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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *of inventorship (Rule 4.17(iv))*

[Continued on next page]

(54) **Title**: DISPLACEMENT SUMP PUMP

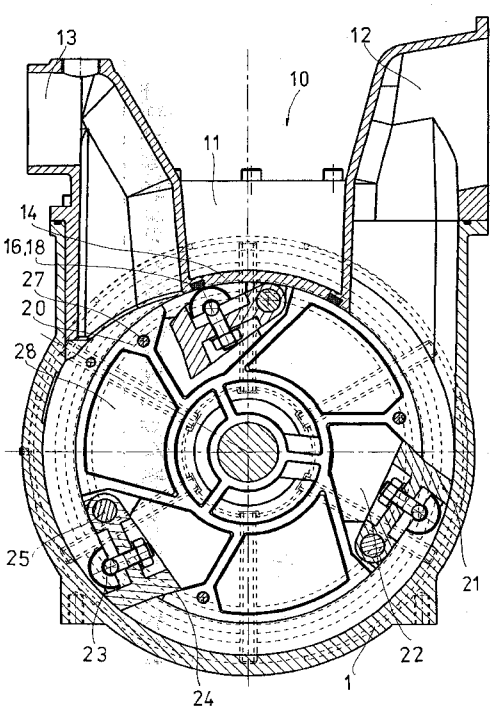


FIG. 2

(57) **Abstract**: A displacement sump pump consists of stator (1) with inner cylindrical working chamber (6) in which at central axe is the rotor (20) placed on powered shaft (34) and equipped with at least three working segments (21) pendulously in vertical plane to inner surface of cylindrical working chamber (6) fixed in segments cavities (22) created equally on outside dia of the rotor (20) and equipped by seating lockers (24) limiting maximum puling of working segments (21) from segments cavities (22) towards inner surface of inner cylindrical working chamber (6) of stator (1). The stator (1) is above working chamber (6) with rotor (20) closed by removable cover (10) with intake throat (12) and outlet throat (13) that are from the bottom side of removable cover (10) divided by splitting wall (14) where in direction to outlet throat (13) are connected vertically oriented inclination edges (15) of inclination pulleys (23) which are part of working segments (21) of rotor (20). The splitting wall (14) with inclination edges (15) creates with removable cover (10) including intake' throat (12) and outlet throat (13) one unit body where is created intake space (17) between inclination edges (15) for uniform flow of pumped liquid from inner working chamber (6) of stator (1) to outlet throat (13) in removable cover (10).

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Displacement sump pump

Field of the Invention

The invention relates to a displacement sump consisting of stator with inner cylindrical working chamber in which at central axe is the rotor placed on powered shaft and equipped with at least three working segments pushing by rotation of the rotor from liquid intake thru working chamber to delivery pipe branch.

Background of the Invention

Pumps of this type are known e.g. from document CZ 10989 U1. The subject of this document is universal self-priming high pressure pump. This pump consists of stator with rotary working chamber equipped by liquid intake and outlet, and rotor assembled in stator body. Liquid intake and outlet are situated one beside other and are spitted by wall that is as closed to outer circumference of the rotor. Rotor is equipped at least by three "T" shape working segments, that are moveable located at rotor cavities on pin. Rotary pulleys are in centre of each segment. Working segments are powered by centrifugal force within rotor rotation. Upper parts of segments seat as close as possible on inner stator diameter and side covers without creating of friction force. Part of splitting wall is controlling track for rotary pulleys of segments that interfere in to area of liquid outlet throat. This track takes care of segments retracting into rotors pockets to allow the movement under the track.

The target of the invention is improvement of this pump as regards utility, simplify maintenance and possibility of replacement worn out parts.

Summary of the Invention

This task is solved by displacement sump pump consisting of stator with inner cylindrical working chamber in which at central axe is the rotor placed on powered shaft and equipped with at least three working segments pendulously in vertical plane to inner surface of cylindrical working chamber fixed in segments cavities created equally on outside dia of the rotor and equipped by seating lockers limiting maximum puling of working segments from segments cavities towards inner surface of inner cylindrical working chamber of stator according to the invention, where the stator is above working chamber with rotor closed by removable cover with intake throat and outlet throat . Intake throat and outlet throat are from the bottom side of removable cover divided by splitting wall where in direction to outlet throat are connected vertically oriented inclination edges of inclination pulleys which are part of working segments of rotor. Splitting wall with inclination edges creates with removable cover including intake and outlet throat one unit body where is created intake space between inclination edges for uniform flow of pumped liquid from inner working chamber of stator to outlet throat in removable cover.

Compare to pumps used up to now the basic advantage of this pump according to the invention is design of its removable cover, where are combined intake and outlet throat as well as dividing wall that creates by inclination edges inclination pulleys driving track of working segments between intake and outlet throat. By this the dividing wall with inclination edges creates one inseparable unit with removable cover and it can not happen that during pumping process anything can be lose. This design of removable cover allows after simple disassembly from stator body free reach into working chamber of the stator as well as to pump rotor that allows making of its complete maintenance and replacement of worn out parts without complete disassembly of the whole pump.

According to this invention are working segments compared to the pump known from the document CZ 10989 U1 equipped by two inclination pulleys or splitting wall by two side inclination edges, any turbulence of pumped liquid is limited according to this invention.

The principle of this invention further consist in, that segments cavities are from its sides closed by side walls of rotor whereas the working segments are in these segment cavities fixed on transversally oriented fixing pins that are fasten from the top on rotor body by fastening screws. This creates possibility of disassembly of working segments from rotor body after removing of removable cover.

The rotor body is with advantage splitted by dividing plane vertically to the axle of powered shaft to two halves which are connected together by connecting screws, whereas between its segments cavities are inside the rotor body created closed lightening chambers.

As well as with advantage is in splitting wall on removable cover created at least one transverse recess for placing of sealing plinth of rotor body. Optimally we are talking about two transversal sealing plinths, usually made of plastic, that are practically perfectly splitting intake opening from outlet by other words intake throat from outlet one, which increase efficiency of the pump dramatically.

The principle of the invention further consist in that the stator is created by stator shell with fastening flange of removable cover which is closed by side flanges from both sides connected with stator shell by outer bayonet lockers with at least one fixing screw for proper position of side flange. By that are side flanges fixed to stator body by pure turn which allows very fast disassembly of stator in case of need.

In another advantageous implementation of the invention working segments are from its side sides equipped by side recess for side sealing against side flanges. Working segments can make of metal as well as of plastic. The side sealing by plinths increase efficiency of the pump within working segments pulling out of the segment cavity in the rotor body.

Every inclination pulley of working segments is with advantage equipped by sliding bushing inside by which is inclination pulley rotary swingy fixed on segment pin in segment cavity whereas inclination pulley is closed from one side and from the other sealed by sealing ring to protect from impurities to get in and is assembled on segment pin.

Powered shaft is fixed in bearing seats that are created in side flanges of the stator. The shaft is sealed by intermediate sealing and from intermediate zone leads at least one connecting channel thru the rib made on side flange of the stator. The channel leads to area intake of the stator body.

The pump according to this invention could be operated as low rotation or high speed rotation and based on robustness of the pump low pressure or high pressure one. Within low rotation usually fewer than 100 rpm the centrifugal force do not have to be enough to push out working segments from rotor cavities but than it is convenient that there are pushing springs under working segments that will take care of segments push towards inner stator working surface.

Essential pump advantage according this invention is that sealing of inner space is not counted with special and financially expensive packing which reduces pumps purchase costs as well as maintenance costs.

Brief Description of the Drawings

Displacement sump pump in the preferred embodiment of this invention is closer explained by the drawings where is showed:

Fig.1 - Over all pump view

Fig.2 - Cut view of the pump unit – vertical projection

Fig.3 - Cut view of the pump unit – side projection

Fig.4 - Removable pump cover in stereo metric view

Fig.5 - Pumps stator in stereo metric view

Fig.6 - Half of the pump rotor in stereo metric view

Fig.7 - Detail view o working segment

Fig.8 - Cut view of pump flange – vertical projection

Fig.9 - Detail view of inclination pulley

Description of the Preferred Embodiment

Displacement sump pump according to the Fig. 1 - 9 consists of stator 1 with inner cylindrical working chamber 6 in which at central axe is placed powered shaft 34 with the rotor 20. Rotor 20 is equipped by three working segments 21 that are pendulously in vertical plane to inner cylindrical working chamber 6 fixed in segments cavities 22 created equally on outside dia of rotor 20. Segment cavities 22 are equipped by seating lockers 24 that limit maximum puling of working segments 21 from segment cavities 22 towards inner surface of inner cylindrical working chamber 6 of stator 1. Within these maximal working segments 21 pulling out is clearance between working

segments 21 and inner surface of stator 1 inner working chamber 6 max. 0,05 mm.

Stator 1 is closed by removable cover 10 above working chamber 6 with rotor 20 which is mounted by terminal screw 19. Removable cover 10 is equipped by intake throat 12 and outlet throat 13 that are from the bottom side of removable cover 10 divided by splitting wall 14 where in direction to outlet throat 13 are connected vertically oriented inclination edges 15 of inclination pulleys 23 which are part of working segments 21 of rotor 20. Splitting wall 14 with inclination edges 15 creates with removable cover 10 including intake throat 12 and outlet 13 throat one unit body where is created intake space 17 between inclination edges 15 for uniform flow of pumped liquid from inner working chamber 6 of stator 1 to outlet throat 13 in removable cover 10.

The segment cavities 22 are from its sides closed by side walls of rotor 20 whereas the working segments 21 are in these segments cavities 22 fixed on transversally oriented fixing pins 25 that are fasten from the top on rotor 20 body by fastening screws 26.

The rotor 20 body is splitted by dividing plane vertically to the axle of powered shaft 34 to two halves which are connected together by connecting screws 27, whereas between its segments cavities 22 are inside created closed lightening chambers 28. There are two transverse recess 18 in splitting wall 14 of removable cover 10 of the stator 1 where are placed transverse sealing plinth 16 of rotor 20 body.

The stator 1 consists of stator shell 3 with fastening flange 2 of removable cover 10 which is closed by side flanges 4 from both sides connected with stator shell 3 by peripheral bayonet lockers 5 with at least one fixing screw 7 for proper position of side flange 4.

Working segments 21 are made of plastic and are from its side sides equipped by side recess 29 for side sealing which is not displayed at the drawings. Each inclination pulley 23 of working segments 21 is equipped by sliding bushing 30 inside by which is inclination pulley 23 rotary swingy fixed on segment pin 31 situated in segment cavity 22. Inclination pulley 23 is closed from one side and from the other sealed by sealing ring 32 and is assembled on segment pin 31.

There are installed pushing springs 33 under working segments 21 in case when the pump is used as low speed one the centrifugal force does not guarantees proper pulling of working segments 21 out of rotor segment cavities 22, schematic displayed on Fig. 3.

The powered shaft 34 of rotor 20 is seating in bearing seats 8 that are created in side flanges 4 of the stator 1 where the powered shaft 34 is sealed by inter zones sealing 35, whereas from inter zone area 36 of inter zones sealing 35 is at least thru one rib 9 made on side flanges 4 leads connecting channel 37 to area of intake.

Field of the Application

Displacement sump (mud) pump is wide utilizable in different areas of human activities according to this technical solution.

List of Reference Signs

1 stator
2 fastening flange
3 stator shell
4 side flanges
5 bayonet lockers
6 work chamber
7 fixing screw
8 bearing seats
9 rib
10 removable cover
11 compact unit
12 intake
13 outlet throat
14 splitting wall
15 inclination edges
16 sealing plinth
17 intake space
18 transverse recess
19 terminal screw
20 rotor
21 working segment
22 segments cavities
23 inclination pulleys
24 seating lockers
25 fixing pins
26 fastening screws
27 connecting screws
28 lightening chambers
29 side recess

30 sliding bushing
31 segment pin
32 sealing ring
33 pushing springs
34 powered shaft
35 inter zones sealing
36 inter zone area
37 connecting channel

PATENT CLAIMS

1. A displacement sump pump consisting of stator (1) with inner cylindrical working chamber (6) in which at central axe is the rotor (20) placed on powered shaft (34) and equipped with at least three working segments (21) pendulously in vertical plane to inner surface of cylindrical working chamber (6) fixed in segments cavities (22) created equally on outside dia of the rotor (20) and equipped by seating lockers (24) limiting maximum puling of working segments (21) from segments cavities (22) towards inner surface of inner cylindrical working chamber (6) of stator (1), **characterized by the fact** that the stator (1) is above working chamber (6) with rotor (20) closed by removable cover (10) with intake throat (12) and outlet throat (13) that are from the bottom side of removable cover (10) divided by splitting wall (14) where in direction to outlet throat (13) are connected vertically oriented inclination edges (15) of inclination pulleys (23) which are part of working segments (21) of rotor (20), whereas splitting wall (14) with inclination edges (15) creates with removable cover (10) including intake throat (12) and outlet throat (13) one unit body where is created intake space (17) between inclination edges (15) for uniform flow of pumped liquid from inner working chamber (6) of stator (1) to outlet throat (13) in removable cover (10).

2. The displacement sump pump according to the claim 1, **characterized by the fact** that the segment cavities (22) are from its sides closed by side walls of rotor (20) whereas the working segments (21) are in these segments cavities (22) fixed on transversally oriented fixing pins (25) that are fasten from the top on rotor (20) body by fastening screws (26).

3. The displacement sump pump according to the claim 2, **characterized by the fact** that the rotor (20) body is splitted by dividing plane vertically to the axle of powered shaft (34) to two halves which are connected together by connecting screws (27), whereas between its segments cavities (22) are inside created closed lightening chambers (28).

4. The displacement sump pump according to at least one of previous claims, **characterized by the fact** that at least one transverse recess (18) for placing of transverse sealing plinth (16) of rotor (20) body is created in splitting wall (14) of removable cover (10) of the stator (1).

5. The displacement sump pump according to at least one of previous claims, **characterized by the fact** that the stator (1) is created by stator shell (3) with fastening flange (2) of removable cover (10) which is closed by side flanges (4) from both sides connected with stator shell (3) by outer bayonet lockers (5) with at least one fixing screw (7) for proper position of side flange (4).

6. The displacement sump pump according to at least one of previous claims, **characterized by the fact** that the working segments (21) are from its side sides equipped by side recess (29) for side sealing against side flanges (4).

7. The displacement sump pump according to at least one of previous claims, **characterized by the fact** that each inclination pulley (23) of working segments (21) is equipped by sliding bushing (30) inside by which is inclination pulley (23) rotary swingy fixed on segment pin (31) situated in segment cavity (22) whereas inclination pulley (23) is closed from one side and from the other sealed by sealing ring (32) and is assembled on segment pin (31).

8. The displacement sump pump according to at least one of previous claims, **characterized by the fact** that under working segments (21) are installed pushing springs (33) for proper pulling of working segments (21) out of segment cavities (22).

9. The displacement sump pump according to at least one of previous claims, **characterized by the fact** that the powered shaft (34) of rotor (20) is fixed in bearing seats (8) that are created in side flanges (4) of the stator (1) where the powered shaft (34) is sealed by inter zones sealing (35), whereas from inter zone area (36) is at least thru one rib (9) made on side flanges (4) leads connecting channel (37) to area of intake.

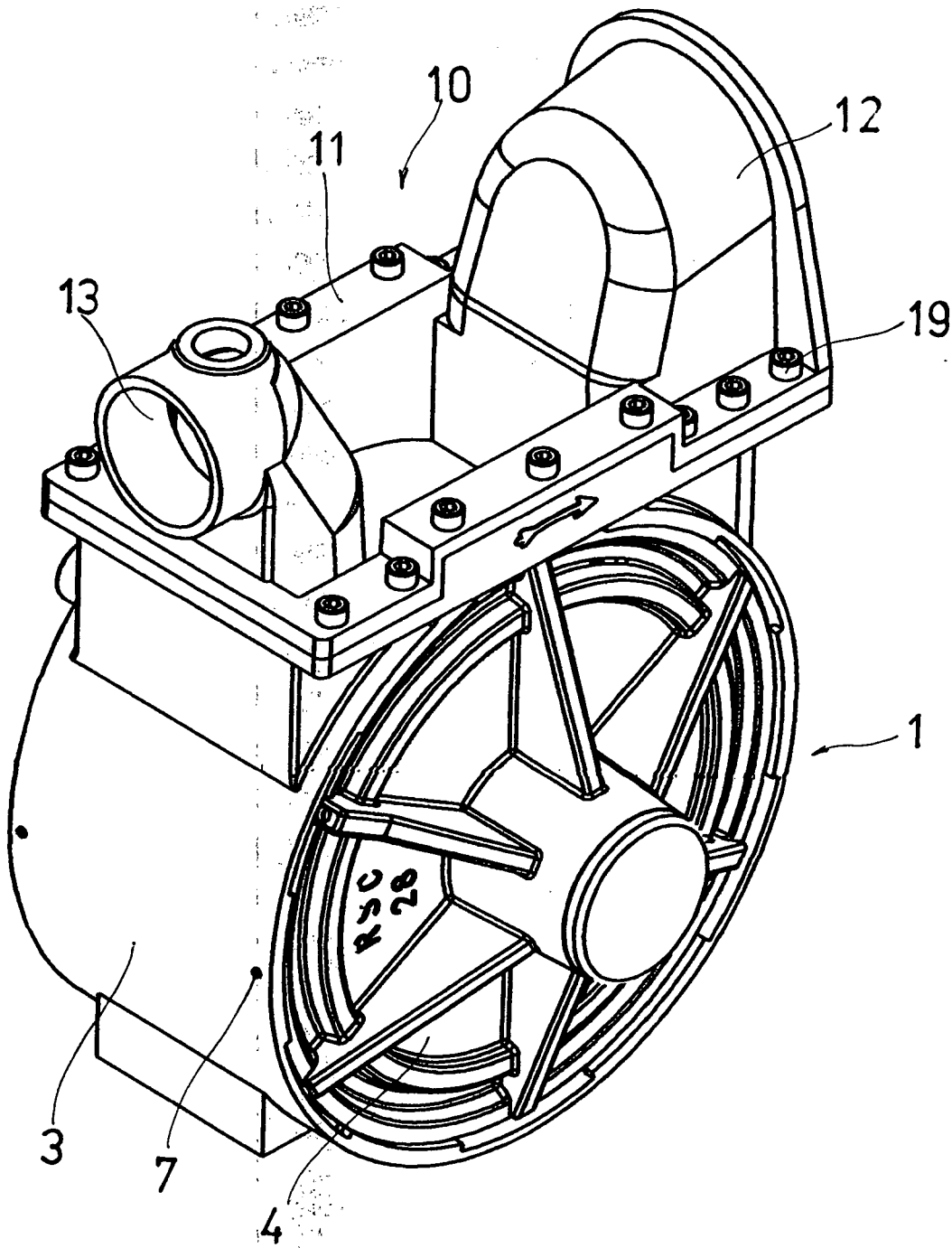


FIG. 1

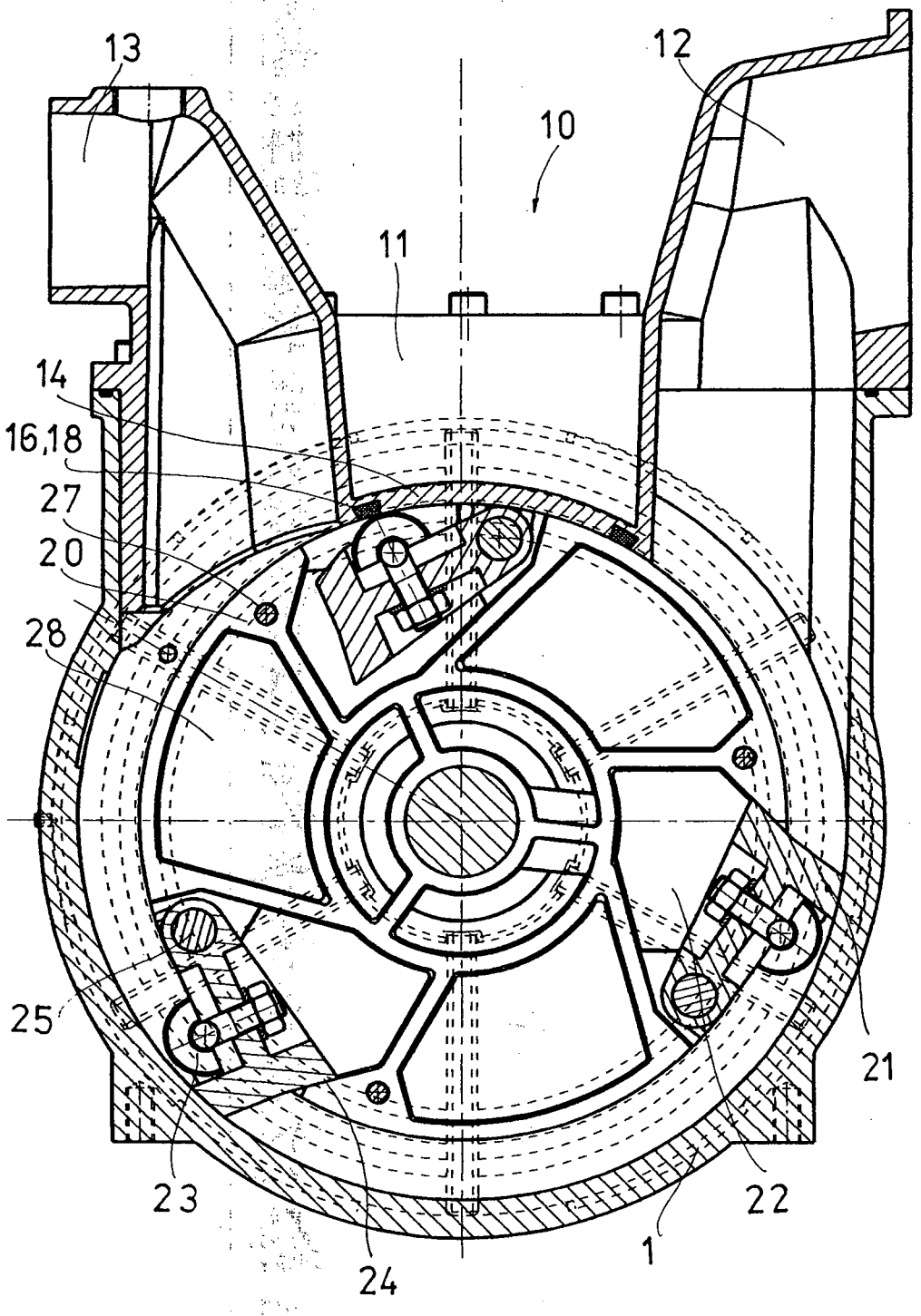


FIG. 2

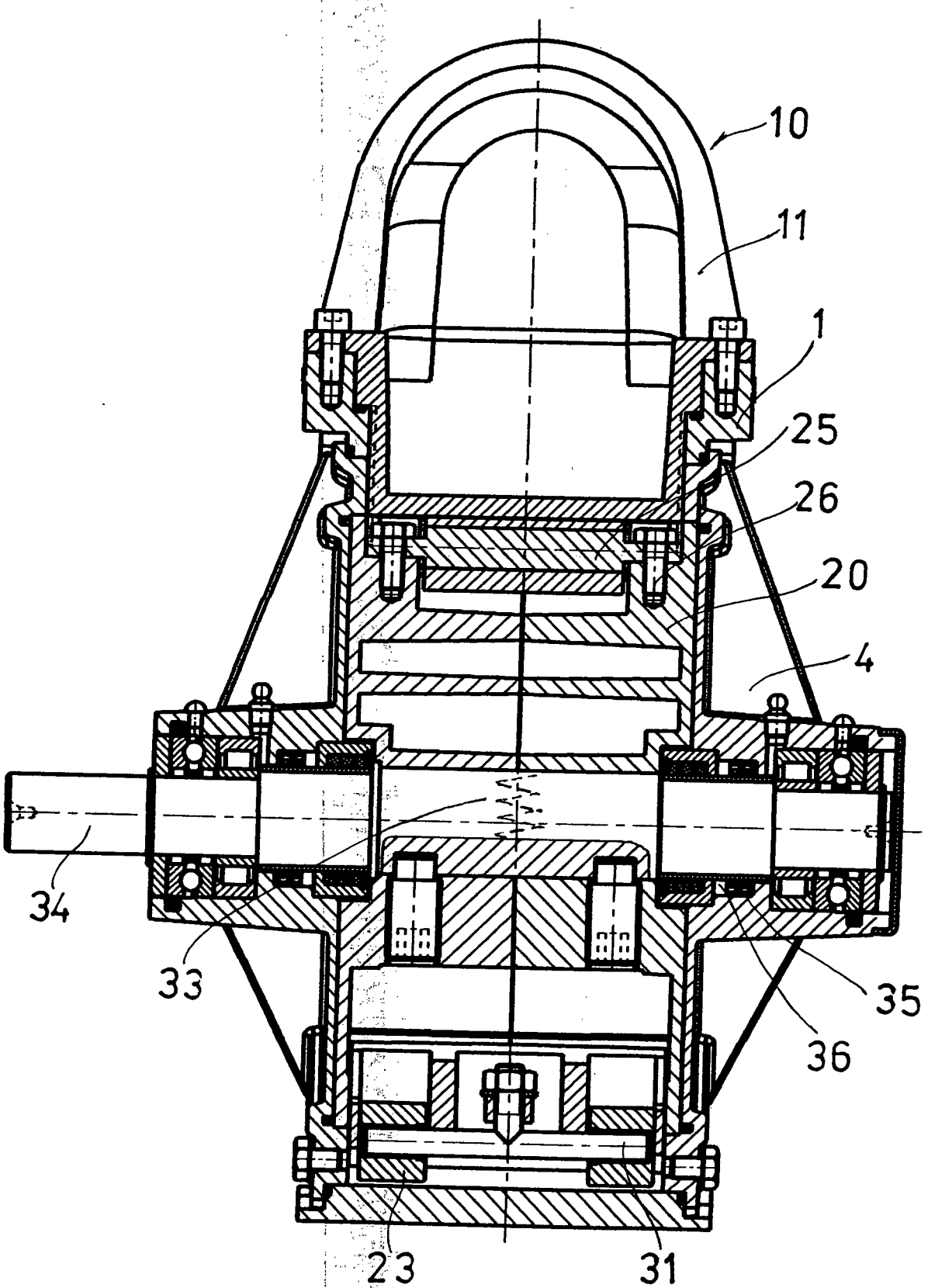


FIG. 3

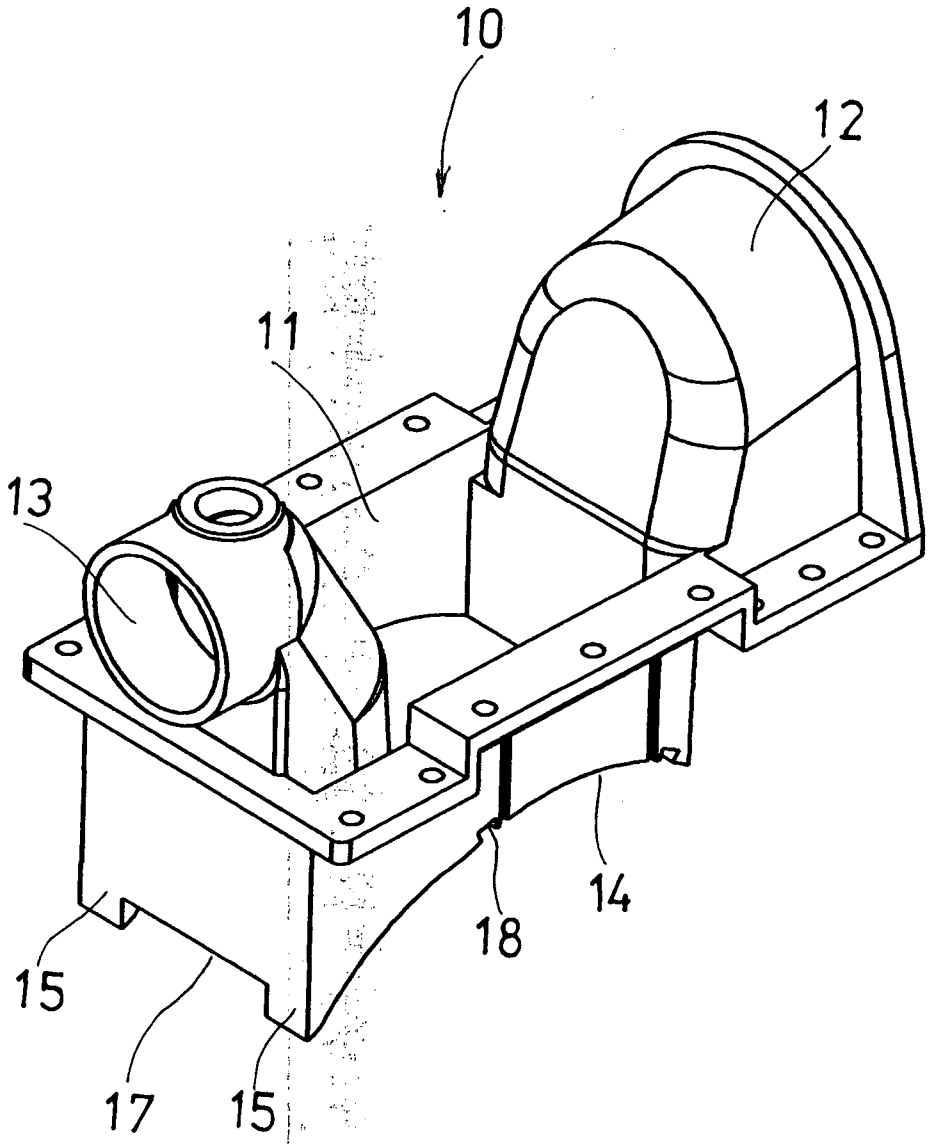


FIG. 4

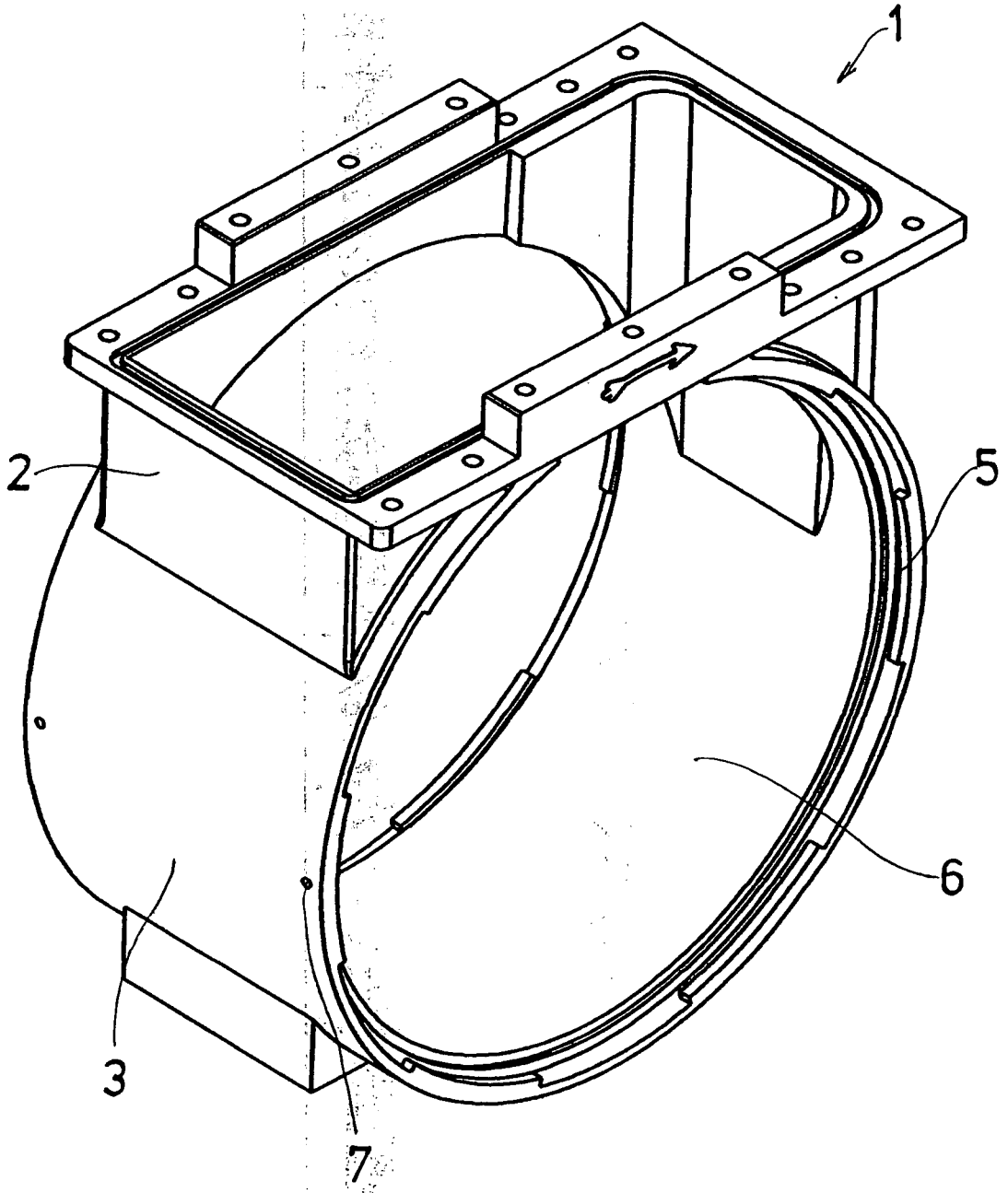


FIG. 5

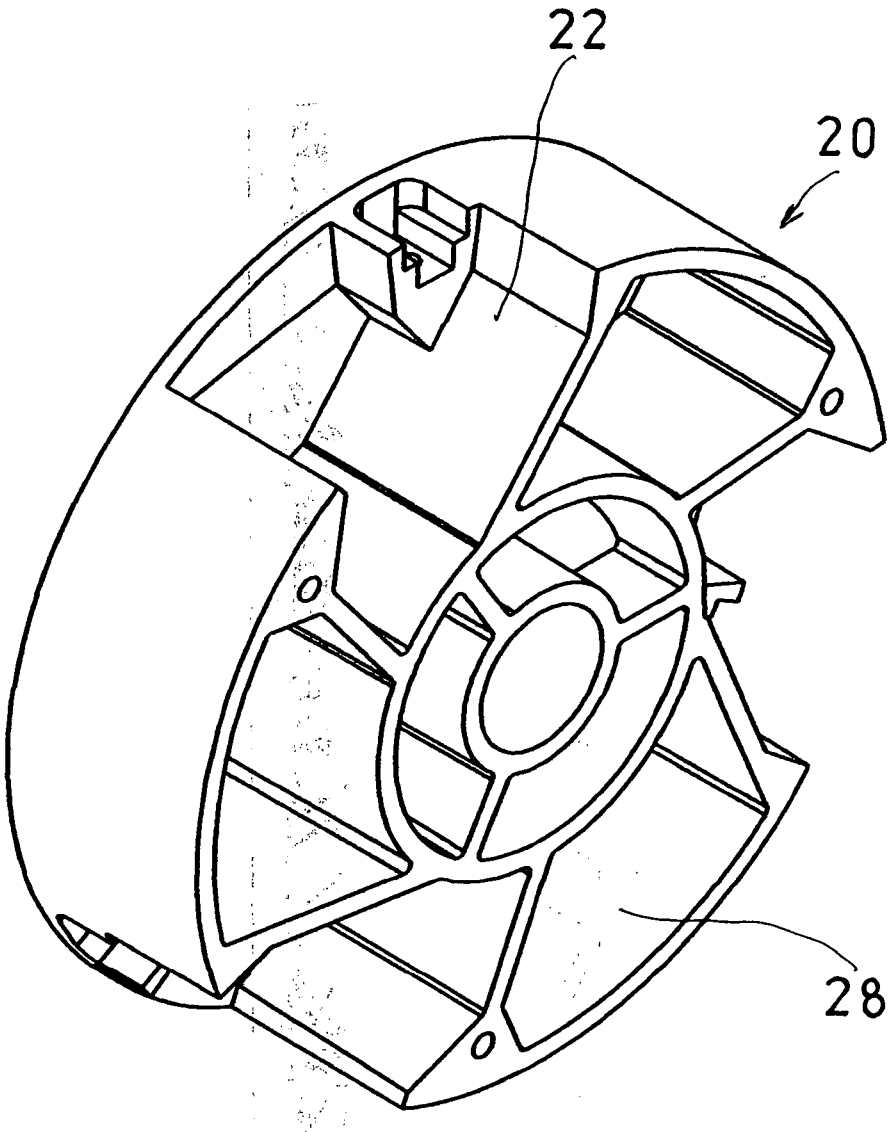


FIG. 6

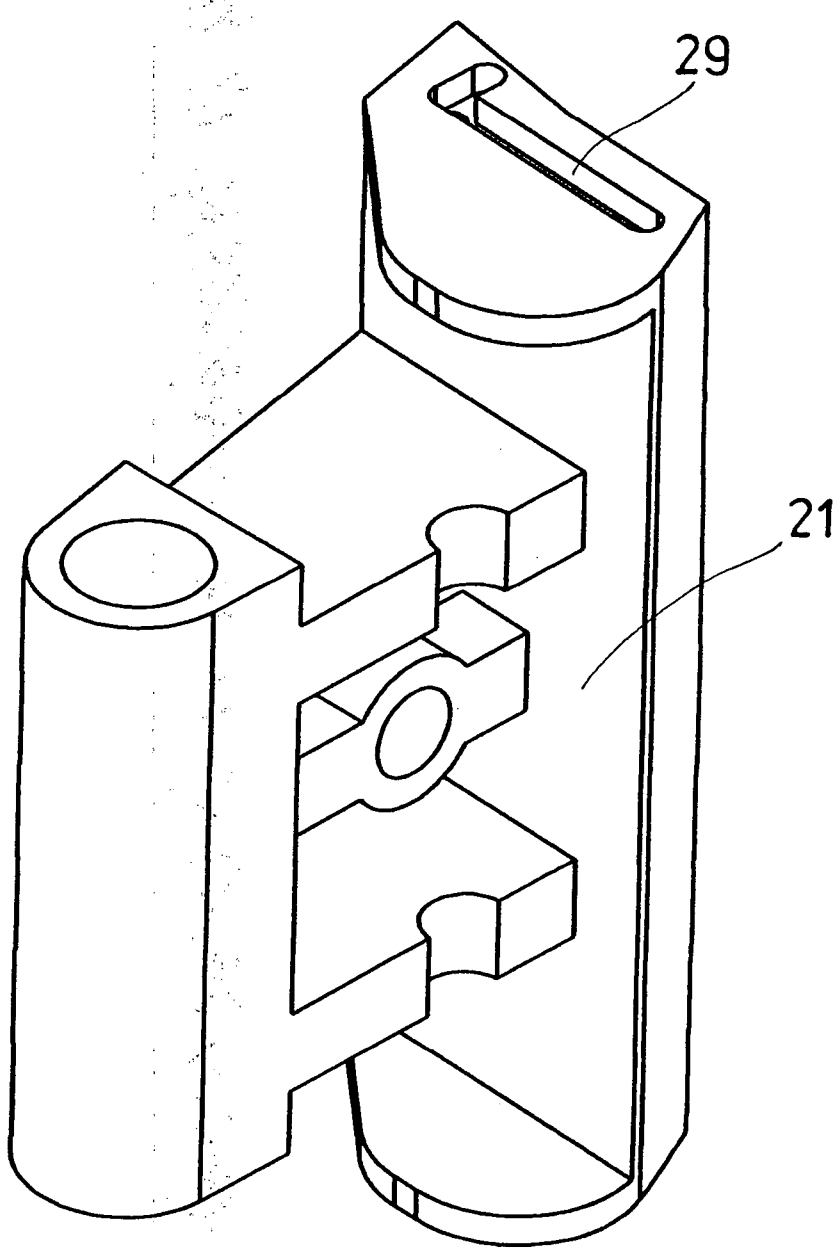


FIG. 7

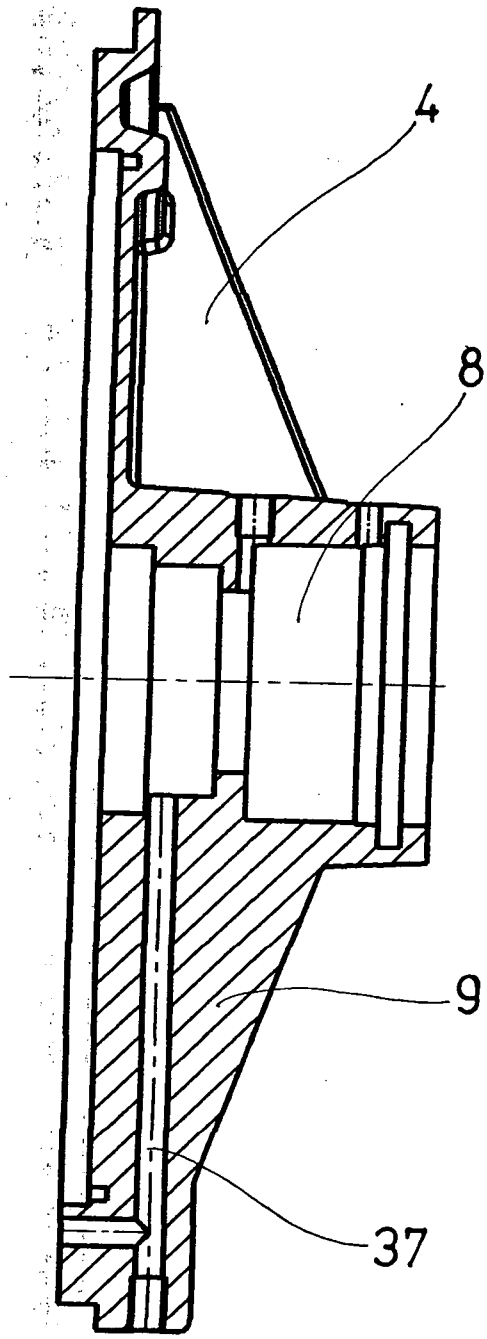


FIG. 8

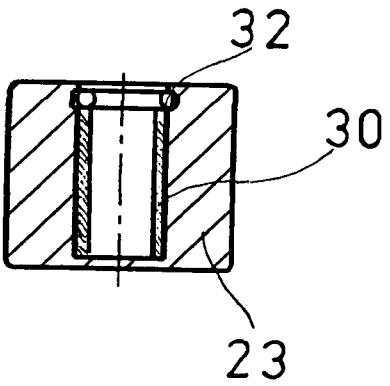


FIG. 9