Sept. 14, 1948. O. I. PRICE 2,449,086

ELECTRIC RELAY

Filed Jan. 7, 1947 2 Sheets-Sheet 1

FIG. 1

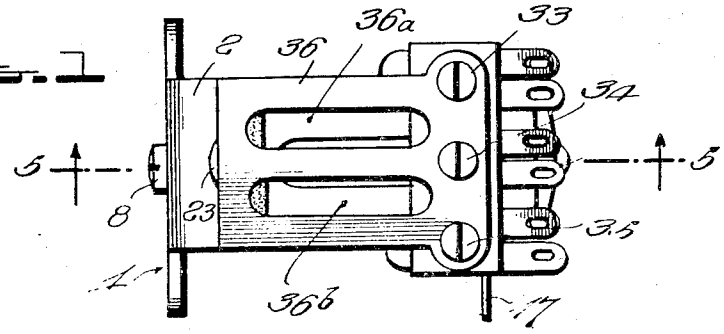


FIG. 2

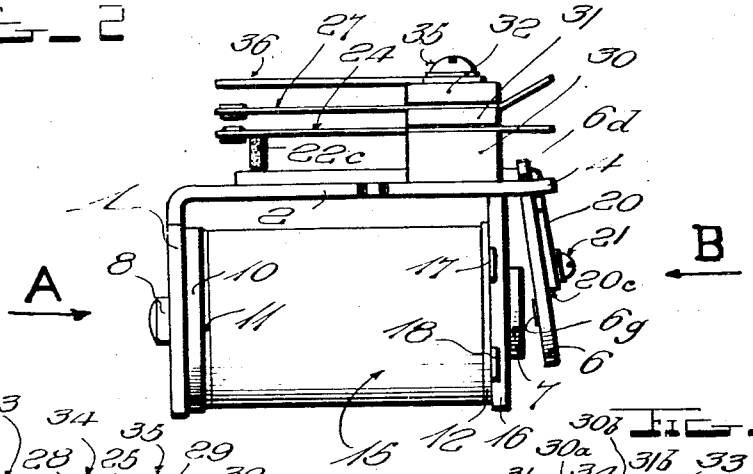


FIG. 3

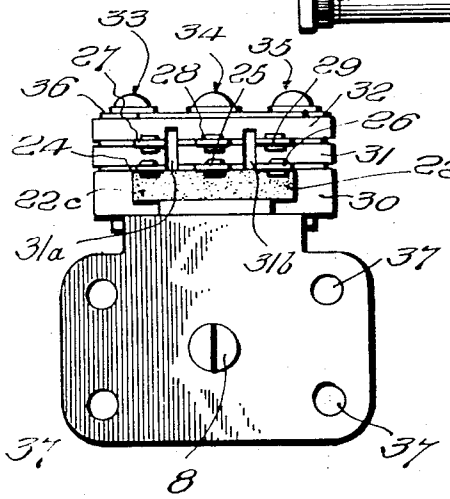
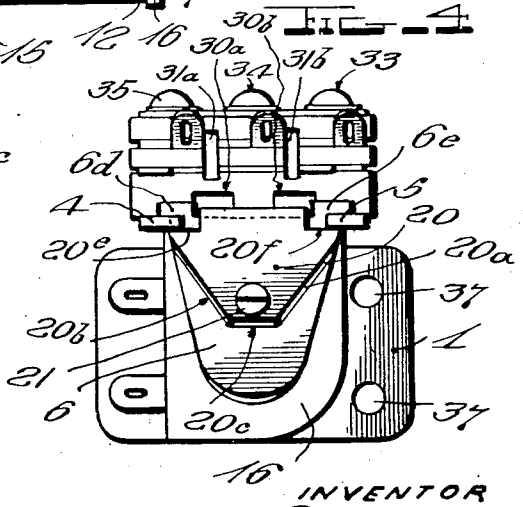


FIG. 4



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Sept. 14, 1948. O. I. PRICE 2,449,086

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Filed Jan. 7, 1947 2 Sheets-Sheet 2

FIG. 5

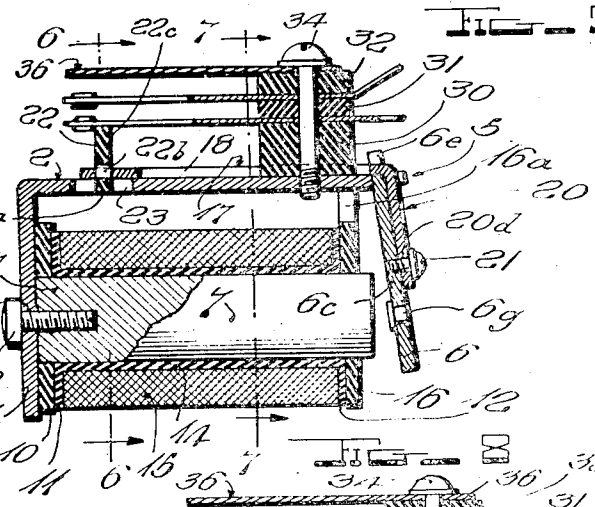


FIG. 6

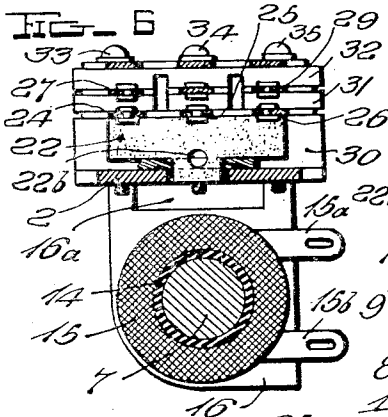


FIG. 7

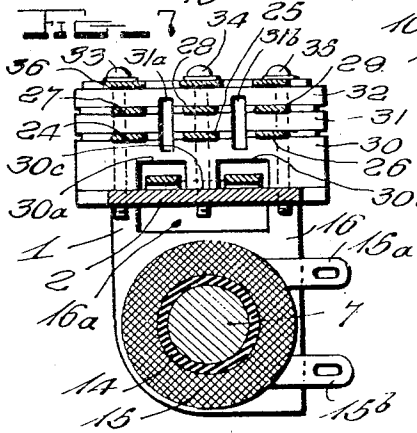


FIG. 8

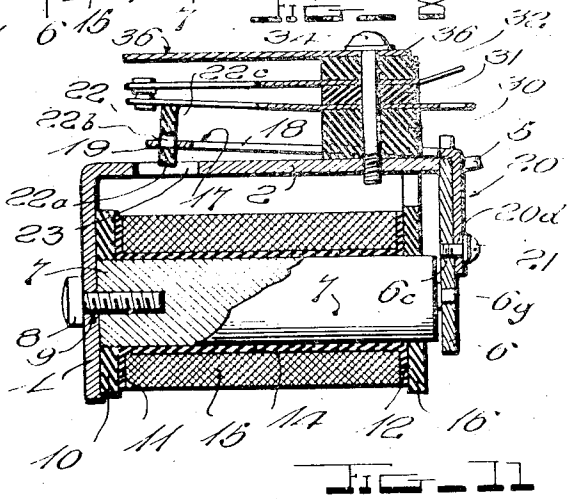


FIG. 9

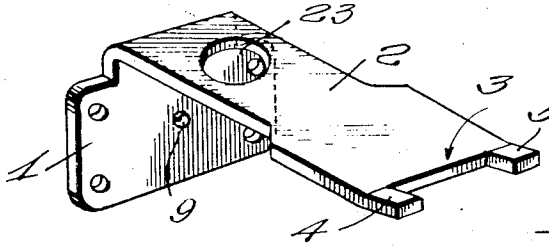


FIG. 10

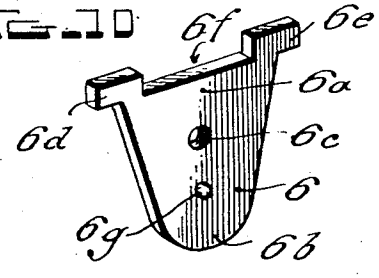


FIG. 11

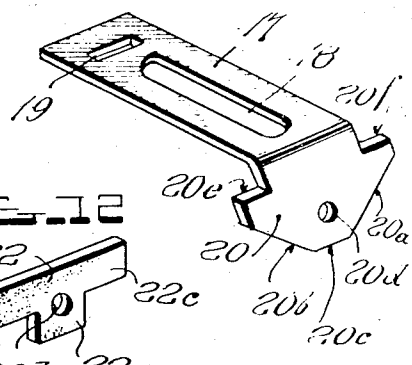


FIG. 12

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UNITED STATES PATENT OFFICE

2,449,086

ELECTRIC RELAY

Osborne I. Price, Frederick, Md.

Application January 7, 1947, Serial No. 720,557

9 Claims. (Cl. 200—104)

1

My invention relates broadly to electric relays and more particularly to an improved construction of electromagnetic relay capable of reliable operation even under conditions of substantial shock vibration.

One of the objects of my invention is to provide an improved construction of electromagnetic relay formed from a minimum number of parts capable of assembly by relatively unskilled labor for producing a substantially shock-proof electromagnetic relay.

Another object of my invention is to provide a construction of electromagnetic relay in which the movable armature of the relay may be assembled with respect to the magnetic frame structure of the relay by a two part clamp arrangement without the interposition of relatively costly pivot means or bearing structures and with one part of the clamp arrangement serving as the actuating means for the relay contactor.

A still further object of my invention is to provide a simplified construction of electromagnetic relay in which the movable armature directly operates the contactor system of the relay without the interposition of extension arms, links or other auxiliary connection members.

Still another object of my invention is to provide an improved construction of electromagnetic relay in which the movable armature member carries a displaceable insulator which is arranged to directly operate yieldable leaf spring members for opening or closing associated contactors.

Still another object of my invention is to provide an improved multiple leaf spring contact assembly for electromagnetic relays including mechanical guard means for protecting the leaf spring against injury.

Still another object of my invention is to provide a construction of armature assembly and coacting multiple leaf spring contactor assembly for electromagnetic relays in which a portion of the armature assembly is longitudinally slotted and extends through the multiple leaf spring contact support of the relay system.

Other and further objects of my invention reside in the construction of electromagnetic relay as set forth more fully in the specification hereinafter following by reference to the accompanying drawings in which:

Figure 1 is a plan view of the electromagnetic relay of my invention; Fig. 2 is a side elevational view of the relay shown in Fig. 1; Fig. 3 is an end view of the relay looking in the direction of arrow A in Fig. 2; Fig. 4 is an end view of the relay looking in the direction of arrow B in Fig. 2; Fig. 5 is a longitudinal sectional view taken through the relay with the armature maintained in deenergized position and showing the spring pile-up assembly in deactivated position, the view being taken substantially on line 5—5 of Fig. 1 and illustrating certain of the parts in side elevation; Fig. 6 is a transverse sectional view taken substantially on line 6—6 of Fig. 5; Fig. 7 is a transverse sectional view taken substantially on line 7—7 of Fig. 5; Fig. 8 is a longitudinal sectional view through the relay, the view being similar to the view shown in Fig. 5 but illustrating the spring pile-up assembly and the armature in activated position; Fig. 9 is a perspective view of the magnetic frame of the relay; Fig. 10 is a perspective view of the magnetic armature of the relay; Fig. 11 is a perspective view of the actuator for the spring pile-up assembly employed in the relay structure and Fig. 12 is a perspective view of the insulator which is carried by the actuator of Fig. 11.

2

Referring to the drawings in detail reference character 1 designates the magnetic frame of the relay having a longitudinally extending supporting portion 2 terminating in a bifurcated end portion 3. The bifurcated end portion 3 includes a pair of outwardly extending tongues 4 and 5 which are canted upwardly with a sufficiently angular inclination to provide a confining support for the movable magnetic armature 6. The movable magnetic armature 6 is tapered in contour from a relatively wide end portion 6a to a relatively narrow opposite end portion 6b substantially conforming with the circular section of the magnetic core 7 which is secured to the frame 1 of the relay by means of screw 8 which passes through aperture 9 in the frame 1 and enters the end of magnetic core 7 for firmly securing magnetic core 7 in magnetically coupled relation to the frame 1 of the relay.

I provide a spacer member 10 of insulation material which is apertured to extend over the end of magnetic core 7 and electrically separate the flanged end of the coil support 11 from the metallic frame 1 of the relay.

The coil support 11 is constructed from insulation material and includes the opposite flange 12 of insulation material which is interconnected with flange 11 through sleeve 14 of insulation material. The coil support 11—12—14 carries the electromagnetic winding 15 which may be protected by insulation varnish and covered with cellulose acetate tape and treated with cellulose acetate to provide a substantially sealed-in insulated electromagnetic winding for the relay.

The flanged end 12 of the coil support intimately contacts with the end panel 16 of insulation material. The end panel 16 forms a terminal support for the terminal lugs 15*a* and 15*b* which connect to opposite ends of the electromagnetic winding 15 for providing convenient electrical terminals for opposite ends of the coil winding. The end panel 16 is bifurcated at the end 16*a* thereof providing a pair of spaced supporting feet by which the panel 16 may be secured to the frame 2 of the relay.

An actuating member which compositely serves to mount the armature 6 and to operate the spring pile-up assembly is provided as illustrated more particularly in Fig. 11 at 17. The actuating member 17 is provided with a central longitudinally extending slot 18 therein and a transverse slot 19 therein adjacent the end of the actuator. The other end of the actuator terminates in an angularly inclined head 20 provided with tapered edge portions 20*a* and 20*b* abruptly terminating in the end 20*c*. The angularly inclined head 20 is provided with an aperture 20*d* therein adapted to accurately register with the screw-threaded aperture 6*c* in armature 6 in such manner that when armature 6 is suspended with the oppositely extending lug-like projections 6*d* and 6*e* thereof rockably mounted with the plane edge faces thereof supported in intimate contact with the inclined projections 4 and 5 on frame 2, it is very simple to clamp the armature 6 in proper position by projecting the actuating member 17 through the centrally recessed end 6*f* of armature 6 and sliding the assembly toward the frame 2 whereupon the opposite projecting edges 20*e* and 20*f* of the inclined end 20 of actuating member 17 enter beneath the projections 4 and 5 on frame 2 while lugs 6*d* and 6*e* of armature 6 enter recess 3 above projections 4 and 5. In this position screw 21 may be passed through aperture 20*d* in inclined face 20 and screwed into screw-threaded recess 6*c* in armature 6 thereby clamping the rockable armature in position with respect to the end of the relay frame 2.

In order to maintain the actuating member 17 in predetermined relation with respect to the magnetic gap between armature 6 and magnetic core 7, I insert in the transverse slot 19 the T-shaped insulator 22 shown more clearly in Fig. 12. The insulator 22 has a downwardly extending portion 22*a* which fills the transverse slot 19 in actuator 17 and projects beyond the under surface of actuator 17 and fits within the aperture 23 of the frame 2. To facilitate insertion of insulator 22 in actuator 17 an aperture 22*b* is provided in insulator 22 which enables the insulator 22 to be mounted by means of a pointed tool in position in the end of the actuator 17. The insulator 22 terminates in a transversely extending insulated bar portion 22*c* which serves as an insulated ledge for effectively lifting or displacing the row of leaf spring members represented at 24, 25 and 26 or multiple leaf spring assembly associated therewith. The leaf springs 24, 25 and 26 and the coacting leaf springs 27, 28 and 29 are mounted in superimposed predetermined spacial relation by means of the transversely extending stack of insulation strips shown at 30, 31 and 32. The transversely extending insulated strips 30, 31 and 32 are each shaped to insure maximum dielectric insulation between each of the leaf springs. The transversely extending insulated strip 30 is recessed at 30*a* and 30*b* for the passage of the actuator 17 therethrough. The strip 30 has a centrally depending portion 30*c* which projects through the longitudinally extending slot 18 and provides a rigid supporting means for the spring pile-up assembly through securing screws 33, 34 and 35. The securing screws 33, 34 and 35 pass through the guard plate 36 and through the stacked insulation strips 32, 31 and 30 for clamping the ends of the coacting leaf springs 24, 25, 26 and 27, 28 and 29 in superimposed aligned spaced positions. The strip 32 is sufficiently recessed between the spring strips as represented at 31*a* and 31*b* to insure maximum dielectric insulation between the spring strips. The strip 31 is actually broken into spacer members secured in position by bolts 33, 34 and 35 to insure the firm anchorage of the leaf spring assembly beneath the protective guard 36. The guard 36 is longitudinally slotted as represented at 36*a* and 36*b* to lighten the relay construction.

The coacting leaf springs 24, 25 and 26 and 27, 28 and 29 each carry aligned contacts on the adjacent ends thereof which are adapted to be displaced with respect to each other by operation of the actuator 17 under control of the displaceable armature 6. The armature 6 carries a non-magnetic plug 6*g* in the center thereof for preventing freezing of the armature upon the magnetic core 7 and insuring quick operation of the relay.

The relay armature 6 is normally spring tensioned to the deactivated position illustrated in Fig. 5 by the spring tension exerted by leaf springs 24, 25 and 26 against insulator 22. When, however, winding 15 of the relay is energized the magnetic armature 6 is moved to activated position as illustrated in Fig. 8 whereby insulator 22 shifts leaf springs 24, 25 and 26 into position in which the contacts carried thereby establish electrical connection with the contacts carried by leaf springs 27, 28 and 29. The leaf springs are provided with connecting lugs which are spacially separated from each other as represented more clearly in Figs. 1, 2, 4, 5 and 8 and which project beyond the insulator strips 30, 31 and 32 to provide terminal connections for each of the leaf springs.

The fact that the armature is mounted with respect to the relay frame by a simple clamping arrangement whereby the actuator 17 and armature 6 are coupled together on opposite sides of the projections 4—5 of the relay frame greatly simplifies the relay construction, decreases assembly costs and serves to insure reliable operation even under conditions of very substantial shock vibration. The relay may be readily mounted with respect to any suitable chassis by attachment screws passed through apertures 37 in frame 1 of the relay.

While I have described my invention in one of its preferred embodiments I realize that modifications in details of construction may be made and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In an electric relay, a frame structure comprising an angle member of magnetic material, a magnetic core secured to said angle member and extending to a position substantially coincident with one end of said angle member, an operating winding carried by said core, the last mentioned end of said angle member being bifurcated and terminating in a pair of angularly inclined

tongues, an armature having a pair of oppositely directed lugs, means for rockably confining said armature with respect to said frame structure comprising a member extending substantially the length of said frame structure and terminating in a pair of oppositely projecting edges and means interconnecting said armature and said member for clamping the oppositely projecting edges on said member and the lugs on said armature on opposite sides of said individually inclined tongues for rockable movement with respect thereto.

2. An electric relay comprising a frame structure consisting of an angle member terminating in a pair of angularly projecting tongues, a magnetic core supported by said angle member and terminating in a position substantially adjacent said tongues, an operating winding carried by said core, an armature including a pair of oppositely directed lugs, an actuating member terminating in a pair of oppositely extending edge portions and means interconnecting said actuating member and said armature for clamping the lugs on said armature and the oppositely extending edges of said member on the opposite sides of said angularly inclined tongues.

3. An electric relay comprising an angle member of magnetic material having relatively short and long side portions, a magnetic core carried by said relatively short portion and extending to a position substantially coincident with the end of the relatively long portion of said angle member, said relatively long portion terminating in tongues angularly inclined in a direction extending away from the axis of said core, an operating winding carried by said core, an armature having a pair of oppositely directed lugs thereon, an actuating member having a pair of oppositely extending edge portions thereon and means interconnecting said armature member and said actuating member for clamping the lugs on said armature and the edge portions on said actuating member on opposite sides of said tongues for rockably mounting said armature with respect to said magnetic core.

4. An electric relay comprising an angle member of magnetic material, a magnetic core carried by one side of said angle member and extending to a position substantially coincident with the end of the other side of said angle member, an operating winding associated with said magnetic core, the last mentioned side of said angle member terminating in a pair of angularly disposed spaced tongues, an armature having a pair of oppositely directed lugs rockably supported on said tongues in a position adjacent the end of said magnetic core and an actuating member having an actuating portion extending substantially the length of the last mentioned side of said angle member and terminating in a head portion disposed in a plane extending substantially at an obtuse angle to the actuating portion thereof, the head portion of said actuating member having a pair of oppositely directed edge portions, and means coupling the head portion of said actuating member and said armature for clamping the oppositely extending lugs of said armature and the oppositely directed edge portions of said head portion on opposite sides of said angularly inclined tongues whereby said armature is maintained at an obtuse angle to the axis of said core when the actuating portion of said actuating member is moved to contacting relation with said angle member and whereby said armature is moved to a position substantially parallel with the end of said core when the actuating portion of said actuating member is displaced away from said angle member.

5. An electric relay comprising an angle member of magnetic material, a magnetic core carried by one side of said angle member and extending to a position substantially coincident with the end of the other side of said angle member, an operating winding associated with said magnetic core, the last mentioned side of said angle member terminating in a pair of angularly disposed spaced tongues, an armature having a pair of oppositely directed lugs rockably supported on said tongues in a position adjacent the end of said magnetic core, an actuating member having an actuating portion extending substantially the length of the last mentioned side of said angle member and terminating in a head portion disposed in a plane extending substantially at an obtuse angle to the actuating portion thereof, the head portion of said actuating member having a pair of oppositely directed edge portions, means coupling the head portion of said actuating member and said armature for clamping the oppositely extending lugs of said armature and the oppositely directed edge portions of said head portion on opposite sides of said angularly inclined tongues whereby said armature is maintained at an obtuse angle to the axis of said core when the actuating portion of said actuating member is moved to contacting relation with said angle member and whereby said armature is moved to a position substantially parallel with the end of said core when the actuating portion of said actuating member is displaced away from said angle member and spring means tending to continuously displace said armature in a plane at an obtuse angle to the axis of said core.

6. An electric relay comprising an angle member of magnetic material, a magnetic core carried by one side of said angle member and extending to a position substantially coincident with the end of the other side of said angle member, an operating winding associated with said magnetic core, the last mentioned side of said angle member terminating in a pair of angularly disposed spaced tongues, an armature having a pair of oppositely directed lugs rockably supported on said tongues in a position adjacent the end of said magnetic core, an actuating member having an actuating portion extending substantially the length of the last mentioned side of said angle member and terminating in a head portion disposed in a plane extending substantially at an obtuse angle to the actuating portion thereof, the head portion of said actuating member having a pair of oppositely directed edge portions, means coupling the head portion of said actuating member and said armature for clamping the oppositely extending lugs of said armature and the oppositely directed edge portions of said head portion on opposite sides of said angularly inclined tongues whereby said armature is maintained at an obtuse angle to the axis of said core when the actuating portion of said actuating member is moved to contacting relation with said angle member and whereby said armature is moved to a position substantially parallel with the end of said core when the actuating portion of said actuating member is displaced away from said angle member, a spring pile-up assembly carried by said angle member and an insulator supported by the actuating portion of said actuating member for operating said spring pile-up assembly when said armature is displaced to an activated position.

7. An electric relay comprising an angle member of magnetic material, a magnetic core carried by one side of said angle member and extending to a position substantially coincident with the end of the other side of said angle member, an operating winding associated with said magnetic core, the last mentioned side of said angle member terminating in a pair of angularly disposed spaced tongues, an armature having a pair of oppositely directed lugs rockably supported on said tongues in a position adjacent the end of said magnetic core, an actuating member having an actuating portion extending substantially the length of the last mentioned side of said angle member and terminating in a head portion disposed in a plane extending substantially at an obtuse angle to the actuating portion thereof, the head portion of said actuating member having a pair of oppositely directed edge portions, means coupling the head portion of said actuating member and said armature for clamping the oppositely extending lugs of said armature and the oppositely directed edge portions of said head portion on opposite sides of said angularly inclined tongues whereby said armature is maintained at an obtuse angle to the axis of said core when the actuating portion of said actuating member is moved to contacting relation with said angle member and whereby said armature is moved to a position substantially parallel with the end of said core when the actuating portion of said actuating member is displaced away from said angle member, an insulated support carried by said angle member and bridging the actuating portion of said actuating member, a spring pile-up assembly mounted on said insulated support and an insulator carried by the actuating portion of said actuating member and operative to transmit operating pressure from said actuating member to said spring pile-up assembly.

8. An electric relay comprising an angle member of magnetic material, a magnetic core carried by one side of said angle member and extending to a position substantially coincident with the end of the other side of said angle member, an operating winding associated with said magnetic core, the last mentioned side of said angle member terminating in a pair of angularly disposed spaced tongues, an armature having a pair of oppositely directed lugs rockably supported on said tongues in a position adjacent the end of said magnetic core, an actuating member having an actuating portion extending substantially the length of the last mentioned side of said angle member and terminating in a head portion disposed in a plane extending substantially at an obtuse angle to the actuating portion thereof, the head portion of said actuating member having a pair of oppositely directed edge portions, means coupling the head portion of said actuating member and said armature for clamping the oppositely extending lugs of said armature and the oppositely directed edge portions of said head portion on opposite sides of said angularly inclined tongues whereby said armature is maintained at an obtuse angle to the axis of said core when the actuating portion of said actuating member is moved to contacting relation with said angle member and whereby said armature is moved to a position substantially parallel with the end of said core when the actuating portion of said actuating member is displaced away from said angle member, an insulated support carried by said angle member and bridging the actuating portion of said actuating member, a spring pile-up assembly mounted on said insulated support and a T-shaped insulator carried by the actuating portion of said actuating member and extending toward said spring pile-up assembly and serving as an actuating abutment therefor, said angle member being recessed in alignment with said T-shaped insulator for allowing said T-shaped insulator to extend therethrough.

9. An electric relay comprising a frame structure, a magnetic core carried by said frame structure, an operating winding associated with said magnetic core, an actuating member extending substantially the length of said frame structure, an armature carried by said actuating member and aligned with said magnetic core, a spring pile-up assembly supported by said frame structure and an insulator carried by said actuating member and forming a coupling abutment between said actuating member and said spring pile-up assembly, said insulator being substantially T-shaped in section with the central portion thereof projecting through said actuating member and apertured to facilitate the insertion thereof into said actuating member and operative to present an elongated pressure transmitting edge portion for operating said spring pile-up assembly in accordance with the displacement of said armature.

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