

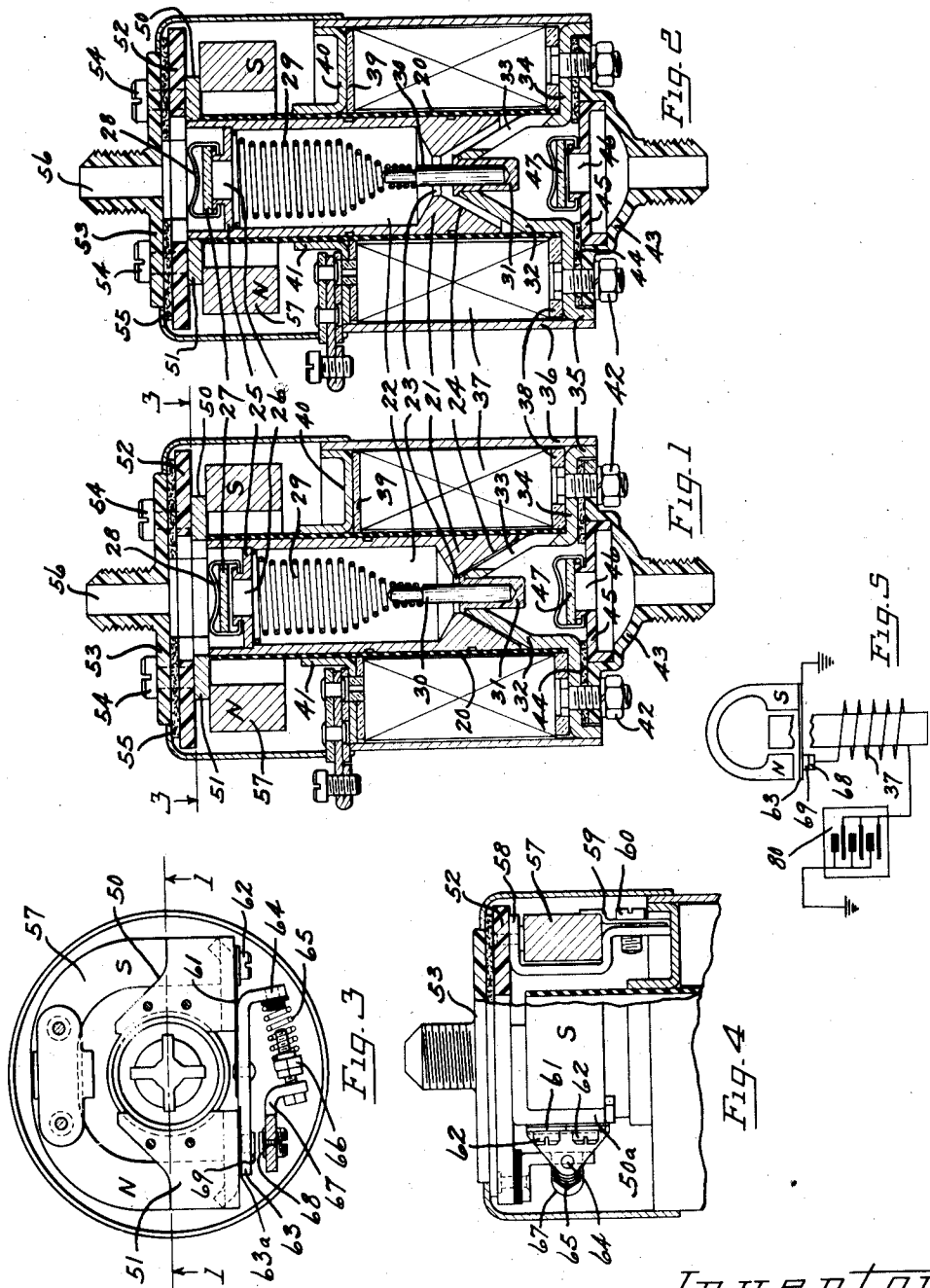
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ELECTROMAGNETIC MOTOR

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ELECTROMAGNETIC MOTOR.

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This invention relates to improvements in electromagnetic motors and more particularly to that type of motor utilized to operate fluid moving devices.

It is among the objects of the present invention to provide a motor device of simple structure and design making a very compact and efficient unit.

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 embodiment of the present invention is clearly shown.

In the drawings:—

Fig. 1 is a longitudinal section taken along the line 1—1 of Fig. 3 showing the electromagnetic motor combined with a fluid moving device in which the reciprocative member or piston is in the attracted position.

Fig. 2 is a view similar to Fig. 1 showing the reciprocative member or piston in its normal position.

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 1.

Fig. 4 is a detail view of the method and means for supporting the permanent magnet as well as the circuit interrupter.

Fig. 5 is a diagrammatic view showing the circuit connections of the device.

Referring to the drawings, the guide or cylinder is designated by the numeral 20 and contains a reciprocative member or piston 21. The cylinder is made up of any suitable non-magnetic material while the piston 21 is made of magnetic material. The piston is provided with a longitudinal passage 22 which has a restricted neck portion 23 forming the apex of a funnel-shaped end of the piston designated by the numeral 24. In the one end of the passage 22 there is provided a valve seat plate 25 having a passage 26, said plate forming a valve seat for the valve 27 which is held in position adjacent the valve seat plate 25 by means of the spider 28. One end of the spring 29 abuts against the valve plate 25 in the piston while the other end of the spring is anchored on the end of pin 30 which is supported in a receptacle 31 carried in the conical shaped end of the core 32, said receptacle 31 acting as a stop for the piston when moved toward the core. The core is provided with a plurality of slots 33 adapted to convey fluid from the chamber inside the core 32 into

the interior of the cylinder. The core has a flange 34 which in turn has a right angle peripheral flange 35 fitting inside the one end of a magnetic casing 36. This casing 36 surrounds the magnet winding 37 which closely fits about the cylinder 20. An insulating plate 38 is interposed between the flange 34 of the core and the electromagnet winding 37. On the other end of this winding another insulating plate 39 is provided upon which rests the end cover plate 40 having an outer peripheral flange which fits in the opposite end of the casing 36, said end cover 40 also having a central aperture surrounded by a flange 41 which closely fits around the cylinder 20.

A plurality of studs 42 having their one end embedded in the insulating plate 38 act as supporting means for the nipple housing 43 which together with the chamber formed in the core 32 forms what may be termed the inlet valve chamber. In order to provide a leak proof connection between the housing 43 and the flange 34 of the core 32 there is provided a gasket 44. The housing 43 supports the inlet valve seat plate 45 which has a central aperture 46. A check valve 47 is associated with this valve seat, said check valve having a spider retainer and being similar to the valve 28.

At the end of the cylinder 20 opposite the core 32 and secured to said cylinder by means of soldering there are two oppositely disposed pole shoes 50 and 51. These pole shoes are also secured to a non-magnetic ring plate 52 by rivets and soldering or welding. The pole shoes 50 and 51 are provided with inner surfaces, said shoes being so shaped that their pole faces are concentric with but larger than the inner surface of the cylinder. As is shown in Fig. 2 the piston when held in normal position by the effect of the spring 29 has its one end extending up into the space between the pole shoes 50 and 51. A nipple plate 53 is secured to the non-magnetic plate 52 by means of screws 54, a gasket 55 being interposed between the nipple plate 53 and the non-magnetic plate 52 to prevent fluid leaks at this point. A longitudinal passage 56 formed in the nipple portion of the plate 53 provides communication with the interior of the cylinder. A horse-shoe shaped permanent magnet 57 is supported by means of a bracket 58, said bracket being carried by the non-magnetic

plate 52. One end of the horse-shoe magnet when in position on the bracket 58 fits against an angular portion 50^a of the pole shoe 50 while the opposite end of said magnet engages with the corresponding portion of the pole shoe 51. A clip 59 is adapted to hold the magnet 57 rigidly in position with the aid of its associate screw 60 which is threaded to the lower end of the bracket 58.

Referring to Figs. 3 and 4 the pole shoe 50 or more particularly its angular portion 50^a has a plate spring 61 secured thereto by means of screws 62. This plate spring resiliently supports the movable armature 63 whose free end is placed adjacent the angular face of the pole shoe 51 and under certain circumstances is adapted to be moved or attracted thereto. The armature has a non-magnetic element 63^a secured thereto on the surface facing the pole shoe 51, to prevent absolute contact of the armature with said shoe. An angular portion 64 of the armature 63 acts as an abutment plate for the spring 65, the opposite end of which engages with an adjustable abutment screw 66 carried on the stationary contact bracket 67. This bracket supports a stationary contact 68 which is adapted to be engaged by the movable contact 69 mounted on and carried by the movable armature 63. As can be seen in Fig. 3 the spring 65 is insulated from the abutment portion 64 of the armature 63.

When the motor is in operation, the one end of the winding or coil 37 is in circuit connection with a source of electrical energy shown as a storage battery 80 in the present drawings. The opposite end of the winding is connected with the stationary contact bracket 67 which includes the stationary contact 68 and which is normally engaged by the movable contact 69 supported by the movable armature 63 which in turn is grounded through the frame of the pump. Current flowing through the winding 37 will energize the core 32 and a magnetic circuit will be established through the following path: core 32, flange 34, magnetic casing 36, through end plate or cover 40 and its flange 41, through the non-magnetic cylinder into the body of the piston 21 thence across the gap between the funnel-shaped end of the piston and into the cone-shaped core. This will cause the piston to be attracted and moved toward the core 32 against the effect of the spring 29 to hold the piston in normal position thus the end of the piston which is normally within the path between pole shoes 50 and 51 will be moved out of this path providing magnetic reluctance at this point.

The magnetic flux through the permanent magnet 57 instead of flowing from the cylinder pole face of the pole shoe 50 to pole shoe 51 or vice versa, now flows from the pole shoe 50, through the armature 63, across

the gap therebetween to the pole shoe 51 thereby tending to move the armature 63 toward the pole shoe 51 against the effect of the spring 65 and thus tending to move the contact 63 out of engagement with the contact 68 thereby breaking the circuit through the winding 37. This breaking of the circuit through winding 37 will cause deenergization of the core 32 thus again permitting the spring 29 to cause a return of the piston 21 to its normal position.

From the foregoing it will be seen that when the piston enters into the path between the pole pieces 50 and 51 which may be termed the primary magnetic circuit, the shunt magnetic circuit which includes the armature 63 will be sufficiently reduced or weakened to permit the spring 65 to cause the armature 63 to be moved to normal contact engaging position. However, when the piston is moved out of the primary magnetic circuit or field the shunt magnetic circuit will be of sufficient strength to cause movement of the armature toward the magnet to break the electric circuit through the piston operating winding 37.

When the piston is moved by means of the electromagnet winding 37 any fluid within said piston chamber 22 or within the core 32 will tend to close the valve 47, the compression of the fluid in these chambers opening the valve 28, said fluid passing out through the passage 26 and valve 28 into the upper portion of the cylinder above the valve 28. Upon the return of the piston to its normal position by means of the spring 29 suction will be created in the chamber within the piston 22 and the space between the piston and core thereby tending to lift the valve 47 and permit fluid to flow from the main source of supply, not shown, through the nipple housing 43, into the passageway of said housing, through the passage 46, past the valve 47 and into the interior of the core 32, through the slots 33 and then into the interior of the piston. During this stroke of the piston the valve 28 is tightly held in engagement with its valve seat plate 25.

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 guide; a reciprocative member in said guide; an electromagnet including a winding for operating the said member; a circuit interrupter associated with the magnet winding; and a permanent magnet having its magnetic circuit varied by said reciprocative member to control the operation of the circuit interrupter.

2. An electromagnetic motor comprising

in combination a guide; a reciprocative member; an electromagnet including a winding for operating the said member; a circuit interrupter associated with the magnet winding and including a stationary and a movable contact normally in engagement; a permanent magnet having its poles associated with the movable contact of the circuit interrupter and adapted under control of the reciprocative member, to control the operation of the circuit interrupter.

3. An electromagnetic motor comprising in combination a guide; a magnetic, reciprocative member in the guide; a solenoid magnet coil carried by the guide and adapted to operate the said member; a permanent magnet having its pole faces forming part of the inner surface of the guide; and a circuit interrupter associated with the solenoid coil and including a stationary and a movable contact, the latter having its one end resiliently secured to the one magnet pole while the other end is normally held contiguous with the other magnet pole, said pole being adapted under control of the reciprocative member to attract the movable contact for controlling the energization of the solenoid coil.

4. An electromagnetic motor comprising in combination a guide cylinder; a reciprocative member in said guide cylinder; an electromagnet winding for operating the said member; a permanent magnet having alternative magnetic circuits; a circuit interrupter including a movable armature, in one of the alternative circuits and operable by the magnetism therein, to control the energization of the reciprocative member operating winding; and means associated

with the said member for varying the flow of magnetic flux through the other alternative circuit to control the flux flowing through the circuit including the interrupter whereby to cause operation of said interrupter.

5. An electric motor device comprising in combination; a guide cylinder; an operating coil surrounding the said cylinder; a permanent magnet having a primary magnetic circuit and a shunt magnetic circuit; a circuit interrupter associated with the operating winding and including a movable armature arranged in the shunt circuit of the permanent magnet; and a reciprocative member for transmitting motion and for varying the magnetism flowing through the primary magnetic circuit whereby the flux in the shunt circuit will be varied to effect the operation of the interrupter armature.

6. An electric motor device comprising in combination, a guide; a reciprocative member in the guide; an electro-magnetic coil surrounding the guide; a circuit interrupter comprising a permanent magnet and a movable armature forming the movable contact arm of the interrupter, said permanent magnet having a primary and a shunt magnetic circuit the latter including the movable armature; and means provided on the reciprocative member in the guide for diverting the magnetic flux from the shunt circuit and to permit the armature to effect the energization of the reciprocative member operating coil.

In testimony whereof I hereto affix my signature.

HUGH WALLACE.