(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 972 789 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.09.2008 Bulletin 2008/39

(51) Int Cl.:
F04D 7/04 *(2006.01)* ***F04D 29/42*** *(2006.01)*
F04D 29/62 *(2006.01)*

(21) Application number: **07104825.0**

(22) Date of filing: **23.03.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

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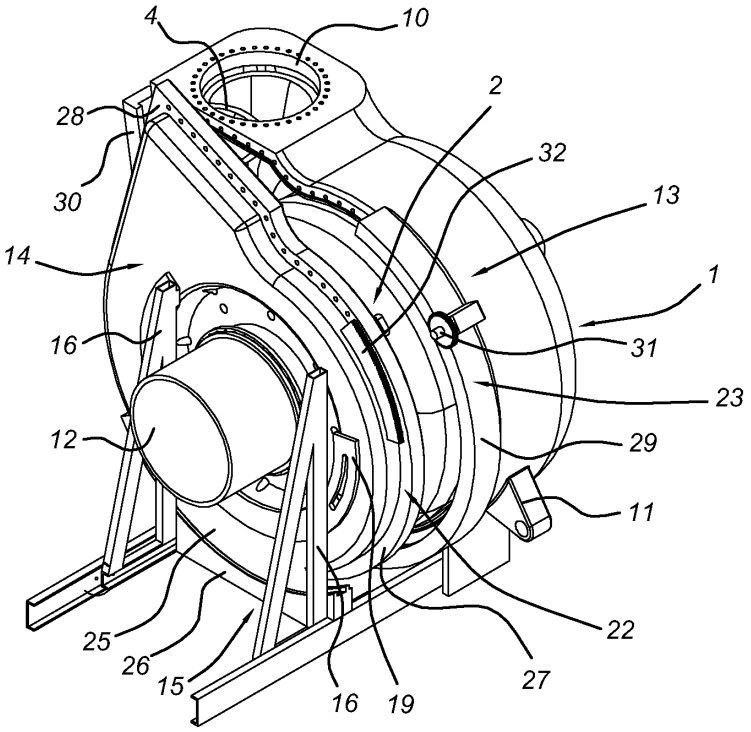
(54) **Centrifugal pump comprising a spiral shape mounting arrangement**

(57) The above mentioned invention is related to a centrifugal pump, comprising an outer casing (1), an inner casing (2) contained in the outer casing (1), an impeller (5) rotatably supported around a central axis (24) within the inner casing, an inlet (3) concentrically arranged with respect to the impeller (5) as well as a tangential outlet (4), said outer casing (1) comprising a cup shaped part (13), a cover part (14) as well as a mounting arrangement by means of which said cover part (14) is mounted onto the cup shaped part (13), wherein the mounting arrangement comprises mounting means with co-acting spiral shapes associated with the cup shaped part (13) and of the cover part (14), in such a way that a mutual rotation of mounting means around the axis in one direction provides for a mutually fixed position of said parts, and a mutual rotation of mounting means around the axis in the opposite direction provides for a mutually detached position of said parts.

Fig 4



EP 1 972 789 A1

Description

[0001] The invention is related to a centrifugal pump comprising an outer casing, an inner casing contained in the outer casing, an impeller rotatably supported around a central axis within the inner casing, an inlet concentrically arranged with respect to the impeller as well as a tangential outlet, said outer casing comprising a cup shaped part , a cover part as well as a mounting arrangement by means of which said cover part is mounted onto the cup shaped part.

[0002] Such a centrifugal pump is generally known. The cup shaped part and the cover part thereof usually comprise a mounting flanges at their external periphery. These flanges are provided with holes, through which bolts are inserted for clamping the cup shaped part and the cover part onto each other. Having regard to the high internal pressures and the appreciable loads which are exerted on the outer casing, a relatively large number of bolt connections is required so as to reliably connect the parts to each other. This however poses a disadvantage in case maintenance is required of the centrifugal pump, in particular of the impeller or the inner casing thereof. Said inner casing for instance is exposed to high abrasive influences as a result of the dredging or mining material which is transported at a high pressure and at a high-speed. Therefore, the inner casing should be replaced from time to time. The same is true for the impeller and the wear plates mounted inside the outer casing next to the impeller, which are exposed to the same wear phenomena as well. For the purpose of getting access to these components, the outer casing has to be opened which means that all bolt connections have to be removed. This is a tedious and time consuming labour.

[0003] The object of the invention is therefore to provide a centrifugal pump of the type described before which has the advantage of allowing a quick and ready access to the components within the outer casing. Said object is achieved in that the mounting arrangement comprises mounting means having co-acting spiral shapes, said mounting means being associated with the cup shaped part and with the cover part, in such a way that a mutual rotation of said mounting means around the axis in one direction provides for a mutually fixed position of said cup shaped part and said cover part, and a mutual rotation of said mounting means around the axis in the opposite direction provides for a mutually detached position of said cup shaped part and said cover part.

[0004] In the centrifugal pump according to the invention, use is made of the general shape of the mounting means, which shape has a spiral character. This spiral character is inherent to the very functioning of a centrifugal pump, which means that the mounting arrangement can be included in a very convenient way in the design of existing centrifugal pumps. Dependent on the steepness of the spiral shape, the cup shaped part and the cover part can be released from each other after a more or less great mutual rotation of the mounting means.

[0005] The mounting means according to the invention can be carried out in several ways. According to a first possibility, the spiral shapes comprise a spiral shaped radially extending rim on one of the cup shaped part and the cover part and a correspondingly spiral shaped profile with radially inward facing groove on the other of said parts.

[0006] Furthermore, the spiral shapes can extend over various angles of the circumference of the cup shaped part and of the cover part. In a preferred embodiment, the spiral shapes extend over portion, e.g. about three-quarter, of the circumference of the cup shaped part and the circumference of the cover part. Thereby, the cup shaped part and the cover part can be removed from each other in a convenient way, once the spiral shapes have been brought out of the engagement. Preferably, the portion of the circumference of the cup shaped part and of the cover part outside the spiral shapes comprise additional mounting means, such as bolts.

[0007] Having regard to the fact that the outer casing usually comprises a tangentially oriented outlet, it is convenient to provide the rim and the profile with a straight portion in the extension of a corresponding spiral shaped portion. These straight portions of the cup shaped portion and the cover portion are adjacent the tangentially oriented outlet of the outer casing. In particular, said straight portions are tangential to the corresponding spiral shaped portions.

[0008] The spiral shapes need not extend over the full circumference of the cup shaped part and the cover part. In such case removal of the other part from the cup shaped part is made more convenient. In this embodiment therefore, the mutual connection between the rim and the profile is lacking over a portion of the circumference of the cup shaped part and the cover part. However, the outer pump casing should be fully closed so as to withstand the internal overpressures, and therefore the circumference portion of the cup shaped part and the circumference portion of the cover part which extend between the corresponding straight portions and the spiral portions thereof comprise a bolted connection.

[0009] With the aim of facilitating the process of removing the cover apart from the cup shaped part further, the extent in circumferential direction of the rim is larger than the extent in circumferential direction of the profile. Thereby, the cover part, and in particular the rim thereof, is always fully supported irrespective of the rotational position of the cover part with respect to the cup shaped part.

[0010] A further improvement of the process of assembling and disassembling the cup shaped part and the cover part is obtained in case control means are provided for controlling the mutual rotation of the cup shaped part and the cover part. By activating these control means, the need for manual labour in this connection is obviated. The control means can be carried out in various ways, but preferably the control means comprise a tooth gear which is rotatably mounted on one of the cup shaped part and the cover part, as well as a tooth rack which is curved

about the axis on the other of said parts.

[0011] However, the mounting means need not form an integral part of the cup shaped part and the cover part, as described before. Therefore, according to an alternative embodiment, the mounting means may comprise a mounting ring, in which case the spiral shapes may be provided on the mounting ring and on at least one of the cup shaped part and the cover part. In this embodiment, the connection or disconnection of the cup shaped part and the cover part is obtained by mutually rotating the ring and the other part or parts equipped with a spiral shape.

[0012] The step of connecting or disconnecting requires a certain amount of rotation; this amount of rotation can be reduced in case the spiral shapes are comprised of several spiral shapes portions which spiral shapes portions extend over consecutive portions of the circumference of the mounting means.

[0013] An improvement of the process of connecting or disconnecting of the parts can be obtained in case the mounting means comprise a radially outwardly extending rim having a cross section which tapers to a narrow end, and a correspondingly shaped groove.

[0014] The cup shaped part and the cover part described before, the sizes of which depend on the capacity of the pump, are usually of a high mass. The measures described before, such as a the control means for rotating the cover part, make the handling of these massive parts more convenient. During the process of assembling and dissembling however, it is furthermore desirable to support the cover part in an adequate way with respect to the cup shaped part. In this connection, a support structure is preferably provided onto which the cover part is supported rotatably about the axis. With the aim of obtaining the required stability of the support structure, this structure can be connected to the outer casing.

[0015] The cover part is supported with respect to the support structure in the following way. Said cover part is provided with a bottom support sector rim and the support structure comprises a bottom support sector profile within which the bottom support sector ring is slidably accommodated. Alternatively, rollers may be provided for rotatably supporting the lower part. In a practical embodiment, the support structure comprises two A-frames which carry a ring sector provided with slits, and the other part comprises pins which are each slidably accommodated within a corresponding slit. Additionally, the support structure may be movable to and fro, possibly in an automatic fashion, with respect to the outer casing. This facilitates the handling of the cover part further. Once this cover part has been disassembled from the cup shaped part, and supported on the support structure, the cover part can be moved away from the cup shaped part by the support structure. Thus, easy access is obtained to the inner pump casing and impeller. Also, upon assembling of the cover part and the cup shaped part, the support structure can be used as well. Similarly, said support structure plays a role in the process of exchanging the wear plates.

[0016] As has already been mentioned before, the cover part is of a high mass, which is mainly due to the fact that is constructed from a steel material. In order to further facilitate the handling of this cover part, it may comprise a plastic material. In order to gain the required stiffness of such plastic material cover part, at least one reinforcement ring may be provided therein. Also, the cup shaped part may comprise a plastic material.

[0017] The invention will be described further with reference to an embodiment of the centrifugal pump as shown in the drawings.

Figure 1 shows a view on the suction side of an embodiment of the pump according to the invention.
Figure 2 shows a cross-section according to II-II of figure 1.
Figure 3 shows a view in perspective of the pump.
Figure 4 shows a view in perspective of the pump with the cover part detached.
Figure 5 shows a cross-section of the cover part on a larger scale and in more detail, according to V-V of figure 6.
Figure 6 shows an inner view of the cover.
Figure 7 shows a cross-section of the cup shaped part of the outer casing.
Figure 8 shows detail VIII, concerning a seal, of figure 2 on an enlarged scale.
Figure 9 shows a detail concerning the seal of Figure 8 upon removal of the cover part.
Figure 10 shows an embodiment wherein the mounting means comprise a ring.
Figure 11 shows a cross section through a rim and groove of the mounting means.

[0018] The centrifugal pump as shown in figures 1-4 comprises an outer casing 1, in which the inner casing 2 as visible in figures 2 and 4 is contained. Said inner casing 2 has a suction inlet 3, as well as a tangentially oriented outlet 4. An impeller 5, having such an inlet 3, is rotatably supported within the inner casing 2 around axis 24 by means of a drive shaft 6. Said drive shaft 6 in turn is rotatably mounted in a support (not shown), and connected to a drive motor (not shown).

[0019] Similarly, the outer casing 1 has an outer casing inlet opening 7 which is coaxial to the inlet 3 of the impeller 5. Opposite the outer casing, inlet opening 7, the outer casing 1 has a shaft opening 8 through which the drive shaft 6 extends. By means of the lid 9, the drive shaft 6 is sealed with respect to the outer casing 1. Furthermore, the outer casing 1 has a tangentially oriented outer casing outlet opening 10, which is coaxial to the outlet 4 of the inner casing 2. Mounting supports 11 are arranged on the outer casing 1 so as to support the pump, for instance with respect to the deck of a ship. A pipe 12 (only the extreme end of which is shown in the figures) is positioned at a certain distance from the centrifugal pump 1. By means of an intermediate pipe piece (not shown), said

pipe 12 can be connected to the inlet opening 7 of the outer casing 1, as shown in figure 4, and in particular to the suction mouth wear ring 68 which by means of the suction seal 69 is sealed with respect to the impeller 5. As will be clear, said intermediate pipe piece has been removed so as to enable the displaced position of the cover part 14 shown in figure 4.

[0020] The outer casing 1 consists of a cup shaped part 13 and a generally flat cover part 14. The mounting supports 11 addressed before are attached to said cup shaped part 13. The cover part 14 is supported, e.g. with respect to the deck of the ship, by means of the support structure 15. This support structure 15 comprises two A-frames 16, which by means of rollers 17 are displaceable to and fro on the rails 18. Onto the A-frames 16, a ring sector 19 is mounted which is concentric with respect to the axis 24. Said ring sector 19 comprises slits 20, within which pins 21 mounted on the cover part 2 are supported. Additionally, the cover part 2 comprises a bottom support sector rim 25 which is concentric with respect to the axis 24. Said bottom support sector rim 25 in turn is slidably held within bottom support sector profile 26, which has in cross-section a radially inward oriented U-shape. Thereby, the cover part 2 is rotatably supported around axis 24 between the fitted position shown in figures 1, 2 and 3, and the rotated, detached position as shown in figure 4. Also, the support structure 15 can be used to support the cover part 14 for moving said cover part 14 to, and fitting it to, the cup shaped part 13. A wear plate 62 and a shoulder plate 66 are connected to the inner surface of the cover part 14, next to the impeller 2.

[0021] As shown in figure 4, the cover part 14 comprises a radially outward facing closure rim 22 which is positioned behind the bottom support sector rim 25 (see figure 2). Said closure rim 22 is part of a slight spiral shape with respect to the axis 24, and comprises a spiral shaped portion 27 extending over about 270 degrees with respect to the axis 24, and a straight portion 28. The spiral shaped portion 27 ends at the top of the cover portion 2 which adjoins the outlet opening 10 in the cup shaped part 1. Furthermore, the closure rim 22 comprises a flange portion 57 which extends between the spiral shaped portion 27 and the straight portion 28, at the location of the tangential outlet 4. Said mounting flange is provided with a series of holes 58, the purpose of which will be described below.

[0022] The cup shaped part 13 is provided with a profile 23 of a similar spiral and straight shape, which profile 23 defines, as seen in figure 2, a U-shaped cross-section facing radially inward and defining a groove 33. Said profile has a spiral shaped portion 29 and a straight portion 30. As is clear from the figures 1-4, the profile does not extend over the full circumference of the cup shaped part 13. In particular, the circumferential portion 59 extending between the spiral shaped portion 29 of the profile 23, and the straight portion 30 of the profile 23, lacks said profile. Instead, said circumferential portion 59 comprises screw threaded holes, the purpose of which will be described below. A tooth wheel 31 is rotatably mounted on the spiral shaped part 29 of the profile 23, and a corresponding arc shaped tooth rack 32 is mounted on the cover part 14. Said tooth rack 32 is concentric with respect to the axis 24. A wear plate 63 and shoulder plate 67 are connected to the cup shaped part 13, next to the impeller.

[0023] Subsequently, the process of mounting the cover part 14 with respect to the cup shaped part 13 will be described, starting from figure 4. From the position as shown in figure 4, the cover part 2 is moved towards the cup shaped part 13 by means of the support structure 15. In this process, the rim 22 of the cover part 14 can move past the profile 23 of the cup shaped part 13, having regard to the rotated position of the cover part 14. Once the cover part 14 abuts the cup shaped part 13, and the tooth wheel 31 and the tooth rack 32 have come into engagement, the cover part 14 can be rotated. This rotation is obtained by rotating the tooth wheel 31, e.g. by means of an electric motor (not shown), whereby the tooth rack 32 together with the cover part 14 is rotated. The rim 22 of the cover part 14 now becomes gradually engaged in the groove 33 of the profile 23, whereby in particular the spiral shaped portion 27 of the rim 22 is moved into the spiral shaped portion 29 of the profile 23, and the straight portion 28 of the rim 22 is moved into the straight portion of the profile 23. Finally, bolts 61 are inserted through the holes 58 in the flange portion 57 of the cover part 14, and threaded into the screw threaded holes 60 in circumferential portion 59 of the cup shaped part 13. Thus, a tight connection between the cover part 14 and the cup shaped part 13 is established.

[0024] Disassembling of the cover part 14 from the cup shaped part 13 occurs in the opposite way. After removing the cover part 14, the impeller 5 may be exchanged, if necessary. Also, the wear plate 62 and/or shoulder plate 66 on the inner wall 35 of the cover part 14 may be removed, as well as the wear plate 63 (the latter one after removal of the impeller 2) and/or shoulder plate 67.

[0025] Both the cup shaped part 13 and the other part 14 are carried out in a plastic material. As shown in figure 5, the cover part 14 comprises an inner main wall 35 and an outer main wall 36, between which a core 37 is present which can also be carried out in a plastic material. In the embodiment shown, the inner main wall comprises an integral tubular part 38 (defining the inlet opening 7 of the centrifugal pump) onto which the pipe 12 (see figures 1-4) can be fitted by means of an intermediate pipe piece. Said tubular part 38 extends along and is connected to the opening 46 of the outer main wall 36. The outer main wall 36 comprises an axially extending edge 39 provided with a radially extending flange 40, connected to the corresponding radially extending flange 41 of the inner main wall 35. The flanges 40, 41 together constitute the rim 22 addressed before.

[0026] As a generally flat element such as the present cover part 14 has a limited rigidity with respect to loadings in a direction perpendicular to said element, the reinforce-

ment rings 42, 43 have been provided. The outer reinforcement ring 42 is positioned against the inner surface of the axially extending edge 39, and extends between the the main walls 35, 36. The inner reinforcement ring 43 is positioned against the outer surface of the tubular portion 38, and extends between the outer main wall 36 and a ridge 44 of the inner main wall 35.

[0027] In the embodiment shown, both rings 42, 43 are of a tubular shape, although other shapes are possible as well. The rings 42, 43 comprise a high strength fibre material, such as carbon fibres or glass fibres, which are wound in the circumferential direction. Thereby, the rings 42, 43 provide the cover part 14 with a considerable stiffness, which means that deformations of said cover part 14 under internal overpressure remain within acceptable limits during service of the centrifugal pump in question.

[0028] An important advantage of the cover part 14 according to the present invention is related to the fact that the dimension thereof in axial direction is limited in comparison to the axial dimension of the state of the art steel cover parts. Said steel cover parts are provided with reinforcement rings which extend from the outer main wall thereof, resulting in a considerable axial dimension of said cover part.

[0029] The wear plate 62 and/or shoulder plate 66 may be removed while the cover part 14 is supported by means of the support structure 15.

[0030] As shown in the cross-section of figure 7, the cup shaped part 13 of the outer casing 1 can consist of a plastic material as well. To that end, said cup shape part 13 comprises an outer cup shaped element 50 an inner cup shaped and 51, each having a bottom 52 respectively 53 as well as walls 54 respectively 55. The walls 54, 55 are connected to each other, e.g. by gluing, whereas the bottom is 52, 53 interconnected through a core 56. Furthermore, the profile 23, comprising the inwardly facing U-shaped groove 33, is integral with the outer cup shaped element 50. By means of a connection 47 as contained in the cup shaped part 13 of the outer casing 1, an overpressure can be maintained within said outer casing 1.

[0031] As shown in figures 8 and 9, an inflatable sealing ring 64 is present between the cover part 14 and the cup shaped part 13. Said sealing ring 64 is fitted within a slot 70 of the cup shaped part 13, which slot 70 opens out next to the groove 33 of the profile 23. Said slot 70, together with the sealing ring 64, extends fully around the circumference of the cup shaped part 13, so as to obtain the required tightness of the inner space of the outer casing 1. The sealing ring 64 is a labyrinth type sealing ring having a series of external ridges 71, which seal against the surface of the cover part 14.

[0032] The sealing action of the sealing ring 64 it is obtained by inflating said ring. The step of inflating is obtained by feeding a pressure gas into the internal chamber 65 of the sealing ring 64. In case the cover part 14 is removed from, or applied onto the cup shape part 13, first of all the sealing ring 64 is deflated by letting the pressure gas flow out of the chamber 65. Thus, any damage to the sealing ring 64 which might be caused by the movement of the other part 14, is prevented. The deflated state of the sealing 64 is shown in figure 9, which also shows the cover part 14 rotated in such a way that the spiral shaped portion 27 thereof has just been rotated out of the groove 33 of the profile 23 of the cup shaped part 13.

[0033] In the alternative embodiment of figure 10 a mounting ring 70 has been applied. Within this mounting ring 70, the closure rim 22 of the cover part 14 is accommodated. Furthermore, a closure rim 71 provided around the cup shaped part 13 is also accommodated within the mounting ring 70. To that end, the mounting ring 70 comprises a relatively wide groove 33 in the embodiment shown. Both the groove 33 as well as the closure rims 22 and/or 71 may comprise spiral shapes. By rotating the mounting ring 70 with respect to the cover part 14 and the cup shaped part 13, a connection or disconnection of said parts 13,14 can be obtained, similarly to the embodiment described before.

[0034] In the embodiment of figure 11, which closely resembles the embodiment of figures 1-9, the closure rim 22 of the cover part 14 tapers towards a narrow end. The groove 33 of the cup shaped part 13 is of a similar shape. By means of these tapering shapes, the process of connection and disconnection can be further improved.

[0035] It is to be observed that in the foregoing, spiral shapes have been described which extend about a major part of the circumference of both the cup shaped part 13 as well as of the cover part 14. However, it should be noted that it is also possible to apply several spiral shapes portions in the extension of one another. The advantage of such embodiment is that with the aim of connecting or disconnecting the cover part 14 and the cup shaped part 13 with respect to each other, a limited amount of rotation is necessary. In general, the rotation needed is reduced by one half in case two spiral shapes portions are applied in the extension of one another.

Claims

1. Centrifugal pump, comprising an outer casing (1), an inner casing (2) contained in the outer casing (1), an impeller (5) rotatably supported around a central axis within the inner casing (2), an inlet (3) concentrically arranged with respect to the impeller (5) as well as a tangential outlet (4), said outer casing (1) comprising a cup shaped part (13), a cover part (14) as well as a mounting arrangement by means of which said cover part is mounted onto the cup shaped part (13), **characterised in that** the mounting arrangement comprises mounting means having co-acting spiral shapes (29, 27), said mounting means being associated with the cup shaped part (13) and the cover part (14), in such a way that a mutual rotation of said mounting means around the

axis in one direction provides for a mutually fixed position of said, cup shaped part (13) and said cover part (14) and a mutual rotation of said mounting means around the axis in the opposite direction provides for a mutually detached position of said cup shaped part (13) and said cover part (14).

2. Centrifugal pump according to claim 1, wherein the mounting means comprise a spiral shaped radially extending rim (22) on one of the cup shaped part (13) and the cover part (14) and a correspondingly spiral shaped profile (23) with radially inward facing groove (33) on the other of said parts.

3. Centrifugal pump according to claim 2, wherein the spiral shapes (29, 27) extend over portion, e.g. about three-quarter, of the circumference of the cup shaped part (13) and the circumference of the cover part (14).

4. Centrifugal pump according to claim 3, wherein the circumference portion of the cup shaped part (13) and of the cover part (14) outside the spiral shapes (29, 27) comprise additional mounting means, such as bolts (61).

5. Centrifugal pump according to any of claims 2-4, wherein the rim (22) and the profile (23) each comprise a straight portion (28 respectively 30) in the extension of a corresponding spiral shaped portion (27 respectively 29).

6. Centrifugal pump according to claim 5, wherein the straight portions (28, 30) are tangential to the corresponding spiral shaped portions (27, 29).

7. Centrifugal pump according to claim 5 or 6, wherein the circumference portion of the cup shaped part (13) and the circumference portion of the cover part (14) which extend between the corresponding straight portions (30 respectively 28) and the spiral portions (29 respectively 27) thereof comprise a bolted connection (58, 61).

8. Centrifugal pump according to any of claims 4-7, wherein the extent in circumferential direction of the rim (22) is larger than the extent in circumferential direction of the profile (23).

9. Centrifugal pump according to any of the preceding claims, wherein control means (31, 32) are provided for controlling the mutual rotation of the cup shaped part (13) and the cover part (14).

10. Centrifugal pump according to claim 9, wherein the control means comprise a tooth gear (31) which is rotatably mounted on one of the cup shaped part (13) and the cover part (14), as well as a tooth rack (32) which is curved about the axis (24) on the other of said parts.

11. Centrifugal pump according to claim 1, wherein the mounting means comprise a mounting ring (70), and the spiral shapes (29, 27) are provided on the mounting ring (70) and on at least one of the cup shaped part (13) and the cover part (14).

12. Centrifugal pump according to claim 11, wherein the spiral shapes (29, 27) are provided on the mounting ring (70) and on both the cup shaped part (13) and the cover part (14).

13. Centrifugal pump according to any of the preceding claims, wherein the spiral shapes are comprised of several spiral shape portions which spiral shape portions extend over consecutive portions of the circumference of the mounting means.

14. Centrifugal pump according to any of the preceding claims, wherein the mounting means comprise a radially outwardly extending rim having a cross section which tapers to a narrow end, and a correspondingly shaped groove.

15. Centrifugal pump according to any of the preceding claims, wherein the cover part (14) comprises a plastic material.

16. Centrifugal pump according to claim 15, wherein the cover part (14) comprises at least one reinforcement ring (42, 43).

17. Centrifugal pump according to any of the preceding claims, wherein the cup shaped part (13) comprises a plastic material.

18. Centrifugal pump according to any of the preceding claims, wherein a wear plate (62) is provided on the inner surface of the cover part (14).

19. Centrifugal pump according to any of the preceding claims, wherein a wear plate (63) is provided on the inner surface of the cup shaped part (13).

20. Centrifugal pump according to claim 19 and 19, wherein shoulder plates (66, 67) are provided between the respective wear plates (62, 63) and the inner casing (2).

21. Centrifugal pump according to any of the preceding claims, comprising a sealing ring (64) between the cup shaped part (13) and the cover part(14), wherein said sealing ring (64) is expandable.

22. Centrifugal pump according to claim 21, wherein the sealing ring (64) comprises an internal chamber (65)

which can be connected to a fluid source for inflating the sealing ring (64).

23. In combination, a centrifugal pump according to any of the preceding claims, as well as a support structure (15) for supporting the cover part (14) rotatably about the axis (24).

24. Combination according to claim 23, wherein the support structure (15) is connectable to the outer casing (1).

25. Combination according to claim 23 or 24, wherein the cover part (14) is provided with a bottom support sector rim (25) and the support structure (15) comprises a bottom support sector profile (26) within which the bottom support sector ring (25) can be slidably or rotatably accommodated.

26. Combination according to any of claims 23-25, wherein the support structure (15) comprises two A-frames which carry a ring sector (19) provided with slits (20), and the other part (14) comprises pins (21) which can each be slidably accommodated within a corresponding slit (20).

27. Combination according to any of claims 23-26, wherein the support structure (15) is movable to and fro with respect to the outer casing (1).

28. Use of the support structure (15) according to any of claims 23-27 for mounting or dismounting the cover part (14) with respect to the cup shaped part (13).

29. Use according to claim 28, wherein a wear plate (62) and/or a shoulder plate (66) is removed or changed while the dismounted cover part (14) is supported by means of the support structure (16).

Fig 1

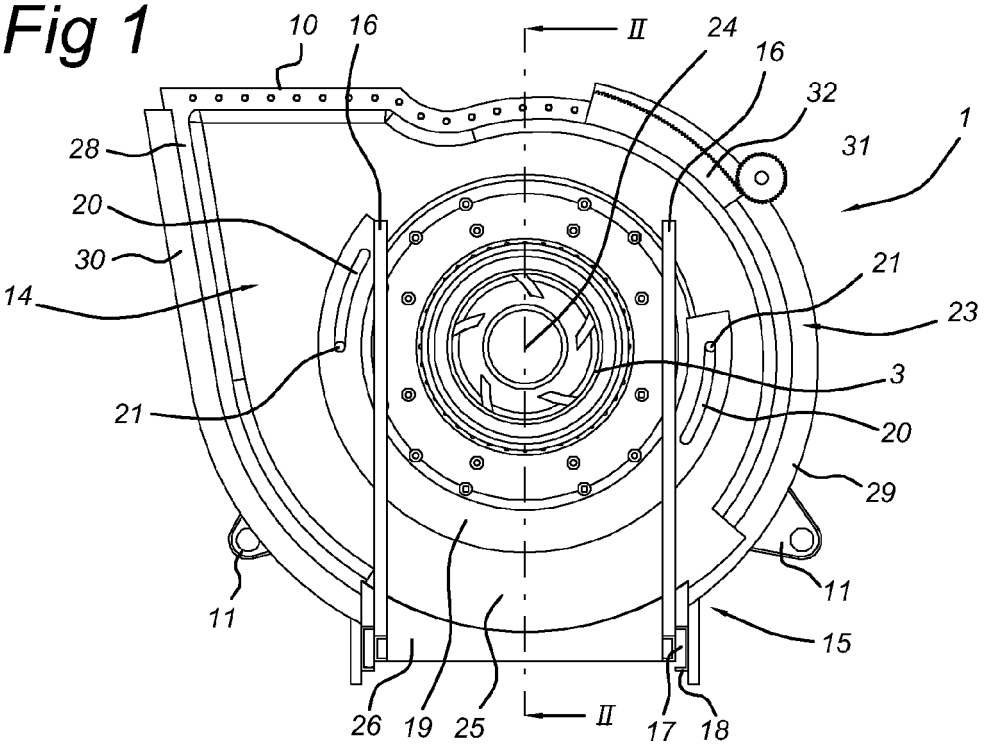

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Fig 2

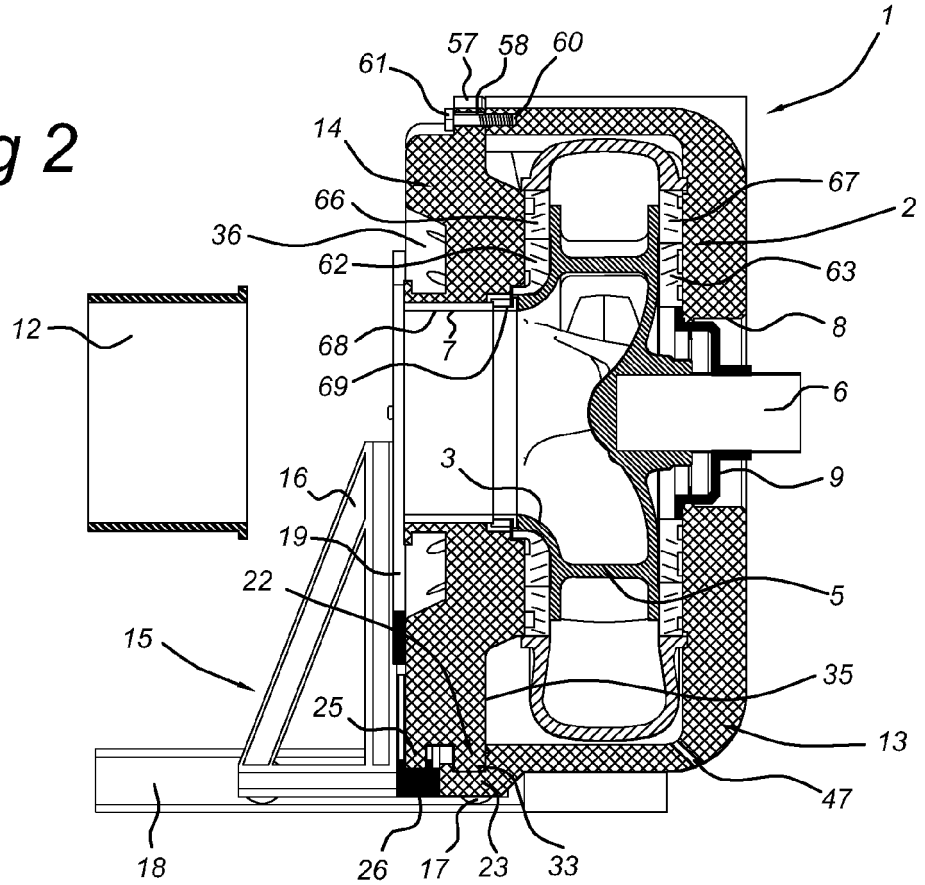
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Fig 3

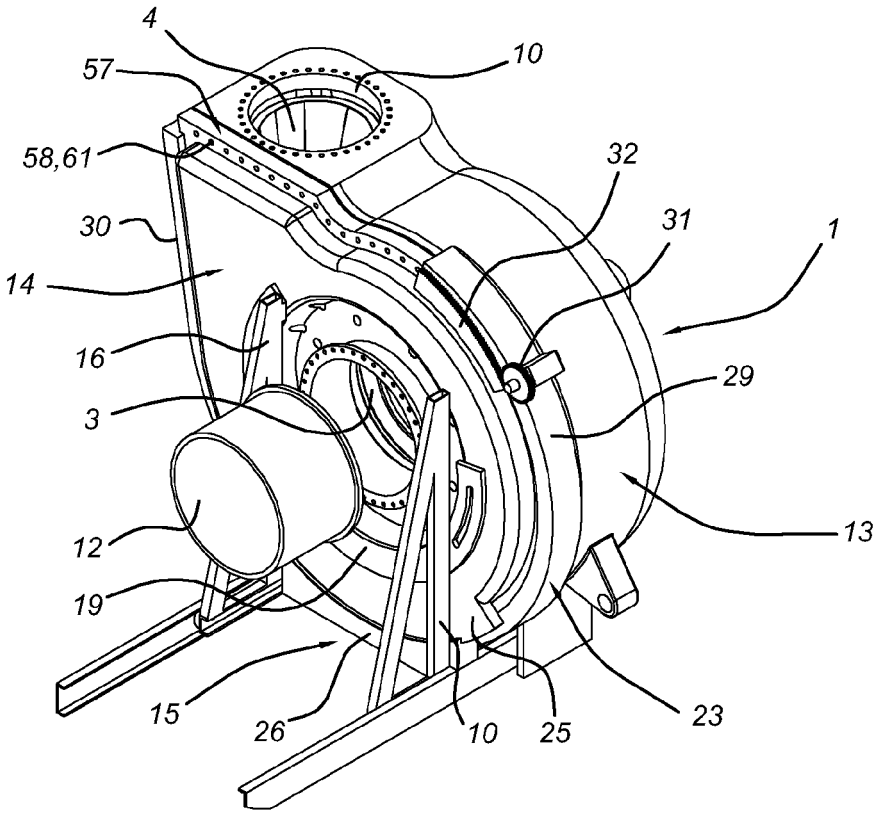
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Fig 4

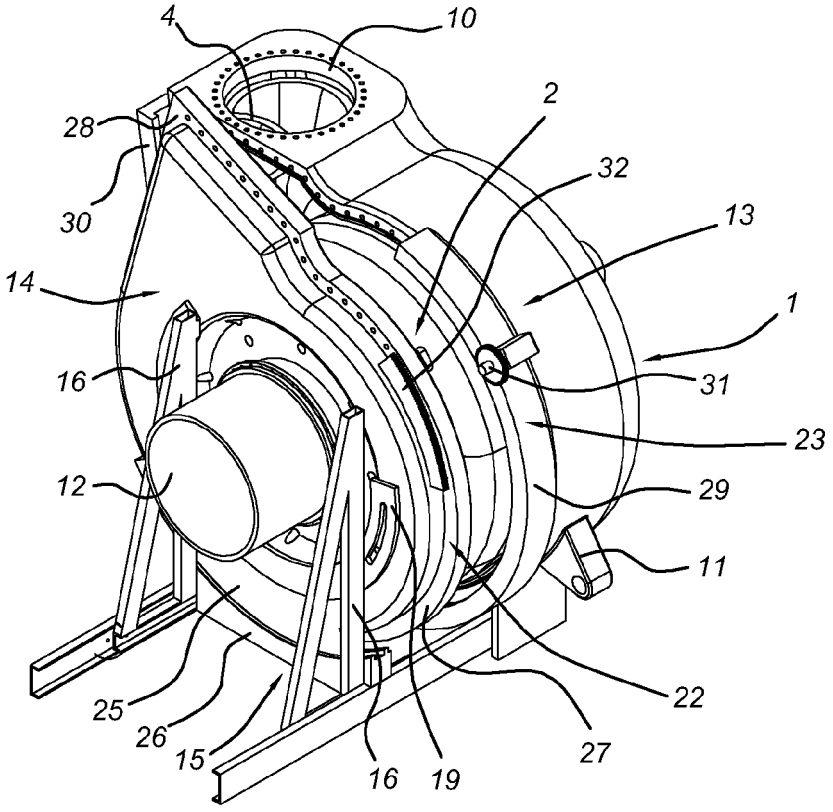
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Fig 5

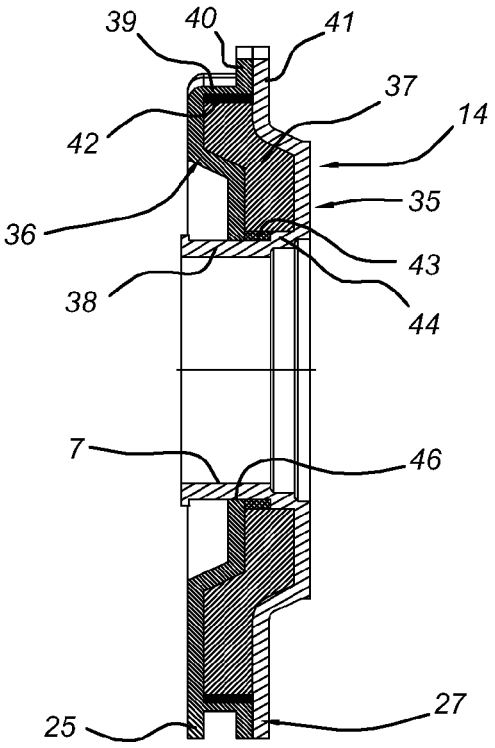


Fig 6

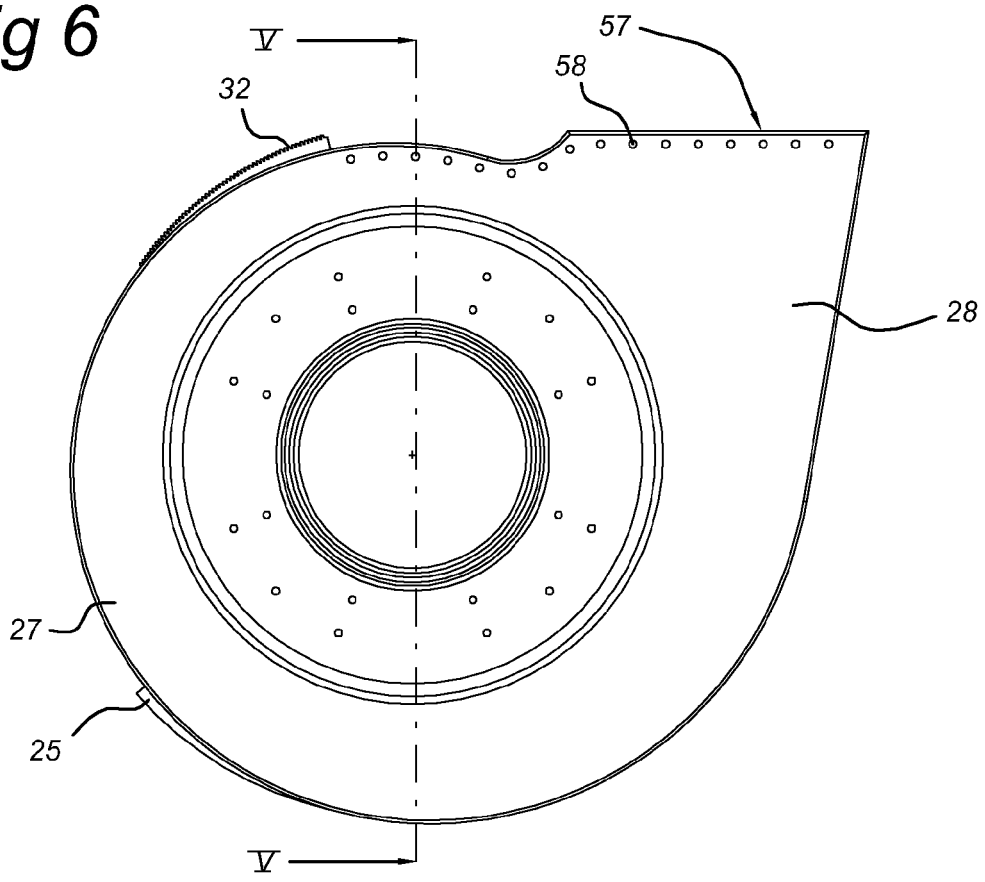


Fig 7

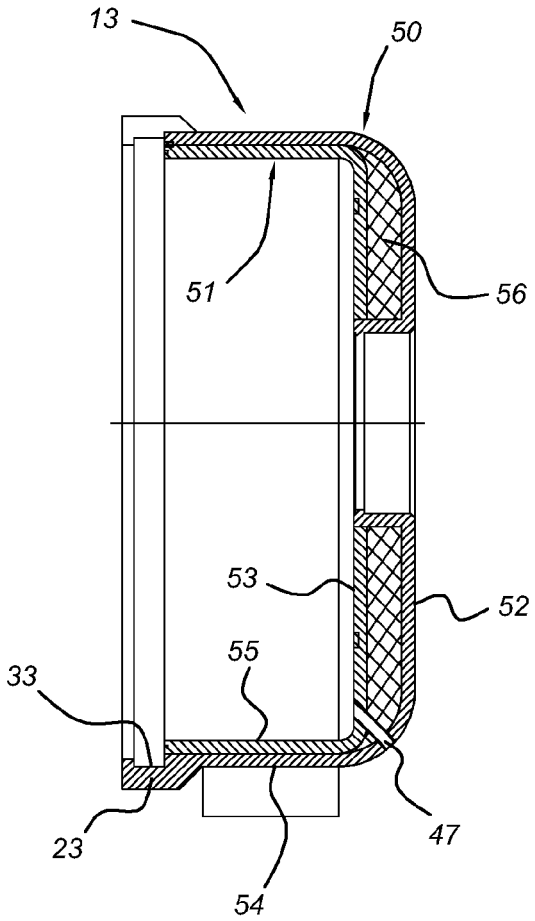


Fig 8

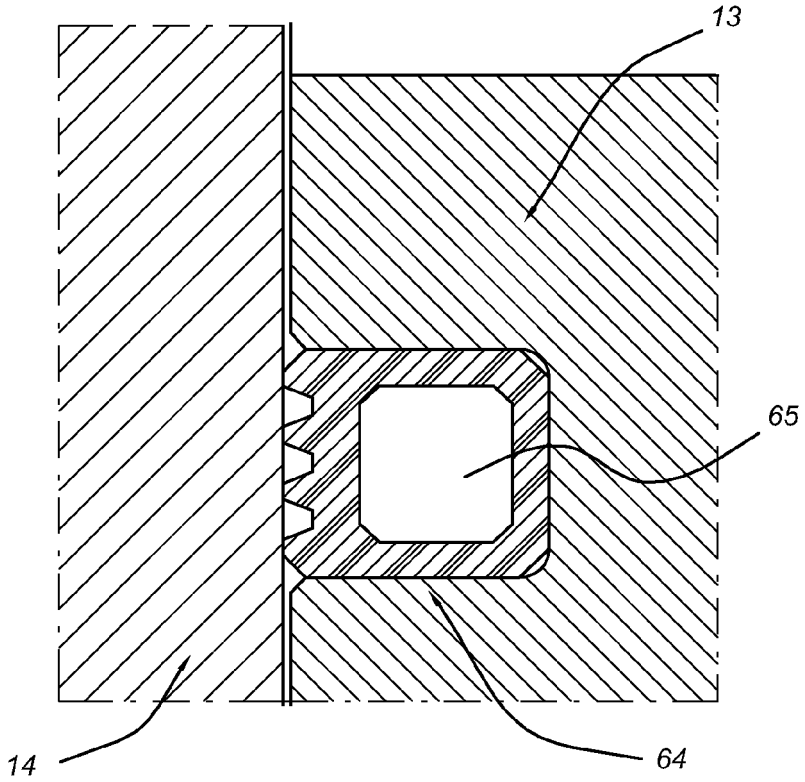


Fig 9

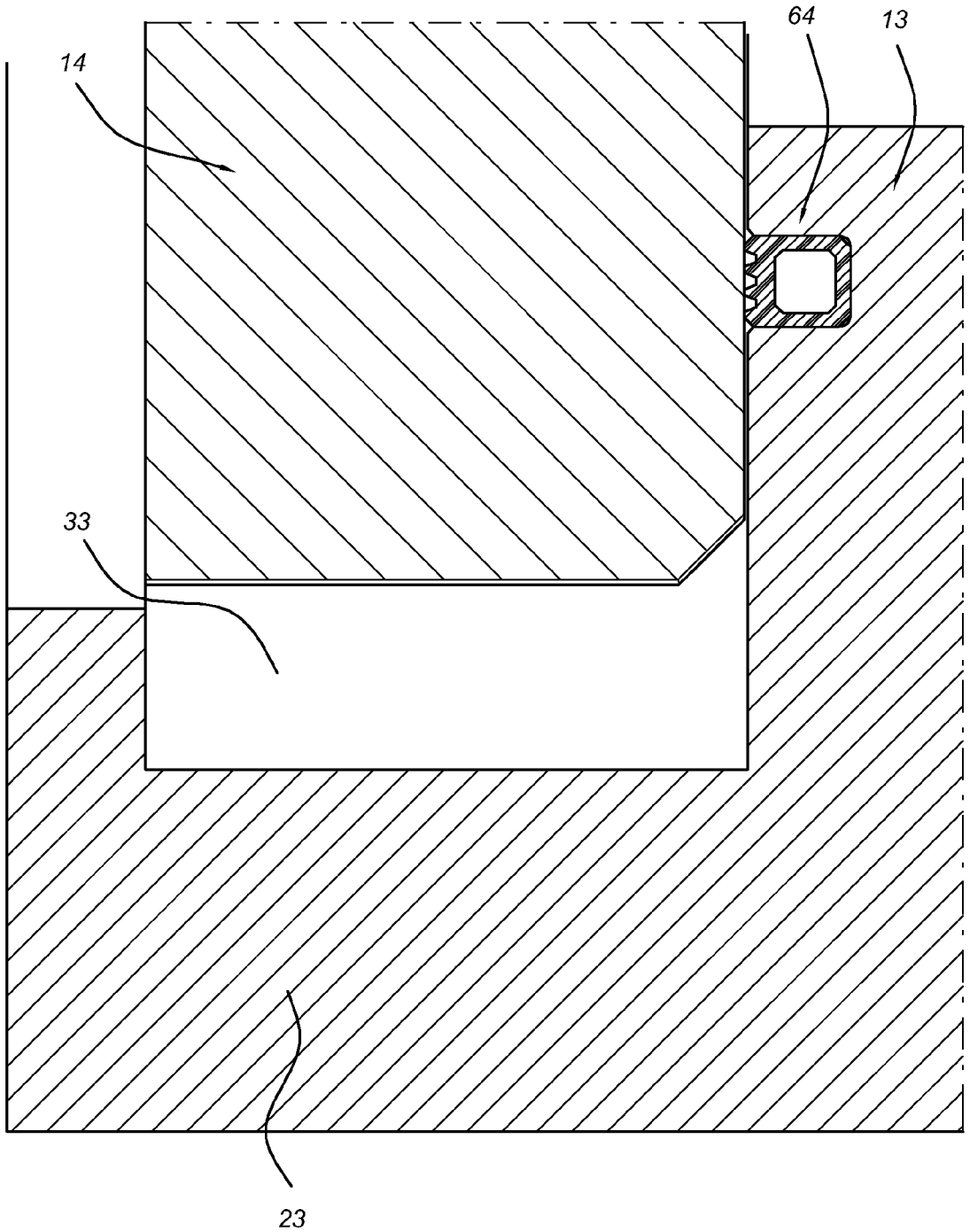


Fig 10

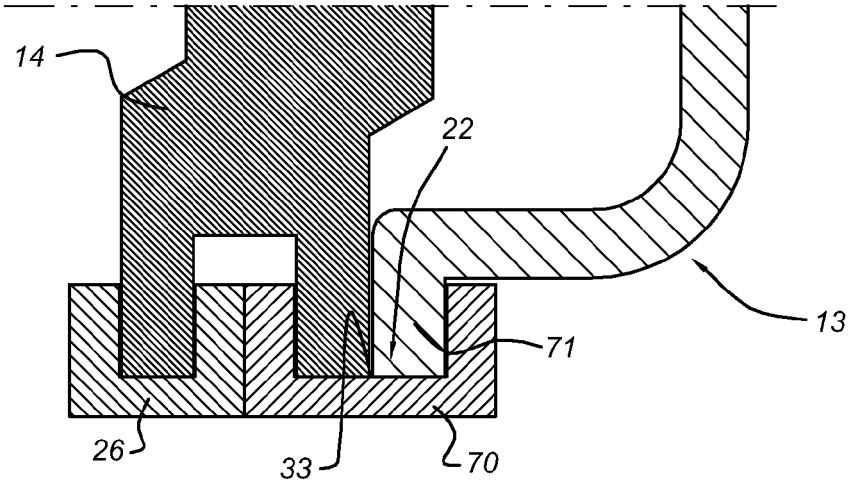
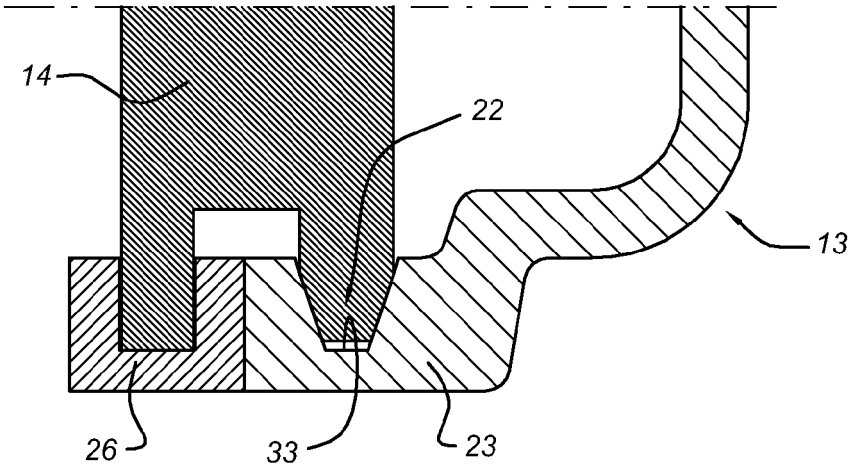


Fig 11



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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 August 2007	de Martino, Marcello

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