Nov. 3, 1959 J. L. BETZEN 2,910,948

HYDRAULIC ROTARY PUMPS

Filed July 16, 1957 2 Sheets-Sheet 1

Fig. 1

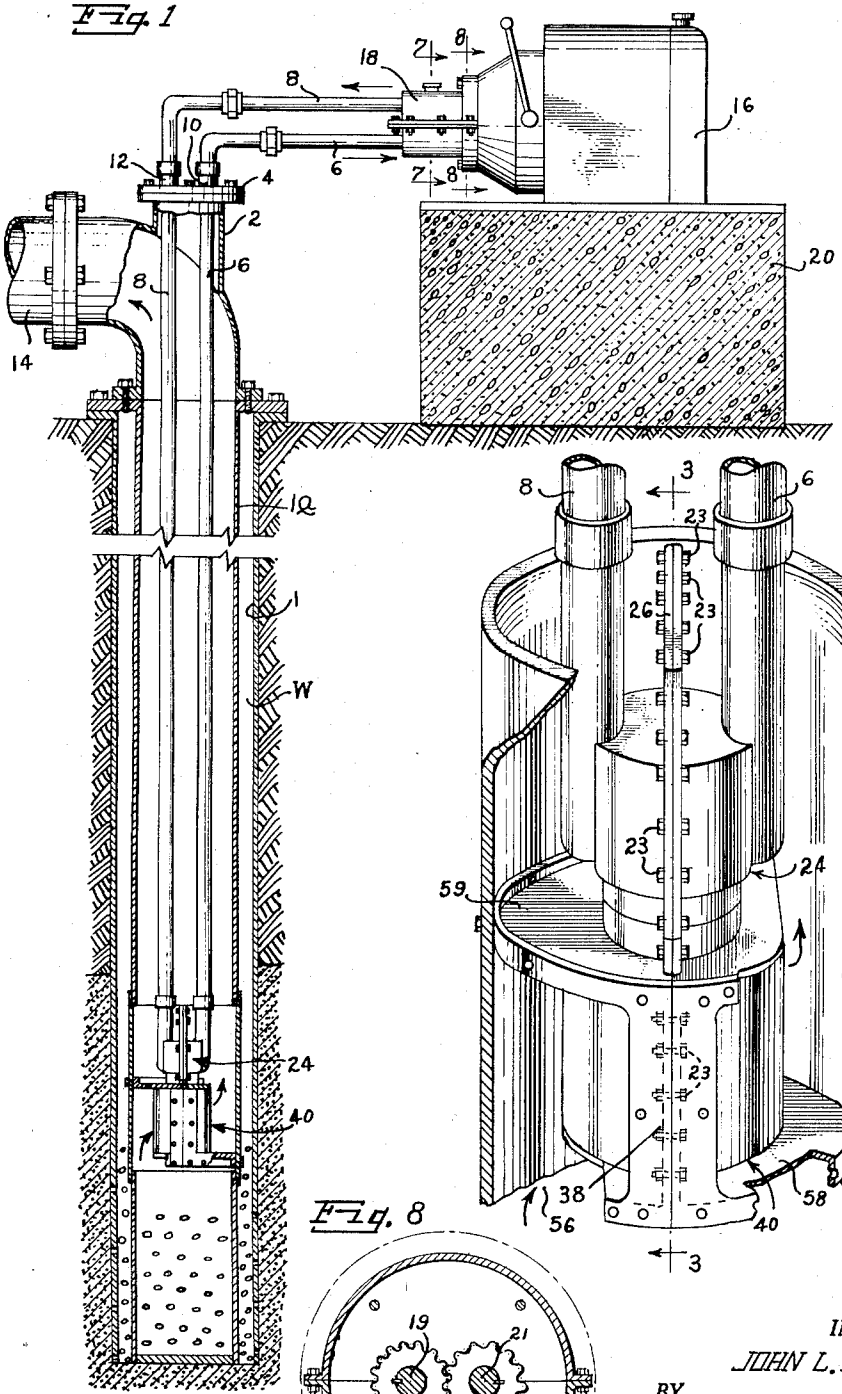


Fig. 2

Fig. 8

INVENTOR.
JOHN L. BETZEN
BY
Wayland D. Keith
HIS AGENT

Nov. 3, 1959 J. L. BETZEN 2,910,948

HYDRAULIC ROTARY PUMPS

Filed July 16, 1957 2 Sheets-Sheet 2

Fig. 3

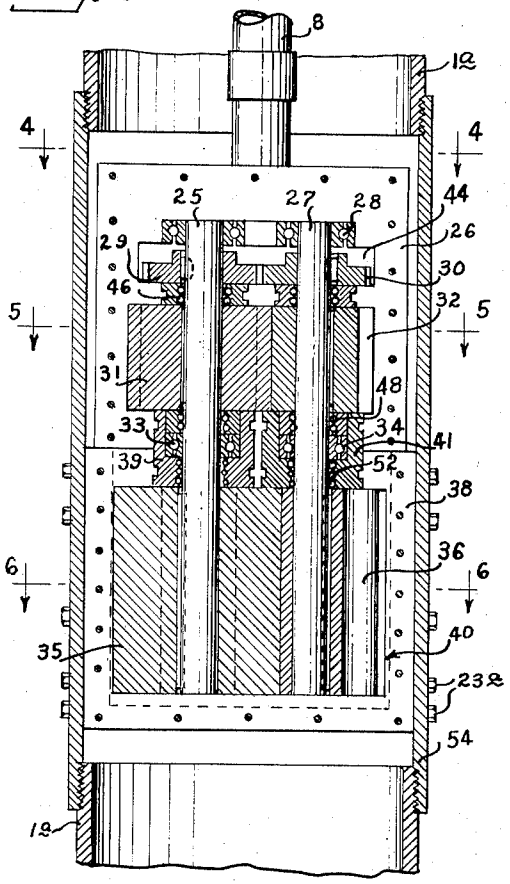


Fig. 4

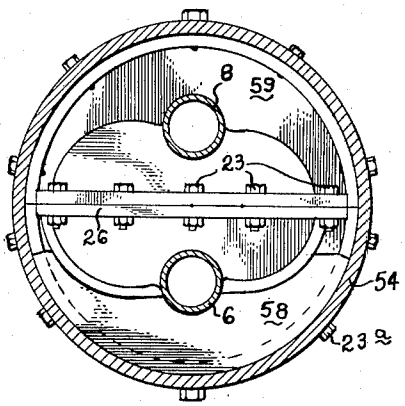


Fig. 5

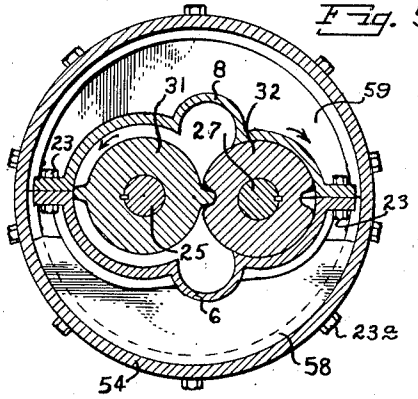


Fig. 6

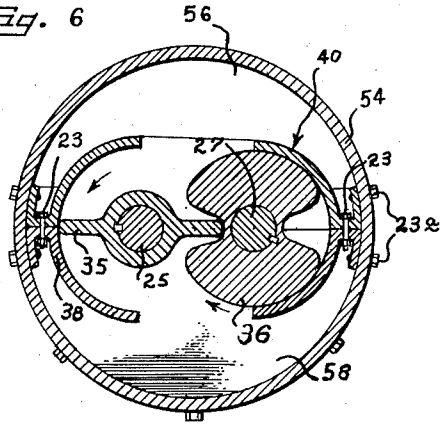
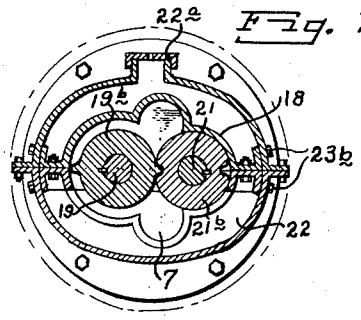


Fig. 7



INVENTOR.
JOHN L. BETZEN
BY
Wayland D Keith
HIS AGENT

United States Patent Office

2,910,948

Patented Nov. 3, 1959

2,910,948

HYDRAULIC ROTARY PUMPS

John L. Betzen, Hereford, Tex.

Application July 16, 1957, Serial No. 672,256

1 Claim. (Cl. 103—118)

This invention relates to improvements in hydraulic pumps and more particularly to hydraulically driven rotary pumps for use in wells, such as water wells, oil wells, and the like.

The present pump is so constructed as to give a wide variety of uses, especially for handling large volumes of liquid under both low and high pressures.

An object of this invention is to provide a pump which may be placed in the bottom of a well or the like, and which may be driven by a rotary hydraulic motor which is connected integral therewith, thereby eliminating the necessity for reciprocating rods and the like, or for rotating shafts driven by a power unit at the surface.

Another object of the invention is to provide a pump that is simple in construction, low in cost of manufacture, which is comparatively free of maintenance and repair, and which is efficient in operation.

A still further object of the invention is to provide a pair of hydraulic fluid impeller elements which have a minimum of toothed projections thereon so as to minimize heat, friction and agitation during the movement of the fluid thereby.

With these objects in mind, and others which will become manifest as the description proceeds, reference is to be had to the accompanying drawings, in which like reference characters designate like parts in the several views thereof, in which:

Fig. 1 is a longitudinal sectional view through a well, with parts broken away and shortened, and showing the pump and pump motor installed therein, and showing a power unit and a pressure supply pump connected thereto;

Fig. 2 is an enlarged, fragmentary, perspective view of the lower portion of a well casing showing the pump and pump motor installed therein;

Fig. 3 is a longitudinal, sectional view through the pump and the hydraulically actuated motor, taken on the line 3—3 of Fig. 2, looking in the direction indicated by the arrows;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3, looking in the direction indicated by the arrows;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 3, looking in the direction indicated by the arrows;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 3, looking in the direction indicated by the arrows;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 1, looking in the direction indicated by the arrows; and

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 1, looking in the direction indicated by the arrows.

With more detailed reference to the drawing, the numeral **1** designates a well casing, such as used in well W, which casing has a flow pipe **1***a* therein, which flow pipe is shown to have a head **2** on which a cap member **4** is secured. The cap member **4** has holes therethrough, through which pipes **6** and **8** pass. The respective stuffing boxes **10** and **12** form tight seals between the cap member **4** and the respective pipes **6** and **8**. An outlet pipe **14** is connected to the flow pipe **1***a* for directing the liquid

being pumped outward to a place of storage or to a place of use, as the case may be.

A power unit **16** is provided, which power unit may be an electric motor or an internal combustion engine or the like, and on which is fitted a hydraulic pump designated generally at **18**, for generating hydraulic pressure. The power unit **16** is mounted on a base **20**.

A hydraulic reservoir **22** surrounds the hydraulic pump, which is designated generally at **18**, and keeps the inlet **7** of the pump submerged in hydraulic fluid at all times. The hydraulic pump has a casing, which casing is split longitudinally to enable the ready assembly and disassembly, which casing is secured within reservoir **22** by means of cap screws **23***b*.

The reservoir **22** completely surrounds the pump **18**, which reservoir **22** is provided with a fill cap **22***a* to supply the necessary hydraulic fluid therefor.

The hydraulic pressure pump **18** directs the fluid downward through pipe **8** into hydraulically actuated motor **24**. The hydraulically actuated motor **24** is of the rotary type and has a split casing **26**, the portions of which split casing are bolted together by means of bolts **23**, as will best be seen in Fig. 3. It is preferable to mount the shafts **25** and **27** on anti-friction bearings **28**, which bearings are preferably sealed against the entrance of fluid or of foreign matter. The casing **26** is recessed to receive bearings **28**, gears **29** and **30**, seals **46**, and impeller rollers **31** and **42**. The bearings **33** and **34**, as well as the seals **48** and **52**, which form the seal between the respective shafts, are fitted in sleeves **39** and **41** which surround the respective shafts **25** and **27**, and which sleeves are positioned in and between housings **26** and **38**.

The pump impellers **35** and **36** are mounted on the respective shafts **25** and **27** and rotate therewith. The pump impeller elements **35** and **36** are fitted within a housing **38**, which housing is similar in construction to housing **26**. The housing **38** is positioned adjacent and immediately below housing **26**, and fits over a pair of complementary sleeve members **39** and **41**, which sleeve members are grooved to complementarily receive complementary, semi-annular ribs formed in the bores in the upper end of housing **38**. The lower end of housing **26** also has similar complementary, semi-annular ribs in the lower ends of the bores thereof, to complementarily engage the grooves in the upper ends of the respective sleeves **39** and **41**, so when the complementary split housings **26** and **38** are bolted together, they will engage the sleeves **39** and **41** therebetween to hold the two housings in longitudinally aligned relation. Bolts **23***a* secure the flanges of the pump housing **38** to the sleeve **54**. Bolts **23***a* also secure the flanges of the peripheral portion of plates **58** and **59** at the lower and upper portions of housing **38**, respectively, which plates **58** and **59**, together with the impellers **35** and **36** close the sleeve **54** against return flow of fluid which passes upward through pump **40**.

The motor for actuating the pump impellers comprises two cylindrical bodies **31** and **32**. The cylindrical impeller body **31** of which carries a pair of teeth mounted longitudinally thereof at a spacing of 180 degrees, while the cylindrical impeller body **32** has complementary recesses formed therein, which recesses complementarily engage the teeth of the impeller body **31**, with the peripheries of the respective bodies forming a rolling contact one with the other, while the motor is being actuated. The motor impellers **31** and **32** have their adjacent peripheries in fluid tight contact relation and the peripheries of the bodies are in fluid tight contact with the housing **26**, so as to prevent leakage of hydraulic fluid thereby, as the hydraulic fluid passes through the motor. The cylindrical impeller bodies **31** and **32** are secured to the respective

shafts 25 and 27 by means of keys, as will best be seen in Fig. 5.

The pump impellers 35 and 36, which are mounted on and keyed to the respective shafts 25 and 27, are maintained in timed relation by gears 29 and 30, which gears are keyed to the respective shafts 25 and 27. The gears 29 and 30 are maintained in a sealed chamber 44, which chamber is not in fluid communication with the chambers in which cylindrical impeller bodies 31 and 32, and impellers 35 and 36 are positioned. O-ring sealing units 46, 48 and 52 are provided on the shafts 25 and 27, to prevent the ingress of hydraulic fluid, lubricant, or of fluid being pumped from one chamber to another.

While O-ring sealing elements have been shown and described as the sealing means, it is to be understood that other types of sealing means, which are applicable, may be substituted therefor, and while anti-friction bearings have been specified, other types of bushings or bearings may be utilized when applicable.

It is to be pointed out that, while straight conduit, such as rigid pipe, is shown as connecting the pump 18 and the hydraulically actuated motor 24, a flexible conduit or even a hose may be used to interconnect the pump 18 and the hydraulically actuated motor 24, which will enable the pump to be run into a well, or placed in other places where it would be impossible for a straight pipe to be used, with the pump delivering the full efficiency. Pumps that are placed at or near the bottom of a well which utilize rotating shafts from a source of power at or near the top of the well, require that the bore of the well be sufficiently straight to enable the shafts to be journaled in axially aligned bearings, otherwise damaging wear will occur on the misaligned parts. Furthermore, wells which utilize reciprocating rods should also have a straight bore hole, or the rods will "drag" on the sides of the tubing, thereby causing material wear and damage to both the tubing and the rods. The bore hole of a deep well cannot, as a rule, be kept sufficiently straight for non-flexible pipe to be used between the pump and the power, without causing a drag on the rods or misalignment of rotating shafts. In the present pump the above mentioned difficulties are not present.

The pump 18 has shafts 19 and 21 therein, with the shaft 21 being connected with the power unit 16, the shaft 19 being in driven relation. While the gears 19*a* and 21*a* are shown to be in one to one ratio, it is to be understood that other ratios may be used if desired, by altering the pump impellers 19*b* and 21*b* so as to cause the respective teeth and recesses of the respective impellers to engage in timed relation. The same is true of the motor 24 and pump 40.

Operation

With the power unit 16 running, so as to operate the hydraulic pressure pump 18, hydraulic fluid is withdrawn from reservoir 22 into inlet 7 of the pump 18, and is directed outward through pipe 8, and thence through stuffing box 12, downward through pipe 8 in well casing 1. The pipe 8 is connected to a pressure actuated motor 24 to drive the motor impellers 31 and 32 in the direction indicated by the arrows in Fig. 5, and since the gears 29 and 30, as well as the pump impellers 35 and 36 are secured to the respective shafts, the cylindrical motor impeller bodies 31 and 32 drive pump impellers 35 and 36 of the pump 40, which pump 40 is submerged in the liquid being pumped. The housing 38 and the pump 40 are bolted to the casing sleeve 54, with a portion of the bottom of the sleeve being open, as indicated at 56, Fig. 6, and with a portion of the bottom being closed as indicated at 58, Fig. 6, therefore, the liquid being pumped will be drawn in through the open portion 56 and will be directed from the chamber therein around the periphery of pump impellers 35 and 36 into chamber portion 57 of the sleeve 54. Since the chamber 56 is in open communication with the lower portion of flow pipe 1*a*, the water, oil, or the like which is being pumped, will be directed into chamber 57 and thence upward around gear motor 24 into flow pipe 1*a* and out through outlet pipe 14. The liquid that is pumped upward around and by motor 24 will maintain the motor in cooled condition while it is operating.

While the invention has been illustrated and described for use in a well, it is to be pointed out that it may also be used for rotary machinery or for vehicles, or any use to which it may be applicable.

It is also to be understood that, while the invention has been described and illustrated in one embodiment thereof, that changes may be made in the minor details of construction and adaptations made to different installations, without departing from the spirit of the invention or the scope of the appended claim.

Having thus clearly shown and described the invention, what is claimed as new and desired to be secured by Letters Patent is:

A hydraulically actuated rotary motor adapted to be positioned within a well, a rotary well pumping unit adapted to be positioned within said well and being integrally connected in timed relation with said hydraulically actuated motor; comprising a hydraulically actuated motor having a pair of parallel shafts extending therethrough, a timing gear on each of said shafts, which gears are in meshed relation, complementary, hydraulically actuated motor impellers, one mounted on each of said shafts and being secured thereto for rotation therewith, complementary, rotary well pumping unit impellers, one of which impellers is mounted on and secured to each of said shafts for rotation therewith, a housing surrounding said hydraulically actuated motor impellers in fluid tight relation, an inlet opening formed in one side of said housing and an outlet opening formed in the opposite side thereof; a housing surrounding said impellers of said rotary well pumping unit in fluid tight relation, said last mentioned housing having an inlet opening formed in a side thereof and an outlet opening formed in the opposite side thereof, bearings journaling shafts in said housings for rotation about the axis thereof, said housings being divided along a longitudinal medial plane passing through the axes of said shafts, which housing portions are complementary, bolts passing through adjacent portions of said housing portions to secure said housing portions together in unitary, rigid relation, said complementary housing portions, when fitted together, forming pairs of parallel cylindrical bores, annular ribs formed in each of said housings to extend into the respective bores, said housings being adapted to be fitted together in end to end, auxiliary aligned relation, the cylindrical bores of the respective housings adapted to be in axial alignment, a pair of sleeves, each of which sleeves has a pair of annular grooves formed within the exterior thereof so as to complementally receive said respective annular ribs, at least one of said bearings being positioned in each of said sleeves, and sealing means intermediate the respective shafts and the respective sleeves, when said respective sleeves are fitted within said respective bores.

References Cited in the file of this patent

UNITED STATES PATENTS

744,352	Johnston	Nov. 17, 1903
1,254,358	Rinehart	Jan. 22, 1918
2,100,560	Kennedy	Nov. 30, 1937
2,180,378	Whitfield	Nov. 21, 1939
2,269,189	Downs	Jan. 6, 1942