

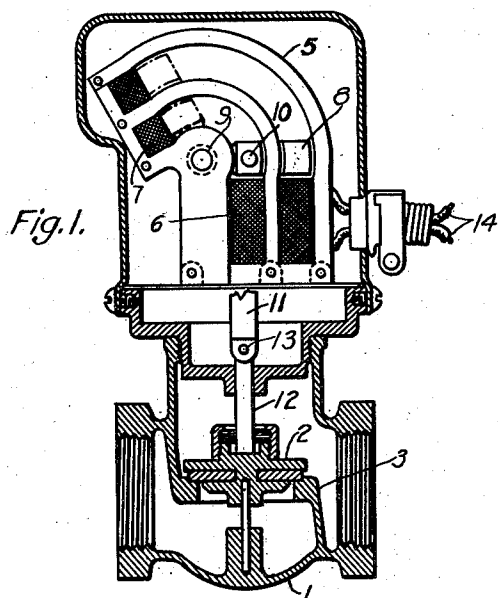
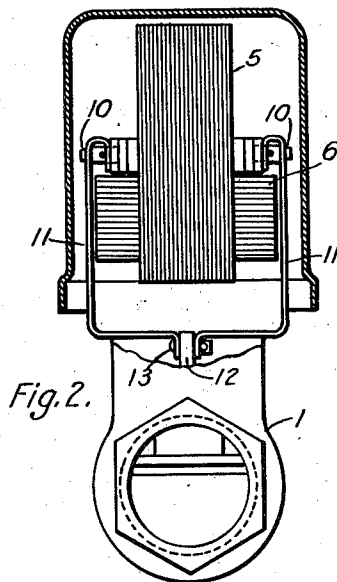
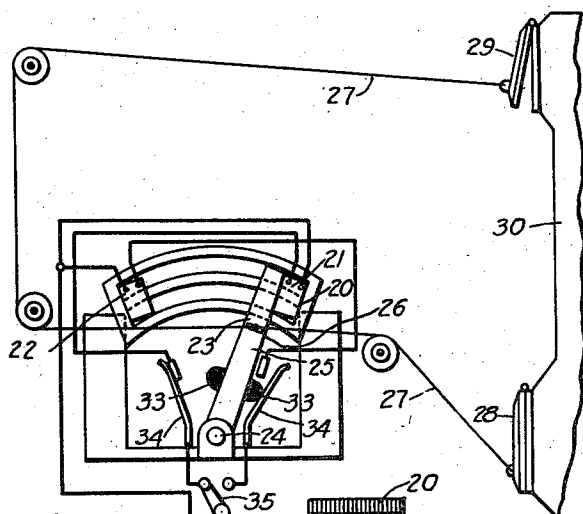
June 5, 1928.

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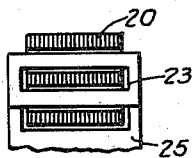
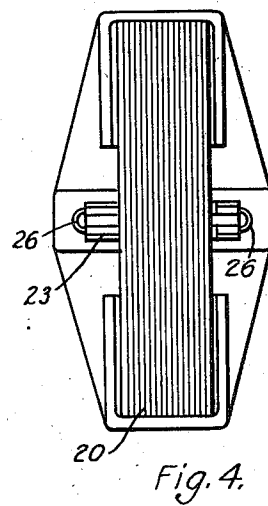
G. F. BASON

ELECTROMAGNETIC OPERATING MEANS

Filed March 30, 1926



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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC OPERATING MEANS.

Application filed March 30, 1926. Serial No. 98,476.

My invention relates to electrical apparatus and particularly to electromagnetically operated valves and the like.

One object of my invention is to improve and simplify the construction of electrical apparatus of the above-indicated character.

A further object of my invention is to improve the construction and operating characteristics of electromagnetic operating means for devices requiring a large initial or starting force.

A still further object of my invention is to provide an improved electroresponsive device utilizing the force of electromagnetic repulsion in contradistinction to the ordinary electromagnetic devices utilizing the force of attraction. In such devices, the force exerted is sometimes a minimum in the initial position, whereas in the repulsion device which I have devised, the initial operating force is always a maximum.

For operating valves and other mechanisms in which the moving parts have considerable mass and tend to bind or become wedged in the closed position, or in which the pressure of the controlled fluid tends to hold the valve closed, a power source must be used which is large enough to overcome the inertia and friction of the moving parts and the fluid pressure. It has been considered impracticable to employ electrically operated valves generally for use in ordinary steam or water pressure systems because of the size of motor required to open the valve positively. In accordance with my invention, a repulsion motor device is used which exerts a maximum initial operating force. As the force required for valves and the like is a maximum in the closed position, the motor device may be much smaller than would be possible with any form of motor having a constant or rising torque characteristic.

Other detailed objects and advantages of my invention will appear from the following description of a preferred embodiment of my invention illustrated upon the accompanying drawings.

The present application is a continuation in part of my prior application, Serial No. 665,138, filed September 27, 1923.

Figure 1 of the drawings is a vertical sectional view through a valve and operating means embodying my invention.

Fig. 2 is an end view of the electromagnetically operated valve shown in Fig. 1.

Fig. 3 is a diagrammatic view of a modification of my invention applied to the operation of the draft and damper doors of a furnace, and

Figs. 4 and 5 are detail views of the electromagnetic operating device shown in Fig. 3.

Referring to Figs. 1 and 2, a valve 1 comprises the usual reciprocating valve member 2 cooperating with the valve seat 3. The valve member 2 is controlled by an electromagnetic operating means comprising a laminated magnetizable core member 5, two spaced windings 6 and 7 and a movable armature member 8, the windings and armature member each surrounding portions of the core member. The armature member 8 is of low-resistance, electrically-conducting metal, such as copper, in the form of a closed loop or short-circuited winding, and is pivoted at 9 in such manner as to oscillate or vibrate between two extreme positions in which it is in close mutual inductive relation with the windings 6 and 7.

The armature member 8 is secured, as shown in Fig. 2, at the points 10 to a pair of levers 11 that are bent inwardly at their lower ends and secured to the stem 12 of the valve member 2 by a pin 13. The connection between the armature member 8 and the valve member 2 is such that the movement of the armature member from the position shown in Fig. 1 to the position in which the armature member is adjacent the winding 7, lifts the valve member 2, thereby opening the valve.

In a valve of the type shown, the weight of the moving parts and, in some cases, the wedging action of the movable members or the fluid pressure of the controlled medium are such as to require a relatively large initial operating force as compared with the operating force required to continue opening the valve after it has begun to open.

The principal advantage of the construction shown resides in the fact that the force exerted by the armature member 8, when repelled by the operating winding 6, is a maximum in the initial or starting position shown and, accordingly, a relatively small electromagnet will be sufficient to operate the valve in contradistinction to the relatively large motors or electromagnets heretofore proposed.

To open the valve, the winding 6 is energized by alternating current through con-

ductors 14, whereupon the armature member 8 is repelled to the position shown in dotted lines in close mutual inductive relation to the winding 7. To reclose the valve, the winding 7 is energized with alternating current, thereby repelling the armature member 8 from the winding 7 and restoring the valve member 2 to the closed position shown. As indicated, the winding 7 may be smaller than the winding 6 because the operating force required to close the valve is less than that required to open it. The arrangement of the windings may be modified in various other ways, if found necessary under different conditions.

While my invention is of particular advantage in connection with the ordinary fluid valve, it is not limited to such applications, but may be used in connection with any device requiring a relatively large starting torque or initial force. It may be employed, for example, in relays or circuit breakers or in the control of relatively heavy mechanical devices which present considerable inertia to the operating device.

For example, as shown in Fig. 3, the device may be employed for controlling the relatively heavy draft and damper doors of a furnace. The size of the electromagnet required for this use is relatively small because of the fact that a large initial force is available and devices of this kind require a considerably larger initial force than is required to complete the movement of the doors.

The operating device shown in this figure comprises a magnetizable core member 20, two windings 21 and 22 thereon and a movable armature member 23 pivoted at the point 24 in such manner as to oscillate or vibrate between two extreme positions in which the armature member is in close mutual inductive relation to the two windings 21 and 22.

As shown in Fig. 5, the armature member 23, preferably of copper or the like, forms a closed loop or ring around the central leg of the core member 20 so that it will be repelled from the coils 21 and 22 when each is energized with alternating current. A supporting lever 25 for the armature member 23 is provided with a projecting pin or loop 26 which is secured to a cable 27 connected to the draft and damper doors 28 and 29, respectively, of a furnace 30.

In order to balance the forces upon armature member 23, a pin 26 may be provided on each side of the armature member, as indicated in Fig. 4, and the cable 27, or a pair of such cables, may be secured to the pins 26 in such manner that the forces exerted by the cables upon the armature member are balanced and the friction is reduced.

In the device shown in Fig. 3, the lever 25 is provided with two insulating members

33 cooperating with movable contact members 34 and a switch 35 for controlling the circuits of the windings 21 and 22. Operation of the switch 35 serves to energize alternately the windings 21 and 22, depending upon the position of the armature 23 and the positions of the contact members 34 controlled thereby.

It should be noted that the electromagnetic device functions in this instance as a relay or circuit-breaker. As a relay or circuit-breaker, the construction shown is of particular advantage when a relatively small amount of energy is available for vibrating the armature member or when the inertia or mass of the movable armature member and the members attached thereto is so large as to require a large initial operating force.

It will be apparent that the improved and efficient electromagnetic operating means which I have described is capable of wide application and that the construction thereof may be modified considerably from that which I have shown and described in detail without departing from the scope of my invention. Consequently, I desire that only such limitations shall be imposed upon the invention as are indicated in the appended claims.

I claim as my invention:

1. In apparatus of the class described, the combination with a valve or closure member, of a short-circuited electrically conducting element arranged to control said member, two spaced electrical windings, means for supporting said element for movement between two extreme positions in which it is in close mutual inductive relation with the spaced windings and a magnetizable core member arranged to provide magnetic paths of low reluctance between said element and each of said windings, the valve or closure member being in the fully closed position when said conducting element is in the extreme position in close mutual inductive relation with one of said windings.

2. In apparatus of the class described, the combination with a valve or closure member, of a short-circuited electrically conducting element arranged to control said member, a stationary electrical winding, means for supporting said element for movement between two extreme positions, said means permitting the short-circuited element to be in close mutual inductive relation with said winding in one of said positions and a magnetizable core member providing a continuous magnetic circuit of magnetizable material for the magnetic flux common to the electrical winding and short-circuited element.

3. In apparatus of the class described, the combination with a valve or closure member, of a short-circuited electrically conducting

element arranged to control said member, a stationary electrical winding, means for supporting said element for movement between two extreme positions, said means permitting the short-circuited element to be in close mutual inductive relation with said winding in one of said positions, means for controlling said short-circuited element in the other extreme position and a magnetizable core member arranged to provide a path of low reluctance between said element and said winding.

4. In apparatus of the class described, the combination with two spaced windings, of a movable coil-supporting element of considerable mass, means for supporting said element for movement between two extreme positions in which it is in close mutual inductive relation to the two spaced windings, a magnetizable core member providing a continuous magnetic circuit of magnetizable material for the magnetic flux common to the movable element and the two spaced windings and means for utilizing both the electromagnetic and the kinetic energy of the movable element.

5. In apparatus of the class described, the combination with a winding, of means for energizing said winding, a movable coil-supporting element of considerable mass, a magnetizable core member providing a continuous magnetic circuit of magnetizable material for the magnetic flux common to the winding and the movable element, means for supporting said element for movement between initial and operated positions, the element being in close mutual inductive relation to the said winding in its initial position and means cooperating with said movable element in its operated position for utilizing both the electromagnetic and the kinetic energy of the element.

6. In apparatus of the class described, the combination with a movable coil-supporting element having only two positions of stable equilibrium and a short-circuited coil on said element, of means for actuating said element by electromagnetic repulsion, said means including two windings of which one is adjacent to the movable coil at each of said positions of stable equilibrium.

7. In apparatus of the class described, the combination with a movable coil-supporting element having only two positions of stable equilibrium and a short-circuited coil on said element, of means for actuating said element by electromagnetic repulsion, said means including a winding adjacent to the movable coil at one of said positions.

8. An electrically operated valve comprising cooperating valve and valve-seat members, means for movably supporting said valve member, a stationary magnetizable core member, a movable conducting mem-

ber surrounding a portion of said core member secured to said valve member and a winding on said core member adjacent to said conducting member in the closed position of said valve member.

9. In apparatus of the class described, a pivotally mounted arm, an arcuate core piece, a coil mounted on said arm and encircling said core piece, and a coil rigidly mounted at each end of said core piece adapted to be energized for repelling the coil carried by said arm.

10. In apparatus of the class described, a substantially U-shaped support, an arm pivotally mounted in the crotch of said support and movable toward the opposite sides thereof, an arcuate laminated core piece disposed upon the ends of said support, a coil mounted on said arm and encircling said core piece, and a coil mounted at each end of said core piece adapted to be energized for repelling the coil carried by said arm.

11. In apparatus of the class described, a substantially U-shaped support, an arm pivotally mounted in the crotch of said support and movable toward the opposite sides thereof, an arcuate core member connected to the ends of said support, a coil mounted on said arm and encircling the said core piece, and a coil rigidly mounted at each end of said core piece adapted to be energized for repelling the core carried by said arm.

12. In apparatus of the class described, a substantially U-shaped support, an arm pivotally mounted in the crotch of said support and movable toward the opposite sides thereof, an arcuate laminated core member connected to the ends of said support, a coil mounted on said arm and encircling said core piece, and a coil rigidly mounted at each end of said core piece adapted to be energized for repelling the coil carried by said arm.

13. In apparatus of the class described, a substantially U-shaped support, an arm pivotally mounted in the crotch of said support and having a bifurcated outer end, an arcuate laminated core piece connected to the ends of said support, a coil mounted between the furcations of said arm and encircling said core piece, and a coil rigidly mounted at each end of said core piece adapted to be energized for repelling the coil carried by said arm.

14. An electrically operated valve comprising a movable valve member and an electromagnetic operating device therefor comprising a repulsion armature secured to the valve member, a winding and a magnetizable core member providing a continuous magnetic circuit of magnetizable material for the magnetic flux common to the winding and armature, said armature including a short-circuited element surrounding the

core member and substantially in contact with said winding when the valve member is in the closed position.

15 An electrically operated valve comprising a movable valve member and an electromagnetic operating device therefor comprising a pivoted repulsion armature secured to the valve member, two windings and a magnetizable core member providing a continuous magnetic circuit of magnetizable material for the magnetic flux common to the windings and the armature, said armature including a short-circuited element surrounding the core member and substantially in contact with one of said windings at each end of its operative movement.

16 An electrically operated valve comprising a movable valve member and an electromagnetic operating device therefor comprising a repulsion armature secured to the valve member, two spaced windings and a magnetizable core member threading the ar-

mature and windings, said armature including a short-circuited element surrounding the core member and substantially in contact with one of said windings at each end of its operative movement. 25

17 In apparatus of the class described, the combination with a valve or closure member, of a short-circuited electrically conducting element arranged to control said member, a stationary electrical winding, a magnetizable core member on which said winding is disposed and providing a continuous magnetic circuit for the magnetic flux common to the winding and short-circuited element and means for supporting said element for movement between two extreme positions at one of which it is in close mutual inductive relation with said winding. 30 35 40

In testimony whereof, I have hereunto subscribed my name this 16th day of March, 1926.

GEORGE F. BASON.