United States Patent

Good

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[45] **Aug. 15, 1972**

[54] **VALVE CONSTRUCTION**

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[73] Assignee: **Robertshaw Controls Company,** Richmond, Va.

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[52] **U.S. Cl.**.....**137/609,** 251/138

[51] **Int. Cl.**.....**F16k 11/02**

[58] **Field of Search**.....251/58, 138, 78, 243, 75; 137/609, 607, 636, 636.1

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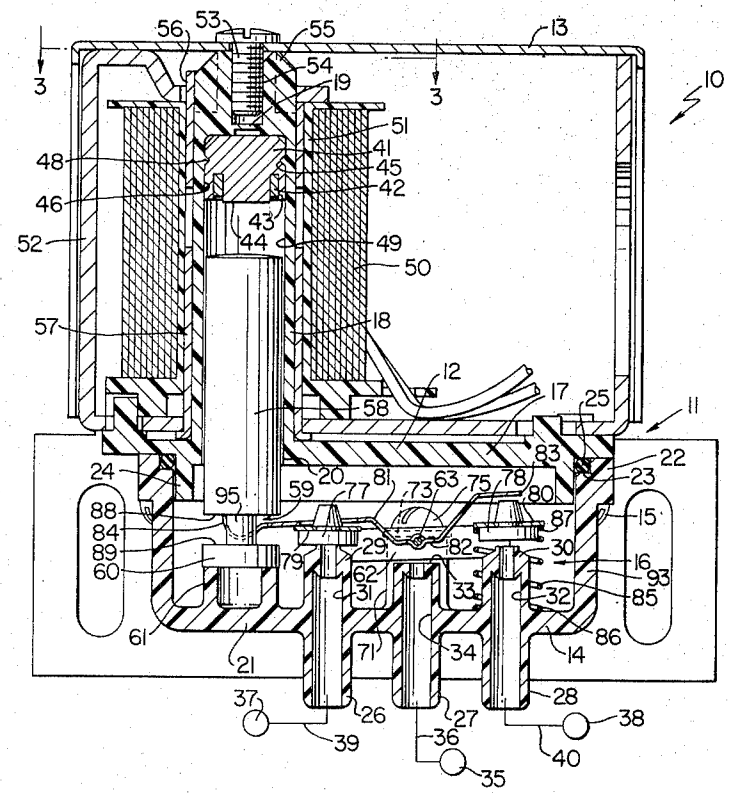
[57] **ABSTRACT**

A housing having a valve seat and a valve member for opening and closing the valve seat. A lever is pivotally carried by the housing and carries the valve member whereby pivoting movement of the lever moves the valve member relative to the valve seat for controlling the same. A movable actuator member is carried by the housing and is operatively interconnected to the lever by a leaf spring so that movement of the actuator member causes pivotal movement of the lever whereby the leaf spring eliminates the need for any adjustments necessary to maintain proper valve closure relative to a seated position of the actuator member.

12 Claims, 8 Drawing Figures



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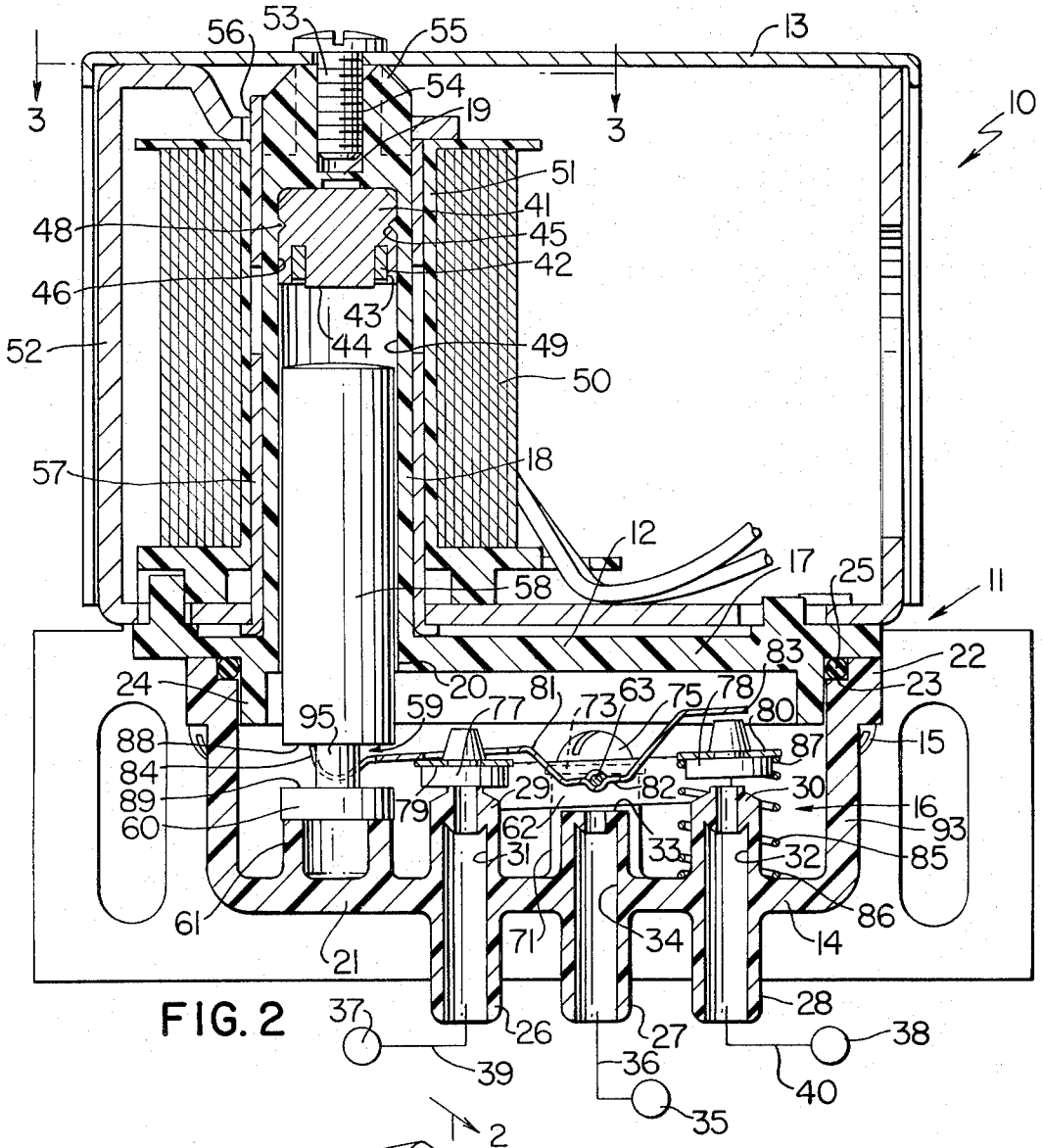

FIG. 2

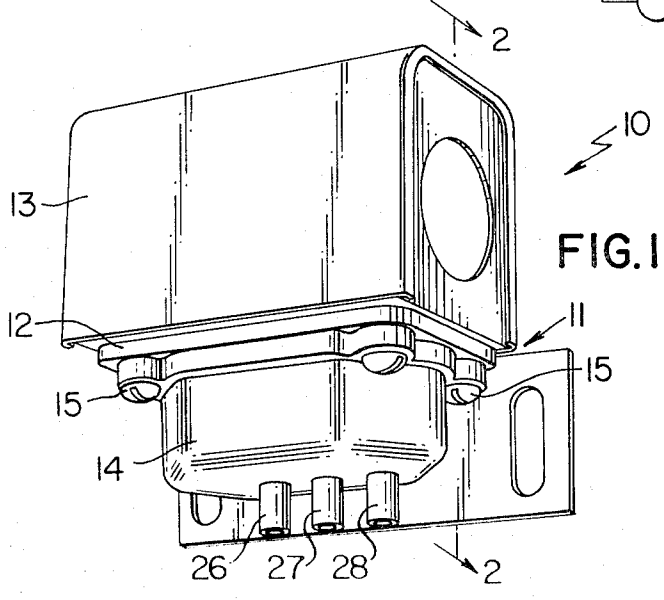

FIG. 1

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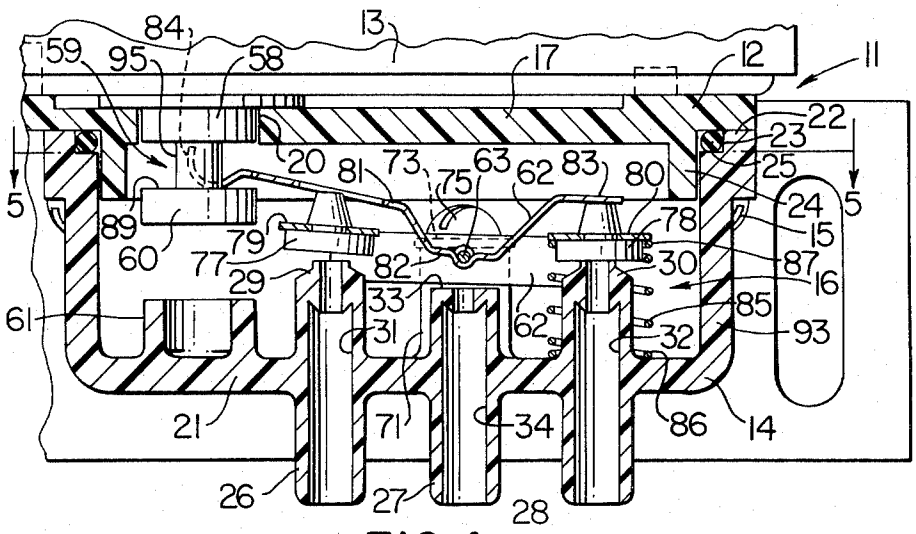

FIG.4

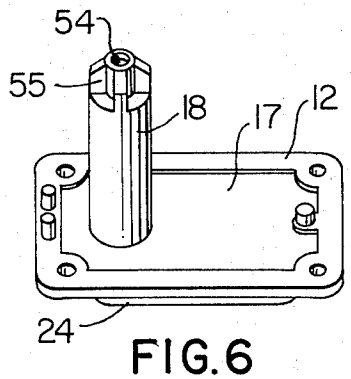

FIG.6

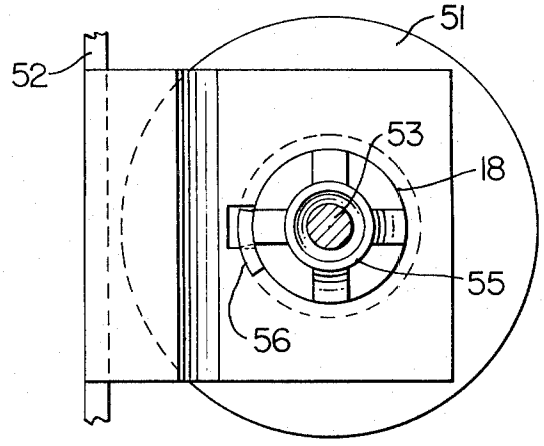

FIG. 3

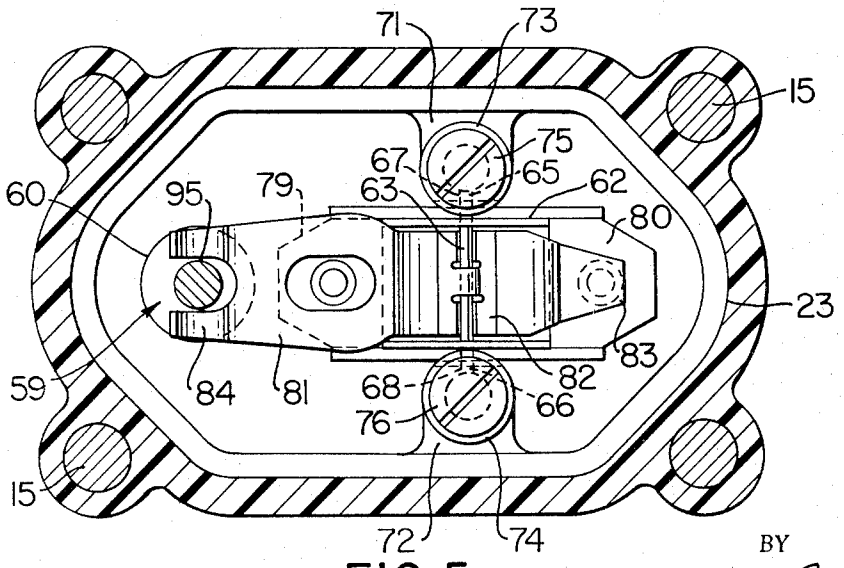

FIG. 5

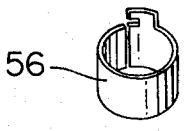

FIG. 7

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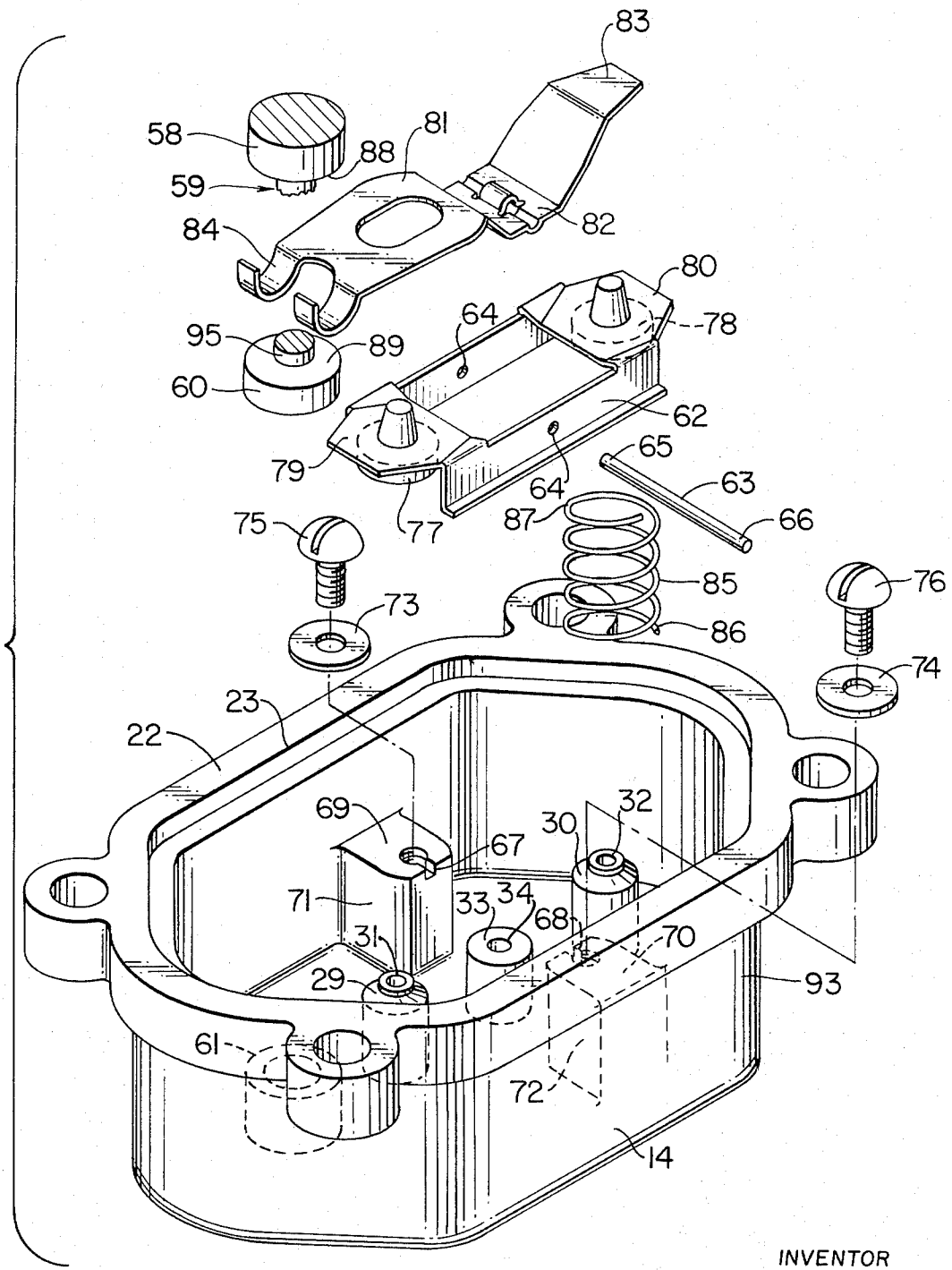

FIG. 8

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VALVE CONSTRUCTION

This invention relates to an improved valve construction as well as to improved parts for such a valve construction or the like.

It is well known that various valve constructions have been provided wherein the movable valve member is controlled by a solenoid plunger or the like moved between its various positions by an electrical coil means.

It is a feature of this invention to provide an improved valve construction of the above type wherein an ease of assembly is provided by utilizing a minimum number of uniquely formed parts.

Another feature of this invention is to provide such a valve construction wherein a sealed armature and valve assembly is obtained without the necessity of soldering or brazing.

A further feature of this invention is the use of a pole piece and shading ring assembly that can be snapped into the housing means of the valve construction and still maintain sufficient flux density for good armature action.

Another feature of this invention is to provide a valve construction wherein the various parts thereof eliminate the need for adjustment necessary to maintain proper valve closure when the armature is in a deactuated or seated position thereof.

A further feature of this invention is to provide a valve construction wherein field repairs can be easily made and different voltage coils can be installed in the field.

In particular, one embodiment of this invention provides a housing means having a valve seat and a valve member for opening and closing the valve seat. A lever is pivotally carried by the housing means and carries the valve member whereby pivoting movement of the lever moves the valve member relative to the valve seat for controlling the valve seat. A movable actuator member is carried by the housing means and is interconnected to the lever by a leaf spring so that movement of the actuator member is transmitted by the leaf spring to the lever to pivot the lever and thereby move the valve member relative to the valve seat whereby the leaf spring eliminates the need for making adjustments to insure proper valve seating.

Accordingly, it is an object of this invention to provide an improved valve construction having one or more of the novel features set forth above or hereinafter shown or described.

Other objects, uses and advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings wherein:

FIG. 1 is a perspective view of the improved valve construction of this invention.

FIG. 2 is an enlarged cross-sectional view taken on line 2—2 of FIG. 1.

FIG. 3 is a fragmentary, cross-sectional view taken on line 3—3 of FIG. 2.

FIG. 4 is a fragmentary view similar to FIG. 2 and illustrates the valve means in another operating position thereof.

FIG. 5 is a fragmentary, cross-sectional view taken on line 5—5 of FIG. 4.

FIG. 6 is a perspective view of one of the housing members of the valve construction of FIG. 1, FIG. 6 being reduced in size.

FIG. 7 is a perspective view of one of the parts of the valve construction of FIG. 2 with FIG. 7 being reduced in size.

FIG. 8 is an exploded perspective view of various parts of the valve construction of FIG. 2.

While the various features of this invention are hereinafter described and illustrated as being particularly adapted to provide a valve construction to be solenoid operated, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide other types of valve constructions as desired.

Therefore, this invention is not be limited to only the embodiments illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIGS. 1 and 2, the improved valve construction of this invention is generally indicated by the reference numeral **10** and comprises a housing means **11** formed from a first housing part **12** carrying a cover member **13** and being secured to a second housing part **14** by threaded fastening members **15** to define a sealed chamber **16** therebetween.

The first housing part **12** is formed from plastic material suitably molded or otherwise formed to define a substantially flat plate-like part **17** and an outwardly extending closed ended tubular part **18** having its upper end in FIG. **2** completely closed by an end wall means **19** while its lower end **20** leads to the chamber **16** when the housing members **12** and **14** are secured together in the assembled relation illustrated in FIG. **2**.

The other housing member **14** is also formed from plastic material suitably molded or otherwise formed into a substantially cup-shape and thereby defines a closed end **21** and an open end **22**, the open end **22** having an annular groove **23** formed therein and being adapted to telescopically receive an annular flange **24** projecting outwardly from the plate part **17** of the housing member **12** as illustrated in FIG. **2** to trap and hold an annular sealing member **25** therebetween whereby the housing members **12** and **14** cooperate together to define the sealed chamber **16** therebetween when the same are secured together by the fastening members **15**.

The closed end **21** of the housing member **14** is provided with three nipple extensions **26**, **27** and **28** extending in opposite directions from the end wall **21** with the upper ends **29** and **30** of the nipple extensions **26** and **28** defining valve seats having passage means **31** and **32** passing therethrough.

The middle nipple extension **27** has an upper end **33** disposed lower than the valve seats **29** and **30** and has a passage means **34** passing therethrough whereby a suitable pneumatic pressure source **35** is adapted to be coupled to the nipple extension **27** by suitable conduit means **36** and, thus, be interconnected to the chamber **16** of the valve construction **10**. The nipple extensions **26** and **28** can be respectively interconnected to pneumatically operated devices **37** and **38** by suitable conduit means **39** and **40** whereby the pneumatic pressure source **35** is adapted to be interconnected to the pneumatically operated device **37** or to the pneumatically

operated device 38 depending upon whether or not the valve seat 29 or 30 is open to the chamber 16 as will be apparent hereinafter.

A pole piece 41 carrying a shading ring 42 in an annular groove 43 provided in a surface 44 thereof has an annular groove 45 formed in the outer cylindrical surface 46 thereof and is adapted to snap-fittingly receive an inwardly directed annular tongue 48 formed on the internal cylindrical surface 49 of the tubular part 18 of the housing member 12 whereby the pole piece 41 and its shading ring 42 are adapted to be snap-fitted in the upper end of the tubular part 18 so as to provide sufficient flux density for good armature action as will be apparent hereinafter.

An electrical coil 50 is adapted to have its insulating carrier or bobbin 51 telescopically disposed about the tubular part 18 of the housing member 17 and be secured in place by a frame structure 52 being held on the housing member 12 by the same fastening member 53 that fastens the cover member 13 to the tubular part 18 of the housing member 12, the fastening member 53 being threaded into a threaded bore 54 at the upper end 55 of the tubular part 18. Suitable upper and lower core inserts 56 and 57 are utilized between the coil bobbin 51 and the tubular part 18 of the housing member 12 as illustrated in FIGS. 2 and 7.

A cylindrical armature or actuator member 58 is disposed in the tubular part 18 of the housing member 12 and has an annular groove 59 formed adjacent the lower end 60 thereof, the lower end 60 of the armature or plunger 58 normally resting on an annular flange 61 projecting upwardly from the bottom wall 21 of the housing member 14 when the coil 50 is in a deenergized condition thereof. However, the armature 58 is pulled upwardly against the pole piece 41 when the coil 50 is energized in the manner illustrated in FIG. 4 whereby FIG. 2 illustrates the armature 58 in its deactuated or seated position and FIG. 4 illustrates the armature 58 in its actuated position.

A lever member 62 is pivotally carried in the chamber 16 of the valve construction 10 by a pivot pin 63 passing through suitable openings 64 in the lever 62 and having its opposed ends 65 and 66 respectively received in notches 67 and 68 formed in flat upper surfaces 69 and 70 of a pair of embossments or ears 71 and 72 formed integral with the side wall means 93 of the housing member 14. The ends 65 and 66 of the pivot rod 63 are respectively held in place within the grooves 67 and 68 by washers 73 and 74 being secured on the flat upper surfaces 69 and 70 of the ears 71 and 72 by threaded fastening members 75 and 76 as illustrated in FIGS. 2 and 4.

The lever 62 carries a pair of resilient valve members 77 and 78 snap-fitted thereto at the opposed ends 79 and 80 of the lever 62 with such resilient valve members 77 and 78 being adapted to respectively cooperate with the valve seats 29 and 30 for controlling the same.

In order to translate axial movement of the armature 58 to pivotal movement of the lever 62, as well as to eliminate any need for adjustment between the armature 58 in its seated or deactuated position and the pivoted position of the lever means 62 for normally maintaining the valve member 77 in its closed position against the valve seat 29, a leaf spring 81 is also pivotally mounted to the pivot pin 63 at a central portion 82 of the leaf spring 81 with the leaf spring 81 having one free end 83 disposed adjacent the end 80 of the lever 62 and the other end 84 thereof being bifurcated and suitably formed to receive the reduced portion 95 of the armature 58 at the annular groove 59 thereof therebetween in the manner illustrated in FIGS. 2 and 4.

A compression spring 85 is disposed about the upper part of the nipple extension 28 of the housing member 14 so that the lower end 86 of the spring 85 bears against the end wall 21 of the housing member 14 and the upper end 87 thereof bears against the end 80 of the lever 62 to normally tend to maintain the same in the pivoted position illustrated in FIG. 2 where the valve member 77 is closing the valve seat 29 and the valve member 78 is in an open position relative to its valve seat 30. In addition, with the armature 58 in its deactuated or seated position, the upper annular shoulder 88 thereof bears against the end 84 of the leaf spring 81 and causes the same to engage against the end 79 of the lever 62 and hold the same in a downward position with the valve member 77 disposed against the valve seat 29 to fully close off the valve seat 29 from the chamber 16.

The operation of the valve construction 10 will now be described.

When the coil 50 is in its deenergized condition, the weight of the armature 58 causes the same to have the end 60 thereof seated against the annular flange 61 of the housing member 14 whereby the valve member 77 is held firmly against the valve seat 29 to prevent fluid communication between the chamber 16 and the pneumatically operated device 37 in the manner illustrated in FIG. 2. However, such pivotal position of the lever 62 causes the valve member 78 to be in an open position relative to the valve seat 30 so that the pressure source 35 is interconnected to the pneumatically operated device 38. The valve member 77 is assured of being maintained against the valve seat 29 because the leaf spring 81 can bend in opposition to its natural bias relative to the lever 62 even though the leaf spring 81 is engaging against the lever 62 when the lever 62 is maintaining the valve member 77 against the valve seat 29 whereby no adjustments are needed between the armature 58 and the valve lever 62 to assure that the valve member 77 will be in its seated position against the valve seat 29 when the armature 58 is in its seated position against the valve member 14. Further, the compression spring 85 also tends to maintain the lever 62 in its valve seating position on the valve seat 29 should the leaf spring 81 not engage against the lever 62 when the armature 58 is seated against the flange 61.

When the coil 50 is energized and remains energized, the same pulls the armature 58 upwardly to the actuated position illustrated in FIG. 4 whereby the lower annular shoulder 89 of the armature 58 pulls the end 84 of the lever 81 upwardly to pivot the same in a clockwise direction from the position illustrated in FIG. 2 to the position illustrated in FIG. 4 where the end 83 of the leaf spring 81 engages against the valve member 78 and moves the same downwardly in opposition to the force of the compression spring 85 whereby the lever 62 is pivoted in clockwise direction so that the valve member 78 now closes off the valve seat 30 as illustrated in FIG. 4 while the valve member 77 is moved

away from the valve seat **29**. In this manner, the valve lever **62** now interconnects the pneumatically operated device **37** to the source **35** while disconnecting the pneumatically operated device **38** from the source **35**.

Thus, because of the flexibility of the leaf spring **81** between the armature **58** and the valve lever **62**, regardless of the seated or actuated position of the armature **58**, the lever **62** is sufficiently pivoted so that the same will open one valve seat while closing the other valve seat in the manner previously described. Accordingly, no adjustments need be made between the armature **58** and the valve member **62** in order to assure that proper valve seating will be provided by the valve construction **10** of this invention.

Further, it can be seen that the various parts of the valve construction **10** of this invention are uniquely formed so that the same can be relatively easily assembled together without requiring soldering or brazing while the chamber **16** is completely sealed closed from the exterior of the housing means **11** except for the nipple extensions **26**, **27** and **28** thereof because the pole piece **41** and its associated shading ring **42** can be snap-fitted in place in the tubular part **18** of the housing member **12** in a simple and effective manner.

Therefore, it can be seen that not only does this invention provide an improved solenoid operated valve construction, but also this invention provides improved parts for such a valve construction or the like.

While the forms of the invention now preferred have been disclosed as required by the statutes, other forms may be used, all coming within the scope of the claims which follow.

What is claimed is:

1. A valve construction comprising a housing means having a valve seat, a valve member for opening and closing said valve seat, a pivot member carried by said housing means, a lever pivotally carried by said pivot member of said housing means and carrying said valve member whereby pivoting movement of said lever moves said valve member relative to said valve seat for controlling the same, a movable actuator member carried by said housing means, and a spring means operatively interconnecting said actuator member to said lever to cause pivotal movement of said lever upon movement of said actuator member, said spring means comprising a leaf spring pivotally carried by said pivot member and being pivotally movable relative to said lever.

2. A valve construction as set forth in claim **1** wherein said housing means has another valve seat, and another valve member for opening and closing said other valve seat, said other valve member being carried by said lever.

3. A valve construction as set forth in claim **2** wherein said actuator has two positions relative to said housing means, said spring means causing said other valve member to be in open position relative to said other valve seat and the first-mentioned valve member to be closed against its respective valve seat when said actuator member is in one of its said positions, said spring means causing said other valve member to be closed against said other valve seat and the first-mentioned valve member to be open relative to its respective valve seat when said actuator member is in the other of its positions.

4. A valve construction as set forth in claim **3** wherein said housing means has an internal chamber, said valve seats projecting into said chamber, said housing means having a passage means therein leading to said chamber and being interconnected by said chamber to the opened valve seat.

5. A valve construction as set forth in claim **4** wherein said valve seats and said passage means of said housing means are respectively provided in three nipple means carried by said housing means.

6. A valve construction as set forth in claim **1** wherein another spring means is carried by said housing means and tends to move said lever to one pivotal position thereof.

7. A solenoid operated valve construction comprising a housing means having a valve seat, a valve member for opening and closing said valve seat, a pivot member carried by said housing means, a lever pivotally carried by said pivot member of said housing means and carrying said valve member whereby pivoting movement of said lever moves said valve member relative to said valve seat for controlling the same, an axially movable solenoid armature member carried by said housing means, electrical coil means carried by said housing means for causing axial movement of said armature member from a seated position thereof to an actuated position thereof, and a spring means operatively interconnecting said solenoid member to said lever to cause pivotal movement of said lever upon axial movement of said solenoid member between said positions thereof, said spring means comprising a leaf spring pivotally carried by said pivot member and being pivotally movable relative to said lever.

8. A solenoid operated valve construction as set forth in claim **7** wherein said housing means has another valve seat, and another valve member for opening and closing said other valve seat, said other valve member being carried by said lever.

9. A solenoid operated valve construction as set forth in claim **8** wherein said spring means causes said other valve member to be in open position relative to said other valve seat and the first-mentioned valve member to be closed against its respective valve seat when said solenoid member is in its seated position, said spring means causing said other valve member to be closed against said other valve seat and the first-mentioned valve member to be open relative to its respective valve seat when said solenoid member is in its actuated position.

10. A solenoid operated valve construction as set forth in claim **9** wherein said housing means has an internal chamber, said valve seats projecting into said chamber, said housing means having a passage means therein leading to said chamber and being interconnected by said chamber to the opened valve seat.

11. A solenoid operated valve construction as set forth in claim **10** wherein said valve seats and said passage means of said housing means are respectively provided in three nipple means carried by said housing means.

12. A solenoid operated valve construction as set forth in claim **7** wherein another spring means is carried by said housing means and tends to move said lever to one pivotal position thereof.

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