

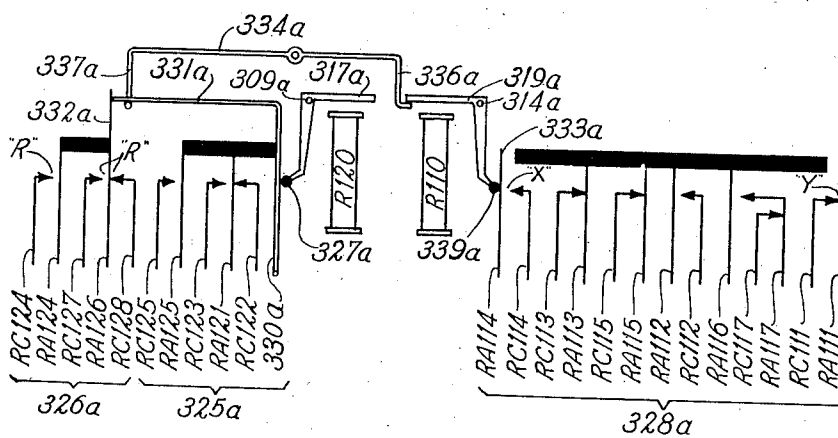
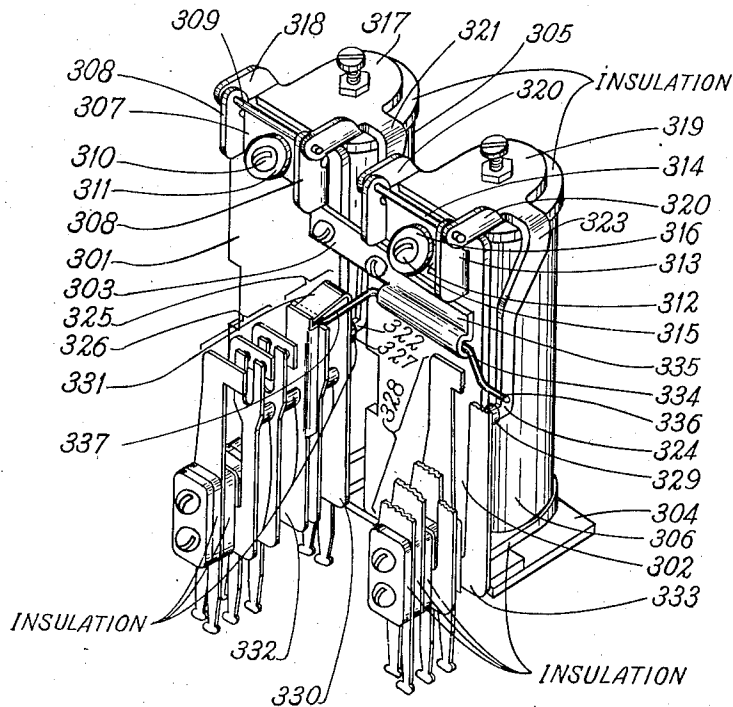
May 7, 1940.

J. E. OSTLINE

2,199,570

RELAY

Filed Nov. 12, 1938



UNITED STATES PATENT OFFICE

2,199,570

RELAY

John E. Ostline, Chicago, Ill., assignor to Associated Electric Laboratories, Inc., Chicago, Ill., a corporation of Delaware

Application November 12, 1938, Serial No. 240,001

17 Claims. (Cl. 200—98)

The present invention relates to line circuits for automatic telephone systems and more particularly to improved relays adapted to be incorporated in the line circuits.

5 In an automatic telephone system, usually a line circuit is individually associated with each line thereof, which line circuit conventionally comprises separate and distinct line, cut-off and lockout relays mounted upon a supporting panel. 10 These three relays are ordinarily so connected and arranged that the automatic switches in the system having access to a line are controlled in accordance with the various operations thereof to set up, by way of the line, outgoing call connections from and incoming connections to a sub- 15 scriber substation associated with the line, and that the line is marked as busy to the automatic switches having access thereto in the event a fault appears upon the line. Furthermore, these 20 relays are so connected and arranged that the automatic switches in the system having access to the line are controlled in accordance with other operations thereof to set up, by way of the line, reverting call connections between two of the 25 subscriber substations associated with the line, in the event the line is of the multiparty type.

While line circuits of the type briefly described above are entirely satisfactory in operation, they are more expensive to manufacture and to maintain in service than is desired, primarily due to the fact that three separate and distinct relays are required in each line circuit in order to render the previously mentioned services by way of the associated line.

30 In order to reduce the manufacturing and maintenance costs of line circuits, improved line circuits, disclosed in the copending application of Clarence E. Lomax, Serial No. 234,781, filed October 13, 1938, were developed. Also, in the above-mentioned Lomax application, a combined line and cut-off relay is disclosed which is incorporated in the improved line circuits disclosed therein. Briefly, this combined line and cut-off 40 relay disclosed in the above-mentioned Lomax application comprises a support, line and cut-off magnets carried by the support, contact actuating members respectively associated with the magnets, a contact set operatively associated with each of the members, and a mechanical arrangement for controlling the operation of the mem- 50 ber associated with the line magnet in two steps. The mechanical arrangement is controlled by the operation of the member associated with the cut-off magnet and is so constructed and arranged 55 that the member associated with the line magnet

is only partially operated when the line magnet winding is energized prior to the energization of the cut-off magnet winding, that this member is fully operated when the line magnet winding is energized subsequent to the energization of the cut-off magnet winding, and that this member is operated from a partially operated position to a fully operated position when the cut-off magnet winding is energized subsequent to and while the line magnet winding is energized. The contact sets operatively associated with these members are controlled in accordance with the various operations thereof.

Although the improvements as disclosed in the previously mentioned Lomax application considerably reduce the manufacturing and maintenance costs of line circuits, further reductions in these costs are desirable and may be realized by further simplifying the construction and arrangement of the combined line and cut-off relays incorporated therein and by incorporating these improved combined line and cut-off relays in the improved line circuits embodying further simplified control circuits disclosed in the copending application of Pier Bakker, Serial No. 239,990, filed November 12, 1938.

Accordingly, it is an object of the present invention to provide an improved relay particularly adapted for use as a combined line and cut-off relay in a telephone line circuit, which is of extremely simple and rugged construction and arrangement and which is economical to manufacture and thoroughly reliable in operation.

Another object of the invention is to provide a relay of the character described which includes a support, first and second magnets carried by the support, a plurality of contact sets, and an improved arrangement for controlling the operations of the contact sets in accordance with the operations of the magnets.

A further object of the invention is to provide a relay of the type described which comprises an improved mechanical arrangement for governing the operation of at least one of the contact sets, and means for controlling the mechanical arrangement in accordance with the operations of first and second magnets.

The features of the present invention are illustrated as being incorporated in a relay particularly adapted for use as a combined line and cut-off relay in a telephone line circuit and comprising a support, first and second magnets carried by the support, a movable contact actuating member operatively associated with the first magnet, a movable contact actuating member oper-

actively associated with the second magnet, a first contact set operatively associated with the first-mentioned member, a second contact set operatively associated with the second-mentioned member, a third contact set, each of the contact sets having a normal position and being movable away from its normal position in response to the operation of the one of the members with which it is operatively associated, and means for operatively associating the third contact set with the first-mentioned member, thereby to control the operation of the third contact set away from its normal position and to control the return of the third contact set to its normal position.

In accordance with one feature of the invention, the relay comprises a support, first and second magnets carried by the support, a movable contact actuating member operatively associated with the first magnet, a movable contact actuating member operatively associated with the second magnet, a first contact set operatively associated with the first-mentioned member, a second contact set operatively associated with the second-mentioned member, a third contact set, means normally effective operatively to associate the third contact set with the first-mentioned member, each of the contact sets having first and second positions and being movable from its first position to its second position in response to a predetermined movement of the one of the members with which it is operatively associated, and automatic means for rendering the first-mentioned means ineffective. More particularly, the means normally effective operatively to associate the third contact set with the first-mentioned member comprises a blocking element carried by one of the first and third contact sets and normally engaging the other of the first and third contact sets; and each of the contact sets has a normal position and is movable away from its normal position in response to the operation of the one of the members with which it is operatively associated. Also, means is provided for biasing each of the contact sets to its normal position, whereby the third contact set is not moved away from its normal position in the event the first-mentioned member is operated subsequent to the operation of the second-mentioned member and the third contact set is returned to its normal position in the event the second-mentioned member is operated subsequent to the operation of the first-mentioned member.

In accordance with another feature of the invention, the relay comprises an actuating element associated with the blocking element, and means controlled when the winding of the second magnet is energized for causing the actuating element to move the blocking element, whereby the third contact set is controlled as previously pointed out. Furthermore, the actuating element comprises a rocking element pivotally mounted on the support, the rocking element having a first arm associated with the blocking element and a second arm associated with the second-mentioned member, the rocking element being so constructed and arranged that the second arm is operated in response to the operation of the second-mentioned member to rock the rocking element and cause the first arm to move the blocking element whereby the third contact set is controlled, as previously pointed out. Finally, the blocking element is reset when the windings of both of the first and second magnets are deenergized.

In accordance with a further feature of the

invention, the relay comprises first, second and third switch spring assemblies, each including a number of flexible switch springs and having a normal position, means for biasing each of the switch spring assemblies to its normal position, the first switch spring assembly being operatively associated with the first-mentioned member, the second switch spring assembly being operatively associated with the second-mentioned member, each of the first and second switch spring assemblies being movable away from its normal position in response to the operation of the one of the members with which it is operatively associated, and means including a flexible element carried by a spring in one of the first and second switch spring assemblies and normally engaging a cooperating spring in the other of the first and third switch spring assemblies for operatively associating the third switch spring assembly with the first switch spring assembly, whereby the third switch spring assembly is moved away from its normal position when the first switch spring assembly is moved away from its normal position. Furthermore, the relay comprises means controlled by the operation of the second-mentioned member for moving the flexible element out of engagement with the cooperating spring, whereby the third contact set is controlled, as previously pointed out.

The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawing, in which Figure 1 is a perspective view of a relay embodying the present invention and which is adapted to be incorporated in the line circuit of a telephone system; and Fig. 2 illustrates diagrammatically the arrangement of the switch springs associated with the relay when it is incorporated in the line circuit of a telephone system.

Referring now more particularly to Fig. 1 of the drawing, the relay there shown comprises a supporting plate including two portions 301 and 302 suitably secured together by an arrangement including a strap 303 and an outwardly extending plate 304. The portions 301 and 302 of the supporting plate respectively carry first and second magnets 305 and 306 arranged in spaced parallel relationship with respect to each other and to the corresponding portions of the supporting plate, each being provided with a suitable energizing winding. Also, the magnets 305 and 306 are arranged closely adjacent to each other and comprise, together with the portions 301 and 302 of the supporting plate, a unitary structure. A supporting bracket 307 provided with two upwardly extending arms 308 carrying a pivot pin 309 is secured to the upper portion 301 of the supporting plate by an arrangement comprising a screw 310 and a washer 311; and a supporting bracket 312 provided with two upwardly extending arms 313 carrying a pivot pin 314 is secured to the upper portion 302 of the supporting plate by an arrangement comprising a screw 315 and a washer 316. An armature 317 provided with two rearwardly extending arms 318 is pivotally supported on the pivot pin 309 adjacent the pole face of the core of the first magnet 305; and an armature 319 provided with two rearwardly extending arms 320 is pivotally supported on the pivot pin 314 adjacent the pole face of the core

of the second magnet 306. The armature 317 is provided with a downwardly extending arm 321 having a rearwardly projecting finger 322 on the outer end thereof extending to the rear of the portion 301 of the supporting plate adjacent the right-hand edge thereof; and the armature 319 is provided with a downwardly extending arm 323 having a rearwardly projecting finger 324 on the outer end thereof extending to the rear of the portion 302 of the supporting plate adjacent the right-hand edge thereof. Two contact sets or switch spring assemblies 325 and 326, each comprising a plurality of individual flexible switch springs suitably insulated from each other and from the portion 301 of the supporting plate, are secured to the rear side of the portion 301 of the supporting plate and cooperate with an insulating button 327 carried by the finger 322 in such a manner that the individual switch springs in these switch spring assemblies are actuated into engagement and disengagement with each other in a predetermined manner, when the armature 317 is rotated about the pivot pin 309. Also, a contact set or switch spring assembly 328, comprising a plurality of individual flexible switch springs suitably insulated from each other and from the portion 302 of the supporting plate, is secured to the rear side of the portion 302 of the supporting plate and cooperates with an insulating button 329 carried by the finger 324 in such a manner that the individual switch springs in this switch spring assembly are actuated into engagement and disengagement with each other in a predetermined manner, when the armature 319 is rotated about the pivot pin 314.

More particularly, the switch spring assembly 325 comprises a spring 330 provided with a flexible rearwardly extending flange or blocking element 331 adjacent the upper portion thereof which normally abuts or engages the upper portion of a spring 332 included in the switch spring assembly 326. Accordingly, when the armature 317 is rotated in a clockwise direction about the pivot pin 309, as viewed in Fig. 1, the insulating button 327 carried by the finger 322 engages the spring 330 and flexes the upper portion thereof rearwardly. The rearward movement of the spring 330 actuates the individual switch springs included in the switch spring assembly 325 into engagement and disengagement with each other in a predetermined manner more fully described subsequently. Furthermore, the flange 331 provided on the upper portion of the spring 330 engages the upper portion of the spring 332 and flexes the upper portion thereof rearwardly. This rearward movement of the spring 332 actuates the individual switch springs included in the switch spring assembly 326 into engagement and disengagement with each other in a predetermined manner more fully described subsequently. When the armature 319 is rotated in a clockwise direction about the pivot pin 314, as viewed in Fig. 1, the insulating button 329 carried by the finger 324 engages a switch spring 333 included in the switch spring assembly 328 and flexes the upper portion thereof rearwardly. This rearward movement of the switch spring 333 actuates the individual switch springs included in the switch spring assembly 328 into engagement and disengagement with each other in a predetermined manner more fully described subsequently.

As previously noted the switch spring assemblies 325 and 326 are normally simultaneously actuated away from their normal positions by the movement of the armature 317. However, an arrangement is provided for rendering the actuation of the switch spring assembly 325 independent of the actuation of the switch spring assembly 326 and for releasing the switch spring assembly 326, thereby to cause the latter switch spring assembly to be returned to its normal position in the event that it is actuated. This arrangement comprises a rocking bar 334 comprising a bearing portion rotatably secured between the rear wall of the portion 302 of the supporting plate and a tab 335 formed integral with the strap 303 and arranged closely adjacent to the rear wall of the portion 302 of the supporting plate. Furthermore, the rocking bar 334 comprises an outwardly and downwardly extending arm 336 arranged in the path of movement of the arm 323 carried by the armature 319 and an outwardly and rearwardly extending arm 337 arranged beneath the flange 331 provided on the upper portion of the spring 330 included in the switch spring assembly 325. When the armature 319 is rotated in a clockwise direction about the pivot pin 314, the arm 323 thereon engages the arm 336 on the rocking bar 334, thereby to cause the rocking bar to be rotated in a clockwise direction upon its bearing, as viewed in Fig. 1. When the rocking bar 334 is rotated in a clockwise direction upon its bearing, the arm 337 thereof engages the flange 331 provided on the upper portion of the spring 330 included in the switch spring assembly 325 and flexes the flange 331 upwardly and out of abutting relation with the upper portion of the spring 332 included in the switch spring assembly 326. At this time, if the armature 317 occupies a non-operated position and is subsequently operated, only the switch spring assembly 325 will be actuated. However, if the armature 317 occupies an operated position, the switch spring assembly 326 will be released and returned to its normal position due to the fact that the outer end of the flange 331 provided on the upper portion of the spring 330 is flexed out of abutting relation with the upper portion of the spring 332. Thus, it will be apparent that in the event the winding of the first magnet 305 is energized prior to the energization of the winding of the second magnet 306, the switch spring assemblies 325 and 326 are simultaneously actuated away from their normal positions. However, in the event the winding of the second magnet 306 is energized prior to the winding of the first magnet 305, only the switch spring assembly 325 is actuated upon the energization of the winding of the first magnet 305. Finally, in the event that the winding of the second magnet 306 is energized subsequent to the energization of the winding of the first magnet 305, the switch spring assembly 326 is released and returned to its normal position when the winding of the second magnet is energized. The switch spring assembly 328 is actuated away from its normal position directly in accordance with the energization of the winding of the second magnet 306 and the actuation thereof is independent of the sequence of energizing the windings of the first and second magnets 305 and 306, respectively.

Referring now more particularly to Fig. 2 of the drawing, it will be observed that the switch spring assemblies associated with the first and second magnets R120 and R110, respectively, are so constructed and arranged that, when the first magnet R120 is energized, the armature indicated at 317a is rotated in a clockwise direction about the pivot pin 309a, thereby to cause the insulating button 327a carried thereby to flex

the upper portion of the spring 330a. This movement of the spring 330a is effective to actuate the switch spring assembly 325a, thereby to move the switch springs RA125 and RC125 into engagement, to move the switch springs RA121 and RC122 into disengagement, and to move the switch springs RA121 and RC123 into engagement. Also, this movement of the spring 330a causes the flange 331a carried by the upper portion thereof to engage the spring 332a included in the switch spring assembly 326a, thereby to actuate the latter switch spring assembly. This actuation of the switch spring assembly 326a is effective to move the switch springs RA126 and RC126 into disengagement, to move the switch springs RA126 and RC127 into engagement, and to move the switch springs RA124 and RC124 into engagement. This movement of the switch springs RA124, RC124 and RA126, RC127 is effective to close the "R" contacts associated therewith; and this movement of the switch springs RA126, RC126 is effective to open the "R" contacts associated therewith. Subsequently, when the second magnet R110 is energized, the armature indicated at 319a is rotated in a counterclockwise direction about the pivot pin 314a, thereby to cause the insulating button 329a carried thereby to engage the switch spring 333a included in the switch spring assembly 328a and flex the upper portion thereof, thereby to actuate the individual switch springs included in this switch spring assembly. This movement of the switch spring 333a is effective to move the switch springs RA114 and RC114 into engagement, thereby to close the "X" contacts associated therewith. Subsequent movement of the switch spring 333a is effective to move the switch springs RA113 and RC113 into disengagement, to move the switch springs RA115 and RC115 into disengagement, to move the switch springs RA112 and RC112 into engagement, to move the switch springs RA116 and RA117 into engagement, and, finally, to move the switch springs RA117 and RC117 into disengagement. Final movement of the switch spring 333a is effective to move the switch springs RA111 and RC111 into disengagement, thereby to open the "Y" contacts associated therewith.

Also, when the armature 319a is rotated in a counterclockwise direction about the pivot pin 314a, the arm 336a of the rocking bar 334a is engaged, thereby to cause the rocking bar to be rotated in a clockwise direction about its pivot. This rotation of the rocking bar 334a is effective to cause the arm 337a thereof to flex the outer end of the flange 331a provided on the upper portion of the spring 330a included in the switch spring assembly 325a out of engagement with the upper portion of the spring 332a included in the switch spring assembly 326a. The switch spring assembly 326a is then released and the individual switch springs thereof are actuated to their normal positions, thereby to move the switch springs RA124, RC124 and RA126, RC127 into disengagement and to move the switch springs RA126, RC126 into engagement. Also, it is noted that in the event the second magnet R110 is energized prior to the energization of the first magnet R120, the switch spring assembly 328a is actuated, in the previously described manner, incident to the energization of the second magnet R110, and the flange 331a provided on the upper portion of the spring 330a included in the switch spring assembly 325a is flexed out of engagement with the upper por-

tion of the spring 332a included in the switch spring assembly 326a. Accordingly, when the first magnet R120 is then energized, only the switch spring assembly 325a is actuated, in the previously described manner.

The manner of utilizing a relay of the character of that disclosed as a combined line and cut-off relay in the line circuit of a telephone system is disclosed in the previously referred to copending application of Pier Bakker.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, means normally effective operatively to associate said third contact set with said first-mentioned member, each of said contact sets having first and second positions and being movable from its first position to its second position in response to a predetermined movement of the one of said members with which it is operatively associated, and automatic means for rendering said first-mentioned means ineffective.

2. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, means normally effective operatively to associate said third contact set with said first-mentioned member, each of said contact sets having first and second positions and being movable from its first position to its second position in response to a predetermined movement of the one of said members with which it is operatively associated, and means controlled by the predetermined movement of said second-mentioned member for rendering said first-mentioned means ineffective.

3. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, means normally effective operatively to associate said third contact set with said first-mentioned member, each of said contacts having a normal position and being movable away from its normal position in response to the operation of the one of said members with which it is operatively associated, and means controlled by the operation of said second-mentioned member for rendering said first-

mentioned means ineffective, whereby said third contact set is not moved away from its normal position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned member.

4. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, means normally effective operatively to associate said third contact set with said first-mentioned member, each of said contacts having a normal position and being movable away from its normal position in response to the operation of the one of said members with which it is operatively associated, means for biasing each of said contact sets to its normal position, and means controlled by the operation of said second-mentioned member for rendering said first-mentioned means ineffective, whereby said third contact set is returned to its normal position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member.

5. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, mechanical means for operatively associating said third contact set with said first-mentioned member, each of said contact sets having first and second positions and being movable from its first position to its second position in response to the operation of the one of said members with which it is operatively associated, means for biasing each of said contact sets to its first position, and automatic means for actuating said mechanical means, whereby said third contact set is not moved to its second position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned member and said third contact set is returned to its first position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member.

6. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, mechanical means for operatively associating said third contact set with said first-mentioned member, each of said contact sets having first and second positions and being movable from its first position to its second position in response to the operation of the one of said members with which it is operatively associated, means for biasing each of said contact sets to its first position, and means controlled by the operation of said second-mentioned mem-

ber for actuating said mechanical means, whereby said third contact set is not moved to its second position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned member and said third contact set is returned to its first position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member.

7. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, mechanical means for operatively associating said third contact set with said first-mentioned member, each of said contact sets having first and second positions and being movable from its first position to its second position in response to the operation of the one of said members with which it is operatively associated, means for biasing each of said contact sets to its first position, and an actuating element operatively associated with said mechanical means and said second-mentioned member, said actuating element being so connected and arranged that said mechanical means is actuated in response to the operation of said second-mentioned member, whereby said third contact set is not moved to its second position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned member and said third contact set is returned to its first position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member.

8. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, means including a blocking element having a normal position for operatively associating said third contact set with said first-mentioned member, each of said contact sets having first and second positions and being movable from its first position to its second position in response to the operation of the one of said members with which it is operatively associated, means for biasing each of said contact sets to its first position, and actuating element operatively associated with said blocking element and said second-mentioned member, said actuating element being so constructed and arranged that said blocking element is actuated away from its normal position in response to the operation of said second-mentioned member, whereby said third contact set is not moved to its second position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned member and said third contact set is returned to its first position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member, and means controlled by the restoration

of both of said members for returning said blocking element to its normal position.

9. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, mechanical means for operatively associating said third contact set with said first-mentioned member, each of said contact sets having first and second positions and being movable from its first position to its second position in response to the operation of the one of said members with which it is operatively associated, means for biasing each of said contact sets to its first position, and a rocking element pivotally mounted on said support, said rocking element having a first arm associated with said mechanical means and a second arm associated with said second-mentioned member, said rocking element being so constructed and arranged that said second arm is operated in response to the operation of said second-mentioned member to rock said element and cause said first arm to actuate said mechanical means, whereby said third contact set is not moved to its second position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned member and said third contact set is returned to its first position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member.

10. A relay comprising, in combination, a support, first and second magnets carried by said support and each provided with an energizing winding, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, means normally effective operatively to associate said third contact set with said first-mentioned member, each of said members being operative when the winding of the associated magnet is energized, each of said contact sets having first and second positions and being movable from its first position to its second position in response to the operation of the one of said members with which it is operatively associated, means for biasing each of said contact sets to its first position, and means controlled when said second magnet winding is energized for rendering said first-mentioned means ineffective, whereby said third contact set is not moved to its second position in the event said first magnet winding is energized subsequent to the energization of said second magnet winding and said third contact set is returned to its first position in the event said second magnet winding is energized subsequent to the energization of said first magnet winding.

11. A relay comprising, in combination, a support, first and second magnets carried by said support and each provided with an energizing winding, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first con-

tact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, mechanical means for operatively associating said third contact set with said first-mentioned member, each of said contact sets having first and second positions and being movable from its first position to its second position in response to the operation of the one of said members with which it is operatively associated, means for biasing each of said contact sets to its first position, each of said members being operative when the winding of the associated magnet is energized, and means controlled when said second magnet winding is energized for actuating said mechanical means, whereby said third contact set is not moved to its second position in the event said first magnet winding is energized subsequent to the energization of said second magnet winding and said third contact set is returned to its first position in the event said second magnet winding is energized subsequent to the energization of said first magnet winding.

12. A relay comprising, in combination, a support, first and second magnets carried by said support and each provided with an energizing winding, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, a first contact set operatively associated with said first-mentioned member, a second contact set operatively associated with said second-mentioned member, a third contact set, means including a mechanical element having a normal position for operatively associating said third contact set with said first-mentioned member, each of said contacts sets having first and second positions and being movable from its first position to its second position in response to the operation of the one of said members with which it is operatively associated, means for biasing each of said contact sets to its first position, each of said members being operative when the winding of the associated magnet is energized, means controlled when said second magnet winding is energized for actuating said mechanical element away from its normal position, whereby said third contact set is not moved to its second position in the event said first magnet winding is energized subsequent to the energization of said second magnet winding and said third contact set is returned to its first position in the event said second magnet winding is energized subsequent to the energization of said first magnet winding, and means controlled when said first and second magnet windings are deenergized for returning said mechanical element to its normal position.

13. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, first, second and third contact sets each having first and second positions, means for biasing each of said contact sets to its first position, said first contact set being operatively associated with said first-mentioned member, said second contact set being operatively associated with said second-mentioned member, each of said first and second contact sets being movable from its first position to its second position in response to the opera-

tion of the one of said members with which it is operatively associated, means including an element normally effective operatively to associate said third contact set with said first contact set, whereby said third contact set is moved from its first position to its second position when said first contact set is moved from its first position to its second position, and means controlled by the operation of said second-mentioned member for rendering said element ineffective, whereby said third contact set is not moved to its second position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned member and said third contact set is returned to its first position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member.

14. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, first, second and third contact sets each having first and second positions, means for biasing each of said contact sets to its first position, said first contact set being operatively associated with said first-mentioned member, said second contact set being operatively associated with said second-mentioned member, each of said first and second contact sets being movable from its first position to its second position in response to the operation of the one of said members with which it is operatively associated, means including a movable element carried by one of said first and third contact sets and normally engaging the other of said first and third contact sets for operatively associating said third contact set with said first contact set, whereby said third contact set is moved from its first position to its second position when said first contact set is moved from its first position to its second position, and means controlled by the operation of said second-mentioned member for moving said element out of engagement with said other of said contact sets, whereby said third contact set is not moved to its second position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned member and said third contact set is returned to its first position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member.

15. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, first, second and third contact sets each having first and second positions, means for biasing each of said contact sets to its first position, said first contact set being operatively associated with said first-mentioned member, said second contact set being operatively associated with said second-mentioned member, each of said first and second contact sets being movable from its first position to its second position in response to the operation of the one of said members with which it is operatively associated, means including an element having a normal position for operatively associating said third contact set with said first contact set, whereby said third contact set is moved from its first position to its second position

when said first contact set is moved from its first position to its second position, means controlled by the operation of said second-mentioned member for actuating said element away from its normal position, whereby said third contact set is not moved to its second position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned means and said third contact set is returned to its first position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member, and means controlled by the restoration of both of said members for returning said element to its normal position.

16. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, first, second and third switch spring assemblies each including a number of flexible switch springs and having a normal position, means for biasing each of said switch spring assemblies to its normal position, said first switch spring assembly being operatively associated with said first-mentioned means, said second switch assembly being operatively associated with said second-mentioned member, each of said first and second switch spring assemblies being movable away from its normal position in response to the operation of the one of said members with which it is operatively associated, means including a flexible element carried by a spring in one of said first and third switch spring assemblies and normally engaging a cooperating spring in the other of said first and third switch spring assemblies for operatively associating said third switch spring assembly with said first switch spring assembly, whereby said third switch spring assembly is moved away from its normal position when said first switch spring assembly is moved away from its normal position, and means controlled by the operation of said second-mentioned member for moving said element out of engagement with said cooperating spring, whereby said third contact set is not moved away from its normal position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned member and said third contact set is returned to its normal position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member.

17. A relay comprising, in combination, a support, first and second magnets carried by said support, a movable contact actuating member operatively associated with said first magnet, a movable contact actuating member operatively associated with said second magnet, first, second and third switch spring assemblies, each including a number of flexible switch springs and having a normal position, means for biasing each of said switch spring assemblies to its normal position, said first switch spring assembly being operatively associated with said first-mentioned means, said second switch spring assembly being operatively associated with said second-mentioned member, each of said first and second switch spring assemblies being movable away from its normal position in response to the operation of the one of said members with which it is operatively associated, means including a flexible element carried by a spring in one of

said first and third switch spring assemblies and normally engaging a cooperating spring in the other of said first and third switch spring assemblies for operatively associating said third switch spring assembly with said first switch spring assembly, whereby said third switch spring assembly is moved away from its normal position when said first switch spring assembly is moved away from its normal position, and a rocking element pivotally mounted on said support, said rocking element having a first arm associated with said flexible element and a second arm associated with said second-mentioned member, said rocking element being so constructed and arranged that said second arm is

operated in response to the operation of said second-mentioned member to rock said element and cause said first arm to move said flexible element out of engagement with said cooperating spring, whereby said third contact set is not moved away from its normal position in the event said first-mentioned member is operated subsequent to the operation of said second-mentioned member and said third contact set is returned to its normal position in the event said second-mentioned member is operated subsequent to the operation of said first-mentioned member.

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