July 17, 1956 J. JUCKER 2,755,356

ELECTROMAGNETIC RELAYS

Filed Nov. 20, 1951

2 Sheets-Sheet 1

Fig. 1

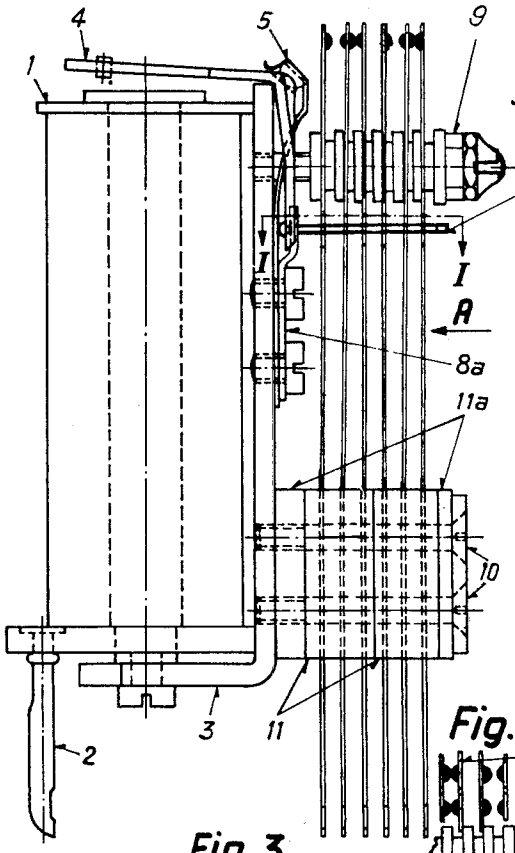


Fig. 2

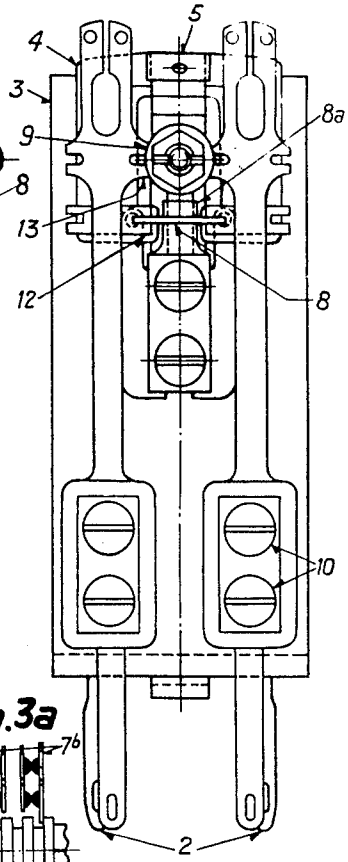


Fig. 3a

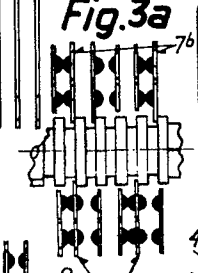


Fig. 3

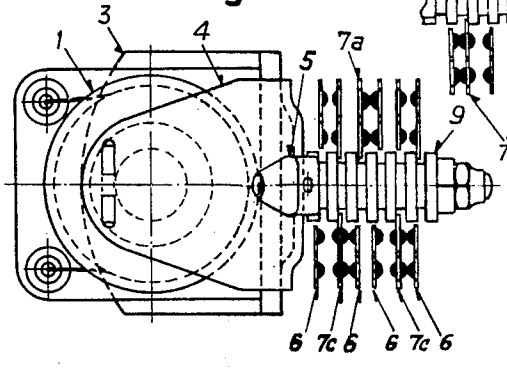
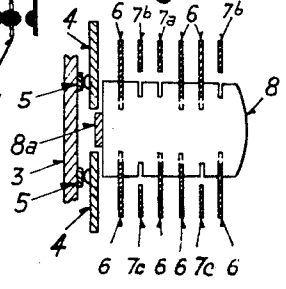


Fig. 4



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Fig.5

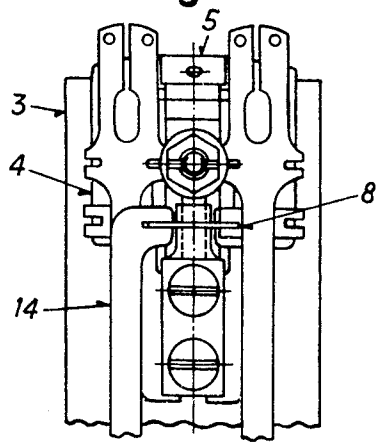


Fig.6

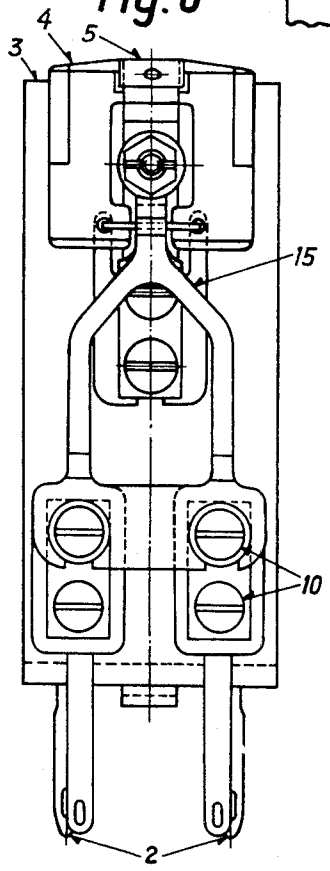
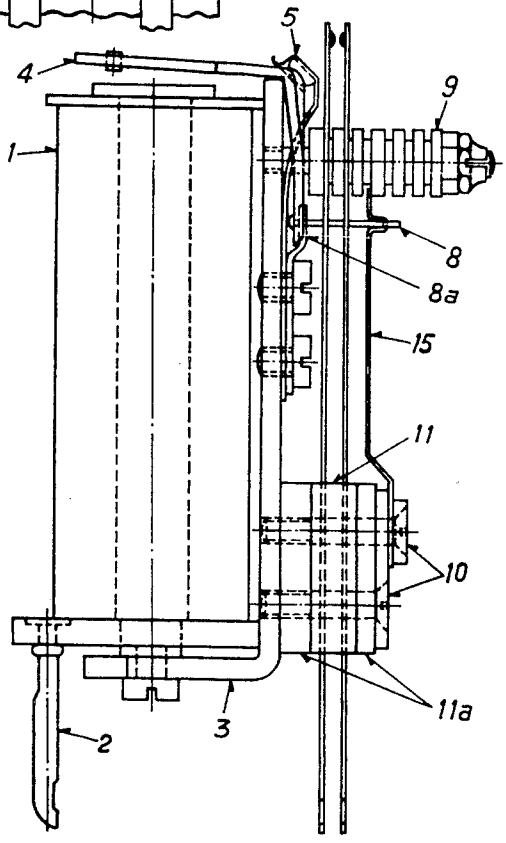


Fig.7



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United States Patent Office 2,755,356 Patented July 17, 1956

2,755,356

ELECTROMAGNETIC RELAYS

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Application November 20, 1951, Serial No. 257,230
Claims priority, application Switzerland November 21, 1950
5 Claims. (Cl. 200—104)

The present invention relates to electromagnetic relaying structures and more particularly to a relay of the aforesaid type having adjustable fixed and movable contacts.

In known relay structures having multiple fixed and movable contacts great difficulty has been encountered in varying the contacts with respect to each other in accordance with the particular type of relaying operation to be accomplished. The present invention eliminates the aforesaid disadvantage and contemplates a simplification of the contact sets or assemblies whose operative conditions are most favorably and considerably improved.

The present contact assemblies may be readily applied to all types of relays with or without minor adjustments. Accordingly, it is an object of the present invention to provide means facilitating the rapid interchanging and adjustment of the contact sets or assemblies of a multiple contact relay structure thereby permitting the same to be readily employed for various relay operations.

It is another object of the present invention to provide means mounting the fixed and movable contact sets of a relay with respect to each other, whereby the relaying function performed by the aforesaid sets can be readily changed by varying the position of the respective mounting means.

It is a further object of the present invention to provide means assuring the rapid movement of the contacts of relays of the aforesaid type in response to energization of the armature thereof.

According to the present invention there is provided in an electromagnetic relay, including a frame and an armature support on the frame and movable in response to the energization of the relay, a contact assembly which is mounted on the frame and includes resiliently supported fixed and movable contact blade sets. The respective contacts of the sets are electrically insulated from each other and the fixed contacts extend into guideways of a positioning member, while the movable contacts are supported in notches of an actuating plate, the latter being operatively connected to the aforesaid armature for movement in response to the movement of the armature. Upon operation, the movable blades contact the fixed blades which are limited in movement, due to said guideways and an increased contact pressure results.

The above objects and brief description of the invention will become readily apparent upon consulting the detailed description of the invention in conjunction with the drawings, wherein:

Fig. 1 is a side elevational view of a multiple contact relay constructed according to the present invention;

Fig. 2 is a front elevational view of the relay illustrated in Fig. 1, taken in the direction of the arrow A;

Fig. 3 is a top plan view of the relay illustrated in Fig. 1 in released position;

Fig. 3*a* is a partial top plan view showing the relay of Fig. 3 in operated position;

Fig. 4 is a cross-sectional view taken along the line 4—4 of Fig. 1;

Fig. 5 is a fragmentary front elevational view of the present relay provided with an asymmetrical number of contact assemblies;

Fig. 6 is a front elevational view of a modified form of the present invention, including a lesser number of contact assemblies; and,

Fig. 7 is a side elevational view of the modification illustrated in Fig. 6.

Referring now with particularity to the drawings, there is shown the multiple contact relay of the present invention which includes a relay core 1 of conventional structure, the core being mounted on a frame 3. Dependingly carried by the frame 3 are the contacts 2 which are adapted to be electrically connected to suitable lead wires, not shown. Pivotally supported on the frame 3 is an L-shaped bifurcated armature 4 which is pivoted on the knife-edge provided on the frame and is movable in response to the energization of the core 1. Bearing against the armature 4 is a retaining spring 5 which biases the armature onto the knife-edge into a predetermined position with respect to the frame 3 and the core 1.

Mounted on the frame 3 is the contact assembly which includes movable contact blades 6 and fixed contact blades *7a, 7b, 7c*. The contact blades are assembled in stack formation and supported on the frame by means of screws 10; said blades being off center with respect to said and insulating separators 11, the latter being preferably fabricated of a compact synthetic material, such as "Bakelite."

Disposed transversely of the contact blades is an actuating or lifting plate 8 which is operatively connected to the armature 4 and engages the movable contact blades 6 for actuating the latter in response to the energization of the relay. As clearly illustrated in Fig. 4, the plate 8 is provided with a plurality of inwardly extending notches at spaced intervals along the sides thereof, select ones of the notches embracing the receiving adjacent portions of the movable contact blades 6. *8a* is the top for plate 8 in released position.

The plate 8 is fabricated of an electrically insulating material and secures together the respective movable contact blades 6 for movement as a unit. Arranged in spaced parallel relation with respect to the plate 8 is a fixed support or positioning member 9 which is carried by the frame 3 and engages the fixed contact blades *7a, 7b, 7c* for maintaining the same in a predetermined relationship with respect to the frame and with respect to the movable contact blades 6.

The support or positioning member 9 is preferably a cylinder fabricated of insulating material which is supported on a threaded spindle and is movable toward and away from the adjacent portions of the frame 3. The cylinder is provided with longitudinally spaced transversely extending guideways which selectively accommodate the fixed blades *7a, 7b, 7c* and which are of greater width than said blades. Abutting the end of the cylinder remote from the frame is a lock nut which is threadedly supported on the spindle and maintains the cylinder 9 in a predetermined position thereon.

The engagement of the blades with the lifting plate 8 and the support or positioning member 9 is effected through lugs or projections 12, 13, respectively (Fig. 2), provided on the sides of the blades. These projections on the fixed contact blades can be split into two or more parts so that by bending the respective parts in either direction, the play in the guideways or slots of the support 9 may be either decreased or completely taken up, thus adjusting the contact slack or gap and pressure for a given armature movement.

Furthermore, the mounting of the individual contact

blades in the member 9 is so chosen that the opening contact blades after adjustment of the correct spacing between the blades abut against a stop or abutment defined by one side wall of the adjacent guideway and that the closing contact blades, after adjustment of the contact spacing with the contact blades closed likewise bears against the stop or abutment provided by the opposite bounding wall of the guideway.

In a relay construction such as that illustrated in Figs. 6 and 7 where the relay has a small number of contact blades on one side than on the other, there results an unbalance in the structure. In the situation illustrated the contact assembly has only one active contact blade on the left side and accordingly the actuating or lifting plate 8 must be held in the desired position by a further point of support.

As illustrated in Fig. 5, this can be accomplished by means of a contact blade 14 which is devoid of an electrical connection and acts independently as an additional support for the lifting plate 8. The contact blade 14 is mounted in the same manner as the other contact blades, that is by the assembly of the insulators 11 and the screws 10. The contact blade 14 is of same shape as the other contact blades. However, the lower depending contact head is preferably omitted. A different structure for guiding the lifting plate 8 when the contact blades on both sides are small in number is illustrated in Figs. 6 and 7 and provides for the addition of a lifting plate guide spring 15.

While the contact blade 14 engages in the suitable slot of the lifting plate 8 in exactly the same way as the other contact blades, the lifting plate guiding spring 15 grips the lifting plate on the end edge thereof. Accordingly, this spring may be employed as an armature loading spring whereby the amount of current required to operate the relay can be varied according to the tensioning effect of the spring 15.

As clearly illustrated in Figs. 3 and 4, the fixed contact blades 7*a*, 7*b* are arranged in a first pair of spaced rows, the rows being arranged on opposite sides of the positioning member 9. The movable contact blades 6 are likewise arranged in a second pair of spaced rows of the lifting plate 8.

In actual operation upon energization of the core 1, the armature 4 is pivoted in counter-clockwise direction about the knife-edge whereupon the lifting plate 8 is moved in a direction opposite to that of the arrow A in Fig. 1. The position of the respective contact blades prior to movement of the lifting plate 8 is illustrated in Fig. 3. Upon movement of the plate 8, the movable contact blades 6 are brought out of electrical contact with the fixed contacts 7*a* and/or brought into electrical contact with the fixed contact blades 7*b* (see Fig. 3*a*). Upon subsequent deenergization of the core 1 the respective movable contact blades 6 return to the position illustrated in Fig. 3.

From the foregoing it is readily apparent that various relaying operations can be performed by changing the position of the respective fixed and movable contact blades with respect to each other and by varying the arrangement of the staggered and spaced rows of blades.

It is apparent to one skilled in the art that the present invention does not necessarily have to be confined to electromagnetic relays of the knife-edge type and may also be employed in other types of relay constructions. It must, however, be possible to impart a movement of armature upon operation of the relay to the lifting plate 8. In addition to the previously mentioned advantages of the present relay construction, it is further observed that the resilient contact blades may be interchangeably mounted at will and that they can be mounted on either side of the relay. Thus, assemblies of resilient contact blades can be achieved whose function in either opening or closing the relay can be determined by the position of the respective mounting elements.

Further, it is to be noted that, when the contact setting or distance is altered, the stops of the fixed contact blades are likewise altered thereby resulting in a variation of contact gap or slack and contact pressure. Thus, the fixed contact blades need not, as in other relays, be preloaded with a pressure which corresponds to the contact pressure necessary for the proper operation of the relay.

This new technique fo predetermining and guiding the tensile preload of the blades and contact engaging motion works as follows: with the make-contact, the passive contact-blade is slightly precharged with tensile load against the alignment (direction of movement) of the active contact blade. With the break-contact, the passive blade is slightly precharged with tensile load with the alignment of the active contact blades, whereby they develop a predetermined contact engaging pressure through the tensile preload and the ability to move with the alignment (direction of movement) of the passive blades. This improvement proves to be quite new in the technique of contact engaging in relays.

Through this improved technique the contact pressure is substantially increased, for example, from 7–10 cN per contact over the engaging (which starts about halfway in the guideway of the member) to the final contact (end of the guideway) to 23–40 cN. This means a reduction in ampere turns of 15%. There is thus a fundamental advantage in this technique of determining and guiding the tensile preload of the blades and their engaging, since the engaging of the contacts starts about halfway in the guideways of the common support member. By this new technique the armature has to overcome the larger part of the tensile preload only at the close of the armature travel ($\frac{1}{10}$ mm. before the operated position).

The required contact pressure, necessary for proper relay operation is thus not made through tensile preload of the passive blades, corresponding approximately to the contact pressure, but the necessary contact pressure is only realized at the close of the armature travel, as the passive blades in contacting come to a stop. The logical result is thus preliminary engaging with increased contact pressure at the close (stop) of the armature travel. Therefore, the fundamental advantage of the present invention for miniature relays is increased, determined engaging of the contacts with additional contact pressure.

While preferred embodiments of the invention have been shown and herein described, it will be understood that the same is capable of modifications without departure from the general scope and spirit of the invention as defined in the claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. In an electromagnetic relay having a frame, an electromagnetic core and an armature movable relative thereto, the improvement which comprises; a contact assembly including elongated passive and active contact blades each having two ends and supported parallel to each other, insulating support means interposed between said blades adjacent one of said ends thereof, an actuating plate of insulating material operatively connected to said armature and arranged for movement in a direction substantially perpendicular to the longitudinal axes of said blades upon operation of said core, said plate being provided with notches, said active and said passive contact blades being provided, respectively, with bifurcated lateral projections adjacent their other ends with the slots of said projections extended perpendicularly to the longitudinal axes of said blades, said bifurcated projections of said active blades engaging said notches of said plate, respectively, at said slots, a positioning member mounted on said frame and provided with a plurality of guideways having abutments spaced from each other axially of said positioning member, and means operatively connected to said positioning member for adjusting the same parallelly with respect to said direction of movement of said plate, said projections of said passive blades extending into said guideways of said positioning member, the width of each of said guideways being greater than that of the

corresponding passive blades, said bifurcated projections of said passive blades being adapted to be deformed to vary the position of said passive blades in said guideways, whereby upon energization of said core and actuation of said armature said plate is moved in said direction, thereby carrying said active blades therewith, corresponding ones of said passive blades being contacted by said active blades upon movement of said plate and being moved in said guideways of said positioning member until the projections of said passive blades abut against respective abutments of said guideways, thereby producing an increased contact pressure between said contact blades upon termination of the movement of said passive blades in said guideways.

2. An electromagnetic relay according to claim 1, including a movable blade devoid of electrical contacts for supporting and guiding said actuating plate.

3. An electromagnetic relay according to claim 1, including spring means operatively connected to said actuating plate remote from said armature, for guiding said plate.

4. An electromagnetic relay according to claim 3, including means for adjusting said spring means to vary the loading on said armature, whereby the amount of current required to operate the relay can be varied.

5. An electromagnetic relay according to claim 1, wherein said passive contact blades include a first pair of

spaced rows of blades, at least some of the blades of said rows being staggered with respect to each other, and said active contact blades include a second pair of spaced rows of blades, at least some of the blades of said second pair of rows being staggered with respect to each other and interposed between the blades of said first pair of rows.

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