Oct. 10, 1961 F. O. LUENBERGER 3,003,593

RATCHET MECHANISM FOR PREVENTION REVERSE ROTATION

Filed Jan. 20, 1958 2 Sheets-Sheet 1

FIG. 1.

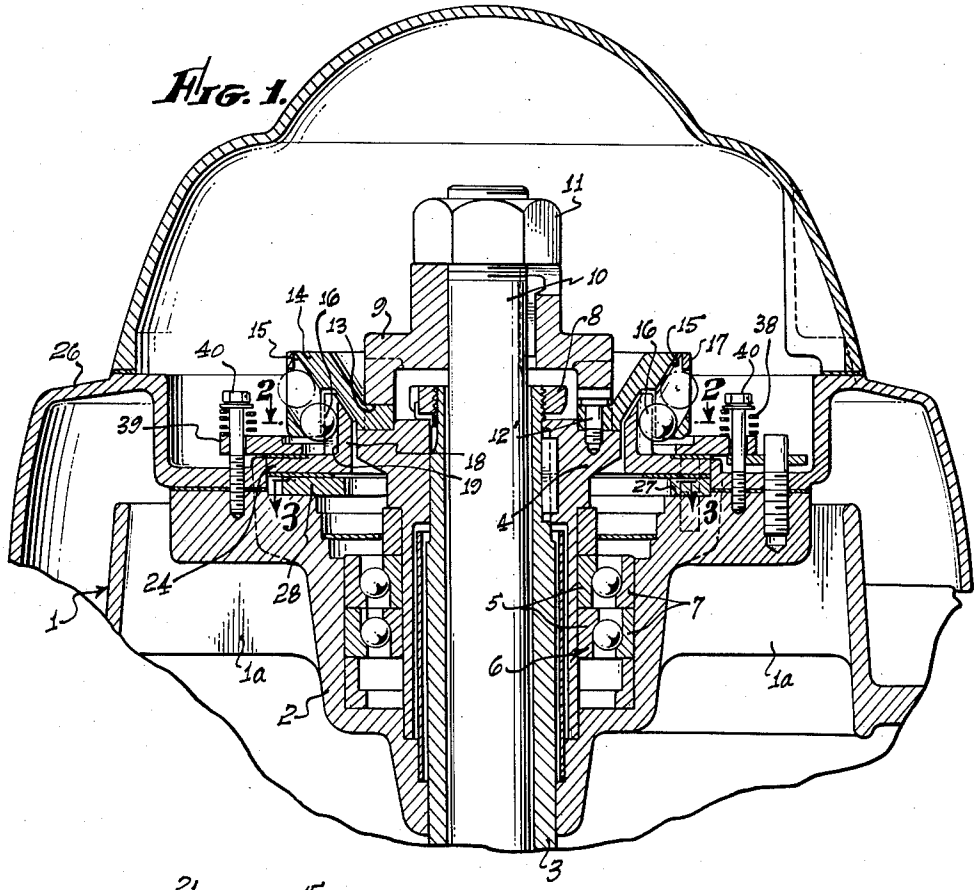
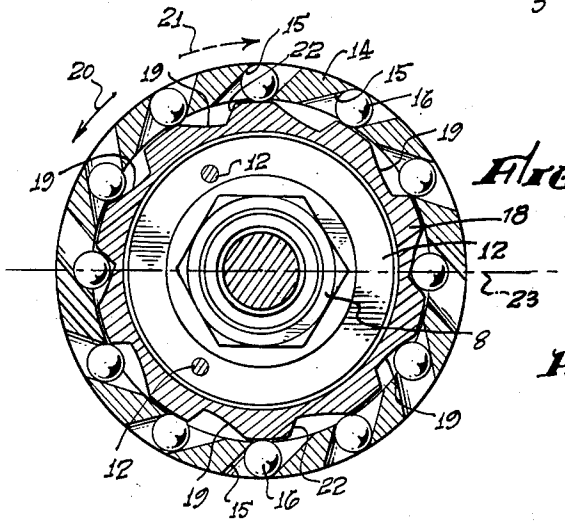


FIG. 2.



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FIG. 3.

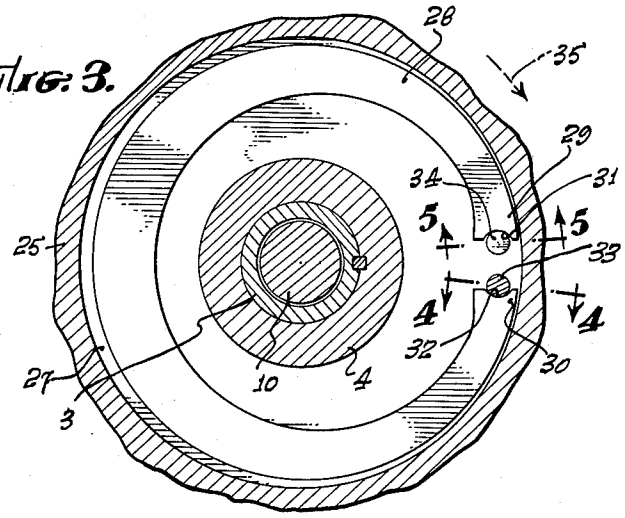


FIG. 4.

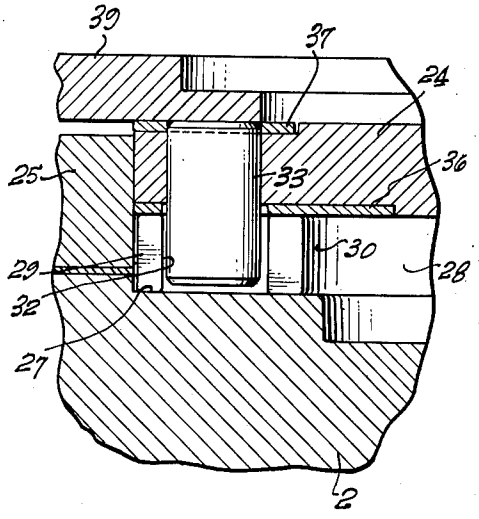
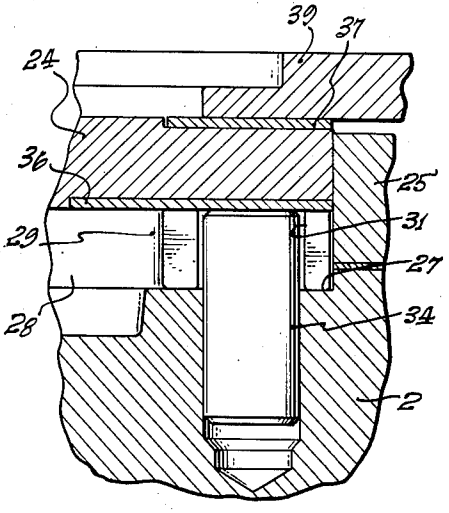


FIG. 5.



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RATCHET MECHANISM FOR PREVENTING REVERSE ROTATION

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3 Claims. (Cl. 188—82.84)

This invention relates to provisions for stopping or preventing backward motion of rotary apparatus.

Such devices in general are now well-known for use with vertical electrical motors adapted to drive pumps located within wells. One such ratchet device is described in Patent No. 2,793,714, issued May 28, 1957. However, other forms of backstops may be utilized in association with the present invention.

The backstops come into operation when the power to the motor is interrupted. The hydraulic forces then acting on the pump runners produce a resultant torque urging the rotor of the motor in a reverse direction. If this reverse rotation be permitted, serious injury to the motor might result.

Without further provisions, such ratchets abruptly stop reverse rotation, with attendant severe stresses on the ratchet mechanisms. Such stresses are especially pronounced when the motor is of relatively large capacity.

It is one of the objects of this invention to make it possible to interpose an opposing resilient (instead of an unyielding) force against reverse rotation. Thereby the harmful and destructive stresses and strains on the mechanism are greatly minimized.

It is another object of this invention to provide a simple and compact and inexpensive resilient device to accomplish these results.

In the preferred embodiment of the invention, the resilient device is in the form of a resilient open ring which is caused to expand upon imposition of the reversing forces.

It is another object of this invention effectively to damp any oscillation or rebounds if the reversing force is suddenly removed.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of one embodiment of the invention. For this purpose, there is shown a form in the drawings accompanying and forming a part of the present specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

Referring to the drawings:

FIGURE 1 is a fragmentary vertical section of the upper portion of a structure incorporating the invention installed in connection with a vertical electric motor;

FIG. 2 is a sectional view, taken generally along the plane indicated by line 2—2 of FIG. 1;

FIG. 3 is a sectional view, taken along a plane corresponding to line 3—3 of FIG. 1; and

FIGS. 4 and 5 are enlarged fragmentary sectional views, taken respectively along planes corresponding to lines 4—4 and 5—5 of FIG. 3.

In FIG. 1 there is shown an electric motor bracket **1**, integrally formed with a central boss **2**. This boss **2** is joined to the bracket **1** by ribs **1***a*. The boss serves to support bearing structures for the rotor of the motor.

Thus the rotor of the electric motor is mounted upon a vertical hollow shaft **3** to drive it. This hollow shaft **3** is shown as keyed to a lower coupling member **4**. The lower coupling member **4** in turn supports the inner races **5** of a series of thrust ball bearing structures **6**. The

outer races **7** of these ball bearing structures are appropriately accommodated in the central boss **2**.

The hollow shaft **3** has a threaded upper end for the accommodation of a nut **8** adapted to rest upon the upper surface of the coupling member **4**.

An upper coupling member **9** is joined to the lower coupling member **4** in any convenient manner as by screws, such as **12** (FIG. 2). Upper coupling member **9** is keyed to a pump shaft **10** which extends downwardly and carries the subterranean pump runners. Shaft **10** is provided with a threaded upper end accommodating a nut **11** for the purpose of adjusting the vertical position of the shaft **10**.

The upper coupling member **9** has slots or recesses **13** for the accommodation of inwardly directed bosses formed on the inner flange of a rotating ratchet member **14**. This member may be fastened as by screws **12'** to coupling member **4**. Rotating ratchet member **14**, as indicated most clearly in FIG. 2, is provided with a series of equiangularly spaced, downwardly directed apertures **15** for the accommodation of balls **16**. These balls are retained against radial removal by the aid of a ring **17** extending around the upper edge of the member **14**. These apertures are non-radial and extend inwardly toward the axis of rotation.

The balls **16** cooperate with another ratchet member **18** which has a series of equiangularly spaced recesses **19**. This ratchet member is restrained against substantial movement in a manner to be hereinafter described.

When the rotary structure rotates in a counterclockwise direction, as indicated by arrow **20**, there is no restraint against rotation. This is apparent from a consideration of the direction of the apertures **15** as viewed in FIG. 2. For this direction of rotation, the wall of each aperture **15** tends to urge the associated balls **16** radially outwardly with respect to the ratchet member **18**. Accordingly, the balls roll on the inner walls of the recesses **19**.

When there is a reversal of this desired direction of rotation as indicated by the arrow **21** (FIG. 2), the balls **16** are urged by the walls of apertures **15** inwardly toward the abrupt portions **22** of the recesses **19**. As hereinafter explained, only a portion of the total number of balls are actually in restraining position. This position is shown, for example, by the diametrically opposite balls having their centers on a horizontal line **23** of FIG. 2.

Since there are twelve balls and only ten recesses, two diametrically opposite balls serve simultaneously to restrain rotation, the other balls being out of register with any abrupt wall **22**. Thus rotation is restrained after a very short angular travel of the rotary apparatus, since at least two of the balls **16** must be quite close to a corresponding abrupt wall **22** of recesses **19**.

Since this mode of operation has been described in said prior patent, particularly FIGS. 6 and 7 thereof, further description of the action of the ratchet mechanism is considered unnecessary. Furthermore, any equivalent form of ratchet device could be substituted for the specific form herein disclosed, since the invention is not at all concerned with any particular form of ratchet device.

The inner ratchet member **18** is provided with an outwardly directed flange **24** (see also FIGS. 4 and 5). The outer periphery of the flange has a running fit within the internal diameter of a flange **25** extending from the upper edge of the boss **2**. This flange is formed integrally with a casing or cover member **26**.

Underlying the ratchet member **18** and resting upon the upper surface **27** of the boss **2** there is located a resilient split ring member **28**. This spring member **28** is shown in the present instance as of rectangular cross-section, flat on both its upper and lower surfaces, and hav-

ing ends 29 and 30. Each of these ends is provided with an arcuate recess 31 or 32. Furthermore, the ring is made of material sufficiently springy so that it may be expanded when an expanding force is exerted by forces acting on the recesses 31 and 32.

This expanding force is created by the force imposed upon the ratchet member 18, due to the urging of balls 16 against walls 22. Thus the flange 24 of ratchet member 18 carries an abutment or pin 33 that is force-fitted into the flange 24. This pin 33, as shown most clearly in FIG. 4, extends downwardly and in contact with the recess 32. On the other hand, a pin 34 is anchored firmly in the boss 2 and extends upwardly to serve as an abutment for the recess 31. Accordingly, when the ratchet member 18 tends to move in a clockwise direction as indicated by the arrow 35 of FIG. 3, the pin 33 serves to expand the ring 28 resiliently. The abutment pin 34 being stationary, this expansion occurs until stopped by the resilient force exerted by the spring ring 28. The ring 29 has ample clearance within flange 25 to permit this expansion.

This resilient force created by ring 28 opposing rotation of the ratchet member 18, cushions the shock of any sudden reverse rotation.

If the force due to this reverse rotation is suddenly removed, the spring ring 28 may have a tendency to oscillate and vibrate. In order to damp these oscillations, use is made of a friction plate 36 (FIGS. 4 and 5) disposed on the under surface of the flange 24 and in contact with the upper surface of the ring 28. This frictional plate 36 may be of any appropriate fabric or metal and may be accommodated in a recess adjacent the edge of the flange 24.

Another friction plate 37 is firmly disposed on the upper surface of the flange 24 in order to restrain sudden movement of the ratchet member 18.

The flange 24 is urged resiliently downwardly against the spring ring 28 by the aid of compression springs 38 (FIG. 1) that are arranged equiangularly around the axis of the device and that urge a pressure ring 39 downwardly. Four of these springs 38 may be used. They are held in appropriate position by the aid of the screws 40 threaded into the upper surface of the boss 2.

The inventor claims:

1. For use with a pump structure: a support; a shaft extending transverse to the support and adapted to drive the pump; means mounting the shaft so that the shaft is capable of continuous rotation relative to the support; said shaft having a desired direction of rotation; selectively operable means for rotating said shaft member in said desired direction; a pair of ratchet members, one of the members being carried by the shaft; the second ratchet member being mounted by the support; means confining the second ratchet member for movement relative to the support about the axis of said shaft; an open ring having spaced ends; each end having a concave recess; a pin carried by said support and engaging the concave recess at one end of the ring for anchoring the corresponding ring end; and a pin carried by the second ratchet member and engaging the concave recess at the other end of the ring, whereby said ring resiliently opposes movement of said second ratchet member about said axis upon engagement of said ratchet members.

2. For use with a pump structure: a support providing a recess; a shaft having an axis aligned with the recess and adapted to drive the pump; means mounting the shaft so that the shaft is capable of continuous rotation relative to the support; said shaft having a desired direction of rotation; a pair of ratchet members; one of the members having a flange received in the recess and confined for movement about the axis of the recess; a flat resilient open ring between the flange and the bottom of the recess; anchor means cooperable with the support for confining one end of the ring; anchor means carried by the said one member and engaging the other end of the ring; the second of said ratchet members being carried by said shaft; and means frictionally urging said flange into contact with said ring to provide damping to all movement of the said one ratchet member.

3. For use with a pump structure: a support providing a recess; a shaft having an axis aligned with the recess and adapted to drive the pump, and rotatable relative to the support; said shaft having a desired direction of rotation; a pair of ratchet members; one of the members having a flange received in the recess and confined for movement about the axis of the recess; a flat resilient open ring between the flange and the bottom of the recess; anchor means cooperable with the support for confining one end of the ring; anchor means carried by the said one member and engaging the other end of the ring; the second of said ratchet members being carried by said shaft; and means frictionally urging said flange into contact with said spring including an annular element engaging the flange, and resilient means mounted on the support urging the annular element against said flange, and adjustable to provide a selected damping force.

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