

April 15, 1941.

J. N. REYNOLDS
MULTICONTACT RELAY
Filed Aug. 5, 1939

2,238,076

3 Sheets-Sheet 1

Fig. 2.

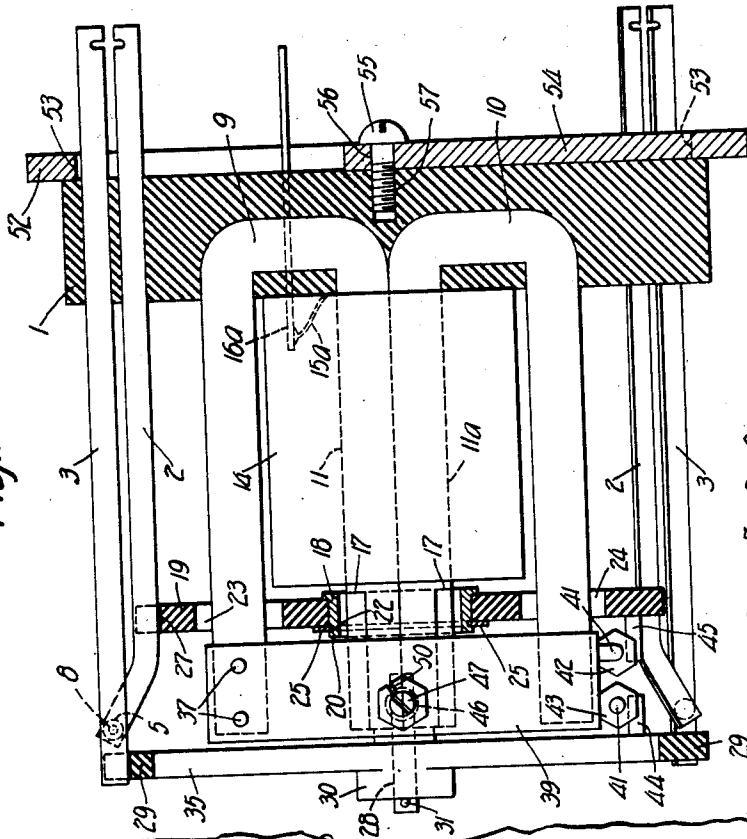


Fig. 3.

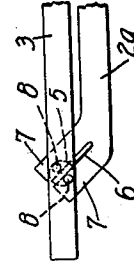
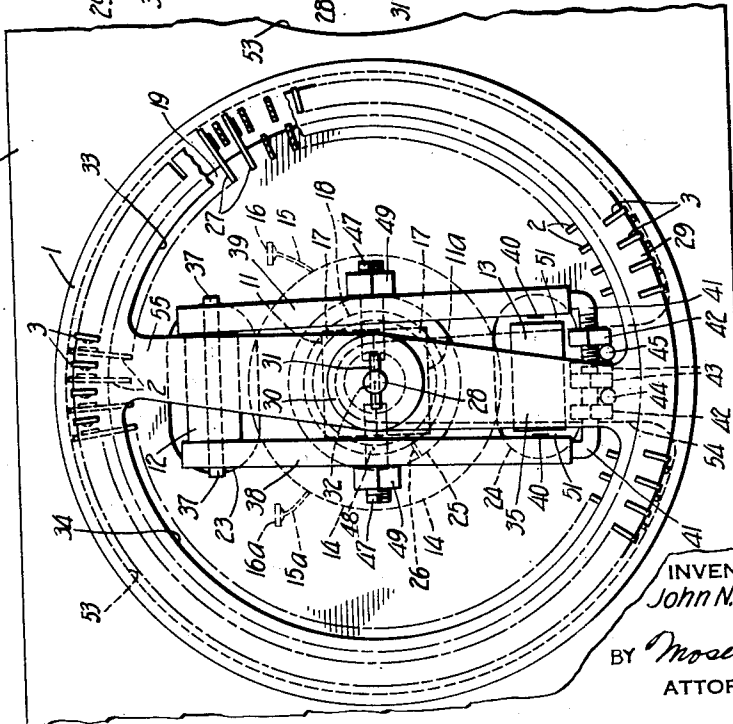


Fig. 1.



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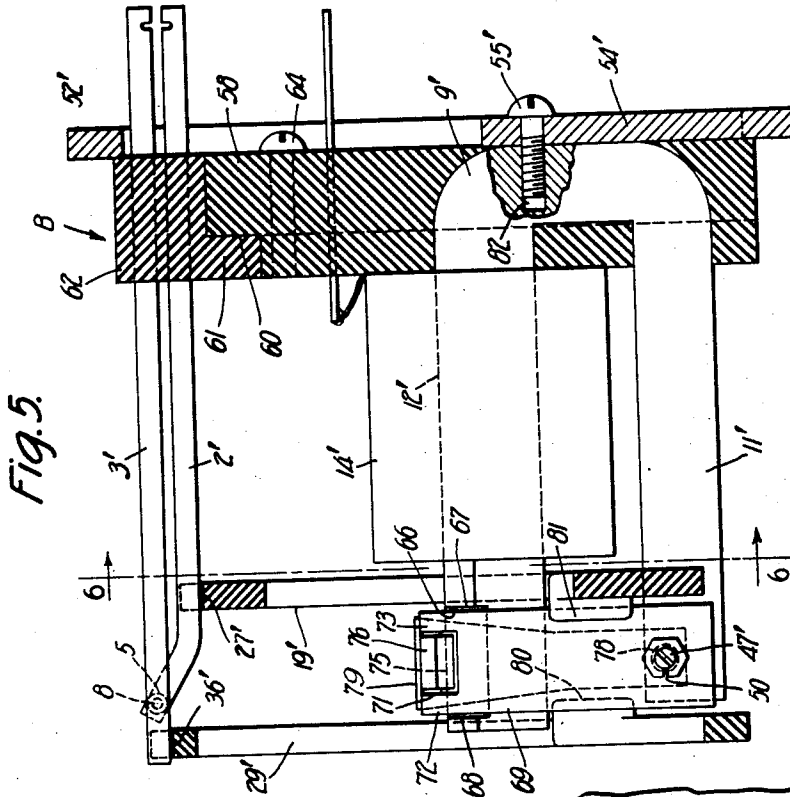
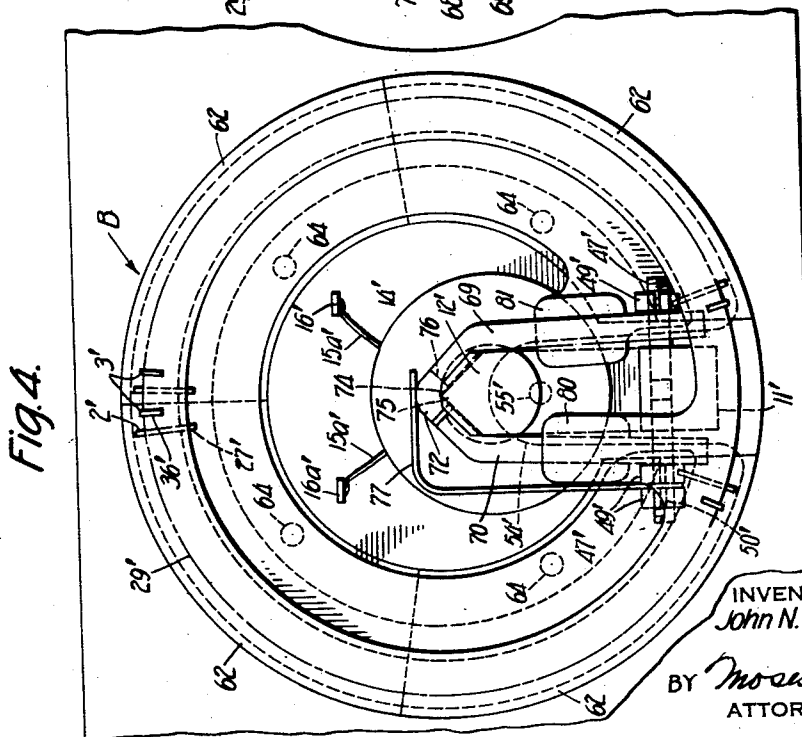
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3 Sheets-Sheet 2



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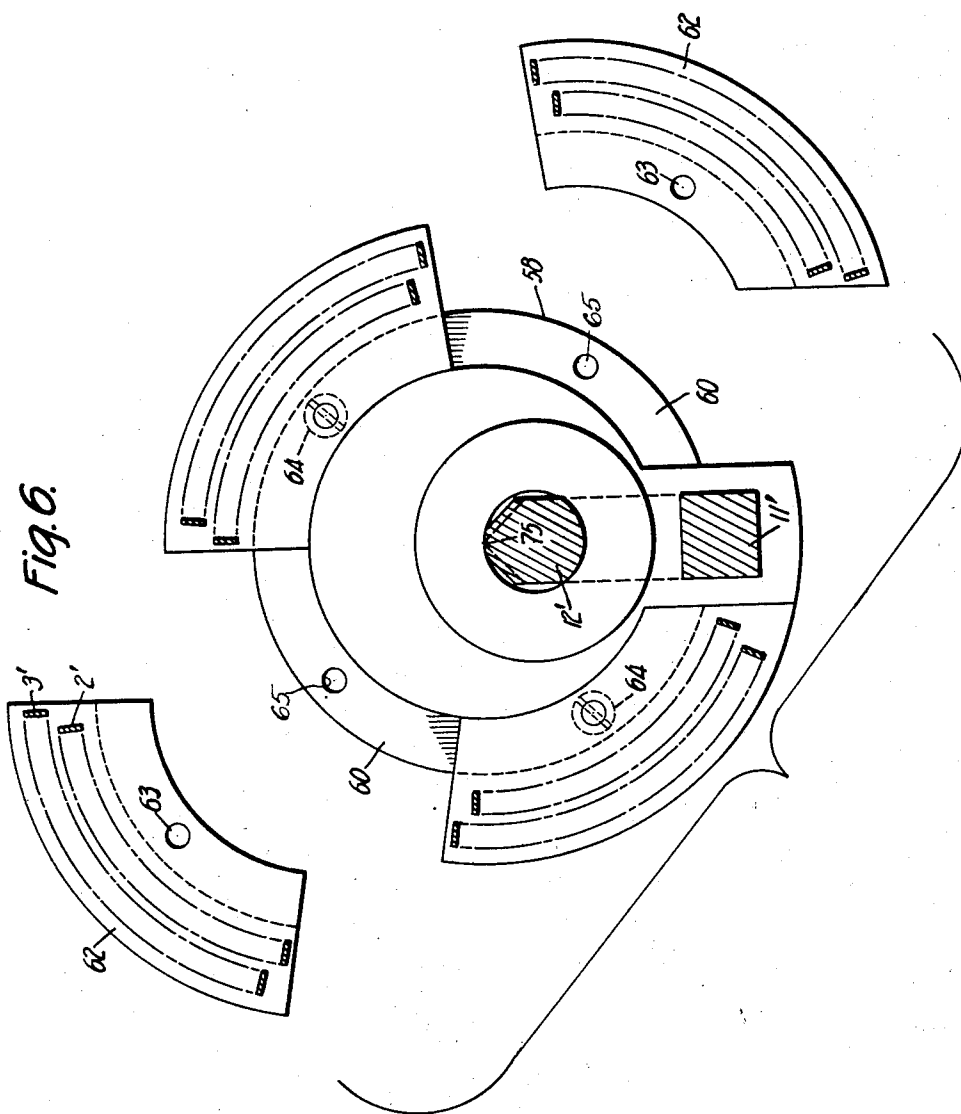
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3 Sheets-Sheet 3



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2,238,076

MULTICONTACT RELAY

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Application August 5, 1939, Serial No. 288,516

22 Claims. (Cl. 200—103)

This invention relates to relay devices which are adapted for making and breaking electrical circuits, and more especially circuits used in connection with telephone work. The subject matter of the present invention is in the nature of an improvement on the invention disclosed in my earlier filed application Serial No. 280,777, filed June 23, 1939. In said application a relay is disclosed in which a plurality of movable contact springs are actuated by a rotatable actuating plate which in turn is actuated by the armature of a two pole magnet. The movable contact springs cooperate with fixed contact springs which are supported in stationary positions to make or break circuits or to transfer circuits.

It is a main object of the present invention to provide a relay of the type described in which neither set of contact springs is stationary but both sets are movable toward and away from each other, so that each set has to move over only approximately one half of the total distance in order to effect the desired closure or opening of the circuits. In further pursuance of this object, each set of contact springs is actuated by a separate, rotatable actuating member or plate, these actuating plates being so arranged that they are rotated in opposite directions by an electromagnetic device having a single energizing coil.

A further object of the invention is to provide a novel means for rotating the contact spring actuating plates in opposite directions. In the preferred construction this means comprises a novel form of electromagnet provided with oppositely disposed movable armatures, one of which is mechanically connected to one of the actuating plates and the other to the other plate. In further pursuance of this object each armature is molded in the plate which it actuates, the plates being preferably molded of a moldable insulation material such as "tenite," "Bakelite," etc.

A still further object of the invention is to provide a novel and inexpensive means for pivotally mounting the armatures so arranged that they are both supported on an edge of the magnet pole which is coaxial with the axes of rotation of the contact spring actuating plates.

Another object of the invention is to provide a novel arrangement for mounting a large number of contact springs in which the total number of springs is divided into several groups, and all the springs of each group are molded in a sector shaped annular block of moldable insula-

tion material, these blocks being in turn secured to a common supporting base so that any one or more of the blocks, together with its attached contact springs, may be readily removed for repair or renewal.

Further objects will become apparent to those skilled in the art as the description of the invention proceeds. For a better understanding of the invention, reference is made to the accompanying drawings, in which,

Fig. 1 is a front and partially sectional view of a relay embodying the invention, showing also a portion of a relay supporting member;

Fig. 2 is a longitudinal sectional view of the relay and its supporting member shown in Fig. 1;

Fig. 3 is a fragmentary view showing the end portions of a modified form of contact springs;

Fig. 4 is a front view of a relay showing a modified form of the invention, also showing a portion of a support for the relay;

Fig. 5 is a longitudinal sectional view of the relay and its supporting member shown in Fig. 4; and

Fig. 6 is a fragmentary end view in section, taken on the line 6—6 of Fig. 5 showing certain portions of the relay and showing two of the component contact spring supports separated from the main supporting base of the relay.

The relays shown may be used to make, break or transfer one or more telephone or other electrical circuits and, referring first to Figs. 1 and 2, the relay therein shown comprises a main base 1 which is of generally cylindrical shape and has molded therein near its periphery a circular series of thin, metallic contact springs 2 and at a larger radius a second series of contact springs 3, the springs 2 being interposed midway between the springs 3 and being curved outwardly at their upper ends, as shown in Fig. 2, so that their contacts 4 lie opposite the contacts 5 secured to the springs 3, the springs 3 being substantially straight, as shown. To insure two different areas of contact and thus insure more certainty of contact in event one of the contact areas became covered with a slight insulating film, the end of each spring 2a may be slitted as at 6, Fig. 3, to provide the fingers 7, each of which carries a contact 8, so that both of the contacts 8 are adapted to engage the contact 5 carried by the spring 3.

Also molded in the base 1 is an electromagnet comprising the U-shaped iron cores 9 and 10 with their inner legs 11, 11a, disposed in contact with each other and their outer legs 12 and 13 disposed in alignment with the inner legs, as shown.

The energizing coil 14 is disposed about the inner legs 11, 11a with one end seated against the base 1, the ends of the coil being connected by the leads 15, 15a to the coil terminals 16, 16a which are also preferably molded in the base 1. The end of the legs 11, 11a is turned down to provide spaced shoulders 17 on which rests a bearing support 18 for the inner contact spring actuating plate 19. The annular bearing support 18 has outwardly projecting flanges 20 and 21 at its opposite ends and is provided with an undercut groove 22 adjacent the flange 20. In order to permit the mounting of the plate 19 on the bearing support 18, plate 19 is provided with the large open portions 23, 24, which serve to reduce its mass by a substantial amount and to permit the passage therethrough of the magnet legs 12 and 13. After the plate 19 has been placed in position, it is retained in its proper position on bearing support 18 by means of a thin annular washer 25 which is cut through as indicated at 26 to permit it to be spread apart and passed over the flange 20 and to then be released and become seated in the groove 22. The periphery of the plate 19 is provided with a series of narrow slits 27 in which the contact springs 2 are disposed so that upon rotation of the plate 19, the outer ends of the springs 2 will be moved simultaneously over equal distances.

Secured in a central position in the outer end of the magnet leg 11, 11a is a pin 28 which provides a pivotal support for the contact spring actuating plate 29, this plate being retained in its proper operating position by a hub 30 and a pin 31 which passes through a small bore 32 in the outer end of the pin 28. The plate 29 is provided with a pair of large openings 33, 34 disposed on the opposite sides of a central, diametrically disposed connecting rib 35, through which the pin 28 passes. The provision of the large openings 33, 34 in plate 29 serves to reduce its mass and inertia and permit its more rapid response to the passage of an energizing current through the coil 14. The peripheral edge of plate 29 is provided with a series of equally spaced, narrow slits 36 in which the ends of the contact springs 3 are disposed, so that upon rotation of plate 29, the contacts 5 carried by the springs 3 are moved over equal distances.

At its opposite faces the magnet leg 12 is provided with pairs of spaced pins 37, which serve to support the armatures 38 and 39 which extend outwardly a slight distance past the magnet leg 13 and are provided with small buttons 40 of non-magnetic material which engage the leg 13 and prevent the armatures from adhering thereto. For the purpose of adjustably connecting each armature to its contact spring actuating ring, it is provided with an angularly disposed connecting pin 41 which is threaded to engage the spaced nuts 42, 43. Preferably molded in the plate 29 and extending inwardly between the nuts 42, 43 carried by the armature 38, is a pin 44, a similar pin 45 being molded in the plate 19 and extending outwardly between the nuts 42, 43 carried by the armature 39.

Opposite the magnet leg 11, 11a each of the armatures 38, 39 is provided with a bore 46 through which loosely passes a threaded screw 47 whose inner end is screwed into a threaded bore 48 provided in the leg 11, 11a. A nut 49, which is slitted through, as at 50, fits the screw 47 snugly and is adapted to be engaged by the outer face of the armature for the purpose of regulating the thickness of the air gaps 51 between the armatures 38, 39 and the magnet pole 13. These air

gaps may be equalized by proper adjustment of the back stop nuts 49, so that the armatures will actuate the contact spring actuating plates to which they are connected through equal amounts. For the purpose of conveniently mounting a plurality of the relays in assembled relation so that they occupy only a limited amount of space, a supporting panel 52 is provided with a plurality of generally circular, spaced apertures 53 through which the inner ends of the contact springs 2, 3 extend and are available for connection to telephone or any other desired circuits. Extending upwardly within each of the apertures 53 and formed integral with the panel 52 is a supporting finger 54 to the inner surface of which the relay base 1 is clamped by a screw 55 passing loosely through a bore 56 in the finger 54 and engaging a threaded opening 57 in the center of base 1. By spacing the apertures 53 apart by a distance only slightly greater than the outside diameter of the base 1, a number of similar relays may be accommodated on a supporting panel 52 of limited length.

To operate the relay, an energizing current is passed through the coil 14 which causes the outer end of the magnet leg 11, 11a to assume a definite polarity, for example, to become a north pole, the ends of the legs 12, 13 simultaneously becoming south poles. This condition causes magnetic flux to pass through the armatures 38, 39 and their free ends to be attracted to the pole 13. Since the free end of armature 38 moves to the right, the contact spring actuating plate 29 which is connected thereto is rotated in a counter-clockwise direction, while motion of the free end of armature 39 to the left, causes the contact spring actuating plate 19 to be rotated in a clockwise direction. It is thus apparent that the outer ends of the contact springs 3 are simultaneously rotated through a small angle in a counter-clockwise direction while the outer ends of the contact springs 2 are simultaneously rotated in a clockwise direction. Upon stoppage of the current through coil 14, the magnet cores 9 and 10 become deenergized and the resiliency of the contact springs 2 and 3 causes the actuating plates 19 and 29 to return to their initial positions. The upper ends of the armatures 38 and 39 are prevented from working off the pins 37 by the back stop nuts 49 and the connections between the lower ends of the armatures and the actuating plates 19 and 29. With the structure described, it is readily possible to provide a relay having a diameter of substantially three inches with 60 complete sets of contact springs, thus insuring a very compact and inexpensive means for simultaneously making, breaking or transferring 60 electrical circuits.

In the modification shown in Figs. 4, 5 and 6, the arrangement of parts is generally similar to that above described in connection with Figs. 1 to 3 and similar parts are indicated by similar reference characters primed. In this modification, the main supporting base B comprises a central member 58 which is preferably formed of moldable insulation material in which the iron core 9' is molded. The outer face 59 of member 58 is recessed to provide a supporting shoulder 60 adapted for engagement with the inwardly projecting flanges 61 formed on the generally sector-shaped contact spring supports 62. Each of the supports 62 is preferably formed of molded insulation material such as "Bakelite," "tenite" or similar material and in which the inner ends of the contact springs 2' and 3' are molded and

arranged as shown. To permit ready removal for the purposes of repair or replacement, each of the contact spring supports 62 is provided with a threaded bore 63 adapted to be engaged by the end of a screw 64 which passes freely through one of a plurality of holes 65 formed through the base 58. The energizing coil 14' is disposed on the magnet leg 12' which is disposed parallel to leg 11', the outer ends of the legs 11', 12' forming the two poles of the magnet.

As in the modification shown in Figs. 1 and 2, the contact springs 2' are seated in narrow slits 21' formed in the periphery of an inner contact spring actuating plate 19' while the ends of contact springs 3' are seated in the slits 36', formed in the periphery of the contact spring actuating plate 29'. The outer end of magnet leg 12' is cut away as shown to provide the oppositely disposed notches 66 and form inner and outer shoulders 67, 68 between which the end portions of the magnet armatures 69 and 70 are disposed. Armature 69 has its end cut away to provide a centrally disposed notch 71 between the spaced apart fingers 72, 73, the latter fingers being bent over, as shown in Fig. 4, to provide a face 74 for pivotal engagement with a sharp pivotal supporting edge 75 formed on the magnet leg 12'. The end of armature 70 is cut away to provide a narrow tongue 76 which is disposed between the fingers 72, 73 and has a face in pivotal engagement with supporting edge 75. A spring 77 is provided with a bore 78 adapted to pass over one of the screws 47' which are threaded into the leg 11a', the spring being clamped in position between the adjusting nuts 49' each of which snugly engages the screw 47' and is slit through at 50'. The spring 77 widens out as it approaches the inner ends of the armatures 69, 70 (see Fig. 5) and is bent over, as shown in Fig. 4, to provide a wide end portion 79 which engages the fingers 72, 73 and the tongue 76 for yieldingly urging the armatures 69, 70 into pivotal engagement with the pivotal edge 75.

In order to support the actuating plate 29', it is provided with an integral inwardly projecting lug 80 in which the armature 70 is molded whereby the latter supports the actuating plate. Similarly, the actuating plate 19' is provided with an integral, outwardly projecting lug 81 in which the armature 69 is molded, whereby the latter supports the plate 19'. It is thus apparent that no additional pivotal bearing supports for the contact spring actuating plates 19' and 29' are required. In this modification the supporting finger 54 and the main panel 52' from which it extends are formed of metal and the securing screw 55' engages a threaded bore 82 formed in the magnet core 9', which is preferably disposed in contact with the finger 54'. This arrangement causes a large portion of any heat which may be generated in the coil winding 14' to be transferred to the iron core 9' and, by conduction, to the finger 54' and main panel 52' on which a plurality of the relays may be mounted in the manner described.

The relay operates in a manner similar to that described in connection with the form shown in Figs. 1 and 2. Passage of current through the coil 14' causes the outer end of armature 70 to move to the right and cause the actuating plate 29' and its connected contact springs 3' to rotate counter-clockwise. Simultaneously, the outer end of armature 69 is drawn to the left, causing actuating plate 19' and its contact springs to rotate clockwise and effect the closing, open-

ing or transfer of the circuits. Adjustment of the air gaps between the armatures and pole piece 11' is readily secured by adjusting the nuts 49'.

I have described what I believe to be the best embodiments of my invention. I do not wish, however, to be confined to the embodiments shown, but what I desire to cover by Letters Patent is set forth in the appended claims.

I claim:

1. An electrical relay comprising, in combination, an electromagnet, a set of movable contact springs arranged along a circular arc, a second set of movable contact springs arranged along a circular arc surrounding and of greater radius than the first named arc, means actuated by the electromagnet for moving the first named set of contact springs simultaneously in one direction and means actuated by the electromagnet for moving the second set of contact springs simultaneously in the opposite direction.
2. An electrical relay as set forth in claim 1 in which the first and second sets of movable contact springs are concentrically arranged.
3. An electrical relay comprising in combination, a supporting base, an electromagnet mounted on said base, a rotatable actuating member supported on the electromagnet, a second rotatable actuating member supported on the electromagnet, a set of contact springs mounted on said base and having their ends in engagement with the first named actuating member, a second set of contact springs mounted on said base and having their ends in engagement with the second named actuating member, and means energized by the electromagnet for simultaneously rotating the first and second named actuating members in opposite directions.
4. An electrical relay as set forth in claim 3 in which the rotatable actuating members are coaxially mounted.
5. An electrical relay as set forth in claim 3 in which each of the actuating members is provided with a plurality of peripherally arranged narrow slits in which its contact springs are seated.
6. An electrical relay as set forth in claim 3 in which the means energized by the electromagnet comprises a pair of armatures supported on the electromagnet.
7. An electrical relay as set forth in claim 3 in which the means energized by the electromagnet comprises a pair of armatures and means for supporting the armatures on opposite sides of the electromagnet.
8. An electrical relay as set forth in claim 3 in which the means energized by the electromagnet comprises a pair of armatures supported on the electromagnet and independent adjustable means for adjusting the air gap between each armature and the electromagnet.
9. An electrical relay as set forth in claim 3 in which the supporting base is formed of moldable insulation material and both sets of contact springs are molded in the insulation material.
10. An electrical relay as set forth in claim 3 in which the supporting base comprises a centrally disposed member to which the electromagnet is secured and a plurality of radially extending sector shaped members secured to the central member, a plurality of contact springs of each of said sets of springs being secured to each of the sector shaped members.
11. An electrical relay as set forth in claim 3 in which the supporting base comprises a plurality of sector shaped members formed of mold-

able insulation material, a plurality of contact springs of each of said sets of springs being molded in each of the sector shaped members.

12. An electrical relay comprising in combination, a supporting base, an electromagnet supported on said base, a set of movable contact springs mounted on said base, a second set of movable contact springs mounted on said base, a contact spring actuating plate connected to the springs of the first set, a second contact spring actuating plate connected to the springs of the second set, at least two armatures adapted to be rotated in opposite directions and means whereby said armatures support the first and second named actuating plates respectively.

13. An electrical relay as set forth in claim 12 in which the electromagnet is provided with a pivotal supporting edge and each armature is provided with a face in engagement with the pivotal supporting edge.

14. An electrical relay as set forth in claim 12 in which the electromagnet is provided with a pivotal supporting edge in alignment with the centers of the spring actuating plates and each armature has a face in engagement with the pivotal supporting edge.

15. An electrical relay as set forth in claim 12 in which the contact spring actuating plates are formed of moldable insulation material and the armatures are molded in the insulation material.

16. An electrical relay as set forth in claim 12 in which the contact spring actuating plates are provided with integral projecting lugs formed of moldable insulation material and the armatures are molded in said lugs.

17. An electrical relay as set forth in claim 12 in which the electromagnet is provided with a pivotal supporting edge and a recess adjacent said edge and each armature has an end portion disposed in said recess and provided with a face in engagement with the pivotal supporting edge.

18. A relay device comprising an electromagnet, a plurality of movable contact springs, a

plate mounted for rotation and formed of moldable insulation material, means connecting the plate and the contact springs and an armature molded in said plate and disposed adjacent the electromagnet.

19. An electrical relay comprising, in combination, a first set of movable contact springs, a second set of movable contact springs, a rotatable actuating plate connected to the contact springs of the first set, a second rotatable actuating plate connected to the contact springs of the second set and means for simultaneously rotating said actuating plates in opposite directions, said means comprising a pair of armatures disposed between the actuating plates.

20. An electrical relay comprising in combination, a supporting base, a first set of spaced contact springs disposed on said supporting base in the form of a cage, a second set of spaced contact springs disposed on said supporting base in the form of a second cage surrounding the first cage, and means for simultaneously actuating the contact springs of the respective sets in opposite directions.

21. An electrical relay as set forth in claim 20 in which the supporting base is formed of moldable insulation material and the contact springs of both sets are molded in the insulation material with their lower ends projecting therefrom.

22. An electrical relay comprising, in combination, a supporting base, a first set of spaced contact springs disposed on said base, a second set of spaced contact springs disposed on said base, an electromagnet disposed on said base, a pivotal supporting edge and a pair of armatures connected to said sets of contact springs and arranged to actuate them in opposite directions, one of said armatures being provided with a pair of spaced apart fingers in contact with the pivotal supporting edge and the other armature being provided with an extended tongue arranged to contact the pivotal supporting edge between said spaced fingers.

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