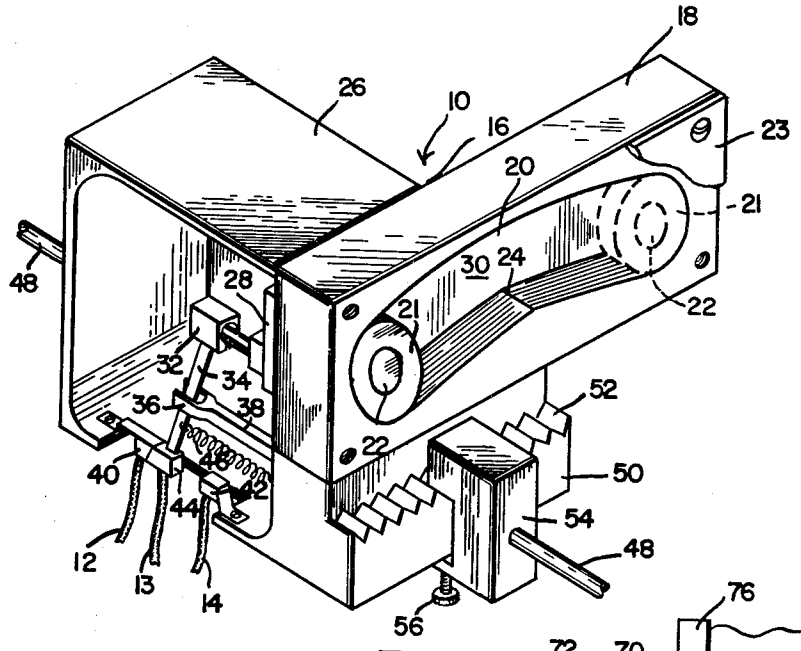
Nov. 7, 1961 J. S. HAMMOND 3,008,018

MAGNETIC SWITCH OR VALVE OPERATOR

Filed May 26, 1958

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FIG. 1



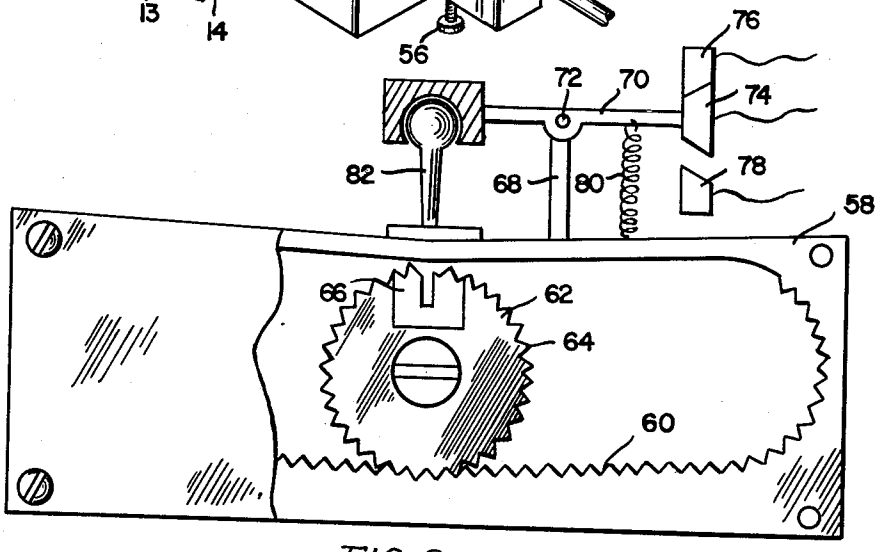




FIG. 2

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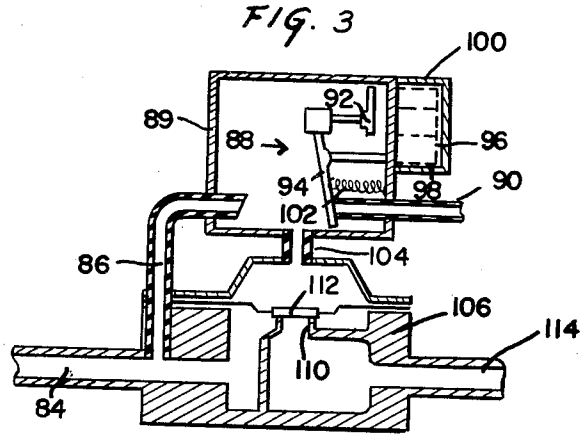
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MAGNETIC SWITCH OR VALVE OPERATOR

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FIG. 3



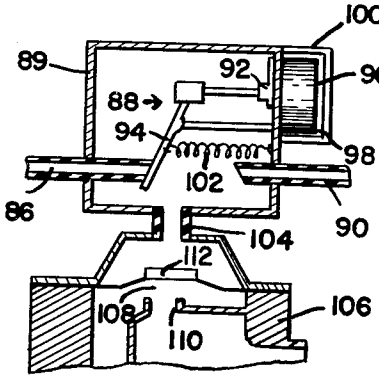




FIG. 4

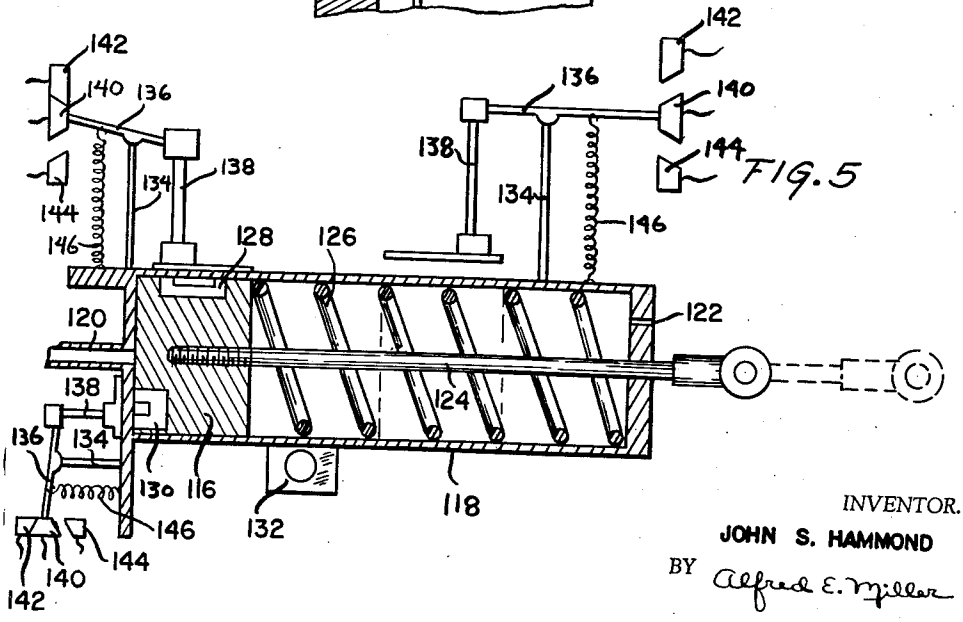



FIG. 5

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# 3,008,018
# MAGNETIC SWITCH OR VALVE OPERATOR

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7 Claims. (Cl. 200—87)

This invention relates to a magnetic operator for switches and valves and more particularly to a magnetic control device for switches or valves which opens and closes the same by means of a predetermined movement of the device.

An object of the present invention relates to a magnetic operator and switch which is a self-contained unit with flexible conducting wires.

A further object of the present invention is to provide a switch and magnetic operator which is activated by gravitational movement.

Another object of the present invention is to provide a rotatable magnet in a raceway that creates a magnetic field when in a predetermined position which thereby activates a switch or a series of switches.

A still further object of the present invention is the utilization of a pendulum magnetic body in order to maintain the device in a certain predetermined equilibrium position in the horizontal and vertical planes, and to maintain this position.

Another object of the present invention is to provide a diaphragm valve arrangement which is operated by the present magnetic control device.

A further object of the present invention is the provision of an economical, reliable, self-contained magnetic switch or valve operator which is effective for the purposes intended.

Another object of the present invention is the provision of a switch or valve magnetic control device that may be activated by gas or oil pressure, flow temperature or liquid level or elapsed time.

The above and other features, objects and advantages of the present invention will be fully understood from the following description considered in connection with the accompanying illustrative drawings.

FIG. 1 is a perspective view of the magnetic control device for switches constructed in accordance with the present invention;

FIG. 2 is a side elevation view of a modification thereof containing a magnetic operator locking device;

FIG. 3 is a diagrammatic view of a magnetic operator associated with a diaphragm valve in one position of said operator;

FIG. 4 is a diagrammatic view of the magnetic operator of FIG. 3 in a different position thereof;

FIG. 5 is a diagrammatic view of another embodiment of the present invention incorporating a cylinder and a piston reciprocating therein as well as the magnetic switch operators constructed in accordance with the invention.

Referring more particularly to the drawings and especially to FIG. 1 in which a magnetic switch operator and switch are housed in a self-contained unit referred to generally by the numeral **10** and having flexible, current-carrying leads **12**, **13** and **14** secured to contacts. The unit **10** comprises a housing **16** having a section **18** provided with a curvilinear raceway **20** in which is movable a disc **21** preferably of brass and a permanent magnet **22** centrally located therein. Housing section **18** is provided with a front cover **23** which is illustrated as substantially broken away. The magnet **22** is shown herein incorporated in a disc but it is to be understood that other configurations may be utilized in forming the carrier and magnetic body. The highest elevation of the raceway appears at the point **24**. In section **26** of the housing **16** a magnetic pole piece or armature **28** is



positioned adjacent to the wall **30** dividing the sections **18** and **26** of the housing **16**. A projection **32** is secured to pole piece **28** and has pivotally secured thereto an arm **34**. The arm **34** is furthermore pinned at **36** to the bifurcation of the bifurcated support rod **38**. Fixed contacts **40** and **42** are secured to the bottom of section **26** of the housing **16** while movable contact **44** is secured to the arm **34**. A spring **46** normally urges the movable contact **44** into engagement with fixed contact **42**. It should be apparent that upon the movement of the magnet **22** to the position in the raceway **20** shown in full lines the magnetic field of the magnet **22** attracts the armature pole piece **28** whereupon the arm **34** pivots to move the contact **44** against fixed contact **40** against the pressure of spring **46**.

The housing **16** rotates about the central axis of shaft **48**. The forward projecting part **50** of section **18** of the housing **16** is provided with a series of teeth **52** and has co-acting therewith a toothed adjusting device **54**. By adjusting the position of the adjusting device **54** on the part **50** of the housing section **18** the angle of tilt necessary to displace the disc **22** in the raceway **20** and thereby operate the device is changed. A clamping screw **56** removably holds the adjusting device **54** on the selected teeth **52** of the device.

FIG. 2 illustrates an alternative embodiment of the invention in which a casing **58** is provided with a partially toothed raceway **60** curved in a direction opposite to raceway **20** of FIG. 1. The disc **62** is provided with teeth **64** which mate with the correspondingly shaped teeth on the raceway **60**. A permanent magnet **66** is embedded in a section of the outer periphery. Mounted on top the housing **58** is a standard **68** having an arm **70** pivoted thereto at **72**. One end of arm **70** has secured to it a movable contact **74**. Fixed contacts **76** and **78** are positioned on opposite sides of movable contact **74**. An helical spring **80** attached at opposite ends to the arm **70** and the casing **58** normally urges the movable contact **74** away from engagement with fixed contact **76**. Mounted on the other end of arm **70** is a ferrous armature pole piece **82** in the form of a free-swinging pendulum. Thus, only when the magnet **66** is in the position shown in FIG. 2, i.e. with the magnet **66** adjacent to the pendulum **82**, will the arm **70** pivot and contact **74** thereon engage fixed contact **76**. It should be apparent that the device shown in FIG. 2 must be precisely in the horizontal and vertical plane for the pendulum **82** to be attracted to the magnet **66** because if casing **58** is tilted on its longitudinal axis either to the right or the left or backward or forward the pendulum will tlit and will move out of the magnetic field of magnet **66** even though the correct position of toothed disc **62** is attained.

FIGS. 3 and 4 are directed to a construction wherein the present magnetic operator is incorporated in a diaphragm valve arrangement. A fluid inlet duct **84** has a flexible branch conduit **86** leading into pilot valve assembly **88** including a casing **89**. A flexible vent port **90** extends out of the casing **89** and is spaced from, but oppositely arranged to, branch conduit **86**. An armature **92** with a pilot valve **94** is operated magnetically by a movable magnet **96** in the raceway **98** of attached housing **100**. A spring **102** is fixed at one end to casing **89** and at the other end to pilot valve **94**. Flexible tube **104** leads from the casing **89** into the main valve housing **106**. Thus, when the casing **89** with its pilot valve assembly is moved in a predetermined direction the movable magnet **96** operates the armature pole piece **92** against the pressure of spring **102** to close branch conduit **86** as seen in FIG. 3. The fluid, therefore, moves through the opening **108** between the valve seat **110** and the diaphragm valve **112** and out the outlet pipe **114**. How-

ever, when the magnet **96** moves away from the armature **92** the spring **102** forces pilot valve **94** against the vent port **90** as seen in FIG. 4 and the fluid flows into the casing 89, flexible tube **104** and main valve housing **106** on the top side of diaphragm valve **112** thereby forcing valve **112** on the valve seat **110** and preventing movement of the fluid into the outlet pipe **114**. It is apparent, therefore, that a magnetic operator constructed in accordance with the present invention may be utilized to control a valving device.

FIG. 5 illustrates a series of switches actuated by a magnet incorporated in a plunger, the latter being operable in a cylinder. In the embodiment shown, the plunger **116** reciprocates in cylinder **118** by means of hydraulic or pneumatic force. The aforesaid hydraulic or pneumatic force enters cylinder **118** by means of conduit **120**. A time delay vent **122** permits the medium behind the plunger **116** to be bled off upon the movement of the plunger **116** from the left to the right in the cylinder. A shaft **124** is screw threaded to plunger **116**. A compression spring **126** surrounds the shaft **124** in the cylinder **118** and urges the plunger **116** to the left in the cylinder. The plunger **116** furthermore has two magnets **128** and **130** embedded in different surfaces thereof. The cylinder mount **132** is also illustrated in FIG. 5. Also shown are three switch assemblies in which like part bear like reference numerals. In this connection, a standard **134** is mounted on the exterior of cylinder **118** having a pivoting arm **136**.

It is within the scope of the invention to construct the housing **16** with a raceway having a detent therein wherein the magnet **22**, when activated, may drop in the detent to thereby effect a latching action. The magnet **22** then may be reset to the unlatched position manually, or by another magnet. The reset may done externally.

Arm **136** has an armature pole piece **138** secured to one end thereof while the other end thereof carries movable contact **140**. Fixed contacts **142** and **144** are also shown in FIG. 5. Spring **146** serves to bias the fixed contact **140** away from fixed contacts **142** and **144** when the armature **138** is not attracted by the magnetic fields of either magnet **128** or magnet **130**.

While I have shown and described the preferred embodiment of my invention, it will be understood that the latter may be embodied otherwise than as herein specifically illustrated or described and that in the illustrated embodiment certain changes in the details of construction may be made without departing from the principle of the invention within the scope of the appended claims.

What I claim is:

1. A magnetic switch operator device comprising a housing containing all the operative elements of the device therein, a slightly curved raceway in said housing, a magnet in said raceway movable in said raceway upon tilting said housing in a given direction and with a given angularity, a switch armature, a movable contact connected to said switch armature, at least one fixed contact, said magnet when moved to a position in said raceway adjacent to said armature the magnetic attraction of the former causes said switch armature to be moved whereby contact between said movable and fixed contact is made.

2. A magnetic switch operator device as set forth in claim 1 wherein the axis of rotation of said housing is substantially transverse to the movement of said magnet in said raceway.

3. A magnetic switch operator device comprising a housing containing all the operative elements of the device therein, a slightly curved raceway in said housing having its highest elevation at an intermediate portion thereof, a disc-shaped element having an outer rim of non-ferrous metal and an inner hub portion of permanent magnetic material, said disc-shaped element rolling in said raceway upon tilting said housing in a given direction and with a given angularity, a switch armature, a movable contact connected to said switch armature, at least one fixed contact, said disc-shaped element when moved to a position in said raceway adjacent to said armature the magnetic attraction of the former causes said switch armature to be moved whereby contact between said movable and fixed contact is made.

4. A magnetic switch operator device comprising a housing; a partially toothed, slightly curved raceway in said housing having its lowest elevation in the intermediate portion thereof; a toothed disc provided with a permanent magnet being a segment of its periphery operable on the toothed portion of said raceway; a ferrous switch armature located exterior to said housing; a movable contact connected to said switch armature; at least one fixed contact; said permanent magnet, when moved to a position in said raceway adjacent to said armature, the magnetic attraction of the former causes said switch armature to be moved whereby contact between said movable and fixed contact is made.

5. A magnetic switch operator device as set forth in claim 4 wherein said armature is a pendulum, and means suspending said pendulum in the direction of said housing permitting contact to be made between the fixed and movable contacts only when said housing is in the proper vertical and horizontal planes and said permanent magnet is located adjacent to said pendulum.

6. A valving device comprising a tiltable first housing, a pivotable closure member including a ferrous armature in said first housing, a second housing, a diaphragm valve in said second housing, a flexible conduit connecting said first and second housing, a flexible supply pipe extending through said first housing and in said second housing, a curved raceway juxtaposed to said first housing, a disc-shaped element having a permanent magnet therein rolling in said raceway upon tilting of said first housing in a given direction and with a given angularity, said disc-shaped element when moved to a position in said raceway adjacent to said ferrous armature the magnetic attraction of said element causes said ferrous armature to be moved whereby said closure member alternately opens and closes said flexible supply pipe to thereby operatively control the operation of said diaphragm valve.

7. A magnetic switch operator device comprising a housing containing all the operative elements of the device therein, a slightly curved raceway in said housing having its highest elevation in an intermediate portion thereof, a permanent magnet in said raceway movable upon tilting said housing in a given direction and with a given angularity, a ferrous switch armature, a movable contact connected to said switch armature, at least one fixed contact, said permanent magnet when moved to a position in said raceway adjacent to said armature the magnetic attraction of the former causes said switch armature to be moved whereby contact between said movable and fixed contact is made, and adjustable means on said housing changing the angle of tilt of said housing that is necessary to displace said magnet in the raceway and consequently make contact between said movable and fixed contacts.

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