April 14, 1953 W. H. REISNER, JR 2,635,138

ELECTROMAGNETIC ACTUATOR FOR ORGAN VALVES

Original Filed Feb. 3, 1947 2 SHEETS—SHEET 1

FIG. 1

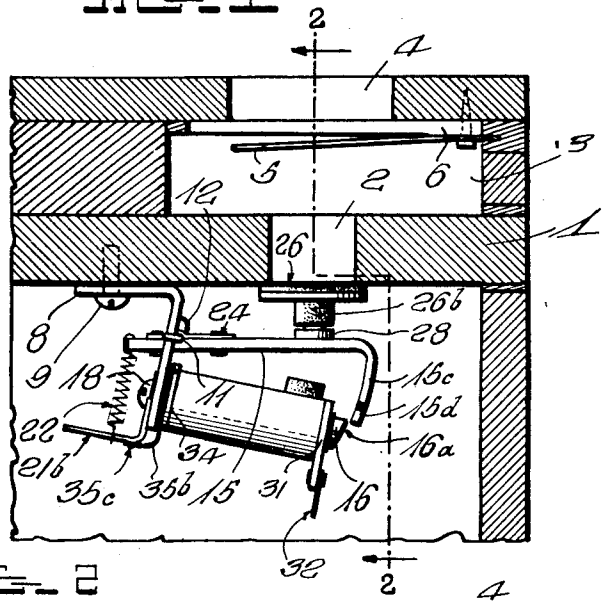


FIG. 2

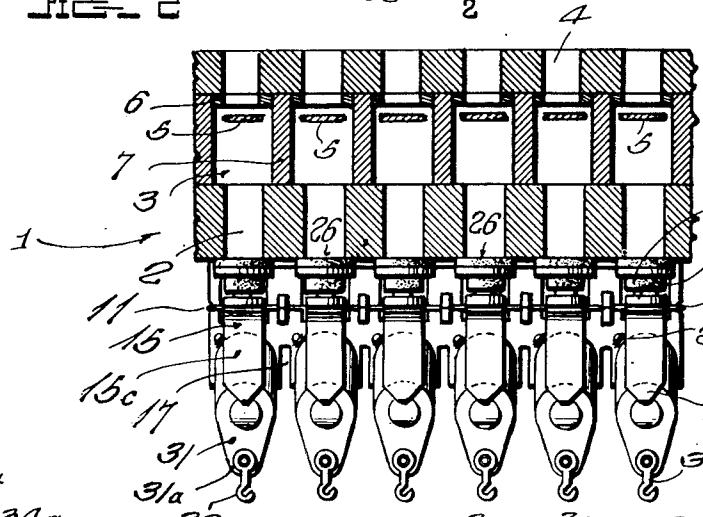


FIG. 3

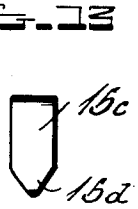


FIG. 4



FIG. 5

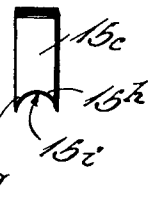


FIG. 9

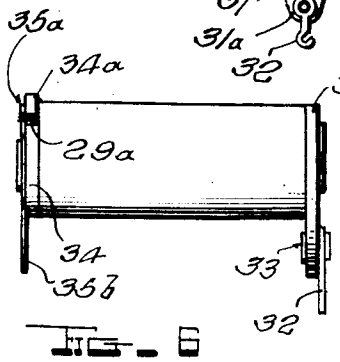


FIG. 6

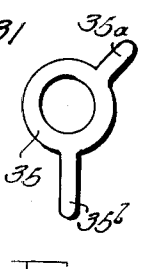


FIG. 8

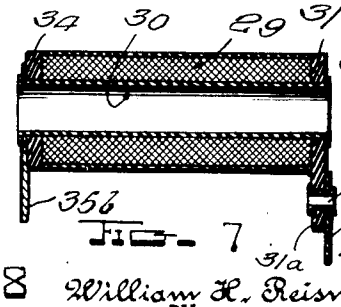


FIG. 7



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ELECTROMAGNETIC ACTUATOR FOR ORGAN VALVES

Original Filed Feb. 3, 1947 2 SHEETS--SHEET 2

FIG. 3

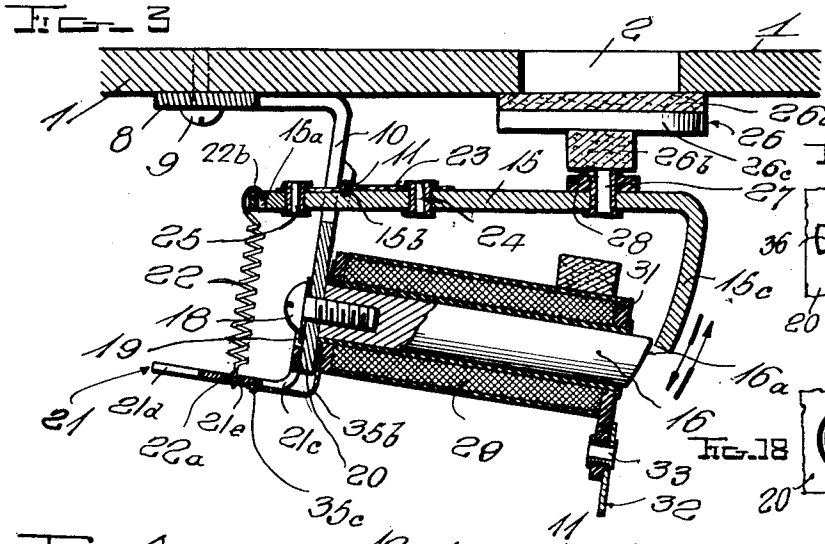


FIG. 17

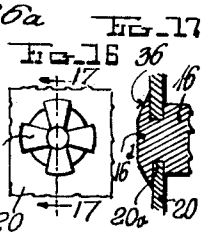


FIG. 16

FIG. 19

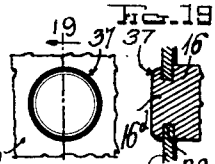


FIG. 18

FIG. 4

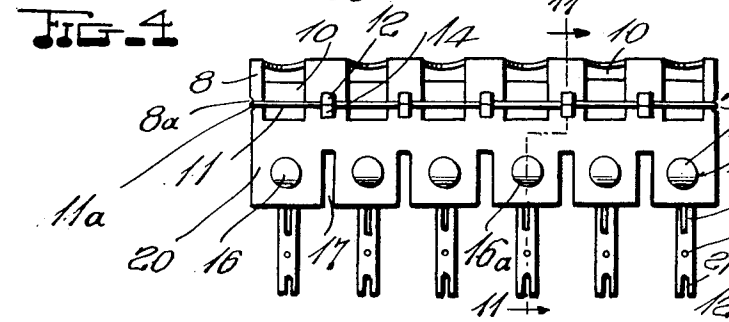


FIG. 21

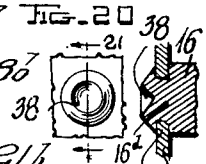


FIG. 20

FIG. 12

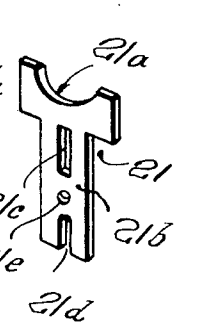
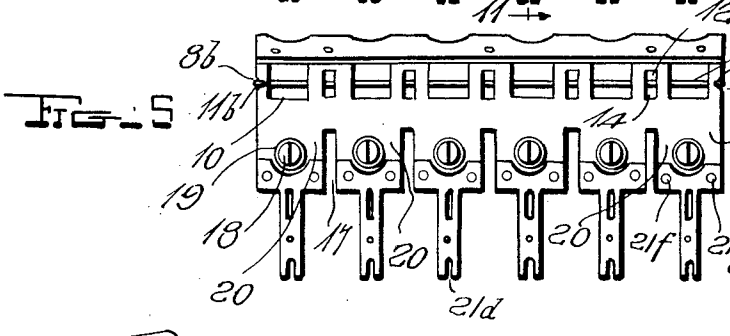


FIG. 5



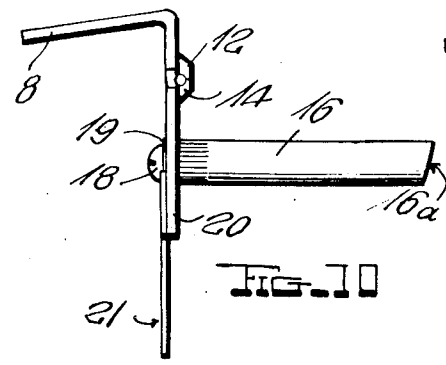
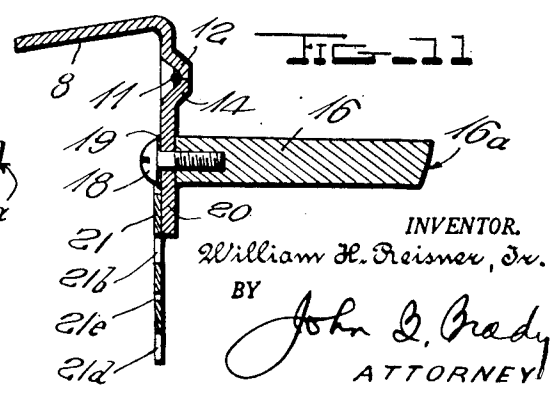


FIG. 10

FIG. 11



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UNITED STATES PATENT OFFICE

2,635,138

ELECTROMAGNETIC ACTUATOR FOR ORGAN VALVES

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Original application February 3, 1947, Serial No. 725,979. Divided and this application September 15, 1950, Serial No. 185,055

2 Claims. (Cl. 175—336)

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My invention relates broadly to organ valves and more particularly to an improved construction of multiple magnetic valve system for organs.

This application is a division of my application Serial Number 725,979 filed February 3, 1947 for Eletromagnetic Operating Mechanism for Organ Valves, which is now abandoned.

One of the objects of my invention is to provide an improved construction of multiple magnetic valve system for organs which may be manufactured with great precision and uniformity on a mass production scale at relatively low cost.

Another object of my invention is to provide an improved construction of grounding means for establishing electrical connection between one end of a magnetic control winding and the grounded frame of a multiple magnetic valve system.

Still another object of my invention is to provide an improved arrangement of insulated terminal for the multiple magnetic winding of a multiple magnetic valve system.

Still another object of my invention is to provide an improved construction of lug member adapted to be welded to the frame of a multiple magnetic organ valve system for effecting individual adjustment of the spring tension on the armatures of a multiple magnetic valve system and at the same time serving as an electrical terminal for the associated magnetic operating winding of the multiple magnetic valve system.

Still another object of my invention is to provide an improved construction of bearing and journalling means for a multiplicity of armatures in the frame structure of a multiple magnetic valve system.

Other and further objects of my invention reside in the improved construction of multiple magnetic organ valve control mechanism as set forth more fully in the specification hereinafter following by reference to the accompanying drawings in which:

Figure 1 is a side elevational view of the improved magnetic control valve structure of my invention, the view showing a fragmentary portion of the pressure chamber of a reed operated organ and the application thereto of the multiple organ valve of my invention; Fig. 2 is a vertical sectional view through the magnetic organ valve of my invention taken substantially on line 2—2 of Fig. 1; Fig. 3 is a longitudinal sectional view taken through the magnetic control valve of my invention with certain of the parts illustrated in side elevation and the direction of movement of the control armature illustrated by arrows; Fig. 4 is a front view of the magnetic frame of

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the multiple magnetic organ valve prior to assembly of the electromagnetic windings thereon; Fig. 5 is a rear view of the frame of the multiple magnetic organ valve of my invention prior to the assembly of the electromagnetic windings and adjustment springs thereon; Fig. 6 is a side elevational view of one of the completely assembled electromagnetic control windings employed on the magnetic cores of the multiple magnetic valve controlled system of my invention; Fig. 7 is a longitudinal sectional view taken through the electromagnetic control windings of Fig. 6 and particularly illustrating the improved construction of grounding means and the improved construction of terminal lug associated with the electromagnetic operating winding; Fig. 8 is a front elevational view of the improved grounding means associated with each of the electromagnetic control windings; Fig. 9 is an end view showing the assembly of the grounding means of Fig. 8 with respect to the electromagnetic operating winding of Figs. 6 and 7; Fig. 10 is an enlarged side elevational view illustrating the manner of assembling the magnetic core with respect to the magnetic frame of the multiple magnetic valve system and illustrating particularly the bearing and journalling means for the armatures of the multiple magnetic valve system; Fig. 11 is a cross-sectional view more clearly illustrating the manner of assembling the magnetic core with respect to the magnetic frame, the arrangement of the adjustable spring tensioning lug and electrical connector therefor and the bearing and journalling structure for the armature system, the view being taken substantially on line 11—11 of Fig. 4 and enlarged to the scale shown in Fig. 10; Fig. 12 is a perspective view of the spring tensioning and electrical connection lug which is welded to the frame of the multiple magnetic control system, the view being enlarged to more clearly illustrate the construction; Figs. 13, 14 and 15 show various modified forms of the contour or shape of the armature which I have found desirable in the efficient operation of the multiple magnetic valve system of my invention; Fig. 16 illustrates one of the production processes I have devised for assembling the magnetic core with respect to the magnetic frame by staking the end of the core to the magnetic frame; Fig. 17 is a transverse sectional view taken substantially on line 17—17 of Fig. 16; Fig. 18 shows a modified form of rolling the end of the magnetic core over the magnetic bracket for speeding up the production process; Fig. 19 is a transverse sectional view taken substantially on line 19—19 of Fig. 18; Fig. 20 shows a further modified form which

may be employed in the production process in producing the structure of my invention by riveting the magnetic core to the magnetic frame; and Fig. 21 is a cross-sectional view taken substantially on line 21—21 of Fig. 20.

Referring to the drawings in more detail reference character 1 indicates the pressure chamber of an organ having ports 2 therein leading to the reed pressure box 3 having an outlet indicated at 4. The reed is indicated at 5 mounted at one end on the reed supporting frame 6. In Fig. 2 I have shown the several reed pressure boxes 3 partitioned one from the other by means of partition members 7 for the independent control of the passage of air therethrough under control of the electric valve action. The electric valve action of my invention may be used for both vacuum and pressure arrangements, as in the conventional pipe and electronic organ systems. The illustration of my invention herein in association with a reed system is merely for the purpose of illustrating one application of the system of my invention.

The bracket for mounting the several electromagnetic control systems of the multiple magnet of my invention is illustrated at 8 comprising a magnetic frame secured by screws 9 to the pressure chamber 1 and extending at an obtuse angle with respect thereto on the side adjacent the organ ports 2. The bracket 8 is provided with a plurality of perforations 10 therein which are struck out of the material forming the bracket 8 and across which the bearing wire 11 is stretched. The bearing wire 11 is fastened intermediate each of the perforations 10 by means of the outstruck clamping jaws 12 and 14 which are formed directly from the material of the frame 8 and which are sufficiently removed from the material of the bracket 8 to enable the bearing wire 11 to be clamped therein. The bearing wire 11 extends beyond opposite ends of bracket 8 and is bent upon itself to form hook-shaped securing means at 11*a* and 11*b* fitting within notches or grooves 8*a* and 8*b* in opposite ends of the frame 8. The hook-shaped ends of the bearing wire 11 embraces the opposite ends of frame 8 by extending around the frame in the notches 8*a* and 8*b*. The bearing wire 11 thus stretched provides a journalling means for the rockable armatures which I have illustrated at 15. Each rockable armature 15 has one end thereof extending through the perforation 10 and the other end projecting beyond the end of the magnetic core 16. The multiple magnet system includes a plurality of magnetic cores 16 secured at spaced intervals along the magnetic frame 8 intermediate the slots 17 in the frame 8 and projecting on axes diverging away from the plane of the ports 2 with which the magnetic cores 16 are aligned and diverging away from the plane of the portion of the rockable armature 15 extending through the perforation 10 when the armature is in deactivated position. The magnetic cores 16 are secured in any suitable manner such as by way of the screws 18, the heads of which pass through washer member 19 and through apertures in the T-shaped tongues 20 of the frame 8.

The T-shaped tongues 20 have secured to the extremities thereof the lugs 21 shown more particularly in Fig. 12. The lugs 21 are each provided with an arcuate shaped recessed end portion 21*a* and a co-extensive central lug portion 21*b* which is slotted at 21*c* and 21*d* and which is apertured at 21*e*. The recessed end portion 21*a* is so shaped that this end portion may be readily spot-welded as represented at 21*f* and 21*g* in Fig. 5 to each of the tongues 20 of frame 8 without interfering with the head of the securing screw 18. The co-extensive central lug portion 21*b* of the lug 21 is sufficiently stiff to insure the maintenance of the lug 21*b* in the position in which it may be set. Accordingly the co-extensive portion 21*b* of the lug serves as an adjusting means for the tension of tension spring 22, the end 22*a* of which passes through apertures 21*e* in lug 21 and the end 22*b* of which passes through aperture 15*a* in the projecting end of armature 15 as shown. The slot 21*c* in lug 21 renders the lug 21 sufficiently pliable to enable the lug to be adjusted to that position in which the desired spring tension is exerted upon the armature 15 and provides a solder connection slot for the conductive arm 35*b* of the electrical connection 35 extending from magnet winding 29. The slotted end 21*d* of lug 21 permits an electrical connection to be readily soldered in the end of the lug.

The armature 15 is journalled upon the bearing wire 11 by the coaction of strip member 23 with the transverse groove 15*b* in armature 15, the strip member 23 extending over bearing wire 11 and conforming in shape with the section of the wire 11 when imbedded in groove 15*b* of the armature, the strip member 23 being secured adjacent its opposite ends by means of rivets 24 and 25 which pass through armature 15. Thus armature 15 is free to rock about bearing wire 11 being confined pivotally with respect thereto on the one side by transverse groove 15*b* and on the other side by shaped strip 23. The end of the armature 15 is shaped in a very special manner for efficiently employing the magnetic lines of flux which emanate from the end of the magnetic core 16.

The magnetic armature 15 in association with the magnetic core 16 and the magnetic frame 8 form a path for the magnetic lines of force threading said members substantially in the shape of a parallelogram. The said path becomes shorter in effective length as the arcuate structure 15*c* of the armature is displaced toward the magnetic core 16. The closed loop for the magnetic lines of force varies in effective length with the displacement of the magnetic armature 15. Rapid action of the magnetic operating mechanism is assured by virtue of the low reluctance for the magnetic path which is established by the continuous magnetic circuit formed by the magnetic frame 8, the magnetic armature 15, and the magnetic core 16 which tends to decrease in length upon energization of magnetic winding 29. This rapid action is increased by reason of the shaped end of the armature structure as shown in Figs. 13, 14 and 15.

The end of magnetic core 16 is provided with an arcuate shaped face 16*a* formed on a radius having a center substantially beyond the end of the magnetic core secured by screw 18. The armature 15 has a correspondingly shaped face 15*c* which is shaped to move in an arcuate path conforming with the contour of the arcuate shaped face 16*a* of core 16. The terminus of the armature face 16*c* is also shaped in a very special manner in order to obtain the maximum pulling force from the magnetic flux emanating from the end of arcuate shaped face 16*a* of core 16. I have found that this terminus may be tapered to a point as represented at 15*d* in Fig. 13; or may be undercut to provide a pair of abruptly spaced

tapered points as represented at 15e and 15f in Fig. 14, or may be provided with a pair of spaced points 15g and 15h as represented in Fig. 15 separated by a curved intermediate face represented at 15i. Utilization of any one of these forms of termini in association with the arcuate structure of the end of the armature at 15c in relation to the arcuate shaped face 16a of magnetic core 16 insures a rapid build up of the magnetic flux which threads the magnetic core 16, magnetic frame 8, and magnetic armature 15 to form a closed magnetic path for effecting an actuation of the valve structure with minimum inertia or delay after application of the exciting current to the operating winding of the magnetic valve system.

The armature 15 carries a multiple layer valve structure 26 adjacent the end thereof constituted by alternately arranged relatively flexible felt portions 26a and 26b separated by the relatively stiff intermediate portion 26c. The relatively flexible felt portion 26b is fastened by a suitable cement or other means to the end of the rivet 27 and spacer member 28 carried by armature 15 as shown. The relative angular adjustment permitted between the superimposed layers of the valve insure the conforming of the valve face with the port 2 in the pressure chamber 1.

The electromagnetic operating system for the multiple valve structure consists of a multiplicity of magnetic windings 29 corresponding in number to the number of magnetic cores 16. Each magnetic winding 29 is wound upon an insulated tube 30 flanged at each end. An insulated spool head 31 is supported on the tube 30 and abuts against the flanged end of the insulated tube 30. The head 31 has an elongated extension 31a at one side thereof which provides a support for a terminal lug 32 which is fastened to the extension 31a by terminal member 33. One end of the winding 29 is threaded through the tubular rivet 33 and is soldered to the terminal lug 32 thus providing a readily accessible connecting terminal for one end of each of the operating windings 29. The other end of each operating winding 29 is brought out at the opposite end of the magnetic structure and wrapped around a projecting insulated lug 34a of the insulated end 34 of the magnet winding structure. Intermediate the insulated end 34 and the flanged end of the tube 30 I provide a unique type of electrical connector shown more particularly in Fig. 8. The electrical connector consists of a conductive ring portion 35 having a pair of radially extending conductive arms 35a and 35b. The conductive arm 35a extends in intimate surface contact with the lug 34a of the insulated end 34 and the end of the magnet winding 29 which is brought out from the magnet winding 29 is freed of insulation and the wire wrapped around lug 34a and the radially extending conductive arm 35a as represented at 29a and a soldered electrical connection made with arm 35a. The coacting conductive arm 35b is bent as represented in Figs. 1 and 3 to a position in which a soldered electrical connection may be made to lug 21 as represented at 35c in Figs. 1 and 3. Thus a good electrical ground may be established and maintained between the end of the operating winding 29 and the solder lug 21d to which electrical connection is made to the control circuits. By reason of the spacing of the several electromagnets in the multiple magnetic frame structure the electrical connections to the several lugs 21 and to the several terminals 32 may be readily spaced and separated from each other in writing the multiple magnet valve into the organ circuit.

In providing for mass production of the magnetic structure of my invention I have evolved special means for securing the magnetic core 16 to the tongues 20 of the magnetic frame 8. I have shown the several methods in Figs. 16–21. In the construction shown in Figs. 16 and 17 the magnetic core 16 has the end 16d thereof reduced in section and passed through the aperture 20a in tongue 20 and the protruding end staked as represented at 36 by blows of a tool under a drop press for expanding the end of the core into a keyed position with respect to the tongue 20.

In the arrangement illustrated in Figs. 18 and 19 the protruding end of the core 16d is rolled over as represented at 37 to secure a confining peripheral edge for maintaining core 16 in position with respect to tongue 20.

In the arrangement illustrated in Figs. 20 and 21 the projecting end of core 16 at 16d is riveted over the tongue 20 as represented at 38 for thereby securing the magnetic core 16 with respect to the tongue 20.

I have found these methods of connection of the magnetic core 16 to be superior to the screw connection illustrated in Figs. 10 and 11.

The magnet windings 29 may be so proportioned that the windings may be directly connected in electronic control circuits in electronic types of organ systems.

The diverging relation of the electromagnetic core 16 with respect to the plane of organ ports 2 and the planes of the portions of armatures 15 that extend through perforations 10, with the armatures in deactivated position, provide desirable space for installation, maintenance and replacement of the valve ports and afford a wide displacement path for the magnetic armatures 15 which swing from minimum to maximum magnetic relation with the cores 15. The tips of armatures, such as 15d, are displaced by reason of the wide angular displacement afforded by the mounting of the cores 16 at a diverging angle adjacent the ports 2, from one edge of the arcuate face 16a of the core 16 to the opposite edge thereof to secure maximum pulling force from the magnetic flux emanating from the end faces 16a of cores 16.

I have found the structure of the multiple valve system of my invention highly efficient and practical in its use and while I have disclosed the structure in certain of its preferred embodiments I realize that modifications may be made and I intend no limitations upon my invention other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. An electromagnetic actuator for organ valves comprising a frame structure forming a supporting bracket for a multiplicity of electromagnetic actuating devices, a plurality of magnetic core members secured in spaced positions along said supporting bracket, said supporting bracket being perforated above each of said magnetic core members, an armature member extending through each of the perforations in said supporting bracket, a bearing wire stretched across said supporting bracket transversely to the perforations therein and hooked around opposite edges of the extreme opposite limits of said supporting bracket, outstruck lugs extending from said supporting bracket intermediate the perforations therein and engaging said bearing wire, said armature members being pivotally

mounted on said bearing wire and selectively operative by electromagnetic excitation of the associated magnetic core members.

2. An electromagnetic actuator for organ valves comprising a frame structure forming a supporting bracket for a multiplicity of electromagnetic actuating devices, a plurality of magnetic core members secured in spaced positions along said supporting bracket, said supporting bracket being perforated above each of said magnetic core members, an armature member extending through each of the perforations in said supporting bracket, a bearing wire stretched across said supporting bracket transversely to the perforations therein, the opposite edges of said supporting bracket being grooved to receive the ends of said bearing wire, said bearing wire being hooked around the grooves in said supporting bracket, lug members outstruck from said bracket intermediate the perforations therein and engaging said bearing wire said armature members being journalled on said bearing wire and projecting through the respective perforations in said bracket and selectively operative by electromagnetic excitation of the associated magnetic core members.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
125,806	Goodyear	Apr. 16, 1872
1,610,279	Gilchrist	Dec. 14, 1926
1,684,929	Snavely	Sept. 18, 1928
1,765,958	Wick	June 24, 1930
1,894,327	Schellenger	Jan. 17, 1933
1,976,781	Graves	Oct. 16, 1934
2,048,623	Redinger	July 21, 1936
2,092,930	Paradise	Sept. 14, 1937
2,425,275	Wood	Aug. 5, 1947
2,453,158	Price	Nov. 9, 1948

FOREIGN PATENTS

Number	Country	Date
149,467	Great Britain	Aug. 19, 1920