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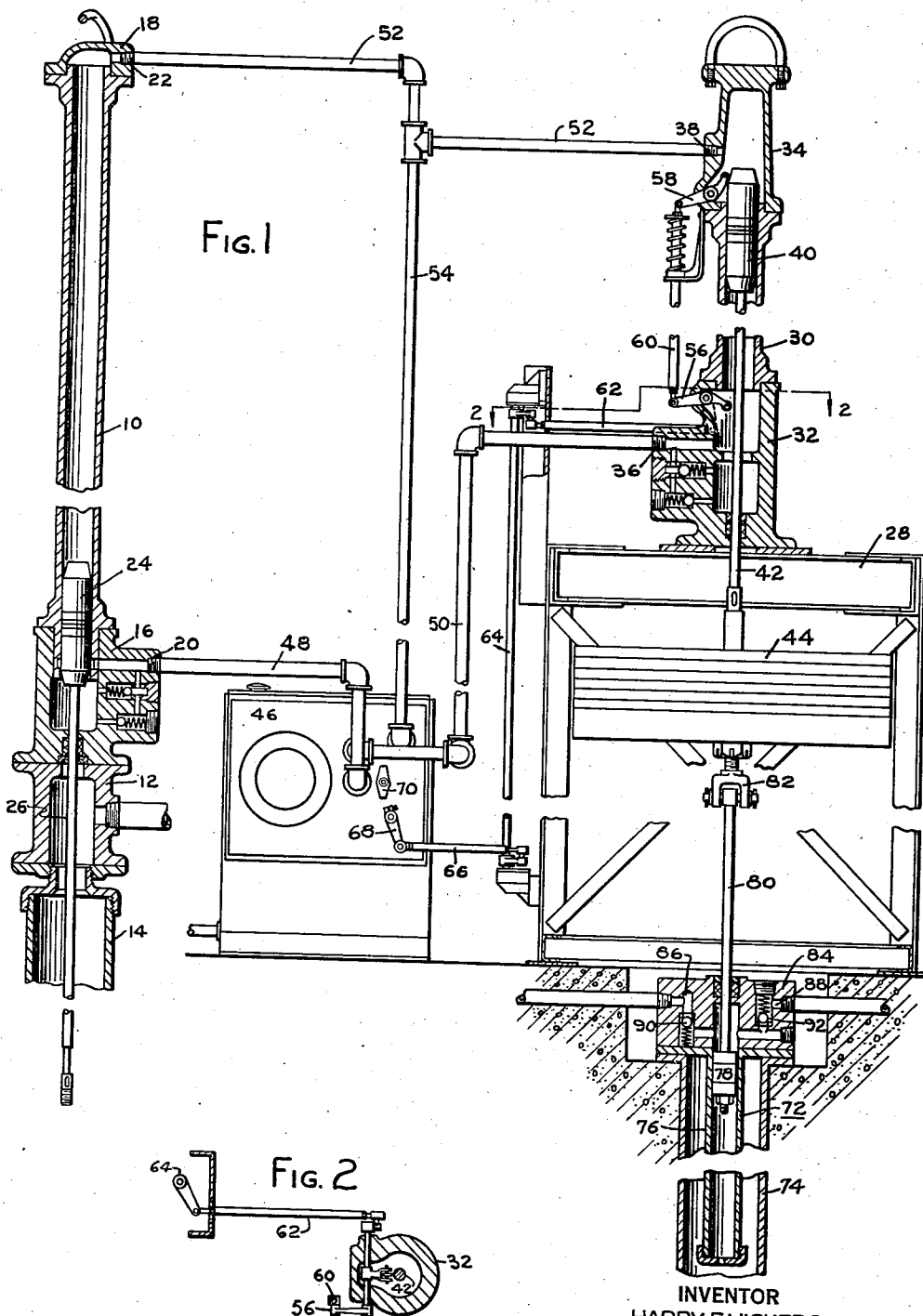
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2,313,404

POWER TRANSMISSION

Filed Jan. 26, 1940 .

2 Sheets-Sheet 1



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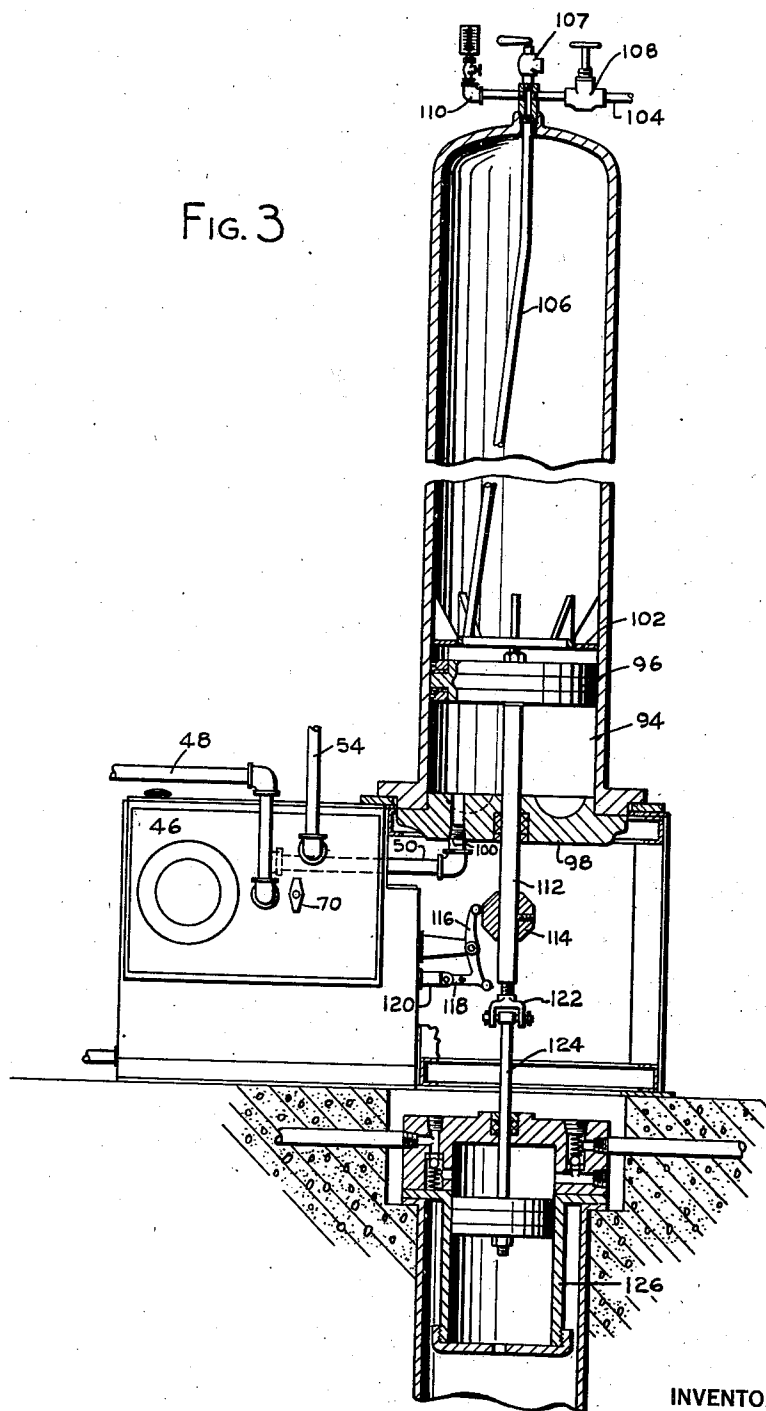
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FIG. 3



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POWER TRANSMISSION

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7 Claims. (Cl. 103—45)

This invention relates to power transmissions, particularly to those of the type comprising two or more fluid pressure energy translating devices, one of which may function as a pump and another as a fluid motor.

The invention is particularly concerned with power transmission systems adapted for pumping oil wells. Pump jacks for oil wells in use at the present time are of various types, one such type which is coming into wider use being the hydraulically actuated type wherein a cylinder and piston hydraulic motor situated directly over the well is utilized to actuate the sucker rods of the well pump. Pump jacks of this character frequently utilize a separate hydraulic cylinder and piston forming a counterbalance reducing the power required to operate the pumping unit.

Many oil wells yield oil which is mixed with a considerable portion of water, and where the yield is of this character it is customary to provide a settling tank into which the mixed oil and water is passed and where the water settles to the bottom leaving the oil to be collected from the top. Certain wells are so situated on the ground surface that it becomes impossible to drain the waste water or tailings by gravity, and it is accordingly necessary to provide a tail pump for elevating the separated water to a point where it may be drained away naturally.

It is an object of the present invention to provide an improved oil well pumping unit incorporating a tail pump which may be readily operated from a hydraulic type of well pumping unit.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is a diagrammatic view partly in section of a well pumping unit embodying a preferred form of the present invention.

Figure 2 is a fragmentary cross section taken on line 2—2 of Figure 1.

Figure 3 is a diagrammatic view partly in cross section showing a modified form of the present invention.

Referring now to Figure 1, there is illustrated a work cylinder 10 which is mounted vertically over the casing head 12 of an oil well, the casing of which is designated as 14. The work cylinder 10 has end castings 16 and 18 through which suitable connections 20 and 22 are provided. A piston 24 is reciprocally mounted in the work cylinder 10 and has a rod 26 which is connected

to the sucker rods in the well. Mounted upon a suitable box-like framework 28 in a counterbalance cylinder 30 having end castings 32 and 34 in which suitable connections 36 and 38 are provided. The counterbalance cylinder 30 has a piston 40 the rod 42 of which projects through the end casting 32 by means of a stuffing box and carries a counterbalance weight 44.

The work and counterbalance cylinders are connected together by a hydraulic circuit which includes a pressure fluid pumping unit 46. Thus the unit 46 is connected by a pipe 48 to the connection 20 of the work cylinder 10 and by a pipe 50 to the connection 36 of the counterbalance cylinder 30. Preferably the upper ends of the cylinders 10 and 30 are connected together by a pipe 52 which also communicates by a branch 54 with the interior of the casing of the pump unit 46. The pump unit 46 may be of any suitable construction operative to alternately deliver fluid in one direction or the other between pipes 48 and 50.

A suitable automatic reversing mechanism is provided comprising a pair of levers 56 and 58 pivotally mounted in the end castings 32 and 34 and adapted to be actuated alternately by contact with the beveled ends of the piston 40 at the limits of its stroke. The levers 56 and 58 may be connected together by a link 60, and by means of linkage 62, crank shaft 64 and link 66 may be connected to actuate the reversing lever 68 provided at the pump unit 46. The latter may also be provided with a starting and stopping control handle 70. The mechanism thus far described forms per se no part of the present invention and is intended merely as a typical hydraulic well pumping unit to which the present invention is applicable. For further details of construction of a pumping unit of this character reference may be had to the copending applications of Harry F. Vickers, et al., Serial No. 281,926, filed June 29, 1939, for Oil well pumping machinery, and of Harry F. Vickers, et al., Serial No. 313,862, filed January 15, 1940, for Oil well pumping apparatus.

For the purpose of elevating the separated water a tail pump generally designated 72 is provided and is mounted in a short drill hole 74 located centrally beneath the counterweight 44. The tail pump 72 comprises a cylinder 76 in which a piston 78 is reciprocally mounted. The latter has an operating rod 80 connected by a pin and yoke coupling 82 with the bottom of the counterweight 44. The coupling 82 is preferably readily separable so as to disconnect the tail

pump from the counterweight when its operation is not required. The cylinder 76 has a head casting 84 communicating with the space above the piston 78 and containing the customary inlet connection 86 and outlet connection 88 in which check valves 90 and 92 are located respectively.

In operation, with the pumping unit 46 running and the starting handle 70 shifted to running position, the pumping unit withdraws power transmission oil from the cylinder 30 through connection 36 and pipe 50 and delivers it through pipe 48 and connection 20 to the lower end of work cylinder 10. The piston 24 and the sucker rods in the well are accordingly elevated while the counterweight 44 is at the same time lowered. When the latter reaches the end of its stroke the piston 40 contacts the lever 56 shifting the reversing linkage causing the pump unit 46 to deliver oil in the opposite direction. Thus the piston 24 is lowered and the piston 40 elevated, this reciprocation of the two pistons in opposite directions continuing as long as the handle 70 remains in the running position. With the coupling 82 connected to the tail pump rod 80, the piston 78 also reciprocates in unison with the counterweight 44 thus operating to withdraw tail water from the tank through inlet connection 86 of the down stroke and to deliver it through the discharge connection 88 on the up stroke.

In the form of the invention illustrated in Figure 3, the counterbalancing function is provided by means of the counterbalance cylinder 94 of considerably larger diameter than the work cylinder 10 and having a counterbalance piston 96 therein. The cylinder 94 has its lower end closed by an end casting 98 with a connection 100 therein which is connected to the pipe 50 in the same manner as the connection 36 of Figure 1. The upper end of cylinder 94, however, forms an air chamber and is not connected to the upper end of the work cylinder, the latter being connected only to the casing of unit 46 through pipe 54. The air chamber may be provided with an internal flange ring 102 forming an upper stop for the piston 96 and also acting as a trough to receive power transmission oil seeping past the piston 96. A suitable air connection pipe 104 connects with the head end of cylinder 94 and leads by an inside pipe 106 to the seepage trough 102. A manually operable blow-off valve 107 is provided for at times discharging the seepage from the trough 102. A suitable shut-off valve 108 and pressure gage 110 are provided for initially charging the air cylinder with compressed air and for indicating when recharging may be necessary.

The piston 96 has a rod 112 extending through the end casting 98 and carrying a cam block 114 adapted to contact a trip lever 116 at the top and bottom ends of the stroke of piston 96. The lever 116 connects by a link 118 to the stem 120 of the reversing valve of pump unit 46. The piston rod 112 also carries a pin and yoke connection 122 by which the actuating rod 124 of a tail pump 126 is operated. The pump 126 may be similar to the pump 72 of Figure 1 except that it is constructed to have a larger bore and smaller stroke to correspond to the reduced stroke of the piston 96.

Operation of this form of the invention will be obvious from the previous explanation of the form illustrated in Figure 1.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be

adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a sucker rod type pumping system for oil wells the combination with a hydraulically actuated well pump actuator including a work cylinder and piston assembly for reciprocating the sucker rod, a counterbalance cylinder and piston assembly reciprocable in timed relation to the movements of the sucker rod, and a hydraulic circuit including a pressure fluid supplying means connecting said cylinders, of a tail water pump having an operating member reciprocable through a stroke equal to the stroke of the counterbalance, and means connecting said member to the counterbalance piston and cylinder assembly for operation thereby throughout the full stroke thereof.
2. In a sucker rod type pumping system for oil wells the combination with a hydraulically actuated well pump actuator including a work cylinder and piston assembly for reciprocating the sucker rod, a weight-loaded counterbalance cylinder and piston assembly reciprocable in timed relation to the movements of the sucker rod, and a hydraulic circuit including a pressure fluid supplying means connecting said cylinders, of a tail water pump having an operating member reciprocable through a stroke equal to the stroke of the counterbalance, and means connecting said member to the counterbalance piston and cylinder assembly for operation thereby throughout the full stroke thereof.
3. In a sucker rod type pumping system for oil wells the combination with a hydraulically actuated well pump actuator including a work cylinder and piston assembly for reciprocating the sucker rod, an air-loaded counterbalance cylinder and piston assembly reciprocable in timed relation to the movements of the sucker rod, and a hydraulic circuit including a pressure fluid supplying means connecting said cylinders, of a tail water pump having an operating member reciprocable through a stroke equal to the stroke of the counterbalance, and means connecting said member to the counterbalance piston and cylinder assembly for operation thereby throughout the full stroke thereof.
4. In a sucker rod type pumping system for oil wells the combination with a hydraulically actuated well pump actuator including a work cylinder and piston assembly for reciprocating the sucker rod, a counterbalance cylinder and piston assembly vertically reciprocable in timed relation to the movements of the sucker rod, and a hydraulic circuit including a pressure fluid supplying means connecting said cylinders, of a tail water pump having an operating member reciprocable in axial alignment with the counterbalance cylinder through a stroke equal to the stroke of the counterbalance, and means connecting said member to the counterbalance piston and cylinder assembly for operation thereby throughout the full stroke thereof.
5. In a sucker rod type pumping system for oil wells the combination with a hydraulically actuated well pump actuator including a work cylinder and piston assembly for reciprocating the sucker rod, a weight-loaded counterbalance cylinder and piston assembly vertically reciprocable in timed relation to the movements of the sucker rod, and a hydraulic circuit including a pressure fluid supplying means connecting said cylinders, of a tail water pump having an operating member reciprocable in axial alignment with the counterbalance cylinder through a stroke equal to the

stroke of the counterbalance, and means connecting said member to the counterbalance piston and cylinder assembly for operation thereby throughout the full stroke thereof.

6. In a sucker rod type pumping system for oil wells the combination with a hydraulically actuated well pump actuator including a work cylinder and piston assembly for reciprocating the sucker rod, an air-loaded counterbalance cylinder and piston assembly vertically reciprocable in timed relation to the movements of the sucker rod, and a hydraulic circuit including a pressure fluid supplying means connecting said cylinders, of a tail water pump having an operating member reciprocable in axial alignment with the counterbalance cylinder through a stroke equal to the stroke of the counterbalance, and means connecting said member to the counterbalance piston and

cylinder assembly for operation thereby throughout the full stroke thereof.

7. In a sucker rod type pumping system for oil wells the combination with a hydraulically actuated well pump actuator including a work cylinder and piston assembly for reciprocating the sucker rod, a counterbalance cylinder and piston assembly reciprocable in timed relation to the movements of the sucker rod, and a hydraulic circuit including a pressure fluid supplying means connecting said cylinders, of a tail water pump having an operating member reciprocable through a stroke equal to the stroke of the counterbalance, and means including a disconnectable coupling for connecting said member to the counterbalance piston and cylinder assembly for operation thereby throughout the full stroke thereof.

HARRY F. VICKERS.