Sept. 2, 1958 F. E. MITCHELL 2,849,958

VERTICALLY-MOUNTED ENGINE-DRIVEN PUMP ASSEMBLY

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Fig. 1

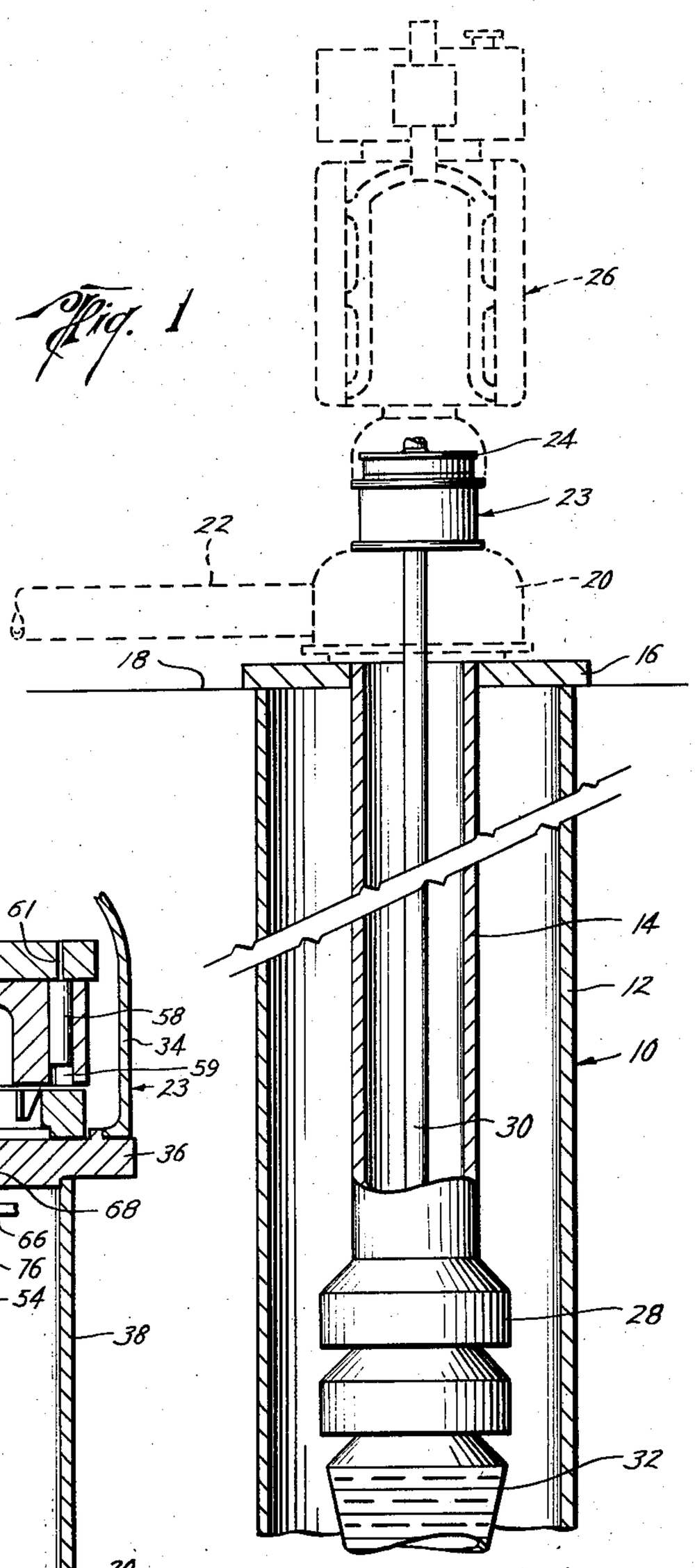
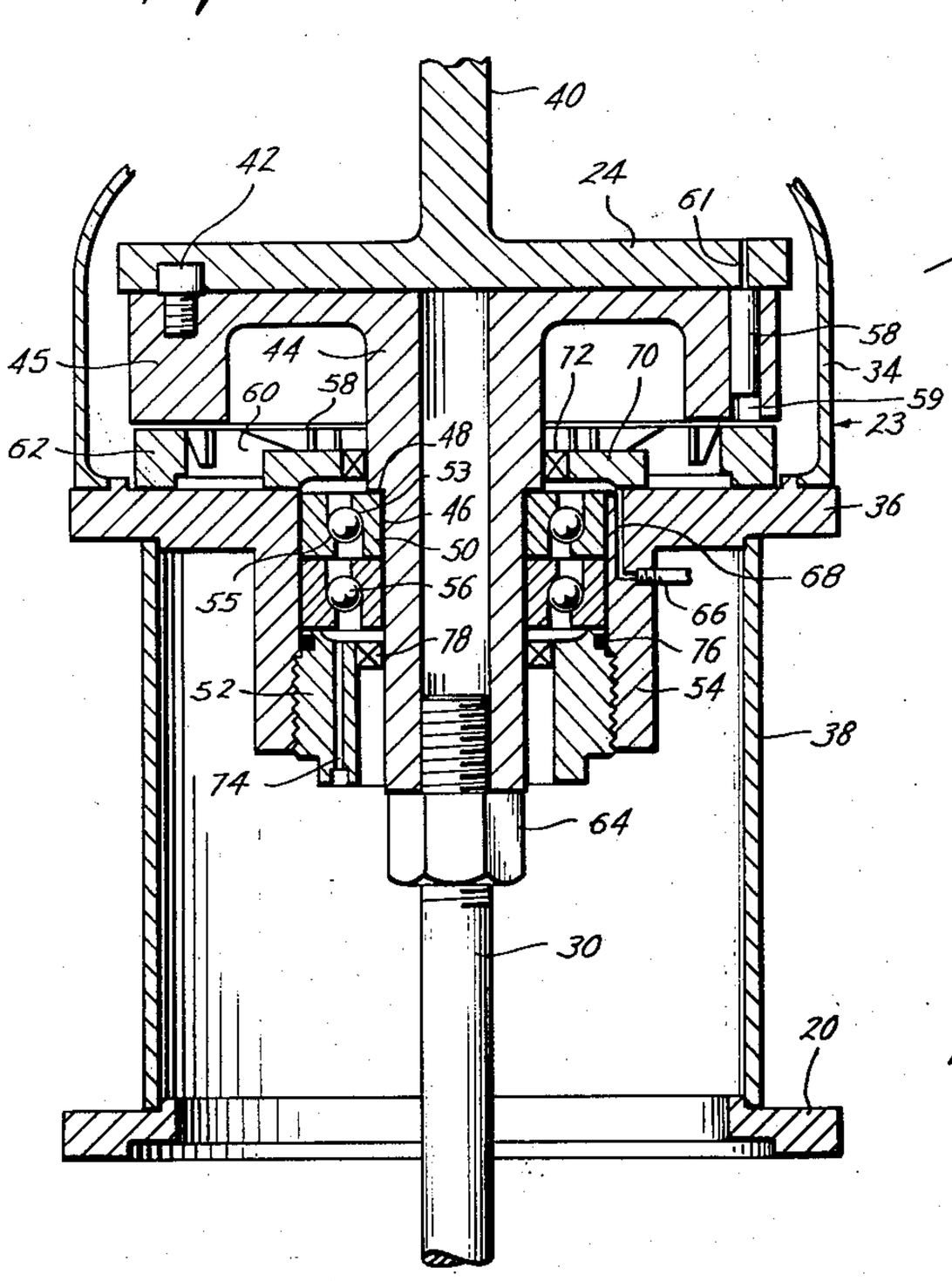


Fig. 2



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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 acccording to the invention for connecting the vertically-mounted internal-combustion engine to the shaft of the pump mechanism in the well.

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-

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 coupling 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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