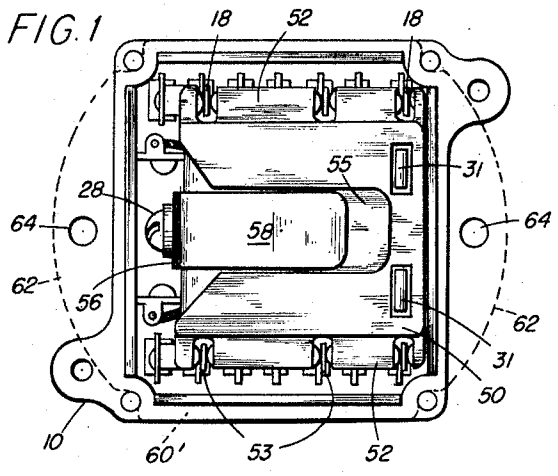
March 9, 1965 H. E. SCHLEICHER 3,172,977

ELECTRICAL RELAY HAVING CONTACT OPERATING MEANS ARRANGED FOR MINIMIZING FRICTION

Filed Sept. 13, 1962

FIG. 1



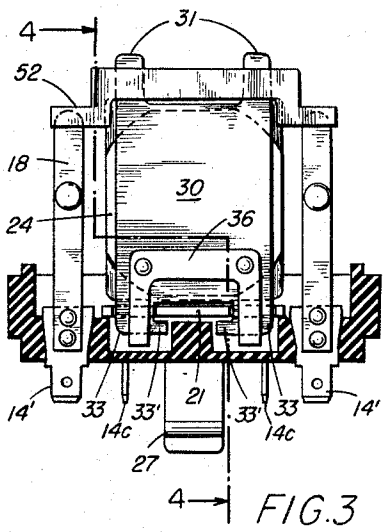


FIG. 3

FIG. 2

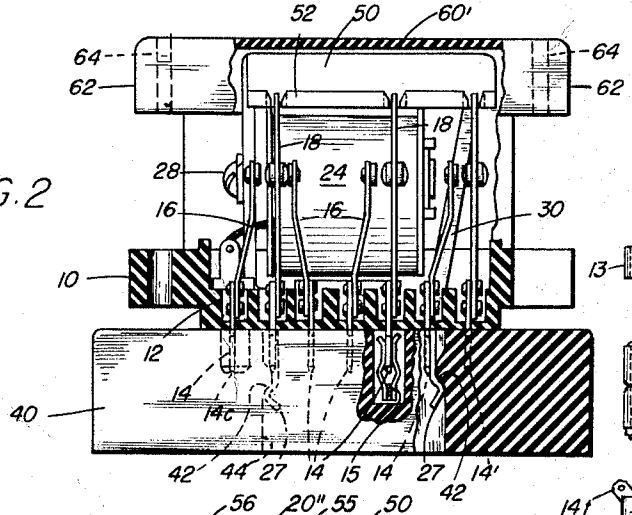


FIG. 4

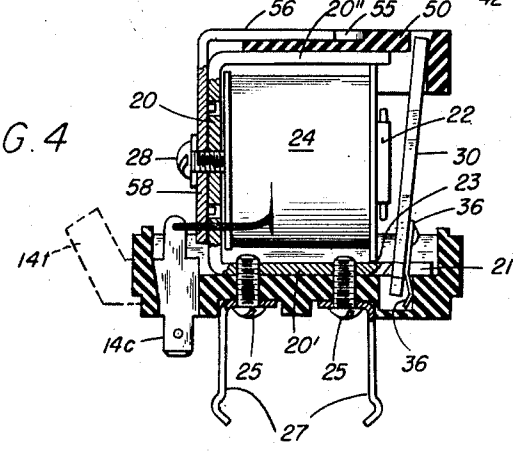
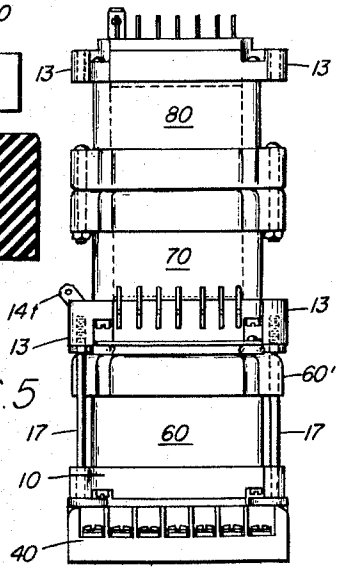


FIG. 5



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ELECTRICAL RELAY HAVING CONTACT OPERATING MEANS ARRANGED FOR MINIMIZING FRICTION

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This invention relates to electromagnetic contactors and relays and, more particularly, to improvements therein relating to the mounting of the armature and the movable contact-operating member to facilitate the assembly and operation of the same.

The invention further relates to a cover for the relay serving the dual purpose (*a*) of facilitating the pulling away of the relay from its sub-base in cases where the relay is mounted by plugging into receptacle contacts of the sub-base, or (*b*) of mounting one relay upon another in cases where relays are to be stacked.

It is an object of the invention to provide an improved electromagnetic relay having a novel, more efficient, reliable and easily assembled armature having biasing means and which is practically frictionless in operation, in combination with a contact-operating member which can be assembled easily and without distorting or over-stressing the movable contacts which it is to operate.

Another object is to provide a novel cover for the relay which serves the dual purposes above mentioned.

Another object is to provide an improved plug in type relay devoid of the conventional flexible wire connectors (pigtails) from the contact fingers to the prong contacts. A related object is to provide these objectives in a direct and simple manner with a minimum of parts and with manufacturing economy.

Another object is to provide means, in a plug in relay, to surface mount it by the cover when a receptacle base is not available or used.

Other objects and advantages of the invention will appear as it is described in connection with the accompanying drawing.

In the drawing:

FIG. 1 is a top plan view of a relay embodying the invention.

FIG. 2 is a side elevation view of the relay of FIG. 1.

FIG. 3 is an end elevation view of the relay of FIG. 1.

FIG. 4 is a side elevation, partly in section, the section being taken along line 4—4 of FIG. 3, of the relay of FIG. 3.

FIG. 5 is a side elevation view of two relays stacked one upon the other.

Referring to the drawing, the parts are mounted on a molded insulating base **10** in which flat stamped sheet metal terminals **14** are fixedly mounted in slots by external stacking and by a hard epoxy resin in internal wells **12**.

To the terminals **14**, leaf-spring contacts **16** are secured at one end by rivets or otherwise to extend up away from the base in position to be engaged and disengaged by movable contacts **18** which may be flexible leaf-spring contacts attached to terminals **14'**, like terminals **14**, and mounted in the base in the same way. The number of fixed and movable contacts may be varied to suit conditions and circuit requirements.

For moving the movable contacts **18**, electromagnetic means are provided consisting of a U-shaped field piece **20** having a core **22** around which is a solenoid coil **24**, the core being secured to the transverse portion of the field piece by a screwbolt **28**.

A flat armature **30** is located across the ends of the

field piece in position to be attracted thereby as the core **22** is energized.

The field piece **20** is attached to the top or interior side of the base **10** by screws **25** which also pass through the base into the short leg of each of a pair of L-shaped resilient attaching prongs **27** whose long legs are laterally offset in V-form near their ends to engage under shoulders **42** provided in the walls of the recess **44** of a sub-base **40**. The prongs serve to hold the relay on the sub-base **40** removably with the terminals **14**, **14'** in contact with socket terminals **15** in the sub-base **40**.

In order to bias the upper end of the armature **30** away from the field piece **20** and to mount it with the least possible friction opposing its movement when the coil is energized, the armature is of generally rectangular shape with fingers **31** extending from that end of the armature that is away from the base as shown in FIG. 3. The end of the armature which is adjacent the base is formed with legs **33** with oppositely directed feet **33'**. The feet **33'** underlie an extension **21** from that portion **20'** as shown in FIG. 4 of the field piece which lies on the base **10**, thus holding the armature from the movement perpendicular to the plane of the extension **21**.

The upper edge of the slot or opening between the feet **33'** and the body of the armature rests on the field piece extension **21** supporting the armature. As may be observed best from FIGURE 4, the edge of the lower portion **20'** of the field piece **20** is beveled or inclined downwardly away from the armature providing a knife edge **23**. The armature is pressed toward the knife edge **23** by an inverted U-shaped thin flexible leaf-spring **36** (FIGS. 3 and 4) which is riveted or otherwise attached to the lower end of the armature between the armature and a recess in the base in which said lower end of the armature extends. The leaf spring is offset away from the armature toward the wall of the aperture of the base.

As the leaf spring presses against the base recess wall, the other side of the armature is pressed against the knife edge **23** which acts as a fulcrum point for pivoting of the armature when it is attracted by energization of the electromagnetic core **22**. The knife edge reduces friction to a minimum so that the armature is very sensitive to attraction by the field piece. It will be understood that as the armature is attracted and tends to pivot, almost the entire force at the pivot point is a horizontal component, i.e. in the direction of the plane of the field piece arm **20'**.

From the foregoing, it will be apparent that the armature is held from vertical movement by the interengagement of the field-piece extension with the edges of the armature slot, and is biased horizontally against the field piece by the spring **36**, and to normally bias the armature away from the core piece **22**.

Movement of the armature at its upper end is transmitted to a slider member **50** made of nylon or other tough slippery material similar to nylon which can be easily molded or fabricated, is non-magnetic, possesses toughness and good wearing qualities.

The slider **50** is of inverted shallow channel shape in cross section and is formed with openings at its outer end to receive the fingers **31**. The upper arm **20''** of the field piece fits loosely in the channel of the slider so the slider can slide with minimum friction on the top surface of the field piece arm **20''**, and be guided by the field piece arm **20''**.

To transmit movement of the slider to the movable contacts, flanges **52** having recesses to receive the upper ends of the movable contacts extend laterally from each edge of the slider.

To hold the slider on the upper arm **20''** of the field piece, an inverted L-shaped member preferably of magnetic material has one part **56** extending over the slider

and fitting in a channel formed in the top or outer surface of the slider while the other part 58 of the L-member is secured by a screw against the outer surface of the transverse portion of the field piece which may be the same screw 28 as secures the core 22 to the field piece or a separate screw, if desired.

Fitting over the entire relay structure is a cup-shaped cover 60' preferably of transparent synthetic molded insulating material and of generally rectangular shape. Extending from opposite sides of the cover adjacent its top surface for the purpose of facilitating the pulling away of the relay from the sub-base are curved lateral extensions 62 which may be readily grasped by the thumb and fingers by anyone desiring to pull the device away from the sub-base or to place the relay on the sub-base. These lateral extensions may also be provided with central apertures 64 parallel to the sides of the cover so that when the device is used without the sub-base 40 and its socket contacts 15, the relay may be inverted and mounted—with its terminals 14, 14' and 14c extending upwardly or in other words oppositely to the direction shown in the drawing—on top of a stack as at 80 in FIG. 5. In such case, bolts inserted thru the registering holes 64 of the cover of the inverted relay 80 and the cover of the upright relay 70 may secure those relays together.

In another case the cover of the inverted relay may be mounted flush against a panel or wall and screws or bolts may be inserted thru the apertures 64 into the panel or wall to secure the relay in position with its terminals extending outwardly or upwardly.

In FIG. 4, a terminal 14t is shown in dotted lines mounted in a slot through the side of the base 10, exemplative of terminals as used for side wiring, leaving the flat bottom of the base available for stacking one or more of such relays as shown in FIG. 5 at 70.

In this case the side wired relay 70 may be mounted upright on top of the plug-in type relay 60 with the ears 13 which extend sidewise from diagonal corners of the base 10 (see FIG. 1) in register with their counter parts. Long-shank bolts 17 may pass thru the apertures 13a in registering ears to hold the upper and lower relays together.

The wire leads from the coil may be soldered to two terminals, for example 14c (but not limited thereto). The other terminals are electrically and physically connected to the movable and fixed contacts as already described. Hence, there are a minimum number of wire leads to be soldered and except for the coil leads, pigtail connections are eliminated within the relay itself. The same applies when the terminals are provided of different shape, extending out sideways from the base as shown in dotted lines in FIG. 4. In such case, the base can be mounted flat against a panel or on a support with the terminals all extending sideways and available for connections to be made thereto.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore, the invention is not limited to the specific embodiment illustrated and described.

What is claimed is:

1. In an electric relay, an insulation base, a plurality of terminal members inserted in slots in said base, a plurality of contact members mounted on some of said terminal members on one side of said base, a plurality of flexible contact members mounted on other of said terminal members on said side of the base and movable to engage and disengage said first mentioned contact members, an electromagnet having a U-shaped frame mounted on said side of the base, a solenoid and core embraced by said frame and attached thereto, an armature edge-supported adjacent one end on one side of said U-shaped frame, a slidable insulating member slidable over the other side of said frame and engaged with said flexible contacts for moving them and engaged with and moved by said armature, and a retaining member affixed to said frame holding said slidable member on said frame, said frame and retaining member having opposed surfaces guiding the movement of said slidable member between said frame and said retaining member.

2. A relay as claimed in claim 1 in which the retaining member is L-shaped and affixed to the transverse portion of said U-shaped frame, said slidable member being separable from said contact members and armature in the direction of their length on removal of said L-shaped member.

3. A relay as claimed in claim 2 in which a single securing means attaches said L-shaped member and solenoid core to said electromagnet frame.

4. A relay as claimed in claim 1 having a knife edge formed on said magnet frame engageable by the side surface of said armature adjacent one end of said armature providing a substantially frictionless fulcrum for said armature to pivot about, and having a leaf-spring member attached to said armature and engaging said base and biasing said armature to unattracted position.

5. In an electric relay, an electro-magnet having a frame with parallel arms, a solenoid and core attached to said frame with said arms on opposite sides of said solenoid, an armature having a slot in one end, an extension from one of said parallel arms extending through said armature slot, a leaf-spring attached to said armature between said armature and said one of said parallel frame arms and biasing said armature to unattracted position, a knife edge on said one of said parallel arms engageable by said armature providing a substantially frictionless fulcrum about which said armature pivots when said solenoid is energized, said spring pressing said armature against said pivot.

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