

Jan. 8, 1963

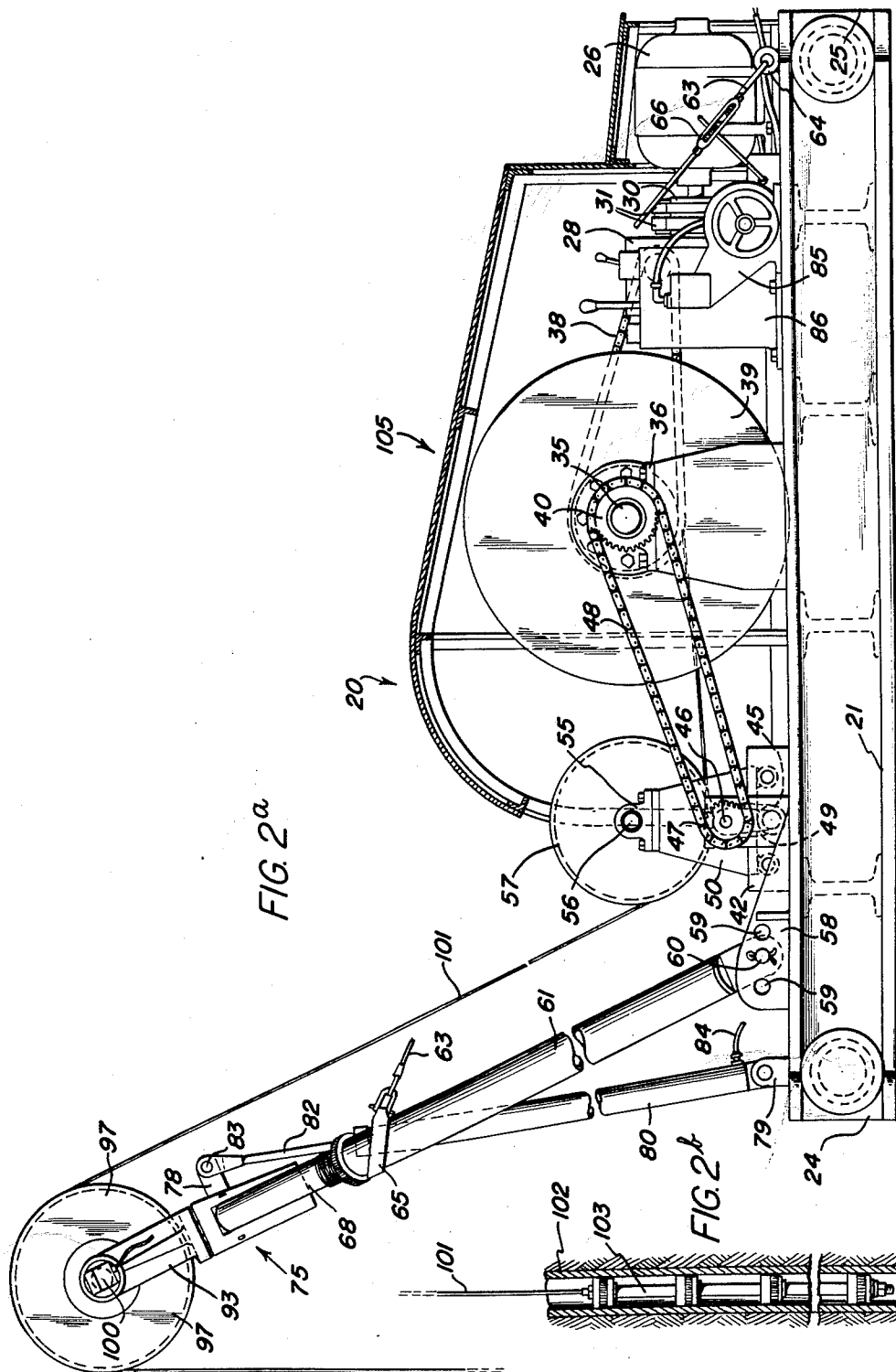
C. J. ZIEGLER ETAL

3,072,193

SWAB PUMP FOR OIL FIELD PRODUCTION

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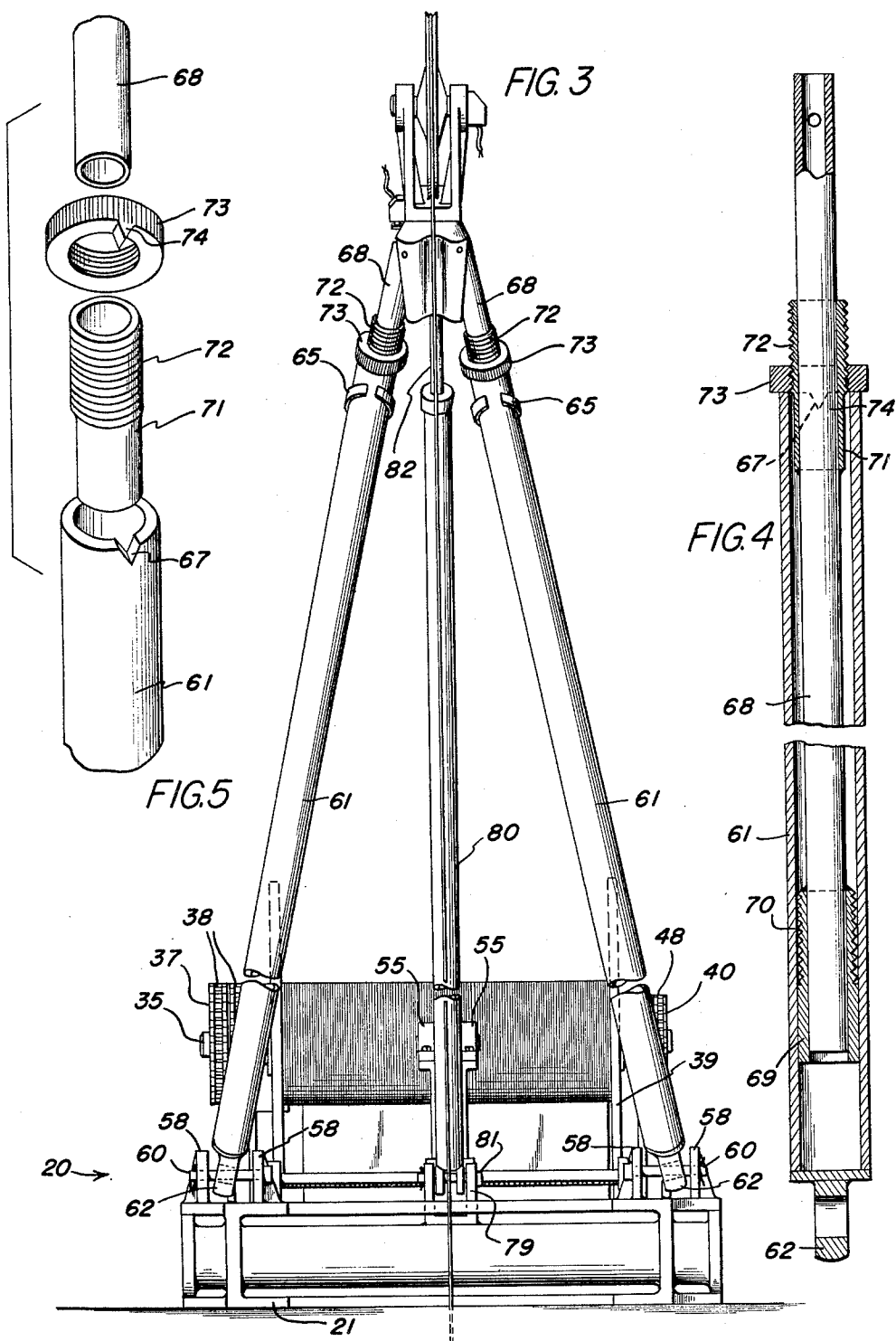
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FIG. 6

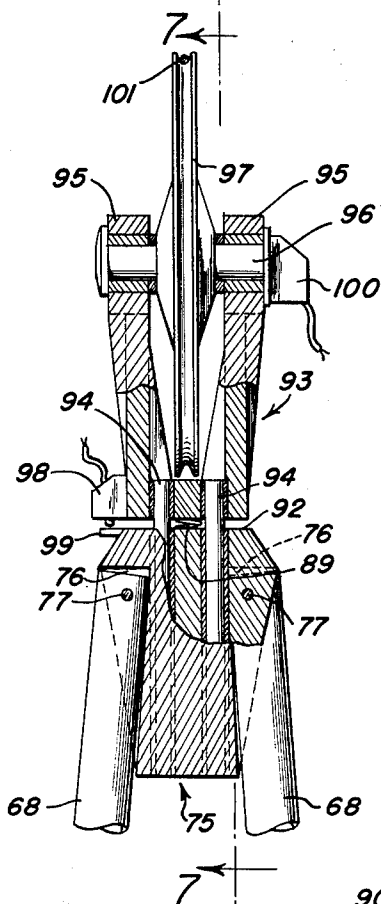
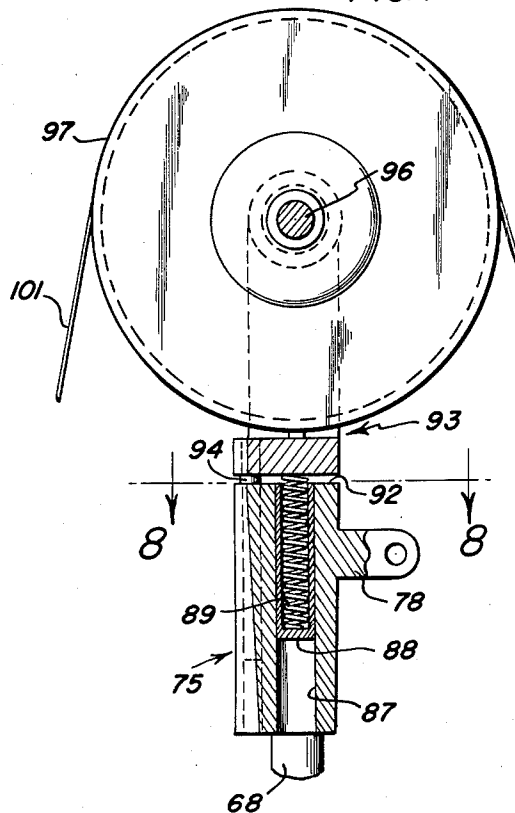
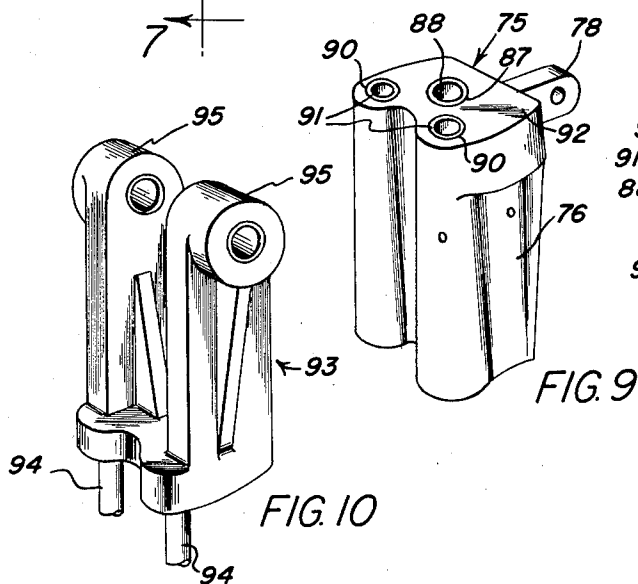
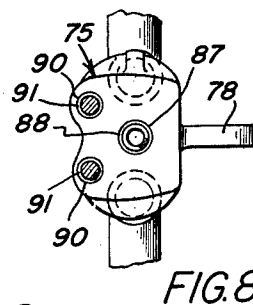


FIG. 7



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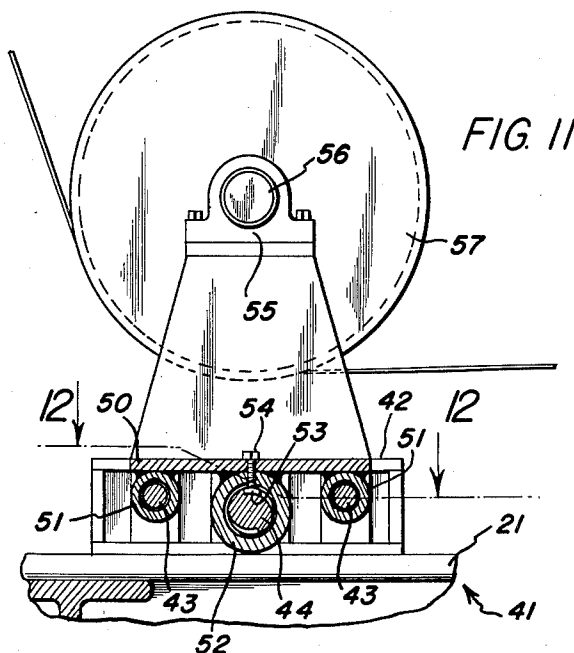
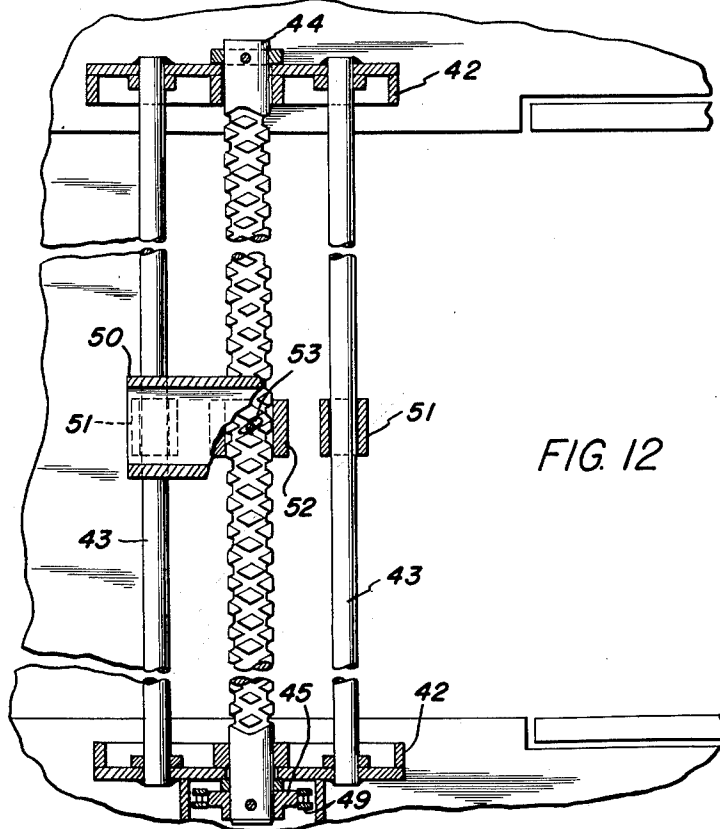
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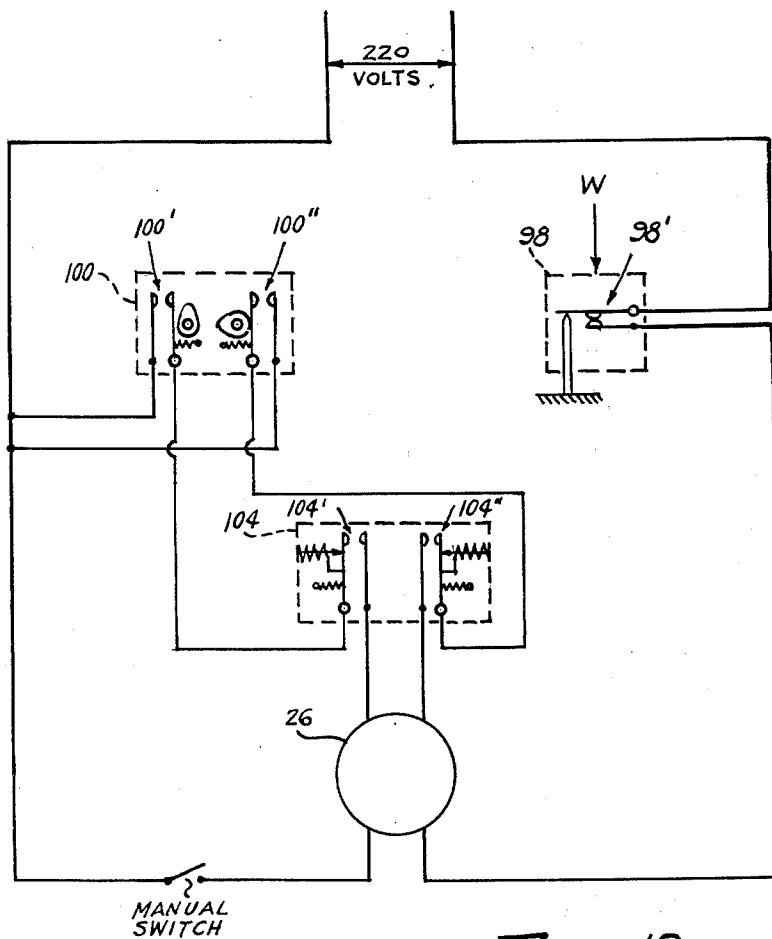


FIG. 13

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3,072,193

SWAB PUMP FOR OIL FIELD PRODUCTION
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 Filed Aug. 29, 1958, Ser. No. 757,968
 2 Claims. (Cl. 166-105)

The present invention relates to a swab pump for oil field production and particularly to such a unit which is completely automatic.

The primary object of the invention is to provide a self contained swab pumping unit which is completely automatic in its operation and adjustable to permit use under varying circumstances.

Another object of the invention is to provide a unitary swab pumping mechanism which is automatically actuated to operate through continuous pumping cycles.

A further object of the invention is to provide in a swab pumping unit of the class described above, a winch structure having a power driven levelwind associated therewith to maintain the cable on the winch in a level condition.

A still further object of the invention is to provide a swab pump unit for oil field production which is inexpensive to manufacture, simple to set up and use, and which effectively produces oil under widely varying conditions.

Other objects and advantages will become apparent in the following specification when considered in light of the attached drawings, in which:

FIGURE 1 is a fragmentary top plan view of the invention shown partially broken away for convenience of illustration;

FIGURE 2a is a side elevation of the invention, shown partially broken away for convenience of illustration;

FIGURE 2b is a side elevation of the swab shown in position in the oil well;

FIGURE 3 is a front elevation of the invention, shown partially broken away for convenience of illustration;

FIGURE 4 is a vertical sectional view taken through one of the support legs;

FIGURE 5 is a fragmentary exploded perspective view of the support leg adjustment mechanism;

FIGURE 6 is a vertical sectional view taken through the upper table sheave support;

FIGURE 7 is a fragmentary vertical sectional view taken along the line 7-7 of FIGURE 6, looking in the direction of the arrows;

FIGURE 8 is a fragmentary horizontal section taken along the line 8-8 of FIGURE 7, looking in the direction of the arrows;

FIGURE 9 is a perspective view of the leg connecting block;

FIGURE 10 is a perspective view of the upper table sheave support;

FIGURE 11 is an enlarged fragmentary vertical sectional view taken along the line 11-11 of FIGURE 1, looking in the direction of the arrows;

FIGURE 12 is a horizontal sectional view taken along the line 12-12 of FIGURE 11, looking in the direction of the arrow; and

FIGURE 13 is a schematic diagram generally illustrating the electrical circuits provided for controlling the operation of the automatic swab pump unit.

Referring now to the drawings in detail wherein like reference characters indicate like parts throughout the several figures, the reference numeral 20 indicates generally a swab pump unit for oil field production constructed in accordance with the invention.

The unit 20 is provided with a horizontal pallet base 21 formed with deck portions 22 and a plurality of

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transversely extending cross beams 23. The pallet 21 has a forward end 24 and a rear end 25.

An electric motor 26 is secured to one of the deck portions 22 and is provided with a longitudinally and forwardly extending motor shaft 27. A right angle drive gear box 28 is supported on the deck 22 forwardly of the motor 26 and laterally offset with respect to the motor 26. The gear box 28 has a rearwardly extending in-put shaft 29. The motor shaft 27 and the input shaft 29 each carry multiple V-belt pulleys 30, having a pair of V-belts 31 trained thereover so that the in-put shaft 29 is driven from the motor 26. The gear box 28 has an out-put shaft 32 extending perpendicularly to the in-put shaft 29 transversely of the pallet 21. The out-put shaft 32 has a pair of chain sprockets 33 secured thereto in adjacent relation. A winch generally indicated at 34 includes a transversely extending shaft 35 mounted on the pallet base 21 by means of bearing blocks 36. The shaft 35 has a pair of chain sprockets 37 secured to one end thereof in aligned relation to the chain sprockets 33 and a pair of drive chains 38 are trained over these sprockets 33, 37, respectively, so that the shaft 35 is driven by the shaft 32.

A winch drum 39 is mounted on the shaft 35 intermediate the bearing blocks 36 for rotation with the shaft 35. A chain sprocket 40 is fixed to the end of the shaft 35 opposite the chain sprockets 37, for reasons to be assigned.

A levelwind unit, generally indicated at 41, extends transversely of the pallet base 21 parallel to and slightly forwardly of the winch 34. The levelwind unit 41 includes a pair of spaced apart parallel support brackets 42 having a pair of spaced apart transversely extending parallel guide rods 43 arranged with their opposite ends fixedly secured and supported therein. A double threaded shaft 44 is arranged intermediate the guide rods 43 and parallel thereto and has its opposite ends journaled in the brackets 42. A drive sprocket 45 is fixed to one end of the screw shaft 44. An idle shaft 46 is mounted above the screw shaft 44, carrying a pair of sprockets 47 thereon. A drive chain 48 extends from the sprocket 40 on the winch shaft 35 to one of the sprockets 47 on the idle shaft 46. A second drive chain 49 extends from the other sprocket 47 to the sprocket 45 so that the double threaded shaft 44 is rotated upon rotation of the winch shaft 35.

A traversing bracket 50 is provided with a pair of spaced apart parallel bushings 51 which encompass and slide on the guide rods 43. The bracket 50 is further provided with a bushing 52 which slides on the shaft 44. A pivoted follower 53 is mounted in the bushing 52 on a set screw 54 for engagement with the threads of the reversely threaded shaft 44. The follower 53 drives the bracket 50 in successive reversing transverse strokes along the reversely threaded shaft 44, when the shaft 44 is rotated. The bracket 50 has a pair of bearing blocks 55 secured thereto and rotatably supporting an axle shaft 56 therein. A sheave 57 is mounted on the axle 56 for free rotation on the bracket 50.

A pair of upstanding closely spaced parallel ears 58 are secured to the pallet 21 on each side thereof adjacent the forward end 24 thereof. The ears 58 are provided with a plurality of transverse bores 59 through which a detachable coupling pin 60 extends.

A pair of inwardly converging upstanding tubular standards 61 extend upwardly and inwardly, respectively, from each pair of ears 58. Each standard 61 is provided with an eye 62 on its lower end which is loosely supported on the coupling pin 60. The plurality of transverse bores 59 permits the lower ends of the standards 61 to be adjusted longitudinally on the pallet 21, as required by the circumstances. The tubular standards 61 are sup-

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ported in upstanding position by means of an elongated guy wire 63 connected at one end to an eye 64 at the rear end 25 of the pallet 21 and at the opposite end to a support 65 welded to the upper end of the standard 61. The eyes 64 are positioned on opposite sides of the pallet 21 to balance the load. The guy wire 63 has a turn buckle 66 mounted therein to permit the guywire 63 to be tensioned as required.

The upper edge of each of the tubular standards 61 is provided with a V-shaped notch 67 extending downwardly therein, as best seen in FIGURE 5.

A sliding standard 68 is positioned in each of the tubular standards 61 and has a guide bushing 69 fixed to its lower end. The guide bushing 69 is arranged for sliding movement vertically in the standard 61 and has the upper portion thereof externally threaded at 70. A second guide bushing 71 is fixed to the sliding standard 68 adjacent the upper end thereof and is provided with a threaded upper portion 72. The threaded portions 70, 72 of the guide bushings 69, 71 are of the same diameter, while the lower portion of the upper bushing 71 is substantially smaller than the lower portion of the lower bushing 69.

A cylindrical nut 73 is arranged for threaded movement on the threads 70, 72 and is provided with a downwardly extending V-shaped dog 74 for locking engagement with the V-shaped notch 67.

A block, generally indicated at 75, is provided with a pair of arcuate recesses 76 on the opposite sides thereof to receive the upper ends of the sliding standards 68 therein. Transverse pins 77 extend through the upper ends of the sliding standards 68 and through the block 75 to secure the sliding standards 68 therein. The block 75 has a rearwardly extending ear 78 formed thereon intermediate the upper and lower ends thereof. The pallet 21 is provided with an upstanding yoke 79 secured to the forward end 24 thereof intermediate the opposite sides thereof.

A hydraulic ram 80 has its lower end pivotally secured in the yoke 79 by a coupling pin 81. A piston rod 82 extends upwardly from the hydraulic ram 80 and is pivotally secured to the ear 78 on the block 75 by means of a pivot pin 83.

The hydraulic ram 80 is connected by a conduit 84 to a hydraulic pump 85 mounted on the pallet 21 along with its reservoir 86. To raise and lower the block 75 with respect to the pallet 21, the ram 80 is operated to force the piston rod 82 thereof upwardly, sliding the upper standards 68 out of the lower standards 61. As the upper standards 68 are lifted sufficiently to release the V-shaped dog 74 from the notch 67, the nut 73 is manually threaded downwardly on the thread 72 until it leaves the upper guide bushing 71. When the upper standards 68 reach their maximum height, the threads 70 of the lower guide gushing 69 will be extending above the upper ends of the lower standards 61 and the nut 73 is manually threaded thereon and positioned so that the V-shaped dog 74 can be engaged in the V-shaped notch 67. As can be readily seen, the nuts 73 can be vertically adjusted on either the thread 70 or the thread 72 to adjust the transverse angular relation between the standards 68 adjusting the position of the block 75, as required. Adjustability of block 75 is provided since it is necessary to raise the sheave 97 to approximately twice the normal height to accommodate the length of the swab 103 when the same is inserted into or removed from the well bore. Hydraulic pump 85 is actuated by the operator of the device to elevate the sheave 97 by the extension of hydraulic ram 80. Operation of the hydraulic pump 85 is effected only when it is desired to insert or remove the swab 103 from the well bore. The pump 85 is driven by a separate motor, pulley, and belt arrangement, not shown.

The block 75 has a relatively large central vertical bore 87 extending therethrough and a spring guide cup 88 is pressed into the upper end of the bore 87 to support a coil compression spring 89 therein. The block 75 is fur-

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there provided with a pair of spaced apart parallel bores 90 arranged parallel to the bore 87 and having guide bushings 91 inserted therein. The upper surface 92 of the block 75 is horizontal and flat, as can be clearly seen in FIGURE 9. A yoke, generally indicated at 93, is supported on the block 75 and has a pair of spaced apart parallel depending guide shafts 94 fixedly secured to the lower end thereof and which are positioned in guide bushings 91, in bores 90, and block 75. The yoke 93 is provided with a pair of bearing blocks 95 arranged in laterally spaced aligned relation and having a shaft 96 journaled therein. A sheave 97 is fixed to the shaft 96 and rotates therewith. The yoke 93 is arranged for sliding movement with respect to the block 75 and the coil spring 89 normally biases the yoke 93 away from the block 75.

A switch 98 mounted on the yoke 93 is positioned to be actuated by a bracket 99 on the block 75 when the yoke 93 has been weighted sufficiently to come in contact with the block 75.

A revolution counter and electric switch 100 is mounted on one of the bearing blocks 95 for operation by the shaft 96, for reasons to be assigned. A relatively thin steel cable 101 is wound on the drum 39 and is trained under the sheave 57 of the levelwind mechanism 41. The cable 101 is then trained over the sheave 97 extending downwardly therefrom into the well casing 102.

The cable 101 is connected to a swab pump 103 for moving the swab pump 103 in the well casing 102.

A conventional commercially available motor control and motor reversing unit 104 is positioned adjacent the motor 26 and is electrically coupled to the switch 98 and the revolution counter and switch 100 to control thereby the operation of the electric motor 26 and the unit 20.

In FIGURE 2a a cover, generally indicated at 105, is provided for the drum 39, electric motor 26 and the driving connections therebetween.

In the operation of the swab pump unit when it is desired to pump fluid from the well, the swab 103 is inserted into the casing 102 and the motor 26 operated upon actuation of a manual switch.

The revolution counter switch 100, which is somewhat similar to the switch disclosed in the patent to Kallenbenz, 2,653,205 issued September 22, 1953, is pre-set prior to the initial operation of motor 26 so that upon a predetermined number of revolutions of sheave 97 after the swab 103 moves downwardly in casing 102, a first pair of contacts 100' are closed. When contacts 100' are closed, a circuit to switch 104, in motor control and reversing unit 104 is completed which causes the rotation of motor 26 to be reversed to effect upward movement of swab 103 in casing 102. The swab 103 is moved upwardly a distance sufficient to discharge a slug of fluid lifted thereby. When the swab 103 has reached the point in its upward travel in bore 102 where the slug of fluid is discharged, a second pair of contacts 100'' in revolution counter switch 100 are closed and contacts 100' opened. Upon closing of contacts 100'' a circuit is completed to switch 104' in motor control and reversing unit 104 to reverse the rotation of motor 26, the circuit to switch 104', of course, being broken, to effect downward movement of swab 103 in the casing 102. A schematic diagram generally illustrating the circuits for the above-mentioned operation is shown in FIGURE 13.

In the event that a slug of fluid above the swab 103 is too heavy to be lifted, the motor 26 is automatically stopped. This is caused by the breaking of the circuit to motor 26 by the separation of the pair of contacts 98' in switch 98. As previously mentioned, yoke 93, to which the switch 98 is fixed, is movable relative to block 75 in response to the combined weight of the cable 101, swab 103, and the slug of fluid to be lifted. If the weight to be lifted is excessive due to too large a slug of fluid, the yoke 93 will move relative to the block 75 until switch 98 engages the same whereby contacts 98' will be opened

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breaking the circuit to motor 26 causing the same to stop. Operation of motor 26 will not being again until the weight of the slug is lowered by a portion of the fluid draining back into the lower portion of casing 102. In this regard it should be noted that some wells will not recover as rapidly as others and would require only a few widely spaced strokes of the swab 103 per day, whereas other wells would require almost continuous pumping operation.

In removing the swab 103 from the casing 102 for repair or replacement, it is necessary to raise the sheave 97 to approximately twice the normal height to accommodate the length of the swab 103. Through operation of the hydraulic ram 80 the sheave 97 can be raised the desired amount and then adjustably locked in its raised position.

With the instant invention protected with suitable fuses and the like, the swab pumping operation can be conducted on an automatic basis with no operator in attendance.

Having thus described the preferred embodiment of the invention, it should be understood that numerous structural modifications and adaptations may be resorted to without departing from the scope of the appended claims.

What is claimed is:

1. A swab pump unit for oil field production comprising a horizontal pallet, a block spaced above the forward end of said pallet, means for vertically adjustably supporting said block with respect to said pallet, a yoke means resiliently supporting said yoke on said block, said block being provided with a pair of tubular bushings extending in parallel relation therethrough, said yoke being provided with a pair of parallel guide shafts slidably positioned in said guide bushings, a sheave journaled in said

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yoke, a winch mounted on said pallet, a cable wound on said winch and trained over said sheave, a pump swab supported by said cable in pumping position in a well, a motor for rotating said winch and means controlling said motor.

2. A swab pump unit for oil field production comprising a horizontal pallet, a block spaced above the forward end of said pallet, means for vertically adjustably supporting said block with respect to said pallet, a yoke, a spring guide cup mounted in said block, a coil compression spring supporttd in said cup at its lower end with its upper end in supporting engagement with said yoke above said block to resiliently support the same, said block further including a pair of tubular bushings extending in parallel relation therethrough, said yoke being provided with a pair of parallel guide shafts slidably positioned in said guide bushings, a sheave journaled in said yoke, a winch mounted on said pallet, a cable wound on said winch and trained over said sheave, a swab pump supported by said cable in pumping position in a well, a motor for rotating said winch and means controlling said motor.

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