May 1, 1962 K. ST. JOHN HOBLITZELLE 3,031,970

MAGNETIC RAM PUMP

Filed Nov. 15, 1960 2 Sheets-Sheet 1

FIG. 1

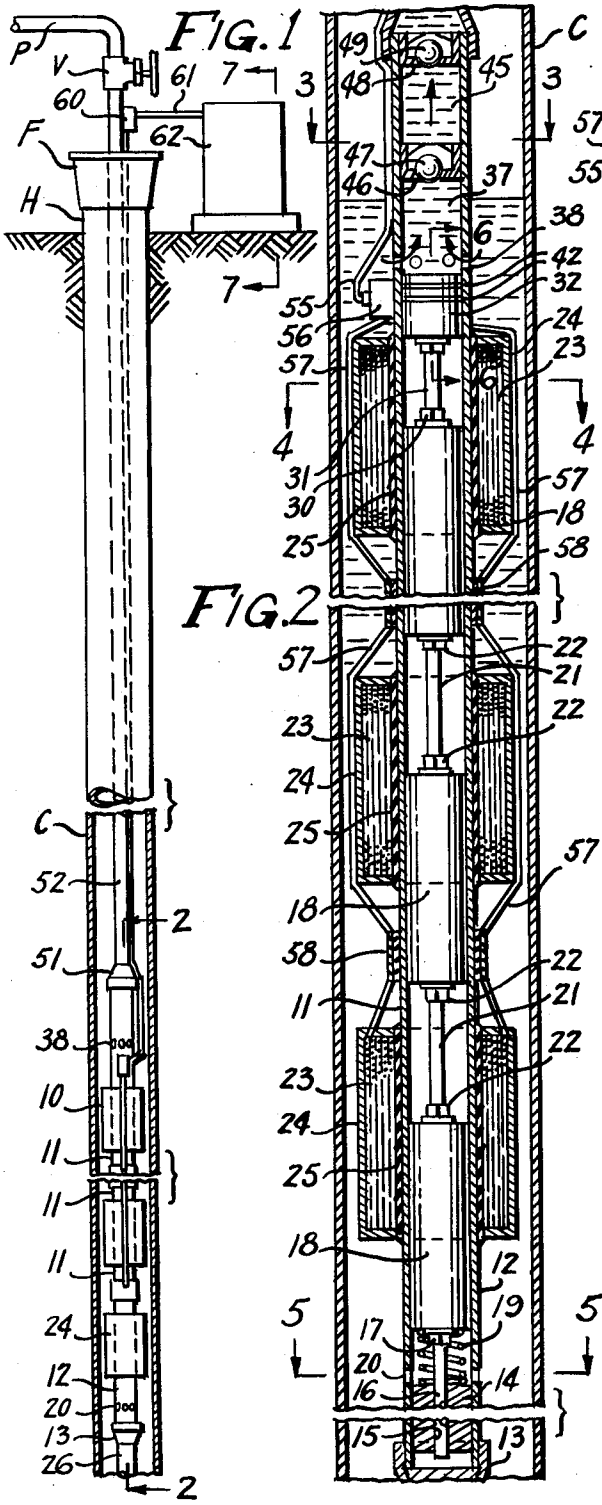


FIG. 2

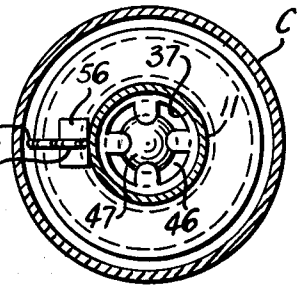


FIG. 3

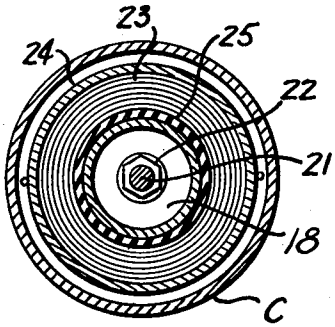


FIG. 4

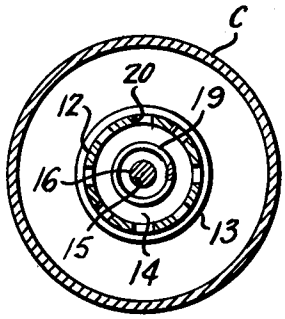


FIG. 5

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May 1, 1962 K. ST. JOHN HOBLITZELLE 3,031,970

MAGNETIC RAM PUMP

Filed Nov. 15, 1960 2 Sheets-Sheet 2

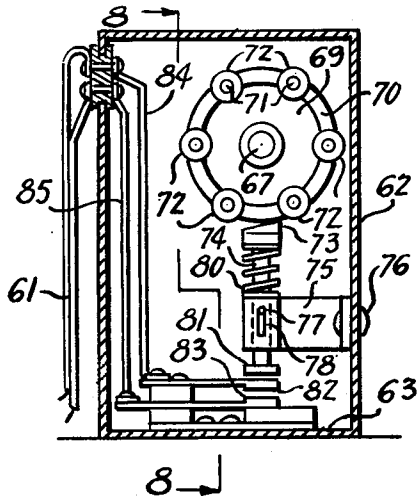


FIG. 7

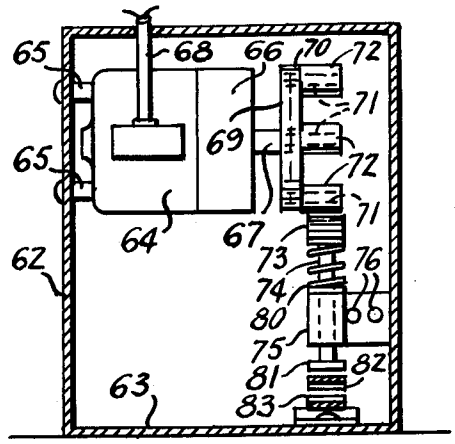


FIG. 8

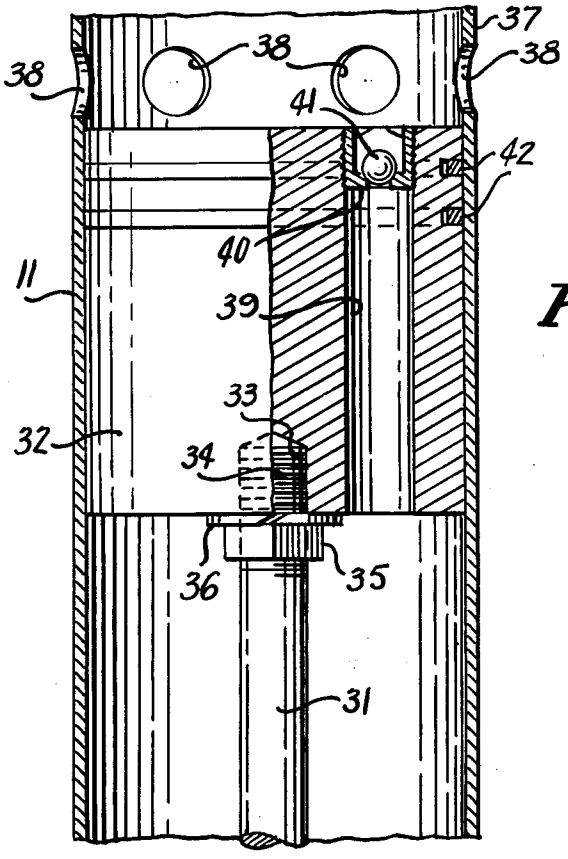


FIG. 6

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MAGNETIC RAM PUMP

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5 Claims. (Cl. 103—46)

This invention relates to a magnetic ram pump, and has particular applicability to a pump adapted to be vertically positioned in a well, for the purpose of lifting fluids, such as oil, gases, gas, water or the like from the well.

A primary object of the invention is the provision of an improved pump which is solenoid actuated, by means of a timer, which will reciprocate a piston at a relatively high rate of speed in order to raise the fluid to the surface of the well.

An additional object of the invention is the provision of a device of this character which is characterized by a fluid trap zone provided with a pair of ball valves, the trap zone being otherwise characterized by complete simplicity of construction and the absence of any complex valve arrangements as is conventional in devices of this character.

A more specific object of the invention is the provision of a piston having a ball check valve therein for the purpose of breaking any air lock or vacuum created beneath the piston.

An additional object of the invention is the provision of a device of this character which is characterized by any suitable number of solenoid cores and coils in accordance with the capacity of the well for the pumping capacity required.

A still further object of the invention is the provision of an improved timing device adapted to energize the solenoid coils of the pump which is protected by an oil bath in order to prevent arcing into the oil or other inflammable fluid, if such is being pumped.

Still another object of the invention is the provision of an improved pump of this character which is sturdy and durable in construction, reliable and efficient in operation, and relatively simple and inexpensive to manufacture, assemble, and utilize.

Still other objects reside in the combinations of elements, arrangements of parts, and features of construction, all as will be more fully pointed out hereinafter and disclosed in the accompanying drawings wherein there is shown a preferred embodiment of this inventive concept.

In the drawings:

FIGURE 1 is a side view partially in elevation and partially in section, showing a well bore or pipe having the pump of the instant invention positioned therein, and disclosing schematically the timing and energizing mechanism of the well head.

FIGURE 2 is an enlarged sectional view taken substantially along the line 2—2 of FIG. 1 as viewed in the direction indicated by the arrows, parts thereof being broken away, disclosing the structure of the magnetic ram pump.

FIGURE 3 is a sectional view on an enlarged scale taken substantially along the line 3—3 of FIG. 2 as viewed in the direction indicated by the arrows.

FIGURE 4 is an enlarged sectional view taken substantially along the line 4—4 of FIG. 2 as viewed in the direction indicated by the arrows.

FIGURE 5 is an enlarged sectional view taken substantially along the line 5—5 of FIG. 2 as viewed in the direction indicated by the arrows.

FIGURE 6 is an enlarged sectional view taken substantially along the line 6—6 of FIG. 2 as viewed in the direction indicated by the arrows.

FIGURE 7 is an enlarged sectional view taken substantially along the line 7—7 of FIG. 1 as viewed in the direction indicated by the arrows; and

FIGURE 8 is a sectional view taken substantially along the line 8—8 of FIG. 7 as viewed in the direction indicated by the arrows.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Having reference now to the drawings in detail, there is generally indicated at C a well casing or pipe such, for example, as an oil well, which includes a well head H at the surface of the ground and well head fitting F. The pump of the instant invention is generally indicated at 10, and comprises a tube 11 of nickel steel or other suitable material, which is provided at its lower end with a depending portion 12, which is closed with an end cap 13, and carries a plug 14 having a bore therein indicated at 15 within which is slidably mounted a guide 16. The guide or guide rod 16 is secured by means of a nut 17 to the lowermost of a plurality of solenoid cores 18, which are slidably mounted within the tube 12. A spring 19 biases the core or cores in an upward direction, and also serves as a cushioning spring. Air holes 20 are provided to prevent undue accumulation of air or fluid interior of the pipe extension 12, in order to provide free movement of the solenoid core 18.

The solenoid core 18 is connected by means of a dielectric rod 21 and a pair of lock nuts 22 to the next adjacent core 18, of which, as previously stated, there may be any desired number.

The tube 12 is surrounded at spaced intervals adjacent each core 18 by a solenoid coil 23, which is enclosed in an insulated casing 24, and insulated by a sheet or tube 25 of insulating material from the nickel steel tube 12.

The arrangement is thus such that a solenoid coil 23 is positioned adjacent each core 18, and, when energized, in a manner to be more fully described hereinafter, will move the cores from the position as shown in FIG. 2, which is the de-energized position of the solenoid to a position concentric with the coil, all for a purpose to be more fully described hereinafter.

A suitable "dead man" 26 may be secured to the end of pipe 12, or to end cap 13, and extend to the bottom of the well, it being noted that the entire pump assembly is positioned below the fluid level of the well, as best seen in FIG. 2.

The uppermost of solenoid cores 18 has secured thereto as by means of a nut 30 an operating shaft 31, which carries at its end a piston 32, which serves as the effective pumping element of the device. The piston has a threaded bore 33, as best shown in FIG. 6, which engages the threaded end 34 of operating rod 31, the assembly being held in position by means of a clamping nut 35 which seats against the washer 36. Piston 32 extends into a chamber 37 having inlet openings 38 therein through which fluid from the well casing may enter the pump assembly, and be forced upwardly as the solenoid cores are reciprocated by the solenoid coils in a manner to be more fully described hereinafter. A bore 39 extends through piston 32, and is provided with a ball check valve seat 40 and a ball valve 41, in order to prevent air lock or vacuum lock beneath the piston 32. Conventional sealing rings 42 are also provided, as best shown in FIG. 6.

Pipe section 37 above the inlets 38 contains a trap chamber 45, which includes a lower valve seat 46 having a ball valve 47 therein, and an upper valve seat 48 containing a ball valve 49, the arrangement being such that as oil is forced upwardly past the ball valve 47 into the chamber defined by the tubing 45, it is retained there until additional oil is moved by the solenoid actuated

piston 32 beyond the ball valve 49. Above the trap chamber 45 there is a reduction fitting 50, and a pipe extension 51, which extends to the well head H and through the fitting F, a suitable control valve V being provided, and an extension pipe T leaving the pumped oil or other fluid from the well to any desired locality.

Current is supplied to the solenoid cores from a cable or conduit 55 which is secured to the pipe 52 in any desired manner, as by clips or the like, and extends to an electrical inlet 56. Wires 57 extend from inlet 56 and communicate with each solenoid coil 23, take-off wires extending the centering rings 58 which surround the tube 11 beneath each coil, and are insulated therefrom as by insulating material 59.

The conduit 55 extends to a fitting 60 above the well head fitting F, from which an additional conduit 61 extends to a control box 62.

The control box 62 is best shown in FIGS. 7 and 8 and comprises a receptacle which includes an insulating base 63, and which has a suitable motor 64 mounted therein in any desired manner, as by bolts and collars 65 connected to the wall. A suitable reduction gearing assembly 66 of conventional type is associated with the motor, and carries a drive shaft 67. Current is supplied to the motor through a cable or conduit 68, and may be either direct or alternating, of any desired voltage, as, for example, 220 volts. The shaft 67 carries a disc 69, which is provided with an annular rim 70, from which extend a plurality of studs 71, upon each of which is mounted a roller 72. The rollers 72 are adapted sequentially to engage the tapered head 73 of a contact shaft 74, which is mounted on the bracket 75 secured as by means of a plurality of bolts 76 to the side wall of receptacle 62. A pin 77 movable in a slot 78 in fitting 75 limits the travel of shaft 74 which is biased upwardly into lower engaging position by means of a coil spring 80. The lower end of shaft 74 carries a head 81 which as the shaft 74 is moved downwardly engages the contact 82 of any conventional design, which upon impact is moved into association with an adjacent contact 83 to close the circuit between wires 84 and 85. The circuit thus closed is carried through conduit 61 and conduits 55 and 57 to the several solenoid coils 23, and as the circuit is closed, energizes the solenoid coils to move the solenoid cores 18 to reciprocate piston 32, and hence move fluid upwardly in the pump in the manner heretofore described.

The speed and timing of the device may be adjusted to suit, but by the relatively rapid reciprocation of the solenoid cores 18, due to the relatively rapid engagement of contacts 82 and 83, a continuous flow of fluid is provided through the mixing chamber 37 and the ball valves 47 and 49 upwardly and through the outlet pipe T to any desired source.

From the foregoing it will now be seen that there is herein provided an improved pump, which accomplishes

all the objects of this invention, and others, including many advantages of great practical utility and commercial importance.

As many embodiments may be made of this inventive concept, and as many modifications may be made in the embodiment hereinbefore shown and described, it is to be understood that all matter herein is to be interpreted merely as illustrative, and not in a limiting sense.

I claim:

1. A magnetic ram pump adapted for insertion in the bore of a well comprising an elongated pipe member, a plurality of solenoid cores mounted for sliding movement in said pipe member, dielectric means connecting said solenoid cores together, a plurality of solenoid coils surrounding said pipe member, one coil being adjacent each core, a piston carried by the uppermost of said cores, inlet openings into said pipe member above said piston, and means for alternately energizing and de-energizing said solenoid coils to reciprocate said cores to actuate said piston, a trap chamber above said piston comprised of a pair of spaced apart ball check valves precluding the downward flow of fluid forced upwardly by said piston, said piston being provided with a bore therethrough, and a check valve in said bore to preclude the formation of a vacuum lock below said piston.

2. The structure of claim 1 wherein said timing mechanism comprises an electrical motor mounted exteriorly of said well bore, and means operable by said motor for alternately making and breaking the circuit to said solenoid coils.

3. The structure of claim 1 wherein said pipe member is provided at its lower end with a closure cap, a plug having a bore therethrough seated in said pipe below the lowermost of said solenoid cores, a guide carried by said lowermost solenoid core, and spring means between said plug and said solenoid core normally biasing said lowermost solenoid core upwardly.

4. The structure of claim 2 wherein said last-mentioned means comprises a disc rotatable by said motor, a plurality of rollers carried by said disc, a rod having an inclined surface sequentially engaged by said rollers, and contact means operable by movement of said rod to close said circuit.

5. The structure of claim 4 wherein spring means are provided for returning said rod to circuit opening position after passage of a roller thereover.

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