

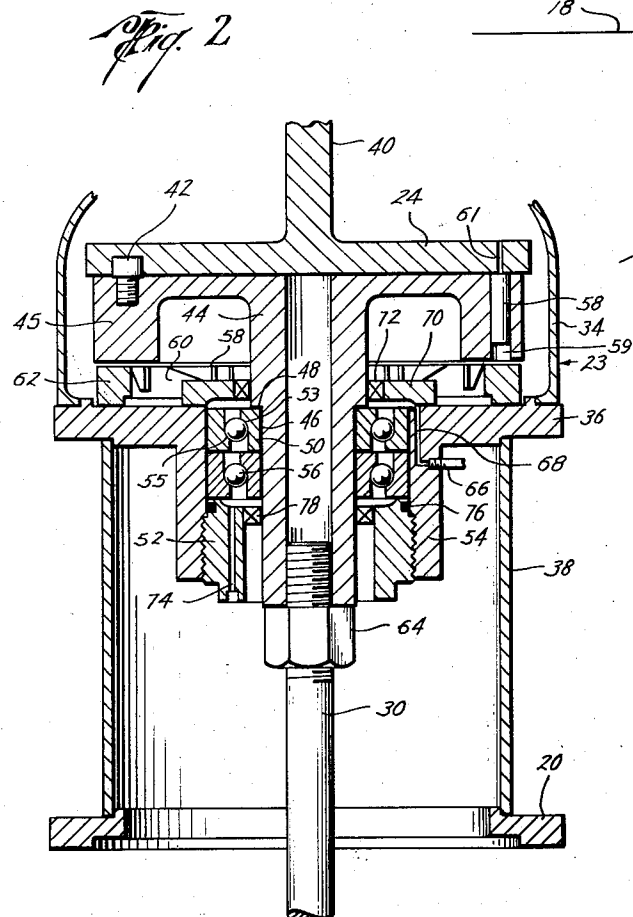
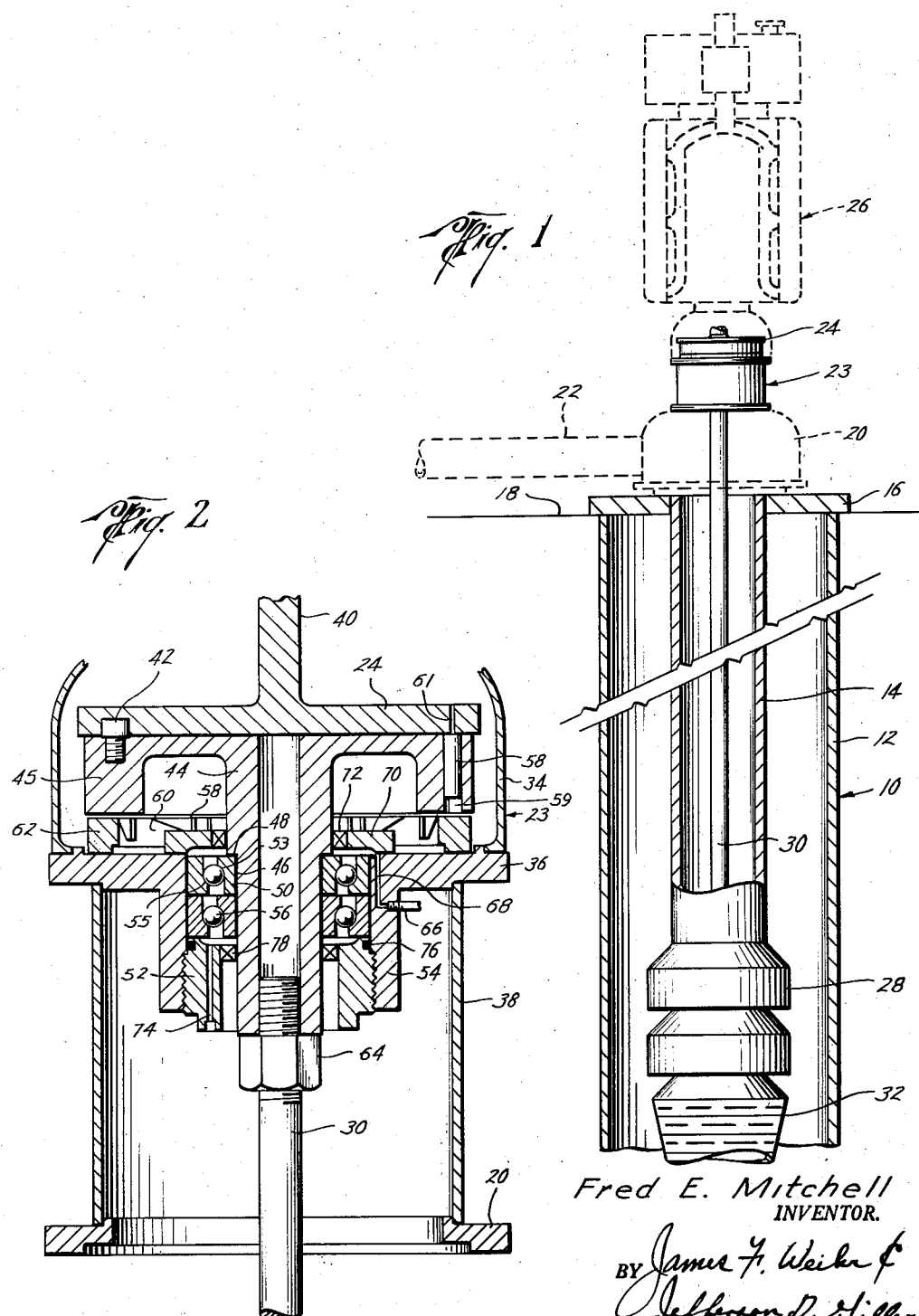
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VERTICALLY-MOUNTED ENGINE-DRIVEN PUMP ASSEMBLY

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VERTICALLY-MOUNTED ENGINE-DRIVEN PUMP ASSEMBLY

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The present invention relates to engine-driven pumps, and, more particularly, to a vertically-mounted internal-combustion engine-driven pump assembly.

Internal-combustion engines have long been used for actuating pump mechanism in a well bore for pumping purposes, such as deep water well pumping units. These internal-combustion engines have been mounted in a generally horizontal position and provide drive at right angles to the axis of the well bore. This necessitates a right angle drive and linkage, such as universal joints, couplings, belts or the like. The right angle drive or quarter turn belt drive structure greatly increases the initial cost of the pump installation and a considerable amount of efficiency is lost in transmitting power by the right angle drive or belt mechanism.

It is therefore a major object of the present invention to provide an internal-combustion engine-driven pump assembly which eliminates the right angle drive or belt mechanism and linkage and, accordingly, eliminates the initial cost and loss of efficiency thereof.

Yet a further object of the present invention is the provision of a pump assembly which includes a vertically-mounted internal-combustion engine thereby eliminating the need for right hand drive or belt mechanism and linkage and eliminating the loss of efficiency occasioned in its use.

It is yet a further object of the present invention to provide a vertically-mounted internal-combustion engine-driven pump assembly in which the engine is connected through an adapter directly to the pump shaft extending downwardly in the well.

Yet a further object of the present invention is the provision of an adapter or coupling assembly by which the flywheel of the vertically-mounted internal-combustion engine may be connected directly to the pump shaft of the pump assembly.

A still further object of the present invention is the provision of a pump mechanism of the character mentioned which is simplified, relatively inexpensive to manufacture, assemble and operate, easily and readily repaired, and which is reliable and of increased efficiency over other internal-combustion engine-driven pump assemblies.

Other and further objects, features and advantages will be apparent from the following description of a presently preferred example constructed in accordance with the invention, given for the purpose of disclosure, and taken in conjunction with the accompanying drawing, where like character references designate like parts throughout the several views, and where

Figure 1 is a side elevation, partly in section, of a vertically-mounted internal-combustion engine-driven pump assembly according to the invention, and

Figure 2 is a side elevation, partly in section, of an adapter according to the invention for connecting the vertically-mounted internal-combustion engine to the shaft of the pump mechanism in the well.

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Referring to the drawing, and particularly Figure 1, the reference numeral 10 designates a well bore, such as a water well bore, into which the casing 12 and the tubing 14 are placed in the usual manner. A casing head 16 is provided at the surface 18 of the ground, and the casing head 16 seals off the annular space between the casing 12 and tubing 14 and supports the tubing 14 and the various elements of the pump mechanism and engine. A tubing head 20 is provided and a discharge pipe 22 extends therefrom through which water is discharged from the tubing 14. All of these parts are conventional, may take a wide variety of forms and no detailed description thereof is deemed necessary.

An adapter or coupling assembly, generally indicated by the reference numeral 23 is connected to the flywheel 24 of the internal-combustion type engine, generally indicated by the reference numeral 26, which is mounted in a vertical position. Preferably, the engine 26 should be of the left hand drive type so that it may be used with the conventional rotary pump mechanism 28 disposed on the lower end of the pump shaft 30 extending from the lower portion of the adapter or coupling assembly 23. For example, the engine may be one that is commercially available by the Chrysler Corporation or may be a General Motors Corporation 71 series. These engines, however, must be modified from a wet sump lubrication system to a dry sump lubrication system for operation in a vertical rather than a horizontal position. Also thrust elements must be modified on the engine crankshaft and camshaft.

Thus, for use with right hand pumping elements 28 it is necessary to use a left hand drive engine, since the direction of drive is determined by facing the front of the engine and the front is disposed in an upward direction. The conversion of an engine from a conventional wet sump lubrication system to a dry sump-type is considered within the skill of the art and, in order not to unduly complicate the disclosure, no detailed description of such a conversion is deemed necessary.

A screen 32 which may be of any conventional type is provided at the lower end of the tubing 14 below the rotary pump elements 28. Thus, as the propellers or rotary pump elements 28 are rotated by the pump shaft 30 water is pumped up from the well 10 into and through the screen 32, on up the interior of the tubing 14, the tubing head 20 and out the discharge pipe 22.

Referring now to Figure 2, the flywheel housing 34, which houses the flywheel 24 is connected to and rests on what may be termed a bearing housing 36 which, in turn, rests on and is connected to the adapter housing 38 which, in turn, is supported by and connected to the upper portion of the tubing head 20.

The flywheel 24, of course, is connected to and driven by the crankshaft 40 and has the downwardly-extending set of dowel pins 42 disposed therein which are disposed circumferentially about and adjacent the periphery of the flywheel 24. While only one is shown in Figure 2, a plurality thereof, such as five or more such dowel pins 42 equally and circumferentially spaced are satisfactory in use. The dowel pins 42 do not support the antireverse pin 44 but cause it to rotate with the flywheel 24.

The ratchet pin or hub 44 is reduced in diameter at 46 to provide the downwardly-facing, annular seating shoulder 48 which seats on the pairs of antifriction assemblies 50 which are supported by the nut 52 threadedly or otherwise secured in the lower skirt portion 54 of the bearing housing 36. Thus, the hub 44 is supported and maintained in an adjusted upward position by the adjusting nut 52 and the antifriction assemblies 50 seating against the downwardly-facing shoulder 48. Thus, the flywheel 24 does not support any of the weight of the coupling elements, but the coupling is adjustably

fixed with respect thereto and is rotated and driven thereby.

Any number of antifriction assemblies 50 may be used and these may be of any desired type so long as the thrust is generally downwardly and outwardly through the assembly, such as diagonally from the upper inside corner of the assembly to the lower outer portion. As illustrated, to this end the races are provided with the downwardly and outwardly facing bearing surface 53 and the upwardly and inwardly facing bearing surface 55 between which the ball bearings 56 are seated. Thus, the thrust is downwardly and outwardly away from the moving elements of the adapter assembly and toward the bearing housing 54.

The hub and antireverse pin 44 are provided with an annular depending portion 45 which is provided with the ratchet pins 58 slidably disposed in the openings 59 in the skirt 45. The openings 59 are vented as at their upper portions 61 and the pins 58 are so positioned that centrifugal force of the flywheel 24 causes them to be in an upper or retracted position when the flywheel is rotating, but the pins 58 drop down when rotation ceases and engage the ratchet teeth 60 extending upwardly from the annular ratchet plate 62 which is rigidly secured to the bearing housing 36. Thus, rotation is permitted in one direction, ordinarily in a counterclockwise direction, and prevented in the other direction, ordinarily a clockwise direction. Preferably five or more equally-circumferentially spaced pins 58 are used although any suitable ratchet arrangement or clutch may be utilized to prevent inadvertent rotation in a direction opposite to that desired.

The pump shaft 30 is threaded or otherwise secured to the lower end of the antireverse hub 44 and may be so secured by a hex locking nut 64 which may be further locked in place by means of a gib key, not shown. Thus, rotation of the flywheel 24 imparts rotation to the antireverse hub 44 and to the pump shaft 30 for rotating the propellers or rotary pump elements 28 for pumping water from the well.

In order to insure proper lubrication, an oil inlet 66 is provided in the bearing housing 36 and a lubricating passage 68 is provided therein to the upper side thereof and opens under the oil seal ring 70 secured to the upper portion of the bearing housing 36. The oil seal ring 70 is packed off by the packing 72 and lubricant moves downwardly through the antifriction bearings 50 and may drain through the adjusting nut 52 by means of the drain hole 74. The adjusting nut 52 is packed off from the interior of the skirt portion 54 of the bearing housing 36 by means of the O-ring 76 and from the reduced diameter portion 46 by the packing assembly 78. Any desired packing or packing assemblies may be used. It is noted, however, that the packing assemblies 72 and 78 should be of the type to permit rotation of one of the elements packed off. By way of example, a National Oil Seal is satisfactory. The O-ring 76 may be of rubber, neoprene or other suitable material. Thus, the adapter or thrust bearing assembly thereof is well lubricated and packed off.

In operation, the pump is assembled in the position illustrated in Figure 1. Preferably, the adjusting nut 52 is adjusted so that there is the proper clearance between the ratchet teeth 60 and the hub 44 and the lock nut 64 is tightened to insure that the pumping elements 28 are located in the well where most desired. The internal-combustion engine 26 has previously been converted into a dry sump lubricating type and, upon actuation of this engine, rotation is transmitted from the flywheel 24 through the antireverse hub 44 and the pump shaft 30 to the propellers 28 thereby pumping water up the interior of the tubing 14, through the tubing head 20 and out the discharge pipe 22.

It is noted that advantageously the right angle drive mechanism including a universal, and its various coupling

members have been eliminated thereby eliminating the expense thereof as well as the loss of efficiency occasioned therethrough. In this connection, the pump shaft 30 is advantageously coupled by a very simple coupling assembly or adapter directly to the flywheel 24 of the engine 26. While advantageous, it is not necessary that the antireverse hub 44 be connected directly to the flywheel 24.

The present invention, therefore, is well adapted to attain the objects and the ends and has the advantages mentioned as well as others inherent therein. While only a single embodiment of the invention is given for the purpose of the disclosure, numerous changes in details and rearrangement of parts will suggest themselves to those skilled in the art which are within the scope of the invention. Accordingly, the present invention is to be limited only by the spirit thereof and the scope of the appended claims.

What is claimed is:

1. A pump assembly comprising, a vertically-mounted internal-combustion engine, a pump shaft provided with one or more rotary pump elements on its lower end extending vertically into a well bore, and coupling means directly connecting the pump shaft coaxially with the flywheel of the engine, said coupling means including a ratchet assembly permitting rotation of the pump shaft in one direction and preventing rotation thereof in the other direction.

2. The pump assembly of claim 1 in which the coupling means is thrust supporting.

3. A pump assembly comprising, a vertically-mounted internal-combustion engine, a pump shaft provided with one or more rotary pump elements on its lower end extending vertically into a well bore, and a coupling assembly connecting the pump shaft coaxially with the flywheel of the engine, said coupling assembly including a housing, a ratchet hub connected directly to the flywheel, a ratchet plate connected to the housing, said ratchet hub and ratchet plate having coacting ratchet teeth permitting rotation of the ratchet hub in one direction and preventing rotation thereof in the other direction, a reduced diameter portion on the ratchet hub extending downwardly and axially through the housing, said reduced diameter portion providing a downwardly-facing seating surface, one or more antifriction assemblies disposed within the housing, the upper inner portion thereof seating against said downwardly-facing seating surface, a nut adjustably secured in the lower portion of the housing adjustably supporting said antifriction assemblies and thereby said ratchet hub, and means connecting the pump shaft to the lower end of the ratchet hub.

4. In a pump assembly including a pump shaft having one or more rotary pump elements at its lower end extending vertically downwardly into a well bore and a vertically-mounted internal-combustion engine, the improvement comprising a coupling assembly connecting the pump shaft directly and coaxially to the flywheel of the engine comprising, a housing, ratchet hub connected directly to the flywheel, a ratchet plate connected to the housing, said ratchet hub and ratchet plate having coacting ratchet teeth permitting rotation of the ratchet hub in one direction and preventing rotation thereof in the other direction, a reduced diameter portion on the ratchet hub extending downwardly and axially through the housing, said reduced diameter portion providing a downwardly-facing seating surface, one or more antifriction assemblies disposed within the housing and about the reduced diameter portion of the ratchet hub, the upper inner portion of the antifriction assemblies seating against said downwardly-facing seating surface, a nut adjustably secured in the lower portion of the housing below the antifriction assemblies adjustably supporting said antifriction assemblies and thereby said ratchet hub, and means connecting the pump shaft to the lower end of the ratchet hub.

5. In a pump assembly including a pump shaft pro-

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vided with one or more rotary pump elements at its lower end extending downwardly and vertically into a well bore and a vertically-mounted internal-combustion engine driving said pump shaft, the improvement comprising, a coupling assembly connecting the pump shaft coaxially and directly to the flywheel of the engine, said coupling assembly comprising, a housing, a hub connected directly to the flywheel, a reduced diameter portion on the hub extending downwardly and axially through the housing, said reduced diameter portion providing a downwardly-facing seating surface, one or more antifriction assemblies disposed within the housing and surrounding the reduced diameter portion of the hub, the upper inner portion of the antifriction assemblies seating against said downwardly-facing seating surface for supporting the hub, a nut adjustably secured in the lower portion of the housing below the antifriction assemblies adjustably supporting said antifriction assemblies and thereby said hub, and means connecting the pump shaft to the lower end of the hub.

6. In a pump assembly including a pump shaft extending vertically downwardly into a well bore and a vertically mounted engine, the improvement comprising a cou-

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pling assembly connecting the pump shaft directly and coaxially to a drive shaft of the engine comprising, a housing, a ratchet hub connected directly to the drive shaft, a ratchet plate connected to the housing, said ratchet hub and ratchet plate having coacting ratchet teeth permitting rotation of the ratchet hub in one direction and preventing rotation thereof in the other direction, an antifriction thrust supporting assembly supporting the ratchet hub, adjustable connecting means adjustably supporting the antifriction thrust assembly on the housing, and means connecting the pump shaft to the ratchet hub.

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