

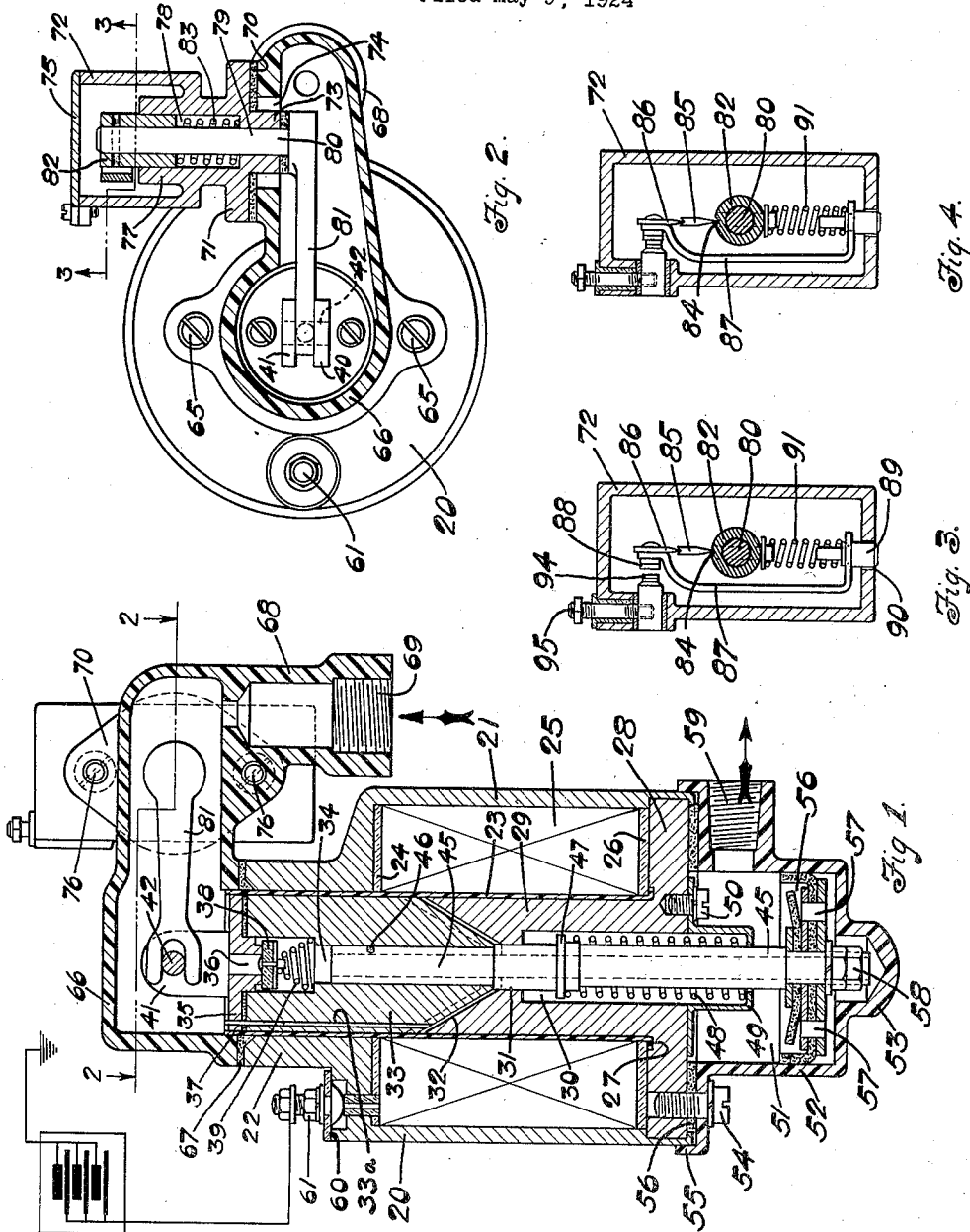
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FUEL PUMP

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FUEL PUMP.

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This invention relates to improvements in pumping devices and more particularly to electromagnetically operated pumping devices.

It is among the objects of the present invention to provide an electrically operated pump of simple design and compact structure.

This object is attained by so constructing the device that certain elements of the electro-magnet will have dual functions, one as part of the electro-magnet and another as a part of the pump itself. For example the armature is an element of the electro-magnet directly, however it is adapted to act also as a conduit and piston rod of the pump.

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

In the drawings:—

Fig. 1 is a longitudinal cross section of the pump, certain parts being shown in elevation for the sake of clearness.

Fig. 2 is a transverse sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is a detail sectional view taken along the line 3—3 in Fig. 2, and shows the circuit breaker apparatus in open position.

Fig. 4 is a view similar to Fig. 3 showing the breaker apparatus in closed position.

Referring to the drawings, the electro-magnet comprises a housing 20, constructed of any suitable magnetic material and includes a barrel portion 21 which in turn is provided with a reduced, hollow, head portion 22. A non-magnetic sleeve or tube 23, concentrically arranged with the barrel portion 21, has its one end extending into the head portion 22, the end of the tube projecting a short distance beyond the surface of said head portion. An insulating ring 24 forms a lining for the inner end of the barrel portion 21. The electro-magnet winding 25 fits inside the barrel portion 21, said winding closely fitting about the tube 23. Another insulating ring 26 is placed in the barrel portion 21 and forms an outer protecting and insulating collar for the elec-

tro-magnet winding 25. The lower end of the cylinder has an outwardly projecting flange that fits into a groove formed in the disc 28 and to which the flange is soldered to provide a leak-proof connection at this point.

The open end of the barrel portion 21 is provided with a peripheral, internal groove, which is adapted to receive the disc 28 forming the end cover for the electro-magnet housing 20. This disc is held in place by means of the flange which is formed by spinning or bending the edge of the barrel portion 21 inwardly over the disc. Disc 28 has a projection 29 concentrically arranged with the tube 23, into which the projection extends, substantially one half the length of the tube. The disc with its projection may be termed the stationary core of the electro-magnet. It has a longitudinal central passage 30 which is reduced near its inner end as at 31.

The inner end of the core is funnel shaped as shown at 32 for the purpose of providing a greater attracting surface to, and permitting greater travel range of the armature 33 which is contained in the tube 23 and whose inner end, contingent with the inner end of the core 29, is cone shaped to conform with the formation of the end of the core.

The armature may be made up of any suitable magnetic material and is provided with a central, longitudinal passage 34 concentrically alined with the longitudinal passage 31 in the core. The upper or outer end of this passage 34 is enlarged to receive the projection on the plate 35 which is provided with a central passage 36 atining with the passage 34 when the plate is in position on the armature. A packing washer 37 is interposed between the armature and plate 35.

The inner edge of the projection on the plate 35 forms a seat for the inlet valve 38 which is normally held in engaged position with said seat by means of the coil spring 39 interposed between the valve and the ledge formed by the passage 34 and its enlarged portion. The plate 35 has two projections 40 and 41 extending from the outer surface of said plate, the purpose of which will be described later.

A passage 33^a provides communication between the chamber in housing 66 and the space between armature 33 and core 29, so that the possibility of a vacuum forming in this last mentioned space is substantially eliminated. Formation of a vacuum at this point would tend to prevent the spring 48 from returning the armature to normal position.

A tube 45 which forms an extension to the armature 33 has its one end projecting into the longitudinal channel 34 of the armature, being secured therein by means of a pin 46. Adjacent the lower end of the armature, the tube 45 is slightly increased in diameter so that this portion of the tube may slidably fit in the reduced channel portion 31 of the core 29.

The tube 45 is provided with a circumferential flange 47, spaced a predetermined distance from the end of the armature 33, adjacent the inner end of the passage 30. This flange forms an abutment for one end of the spring 48 the other end of said spring engaging with an abutment cup 49 secured to the outer surface of the disc 28 by means of screws 50. The flange 47 also acts as a stop, limiting the movement of the armature in the direction away from the end of the core 29 said movement being transmitted to the armature by the spring 48.

The tube 45 extends through a central opening in the abutment cup 49, into the pump chamber 51 which is formed by the cylinder housing 52 having a closed end 53. This housing is secured to the electro-magnet in any suitable manner, preferably by means of screws 54 as shown. To insure alignment the flange 55 is formed on the housing 52 which is adapted to fit about the magnet housing 21. A leak-proof gasket 56 is interposed between the housing and the disc 28.

A piston 56 is provided in the pump chamber 51, and includes a plurality of one way check valves and passages 57. The piston is mounted on the tube 45 being secured thereto by means of nuts 58 which screw onto the end of the tube 45 without obstructing the opening of the tube.

From the foregoing description it may readily be seen that the tube, beside providing a mechanical connection between the armature and the piston also provides a conduit providing communication between the pump chamber on the suction or outer side of the piston and the inlet valve chamber formed in passage 34.

Communicating with the pump chamber 51 on the compression side of the piston 56 is an outlet port 59 which may be connected to the discharge receptacle to which fluid is to be delivered.

On a ledge 60 formed on the magnet housing 20 there is mounted a terminal 61 which,

insulated from the housing in any suitable manner, is in electrical connection with one end of the electro-magnet winding 25.

Secured to the housing portion 22, by means of screws 65, is the inlet housing 66 which has an opening adapted to snugly fit around the projecting end of the tube 23. A leak-proof gasket 67 is placed between the housings 22 and 66. A projection 68 formed on the housing 66 is provided with a passage that communicates with the interior of the housing. This latter passage may be termed the inlet port 69 to which the main fluid supply, not shown, may be connected.

As shown in the Figs. 1 and 2, the housing 66 is provided with a flat side 70 which forms a mounting plate for the flange 71 of the circuit-interrupter housing 72. A projection 73 formed on the inside surface of the flange 71 extends into an opening 74 in the housing 66 the end of said extension being flush with the inner wall of said housing 66. The housing 72 is cup-shaped, the open side being provided with a cover plate 75. This housing is held in position on the housing 66 by screws 76. A leak-proof gasket is interposed between these two housings.

Formed integral with and projecting partly into the interior of the cup-shaped portion 72 is a lug 77 in which there is formed a channel 78 having a restricted portion 79 which passes through the projection 73. The latter restricted portion 79 forms a bearing for the rod 80, said rod being the right angle member of the operating lever 81 whose bifurcated free end fits between the two members 40 and 41 of the armature plate 35, being connected thereto by pin 42. The rod 80 extends through the restricted bearing portion 79 into and through the channel 78 and has a roll 82 pinned thereto, a portion of said roll projecting into and snugly fitting within the channel 78. A spring 83 is interposed between the roller 82 and the ledge formed by the channel 78 and its restricted bearing portion. This spring tends to force the surface of the lever 81 against a gasket which is placed between the lever and the face of the projection 73 to prevent a fluid leak past the bearing 79 into the channel 78.

Referring to the Figs. 3 and 4, the roll 82 is provided with a notch 84 in which the sharp edge of the intermediate toggle element 85 is adapted to set. The opposite edge of the toggle element 85 is V-shaped or grooved to receive the sharp edge of the plate 86 secured to one end of the arm 87 which also carries the contact 88. At the opposite end of the arm 87 there is an angular portion to which is secured the pin 89 one end of which extends beyond one side of the plate 87 into a hole 90 in the housing

72. The other end of the pin forms an anchorage for the spring 91 interposed between the plate 87 and a pin 93 carried by the roll 82 and tends to move the arm 87 toward the opening 90.

Contact 88 is adapted to engage the stationary contact 94 supported in but insulated from the housing 72. A terminal screw 95 is connected with the contact 94 said terminal being in turn connected with the one end of the electro-magnet winding in any suitable manner.

The circuit interrupter is adapted to quickly make and break the electric circuit through the electro-magnet winding when the armature has almost reached its limit of upward and downward travel. When the armature is moving downwardly against the effect of the spring 48 and due to the attraction of the core 29, the lever 81 will rotate the roll 82 in a counterclockwise direction as per Figs. 3 and 4. As soon as the point of contact between element 85 and roll 82 has been moved beyond a vertical plane passing through the point of contact between elements 85 and 86, the effect of the downward pressure of the spring 91 will cause the arm 87 to shift quickly to the right and open the contacts and break the circuit through the magnet-winding, deenergizing the core 29. The spring 48 will now become effective to return the armature to its normal upper position or away from the closer proximity to the core. This movement of the armature will cause clockwise rotation of the roll 82 which, by the aid of the spring 91 is maintaining the arm 87 in contact disengaging position during this upward travel of the armature. However when the point of contact between roll 82 and element 85 has passed the vertical plane passing thru the point of contact between elements 85 and 86, the spring 91 will become effective to throw the lever 87 to the left and cause engagement between contacts 88 and 94. From the foregoing it may be seen that the actual engagement and disengagement of the contacts takes place when the armature has very nearly reached its limit of upward or downward travel respectively.

When the armature 33 is moving downwardly and consequently the piston 56 also, the valve 38 is maintained in closed position and any fluid in the chamber between the piston and the end of the cylinder will be forced thru the valve passages 57 into the chamber 51.

Upon return of the armature and piston to their upper, normal position by the spring 48, a vacuum will be produced in the suction portion of the pump chamber thus drawing the valve 38 away from its seat and permitting fluid to flow from the main source (not shown) thru inlet port 69 into

the inlet housing 66 then thru passage 36 past valve 38 thru the conduit or tube 45 into the chamber between the piston head and end 53 of the cylinder. The fluid in the pressure portion of the pump chamber 51 will be forced out through the outlet port 59 to the fluid work device not shown.

The source of electrical energy to operate the pump is shown in the present instance as a storage battery 96 one side of which is connected to the terminal 61 the other side grounded. When the contacts 88 and 94 are engaged current will flow from the battery 96 to terminal 61 thence thru winding 25 to the terminal 95, across contacts 94 and 88 back to the battery via the ground connections, the contact arm 87 bearing the contact 88 being grounded.

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. A pumping device comprising in combination, an electro-magnet; a stationary core extending partly within said magnet; an armature associated with one end of the core and having an extension projecting through said core; a pump cylinder carried by the core; a piston in the cylinder, secured to the end of the armature extension; and means for controlling the electro-magnet to cause intermittent movement of the armature.

2. A pumping device comprising in combination, a pump housing including an electro-magnet having a winding and a stationary core extending partly within said magnet; a reciprocating armature associated with one end of the core and having an extension projecting through said core; a pump cylinder secured to the core; a piston in the cylinder, secured to the end of the armature extension; an abutment cup carried by the core; means interposed between the abutment cup and the armature extension and adapted to hold the armature normally a determined distance away from the core; and means for affecting the electro-magnet intermittently to attract the armature.

3. A pumping device comprising in combination, a main pump housing including an electro-magnet comprising a magnet winding and a stationary core extending partly within said magnet; an inlet housing supported on one end of the main housing; a cylinder including a pump chamber having an outlet port, said cylinder being secured to and carried by the core; a piston in said pump chamber; an armature associated with the core and including an extension projecting through the core and having the piston secured thereto; means for maintaining the

armature normally away from the core a predetermined distance; and means for affecting the electro-magnet to attract the armature intermittently.

5 4. A pumping device comprising in combination, a main pump housing including an electro-magnet comprising a magnet winding and a stationary core extending partly within said magnet; an inlet housing supported
10 on one end of the main housing; a cylinder including a pump chamber having an outlet port, said cylinder being secured to and carried by the core; a piston in said pump chamber; an armature associated with the
15 core and having a hollow extension projecting slidably through the core and to which the piston is secured, said hollow extension providing communication between the intake chamber and the pump chamber; means for
20 maintaining the armature normally away from the core a predetermined distance; and means for affecting the electro-magnet to attract the armature intermittently.

5. A pumping device comprising in combination, a main pump housing including an electro-magnet comprising a magnet winding and a stationary core extending partly within said magnet; an inlet housing supported on one end of the main housing; a
25 cylinder including a pump chamber having an outlet port, said cylinder being secured to and carried by the core; a piston in said pump chamber; a reciprocating armature; a check valve provided in the armature; a
30 tubular projection associated with the armature and extending thru the core into the pump chamber and to which the piston is secured, the tubular projection providing communication between the check valve and
35 the pump chamber; an abutment cup mounted on the core; a spring interposed between this cup and the armature projection and adapted normally to move the armature away from the core; and means for affecting the
40 electro-magnet to energize the core intermittently to move the armature out of normal position.

6. A pumping device comprising in combination an electro-magnet including a stationary hollow core extending partly within
50 said magnet; a reciprocating armature associated with the inner end of the core; a pump chamber secured to the outer end of the core; a valved piston in said chamber; a hollow tube extending through the core
55 and connecting the armature with the piston;

an inlet chamber housing; an outlet port in the pump chamber; a check valve carried in the armature; means for maintaining the armature in normal position; and
60 means for intermittently affecting the electro-magnet to move the armature out of normal position whereby fluid will be drawn into the inlet chamber, directed past the check valve through the hollow tube into the pump
65 chamber and thence through the piston valves into the outlet port.

7. A pumping device comprising, in combination, a main housing having a central tube extending longitudinally therethrough; a magnet winding in said housing, surrounding the cylinder; a magnet core extending partly within said tube; an armature in said cylinder, having a longitudinal passage counterbored at its one end to form a valve
70 chamber; a check valve in said chamber; a cylinder containing a piston carried by the core; a tube connecting the valve chamber and the cylinder said tube forming a mechanical connection between the armature
75 and piston; a circuit interrupter for the magnet; a lever for operating said circuit interrupter; and means for operatively connecting the lever with the armature said means including a flanged portion and passage forming the valve seat and inlet passage respectively for the check valve.
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8. A pumping device comprising, in combination, a main pump housing of magnetic material, including an electro-magnet comprising a magnet winding and a stationary core of magnetic material, extending partly within the magnet-winding; a cylinder of non-magnetic material extending through the housing and surrounding the core; an
90 inlet housing of non-magnetic material supported on one end of the main pump housing; a cylinder housing of non-magnetic material, including a pump chamber having an outlet port, said cylinder housing being carried by the core; a piston in said pump chamber; a magnetic armature in the non-magnetic cylinder, having an extension projecting through said core and having the piston mounted thereon; yieldable means for
95 holding the armature in spaced relation with the core; and means for energizing the electro-magnet to attract the armature intermittently.

In testimony whereof I hereto affix my
signature.

HUGH WALLACE.