May 12, 1959 K. R. LUNG 2,885,964

PUMPS

Filed March 18, 1957

FIG-1

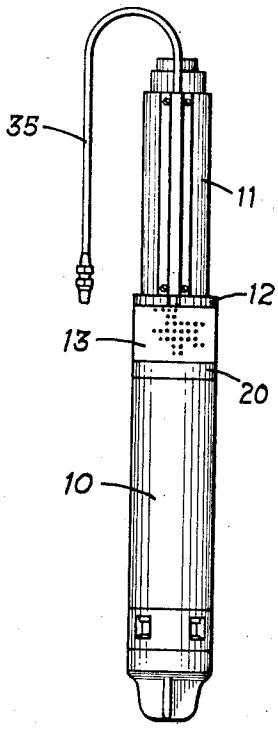


FIG-2

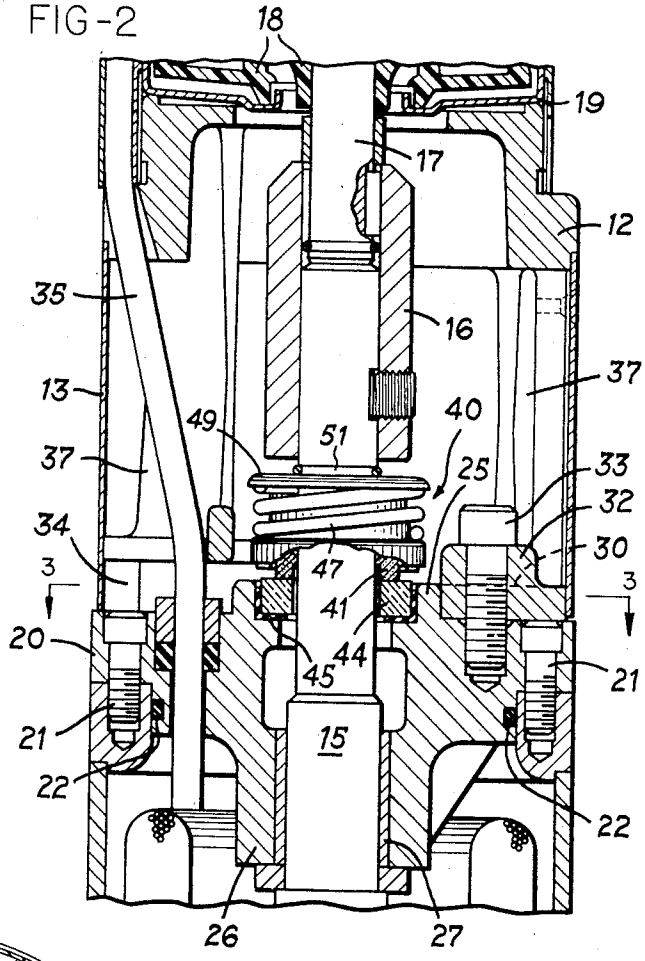


FIG-3

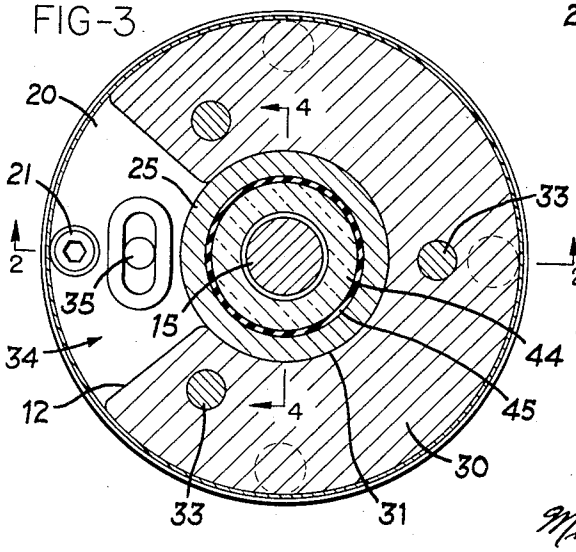
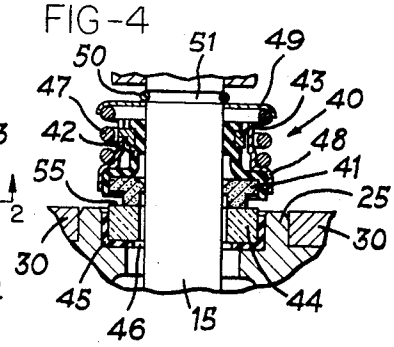


FIG-4



INVENTOR.
KENNETH R. LUNG
BY
Marechal, Biebel, French & Bugg
ATTORNEYS

United States Patent Office 2,885,964
Patented May 12, 1959

2,885,964

PUMPS

Kenneth R. Lung, Dayton, Ohio, assignor to The Tait Manufacturing Company, Dayton, Ohio, a corporatoin of Ohio

Application March 18, 1957, Serial No. 646,693

5 Claims. (Cl. 103—87)

This invention relates to submersible pumps.

The invention has particular relation to submersible pumps of the type including a motor as a part of the entire assembly which is submerged in a well, and with the motor depending below the pump. If such motor is of the totally enclosed type, it is necessary to provide a rotary seal at the junction of the motor shaft and the top of the motor casing where the shaft extends upwardly to the pump portion of the assembly. Pumps of this type are commonly subject to use with relatively sandy water, particularly during the initial period of use of a well, and such sand in the water constitutes a danger to the seal between the shaft and motor casing, since if the seal should be abraded sufficiently to leak, the motor may be flooded and spoiled.

It is a primary object of the present invention to provide a rotary seal for a submersible pump which is so constructed and arranged as to minimize the possibility of damage by sand in the water handled by the pump even after extended periods of use.

An additional object of the invention is to provide such a rotary seal which is so constructed that the natural forces incident to operation thereof in use in a submersible pump assembly tend to dispel sand from access to the relatively moving sealing parts.

It is also an object of the invention to provide a rotary seal construction having the advantages outlined above which in addition can be removed and replaced with maximum ease whenever such operation is necessary or desirable.

Further objects and advantages of the invention will be apparent from the following description, the accompanying drawing and the appended claims.

In the drawing—

Fig. 1 is a perspective view illustrating a submersible pump assembly of the type to which the present invention relates;

Fig. 2 is an enlarged fragmentary view in axial section through the connection between the pump and motor portions of the assembly of Fig. 1, the view being a section on the line 2—2 of Fig. 3;

Fig. 3 is a radial section on the line 3—3 of Fig. 2; and

Fig. 4 is a fragmentary section on the line 4—4 of Fig. 2.

Referring to the drawing, which illustrates a preferred embodiment of the invention, the submersible pump assembly shown in Fig. 1 includes a motor casing **10**, a pump shell **11**, and an intake cap **12** which connects the parts **10** and **11** and is covered by a screen **13**. The motor shaft **15** extends upwardly from the casing **10** into the interior of the cap **12** and is there connected by a coupling **16** to the pump shaft **17**. Fig. 2 also shows a fragment of the impeller **18** and cover **19** of the lowermost pumping stage in casing **11**, these parts being indicated as of the structure shown in my copending application Serial No. 633,412, filed January 10, 1957, and assigned to the same assignee as this application.

The construction of the intake cap **12** and its connection to the motor casing **10** are best seen in Figs. 2 and 3. A bracket **20** forms the upper end of the motor assembly, and it is secured in sealed relation with the upper end of casing **10** as by means of screws **21** and O-ring **22**. An annular shoulder **25** projects upwardly on the upper surface of bracket **22** in concentric relation with shaft **15**, this relationship being established by the bearing portion **26** of bracket **20** in which shaft **15** is journaled by a bushing **27**.

The shoulder **25** serves also to locate the intake cap **12** in concentric relation with the motor casing and the motor shaft **15**. The base portion of cap **12** is formed as a relatively flat internal flange **30** which seats on the upper surface of bracket **20** and is provided with a concentric throughbore **31** proportioned for close fitting telescoping engagement with the shoulder **25**. Bosses **32** on the upper surface of flange **30** receive screws **33** which secure the cap **12** to bracket **20**, and the cutaway opening **34** in flange **30** is to receive the motor cable **35**, which is provided with a sealing gland **36** where it passes through bracket **20** into the interior of motor casing **10**. The flange **30** is connected with the upper portion of cap **12** by ribs **37** which are spaced angularly from each other to provide the inlet passages to the inlet chamber within cap **12**.

The rotary seal assembly provided by the invention is indicated generally at **40** and is located within the intake cap **12**. Referring particularly to Fig. 4, the seal includes a rotary sealing ring **41** which may be of carbon or other suitable material and is secured in sealed relation on shaft **15** as by means of a rubber sleeve **42** and clamping ring **43**. The rotary sealing ring **41** engages a complementary stationary sealing ring **44** which is secured as by means of a rubber sleeve **45** in a counterbore **46** within the shoulder **25**. The rings **41** and **44** are shown as maintained in sealing arrangement in the usual way, by means of spring **47**, a metal sleeve **48**, and back-up plate **49** held axially on shaft **15** by means of a snap ring **50** in a groove **51**.

In accordance with the invention, the several parts of the seal as just described are so proportioned and arranged that the upper surface **55** of stationary sealing ring **44** is located above the plane of the surrounding area of the shoulder **25** and flange **30**. With this construction, any sand entering the interior of inlet cap **30** cannot effectively reach the complementary sealing surfaces of the rings **41** and **45**. Thus not only is the surface **55** higher then the surrounding surfaces so that sand does not tend to stay thereon even when the parts are at rest, but when the pump is in operation, the rotation of ring **41** and its associate parts of the seal will tend to produce outward currents which would sweep any sand off the surface **55**.

If the rotary seal assembly were incorporated within the bracket **20**, or otherwise located internally of motor casing **10**, and if then sand should enter and reach the sealing ring **44**, damage to the seal or to other parts within the casing would be most likely to occur, and this is particularly true in view of the difficulty of eliminating such sand once it had entered. With the present invention, however, the natural forces present in the operation of the rotary seal cooperate to minimize the possibility even of access by sand to the sealing parts, and thus even further reduce the possibility of entry of sand between the sealing surfaces of the rotary and stationary ring. The possibility of abrasion of these parts is therefore most remote, but if they should need replacement, as because of natural wear, they are accessible for easy servicing upon simple removal of the screen **13** and coupling **16**.

As an illustration of proportions of these parts which

have been found satisfactory, with a motor casing having an overall diameter of the order of 4 inches, the shoulder 25 and flange 30 may each be ¼ inch measured axially of shaft 15, and the ring 44 may be formed of a ceramic material and may also be ¼ inch thick. With these dimensions, the rubber mounting sleeve 45 of the relative proportions shown in Fig. 4 is sufficient to support the ring 44 with its upper surface 55 above the level of the end of shoulder 24. Furthermore, even if ring 44 were bottomed in counterbore 46, its surface 55 would still be not less than flush with shoulder 25, and this would provide equivalent advantages so long as the surface 55 is not lower than the surrounding areas to establish a recess where sand might collect.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a submersible motor including a motor shell sealed at the lower end thereof and having a drive shaft projecting from the upper end thereof, the combination of a bracket secured in sealed relation with said upper end of said shell and receiving said shaft therethrough, said bracket being exposed at the top thereof for direct access by liquid wherein said motor is submerged, a rotary sealing ring surrounding said shaft above said bracket, flexible means securing said ring in sealed relation with said shaft providing for limited movement of said ring on said shaft, means on said shaft biasing said ring toward said bracket, a stationary sealing ring located below said rotary sealing ring for sealing engagement between the upper surface thereof and said rotary ring under the biasing action of said biasing means, means securing said stationary ring on the upper end of said bracket, and said securing means being proportioned to support the upper surface of said stationary ring above the surrounding area of said bracket to prevent accumulation of sand therein.

2. In a submersible motor including a motor shell sealed at the lower end thereof and having a drive shaft projecting from the upper end thereof, the combination of a bracket secured in sealed relation with said upper end of said shell and receiving said shaft therethrough, said bracket being exposed at the top thereof for direct access by liquid wherein said motor is submerged, said bracket having a counterbore in the outer end thereof surrounding said shaft, a stationary sealing ring secured within said counterbore, a rotary sealing ring surrounding said shaft above said stationary ring, flexible means securing said rotary ring in sealed relation with said shaft providing for limited movement of said rotary ring on said shaft, means on said shaft biasing said rotary ring into sealing engagement with the upper surface of said stationary ring, and said stationary ring being proportioned to extend axially above the surrounding area of said bracket to prevent accumulation of sand on said upper surface thereof.

3. In a submersible motor including a motor shell sealed at the lower end thereof and having a drive shaft projecting from the upper end thereof, the combination of a bracket secured in sealed relation with said upper end of said shell and receiving said shaft therethrough, said bracket being exposed at the top thereof for direct access by liquid wherein said motor is submerged, an annular shoulder projecting upwardly on said bracket above the surrounding area of said bracket in concentric relation with said shaft, a rotary sealing ring secured to said shaft above said shoulder, a stationary sealing ring secured within said shoulder, means biasing said rotary sealing ring into maintained sealing engagement with said stationary ring, and said sealing ring being proportioned to locate said upper surface thereof axially above said shoulder to prevent accumulation of sand thereon.

4. In a submersible pump assembly including a submersible motor casing having a drive shaft projecting above the upper end thereof and a pump having a driving connection with said shaft, the combination of an intake cap connecting said pump and said motor casing and defining an inlet chamber extending therebetween through which the liquid wherein said assembly is submerged flows to said pump, a rotary sealing ring secured on said shaft for rotation therewith within said inlet chamber in facing relation with said motor casing, a stationary sealing ring for engagement by said rotary ring, means mounting said stationary ring on the upper end of said motor casing within said inlet chamber, means biasing said rotary sealing ring into maintained sealing engagement with the upper surface of said stationary ring, and said stationary ring and said mounting means therefor being proportioned to maintain said upper surface of said stationary ring above the surrounding area of said casing end to prevent accumulation of sand on said ring surface.

5. In a submersible pump assembly including a submersible motor casing having a drive shaft projecting above the upper end thereof and a pump having a driving connection with said shaft, the combination of an intake cap connecting said pump and said motor casing and defining an inlet chamber extending therebetween through which the liquid wherein said assembly is submerged flows to said pump, a bracket forming the upper end of said casing, a flange on the lower end of said intake cap seated on said bracket and having a central throughbore, an annular shoulder extending upwardly on said bracket in concentric relation with said shaft and projecting through said bore in said flange to locate said cap and said casing in coaxial relation, a rotary sealing ring secured on said shaft within said inlet chamber and above said shoulder, a stationary sealing ring for engagement by said rotary ring, means securing said stationary ring within said shoulder and with the upper surface thereof extending above the surrounding area of said shoulder and said flange to prevent accumulation of sand on said surface thereof, and means biasing said rotary ring into maintained sealing engagement with said upper surface of said stationary ring.

References Cited in the file of this patent

UNITED STATES PATENTS

2,268,218	Lum	Dec. 30, 1941
2,577,559	Armstrong et al.	Dec. 4, 1951
2,668,068	Bredemeier	Feb. 2, 1954
2,682,229	Luenberger	June 29, 1954
2,722,892	French	Nov. 8, 1955
2,766,696	Lung	Oct. 11, 1956
2,786,952	Pleuger	Mar. 26, 1957

FOREIGN PATENTS

434,505	Great Britain	Sept. 3, 1935