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ELECTRIC CONTACT DEVICE

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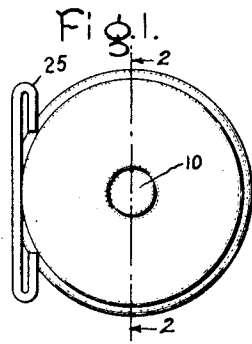
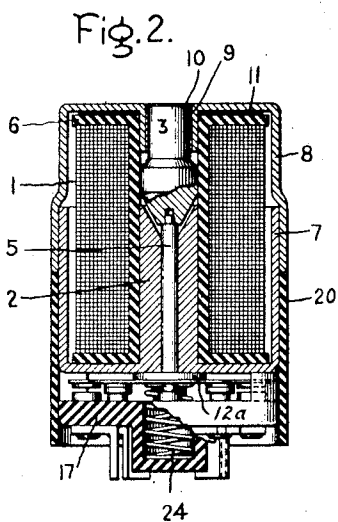
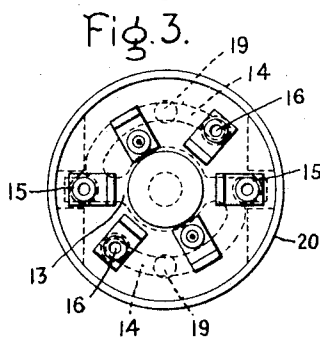
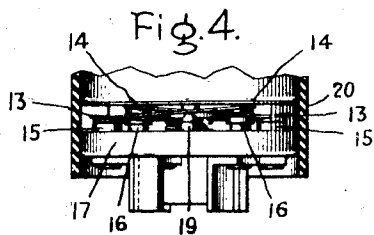
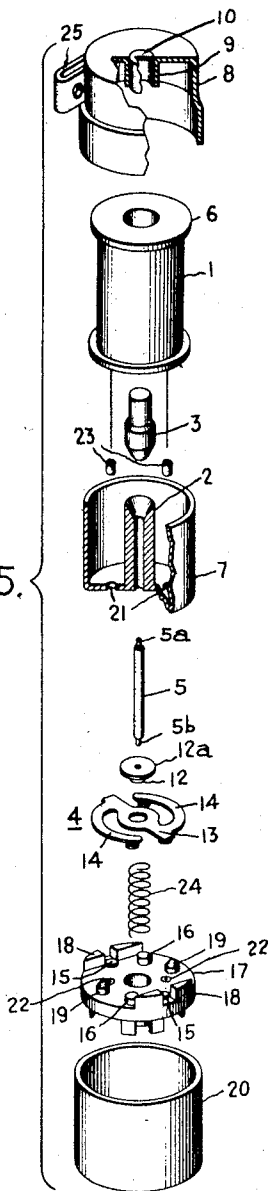


Fig. 5.



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ELECTRIC CONTACT DEVICE

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My invention relates to electric contact devices and more particularly to electromagnetic relay contacts having a single movable contact element providing both normally open and normally closed contacts.

It is a general object of my invention to provide a new and improved electromagnetic relay contact element of the above type which is durable, reliable, and positive in operation as well as inexpensive in manufacture and assembly.

It is a more particular object of my invention to provide a new and improved contact device having a single unitary spring contact element providing both normally open and normally closed contacts.

Briefly, my invention in one form comprises a planar movable contact element of electric conducting material having a bridging contact arm and a pair of resilient auxiliary contact arms extending outwardly from opposite sides of the bridging arm at opposite ends thereof. An actuating member movable perpendicularly to the plane of the contact element is connected to the center of the contact element to move the bridging arm transversely as a bridging contact, while fixed abutments are provided to engage the auxiliary arms intermediate their ends during the actuating movement. The abutments act as fulcrums for the resilient auxiliary arms, so that during movement of the actuating member in one direction the contact carrying free ends of the auxiliary arms move in the opposite direction.

The novel features which are characteristic of my invention will be set forth more particularly in the appended claims. For a clearer understanding of the various features, objects and advantages of the invention, reference should first be had to the accompanying drawing in which Fig. 1 is a plan view of one end of a relay embodying my invention; Fig. 2 is a cross-sectional view taken along the line 2—2 of Fig. 1; Fig. 3 is a plan view of the opposite end of the relay; Fig. 4 is a cutout view showing the contactor, contactor tips, pivots, and mounting member; and Fig. 5 is an exploded perspective view of the entire relay.

Referring now to the drawing, I have shown an electromagnetic relay comprising a coil 1, a core 2, a movable plunger 3, and a movable contact element 4 connected to the plunger by an actuating pin 5. The energizing coil 1 is wound upon a hollow insulating spool 6 and is removably positioned within a cup-shaped housing 7 formed integrally with the core 2 and of magnetizable

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material. An upper cup-shaped coil housing 8 of magnetizable material fits over the coil in telescoping relation with the lower housing 7. The upper housing 8 is provided with a reentrant tubular portion 9 within which the plunger 3 is slidably positioned. Pressed into the tubular portion 9 is a thin cup-shaped liner 10 of a non-magnetic material, such as brass. The liner 10 provides a permanent magnetic "air gap" in the flux path, the function of which will be made clear hereinafter.

The movable plunger 3 and the core 2 are formed of magnetizable material and are positioned within the central aperture in the coil spool 6. The core extends into the spool from the bottom of the cup-shaped housing 7 and the upper end of the plunger is reduced in diameter in order that it will fit slidably into the brass liner 10. The liner 10 thus serves as a bearing for the plunger 3, as well as providing a magnetic "air gap" for the flux path. Since the liner 10 constitutes a necessary "air gap" in the magnetic circuit, it is formed in such a manner as to present a large area for the passage of flux between the top of the housing 8 and the plunger 3. This construction minimizes the reluctance of the brass liner 10. In order to minimize the holding force resulting from the flux leakage between the lower edge of the tubular portion 9 and the head of the plunger 3, the air gap between them is made several times as large as the gap across the brass liner 10, as illustrated in Fig. 2.

A thin spring washer 11 is placed between the face of the upper flange of the spool 6 and the top of the housing 8, as shown at Fig. 2, to minimize jarring of the coil 1 under high-frequency vibration, such as might result from use on aircraft or the like.

The actuating pin 5 is formed of non-magnetic material and is slidably mounted within a central longitudinal bore in the core 2. The upper end of the pin 5 is reduced in diameter, as at 5a, and fits into a recess in the movable plunger 3, as shown in Fig. 2. The lower end of the pin 5 is reduced in diameter, as at 5b, and fits into a knob 12 having at its upper end a peripheral shoulder 12a. The knob 12 serves to transmit downward actuating movement of the plunger 3 and pin 5 to the contact member 4.

The movable contact element 4 is formed of resilient electric conducting material and includes a central bridging contact arm 13 and a pair of like outwardly extending contact arms 14. The arms 14 extend from opposite sides of the bridging contact arm 13 at opposite ends there-

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of, as shown in Figs. 3 and 5. In the form of the invention shown, the contact element 4 is substantially of S- or Z-shape, the arms 14 being arcuate and extending in opposite directions on opposite sides of the diametrical central arm 13.

Two pairs of contacts 15 and 16 are fixed to an insulating base 17 and arranged for engagement with the ends of the movable bridging arm 13 and the free ends of the resilient arms 14, respectively. The insulating base is provided also with a pair of diametrically disposed slotted shoulders 18 arranged slidably to engage opposite ends of the bridging arm 13, thereby to guide the contact member 4 in its movement. Formed upon the base 17 I provide also a pair of fixed abutments or pivots 19 positioned to engage the resilient contact arms 14 intermediate their ends. The insulating base 17 is mounted in a cylindrical housing 20 of insulating material, within which is mounted also the coil and core structure, as shown at Fig. 2. Leads for the coil 1 are brought out through apertures 21 in the base of the cup-shaped housing 7 and aligned apertures 22 in the insulating base 17. Where the leads pass through the housing 7 they are provided with insulating bushings 23.

The contact member 4 is provided with a central aperture and the base 17 is provided with an aligned central recess, both designed to slidably accommodate the knob 12. The peripheral shoulder 12a of the knob 12 thus bears against the contact element 4 at its center and moves substantially perpendicularly to it upon movement of the actuating pin 5.

Within the central recess in the base 17 is seated a helical compression spring 24. The upper end of the spring 24 fits over the knob 12 where the knob passes through the aperture in the contact element 4, so that the contact element is biased upwardly by the spring and away from the base 17. In this normal position the fixed contacts 15 are spaced from the ends of the bridging arm 13, while the fixed contacts 16, being raised above the contacts 15, are in engagement with the free ends of the contact arms 14.

In operation, when coil 1 is energized magnetic flux is established in a path including the core 2, the cup-shaped housing 7, the upper housing 8, the brass liner 10, and the plunger 3. The plunger 3 and actuating pin 5 move the contact member 4 downward against the bias of the spring 24 and the resilient contact arms 14. The initial downward movement of the contact element 4 causes a slight sliding movement between the free ends of the arms 14 and the fixed contacts 16. This wiping is advantageous in that it breaks any welds which may have formed between the normally closed contacts 14 and 16. Continuation of downward movement of the pin 5 causes pivoting of the resilient arms 14 upon the abutments 19, as illustrated in Fig. 4, thus moving the free outer ends of the arms 14 upward and separating the normally closed contacts 14 and 16 substantially simultaneously with the closing of the normally open contacts 15 and 13.

The deflection of the resilient contact arms 14 causes an upward bias by these arms which acts as a "kick-off" spring when the downward pressure of the actuating pin is removed. Thus, the resilience of the movable contact member 4 serves to aid in resetting the contact member and provides a force in addition to that of the biasing spring 24 to break any weld which may have

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formed between the contacts 15 and the movable bridging arm 13.

Settings of contactor gap thickness and air gap are automatically made with the assembly of the relay. After assembly and test the whole unit may be coated with a heavy layer of moisture-resisting insulating paint to seal off the flux path against leakage to surrounding magnetic materials. The base plate 17 may be sealed by a sealing compound around its rim, as shown in Fig. 2, to prevent moisture from reaching the contactor tips. The relay is now hermetically sealed without requiring any additional enclosures over the flux path, and may be mounted on a base of any suitable material by means of a mounting bracket 25. As shown, the bracket 25 is attached to a housing 8 and is preferably of non-magnetic material.

While I have described only one preferred embodiment of my invention by way of illustration, many modifications will occur to those skilled in the art, and I therefore wish to have it understood that I intend in the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

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

1. In an electric contact device, a base having two pairs of fixed contacts mounted thereon, a planar movable contact member of electric conducting material including a bridging contact arm and a pair of resilient contact arms extending outwardly from opposite sides of said bridging arm at opposite ends thereof, said bridging arm cooperating with one said pair of fixed contacts, and the free ends of said resilient arms cooperating with the other said pair of fixed contacts, an actuating member connected to move said bridging arm transversely and in a plane substantially perpendicular to the plane of said contact element, and a pair of fixed abutments mounted upon said base and positioned to engage said resilient contact arms intermediate their ends, said resilient arms pivoting about said abutment when said bridging arm is moved in one direction by said actuating member thereby to move the free ends of said resilient arms in the opposite direction.

2. In an electric contact device, a base having two pairs of fixed contacts mounted thereon, a planar movable contact member of resilient electric conducting material including a bridging contact arm and a pair of auxiliary contact arms extending outwardly from opposite sides of said bridging arm at opposite ends thereof, means for normally positioning said contact element with the free ends of said auxiliary arms in engagement with one said pair of fixed contacts and opposite ends of said bridging arms spaced from the other said pair of fixed contacts, an actuating member connected to move said bridging arm substantially transversely of the plane of said contact element to bridge said other pair of fixed contacts, and a pair of fixed abutments mounted upon said base and positioned to engage said auxiliary arms intermediate their ends during the actuating movement, said auxiliary arms pivoting about said abutments thereby to separate the free ends of said auxiliary arms from said one pair of fixed contacts.

3. In an electric contact device, a base of insulating material having two pairs of fixed contacts mounted thereon, a substantially S-shaped movable contact member of resilient electric conducting material including a central bridging contact arm and a pair of arcuate auxiliary contact arms

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extending from opposite sides of said central arm at opposite ends thereof, spring means for normally positioning said contact element to maintain the free ends of said auxiliary arms in engagement with one said pair of said fixed contacts and opposite ends of said central arms spaced from the other said pair of fixed contacts, an actuating member movable substantially perpendicular to the plane of said contact element and arranged to engage said contact element at substantially the center of said central bridging arm, said actuating member being movable substantially perpendicular to the plane of said contact element to move said bridging arm into engagement with said other pair of fixed contacts and a pair of fixed abutments mounted upon said base and positioned to engage said auxiliary arms intermediate their ends, said auxiliary arms pivoting about said abutments during actuating movement thereby to move the free ends of said auxiliary arms out of engagement with said one pair of fixed contacts.

4. An electric control device comprising a cylindrical casing having an axially movable actuating member mounted in one end thereof and a contact compartment at the other end thereof, a circular base of insulating material in said contact compartment having two pairs of fixed contacts diametrically mounted thereon, a substantially S-shaped movable contact member of resilient electric conducting material including a diametrical bridging arm and a pair of arcuate aux-

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iliary arms extending outwardly from opposite sides of said diametrical arm at opposite ends thereof, spring means interposed between said base and said contact element for normally positioning said contact element with the free ends of said auxiliary arms in engagement with one said pair of said fixed contacts and opposite ends of said diametrical bridging arm in spaced relation with the other said pair of fixed contacts, an actuating pin interposed between said actuating member and said movable contact element, said actuating pin being movable substantially perpendicular to the plane of said contact element thereby to move said diametrical arm into bridging engagement with said other pair of fixed contacts, and a pair of fixed abutments mounted upon said base and positioned to engage said auxiliary arms intermediate their ends, said auxiliary arms pivoting about said abutments in the actuating movement thereby to move the free ends of said auxiliary arms out of engagement with said one pair of fixed contacts.

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The following references are of record in the file of this patent:

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