

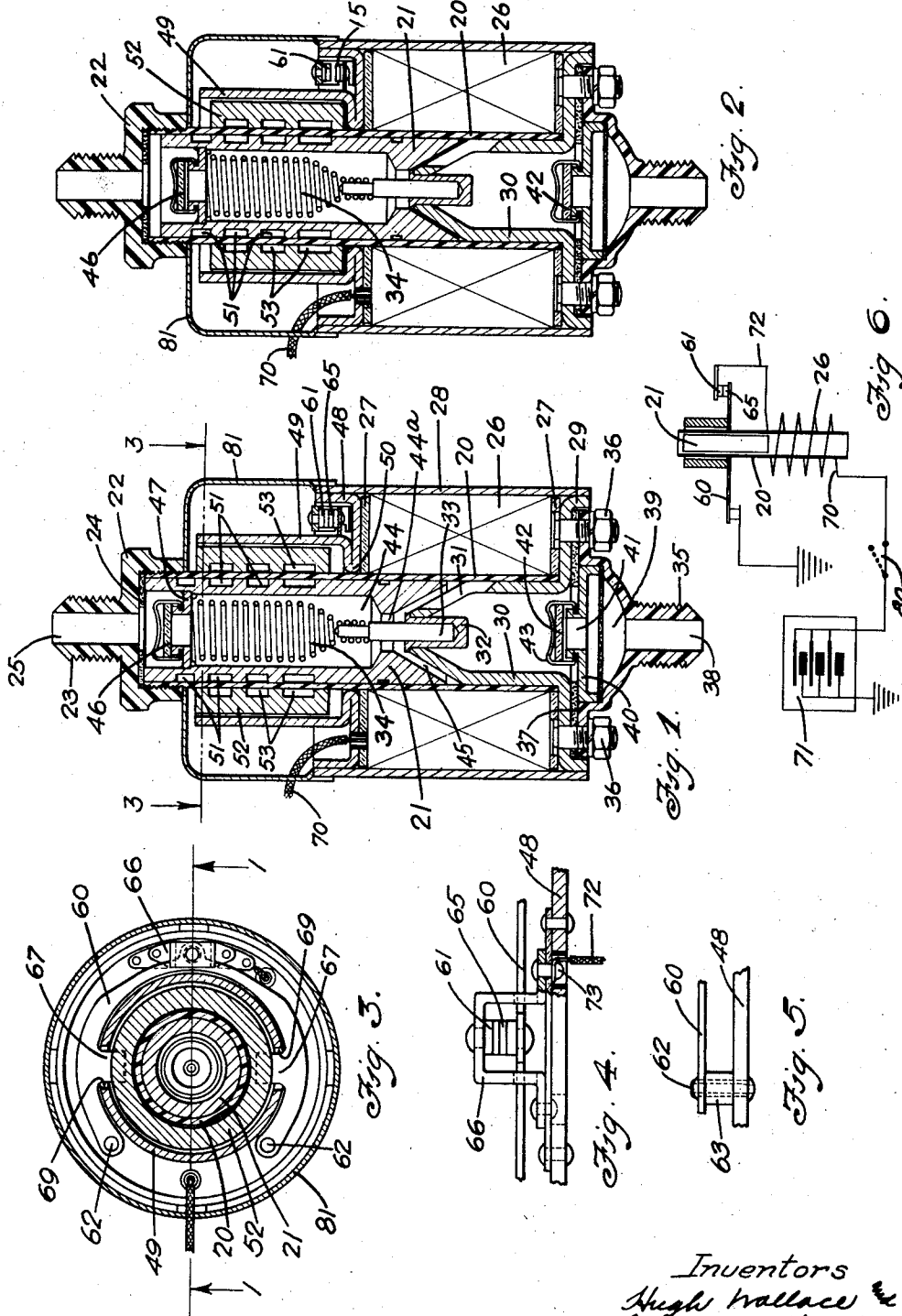
Aug. 30, 1927.

H. WALLACE ET AL

1,640,742

PUMP

Filed May 21, 1924



Inventors
Hugh Wallace
John H. Hunt
by
Spencer, Small & Hardman
his
Attorneys.

UNITED STATES PATENT OFFICE.

HUGH WALLACE AND JOHN H. HUNT, OF DAYTON, OHIO, ASSIGNORS TO GENERAL MOTORS RESEARCH CORPORATION, OF DAYTON, OHIO, A CORPORATION OF DELAWARE.

PUMP.

Application filed May 21, 1924. Serial No. 714,821.

This invention relates to improvements in electromagnetic power devices or motors and more particularly to such motors as are utilized in operating fluid pumps.

5 It is among the objects of the present invention to provide a safe and efficient electromagnetic motor of simple structure and design, forming a compact unit.

10 A further object is to provide a substantially enclosed electromagnetic motor so that when the motor is utilized in connection with a fuel supply pump for an internal combustion engine or other work device using explosive fluid as a propelling means, 15 the danger of fires or explosions due to leaks in the pump will be practically eliminated.

Further objects and advantages of the present invention will be apparent from the 20 following description, reference being made to the accompanying drawing wherein a preferred form of embodiment of the present invention is clearly shown.

In the drawings:

25 Fig. 1 is a longitudinal section taken along the line 1—1 of Fig. 3. The reciprocative element or piston in this figure is shown in the normal unattracted position.

Fig. 2 is a sectional view similar to Fig. 30 1 the piston however being shown in the attracted position.

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

Fig. 4 is a detailed fragmentary view of 35 the circuit interrupter.

Fig. 5 is a detail view of the method of anchoring one end of the movable contact element of the circular interrupter.

Fig. 6 is a diagrammatic view showing the 40 electrical circuits of the power device.

Referring to the drawings the motor is shown comprising a cylinder 20 constructed of any suitable non-magnetic material. A reciprocative element or piston 21 made up 45 of any suitable magnetic material is contained within the cylinder 20. The one end of the cylinder is screw-threaded to receive a cap 22 which is provided with a reduced threaded portion 23 forming a nipple to which may be connected a delivery pipe 50 not shown. A gasket 24 is interposed between the cylinder 20 and the cap 22, to eliminate a fluid leak at this point. The passage 25 formed in this cap provides com-

munication with the interior of the cylinder. 55

The magnet winding 26 adapted to operate the magnetic piston 21, is mounted on and surrounds a portion of the cylinder 20. Each end of the coil or winding is provided with an insulating end cover 27, one being 60 termed the upper end the other the lower end cover. A casing 28 made of any suitable magnetic material surrounds the winding 26, the ends of said casing projecting beyond the insulating end covers 27 of the 65 winding.

Referring particularly to Fig. 1 and Fig. 2 a metal end cover 29 is provided at the lower end of the motor, said end cover being in turn provided with a central, hollow, 70 projecting portion 30, termed the core and which extends partly into the cylinder 20. The end of this core is conical shape and is provided with a plurality of slots 31. A non-magnetic receptacle 32 is carried at the 75 inner end of this core, said receptacle supporting a pin 33 which forms an abutment member for one end of a coil spring 34.

A nipple housing 35 is secured to the end cover 29 by means of studs 36, one end of 80 said studs being embedded in the insulating end cover 27. Gasket 37 is interposed between the nipple housing 35 and the end cover 29 to eliminate fluid leaks at this point. A passage 38 formed in the nipple housing 85 35 communicates with chamber 39 formed between the nipple housing 35 and a valve seat housing 40. The latter is provided with passage 41, at the one end of which there is positioned a check valve 42. A cage 43 90 is adapted to hold the check valve 42 in aligned position with its slot on the valve housing 40. The nipple housing 35 is preferably made out of non-magnetic material as well as the valve seat housing 40. 95

The piston 21 has a central longitudinal channel 44 with a restricted neck portion 44^a and a funnel shaped end 45 conforming with the conical shaped end of the core 30 with which it is contiguously arranged. In the 100 upper end of the longitudinal passage of the piston there is provided a check valve 46 including a valve seat plate 47. Interposed between this valve seat plate 47 and the abutment member 33, is a coil spring 34 which 105 normally maintains the piston in the upper position as shown in Fig. 1. The piston is provided with a plurality of circumferential

grooves 51 spaced apart. The function of these grooves will be described hereinafter.

The length of the piston is so determined, that when the upper end thereof engages with the cap 22 or more specifically the gasket associated with said cap, the funnel shaped end 45 of the piston will be a predetermined distance away from the conical shaped end of the core 30.

The casing 28 is provided at its upper end with a metal end wall or cover 48, fitting inside said casing and resting on the upper insulating plate 27. This end wall or cover has a cup-shaped extension 49 greater in diameter than the cylinder 20 but less than the diameter of the casing 28. A crimped portion 50 is so formed in this end cover as to snugly fit about the cylinder 20 providing a rigid support for the casing at this point. Interposed within the space between the cylinder 20 and the cup shaped extension 49 there is a floating armature 52 whose inner surface is provided with a plurality of circular grooves 53. The floating armature 52 is so formed and mounted that it may readily slide along the cylinder 20 inside the housing portion 49.

The means for controlling the operation of the magnet winding 26 comprises a circuit interrupter including a movable contact arm 60 and a stationary contact 61. As shown in the Figs. 3, 4, and 5 the movable contact arm 60 is horseshoe shaped the ends thereof being secured to the metal end cover 48 by means of rivets 62. The contact arm 60, is held in spaced relation with the cover 48 by means of spacing collar 63. The contact arm 60 carries a contact element 65 which is adapted to engage with the stationary contact 61 carried on the U-shaped bridging element 66 which in turn is mounted on but insulated from the end cover plate 48. The movable contact arm 60 is provided with oppositely disposed, inwardly extending ears 67, which extend through openings 69 in the housing 49, into the space between said housing and cylinder. The inner end surface of the floating armature 52 engages these ears 67 and due to the resiliency in the contact arm 60 the floating armature 52 will normally be maintained in the upper position by means of said contact arm.

The one end of the coil is designated by the numeral 70 and projects through suitable insulating collars to the outside of the pump. It is adapted to be connected with one end of the source of electrical energy shown to be a storage battery 71 in the present drawing. The opposite end of the winding which is designated by the numeral 72 is connected with the rivet 73 which is insulated from the plate 48 but in electrical connection with the contact carrying portion 66. The movable contact as has been mentioned before, is grounded to the plate 48.

Referring to Fig. 6 in the operation of the device when the master controlling switch 80 is closed current will flow from the source of electrical energy, 71 across said switch through wire 70, winding 26, through end 72 of coil to rivet 73, across the contacts 61 and 65, which are normally closed when the motor is starting operation, through the movable contact arm 60, back to the battery via the ground connections.

Current flowing through the winding 26 will energize the core 30 thus tending to create a magnetic path which is as follows: through the core 30, end cover 29, casing wall 28, end cover 48, housing portion thereof 49, across the gap to the floating armature 52, through the non-magnetic cylinder into and through piston 21 and across the gap formed between the end of the piston and core. The piston will now be attracted by the core 30 and be caused to move toward said core against the effect of the spring 34 to maintain said piston in normal position. Any fluid that might be within the chambers formed inside the core and piston will cause the valve 42 to be forced onto its seat while at the same time the valve 46 will be opened, thus the reduction of this space in these chambers due to the approach of the piston to the core will transfer a portion of the fluid in these chambers to the space above the valve 46.

The downward movement of the piston 21 will tend to cause the ridges formed on the piston by the provision of the grooves 51 to move out of alinement with the ridges formed on the floating armature 52, said ridges aligning when in normal position. Thus the floating armature 52 will tend to follow the movement of the piston downwardly against the effect of the contact arm 60 to maintain said floating armature in normal position. Movement of the armature in this downward direction toward and against the movable contact member 60 will move the contact element 65 out of engagement with the stationary contact 61 of the circuit interrupter, breaking the current flowing through the winding 26 and therefore said winding will become de-energized as well as the core 30. This will destroy the attraction of the core 30 for the piston 21, permitting the spring 34 to return the piston to its normal upper position. The piston moving upward through the agency of the spring 34 will cause the valve 46 to close, thus creating a suction within the cylinder 20. Due to this suction the valve 42 will open, permitting fuel from the main fuel supply tank, not shown, to pass through the passage 38, chamber 39, passage 41, past the valve 42 into chamber formed within the core 30 and thence through the slots of passages 31. The floating armature 52 will be returned to its normal upper position by

the resilient contact arm 60. The movable contact 65 will again engage the stationary contact 61 re-establishing circuit connections through the coil 26 and causing repetition of the described operation.

A cover 81 provides a dust and dirt proof guard for the circuit interrupter mechanism as well as keeping the dirt from between the floating armature and its associate stationary elements. By providing the tight gasket connections at the upper end of the cylinder between the cap 22 and the cylinder and at the lower end between the end cover plate or wall 29 and the nipple housing 35, it may readily be seen that it is substantially impossible for fuel to find its way into the housing 81 which includes the circuit interrupter mechanism and where under certain conditions sparking might take place which if leaks were present might cause serious damage to the system.

While the form of embodiment of the present 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 electromagnetic motor comprising in combination a cylinder; a magnetic reciprocative member within said cylinder; a magnet winding for operating said member; means for controlling the energization of the magnet winding; and an armature exterior of the cylinder and operable by the magnetic drag of the moving reciprocative member to effect the operation of the magnet winding controlling means.

2. An electromagnetic motor comprising in combination a non-magnetic cylinder; a magnetic reciprocative member within the cylinder; a magnet winding surrounding said cylinder for operating said member; a switch for controlling the energization of the magnet winding; and an armature exterior of the cylinder but operable by the magnetic drag of the moving reciprocative member to operate the switch to discontinue the attracting effect of the winding upon the said member when the armature has been moved to a predetermined position.

3. An electromagnetic motor comprising in combination, a non-magnetic cylinder; a magnetic reciprocative member within the cylinder; a magnet winding surrounding said cylinder for operating said member; a switch for controlling the effect of the winding on said member; and a cylindrically shaped armature surrounding the cylinder and operable by the magnetic drag of the moving reciprocative member to engage and operate the switch to discontinue the attracting effect of the winding upon the member when the armature has been moved to a predetermined position.

4. In an electromagnetic power device, the combination with a source of electrical energy; of a motor comprising a cylinder; a reciprocative element in the cylinder; an electro-magnet associated with the cylinder and adapted to operate the said element; circuit controlling means in circuit connection with a source of electrical energy and the electro-magnet; and means exterior to the cylinder and operable by the magnetism in the reciprocative element to control the circuit controlling means, whereby to obtain intermittent operation of the electro-magnet.

5. In an electromagnetic power device, the combination with a source of electrical energy; of a motor comprising a non-magnetic cylinder; a magnetic piston in said cylinder; an electro-magnet associated with said cylinder and adapted to operate the piston; circuit controlling means in circuit connection with the source of electrical energy and the electro-magnet; and a magnetic ring slidably surrounding the cylinder and engaging the circuit controlling means, said ring being operable by the magnetism in the piston to control the circuit controlling means, whereby to obtain intermittent operation of the electro-magnet.

6. An electromagnetic power device comprising in combination, a non-magnetic cylinder; a piston of magnetic material in said cylinder; a magnet winding surrounding a portion of the cylinder and adapted to actuate the piston from its normal position; a magnetic housing enclosing the magnet winding and having a reduced portion of slightly greater transverse dimension than the cylinder and surrounding a portion of said cylinder; a floating armature interposed between the reduced housing portion and the cylinder and adapted to move with the piston when the same is attracted by the magnet winding; and a circuit controlling device adapted to be operated by the movement of the floating armature, for controlling the energization of the magnet winding.

7. An electromagnetic power device comprising in combination, a non-magnetic cylinder; a piston of magnetic material in said cylinder; a magnet winding associated with the cylinder and adapted to actuate the piston from its normal position; means for returning the piston to normal position; a magnetic housing enclosing the magnet winding and having a reduced portion greater in transverse dimension than the cylinder a portion of which it surrounds; a circuit interrupter including a stationary contact and a movable contact normally in engagement therewith, the latter comprising a horse-shoe shaped plate partly surrounding the reduced housing portion and including ears which extend through openings in this housing portion; a floating armature located

within the reduced housing portion and exterior the cylinder and engaging the ears of the movable contact plate and adapted to move with the piston when the latter is attracted by the magnet winding, whereby the movable contact arm will be moved out of engagement with the stationary contact of the circuit breaker and cause deenergization.

In testimony whereof we hereto affix our signatures. **10**

HUGH WALLACE.
JOHN H. HUNT.