July 22, 1941. J. H. WILSON 2,249,802

SLUSH PUMP

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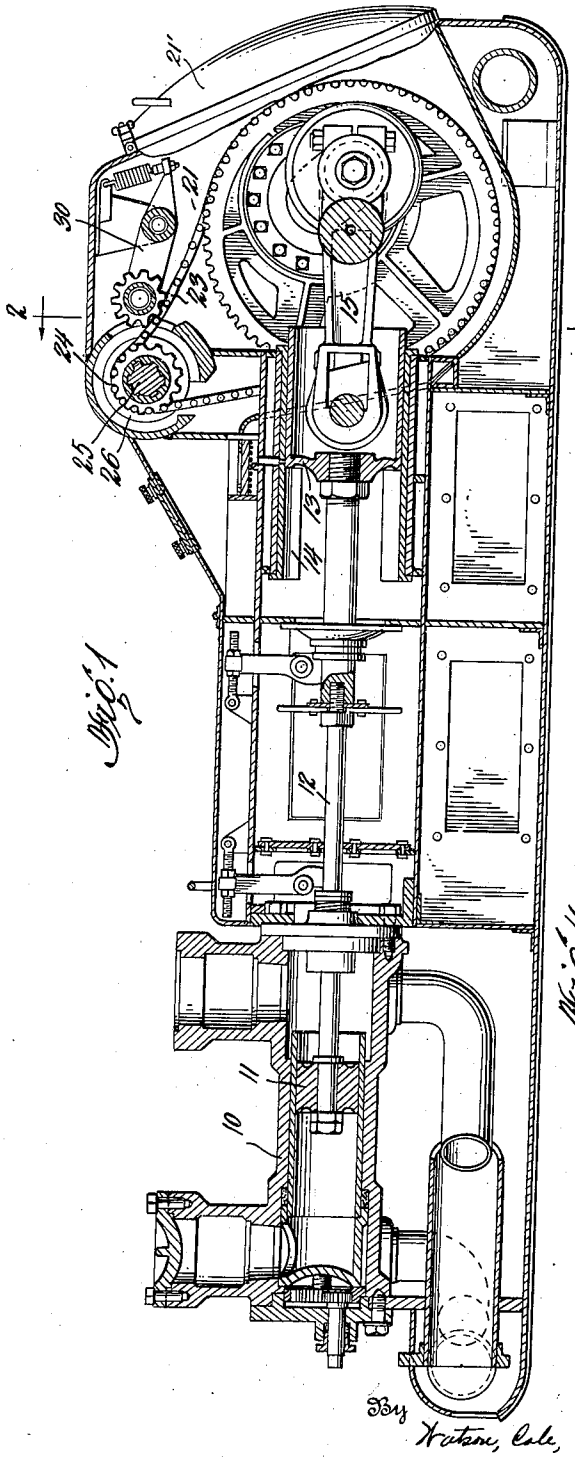

Fig. 1

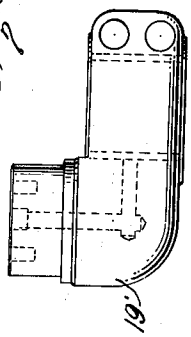

Fig. 5

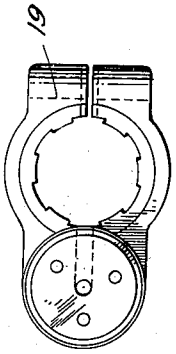

Fig. 4

Inventor
John Hart Wilson

By
Watson, Cole, Grindle & Watson
Attorneys

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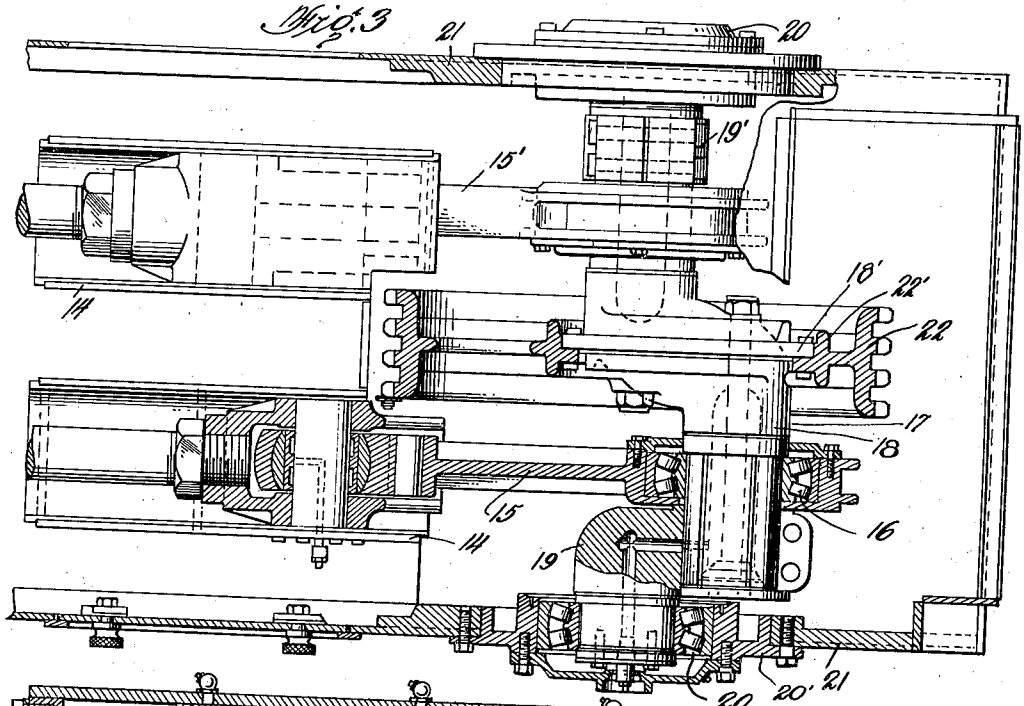
Fig. 3



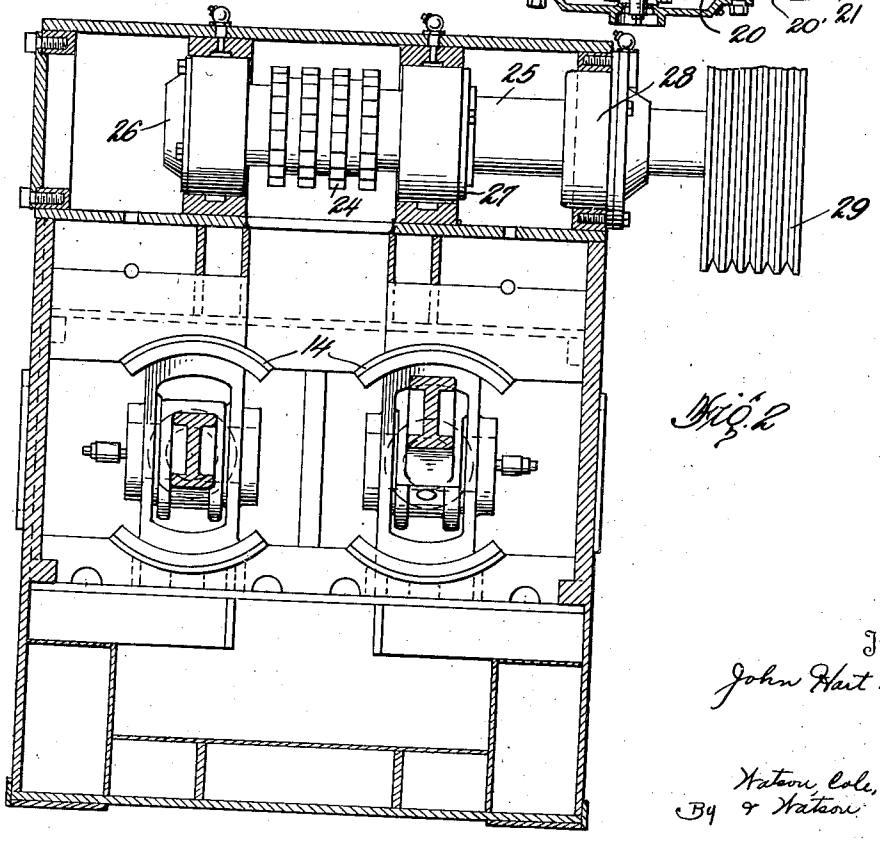


Fig. 2

Inventor
John Hart Wilson

Watson, Cole, Grindle & Watson
By
Attorneys

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SLUSH PUMP

John Hart Wilson, Wichita Falls, Tex.

Application March 20, 1939, Serial No. 263,035

7 Claims. (Cl. 74—44)

This invention relates to power driven pumps, and more particularly to pumps of the type commonly used in connection with well drilling operations, and known as slush pumps or mud pumps. Such pumps are commonly of the duplex double-acting type, and the present invention, accordingly, will be described in connection with that type of pump. However, it will be understood that the features and advantages of the present invention are not wholly limited to duplex pumps, or to double-acting pumps, although such features and advantages are particularly important in connection with heavy duty pumps for handling large volumes of fluids at relatively high pressures.

It is a general object of the present invention to provide a slush pump of superior construction from the standpoint of ruggedness, durability, efficiency and economy, and more particularly to provide a pump having great mechanical strength while at the same time being of economical construction in that the entire unit contains much less metal, by actual weight, and is of considerably smaller overall width than previously known pumps of like capacity.

A principal feature of the present invention resides in the provision of a crank-shaft of novel design, which permits of an advantageous disposition of the main bearings and of the connecting rod bearings, as well as permitting the use of anti-friction bearings in both instances, which is not possible with other types of crank-shafts now commonly used in such pumps. Another object is the provision of novel and advantageous drive means connecting the crank-shaft and the jack-shaft or power shaft of the pump, which drive means is particularly advantageous in connection with the novel crank-shaft employed.

A general object of the invention is to overcome certain disadvantages inherent in the construction of the slush pumps heretofore known. Such pumps consist generally of a pair of double-acting pump cylinders having the necessary valves and provided with pistons, a crank-shaft, connecting rods for driving the pistons from the crank-shaft, and means for driving the crank-shaft. One important respect in which the pumps heretofore known have varied in construction lies in the design of the crank-shaft, the position and type of the main bearings, and the position and type of the connecting rod bearings.

Three principal arrangements have been employed in the past. In the first such arrangement, the crank-shaft has been mounted in main bearings adjacent its center, i. e., on either side of the central gear wheel through which it is driven, and provided with "overhung" cranks secured to the respective ends of the crank-shaft. This arrangement permits of the use of anti-friction main bearings as well as anti-friction connecting rod bearings, but is disadvantageous in that the main bearings are very highly stressed by reason of the application of the connecting rod load at points outside of the main bearing, necessitating the use of large bearings and involving a costly construction. Also, the placing of the main bearings inside of the cranks requires strengthening of the framework at these points, involving the use of heavy beams which add to the weight and cost of the pump, as compared with one in which the main bearings are supported in their logical position, namely, in the side frames of the casing which are normally the strongest parts of the frame structure. In addition, the use of very large and heavy main bearings necessitates the use of split bearings, which is disadvantageous in that the bearings must be bolted together, and the mechanism is thus subject to injury if a bolt breaks, such bolts being under a very heavy load.

In a second type of construction the straight crank-shaft is journalled, at its ends, in the side frames of the pump and the connecting rods are supported on plain eccentrics secured on the crank-shaft or made integral with the central gear wheel. In this construction the main load is transmitted to the side frames, in a proper manner, but the construction does not permit of the use of anti-friction connecting rod bearings and the eccentrics and connecting rod journals are thus subject to excessive wear and relatively high friction losses.

The third type of arrangement employs a conventional crank-shaft journalled in the side frames, the connecting rods being supported on plain bearings secured on the crank throws, much as in the usual steam engine construction. This arrangement, like the second type described, is disadvantageous in not permitting use of anti-friction connecting rod bearings.

In the construction according to the present invention, the crank-shaft is journalled in the side frames, in anti-friction bearings, and due to the novel design of crank-shaft employed, these side frames may be placed closer together than would otherwise be the case, thus reducing the width of the unit and greatly reducing its weight, as well as producing a stronger unit. Also due to the novel crank-shaft design, anti-

friction connecting rod bearings may be used, the advantages thereof being obvious.

Other and further objects, features and advantages of the present invention will be apparent to one skilled in the art from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal vertical section of a pump unit in accordance with the present invention;

Figure 2 is a transverse vertical section on line 2—2 of Figure 1;

Figure 3 is a horizontal section of the mechanism shown on the right in Figure 1, certain parts being shown in plan, for convenience; and

Figures 4 and 5 are an end elevation and a plan, respectively, of one of the removable end sections of the novel crank-shaft of the present invention.

In order to facilitate an understanding of the invention, reference is made to the embodiment thereof shown in the accompanying drawings and detailed descriptive language is employed. It will nevertheless be understood that no limitation of the invention is thereby intended and that various changes and alterations are contemplated such as would ordinarily occur to one skilled in the art to which the invention relates.

Referring to the drawings, it will be seen that the pump of the present invention comprises, generally, the usual cylinders 10, which are provided with suitable inlet and discharge passages and valves, the pistons 11, piston rods 12, slides 13, guides 14, and connecting rods 15, 15', articulated with the slides 13. The connecting rods 15, 15' are journalled on anti-friction roller bearings 16, carried on a crank-shaft 17 (Figure 3). The latter comprises a central section or portion 18, constituting a pair of crank-pins and a diagonal or offset portion connecting said crank-pins, and two similar L-shaped end sections 19, 19'. The L-shaped sections are illustrated in Figures 4 and 5, and are adapted to be splined and bolted upon the respective ends of the central crank-shaft section 18, outside of the connecting rod bearings 16. The web portions of the L-shaped sections 19, 19' which extend at right angles to the central section 18 are mutually angularly displaced by 90°, the outwardly turned journal portions of said L-shaped sections being in alignment and being journalled in suitable anti-friction bearings 20 carried in the side frames or casing walls 21. By virtue of the shape of the crank-shaft it will be seen that the central section 18 moves in an orbit about the axis of the bearings 20, thus actuating the connecting rods 15, 15' in proper phase relation. The end sections 19, 19' being removable, the anti-friction connecting rod bearings 16 may be inserted in place without difficulty.

The anti-friction bearings 20 are carried in bearing cages 20', which are in turn bolted or otherwise suitably secured in the casing walls 21. The cages 20' are of relatively large diameter, in order to facilitate assembling and disassembling of the pump. Thus, in assembling the pump, after the central crank-shaft section 18, with the connecting rods journalled thereon, has been put in place, through the large opening in the rear of the casing, closed by the cover plate 21' (Figure 1), the end sections 19 and 19' may be inserted through the main bearing apertures and slipped onto the respective splined ends of the central section 18, to which they are rigidly secured by bolts. The bearing cages 20', carrying the bearings 20, are then put in place and bolted to the casing walls.

Since the crank-shaft of the present invention is subject to some deflection, it is preferred to employ main bearings and connecting rod bearings of the self-aligning type, as illustrated, which are capable of compensating for any possible deflection of the crank-shaft without damage to the bearings.

Since the crank-shaft above described will, in heavy service, be subject to a certain amount of deflection, it is preferred to use a chain drive in lieu of the usual direct gear drive, although the present organization is by no means limited to use with chain drives alone. In the present embodiment, a sprocket wheel 22 (Figures 1 and 3) is mounted eccentrically on the central section 18 of the crank-shaft at the point where the offset occurs in the latter. The wheel 22 has its center in line with the bearings 20, but since no part of the central section 18 of the crank-shaft lies on this axis, it is necessary to mount the wheel 22 eccentrically with respect to the latter. The section 18 is therefore provided with an integral flange 18', and the wheel 22 is formed with an eccentric hub 22' which is adapted to be bolted to the flange 18'. The sprocket wheel 22 is driven through a chain 23 from a sprocket pinion 24 carried on the jack-shaft 25 (Figure 2), which latter is journalled in anti-friction bearings 26, 27 and 28. The outer end of the jack-shaft 25 carries means for receiving power from an external source, illustrated in the present embodiment as a multiple V-belt sheave 29. Preferably, an automatic chain tightener 30 is employed in connection with the chain 23, as seen in Figure 1.

By reason of the mode in which the sprocket wheel 22 is mounted on the contral section 18 of the crank-shaft, that is, at the point where the offset occurs rather than on a straight portion provided between two offsets, as in the case of a conventional crank-shaft, it is apparent that the overall length of the crank-shaft may be considerably reduced, thus reducing the overall width of the entire pump unit, and effecting a considerable economy in metal. It will also be apparent that the present arrangement of the crank-shaft, connecting rods and bearings results in a strong and rugged construction which, at the same time, is adapted to operate with a minimum of friction, thus reducing friction losses and conducing to the long life of the moving parts. Furthermore, it will be readily understood that by reason of the present construction the connecting rod load is transmitted to the side frames of the unit, which are normally the strongest parts of the frame, and it is unnecessary to provide special reinforcing members inwardly of the side frames, as in the case when the crank-shaft is supported on bearings lying inwardly of its ends.

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

1. In a power driven pump of the duplex double-acting heavy duty type, a crankshaft comprising two aligned axially extending end portions, opposed portions extending transversely to said end portions and arranged at an angle of substantially 90° to each other, and a central portion connecting the ends of said opposed portions, said central portion being disposed eccentrically to the axis of the crankshaft and having a lateral offset, and a power-receiving member

eccentrically secured on said central portion at the point where said offset occurs.

2. In a power driven pump of the duplex double-acting heavy duty type, a crankshaft comprising a central section disposed eccentrically to the axis of the crankshaft and having a lateral offset and two L-shaped end sections removably secured on the respective ends of said central section, each said L-shaped section comprising an axially extending journal portion and a transverse web portion, said web portions being disposed at an angle of substantially 90° to each other, and a power receiving member eccentrically secured on said central section at the point where said offset occurs.

3. In a power driven pump of the duplex double-acting heavy duty type, a frame including a pair of parallel longitudinal outer walls, a crankshaft journalled at its ends in anti-friction bearings carried by said respective walls, said crankshaft comprising two aligned axially extending end portions, opposed portions extending transversely to said end portions and arranged at an angle of substantially 90° to each other, and a central portion connecting the ends of said opposed portions, said central portion being disposed eccentrically to the axis of the crankshaft and having a lateral offset, and a power-receiving member eccentrically secured on said central portion at the point where said offset occurs.

4. In a power driven pump of the duplex double-acting heavy duty type, a crankshaft comprising a central section disposed eccentrically to the axis of the crankshaft and having a lateral offset and two L-shaped end sections removably secured on the respective ends of said central section, each said L-shaped section comprising an axially extending journal portion and a transverse web portion, said web portions being disposed at an angle of substantially 90° to each other, anti-friction bearings on said central section on either side of said offset, connecting rods journalled on said anti-friction bearings, and a power receiving member eccentrically secured on said central section at the point where said offset occurs.

5. In a power driven pump of the duplex double-acting heavy duty type, a frame including a pair of parallel longitudinal outer walls, a crankshaft journalled at its ends in anti-friction bearings carried by said respective walls, a jack-shaft journalled in said frame, and means including a power receiving member on said crankshaft for affording a driving connection between said jack-shaft and crankshaft, said crankshaft comprising two aligned axially extending end portions, opposed portions extending transversely to said end portions and arranged at an angle of substantially 90° to each other, and a central portion connecting the ends of said opposed portions, said central portion being disposed eccentrically to the axis of the crankshaft and having a lateral offset, and said power receiving member being eccentrically secured on said central portion at the point where said offset occurs.

6. In a power driven pump of the duplex double-acting heavy duty type, a frame including a pair of parallel longitudinal outer walls, a crankshaft journalled at its ends in anti-friction bearings carried by said respective walls, said crankshaft comprising a central section disposed eccentrically to the axis of the crankshaft and having a lateral offset and two L-shaped end sections removably secured on the respective ends of said central section, each said L-shaped section comprising an axially extending journal portion and a transverse web portion, said web portions being disposed at an angle of substantially 90° to each other, anti-friction bearings on said central section on either side of said offset, connecting rods journalled on said anti-friction bearings, and a power receiving member eccentrically secured on said central section at the point where said offset occurs.

7. In a power driven pump of the duplex double-acting heavy duty type, a crankshaft comprising two aligned axially extending end portions, opposed portions extending transversely to said end portions and arranged at an angle of substantially 90° to each other, and a central portion connecting the ends of said opposed portions, said central portion being disposed eccentrically to the axis of said crankshaft and comprising two crank-pin portions extending parallel to the axis of the crankshaft and a diagonal portion connecting said crank-pin portions, and a power receiving member eccentrically secured on said diagonal portion and having its axis coincident with the axis of said crankshaft.

JOHN HART WILSON.