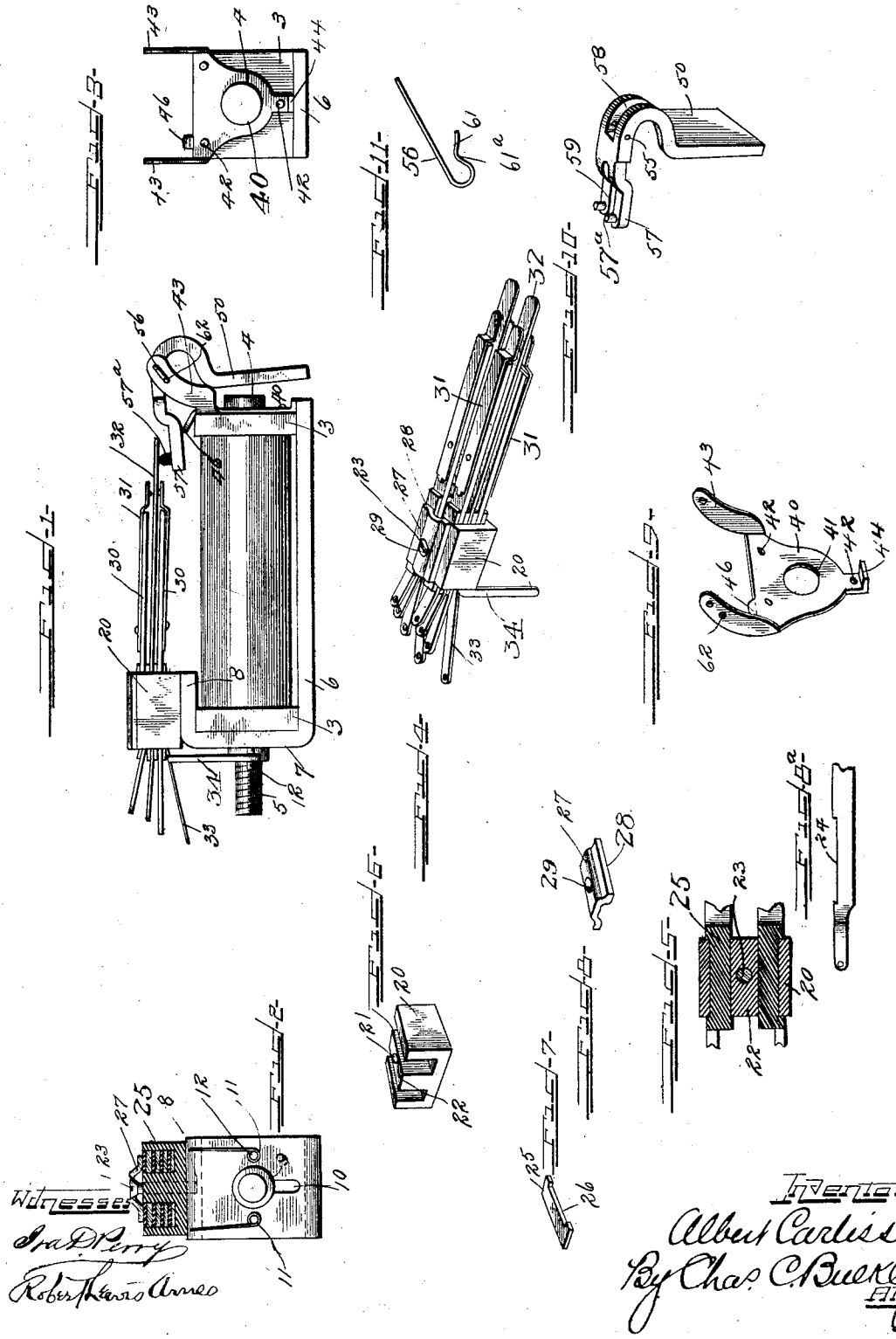
No. 752,613. PATENTED FEB. 16, 1904.

A. CARLISS.

RELAY.

APPLICATION FILED MAY 25, 1901. RENEWED DEC. 23, 1903.

NO MODEL. 2 SHEETS—SHEET 1.



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 12.

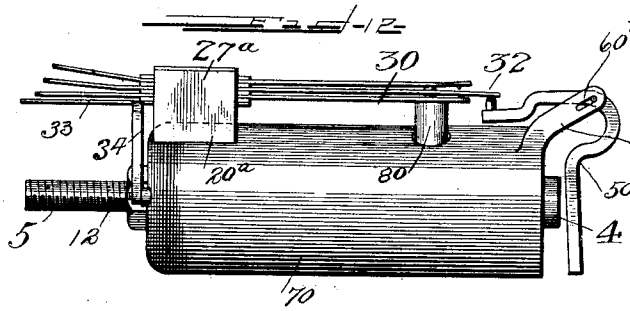


Fig. 13.

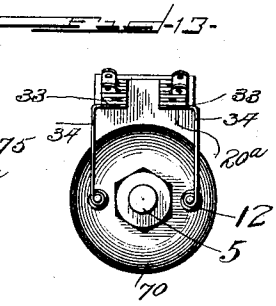
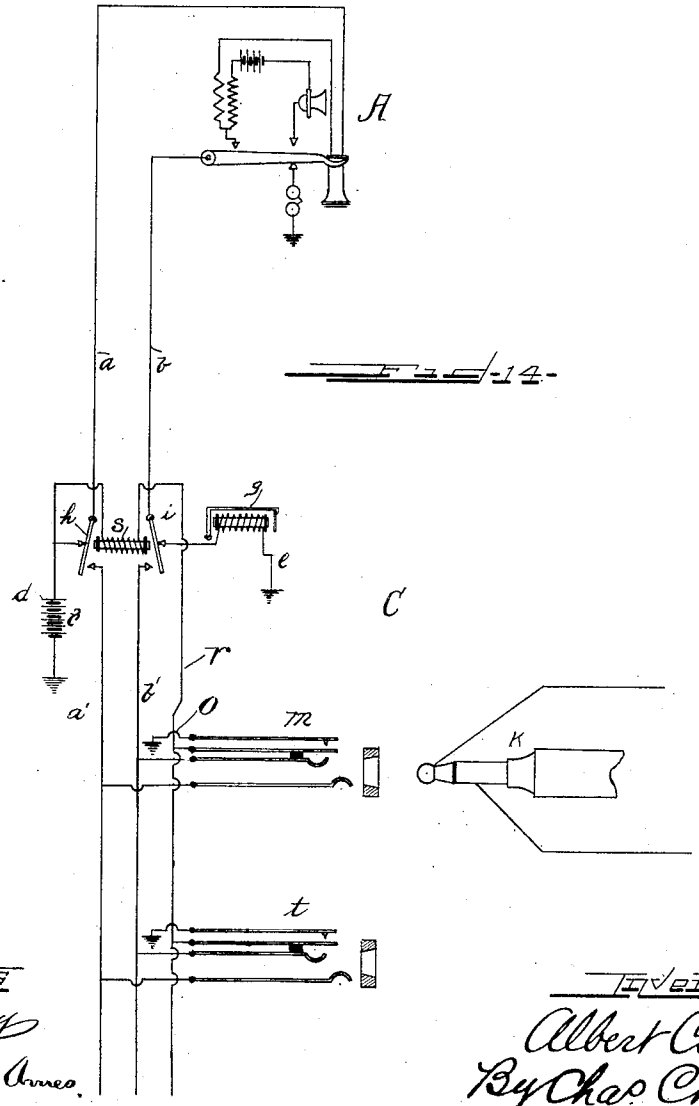


Fig. 14.



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No. 752,613. Patented February 16, 1904.

UNITED STATES PATENT OFFICE.

ALBERT CARLISS, OF CHICAGO, ILLINOIS, ASSIGNOR TO AMERICAN ELECTRIC TELEPHONE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION.

RELAY.

SPECIFICATION forming part of Letters Patent No. 752,613, dated February 16, 1904.

Application filed May 25, 1901. Renewed December 23, 1903. Serial No. 186,414. (No model.)

To all whom it may concern:

Be it known that I, ALBERT CARLISS, a citizen of the United States of America, and a resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Relays, of which the following is a specification.

My invention relates to improvements in relays, and more especially to that class known as "cut-off" relays used in connection with telephone systems to disconnect the subscriber's line from the central battery or source of current and to connect it to the multiple extension of the line extending through the switchboard. It is, however, equally applicable in any place, to any system, or for any purpose where it is desired to break a normal connection and make another connection therethrough, and in many of its aspects and phases it is of still broader scope in that it is capable of use in connection with any form of relay, magnet, switch, and many other places.

It has been found difficult heretofore in relays and elsewhere to supply and conveniently secure a set or pair of sets of coacting contact springs or terminals so that their insulation and alinement will remain perfect and their free ends within operative relation to the operating mechanism, as the armature of the relay, and which will at the same time provide a convenient way of fastening them to their support, as well as to the circuit-wires. Again, no mechanically strong, cheap, and simple way has been devised for connecting the circuit-wires with the terminals of the magnet-coils without either the use of fine delicate wires running to a fixed connecting-terminal from the terminals or connecting the circuit-wires directly to the terminals, either of which is objectionable. So, too, trouble is experienced in relays and the like where the length of the armature and the contact-spring support is limited substantially to that of the magnet-shell, or more frequently is the magnet-shell in obtaining a sufficient movement or leverage from the armature to operate the contact-springs without a prohibitive complication of parts. A way to quickly and easily remove the pivot-pin of the armature and at the same time have it act as an efficient support therefor has long been sought. All these objections it is the design of my invention to remove, as well as to accomplish the results sought in a simple, cheap, and effective manner; and it therefore consists in the novel details of construction and combinations of parts hereinafter fully described, and further pointed out in the appended claims, reference being had to the accompanying drawings, forming a part of this specification, in which the same reference characters represent like parts in the several views, and in which—

Figure 1 is a side elevation of a relay embodying my invention. Fig. 2 is a rear end view of the same. Fig. 3 is a front view of the same with the armature and contact-springs omitted. Fig. 4 is a perspective view of the springs and their mountings. Fig. 5 is a sectional view of the mounting. Fig. 6 is a perspective view of the insulating-block in which the springs are mounted. Fig. 7 is a similar view of the insulating-strip between the contact-springs. Fig. 8 is a similar view of the clamping-piece. Fig. 8ª is a similar view of one of the contact-springs. Fig. 9 is a perspective view of the armature-support. Fig. 10 is a similar view of the armature. Fig. 11 is a corresponding view of the pivot-pin. Fig. 12 is a side elevation of a tubular-shell relay embodying my improvements. Fig. 13 is a rear end view of the same, and Fig. 14 is a diagram of a telephone system in which my invention may be used.

Referring to Sheet 1 of the drawings, 2 designates the magnet-coil, which has end pieces 3, of insulation or of any suitable material, and a core 4, passing through the center of the coil 2 and projecting slightly therebeyond at each end, it being threaded at 5 on the rear end for the purpose of attaching it to its support. A plate or strip 6 extends beneath the coil 2, and upon it rests the end blocks 3, the forward end projecting even with the corresponding end of the core and its rear end being bent vertically at the rear of the block 3 and forward again at the upper side of the block 3. This strip extends the magnetic circuit forward to the front end of the magnet

and corresponds in this respect to the shell of an inclosed or tubular magnet, it being virtually a section of such a shell. It forms as well a support for the operating devices of the relay and in some aspects of the invention is to be considered apart from its magnetic functions. A central aperture in the vertical portion 7 of this shell or supporting-plate is provided, through which the rear end of the core 4 is driven to make a firm and solid connection therebetween, the said aperture 9 being extended by a slot 10 below the core in order that the metal about the core may spring slightly and more closely fit the core. This rear end 7 of the strip, support, or shell-section is also apertured, as at 11, through which the insulated terminals 12 of the magnet-coil project and with which connection is made by a stationary soldering-terminal above, as hereinafter explained.

On the upper side of the arm 8 the contact-springs forming the switching-terminals of the relay and the stationary magnet-soldering connections are located. These consist of two sets of metallic strips side by side of three springs each and extending longitudinally of the relay, their rear ends being spread apart and projecting different distances beyond the rear end thereof, so as to more easily connect them with the circuit-wires. An additional strip is provided beneath each set of the said springs, which has an arm or projecting limb on the outer side extending down and on that side connecting with the magnet-terminal, thus making a rigid and firm connection for the circuit-wires and the magnet-terminals without the use of exposed connecting easily-broken wires. The means for securing these springs to their support, in this case the arm 8, consists of an insulating-block 20, slotted at 21 21 and centrally apertured at 22 at right-angles to the slots, through which a screw 23 is adapted to be inserted to secure all the part together and to their support, as hereinafter explained. This block is mounted upon the top of the arm 8 of the strip 6. The contact-springs are preferably wider than the slots and are therefore notched on their outer edges, as at 24, Fig. 8[a], to fit within the slots and to project slightly beyond the edge of the slots. Insulating-strips 25 are also notched, as at 26, to fit the slots in the block and are placed between the springs to effectually insulate them. The magnet-terminal strips are notched in the same way. When the desired number of springs are placed one above the other in the slots 21 of the block 20 with insulating-strips 25 between, an additional insulating-strip 25 is added, and the whole is clamped by a clamping-piece 27, so formed that its longitudinal edges 28 bear upon the sets of springs and insulating-strips. This piece 27 is centrally apertured, as at 29, and a screw 23 is passed through the apertures in the plate and block and is threaded into the arm 8, whereby the whole device may be securely and rigidly fastened to the said arm 8. It will be observed that the magnet-terminal strips 33 are also clamped and held in place by the screw 33 and plate 27.

In the particular form shown in Fig. 1 the sets of springs consist of upper and lower springs 30, which are more or less rigid, but are provided with flexible contact end pieces 31 riveted thereto and projecting over the ends of the more rigid portions 30. Between these springs 30 of each set a flexible spring 32 is provided, which is normally in contact with the lower spring 30 and is adapted to be lifted therefrom and brought into contact with the upper spring 31. Beneath these springs, as heretofore explained, other strips or terminals 33 are placed, which extend forward of the block 20 and are securely held in place in the grooves 21 and, as before explained, are provided with arms 34 at the rear of the block and upright portion 7, said arms extending downwardly and each arm being electrically connected with one of the magnet-terminals 12. This connection of the magnet-terminals is an especially advantageous one, as stated, in view of the fact that no small wires are placed outside of the protected parts of the magnet, and breakage and injury to them is therefore impossible. This way of mounting the springs prevents any longitudinal movement of them in the support and affords an easy way of keeping them in alinement. Of course it will be understood that the two sets of springs in a telephone-line accommodate both sides of the metallic line, but in other relations this might not be desirable. At the other end of the magnet a brass plate 40 is provided, having substantially the form shown in Fig. 9, and has a central aperture 41, adapted to be placed over the front end of the core 3 of the magnet. It is provided with rivet or screw holes 42, by which it may be secured to the said block 3. At the upper corners of the plate 40 arms 43 project forwardly and upwardly, and the armature 50 of the magnet is adapted to be pivoted between these arms. At the lower side and centrally thereof a lug or short arm 44 extends down to the plate 6 and projects slightly beyond the latter, so as to prevent the armature from freezing to the core 4 and shell-piece 6. At its upper edge and to one side of the center a rearwardly-extending arm 46 is provided, which acts as a stop for the armature-lever 57.

The armature 50 comprises the flat portion adapted to hang substantially in a vertical position in front of the magnet-core and the case 6 and to complete the magnetic circuit thereat. At is upper edge it is provided with an extended arm, which is bent forwardly and then rearwardly over the top of this end of the magnet to a point beneath the free ends of springs 32, a pivot-hole 55 being provided in this raised portion, through which the pivot-pin 56 is adapted to extend to swingingly

mount the armature on the ears 43. The rearward portion 57 of said armature extension is located beneath the ends of the springs 32 and is provided with insulating projections 57^a, adapted to bear against the springs 32, so as to lift the latter. This armature extension may be slotted, as at 58 and 59, in order to lighten the structure, but such formation is not necessary.

Upon the operation of the magnet the flat portion of the armature will be attracted and the rear arm 57 will be raised, lifting the springs 32 from the lower contacts 31 to the corresponding upper contacts. The object of the forwardly-extending arms, lugs, or ears 43 of the armature-support and the corresponding forward bend in the lever of the armature is to secure greater movement of the lever 57 than would be possible if the armature were pivoted to supports directly above or at its inner face in the usual way.

As a means of conveniently pivoting the armature without the necessity of using pivot-screws and other devices which are expensive, besides requiring accurate adjustment, with a corresponding liability to get out of order, a pin 56, having a return-crook or bent arm 61, is provided, the said arm 61 being adapted to extend through the neighboring aperture 62 in the ear 43, the sharp bend 61^a preventing its being shaken or worked out of place in the normal operation of the device, but permitting an easy removal of the same, for it is only necessary to grasp it with pliers or to insert some pointed instrument in the bend to readily withdraw it.

The above-described method of connecting springs to a relay or in a similar place of connecting a strong terminal with the magnet-terminals and of supporting an armature so as to provide a long leverage without complication of parts, as well as to simply and conveniently pivot the same, are or may be advantageously applied in many and various relations. As showing their use in connection with tubular or inclosed shell magnets reference may be had to Figs. 12 and 13, in which the shell 70 is shown having at its rear end the insulating-block 20^a secured thereto, as in the case of Fig. 1, with the exception, of course, that the lower side of the block must be made to conform to the shape of the tubular shell, but in which the same method of supporting the springs together in a block and in clamping them in position, as well as mounting them on the magnet-shell by a single screw, is shown. The same method also of connecting the magnet-terminals to the stationary terminals is shown and is especially valuable in this relation, as in a tubular-shell magnet it is more convenient to lead the magnet-terminal through the rear end of the shell than in any other way. In this case the strip 33, with its arm 34, is shown as connected to a magnet-terminal 12, as above explained. The springs in this case are clamped down by a flat plate 27^a instead of the one shown in Fig. 1, but the same results are accomplished. Insulating-supports 80, seated in depressions in the shell 70, may be provided for the front ends of the lower springs 30. The same kind of an armature-support is applicable here also, integral lugs or ears 75 being provided on the forward end of the magnet-shell 70, in which the armature 50^a is pivoted, as before, by means of the bent pin 60. The armature 50^a is substantially the same as the one previously described.

While this relay is capable of use in any system of circuits where it is desired to accomplish the same results and while its several features are applicable in many relations, one system in which it is especially useful is shown diagrammatically in Fig. 14, in which a telephone subscriber's station A is indicated, having the usual transmitter, receiver, bell, and induction-coil and whose line is extended by the conductors *a* and *b* to the central office C, where they normally terminate in the conductors *d* and *e*, connected with the battery *f* and annunciator *g*, as well as the relay-armatures *h* and *i*, which correspond to the springs 32 in the other figures. When the subscriber removes his receiver, the telephone-hook rises and closes the circuit thereat over the line and through the battery *f* and annunciator *g*. The operator upon seeing the signal inserts her answering-plug *k* into the jack *m*, which connects the ground branch *o* to the conductor *r*, and thereby energizes relay *s* to disconnect the battery *f* and annunciator *g* from the line. The energization of relay S operates to connect the line with the tip-and-sleeve contacts of the jacks *m* and *t* through the medium of the conductors *a'* and *b'*. With the two jacks thus provided and arranged the central station can be of the multiple-switchboard type, though it will be readily understood that this part of the system, and also the apparatus at the substation, can be of any suitable known or approved form. The same operation so far as the relay is concerned takes place whenever any other jack is plugged into.

The invention is not to be limited to the specific details shown and described, for I hold it to include all such changes as fairly fall within its scope and principle.

The invention is defined in the following claims:

1. A relay having a support or body portion, a block of insulating material mounted upon said body or support, said block being formed with a couple of parallel grooves, a plurality of flat strips or switching-terminals with interposed insulation fitted within said grooves, a magnet and armature, said armature being adapted and arranged to engage one or more of said strips or switching-terminals, a clamping member for holding said strips and interposed insulation in place, and

a screw extending through said clamping member and said block of insulation, said screw also extending into said body or support.

2. In a relay, the combination of a body or support, a magnet mounted upon said support, a block of insulation provided with grooves, a set or bundle of superimposed strips or flat springs fitted in each groove, insulation intermediate of said strips or flat springs, the forwardly-projecting end portions of said strips or flat springs serving as contact-pieces, the rearwardly-extending arms or portions of said strips or springs being adapted for connection with circuit-wires, a pivoted armature arranged in front of said magnet and having an arm adapted to engage one or more of said strips or flat springs, a clamping member for holding said strips or flat springs in place, and a connecting member extending through said clamping member and said block of insulation, said block of insulation being rigidly connected with said body or support.

3. A relay comprising a suitable body or support, an electromagnet mounted upon said body or support, the core of said electromagnet having an end portion extending through said body or support, said projecting end portion of the magnet-core being threaded, a brass plate secured at the forward end of the relay structure, an armature pivoted to said brass plate and provided with an arm, said brass plate having a projection adapted to serve as a stop for the armature, a plurality of flat springs or contact-strips secured in a block of insulation, said block of insulation being secured to said body or support, said flat springs or contact-strips having flexible projecting portions, and the arm of said armature being adapted to engage one or more of said flexible projecting portions.

4. In a switching device, the combination with a support, of a block of insulation mounted thereon and having parallel grooves, switching-terminals arranged in two series or sets and notched to fit within said grooves, strips of insulation also notched to fit said grooves and placed between the strips and on top of the two series or sets, a clamping-plate having its two edges adapted to bear upon said series or sets, the said plate and block being centrally apertured, a screw adapted to pass therethrough to clamp said plate upon the series or sets of terminals and to secure the whole to the support.

5. The combination with a magnet-coil having terminals projecting therefrom, of a support for the same, metallic strips mounted upon said support, each strip having an arm secured to one of the said terminals, and each strip being adapted for connection with a circuit-wire.

6. The combination with a magnet-coil, of a support therefor, the terminals of said coil being extended through said support, strips of metal rigidly mounted upon said support, each having two arms of each strip, one of said arms being connected with one of said terminals, and the other arm of each strip projecting outwardly in position to be connected with a circuit-wire.

7. The combination with a magnet-shell or magnetic part, of insulated coil-terminals supported therein and projecting therethrough, insulated connecting or terminal strips rigidly supported on said shell or magnetic part, each strip having an integral arm adapted to be soldered to one of said terminals, and each strip having another projecting arm adapted for attachment to a circuit-wire.

8. The combination with a tubular magnet-shell, of coil-terminals projecting through the rear end of said shell and insulated therefrom, connecting terminal-strips supported upon the said shell and insulated therefrom, each strip having an arm connected with one of the said terminals, and each strip having another arm adapted to be connected with a circuit-wire.

9. The combination with a tubular magnet-shell, of coil-terminals projecting through the rear end of said shell and insulated therefrom, an insulating-block upon the side of said shell, said block having parallel grooves, terminal-strips in said grooves, each strip having an arm attached to one of said terminals, and each strip having a rearwardly-projecting portion, switching-strips mounted in said grooves and provided with rearwardly-projecting ends, insulating-strips between said strips, a clamping-plate adapted to bear upon said strips, and means to firmly clamp all of said strips in the support and to the shell.

10. The combination of an armature, a magnet and a support therefor, said support comprising a brass plate having a flat portion centrally apertured to fit over the magnet-core, and having upwardly and outwardly extending ears, a lower arm projecting beyond the magnetic parts of the magnet to prevent the armature from adhering to the magnet, and an upper rearwardly-extending lug between said ears, said armature being pivoted between said ears and having a rearwardly-extending lever adapted to rest upon said lug when the magnet is deënergized.

11. In a relay the combination with a magnet-support and a magnet, switching-terminals mounted on the rear end of said support with their free ends projecting forwardly, an armature for the front end of the magnet, ears on the front end of the magnet projecting beyond the armature, a lever or arm on said armature pivoted between the projecting ends of said ears, said lever or arm extending rearwardly into operative relation with the said free ends of the switching-terminals.

12. The combination with pivot-arms, of an armature pivoted therein, the said arms and armature having registering apertures, and one of the arms having an adjacent aperture, a pivot-pin having a portion passing through

the said registering apertures, said pin also having a portion adapted to be passed through the said adjacent aperture.

13. The combination with pivot-arms, of an armature pivoted therein, the said arms and armature having registering apertures, and one of the arms having an adjacent aperture, a pivot-pin having a portion passing through the said registering apertures, and provided with another substantially parallel part having a short bend therein, said substantially parallel part being adapted to be passed through said adjacent aperture and held therein by said short bend.

Signed by me at Chicago, Cook county, Illinois, this 22d day of May, 1901.

ALBERT CARLISS.

Witnesses:

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