Oct. 29, 1946. A. W. VINCENT 2,410,136

MULTICONTACT RELAY

Filed Feb. 23, 1945 2 Sheets-Sheet 1

FIG. 1

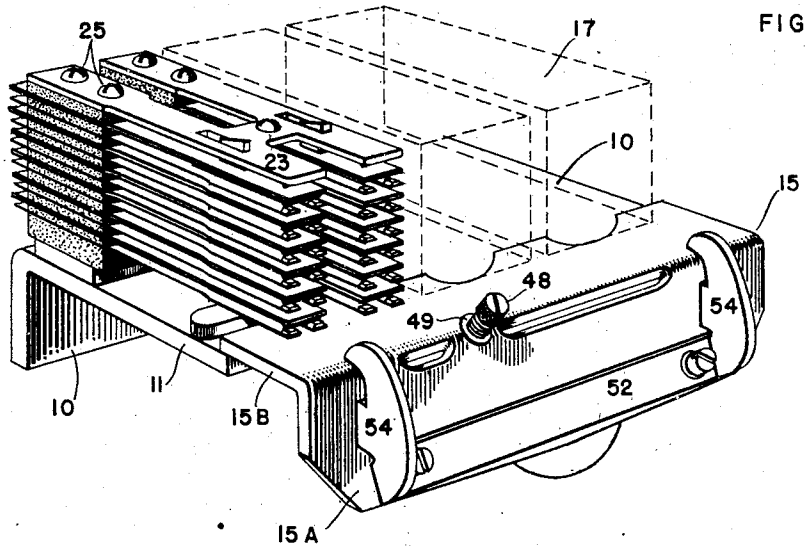


FIG. 2

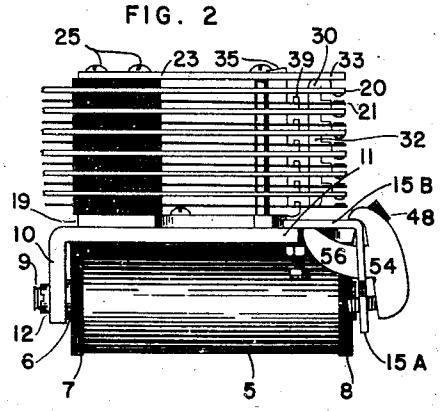
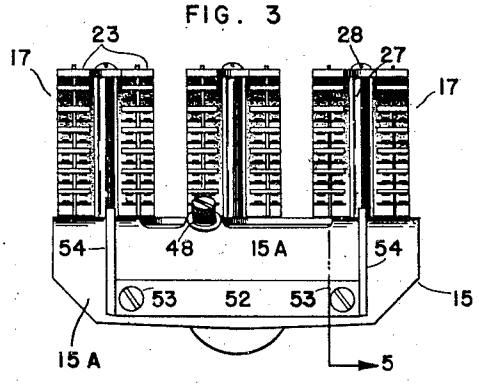


FIG. 3



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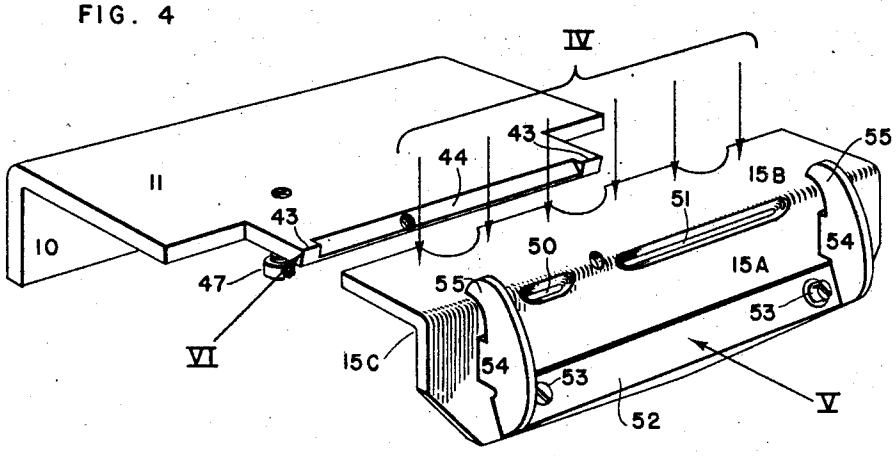
ATTORNEY

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MULTICONTACT RELAY

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FIG. 4



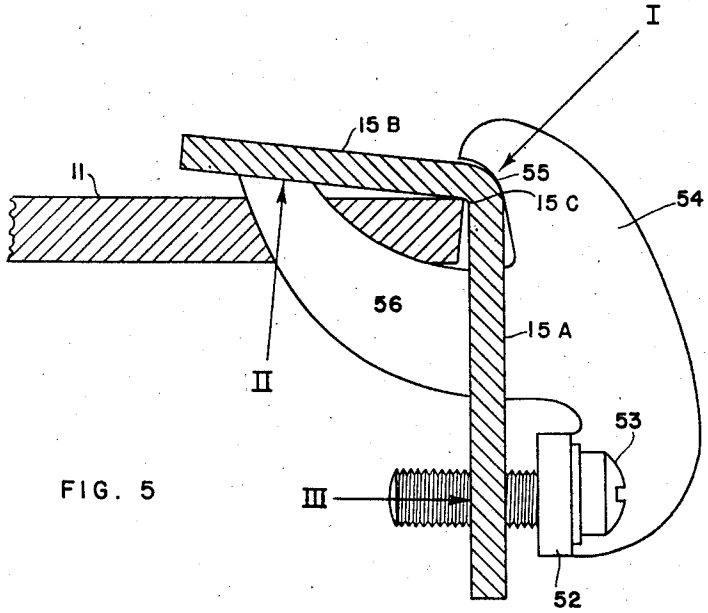


FIG. 5

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UNITED STATES PATENT OFFICE

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MULTICONTACT RELAY

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Application February 23, 1945, Serial No. 579,335

4 Claims. (Cl. 200—104)

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This invention relates to a multicontact or gang relay.

In a relay of the mentioned type, there are usually provided numerous stacks of contact springs arranged in side-by-side relation so that the relay armature for actuating these stacks of springs must be of considerable width. A wide armature presents real difficulties in providing a construction thereof which will possess the desired degree of lightness and yet will have sufficient rigidity and will have balanced forces applied thereto in such a manner that the armature will be substantially free from distortion due to its being operated. In addition the armature must be so constructed as to provide an angular adjustment whereby variations in core lengths and variations in contact spring combination parts, can be absorbed.

The main feature of this invention relates to the construction of a multicontact or gang relay which will satisfy these and other requirements.

Other features of the invention will appear from the detailed description and claims when taken with the drawings in which:

Fig. 1 is a perspective view while Figs. 2 and 3 are respectively a side elevation and an end elevation of the multi-contact relay of the present invention;

Fig. 4 is an exploded perspective view of the relay frame together with the armature having the adjusting and reinforcing support thereon both adapted to rock as a unit on said frame, the arrows indicating the application of forces to the several parts; and

Fig. 5 is an enlarged view of a fragment of the relay frame and the armature with its adjusting support in operating relation thereto, the arrows indicating the application of forces to the several parts.

The relay of this invention includes an energizing coil 5 which is secured on a core 6, of suitable ferromagnetic material. The coil 5 may be wound on a spool of insulating material of which only the end plates 7 and 8 are visible, or it may be wound directly on the core 6 in which case the insulating plates 7 and 8 will be mounted directly on the core to position the coil. An L-shaped frame of magnetic material has a short portion 10 mounted on the left end of the core, as illustrated in Fig. 2 and has its long portion 11 substantially equal in length to the core and extending in spaced parallel relation to the right end thereof. While the frame may be mounted on the core in any suitable manner, it is herein fastened thereto by an extension 12 of the core

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which passes through frame portion 10 where it is locked by the nut 9. Preferably the frame is originally made so that its internal angle is slightly less than ninety degrees. Also the end plate 8 is of such size that when the frame is secured to the core, the free end of the frame portion 11 will contact the end plate 8 which distorts the frame until its internal angle is substantially ninety degrees. The free end of the frame portion 11 is made, in a manner to be described, to provide a knife edge bearing on which the inner corner of an angular armature 15 can rock. This armature has a part 15A adapted to swing toward and away from the free end of the core 6 and has a part 15B which extends generally in the direction of the portion 11 of the magnetic frame. The part 15B of the armature in the course of its rocking movement, changes the relationship between certain of the contacts of a contact spring assembly generally designated 17. The contact spring assembly comprises a mounting plate 19, adapted to be secured by screws to the portion 11 of the frame. On this mounting plate there are secured six stacks of contact spring sets arranged into three pairs, although it will be understood that the invention is not limited to this number of stacks or to the specific arrangement thereof. Each stack of springs comprises a plurality of sets, each set including a stationary contact spring 20 and an armature spring 21. These springs at their left ends are separated from each other and from the mounting plate by strips of insulation, the strips of insulation and the contact springs being clamped between the mounting plate 19 and an H-shaped clamping plate 23 to clamp two adjacent stacks of springs. The clamping of the mentioned left ends of each stack of springs is effected by a pair of screws 25 enclosed by insulating sleeves (not shown) and passing through the clamping plate, the insulating strips and contact springs into the mounting plate 19. Each clamping plate has its right end maintained exactly spaced from the relay frame by a spacing sleeve 27 of insulation located between mounting plate 19 and the clamping plate 23. A screw 28 passing through these plates and through a sleeve 27 is screwed into the relay frame portion 11 to secure the several parts in position.

Since there are several sets of contact springs in each stack, it is important that the stationary springs maintain a definite space relation therebetween and that all of the armature springs have a like motion so that uniform contact pressures can be maintained at the various springs of

the stack. For this purpose, there is provided a spring stop **30** made of a strip of insulating material such as phenolic material and provided with a series of hooks **32**, one hook for each stationary contact spring. The stop strip **30** extends through alined openings in all of the springs of the stack and its upper end engages an extension **33** on the clamping plate, this extension being adapted to be bent upward or downward, in the course of the adjustment of the relay, to locate the free ends of the stationary springs in the desired position. It has been mentioned that the stop strip is provided with a series of hooks which engage parts on the stationary contact springs. It will be understood that since the upper end of the strip **30** engages the extension **33** and since the hooks on the strip are a predetermined distance apart, the upward or downward adjustment of the extension on the clamping plate causes a corresponding movement of the stationary contact springs. However, the spacing between these contact springs will always be maintained uniform. The armature springs, such as **21**, partake of the rocking movement of the free end of the portion **15B** of the armature. This rocking movement of the free end of the armature is translated into rectilinear movement by a pusher **35** for each stack of contact springs. Each pusher which is likewise made of a strip of insulating material, such as phenolic material, extends through alined openings in the stationary springs and armature springs as well as through an opening in the clamping plate. This strip is likewise provided with a series of hooks **39** to engage portions on the armature springs.

The above described spring contact assembly including the pusher and stop members are described and claimed in my co-pending application, Serial No. 647,890, filed February 15, 1946, and assigned to the same assignee as the present invention.

In accordance with present invention, the frame portion **11**, as shown in Fig. 4, has the corners at its right end cut away and the remainder of this end is machined to provide a knife edge bearing **43**, defined by an angle of slightly less than ninety degrees, adjacent each of the side edges of this frame portion. The mentioned end of the frame has a slabbed off portion **44** intermediate the knife edges **43**. The knife edges **43** provide a pivot on which the inner corner **15C** of the angular armature **15** can rock. This armature which is coextensive in length with the width of the frame portion, comprises parts **15A** and **15B**. As previously mentioned, the part **15A** of the armature is adapted to swing toward and away from the adjacent end of the core **6** while the armature part **15B** overlies the right end of the frame portion **11** to actuate certain of the contacts of the contact spring assembly **17** by means of the pushers **35**. The movement of the armature part **15B** away from the contact spring assembly is limited by the single adjustable back stop or screw **47**. This screw is threaded through the frame portion to extend into the path of travel of the armature part **15B**. Since the coil **5** is located along the principal axis of the relay, the screw **47** is necessarily located at one side of the coil **5** and therefore is located unsymmetrically with respect to the portions of the armature **15** at each side of said axis. The armature is held on the frame portion **11** by a retaining screw **48** with its encircling spring **49**, the screw **48** passing through an opening located in the bend of the armature and being threaded into an opening in

the slabbed off portion **14** of the frame (Fig. 4). The screw **48**, although nearer the mentioned axis of the relay than the back stop **47**, is also located unsymmetrically with respect to this axis. It will be noted that the armature has cut away portions **50** and **51** along its bend, the purpose of which will be later described.

The armature has a support **52** mounted thereon to provide angular adjustment of the armature bend so that variations in core lengths and variations in contact spring combination parts, can be absorbed. The support also functions as a rigid mechanical lever which assures such rigidity in the armature that substantially all work available in the magnetic circuit of the relay, will be transmitted for use in flexing the contact springs of the assembly. It will be understood that the movement of the armature is small and that the moment transmitted by the armature is large. Consequently, even a slight amount of bending of the armature would consume a large proportion of the available work.

The support **52** comprises a relatively thick strip extending along a substantial amount of the lower margin of the portion **15A** of the armature to which it is secured by adjusting screws **53**. These screws pass through openings in the support and are threaded into the mentioned margin of the armature. The support is provided at each of its ends with arms **54**, formed at right angles to the remainder thereof. Each arm **54** is provided with a hook-like fulcrum **55** to engage the bend of the armature and with a portion arranged to engage the inner surface of part **15A**. In the drawings, a lever **56** extends through the part **15A** of the armature, to contact the under surface of the armature part **15B**. By the use of this construction, when one of the screws **53** is adjusted inward, the lever **56** by contacting the under surface of armature part **15B** while the fulcrum **55** engages the armature bend, increases the angularity of the armature. The adjustment of a screw **53** outward causes the angularity of the armature to be reduced. In this instance the inherent resilience of the armature causes its part **15B** to follow the end of lever **56**.

In Fig. 5 there are illustrated the three forces I, II and III exerted by the support **52** upon the armature while the armature is being bent to the desired angle during adjustment of the relay. The forces illustrated in this last mentioned figure are also effective in preventing the bending or distortion of the armature due to the load of the several pushers **35** when the relay is operated. In Fig. 4 there are indicated by arrows IV the forces exerted by the armature on the six pushers and force V due to the magnetic circuit as well as the reaction force VI of the pivot edge **43** on the frame. The pusher forces IV and the restraining bending moments in the armature, act against the forces II of the two levers **56**. Inasmuch as these several forces are not directly opposite each other, there is a tendency for the outer ends of the armature beyond the knife edge pivots **43** and also a tendency for the center section of the armature between these knife edges **43** to droop or bow downward. The effect of this bowing is rendered negligible by locating the two arms **54** in such a position that the restraining bending moments and pusher forces on each side of the two supports, are approximately equal. In order to achieve this result it is necessary to provide the cut away portions **50** and **51** of unequal length at the bend in the center section of

the armature to eliminate the effect of the unbalanced bending moment at that region.

The above rather specific description of one form of the present invention is given solely by the way of example, and is not intended in any manner whatsoever, in a limiting sense. It is also to be understood that various modifications, adaptations and alterations may be applied to meet the requirements of practice, without in any manner departing from the spirit or scope of the present invention, except as limited by the appended claims.

What I claim is:

1. In a relay, a core provided with a coil, a frame for supporting said coil and said core and also providing spaced apart bearing portions, an angular armature having its inner corner engaging said bearing portions, whereby said armature can rock thereon with a first part of the armature movable toward and away from said core and with a second part of the armature movable toward and away from a part of the frame, contact springs mounted on said frame and arranged to be actuated in response to movement of the second part of said armature, a support extending along the longest margin of said first part of the armature to provide adjustability for and to give rigidity to the armature, said support being provided with a plurality of fulcrum parts engaging spaced points on the outer bend of said armature, said support being also provided with spaced portions engaging the inner surface of the second part of the armature, and means for adjusting said support toward and away from the first part of the armature.

2. In a relay, a core provided with a coil, a frame for supporting said coil and said core and also providing spaced apart bearing portions, an angular armature having its inner corner engaging said bearing portions, whereby said armature can rock thereon with a first part of the armature movable toward and away from said core and with a second part of the armature movable toward and away from a part of the frame, contact springs mounted on said frame at each side of the mid-point of said armature, means for actuating said springs in response to movement of the second part of said armature, a support extending along the longest margin of said first part of the armature to provide adjustability for and to give rigidity to the armature, said support being provided with a plurality of fulcrum parts engaging spaced points on the outer bend of said armature, said support being also provided with spaced portions engaging the inner surface of the second part of the armature, means for adjusting said support toward and away from the margin of the first part of the armature and an armature retainer extending through an opening in said armature into engagement with said frame, the bent portion of said armature at each side of said opening having cut away parts.

3. In a relay, a core provided with a coil, a frame for supporting said coil and said core and also providing spaced apart bearing portions, an angular armature having its inner corner engaging said bearing portions, whereby said armature can rock thereon with a first part of the armature movable toward and away from said core and with a second part of the armature movable toward and away from a part of the frame, a stop on said frame for limiting the movement of said last mentioned part of the armature toward said frame, said stop being located on said frame at one side of the mid-point of said armature, an armature retaining pin extending through an opening in the bend of the armature and into the end of the frame at one side of the mid-point of the armature, contact springs mounted on said frame at each side of the mid-point of said armature, means for actuating said springs in response to movement of the second part of said armature, a support extending along the longest margin of said first part of said armature to give rigidity to said armature, said support being provided with a plurality of fulcrum parts engaging spaced points on the outer bend of said armature, said support being also provided with spaced lever arms engaging the inner surface of the second part of the armature, and means for adjusting said support toward and away from the margin of the first part of the armature.

4. In a relay, a core provided with a coil, a frame for supporting said coil and said core and also providing spaced apart bearing portions, an angular armature having its inner corner engaging said bearing portions, whereby said armature can rock thereon with a first part of the armature movable toward and away from said core and with a second part of the armature movable toward and away from a part of the frame, contact springs mounted on said frame at each side of the mid-point of said armature, means for actuating said springs in response to movement of the second part of said armature, a support extending along the longest margin of said first part of the armature to provide adjustability for and to give rigidity to the armature, said support being provided with a plurality of fulcrum parts engaging spaced points on the outer bend of said armature, said support being provided with spaced integral arms extending generally at right angles to the main part of the support, each arm comprising a hook-like fulcrum and a lever, each fulcrum engaging the outer bend of the armature in the region of one of said bearings, and each lever engaging the inner surface of the second part of the armature, and means for adjusting said support toward and away from the margin of the first part of the armature.

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