Nov. 15, 1938. A. S. DUBUAR 2,136,612

ELECTROMAGNETIC MULTISWITCHING APPARATUS

Filed Sept. 11, 1936

FIG. 1

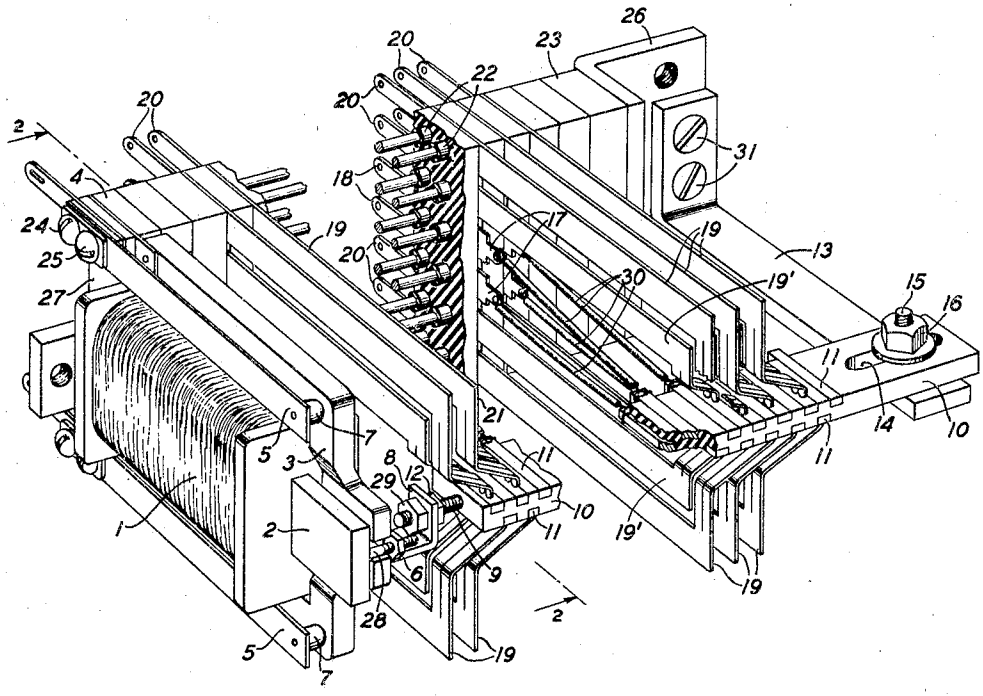


FIG. 2

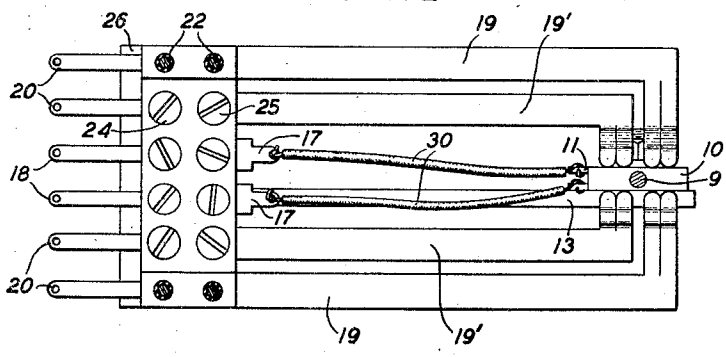
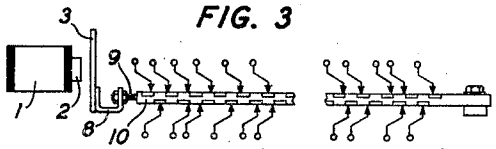


FIG. 3



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ELECTROMAGNETIC MULTISWITCHING APPARATUS

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4 Claims. (Cl. 200—104)

This invention relates to electromagnetic switching apparatus and more particularly to a relay structure of the multicontact type, that is, a relay which is adapted to control the operation of a plurality of contacts through a single draw-bar acted upon by the electromagnetic member of the relay or some element thereof.

One of the principal features of my invention is the application of the sliding contact principle to the construction of a multicontact relay which shall be free from contact vibration when the relay operates and when it releases.

Another object of the invention is the use of a "standard" contact spring which can be adjusted to "make" or "break" in relation to a conducting or non-conducting member of the draw-bar in order to produce any combination of contact closures required by the circuits to be controlled thereover, thereby avoiding the necessity of using different kinds of springs to produce the different contact combinations required by a variety of circuit functions. In the manufacture and maintenance of the relay, this is a great advantage over the conventional type relay, first because it permits the production and installation of a single type of spring which can be used on a number of relays of similar construction adapted to control a plurality of different circuit functions, secondly, because the springs can be assembled on the relay without the necessity of adjustment prior to shipment, and thirdly because the adjustment required by the springs of any relay can easily be made in accordance with the circuit requirements after the relay is installed on the apparatus frame and wired. In other words, the relay of my invention may be characterized as a "universal" relay which is easily adapted to different circuit conditions, is free from the usual contact troubles experienced with the ordinary relay, is relatively cheap to manufacture, and is easy to install and inexpensive to maintain.

These and other objects of the invention are more particularly defined in the appended claims, while the construction of the relay and the mode of its operation can best be understood from the following description taken in connection with the attached drawing in which:

Fig. 1 shows a perspective front elevation of the relay with parts cut away to show the internal structure and arrangement thereof;

Fig. 2 is a section of the relay drawn along line 2—2 of Fig. 1 to show the relation between the draw-bar and the contact springs cooperating therewith; while

Fig. 3 is a front conventional representation of the relay showing the relation of the springs to the common draw-bar and the relation of the latter to the armature of the magnet.

Referring to the construction in detail the magnetic structure of the relay is made up of the core 2 mounted upon the end support 27, the exciting coil 1 wound upon said core, and the armature 3 hinged at the rear to the magnetic block 4 in any suitable manner. The armature is held in its normal position of rest, that is, against the back-stop nut 6 carried by the threaded pin 28 secured to the front end of the core, by balancing springs 5 tensioned against the studs 7 secured on either side of the armature.

To the back-face of the armature and on the front portion thereof immediately behind the threaded pin 28 is attached a U-bracket 8 having an aperture through the center of its right leg to allow for the passage of the threaded stem 9 connected to one end of the commutator draw-bar 10. The commutator draw-bar 10, having a length adapted to the number of contact springs which the relay is designed to carry, is secured to the armature of the relay by the stem 9 passing through the aperture of bracket 8 and locked on either side thereof by the nuts 29 and 12, respectively, and is slidably secured to the end support 13 by bolt 15 which extends through the end support, passes through the elliptical slot 14 in the end of the draw-bar and is secured by nut 16. The support 13 is secured to clamping bracket 26 by screws 31. Thus when the magnet operates and the armature 3 is attracted to the core 2, the draw-bar, being attached to the armature by bracket 8, will move in the direction of the armature by virtue of its slidable attachment to the support 13. When the circuit of the magnet is opened and the armature releases, the draw-bar will move in the opposite direction to its position of rest under the influence of springs 5.

The draw-bar 10 is a non-conducting member transversely slotted to imbed a number of conducting segments 11 which are sunk into the slots flush with the surface of the draw-bar. The draw-bar may be slotted on its top surface alone or on both top and bottom surfaces depending upon the contact spring load which the relay is designed to carry, the whole of each surface being smooth and free of irregularities in order to present a free sliding surface to the contact springs projecting thereover when the draw-bar moves back and forth under the influence of the armature 3.

Each conducting segment 11, whether located on the top or the bottom surface of the draw-

bar, is connected with a lug 17 of a wiring terminal 18 by a flexible extension conductor such as 30, so that if an electric potential is connected to the terminal 18, the corresponding conducting segment 11 is raised to the same potential, which further may be completed into an electric circuit through the spring contact engaging the segment, as more completely described hereinafter.

The contact springs of the relay, indicated by the numerals 19 and 19' are of flexible spring contact metal, substantially L-shaped. The longer or horizontal arm of each spring terminates in a soldering terminal 20 and is provided adjacent thereto with apertures through which mounting screws may be extended for securing the springs to the relay frame as will later be described. The shorter or vertical arm of each spring is offset and may be bifurcated to form contacts which engage with the surface of the draw-bar as disclosed, or may terminate in a single contact portion.

A pair of springs is provided for each conducting segment 11 of the draw-bar, an outer spring 19 and an inner spring 19', the inner spring differing from the outer spring only in that it is smaller and is secured beneath and in vertical alignment with the outer spring. The width of the contact end of each spring is less than the length of a conducting segment 11.

The contact springs 19 and 19' and wiring terminals 18 are assembled in vertical units which may comprise one or two wiring terminals and both an upper and lower pair of contact springs or one pair of contact springs as may be required. The several vertical units are assembled between the end support 27 and the clamping bracket 26 and are insulated from the support 27, from the bracket 26 and from each other by interposed insulating blocks 23, the support 27, bracket 26 and blocks 23 being provided with apertures which align with the apertures in the springs 19 and 19' and in the wiring terminals 18. For clamping the entire assembly together screws 24 and 25 are provided which extend through the aligned apertures, and are insulated from the springs and wiring terminals by the insulating sleeves 22.

As can be seen from the figures of the drawing, the contacting tips of the springs rest upon the surfaces of the draw-bar and may be easily adjusted, when the draw-bar is in the normal position, to engage either the conducting segments 11 or the insulating segments therebetween. When the springs, or any of them, are adjusted to engage the associated conducting segments, the equivalent of a normally made contact, in the conventional sense, is effected due to the fact that an electrically conducting path is then established say, for instance, from the terminal 18, lug 17, conductor 30, segment 11, spring 19, and terminal 20 of said spring. When the armature 3 is operated and the draw-bar 10 moves to the left relative to the spring contacts which are fixed and stationary, this conducting path is broken because the conducting segment 11 of the draw-bar with which the spring is engaged in the normal position, is moved from under the tip of the spring and a contiguous but non-conducting segment is brought into contact with the tip of the spring, thereby giving the equivalent of a relay which, when operated, breaks two of its normally closed contact springs.

On the other hand, the spring may be adjusted quite as easily to engage a non-conducting segment when the draw-bar is in the normal position, in which case the equivalent of a relay with a normally open contact is provided. When the spring is so adjusted and the armature operates and pulls the draw-bar to the left, the conducting segment contiguous with the non-conducting segment with which the spring is engaged is moved under the tip of the spring contact, thereby effecting a closure between the spring and the adjacent conducting segment and completing an electric path through their respective terminals and the circuit conductors connected thereto.

Similarly, all springs regardless of the number used, although of similar construction (except that the inner springs 19' are of smaller dimension than the outer springs 19) can be assembled at the factory on the relay structure without regard to the contact combinations called for by the plurality of circuits which the relay may have to control. When the relay is mounted on the apparatus frame and wired in accordance with the circuit requirements, the individual springs may then be adjusted either to be normally "open" by adjusting their contact tips to engage corresponding non-conducting segments of the draw-bar, or to be normally "closed" by adjusting said tips to engage corresponding conducting segments. When the draw-bar is pulled by the action of the armature, the springs will either open or close the circuits controlled thereover, depending upon the character of their individual adjustment. Thus a relay is provided which readily adapts itself to simple production methods without any special requirements of contact spring construction and permitting the use of one type of contact spring for all circuit combinations.

It is also evident that the relay of my invention will operate and release without causing any vibration of the springs. The draw-bar slides back and forth between the contact springs and whatever momentum is acquired by the draw-bar during the act of operating or releasing is not dissipated by any collision with the contact springs themselves but only by the rebound of the armature against the pole face. This rebound is, of course, communicated to the draw-bar, but the width of its conducting and non-conducting segments is such that any vibration which results from the dissipation of the momentum will not be sufficient to cause the springs to pass out of contact with the respective segments with which they happen to be engaged.

What is claimed is:

1. In a multicontact switching apparatus, the combination with two end supports, of an electromagnet secured to one of said supports, a draw-bar secured to the armature of said electromagnet and slidably secured to the other of said supports, said draw-bar having insulating and conducting segments transverse to the longitudinal axis thereof, a plurality of sets of contact springs for sliding engagement with said segments, a terminal lug for each conducting segment, said sets of contact springs and terminal lugs being assembled into a plurality of units, a plurality of insulating blocks for separating said assembled units, means for clamping said units and blocks between said end supports and flexible conductors extending from said conducting segments to said terminal lugs whereby upon the operation of said electromagnet said draw-bar will be actuated to control a plurality of electrical paths between said springs and said lugs.

2. In an electromagnetic switching device, the combination with an energizing magnet and a

non-conducting draw-bar capable of oscillatory movement under the influence of said magnet, said draw-bar being provided with a plurality of transverse conducting segments, of a plurality of contact elements divided into as many groups as there are conducting segments, said groups being disposed in substantially parallel vertical planes with respect to the surface of said draw-bar, the individual contact elements in each group being adapted for contactual engagement with one conducting segment or the insulating portion of the draw-bar contiguous thereto.

3. In an electromagnetic switching device, a core, an energizing winding on said core, an armature, a draw-bar connected to said armature having conducting segments transversely imbedded in one of its surfaces, each of said conducting segments having a wiring lug projecting beyond the edge of said draw-bar, a group of contact springs for each of said conducting segments supported in planes perpendicular to the surface of said draw-bar, the depending contact portion of each of said contact springs being laterally adjustable to normally engage either said conducting segments or the adjacent non-conducting surface of said draw-bar, a plurality of wiring terminals supported rearwardly in the plane of said draw-bar, each one of said terminals being aligned with the wiring lug of a corresponding conducting segment, and a flexible conductor connecting the wiring lug of a conducting segment and its corresponding wiring terminal.

4. In an electromagnetic switching device, a core, an energizing winding on said core, an armature, a draw-bar connected to said armature having conducting segments transversely imbedded in both of its surfaces, each of said conducting segments having a wiring lug projecting beyond the edge of said draw-bar, a plurality of groups of contact springs, each group comprising a plurality of L-shaped springs having their longer arms supported edgewise and parallel to each other in a plane perpendicular to the surfaces of said draw-bar and the ends of their shorter arms being adjustable to normally engage either the conducting segments on the non-conducting surfaces of said draw-bar, a plurality of wiring terminals supported in the plane of each of said groups of springs and flexible conductors connecting said wiring terminals with the wiring lugs of said segments.

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