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POWER UNIT FOR OIL WELL PUMPING EQUIPMENT

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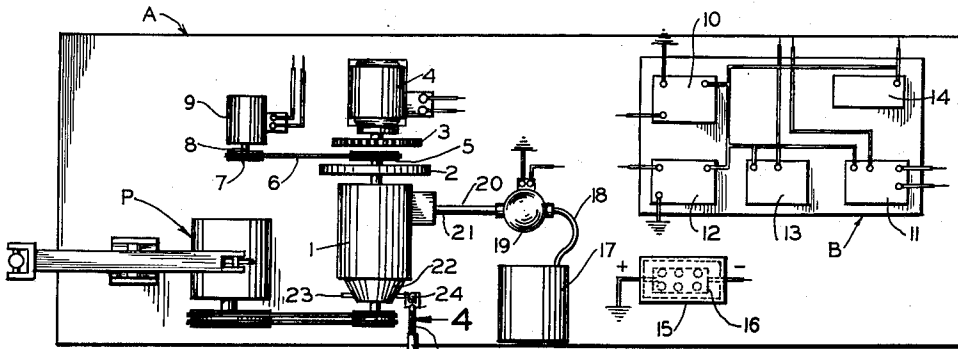


FIG. 1

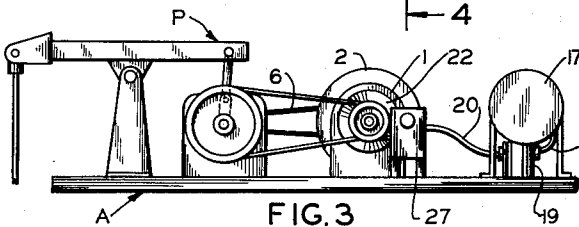


FIG. 3

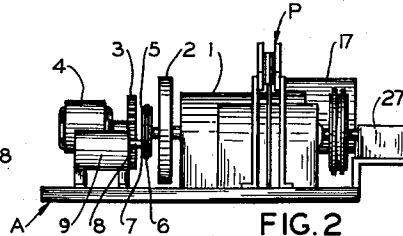


FIG. 2

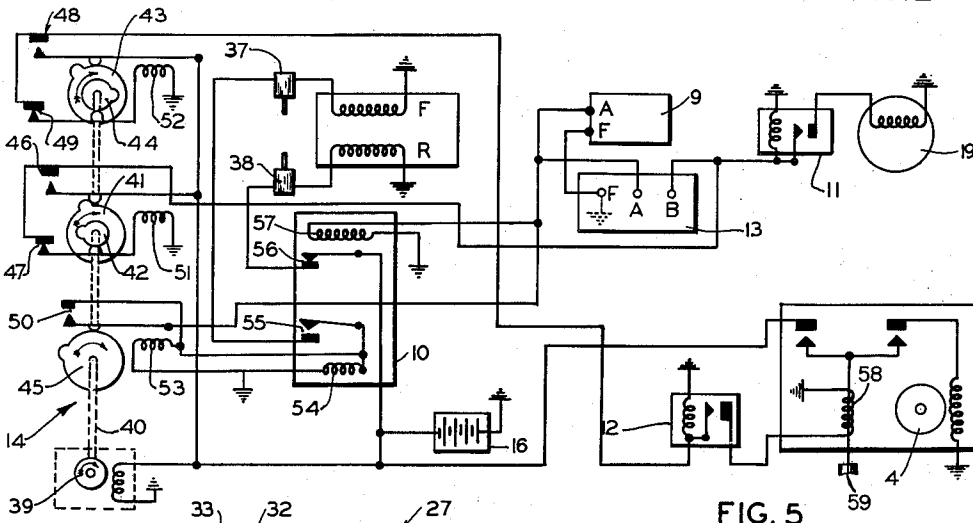


FIG. 5

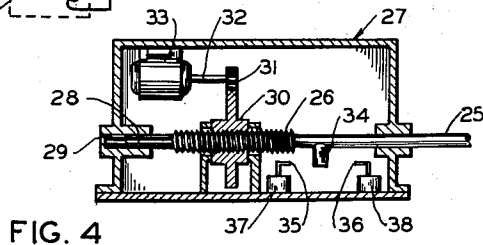


FIG. 4

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POWER UNIT FOR OIL WELL PUMPING EQUIPMENT

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This invention relates in general to certain new and useful improvements in oil well pumping equipment and is an improvement in the type of time-controlled power unit forming the subject matter of U.S. Letters Patent 2,634,682. In said U.S. Letters Patent 2,634,682 it has become highly desirable in established oil fields to provide pumping equipment which is essentially self-contained so as to eliminate the necessity of setting up a network of long, extended, mechanical pumping rods which radiate out over an oil field from a central power station. However, self-containing pumping units which are located at the well-site must be started up and shut down intermittently for various reasons. In many cases, it is technologically undesirable to pump a well continuously. In other cases, legal production restrictions make periodic shut down mandatory.

For practical reasons self-contained oil well pumping installations utilize a gasoline engine as a prime mover and such engines are relatively inflexible so far as starting and stopping characteristics are concerned. On the other hand, the heavy and comparatively slow moving pump has entirely different starting and stopping characteristics. The device forming the subject matter of U.S. Letters Patent 2,634,682, provides an effective and efficient system for overcoming these differences in starting characteristics between the gasoline engine and the pump so that the entire unit may be operated under automatic controls. However, such devices have been found to be somewhat expensive both as to initial cost and maintenance.

It is, therefore, the primary object of the present invention to provide a self-contained well-pumping unit which is not only capable of flexible operation and automatic control but is also comparatively inexpensive both as to installation costs and maintenance costs.

It is also an object of the present invention to provide a well-pumping power unit of the type stated which can be effectively and efficiently controlled by automatic timing means so that it may start up and shut down at predetermined times and thus operate for relatively long periods of time without manual intervention.

With the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawing—

FIG. 1 is a top plan view of a well-pumping unit constructed in accordance with and embodying the present invention;

FIG. 2 is a side elevational view of the well-pumping unit;

FIG. 3 is a front elevational view of the well-pumping unit;

FIG. 4 is a fragmentary sectional view taken along line 4—4 of FIG. 1; and

FIG. 5 is a schematic wiring diagram showing the electrical circuits forming a part of the present invention.

Referring now in more detail and by reference characters to the drawing which illustrates a practical embodiment of the present invention, A designates a conventional platform constructed of any conventional material, such as wood, steel, or reinforced concrete, and located at the well head. Mounted upon the platform A is an internal combustion engine 1 having a flywheel 2

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and a conventional starter gear 3 which is operated by an electrical starting motor 4. Operatively interposed between the flywheel 2 and the starter gear 3 is a pulley 5 for rotation with the flywheel 2 and is connected by a V-belt 6 to a driven pulley 7 pinned or otherwise rigidly fastened upon the driving shaft 8 of a generator 9. Also mounted in any suitable manner upon the platform A in convenient proximate location to the starter 4 and generator 9 is a control panel B provided with three conventional electrical relays 10, 11, 12, a voltage regulator 13, and a timer 14. The platform A is also provided with a suitable cover or housing 15 which contains a storage battery 16. Finally, the platform A is provided with a conventional fuel tank 17 which is connected through a pipe or conduit 18 to a solenoid valve 19 and the latter is, in turn, connected through a supply pipe or line 20 to the fuel-supply intake 21 of the gasoline engine 1.

The gasoline engine 1 is operatively provided with a clutch 22 through which it drives the pump P, with a clutch-actuating lever 23 projecting outwardly therefrom for mechanical connection, by means of a linkage 24 and an actuator bar 25 to a horizontally shiftable lead screw 26 which is shiftable mounted within a housing 27 and is integrally provided at its interior end with an axially projecting spline 28 slidably mounted in a stationary spline socket 29. Threadedly mounted on the lead screw 26 and suitably bearinged within the housing 27 for rotation but non-shiftable movement therein is a gear nut 30 which meshes with a driving pinion 31 keyed or otherwise suitably secured upon a drive shaft 32 of a reversible electric motor 33 having a "forward" winding F and a reversing winding R. Within the housing 27 the actuator bar 25 is provided with a depending arm 34 which optionally engages the actuator-elements 35, 36, of limit switches 37, 38, respectively. Thus, when the forward winding F of the electric motor 33 is suitably energized, the lead screw 26 is shifted to the left (reference being made to FIG. 4). When the lead screw 26 has reached the limit of its travel in such direction, the arm 34 will engage the switch actuator-element 35 and open the limit switch 37, thereby de-energizing the motor 33. Similarly, when the reversing winding R is energized, the motor 33 will rotate in the reverse direction so as to move the lead screw 26 to the right (reference again being made to FIG. 4) and the arm 34 will ultimately actuate the limit switch 38 when the lead screw 26 has reached the desired limit of its travel in this latter direction. The limit switches 37, 38, are, of course, connected as shown in the wiring diagram, FIG. 5, so that when the motor circuit controlled by the limit switch 37 is interrupted the other motor circuit controlled by the limit switch 38 will be closed and conditioned for energizing the motor 33 whenever the relay 10 is closed in the appropriate direction.

The timer 14 is preferably of the conventional clock-motivated type and, as shown schematically in FIG. 5, includes a suitable driving motor 39 preferably of the type now commonly used in battery-powered automobile clocks. The motor 39 drives a timer shaft 40 having two pairs of manually positionable cams 41, 42, and 43, 44. Also operatively mounted on the shaft 40 is a single manually positionable cam 45. The cams 41, 42, 43, 44, and 45 mechanically operate the switches 46, 47, 48, 49, and 50, respectively. The switches 47 and 49 are in series with the holding coils 51, 52, respectively. The switch 50 is in series with the holding coil 53 and also with the relay coil 54 and switch 55 of relay 10, as well as being in series with the limit switch 37 and the generator 9. The switch 46 is in series with the fuel valve relay 11, and the switch 48 is in series with the starter

relay 12. The relay 10 also includes a normally closed switch 56 which is in series with the limit switch 38 and is operatively associated with a hold-out coil 57, the latter being connected between the generator 9 and ground so as to be energized only when the generator 9 is running. Thus, when the generator 9 is running the hold-out coil 57 will hold the switch 56 open and conversely when the generator 9 is not running the switch 56 will be closed.

The relay 12 energizes a starter switch 58 which forms a conventional part of the starter 4. It will, of course, be understood that this starter switch 58 will automatically throw out when the gasoline engine 1 has been started. Switches of this type are well known and available as built-in components of electric starters and, therefore, are not shown or described in detail herein.

The several cams 41, 42, 43, 44, 45 of the timer 14 are manually set so as to interpose an appropriate time delay interval between the closing of the starting circuits and the energizing of the relay coil 54 in the relay 10 so that the gasoline engine 1 will reach full torque before the clutch 22 is engaged. Thus, the wiring diagram, as shown in FIG. 5, is in the configuration just prior to starting the engine 1. As the timer 14 continues to rotate, the cams 41 and 43 will close the switches 46, 48, respectively. The fuel valve 49 accordingly opens and the starter 39 is energized, thereby starting the engine 1. As the engine 1 starts up, the generator 9 energizes the hold-out coil 57, and, as above stated, the switch 56 is held open as long as the engine 1 and the generator 9 continue to run.

After an appropriate interval, the cam 45 closes the switch 50, which is locked in by the series holding coil 53 and the series relay coil 54 is energized, pulling in the switch 55 to complete a circuit from the generator 9, through the circuit switch (now closed) to the forward winding F of the motor 33, and the clutch 22 is shifted into engaged position. In this connection, it should be noted that, as soon as the actuator-bar 25 begins to move, the arm 34 comes away from the actuator-element 36 and the limit switch 38 will close. However, as long as the generator 9 is running the switch 56 remains open and the reversing winding R will not be energized.

As the clutch 22 reaches fully engaged position, the arm 34 will engage the actuator 35 of the limit switch 37 and interrupt the circuit to the forward winding F of the motor 33. The thread ratio between the lead screw 26 and the gear nut 30 is relatively high or "self-locking," so to speak, and, therefore, the clutch 22 will be held in engaged position, notwithstanding the fact that the motor 33 is stopped by reason of the action of the limit switch 37. In addition to this, as soon as the limit switch 37 opens, the circuit through the series coils 53 and 54 is broken and the switches 50, 55, will open.

Shortly thereafter, the cam 44 will open the switch 49 and break the circuit to the starter holding coil 52 so that the switch 48 will, in turn, open, thereby breaking the circuit to the starter relay 12. Subsequently, at the preset time the cam 42 will open the switch 47 breaking the circuit to the holding coil 51 so that the switch 46 will, in turn, open, thereby breaking the circuit to the fuel valve relay 11. As soon as the fuel valve relay 11 opens, the fuel valve will close and the engine 1 will shut down. Immediately the generator 9 will stop and the coil 57 will release the switch 56, thereby connecting the reversing coil R to the battery 16 and driving the motor 33 in a reverse direction to shift the clutch 22 into disengaged position. Similarly, if at any time the engine 1 should stall or stop, as for instance, by reason of an accidental exhaustion of the fuel supply or some other unauthorized cause, the generator 9 will immediately be de-energized and the relay coil 57 will also become de-energized allowing the switch 56 to close again and re-establish a circuit between the limit switch 38 and the battery 16. As a result, the clutch 22 will be disengaged. In order to restart the engine 1, a conventional manual

starting button 59 is preferably incorporated in the starting motor 4.

Under either of these circumstances, the limit switch 38 will be opened as soon as the actuator-bar 25 and its associated switch-actuating arm 34 are shifted over to the opposite extreme position, and, the reversing winding R of the motor 33 will be de-energized. Inasmuch as all gasoline engines have a substantial amount of inertia and coast to a stop through a period of possibly 5 to 10 seconds, the clutch actuating mechanism will have sufficient time in which to complete the clutch-disengaging operation, so that the drag of the pumping equipment will not be transmitted to the engine 1 to any substantial degree.

It should be understood that changes and modifications in the form, construction, arrangement, and combination of the several parts of the oil well pumping equipment may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A power unit for driven means and the like, said unit comprising a driven means, a prime mover, a starter operatively associated with the prime mover, a clutch operatively interposed between the driven means and the prime mover, actuator means for shifting said clutch into engaged and disengaged positions, a battery, a reversible electric motor, mechanical drive means operatively connecting the electric motor with the actuator means, and timer means for connecting the starter to the battery only at a predetermined time, said timer means also including means for causing the electric motor to become energized and rotate in such direction as to move the actuator means and the clutch associated therewith into engaged position.

2. A power unit for driven means and the like, said unit comprising a driven means, a prime mover, a starter operatively associated with the prime mover, a clutch operatively interposed between the driven means and the prime mover, actuator means for shifting said clutch into engaged and disengaged positions, a battery, a reversible electric motor, mechanical drive means operatively connecting the electric motor with the actuator means, and timer means for connecting the starter to the battery only at a predetermined time, said timer means including means for subsequently causing the electric motor to become energized and rotate in such direction as to move the actuator means and the clutch associated therewith into engaged position.

3. A power unit for driven means and the like, said unit comprising a driven means, a prime mover, a starter operatively associated with the prime mover, a clutch operatively interposed between the driven means and the prime mover, actuator means for shifting said clutch into engaged and disengaged positions, a generator driven by the prime mover, a battery, a reversible electric motor, mechanical drive means operatively connecting the electric motor with the actuator means, and timer means for connecting the starter to the battery only at a predetermined time, said timer means also including means for causing the electric motor to become energized and rotate in such direction as to move the actuator means and the clutch associated therewith into engaged position.

4. A power unit for driven means and the like, said unit comprising a driven means, a prime mover, a starter operatively associated with the prime mover, a clutch operatively interposed between the driven means and the prime mover, actuator means for shifting said clutch into engaged and disengaged positions, a generator driven by the prime mover, a battery, a reversible electric motor, mechanical drive means operatively connecting the electric motor with the actuator means, timer means for connecting the starter to the battery only at a predetermined

time, said timer means also including means for causing

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the electric motor to become energized and rotate in such direction as to move the actuator means and the clutch associated therewith into engaged position, and means for reversing the electric motor whenever the prime mover stops whereby to disengage the clutch.

5. A power unit for driven means and the like, said unit comprising a driven means, a prime mover, a starter operatively associated with the prime mover, a clutch operatively interposed between the driven means and the prime mover, actuator means for shifting said clutch into engaged and disengaged positions, a generator driven by the prime mover, a battery, a reversible electric motor, mechanical drive means operatively connecting the electric motor with the actuator means, and timer means for electrically connecting the starter to the battery and energizing said starter only at a predetermined time, said timer means also including control means and mechanical connecting means for subsequently connecting the electric motor to the generator so that the electric motor will rotate in such direction as to shift the clutch into engaged position.

6. A power unit for driven means and the like, said unit comprising a driven means, a prime mover, a starter operatively associated with the prime mover, a clutch operatively interposed between the driven means and the prime mover, actuator means for shifting said clutch into engaged and disengaged positions, a generator driven by the prime mover, a battery, a reversible electric motor, mechanical drive means operatively connecting the electric motor with the actuator means, timer means for electrically connecting the starter to the battery and energizing said starter only at a predetermined time, said timer means also including control means and mechanical connecting means for subsequently connecting the electric motor to the generator so that the electric motor will rotate in such direction as to shift the clutch into engaged position, and means for connecting the electric motor to the battery for reverse operation of said motor whenever the prime mover is not moving whereby to disengage the clutch.

7. A power unit for driven means and the like, said unit comprising a driven means, a prime mover, an electrical starter operatively associated with the prime mover, a source of electrical energy, a clutch operatively interposed between the driven means and the prime mover, actuator means for shifting said clutch into engaged and disengaged positions, a generator driven by the prime mover, a reversible electric motor, means operatively driven by the electric motor for shifting the clutch actuator into engaged and disengaged positions, and a continuously operating electrical timer connected to the source of electrical energy, said timer being operatively connected to first, second, and third switch means, said first switch means for supplying a priming signal to the prime mover, said prime mover including means responsive to said priming signal for preparing the prime mover for operation, said second switch means for connecting the source of electrical energy and the starter thereby completing a circuit to the starter after the prime mover has been prepared for operation, said third switch means for connecting the generator and the reversible electric motor whereby when the prime mover has attained operating speed the power produced by the generator will cause the motor to drive the clutch into engaged position thereby establishing a direct coupling of the driven means and the prime mover.

8. A power unit for driven means and the like, said unit comprising a driven means, a prime mover, an electrical starter operatively associated with the prime mover, a source of electrical energy, a clutch operatively inter-

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posed between the driven means and the prime mover, actuator means for shifting said clutch into engaged and disengaged positions, a generator driven by the prime mover, a reversible electric motor, means operatively driven by the electric motor for shifting the clutch actuator into engaged and disengaged positions, a continuously operating electrical timer connected to the source of electrical energy, said timer being operatively connected to first, second, and third switch means and adapted for actuating said first, second, and third switch means in sequential order at preselected intervals, said first switch means for supplying a priming signal to the prime mover, said prime mover including means responsive to said priming signal for preparing the prime mover for operation, said second switch means for connecting the source of electrical energy and the starter so as to complete a circuit to the starter and initiate operation of the prime mover, said third switch means for establishing an electrical connection between the generator and the reversible electric motor whereby when the prime mover has attained operating speed the generator will supply power to the motor and the motor will drive the clutch into engaged position, and an auxiliary normally closed switch connected in series with reversing winding of the reversible electric motor and the source of electrical energy, said auxiliary switch being responsive to the voltage in a coil which is in series with the generator and is adapted to pull said auxiliary switch open when the generator is functioning.

9. A power unit for driven means and the like, said unit comprising a driven means, a prime mover, an electrical starter operatively associated with the prime mover, a source of electrical energy, a clutch operatively interposed between the driven means and the prime mover, actuator means for shifting said clutch into engaged and disengaged positions, a generator driven by the prime mover, a reversible electric motor having a forward winding and a reversing winding, means operatively driven by the electric motor for shifting the clutch actuator into engaged and disengaged positions, a continuously operating electrical timer connected to the source of electrical energy, said timer being operatively connected to first, second, and third switch means and adapted for actuating said first, second, and third switch means in sequential order at preselected intervals, said first switch means for supplying a priming signal to the prime mover, said prime mover including means responsive to said priming signal for preparing the prime mover for operation, said second switch means being adapted, upon actuation, to complete a circuit between the starter and the source of electrical energy whereby to start operation of the prime mover, said third switch means being adapted upon actuation to connect the generator and the forward winding of the reversible electric motor whereby to shift the clutch into engaged position when the prime mover has attained operating speed, and an auxiliary normally closed switch connected in series with the reversing winding of the reversible electric motor and the source of electrical energy, said auxiliary switch being provided with a coil which is in series with the generator and is adapted to pull said auxiliary switch open when the generator is functioning.

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