket 2 and on the intake body 5, threads which in conventional pumps reduce the internal working cross-section of the pump and therefore give the pump greater hydraulic losses and less structural stiffness.

Claims

1. A submersible centrifugal pump, comprising:

- a containment jacket (2);
- a shaft (3) inserted in the jacket (2), with the possibility of connection to a motor;
- a delivery body (4) connected to a jacket (2) outfeed (2b);
- a plurality of stages (10) each comprising an impeller (11) keyed on the shaft (3) and a fixed diffuser (12);
- an intake body (5) mounted at a jacket (2) in-feed (2a);
- means (28) for clamping the intake body (5) on the jacket (2) to compress said stages (10), between the delivery body (4) and the intake body (5);

said clamping means (28) consisting of at least one screw (29) or one tie rod mounted between the intake body (5) and the jacket (2);

the pump being **characterised in that** it also comprises stopping means (4a, 6a, 14, 36, 37, 39, 50, 51) which stop transversal movements and relative rotations of at least the delivery body (4), the stages (10) and the intake body (5).

2. The pump according to claim 1, **characterised in that** the clamping means (28) also comprise a ring-shaped structure (30) located in the jacket (2) and held in the jacket (2) by an elastic stop ring (31).

3. The pump according to claim 2, **characterised in that** the clamping means (28) is engaged in the ring-shaped structure (30) and in the intake body (5).

5 4. The pump according to any of the foregoing claims, **characterised in that** the delivery body (4) is welded to the jacket (2).

10 5. The pump according to claim 1, **characterised in that** the stop means (4a, 6a, 14, 36, 37, 39, 50, 51) comprise at least one extension (37) of a first stage (10) which engages in a seat (36) made in a second, adjacent stage (10).

15 6. The pump according to any of the foregoing claims, also comprising an outfeed sector (6) for supporting a second end (3b) of the shaft (3).

20 7. The pump according to claims 6, **characterised in that** the stop means (4a, 6a, 14, 36, 37, 39, 50, 51) comprise at least an extension (37) of a first stage (10) which engages in a seat (6a) made in the out-feed sector (6).

25 8. The pump according to any of the foregoing claims, also comprising a closing ring (38) located between a stage (10) and the intake body (5).

30 9. The pump according to claim 8, **characterised in that** the stop means (4a, 6a, 14, 36, 37, 39, 50, 51) comprise at least one tooth (39) made on the ring (38) and engaging in a seat (36) made in the stage (10).

35 10. The pump according to any of the foregoing claims, **characterised in that** each stage (10) also comprises a cup-shaped body (32) positioned in the lower part of the stage (10).

40 11. The pump according to claim 10, **characterised in that** the cup-shaped body (32) comprises a tubular structure (33) connected to the diffuser (12) and transmitting the forces necessary for containing the stages (10), as a pack between the intake body (5) and the delivery body (4).

45 12. The pump according to claim 11, **characterised in that** the cup-shaped body (32) also comprises a ring-shaped surface (34) forming the bottom of the cup-shaped structure (32).

50 13. The pump according to claim 12, **characterised in that** the stop means (4a, 6a, 14, 36, 37, 39, 50, 51) comprise at least one seat (36) made in the ring-shaped surface (34).

55 14. The pump according to any of the foregoing claims, also comprising a coupling (40) located on a first end

- (3a) of the shaft (3) to connect the shaft (3) to the shaft of a motor.
15. The pump according to claim 14, also comprising thrust bearing means (41, 42, 43) for limiting axial movements of the shaft (3), said means being connected to the first end (3a).
16. The pump according to claim 15, **characterised in that** the shaft (3) thrust bearing means (41, 42, 43) comprise at least a thrust bearing washer (41) supported by a ring-shaped support (42) connected to the shaft (3), being designed to engage when pushed against the intake body (5) in the event of shaft (3) axial lifting.
17. The pump according to any of the foregoing claims, **characterised in that** the jacket (2) has an internal cross-section that is substantially constant along the axis (X).
18. The pump according to any of the foregoing claims, also comprising:
- a supporting element (47) in the delivery body; and
 - a non-return valve (22) supported by the supporting element (47).
19. The pump according to claim 18, **characterised in that** the supporting element (47) comprises:
- a ring nut (20) secured to the delivery body (4);
 - a diffuser (18);
 - a plurality of tabs (19), for connecting the diffuser (18) to the ring nut (20).
20. The pump according to claim 19, **characterised in that** the non-return valve (22) comprises a cylindrical support (23) slidably inserted in the diffuser (18) and a closing plate (24) whose centre is fixed to the cylindrical support (23).
21. The pump according to claim 19 or 20 **characterised in that** the ring nut (20) is secured to the delivery body (4) by an O-ring (21) or by screwing.
22. The pump according to any of the claims from 18 to 21, **characterised in that** the non-return valve (22) can be removed through a delivery body (4) outfeed pipe (46) by taking out the supporting element (47).
23. The pump according to any of the claims from 18 to 22 also comprising a spring mounted between the supporting element (47) and the non-return valve (22) for applying a predetermined valve (22) closing force.

24. The pump according to any of the foregoing claims, **characterised in that** the delivery body (4) also comprises a threaded sleeve (15) for connection of a tube.

25. The pump according to claim 24, **characterised in that** the sleeve (15) also comprises means (17, 17a) for securing the tube.

26. The pump according to claim 25, **characterised in that** the means for securing the tube comprise at least a grub screw (17a) inserted in an opening (17) made in the side wall of the sleeve (15).

Patentansprüche

1. Zentrifugaltauchpumpe, enthaltend:

- einen Aufnahmemantel (2);
- eine in den Mantel (2) eingesetzte Welle (3), mit der Möglichkeit des Anschlusses an einen Motor;
- einen Förderkörper (4), angeschlossen an einen Ausgang (2b) des Mantels (2);
- eine Anzahl von Stufen (10), jede enthaltend ein Laufrad (11), das auf die Welle (3) aufgezogen ist, und einen feststehenden Diffusor (12);
- einen Ansaugkörper (5), montiert an einem Eingang (2a) des Mantels (2);
- Mittel (28) zum Befestigen des Ansaugkörpers (5) an dem Mantel (2), um die genannten Stufen (10) zwischen dem Förderkörper (4) und dem Ansaugkörper (5) zu komprimieren; wobei die genannten Befestigungsmittel (28) aus wenigstens einer Schraube (29) oder einer Zugstange bestehen, montiert zwischen dem Ansaugkörper (5) und dem Mantel (2);

wobei die Pumpe **dadurch gekennzeichnet ist, dass** sie ebenfalls Blockiermittel (4a, 6a, 14, 36, 37, 39, 50, 51) enthält, welche die Bewegungen in Querrichtung und die entsprechenden Umdrehungen von wenigstens dem Förderkörper (4), den Stufen (10) und dem Ansaugkörper (5) verhindern.

2. Pumpe nach Patentanspruch 1, **dadurch gekennzeichnet, dass** die Befestigungsmittel (28) ebenfalls eine ringförmige Struktur (30) enthalten, die in dem Mantel (2) angeordnet ist und in dem Mantel (2) durch einen elastischen Anschlagring (31) gehalten wird.

3. Pumpe nach Patentanspruch 2, **dadurch gekennzeichnet, dass** die Befestigungsmittel (28) in die ringförmige Struktur (30) und in den Ansaugkörper (5) greifen.

4. Pumpe nach einem beliebigen der vorstehenden Patentansprüche, **dadurch gekennzeichnet, dass** der Förderkörper (4) an den Mantel (2) angeschweisst ist.
5. Pumpe nach Patentanspruch 1, **dadurch gekennzeichnet, dass** die Blockiermittel (4a, 6a, 14, 36, 37, 39, 50, 51) wenigstens eine Verlängerung (37) einer ersten Stufe (10) enthalten, welche in einen Sitz (36) greift, der in eine zweite angrenzende Stufe (10) eingearbeitet ist.
6. Pumpe nach einem beliebigen der vorstehenden Patentansprüche, ebenfalls enthaltend einen Austrittsabschnitt (6) zum Halten eines zweiten Endes (3b) der Welle (3).
7. Pumpe nach Patentanspruch 6, **dadurch gekennzeichnet, dass** die Blockiermittel (4a, 6a, 14, 36, 37, 39, 50, 51) wenigstens eine Verlängerung (37) einer ersten Stufe (10) enthalten, welche in einen Sitz (6a) greift, der in den Austrittsabschnitt (6) eingearbeitet ist.
8. Pumpe nach einem beliebigen der vorstehenden Patentansprüche, ebenfalls enthaltend einen Schliessring (38), angeordnet zwischen einer Stufe (10) und dem Ansaugkörper (5).
9. Pumpe nach Patentanspruch 8, **dadurch gekennzeichnet, dass** die Blockiermittel (4a, 6a, 14, 36, 37, 39, 50, 51) wenigstens einen Zahn (39) enthalten, vorgesehen an dem Ring (38) und in einen Sitz (36) greifend, der in die Stufe (10) eingearbeitet ist.
10. Pumpe nach einem beliebigen der vorstehenden Patentansprüche, **dadurch gekennzeichnet, dass** jede Stufe (10) ebenfalls einen schalenförmigen Körper (32) enthält, positioniert in dem unteren Teil der Stufe (10).
11. Pumpe nach Patentanspruch 10, **dadurch gekennzeichnet, dass** der schalenförmige Körper (32) eine rohrförmige Struktur (33) aufweist, angeschlossen an den Diffusor (12) und die Kräfte übertragend, die notwendig sind, um die Stufen (10) wie ein Paket zwischen dem Ansaugkörper (5) und dem Förderkörper (4) zu halten.
12. Pumpe nach Patentanspruch 11, **dadurch gekennzeichnet, dass** der schalenförmige Körper (32) ebenfalls eine ringförmige Oberfläche (34) enthält, welche den Boden der schalenförmigen Struktur (32) bildet.
13. Pumpe nach Patentanspruch 12, **dadurch gekennzeichnet, dass** die Blockiermittel (4a, 6a, 14, 36, 37, 39, 50, 51) wenigstens einen Sitz (36) enthalten, eingearbeitet in die ringförmige Oberfläche (34).
14. Pumpe nach einem beliebigen der vorstehenden Patentansprüche, ebenfalls enthaltend eine Kupplung (40), die an einem ersten Ende (3a) der Welle (3) angeordnet ist, um die Welle (3) mit der Welle eines Motors zu verbinden.
15. Pumpe nach Patentanspruch 14, **dadurch gekennzeichnet, dass** sie Drucklagermittel (41, 42, 43) enthält, um die axialen Bewegungen der Welle (3) zu begrenzen, wobei die genannten Mittel an das erste Ende (3a) angeschlossen sind.
16. Pumpe nach Patentanspruch 15, **dadurch gekennzeichnet, dass** die Drucklagermittel (41, 42, 43) der Welle (3) wenigstens eine Drucklager-Unterlegscheibe (41) enthalten, getragen durch eine ringförmige Halterung (42), die an die Welle (3) angeschlossen und dazu bestimmt ist, im Falle des axialen Anhebens der Welle (3) gegen den Ansaugkörper (5) zu drücken.
17. Pumpe nach einem beliebigen der vorstehenden Patentansprüche, **dadurch gekennzeichnet, dass** der Mantel (2) einen internen Querschnitt hat, der entlang der Achse (X) im wesentlichen konstant ist.
18. Pumpe nach einem beliebigen der vorstehenden Patentansprüche, ebenfalls enthaltend:
- ein Halteelement (47) in dem Förderkörper; und
 - ein Rückschlagventil (22), getragen von dem Halteelement (47).
19. Pumpe nach Patentanspruch 18, **dadurch gekennzeichnet, dass** das Halteelement (47) enthält:
- eine Ringmutter (20), gesichert an dem Förderkörper (4);
 - einen Diffusor (18);
 - eine Anzahl von Flügeln (19) zum Befestigen des Diffusors (18) an der Ringmutter (20).
20. Pumpe nach Patentanspruch 19, **dadurch gekennzeichnet, dass** das Rückschlagventil (22) eine zylindrische Halterung (23) enthält, gleitbar eingesetzt in den Diffusor (18), und eine Schliessplatte (24), deren Mitte an der zylindrischen Halterung (23) befestigt ist.
21. Pumpe nach Patentanspruch 19 oder 20, **dadurch gekennzeichnet, dass** die Ringmutter (20) an dem Förderkörper (4) durch einen O-Ring (21) oder durch Verschrauben gesichert ist.
22. Pumpe nach einem beliebigen der Patentansprüche

von 18 bis 21, **dadurch gekennzeichnet, dass** das Rückschlagventil (22) durch eine Ausgangsleitung (46) des Förderkörpers (4) entfernt werden kann, indem das Halteelement (47) herausgenommen wird.

23. Pumpe nach einem beliebigen der Patentansprüche von 18 bis 22, ebenfalls enthaltend eine Feder, die zwischen dem Halteelement (47) und dem Rückschlagventil (22) montiert ist, um eine vorgegebene Schliesskraft des Ventils (22) zu übertragen.
24. Pumpe nach einem beliebigen der vorstehenden Patentansprüche, **dadurch gekennzeichnet, dass** der Förderkörper (4) ebenfalls eine Gewindemuffe (15) für den Anschluss eines Rohres enthält.
25. Pumpe nach Patentanspruch 24, **dadurch gekennzeichnet, dass** die Muffe (15) ebenfalls Mittel (17, 17a) zum Sichern des Rohres enthält.
26. Pumpe nach Patentanspruch 25, **dadurch gekennzeichnet, dass** die Mittel zum Sichern des Rohres wenigstens einen Gewindestift (17a) enthalten, eingesetzt in eine Öffnung (17), die in die Seitenwand der Muffe (15) eingearbeitet ist.

Revendications

1. Une pompe centrifuge submersible, comprenant :
 - une chemise d'enveloppement (2) ;
 - un arbre (3) inséré dans la chemise (2), avec possibilité de raccordement à un moteur ;
 - un corps de refoulement (4) associé à une sortie (2b) de la chemise (2) ;
 - une pluralité d'étages (10) comprenant chacun une roue (11) calée sur l'arbre (3) et un diffuseur fixe (12) ;
 - un corps d'aspiration (5) monté au niveau d'une entrée (2a) de la chemise (2) ;
 - des moyens (28) pour serrer le corps d'aspiration (5) sur la chemise (2) afin de comprimer lesdits étages (10) entre le corps de refoulement (4) et le corps d'aspiration (5) ; lesdits moyens de serrage (28) étant constitués d'au moins une vis (29) ou d'un tirant montés entre le corps d'aspiration (5) et la chemise (2) ;
 la pompe étant **caractérisée en ce qu'elle** comprend aussi des moyens d'arrêt (4a, 6a, 14, 36, 37, 39, 50, 51) qui bloquent les mouvements transversaux et rotations relatives d'au moins le corps de refoulement (4), les étages (10) et le corps d'aspiration (5).
2. La pompe selon la revendication 1, **caractérisée en ce que** les moyens de serrage (28) comprennent

aussi une structure annulaire (30) située dans la chemise (2) et maintenue dans ladite chemise (2) par un anneau élastique d'arrêt (31).

3. La pompe selon la revendication 2, **caractérisée en ce que** les moyens de serrage (28) sont en prise avec la structure annulaire (30) et le corps d'aspiration (5).
4. La pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce que** le corps de refoulement (4) est soudé à la chemise (2).
5. La pompe selon la revendication 1, **caractérisée en ce que** les moyens d'arrêt (4a, 6a, 14, 36, 37, 39, 50, 51) comprennent au moins un prolongement (37) d'un premier étage (10) qui vient en prise dans un logement (36) réalisé dans un deuxième étage (10) adjacent.
6. La pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'elle** comprend aussi un secteur de sortie (6) servant à supporter une deuxième extrémité (3b) de l'arbre (3).
7. La pompe selon la revendication 6, **caractérisée en ce que** les moyens d'arrêt (4a, 6a, 14, 36, 37, 39, 50, 51) comprennent au moins un prolongement (37) d'un premier étage (10) qui vient en prise dans un logement (6a) réalisé dans le secteur de sortie (6).
8. La pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'elle** comprend aussi une bague de fermeture (38) située entre un étage (10) et le corps d'aspiration (5).
9. La pompe selon la revendication 8, **caractérisée en ce que** les moyens d'arrêt (4a, 6a, 14, 36, 37, 39, 50, 51) comprennent au moins une dent (39) réalisée sur la bague (38) et venant en prise dans un logement (36) réalisé dans l'étage (10).
10. La pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce que** chaque étage (10) comprend aussi un corps (32) en forme de coupe disposé dans la partie inférieure de l'étage (10).
11. La pompe selon la revendication 10, **caractérisée en ce que** le corps (32) en forme de coupe comprend une structure tubulaire (33) associée au diffuseur (12) et transmettant les forces nécessaires pour contenir les étages (10) en paquet entre le corps d'aspiration (5) et le corps de refoulement (4).
12. La pompe selon la revendication 11, **caractérisée en ce que** le corps (32) en forme de coupe comprend aussi une surface annulaire (34) définissant le fond

de cette même structure (32) en forme de coupe.

13. La pompe selon la revendication 12, **caractérisée en ce que** les moyens d'arrêt (4a, 6a, 14, 36, 37, 39, 50, 51) comprennent au moins un logement (36) réalisé dans la surface annulaire (34). 5
14. La pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'elle** comprend aussi un manchon de jonction (40) situé sur une première extrémité (3a) de l'arbre (3) pour accoupler l'arbre (3) lui-même avec l'arbre d'un moteur. 10
15. La pompe selon la revendication 14, **caractérisée en ce qu'elle** comprend aussi des paliers de butée (41, 42, 43) servant à limiter les mouvements axiaux de l'arbre (3), lesdits paliers de butée étant associés à la première extrémité (3a). 15
16. La pompe selon la revendication 15, **caractérisée en ce que** les paliers de butée (41, 42, 43) de l'arbre (3) comprennent au moins une rondelle de butée (41) supportée par un support annulaire (42) associé à l'arbre (3) et destinée, en poussée, à venir se placer contre le corps d'aspiration (5) en cas de soulèvement axial dudit arbre (3). 20
17. La pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la chemise (2) a une section transversale intérieure qui est essentiellement constante le long de l'axe (X). 30
18. La pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'elle** comprend aussi : 35
 - un élément de support (47) situé dans le corps de refoulement ; et
 - un clapet de non-retour (22) supporté par ledit élément de support (47). 40
19. La pompe selon la revendication 18, **caractérisée en ce que** l'élément de support (47) comprend : 45
 - une bague (20) fixée au corps de refoulement (4) ;
 - un diffuseur (18);
 - une pluralité d'ailettes (19) servant à associer le diffuseur (18) à la bague (20). 50
20. La pompe selon la revendication 19, **caractérisée en ce que** le clapet de non-retour (22) comprend un support cylindrique (23) inséré de façon coulissante dans le diffuseur (18) et une plaque de fermeture (24) dont le centre est fixé audit support cylindrique (23). 55
21. La pompe selon la revendication 19 ou 20, **caracté-**

risée en ce que la bague (20) est fixée au corps de refoulement (4) au moyen d'un joint torique (21) ou par vissage.

22. La pompe selon l'une quelconque des revendications de 18 à 21, **caractérisée en ce que** le clapet de non-retour (22) peut être enlevé à travers un conduit de sortie (46) du corps de refoulement (4) en déposant l'élément de support (47). 10
23. La pompe selon l'une quelconque des revendications précédentes de 18 à 22, **caractérisée en ce qu'elle** comprend aussi un ressort monté entre l'élément de support (47) et le clapet de non-retour (22) pour appliquer une force prédéfinie de fermeture dudit clapet (22). 15
24. La pompe selon l'une quelconque des revendications précédentes, **caractérisée en ce que** le corps de refoulement (4) comprend aussi un manchon fileté (15) pour le raccordement d'un tube. 20
25. La pompe selon la revendication 24, **caractérisée en ce que** le manchon (15) comprend aussi des moyens (17, 17a) de blocage du tube. 25
26. La pompe selon la revendication 25, **caractérisée en ce que** les moyens de blocage du tube comprennent au moins une vis sans tête (17a) introduite dans une ouverture (17) réalisée dans la paroi latérale du manchon (15). 30

FIG 1

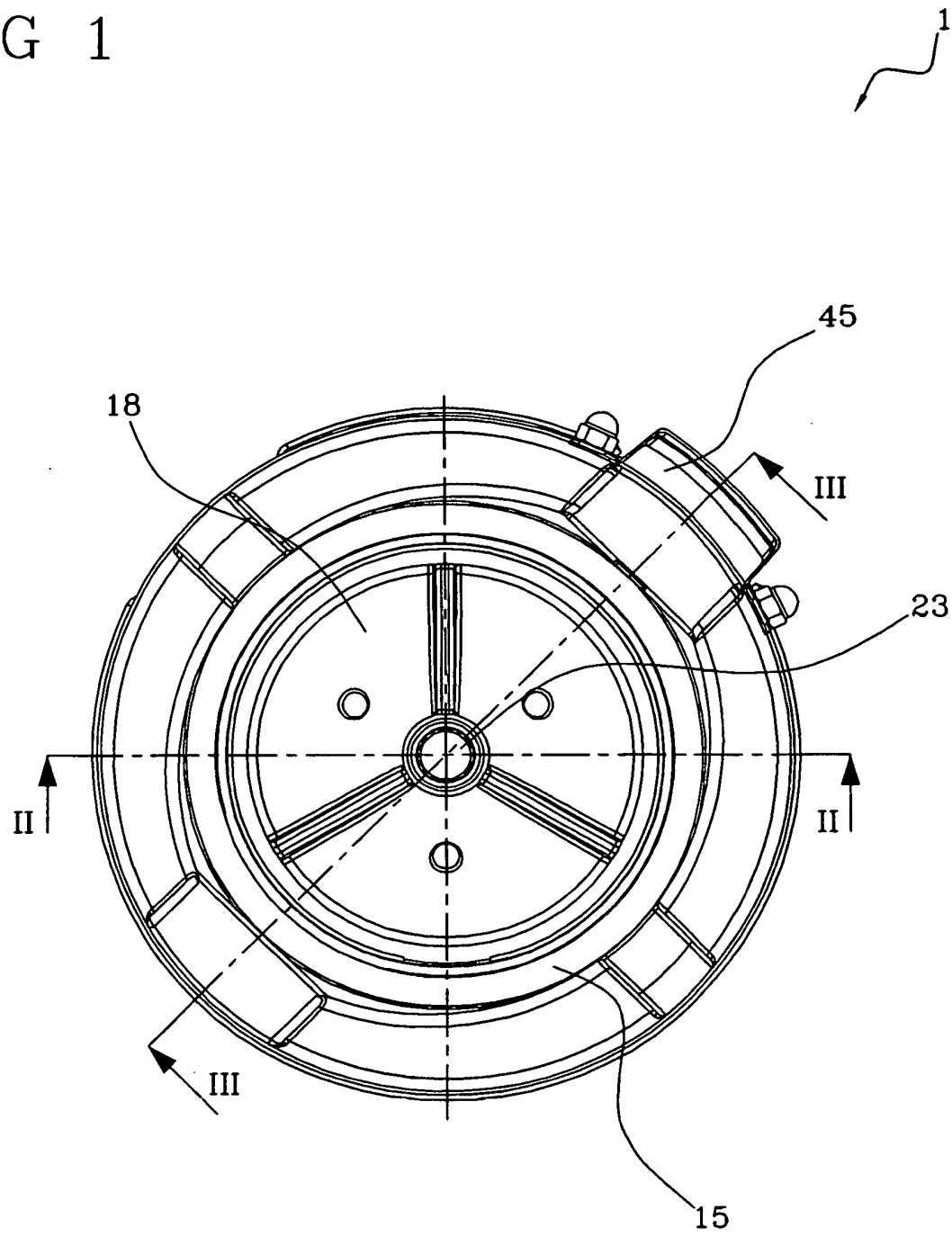


FIG 2

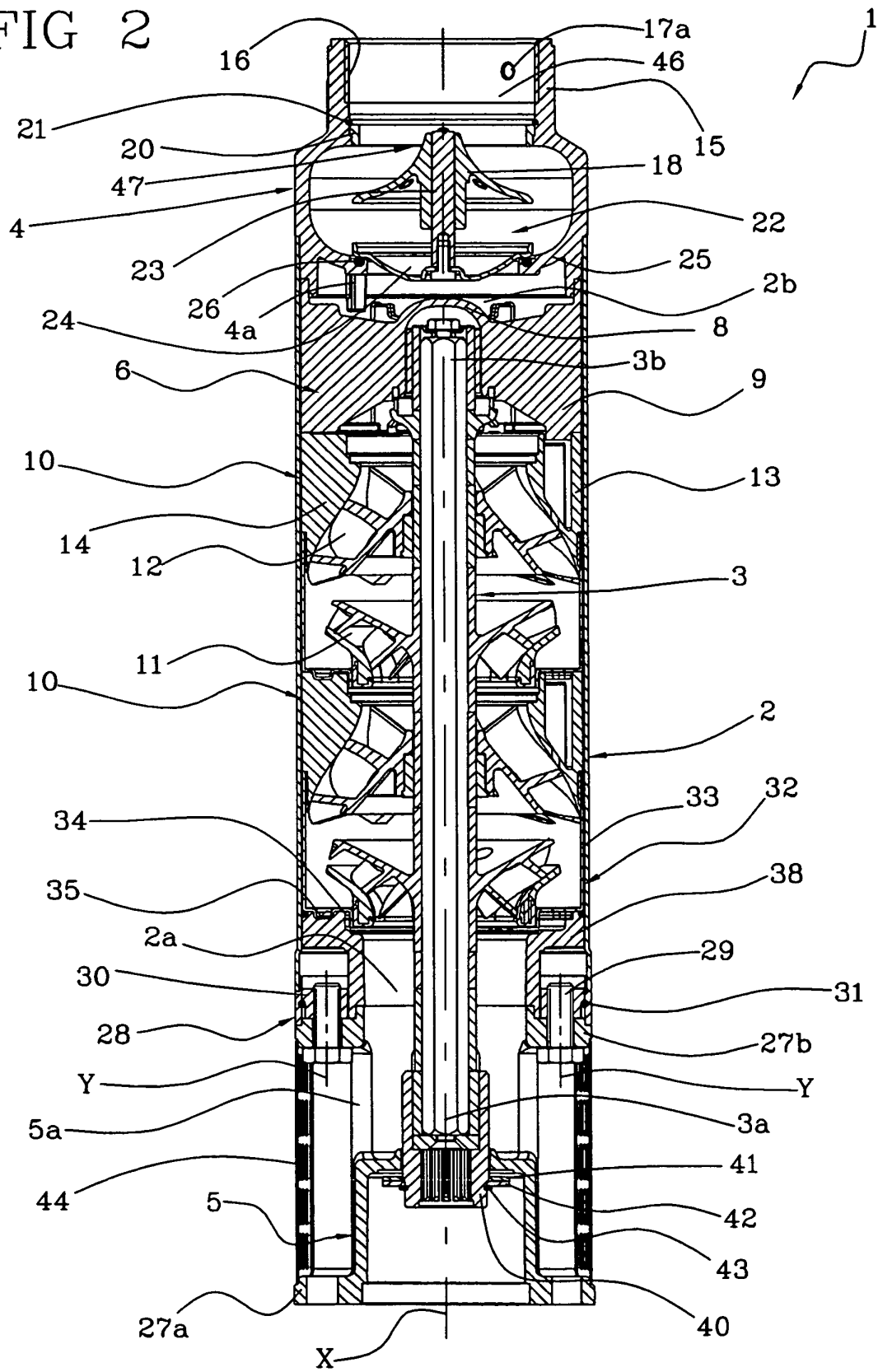


FIG 3

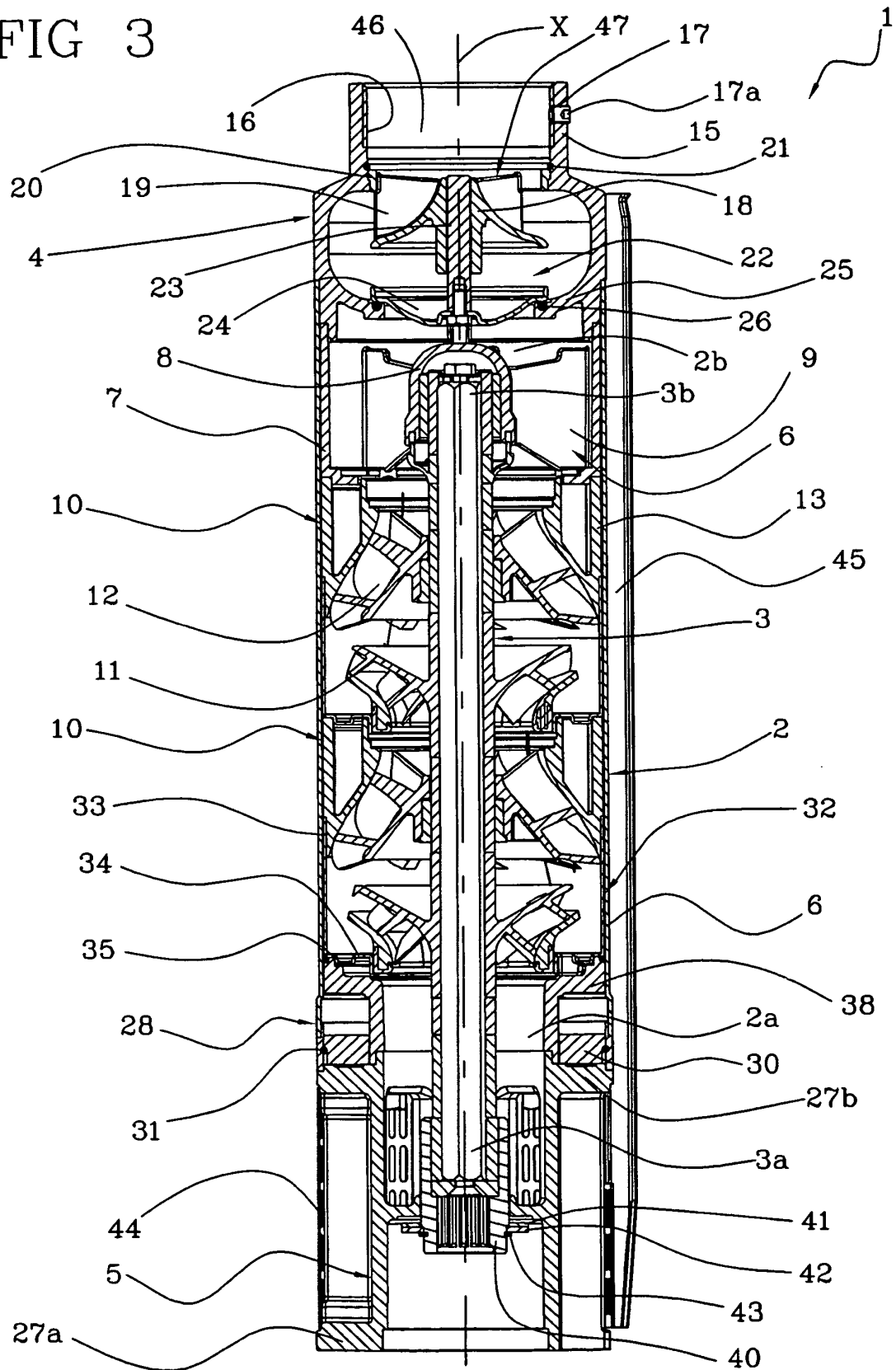


FIG 4

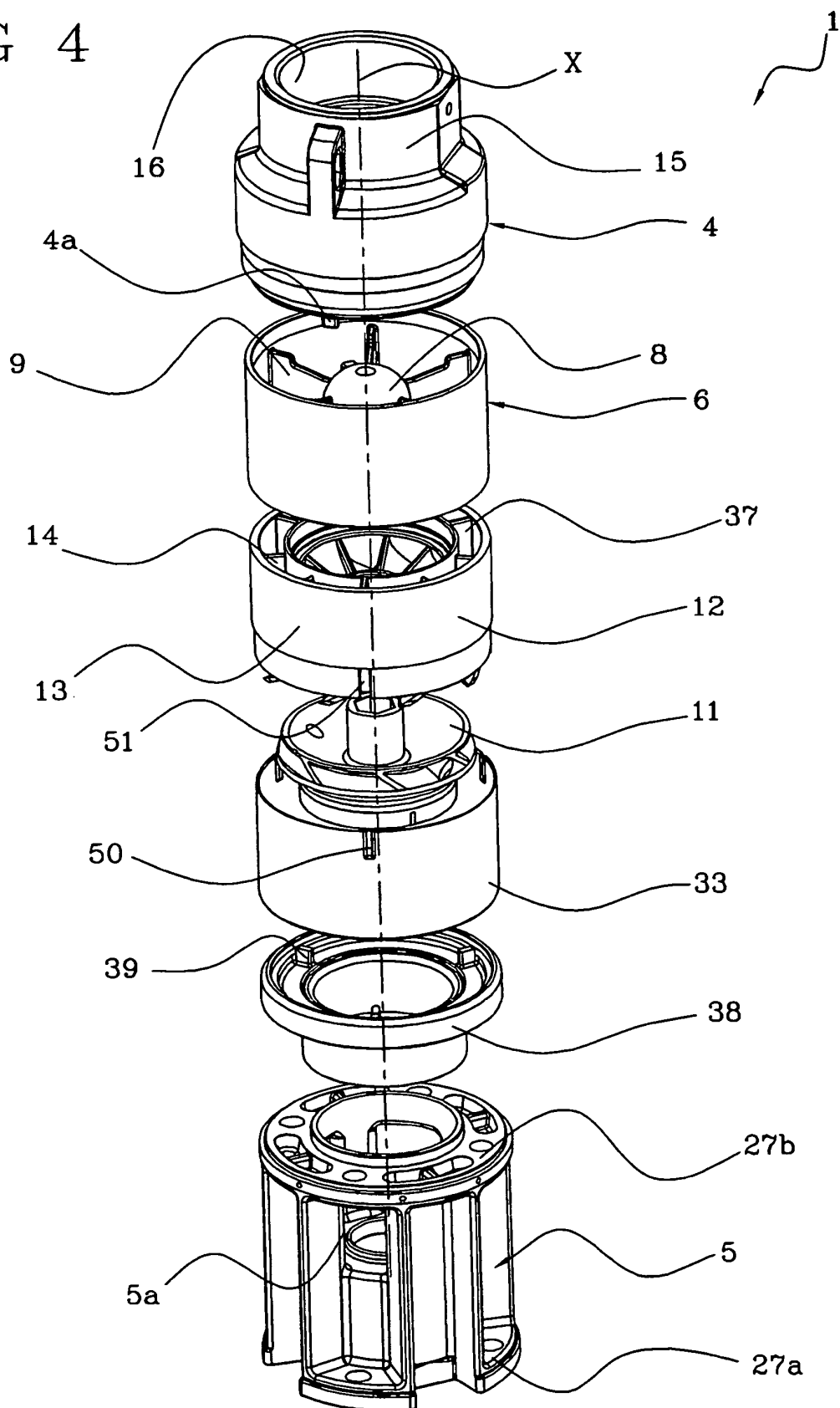


FIG 5

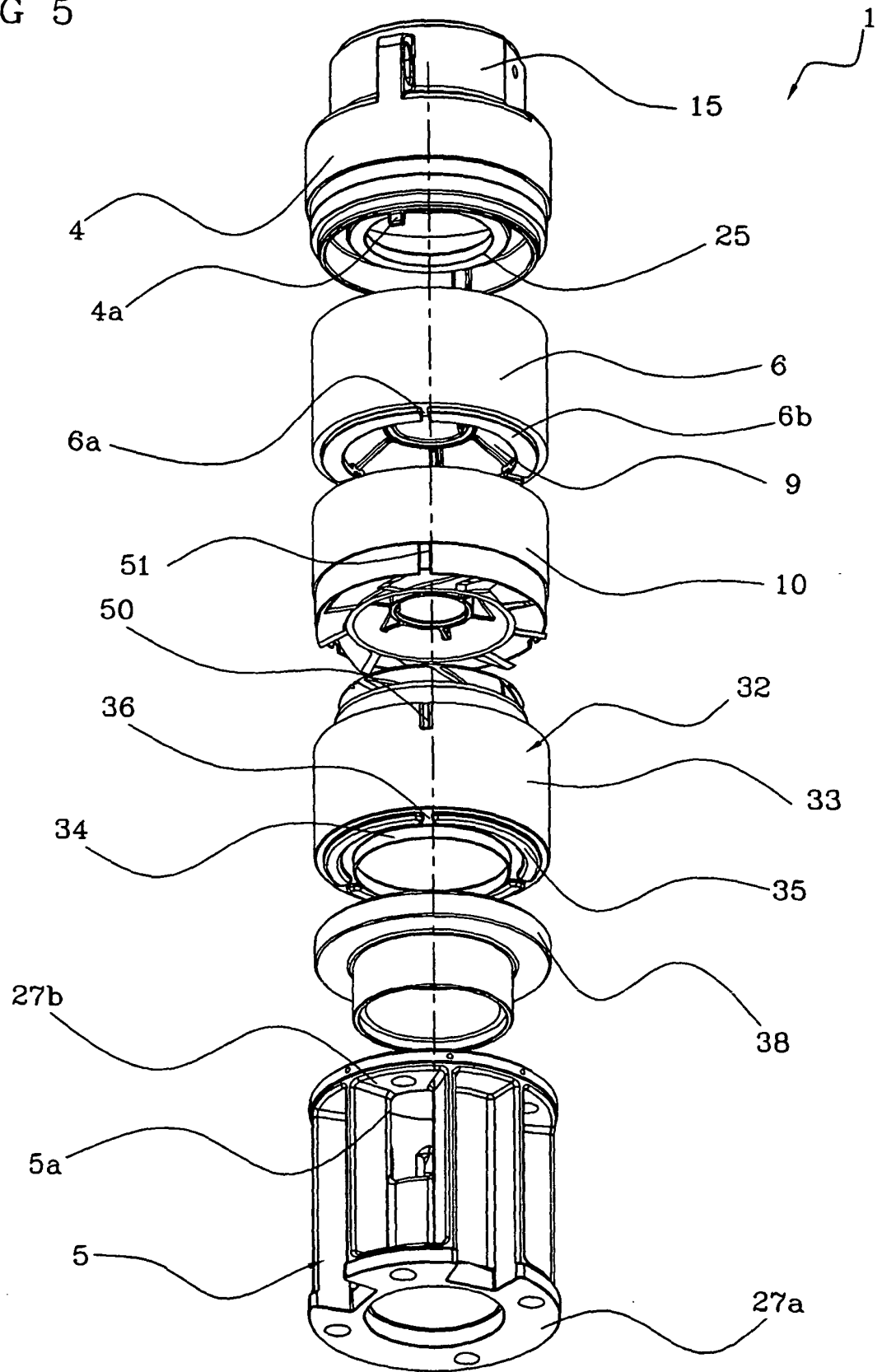


FIG 6

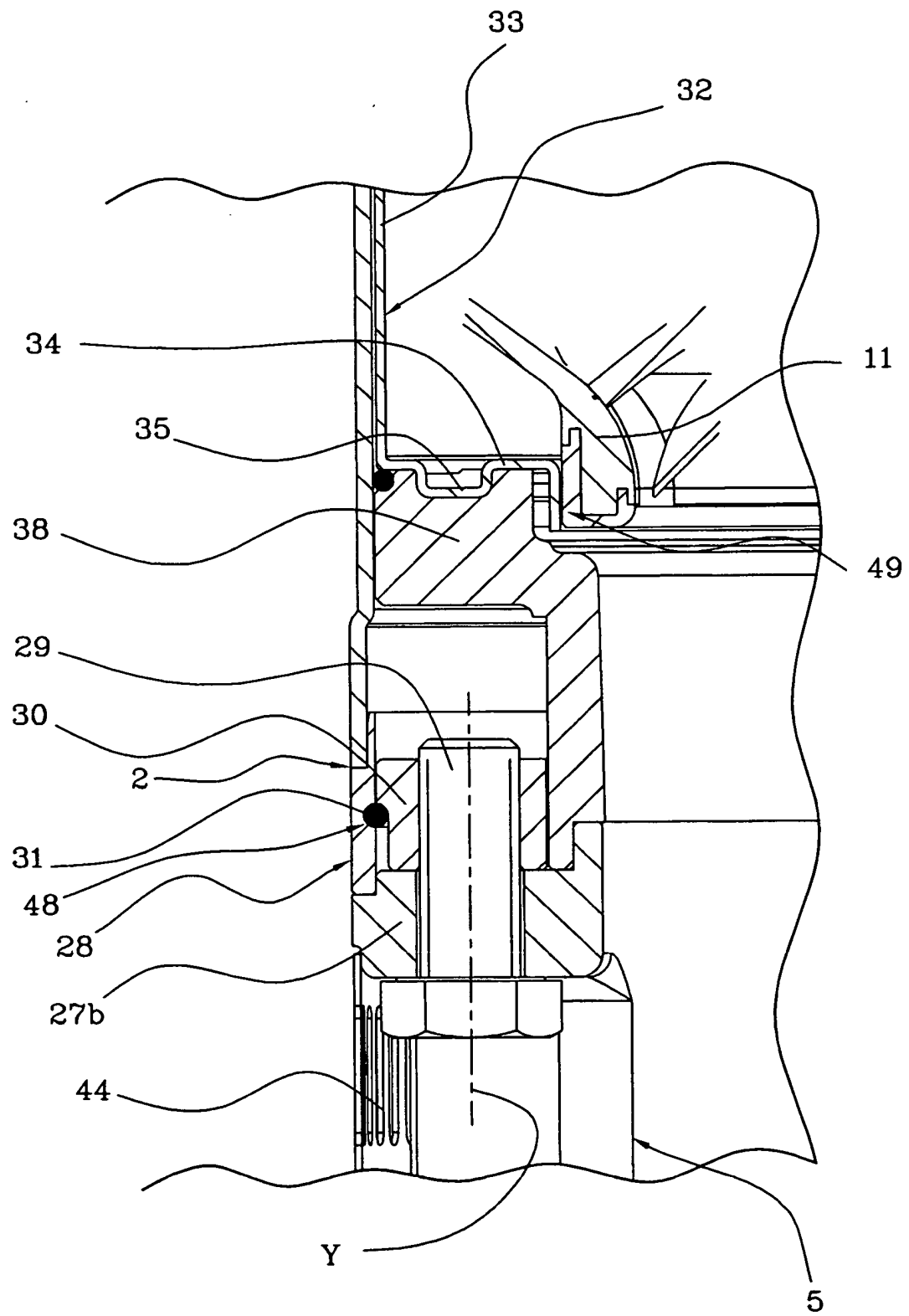
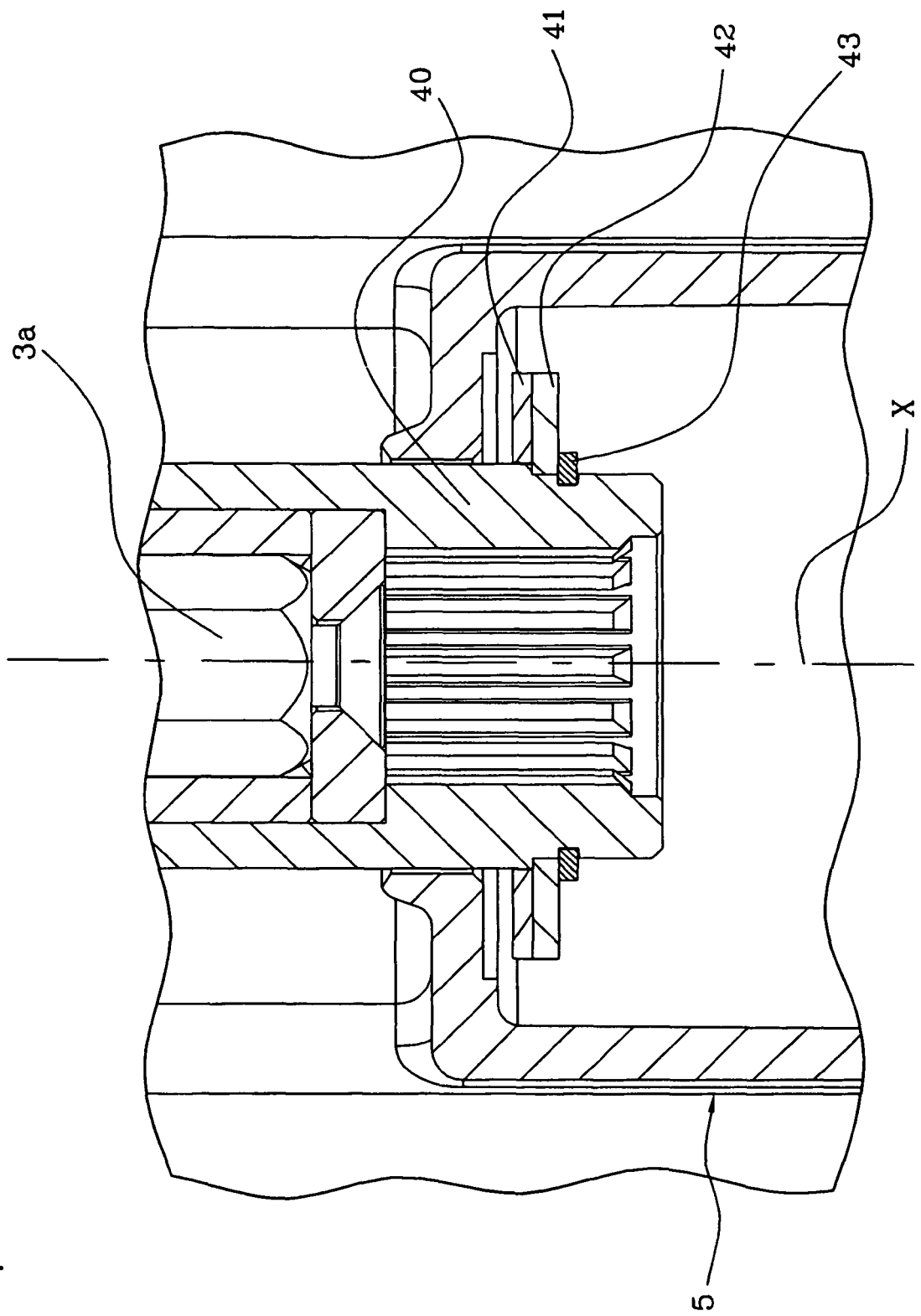


FIG 7



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0267445 A [0007]
- EP 0774584 A [0008]
- US 4523899 A [0009]