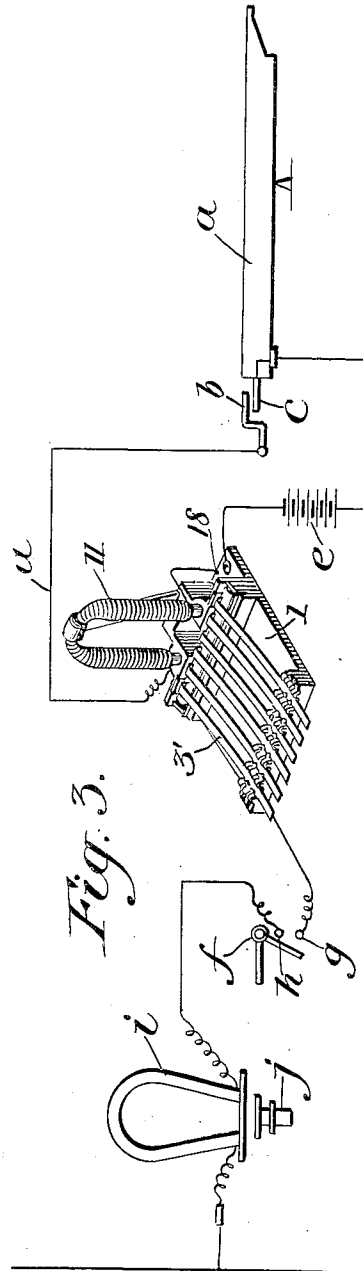
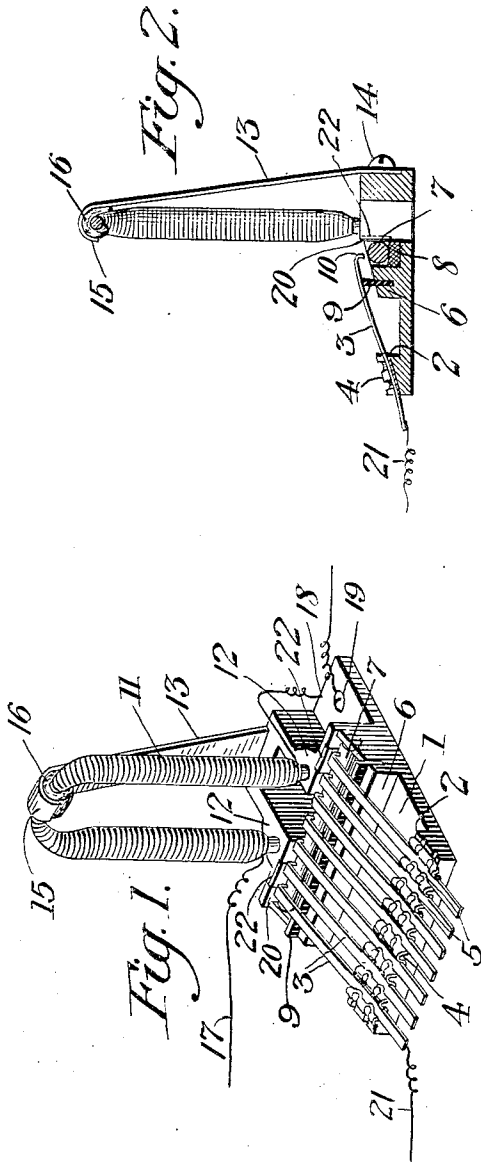


1,204,469.

Patented Nov. 14, 1916.



Witnesses.  
W. Adeline  
Chait

Inventor:  
Victor C. Middlebush  
by  
Jesse Goldsborough Mills  
Atty.

# UNITED STATES PATENT OFFICE.

VICTOR E. MIDDLEKAUFF, OF HAGERSTOWN, MARYLAND, ASSIGNOR TO W. H. REISNER MANUFACTURING COMPANY, OF HAGERSTOWN, MARYLAND, A CORPORATION OF MARYLAND.

## ELECTROMAGNETIC RELAY.

1,204,469.

Specification of Letters Patent.

Patented Nov. 14, 1916.

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*To all whom it may concern:*

Be it known that I, VICTOR E. MIDDLEKAUFF, a citizen of the United States, residing in the city of Hagerstown, county of Washington, and State of Maryland, have invented certain new and useful Improvements in Electromagnetic Relays; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to electro-magnetic relays and has for its object to provide a novel relay especially adapted for use in combination with an electrically coupled pipe organ, although it is not limited to such use and may be used in other relations.

The improved relay is illustrated in the accompanying drawing, electrically connected in circuit with the associated elements of a pipe organ, for the purpose of exemplifying the use of the relay.

In the drawing, Figure 1 is a perspective view of the improved relay; Fig. 2 is a vertical section taken through the central portion of the device shown in Fig. 1; and Fig. 3 is a more or less diagrammatic view showing the relay electrically connected in circuit with a pipe-controlling magnet of an organ, a stop switch and one of the organ keys.

Referring to the drawing, the improved relay comprises a base 1 which is preferably made of metal, such as cast lead, and provided with a transverse upstanding rib or projection 2 constituting a support for a plurality of spring contact fingers 3. The said contact fingers are preferably made of phosphor-bronze, but obviously any suitable material may be employed. The spring fingers 3 may be secured in place to the transverse projection 2 in any appropriate manner, but preferably the transverse projection 2 is provided with a plurality of recesses disposed transversely of the projection 2, and each of which is adapted to receive one of the contact fingers 3. Before the contact fingers are positioned in the recesses, however, a strip of suitable insulating material 4 is interposed between the surface of the projection 2 and the contact fingers 3. The contact fingers 3 are held in place by scoring the upper surface of the projection 2

along one or more lines running longitudinally of the projection 2. This may be done by any appropriate straight-edge tool capable of indenting or scoring the surface of the projection 2, so that the material of the base projecting above and between the contact fingers 3 is slightly upset along the scored lines to form small laterally projecting portions 5 of displaced metal and insulating material which partly overlie the surface of the contact fingers 3, and, therefore, firmly hold the same in their recesses. The other ends of the contact fingers 3 project over a recess formed in the base 1, which recess is designed to receive the magnet armature. The recess may be formed in any suitable manner, but preferably the base 1 is so cast as to form a second upwardly projecting portion 6, which is longitudinally recessed to accommodate the magnet armature. The armature itself is preferably cylindrical in shape, as shown at 7, and may be made of soft iron plated with a thin layer of phosphor-bronze or other suitable material. The armature rests loosely in the recess provided in the projection 6, and preferably rests upon a silencing pad 8 made of felt or similar material.

The free ends of the contact fingers 3 normally rest upon a strip of insulating material 9 running transversely of the relay and longitudinally of the projection 6, as clearly shown in Figs. 1 and 2. The extremital portions of the contact fingers 3 are preferably bent downwardly, as shown at 10, but are normally held out of contact with the armature 7 by means of the transverse supporting strip 9, as best shown in Fig. 2. An electro-magnet 11 is supported by the base 1, preferably by embedding the extremities of its core in the metal of the base, as best shown in Fig. 1. For this purpose, the upstanding projection 6 may be so shaped as to accommodate the extremities of the magnet core, as shown at 12. The magnet may be braced by means of a brace 13 secured to the rear part of the base 1 at 14, and engaging the top part of the magnet, as shown at 15, a piece of felt or like material 16 preferably being interposed between the top of the brace and the electro-magnet. The core of the magnet is wound with wire in the usual manner, the free end of which is shown at 17. The other

end of the magnet wire may be electrically connected to the base, as shown at 18, and the conductor from the source of current may be connected to the base at 19.

5 From the foregoing description, it will be obvious that when the electro-magnet 11 is energized by the passage of an electric current therethrough, the armature 7 will be attracted by the poles of the magnet and  
10 pulled simultaneously upwardly and toward the rear wall 20 of the recess formed in the projection 6. The result is that the armature 7 will roll up the rear wall 20 of the recess in the projection 6 until the armature  
15 makes simultaneous contact with the extremital portions of the contact fingers 3. When the electric current discontinues to pass through the magnet, the armature drops back in the recess with substantially  
20 no rolling action, and, therefore, each time the magnet is energized the contact fingers 3 come in contact with a different portion of the armature, due to the rotation thereof each time it is actuated. By connecting  
25 electric conductors to the extremities of the contact fingers 3, as shown at 21, in Figs. 1 and 2, it is obvious that a plurality of electric circuits may be completed through the armature 7, and the several contact  
30 fingers 3. For this purpose, it is desirable to embed small strips 22 of suitable conducting material in the rear wall 20 adjacent the armature, so that when the armature 7 rolls up the rear wall 20, it will make  
35 a good electrical contact with the conducting portion 7, instead of with the relative rough and uneven leaden surface of the wall 20.

It is obvious that when the armature 7  
40 is held in contact with the fingers 3, a plurality of circuits may be completed through the metal of the base, the contacts 22, armature 7, individual contact fingers 3, and thence through any other apparatus which  
45 it is desired to place in the auxiliary circuits. This is made clear in Fig. 3, in which the relay is connected in circuit with the pipe-controlling magnet of a pipe organ, a stop switch and one of the organ keys.  
50 The organ key is diagrammatically shown at *a*, and when depressed, is adapted to establish contact at *b-c* to complete a circuit through a conductor *d*, the electro-magnet, and back through a source of current  
55 *e* to the contact members *b-c*. This will energize the electro-magnet 11 and attract the armature to complete auxiliary circuits, only one of which is shown in Fig. 3, which may be traced as follows:—from  
60 the source of current *e* through the metal of the base of the magnet, through the contacts 22, armature 7, spring finger 3', and if the stop switch *f* is closed to bridge the contacts *g* and *h*, the current passes through the pipe-controlling magnet *i*, and back to

the source of current *e*. The pipe-controlling magnet *i* will, therefore, be energized to attract one of the pallet armatures *j* which control the air passages of the wind-  
chest of the organ. The magnet *i* may be  
70 assumed to be one of the pipe-controlling magnets of the "swell organ" and may be electrically coupled with similar pipe-controlling magnets of other organs by connecting the magnets of the said other organs  
75 in circuit with the other contact fingers 3. It is obvious then that several of the organs may be coupled and simultaneously operated, as the depression of any single key *a* will cause the operation of all of the mag-  
80 nets *i* electrically connected in circuit with the relay. The well known stop mechanism may be employed, for causing the key *a* to operate only its own magnet *i*, or simultaneously actuate several other magnets at  
85 will. It is obvious that by the use of the improved relay, the various organs may not only be coupled, but the relay may be so connected with the organ keys as to cause the depression of one key to simultaneously  
90 actuate other pipe-controlling magnets belonging to the same bank of keys, instead of to other banks, as above described. In this way, various chords may be played by the depression of single keys.  
95

The metal base of the relay constitutes an excellent support for the relay, and has the advantage of eliminating the possibility of warpage. The novel formation of all  
100 the parts makes the construction simple and compact, and the novel mounting of the armature effectively causes a new surface portion of the armature to make contact  
105 with the fingers 3 at each energization of the magnet, due to the rolling action of the armature hereinbefore described.

As above stated, the relay may be used for numerous electrical purposes, and, although the specific form herein disclosed  
110 was designed specifically for use in combination with a pipe organ, it may be just as satisfactorily used in other relations.

What I claim is:—

1. An electric relay comprising an electro-magnet, a cylindrical armature adapted to  
115 be actuated by said magnet, and a plurality of electric contacts so positioned as to be engaged by the armature when the same is actuated whereby a plurality of electric circuits may be completed through the arma-  
120 ture and said contacts, and means to effect a turning movement of the armature upon each actuation thereof.

2. An electric relay comprising an electro-magnet, a cylindrical armature adapted to  
125 be actuated by said magnet, and a plurality of spring contact fingers so positioned as to be engaged by the armature when the same is actuated whereby a plurality of electric circuits may be completed through the ar-  
130

mature and said contacts, and means to effect a turning movement of the armature upon each actuation thereof.

3. An electric relay comprising a base, an electro-magnet supported thereby, a cylindrical armature mounted in the base adjacent the poles of the magnet to be attracted thereby, a surface on which the cylindrical armature rolls to its attracted position when the magnet is energized, and a plurality of spring contact fingers with which the armature engages when attracted by the magnet.

4. An electric relay comprising a base, an electro-magnet supported thereby, a cylindrical armature mounted in the base adjacent the poles of the magnet to be attracted thereby, a surface on which the cylindrical armature rolls to its attracted position when the magnet is energized, and a plurality of electric contacts with which the armature engages when the same is attracted by the magnet.

5. An electric relay comprising a base, an electro-magnet supported thereby, a cylindrical armature mounted in the base and adapted to be attracted by the magnet, said base having a substantially vertical wall adjacent the armature up which the armature rolls when attracted by the magnet, and a plurality of electric contacts with which the armature engages when the same is attracted by the magnet.

6. An electric relay comprising a base having a recess therein, a rotatable armature mounted in said recess, an electro-magnet supported by the base and having at least one pole positioned adjacent said recess to attract the armature and cause it to roll up the side of said recess, and a plurality of electric contacts with which the armature engages when the same is attracted by the magnet.

7. An electric relay comprising a base having a recess therein, a cylindrical armature loosely mounted in said recess, a plurality of contact fingers having extremital portions projecting over said recess, and an electro-magnet to shift said armature into contact with said fingers whereby a plurality

of electric circuits may be completed through said armature and contact fingers.

8. An electric relay comprising an electro-magnet, a horizontal row of electric contacts, a cylindrical armature, and a surface upon which said armature rolls into engagement with said contacts when attracted by the magnet.

9. A device of the kind described comprising an electromagnet, at least one electric contact, a rotatable armature, and a surface upon which said armature rolls into engagement with said contact when attracted by the magnet.

10. An electric relay comprising a metallic base, an electro-magnet mounted thereon, an armature adapted to be attracted by the magnet, and a plurality of contact fingers mounted on the metallic base to make contact with the armature in its attracted position, the base being provided with recesses to receive the contact fingers and a portion of the metal of the base between and projecting above the fingers being displaced to retain the contact fingers in the recesses.

11. An electric relay comprising a base having a recess therein, a cylindrical armature mounted therein, a plurality of contact fingers having extremital portions projecting over said recess, and an electro-magnet adapted to shift said armature into contact with said fingers, whereby a plurality of electric circuits may be completed through said armature and contact fingers, the extremital portions of said contact fingers being so formed as to produce a scraping or cleaning action on the armature at each actuation thereof.

12. A device of the kind described comprising an electro-magnet, at least one electric contact, a rotatable armature, and means to effect a turning movement of the armature upon each actuation thereof.

In testimony whereof I affix my signature, in presence of two witnesses.

VICTOR E. MIDDLEKAUFF.

Witnesses:

W. H. REISNER,

JOHN E. WHITE, Jr.