

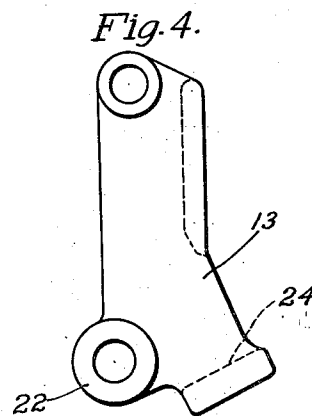
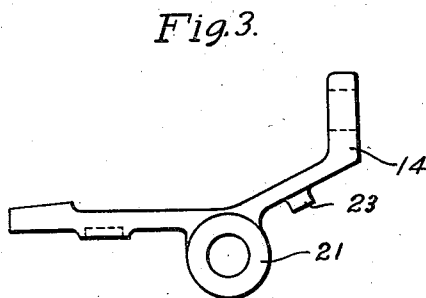
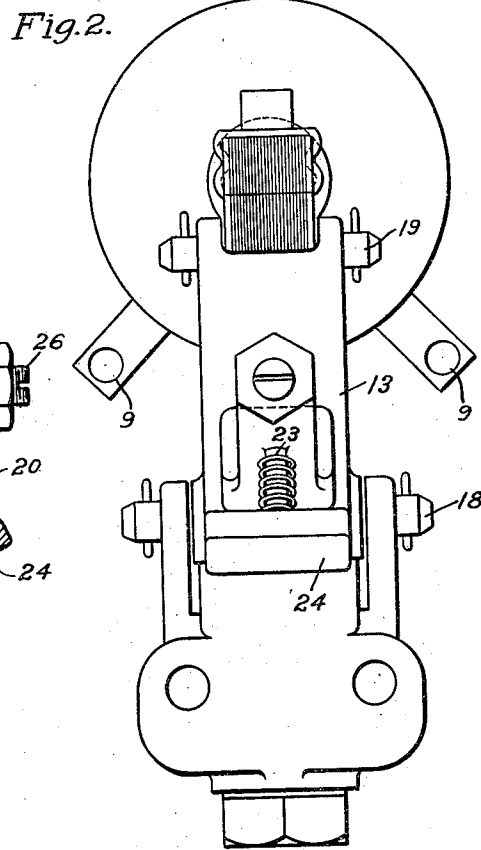
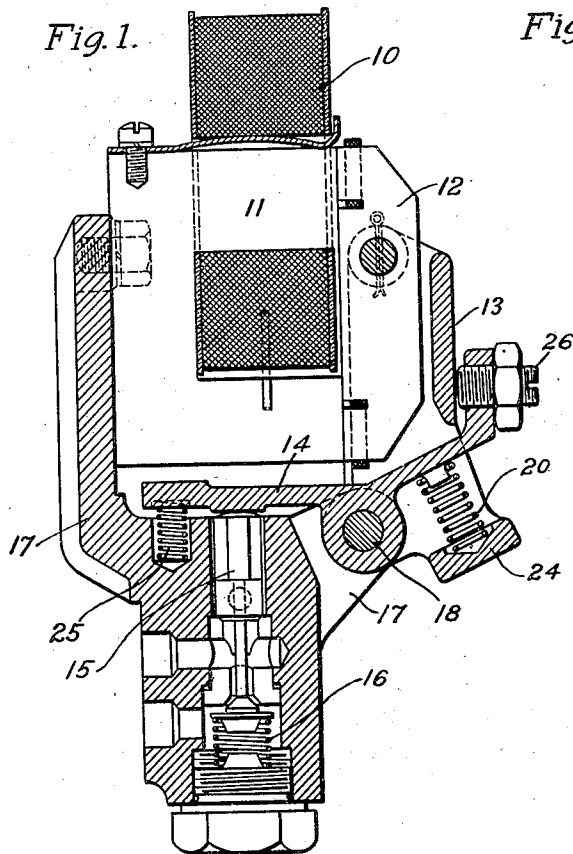
Aug. 18, 1931.

L. C. FRANK

1,819,461

MAGNETICALLY OPERATED VALVE

Filed April 5, 1928



INVENTOR

Leo C. Frank.

BY
Wesley S. Carr
ATTORNEY

UNITED STATES PATENT OFFICE

LEO C. FRANK, OF FOREST HILLS, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

MAGNETICALLY OPERATED VALVE

Application filed April 5, 1928. Serial No. 267,586.

My invention relates generally to magnetically operated devices and particularly to the operation of pneumatic valves by electro-pneumatic means energized from an alternating current source of power.

Heretofore the use of electro-magnetic devices energized from an alternating current power source have been found unsatisfactory for the control of air engines since the chatter which is characteristic of an armature operated by an alternating current magnet is transmitted to the valves.

An object of my invention, generally stated, is to provide for operating a pneumatic valve electro-magnetically from a source of alternating current.

A more specific object of the invention is to provide for operating a mechanism by means of an armature actuated by an alternating current magnet without transmitting the chatter of the armature which is characteristic of an armature actuated by an alternating current magnet.

Other objects of my invention will become apparent to those skilled in the art when the following description is considered in connection with the drawings in which:

Figure 1 is a view in longitudinal section of an electro-magnetically operated valve mechanism constructed in accordance with my invention.

Fig. 2 is a top plan view of the valve mechanism shown in Fig. 1.

Fig. 3 is a view in side elevation of a lever member employed in the transmission of force in the electro-magnetically operated device shown in Figs. 1 and 2, and

Fig. 4 is a view in side elevation of another lever member which co-acts with the lever member shown in Fig. 3 in the transmission of force in a device constructed in accordance with my invention.

Referring now to the drawings, a coil 10 is mounted on one leg of a magnetizable U-shaped core member 11 and is disposed to be connected to a source of electric energy through its terminals 9. When the coil 10 is excited from a source of alternating current the core member 11 becomes energized and deenergized periodically by the fluctuat-

ing current in the coil 10. The flux established in the core member 11, however, attracts the armature member 12, thereby completing the magnetic circuit through core member 11 and the armature member 12. When in this position a force is exerted through the levers 13 and 14 upon the plunger 15 of the valve mechanism 16.

The lever member 13 is pivotally mounted by the pin 18 upon the frame structure 17 which also supports the core 11 and houses the valve mechanism 16. The lever member 13 has a bifurcated portion as shown in Fig. 2, into which the armature member 12 nests and is pivotally mounted through the pin 19. At the back of the bifurcated portion of the lever member 13 a seat 24 is provided into which the coil spring 20 is fitted.

Another lever member 14 is also pivotally mounted through the pivot pin 18 upon the frame structure 17. The hinge portion 21 of the lever member 14 nests within the hinge portion 22 of the lever member 13 at the pivot pin 18. One end of the lever member 14 is provided with a seat for engaging the plunger 15 of the valve mechanism 16 to transmit force exerted through the armature member 12 and the lever members 13 and 14, to the valve mechanism 16. A lug 23 is provided on the opposite end of the lever member 14, and in conjunction with the seat 24 on the lever member 13, is disposed to retain the coil spring 20 in position between them.

When the levers are in their assembled positions, a force applied to the armature member 12 is transmitted through the lever member 13 to the coil spring 20 which reacts against the seat provided on the lever member 14 and biases the lever member 14 in a direction to actuate the plunger 15 and open the valve mechanism 16. The lever member 14 is, however, biased by the spring 25 into a position at which the plunger 15 will allow the valve mechanism 16 to remain in its closed position when the armature 12 is disengaged from the core 11.

It will be seen by reference to the drawings that the lever member 14 is biased in

opposite directions about its pivot point 18 by two separate coil spring 20 and 25. However, the positions of the two springs is such that the spring 25 is capable of holding the lever member 14 in a position at which the valve mechanism 16 stands in its closed position when the armature member 12 is in its open position, that is to say when the coil 10 is deenergized.

When the coil 10 is energized and the armature member 12 begins its counter-clockwise travel, the motion is transmitted to the lever 14 depressing the spring 25 to its limit and actuating the valve mechanism 16 to its open position without causing any depression in the spring 20. The spring 20 is of greater stiffness than the spring 25 and for this reason the spring 25 is completely depressed at the beginning of the counter-clockwise motion of the armature member 12. After the lever member 14 has reached its final position, the lever member 13 continues to move, depressing the spring 20 while the lever 14 is held stationary. Accordingly any vibration which occurs in the armature 12 after it has reached the limit of its counter-clockwise travel, is absorbed by the spring 20 which biases the lever 14 into its valve actuating position.

The chattering, which must necessarily occur, although to a limited extent in an electro-magnetic device operated from an alternating current source of power, is confined to the armature member 12 and the lever member 13, and its transmission to the valve mechanism 16 is prevented by the buffing effect of the spring 20. Thus when the armature 12 is once sealed in its closed position, such chattering as occurs does not effect the supply of air flowing through the valve mechanism 16 and when once opened the valve mechanism 16 remains open until the coil 10 is deenergized, at which time the armature member 12 returns to its open position and the plunger 15 is permitted to return to its upper position through the clockwise movement of the lever 14 caused by the action of the spring 25.

An adjusting screw 26 is provided to limit the air gap between the armature member 12 and the core member 11 when the armature member 12 is in its open position as well as to compensate the pressures of the springs 20 and 25 which influence the respective ends of the lever member 14.

Since it is possible to modify the embodiment of my invention hereinbefore set forth and adapt it to various applications without departing from the spirit and scope of the invention, it is desired that the foregoing description be construed as entirely illustrative and not in a limiting sense.

I claim as my invention:

1. In an electro-magnetically operated valve, an electro-magnet having an operat-

ing coil disposed to be energized by alternating current, an armature member responsive to the operating coil, a valve mechanism, a system of co-axially mounted levers disposed to transmit motion from the armature member to the valve mechanism, one of said levers being pivotally connected to the armature member, and resilient means interposed between the pivotally connected lever and another lever, whereby one lever may vibrate while the other is held stationary by the reaction of the resilient means.

2. In an electro-magnetically operated valve, in combination, a valve mechanism, an electro-magnet having an operating coil disposed to be energized by alternating current and an armature responsive to the operating coil, a pivotally-mounted lever disposed to support the armature in an operative position, a second lever pivotally mounted in co-axial relation to said first lever disposed to actuate the valve mechanism, and a spring member interposed between the free ends of said pivotally-mounted levers to provide a resilient connection thereby to prevent the vibrations of the armature from being transmitted to the valve mechanism.

3. In an electro-magnetically operated valve, an electro-magnet disposed to be energized by alternating current, an armature member responsive to the electro-magnet, a valve mechanism, a plurality of levers pivotally mounted in co-axial relation, one of said levers being connected with said armature, the other of said levers being disposed to engage a push rod, said push rod being disposed to actuate the valve mechanism, and means interposed between said levers for absorbing vibrations which may occur in said armature member.

4. In an electro-magnetically operated valve, an electro-magnet, an armature member responsive to the electro-magnet, a valve mechanism, resilient means for retaining said valve mechanism in its closed position, a pair of lever members for transmitting motion from the armature to actuate the valve mechanism to its open position, a second resilient means connecting said lever members and providing a cushion between them, said second resilient means being of greater stiffness than said first resilient means and thereby permitting a flexibility to prevent transmission of vibrations in the armature to the valve mechanism when said first resilient means is completely depressed.

5. In an electro-magnetically operated valve, an electro-magnet disposed to be energized by alternating current, an armature member responsive to the electro-magnet, a valve mechanism, a plurality of pivotally mounted levers, the first of said levers being connected with said armature, the last of said

levers being disposed to engage a push rod, said push rod being disposed to actuate the valve mechanism, a spring disposed to bias said lever out of engagement with said push rod, and resilient means connecting said first and last lever members for allowing said first lever to have an over-travel after said last lever has reached its final position and opened the valve mechanism.

6. In an electro-magnetically operated valve mechanism, in combination, an armature, an alternating-current magnet having a core and operating coil for actuating the armature, a lever system comprising a pair of levers pivotally mounted in co-axial relation connected to the armature and disposed to transmit a predetermined motion to the valve mechanism, a spring member interposed between the separate members of the lever system to absorb vibrations from the electromagnet, and means carried by one lever for changing the relative angular positions of the lever members to adjust the operating position of the armature with respect to the core.

7. In an electro-magnetically operated valve, in combination, a valve mechanism, an electro-magnet for actuating the valve mechanism, said electro-magnet comprising a core and a movable armature, a plurality of levers disposed to transmit motion from the armature to the valve mechanism, said levers being disposed to pivot about a common axis, a resilient member interposed between the levers to render one responsive to the movement of the other, and means for adjusting the relative positions of the levers, thereby to provide for varying the air gap between the armature and the core in accordance with changes in the operating voltage for operating the electromagnet.

8. In an electro-magnetically operated valve for controlling fluids, in combination, a valve mechanism, an electromagnet provided with a pivotally mounted armature for operating the valve mechanism, a pair of cooperating lever members interposed between the armature and the valve mechanism, said lever members being pivotally secured at a common point and having inter-fitting end portions, a spring member interposed between the end portions forming a flexible bell crank, the opposite end of one lever being pivotally connected to the armature, the opposite end of the other member being disposed to operate the valve mechanism, a second spring member disposed to bias said lever from out of engagement with the valve mechanism, said flexible bell crank being disposed to effect the opening of the valve mechanism in response to the movement of the armature without compressing the connecting spring, said spring becoming compressed in response to the full closure of the armature to subject the valve mecha-

nism to an additional holding force, whereby vibrations may occur in the armature without affecting the valve mechanism.

9. In an electro-magnetically operated valve mechanism, in combination, a fluid-controlling valve having a valve-operating plunger, an electro-magnet provided with an armature for operating the valve, a frame member for supporting the valve and electromagnet in operative relation, a lever pivotally secured to the frame member disposed to support the armature in an operating position, a second lever pivotally secured to the frame member to rotate about the same axis as the first lever, said second lever having one end positioned in cooperative relation to the free end of the armature-actuated lever and its other end positioned for actuating the valve-operating plunger when rotated about its pivot point, and a coil spring interposed between the cooperatively positioned ends of the levers, said spring being under compression when the armature is closed in response to the energization of the electromagnet, thereby to impose a reactive force upon the plunger-actuating lever in response to vibrations occurring in the armature.

10. In an electro-magnetically operated valve mechanism, in combination, a fluid-controlling valve having a valve-operating plunger, an electro-magnet provided with an armature for operating the valve, a frame member for supporting the valve and electromagnet in operative relation, a lever pivotally secured to the frame, said lever being disposed to pivotally support the armature of the electromagnet, a spring-biased lever pivotally mounted upon the frame member, said lever being disposed to engage the valve-operating plunger when actuated against the force of the biasing spring, a spring member for resiliently connecting said levers together, said spring having such characteristics as to prevent its depression until the spring-biased lever reaches the end of its travel to open the valve, whereupon further movement of the armature member effects a predetermined depression of said connecting spring, whereby the connecting spring member functions as a buffer between the levers to prevent the valve actuating lever from moving in response to the vibrating movements of the armature-actuated lever when the electromagnet is energized.

In testimony whereof, I have hereunto subscribed my name this 27th day of March, 1928.

LEO C. FRANK.