

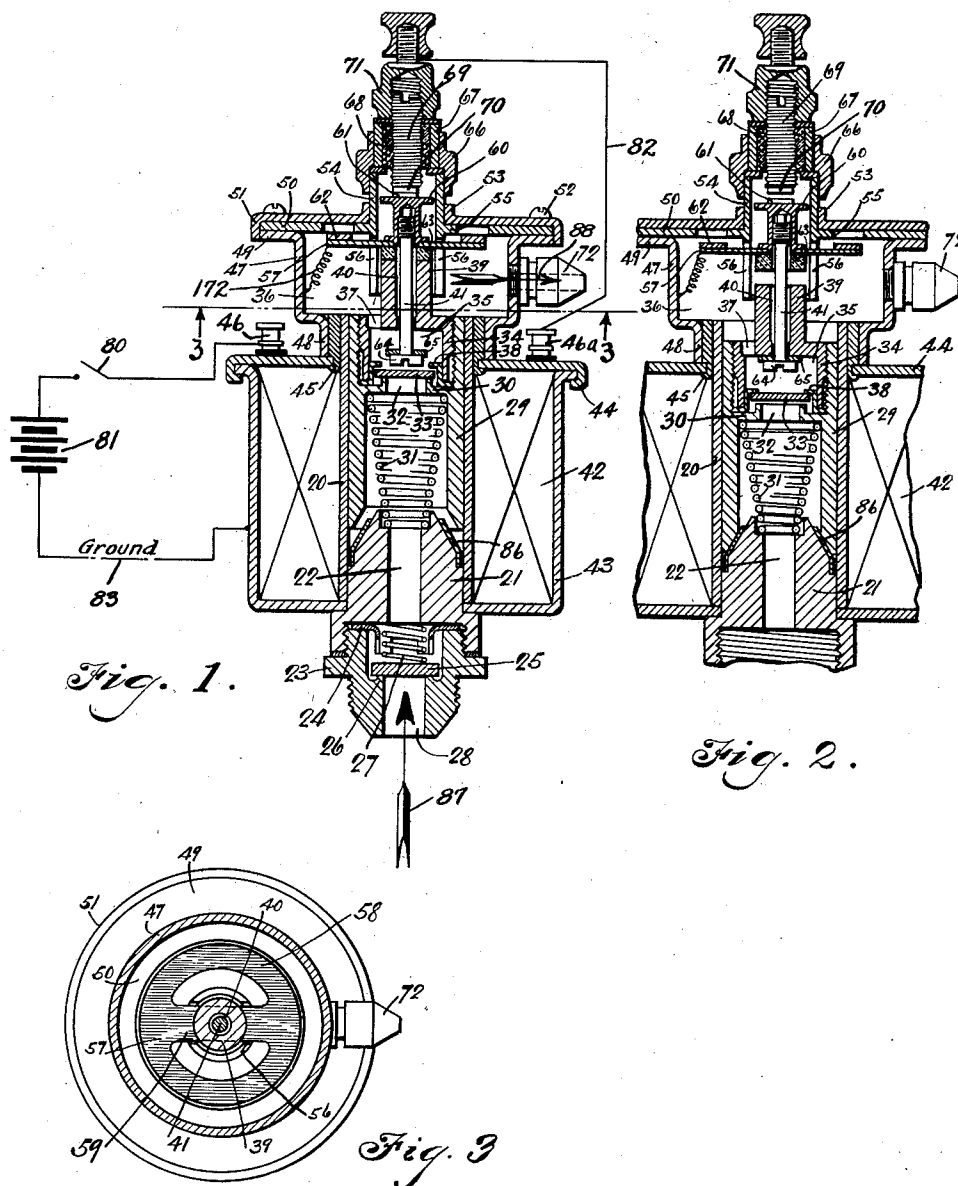
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ELECTROMAGNETIC PUMP

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ELECTROMAGNETIC PUMP

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This invention relates to improvements in reciprocating motors and especially to that type motor particularly adapted for use in connection with pumps for motor vehicles and the like.

It is among the objects of the present invention to improve the type of reciprocating motor referred to by simplifying the construction and enclosing the contacts and contact-operating mechanism in one of the pump chambers.

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:

Fig. 1 is a view in longitudinal section of the pump.

Fig. 2 is a view similar to Fig. 1, showing the piston in the contact-separation position; and

Fig. 3 is a transverse section taken along the line 3—3 of Fig. 1.

Referring to the drawings, numeral 20 designates the pump cylinder, in the one end of which there is provided a magnetizable core 21. This core has a longitudinal passage 22 communicating with the interior of the cylinder, and a counterbore portion, screw-threaded for receiving the valve casing 23. Interposed between the valve casing 23 and the core 21, there is a cage 24 which has a depending portion adapted to act as a stop for the inlet check valve 25. This valve is normally held against a seat 26 formed upon the valve casing 23, by means of spring 27. The valve casing 23 has a passage 28 which is adapted to communicate with a fuel conduit to be secured to said valve casing by any suitable connection. A hollow, magnetizable piston 29 is located in the cylinder 20, said piston having an intermediate wall 30. Interposed between the core 21 and the wall 30, there is a spring 31 which tends to hold the piston in spaced relation with said core, as shown in Fig. 1. A passage 32 is formed in the wall 30, and wall 30 provides a valve seat for the outlet check valve 33.

The upper end of the piston is counter-bored and screw-threaded for receiving a magnetizable cap 34. This cap 34 provides a chamber 35 which is in communication with the liquid-receiving chamber 36 by means of the passages 37. A valve cage 38, which limits the movement of the valve 33 off its seat, is clamped by the cap 34 against the wall 30. Cap 34 has a tubular extension 39 having a passage 40 for receiving a screw 41 to be described.

The cylinder 20, which is nonmagnetizable, is surrounded by magnet coil 42 which is enclosed within a magnetizable cup-shaped housing 43, the bottom of which is provided with an opening in which the core 21 is adapted to fit. This casing 43 is held in position between the core 21 and the cylinder 20. A magnetizable cover plate 44 is provided on the electromagnet casing 43, said cover plate having a central opening in which there is secured a magnetizable sleeve 45 adapted to closely fit about the upper end of the cylinder. The ends of winding 42 are connected with terminals 46 and 46^a. Terminal 46 is connected by switch 80 with battery 81 and terminal 46^a is connected by wire 82 with a terminal nut 70 to be described. The battery 81 and pump case 43 are connected by ground 83 which, in an automobile includes the chassis upon which the battery and pump are grounded.

A liquid-receiving chamber 36 is provided within a magnetizable casing 47. This casing 47 has a flange portion 48 of lesser diameter than its body portion, said flange closely fitting about the sleeve 45. The flange 48, sleeve 45 and cylinder 20 are joined in any suitable manner, so as to prevent leaking of liquid. Casing 47 has an outwardly extending flange 49 carrying a ring 50 of magnetic material, the diameter of the opening in said ring being less than the inside diameter of the casing 47. A cap 51 of non-magnetic material closely fits about the flange element 49 and is held in position by screws 52 which extend through the ring 50 and are received by tapped holes in the flange 49.

The cover 51 is provided with a central opening, surrounded by a flange 53. Through this there extends a cylindrical member 54 100

of magnetizable material which provides a contact housing. A flange 55 is formed substantially midway between the ends of member 54 said flange abutting against the inner surface of the cover 51. Below this flange 55 the contact housing 54 is slotted, as shown at 56. A nonmagnetizable armature support 57 comprises a ring 58 having a web portion 59 extending across slots 56 as shown in Fig. 3. This web 59 is provided with a central opening in which a post 60 covering a contact 61 is secured. The support 57 carries a magnetizable ring-form armature 62. A fibre collar 63 is secured to the bottom surface of the armature support 57, said collar being of lesser diameter than the interior of member 54.

The one end of the screw 41 is screw-threaded into the standard 60, and slidably extends through the collar 63 and the longitudinal passage 40 of cap 39. The lower end of the screw 41 extends into the chamber 35 and is provided with a head 64 carrying a fibre washer 65 which engages the cap 34 when the piston 20 is moved downwardly. A collar 66 tightly fits about the member 54 and contains a sleeve 67 having an insulating bushing 68 which is threaded to receive a screw 69 carrying a stationary contact element 70. A nut 71 is screwed along the upper end of the screw 69 to lock the screw 69 in adjusted position relatively to the bushing 68.

A tubular coupling 72 is screwed into the side wall of the casing 47 to form a connection for a fluid conduit leading from the pump.

The operation of the device is as follows: By closing switch 80 electric current is caused to flow through the electromagnet 42 through the following circuit: battery 81, switch 80, terminal 46, magnet 42, terminal 46^a, wire 82, nut 71, screw 69, contact 70, contact 61, post 60, support 57, flexible conductor 172, case 47, cover 44, case 43 and ground 83. The piston 29 will be attracted against the action of spring 31 toward the core 21 and into contact with a nonmagnetic stop 86. Fluid within the chamber 30 will be compressed and tend to force the inlet check valve 25 down against its seat and lift the outlet check valve 33 from its seat, thereby permitting fluid to flow past this valve into the chamber 35 through passages 37 into the chamber 36. During downward movement of the piston the contact 61 remains engaged with contact 69 due to the armature 62 being attracted toward the magnetizable ring 51. But when the piston 29 has traveled downwardly, so that the cap 34 will engage with the washer 65 on screw head 64, the piston will pull the movable contact 61 out of engagement with the stationary contact 70 to interrupt the magnet circuit. At the same time the armature 62 will be drawn downwardly from the ring 50 and flange 55, which form poles of a magnetic field comprising the casing 47, ring 50, cylindrical member 54, cap extension 39, caps 34 and pis-

ton 29. The position of the various elements in the contact-separated position is shown in Fig. 2.

The magnet 42 being deenergized the spring 31 is released to return the piston to its upper position. While traveling upwardly, the extension 39 of the cap 34 will engage collar 63 to move contact 70 into engagement with contact 61 and to move the armature 62 nearer to the magnetic field including casing 47, ring 50 and member 54. This cycle of operation will be repeated as long as switch 80 remains closed.

Downward movement of the piston displaces fluid from the chamber 30 into chamber 35 and 36, and upward movement of the piston will draw fluid through the passage 28 as indicated by arrow 87 and will force the fluid from passage 36 through the outlet port 72 as indicated by arrow 88.

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. An electro-magnetic motor comprising, in combination, an electro-magnet, a magnetizable, reciprocable member adapted to be operated by the electro-magnet; contacts for controlling the operation of the electro-magnet, one of said contacts being rigidly, insulantly supported by the electro-magnet in coaxial alignment with the reciprocable member; an armature movably supported between the stationary contact and the reciprocable member and having the other contact rigidly mounted thereon; and a lost motion connection between the reciprocable member and the armature, comprising a screw secured to the armature and extending through a head portion provided on the said member, said connection providing means whereby the said head portion will engage and move the armature into a region of magnetic influence to hold the contacts closed, when said member moves away from the electro-magnet, the head portion engaging said screw to open the contacts only after the reciprocable member has moved toward the electro-magnet a predetermined distance.

2. An electro-magnetic motor comprising, in combination, a solenoid electro-magnet having a non-magnetic tube about which a magnet coil is wound, a core extending into one end of the tube providing one pole piece, a ring-shaped pole piece surrounding the other end of the tube and a magnetizable casing surrounding the winding and connecting the two pole pieces; a magnetizable, reciprocable piston in said tube; a spring between the core and piston normally holding the piston in spaced relation with the core; a magnetizable, cup-shaped casing supported by the ring-shaped pole piece and having a non-

magnetic cover, said casing presenting a magnetic shunt field controlled by the electro-magnet; a circuit interrupter including contacts, within the cup-shaped casing; and a movable armature in said casing, having one of the contacts rigidly secured thereto, said armature being adapted to be held in contact engaging position through magnetic attraction of the magnetic shunt field while the piston is being moved toward the core and until said piston has reached its limit of travel in this direction.

3. An electromagnetic motor comprising in combination, an electro-magnet presenting magnetic circuits; a main armature and an auxiliary armature both having bodily, linear movement; a circuit interrupter including cooperating contacts for controlling the electro-magnet; a spring for moving the main armature away from a magnet pole and for moving the auxiliary armature toward a magnet pole to close the contacts of the circuit interrupter; and a lost motion connection between the armatures whereby the auxiliary armature remains stationary under the influence of the electro-magnet while the main armature is moved toward its pole under magnetic attraction and until the lost motion is taken up, at which time the auxiliary armature is moved away from its magnet pole to break the contact engagement.

4. An electro-magnetic motor comprising in combination an electro-magnet; a main armature bodily movable in a straight line; an auxiliary armature bodily movable in alignment with the main armature, both of said armatures, however, being magnetically attracted in opposite directions; a circuit interrupter for controlling the operation of the electro-magnet, said interrupter comprising a contact insulatingly supported by the electro-magnet and a contact carried directly upon the auxiliary armature; and means supported by the auxiliary armature and adapted to be engaged by the main armature for moving the auxiliary armature to open the circuit interrupter at a proper point in the movement of the main armature.

5. An electro-magnetic motor comprising in combination an electro-magnet; a main armature adapted to be operated bodily in one direction by magnetic attraction; a spring for operating the main armature in the other direction; an auxiliary armature adapted to be moved bodily in direct alignment with the main armature; a magnetic circuit including the electro-magnet, the main and the auxiliary armatures; means interposed between the two armatures whereby the auxiliary armature is moved out of its magnetic circuit during the movement of the main armature into the region of its magnetic circuit and again moved into its magnetic circuit when the spring operates the main armature; a circuit interrupter comprising contacts, one

of which is carried by the electro-magnet, the other directly by the auxiliary armature.

6. An electro-magnetic motor comprising in combination, an electro-magnet having a non-magnetizable tube; a magnetizable casing supported by said tube, presenting a plurality of regions of magnetic influence and presenting two chambers; a magnet coil in one of said chambers, around the tube; a plunger within said tube, adapted to be moved in one direction by magnetic attraction; a spring for moving the plunger in the other direction; a stationary contact insulatingly carried within the other chamber; a movable contact; an armature movably supported within said other chamber and supporting the movable contact, said armature being engaged and moved by the plunger, when spring operated, into a region of magnetic influence, to hold its contact in engagement with the stationary contact; and a lost motion connection between the armature and plunger, said connection comprising a screw attached to the armature and extending into the plunger and permitting said plunger to be moved away from the armature by magnetic attraction without moving said armature until said plunger has approached within a proper distance of its region of magnetic influence.

7. An electro-magnetic motor comprising in combination an electro-magnet having a non-magnetizable tube; a magnetizable casing supported by said tube, presenting a plurality of regions of magnetic influence and presenting two chambers; a magnet coil in the one chamber; a magnetizable plunger within the tube; an armature supported within the other chamber so as to be movable in the same linear directions as the plunger; a spring within the tube and normally urging the plunger to engage the armature and maintain it within a region of magnetic influence; a contact insulatingly supported within the said other chamber; a contact carried by the armature and held in engagement with the stationary contact while the armature is maintained within the region of magnetic influence; and a lost motion connection between the plunger and armature, comprising a screw carried by the armature and extending into the plunger, said screw permitting the plunger to be attracted and moved away from the armature without moving the said armature until the plunger has approached within a proper distance of its region of magnetic influence, at which time said connection will move the armature to sever the contacts.

8. An electro-magnetic motor comprising in combination, an electro-magnet having a casing presenting two chambers and a tubular member in each chamber said tubular members being in substantially direct alignment; a main armature slidably supported in the one tubular member; an auxiliary armature

slidably supported by the other tubular member; a magnet winding in the one chamber; adapted to provide a region of magnetic influence for each armature; a spring for moving the main armature out of its region of magnetic influence; a circuit interrupter for controlling the electro-magnet said interrupter comprising a stationary contact insulatingly carried by the tubular member supporting the auxiliary armature and a cooperating contact mounted directly upon the auxiliary armature; and means interposed between the two armatures whereby the main armature, as it is magnetically moved into its region of magnetic influence, will move the auxiliary armature out of its region of magnetic influence to open the contacts and as it is moved out of its region of magnetic influence by the spring, will return said auxiliary armature into the region of magnetic influence.

In testimony whereof I hereto affix my signature.

HUGH WALLACE.