

March 17, 1970

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RELAY CONSTRUCTION

3,501,719

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3 Sheets-Sheet 1

FIG. 1

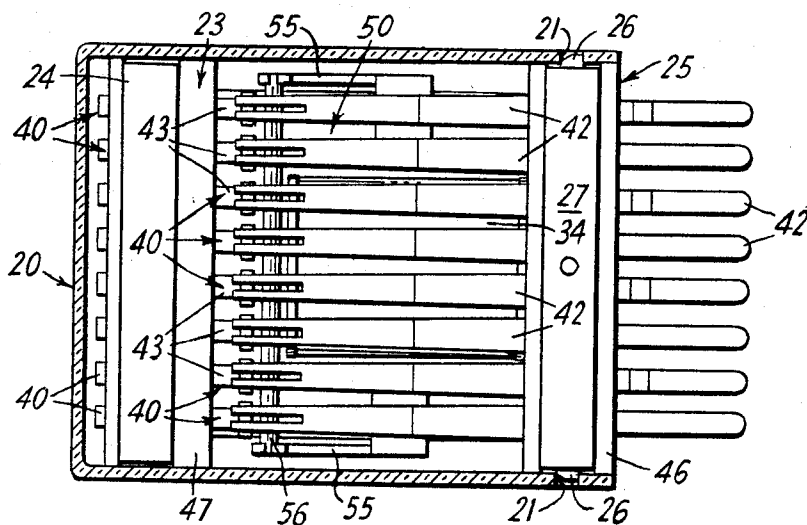


FIG. 2

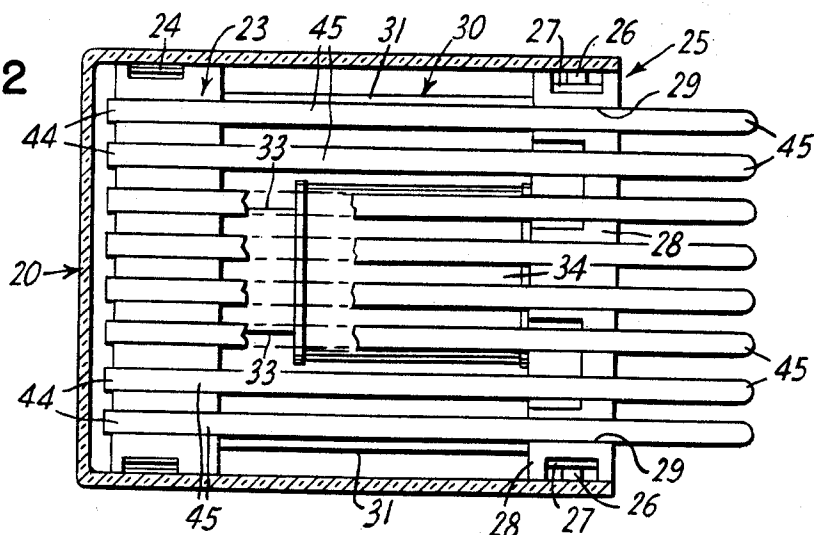
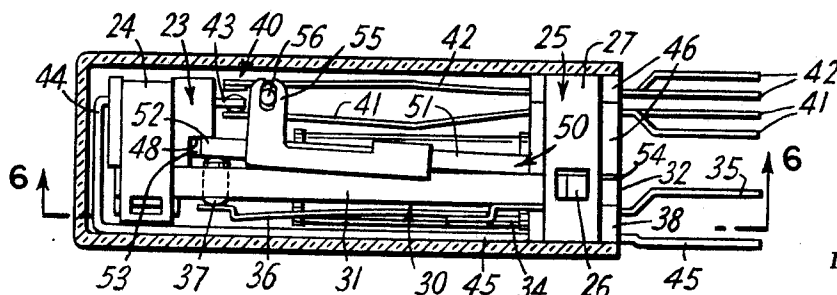


FIG. 3



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FIG. 4

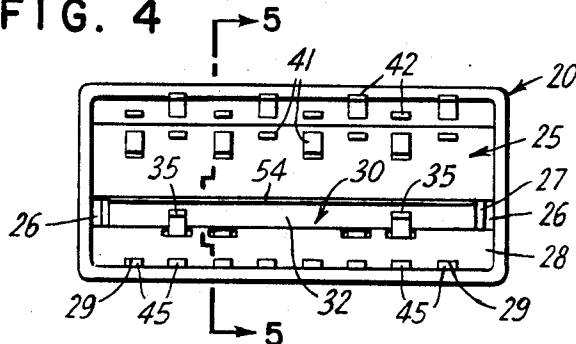


FIG. 5

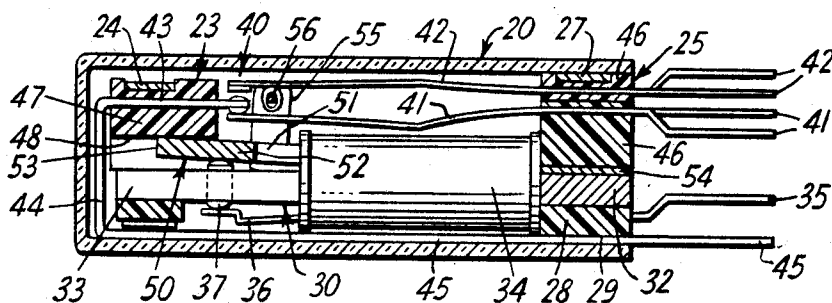
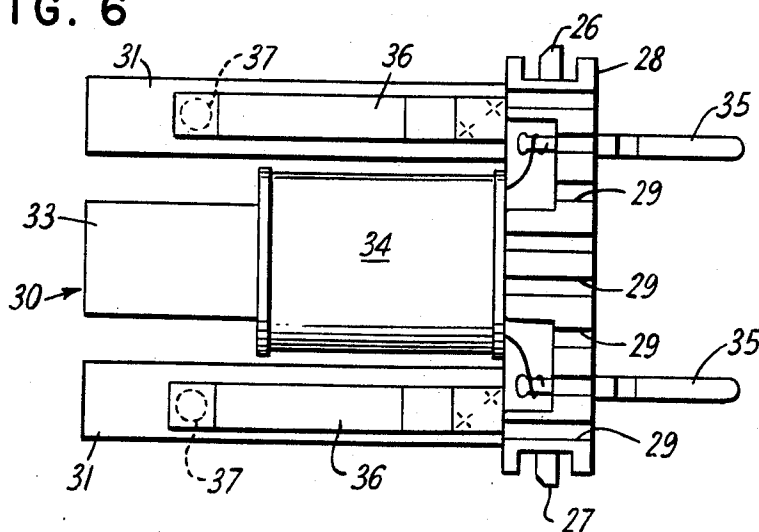


FIG. 6



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FIG. 7

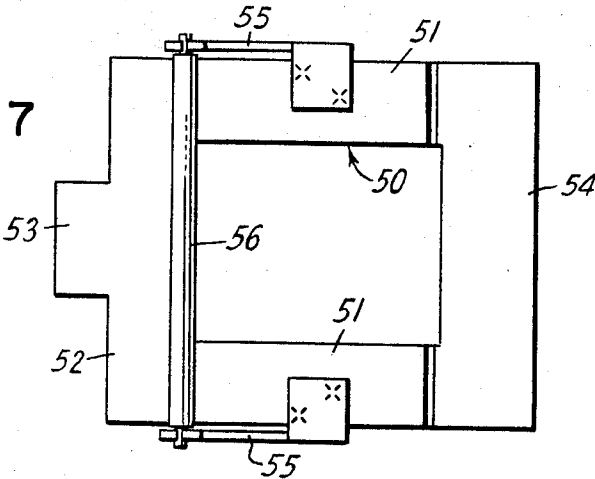


FIG. 9

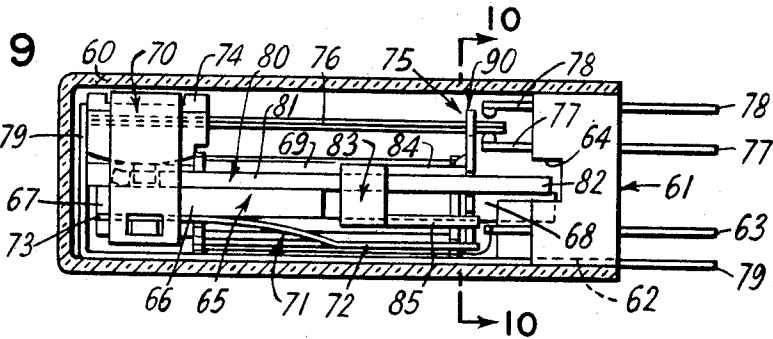


FIG. 8

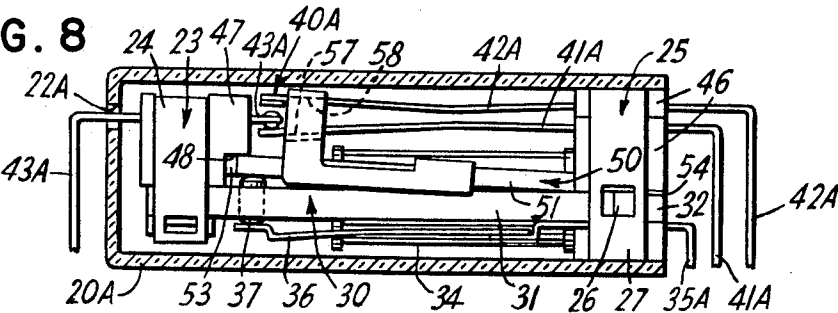
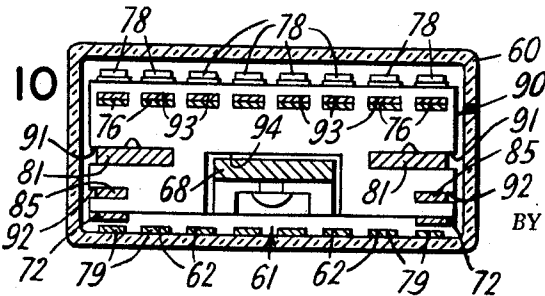


FIG. 10



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RELAY CONSTRUCTION

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U.S. Cl. 335—106

14 Claims

ABSTRACT OF THE DISCLOSURE

A flat pack electromagnetic relay with one dimension substantially smaller than the other two dimensions thereof, having a plurality of switches and terminals for the switch contacts and the electromagnet coil extending through one end or, alternatively, opposite ends of the relay.

This invention relates generally to clapper type relays and more particularly to a modified form thereof which when enclosed are cuboids with one dimension substantially smaller than the other two providing what are commonly called flat pack configurations.

Flat pack components are shaped to generally conform to configurations of present day plug-in modules which are based on printed circuit boards. Such components can be connected to printed circuit boards with facility while adding only limited thickness to the resulting module, and also can be utilized in equipment as independent plug-ins.

An electromagnetic relay of substantially conventional construction normally has a core extending through a coil with a flat clapper or one leg of an L-shaped clapper disposed in a plane transverse to the core axis. In some instances, switch contacts have been arranged on opposite sides of the coil along axes generally parallel to the core axis to a flat pack configuration.

To further approach a flat configuration, U-shaped armatures have been utilized. With this improvement, the desired flat configuration was lost unless the number of switch means were limited or the relay construction became extremely complicated. Therefore, to provide a relay with a desired configuration and with adequate switching capabilities was heretofore very costly and resulted in a device which was difficult to manufacture and subject to malfunction.

Accordingly, an object of the present invention is to provide a relay with a flat configuration having a substantially uncomplicated and rugged construction which can be manufactured and assembled with facility.

Another object of the present invention is to provide the foregoing relay with exposed terminals extending from one end for plug-in connection or extending from opposite ends for connection to a printed circuit board or the like.

And another object of the present invention is to provide the foregoing relay having means engaging one contact arm of each of a plurality of switch means and alternatively moving the contacts thereof into or out of engagement with corresponding fixed contacts.

Still another object of the present invention is to provide the foregoing relay having the switch means disposed in a plane substantially parallel to the plane of the electromagnet and spaced therefrom along the minimum dimension of the relay.

And still another object of the present invention is to provide the foregoing relay having a pair of header type support means each fixedly spaced from the other and a cover or case enclosing the relay having an open end which is closed by one of the support means.

The present invention contemplates a flat cuboid electromagnetic relay having a smallest dimension substan-

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tially smaller than the other two dimensions thereof, comprising a pair of header means each spaced from the other; a plate like frame piece of magnetic material connected at opposite ends each to a different one of said header means, and having a central leg portion extending from one of the opposite ends towards the other; a substantially flat coil disposed on said central leg portion and having a plurality of terminals supported by one of said header means; a plurality of switch means each having first contact means supported by one of said header means and second contact means supported by the other of said header means; said switch means being disposed in a plane substantially parallel to the plane of said frame piece and spaced therefrom in a direction along the smallest dimension of the relay; a plate like armature means of magnetic material disposed between said switch means and said frame piece, and pivotally connected at one end to one of said header means for movement between two terminal positions; spring means biasing said armature means toward one of its terminal positions and said armature means being magnetically biased against said spring means toward its other terminal position when said coil is energized; means connected to said armature means for actuating all of said switch means in response to movement of said armature; a cover having a close end adjacent one of said header means and being open at its opposite end which is closed by said other header means to form an enclosure for said relay; and each of said contact means and terminals extending through at least one of the closed ends of said formed enclosure providing exposed electrical connection means.

The foregoing and other objects and advantages of the invention will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawings wherein several embodiments of the invention are illustrated by way of example. It is to be expressly understood, however, that the drawings are for illustration purposes only and are not to be construed as defining the limits of the invention.

FIGURES 1, 2 and 3 are top plan, bottom plan and side elevational views, respectively, of a relay, with its cover broken away, made in accordance with the present invention.

FIGURE 4 is an end elevational view of the relay of FIGURES 1, 2 and 3.

FIGURE 5 is a sectional view taken on line 5—5 of FIGURE 4.

FIGURE 6 is a bottom plan view of the combination core and frame with a coil thereon of the novel relay when viewed generally in the plane 6—6 of FIGURE 3.

FIGURE 7 is a plan view of the relay armature.

FIGURES 8 and 9 are views similar to FIGURE 3 each illustrating a different modified relay made in accordance with the present invention, and

FIGURE 10 is a sectional view taken on line 10—10 of FIGURE 9.

Relays made in accordance with the present invention are cubiforms with one dimension being substantially smaller than its other dimensions, and the terminals thereof may alternatively extend all from one end or from opposite ends of the relay package. The resulting relay package generally conforms flat pack type solid state circuits, and subjects the operating component thereof to new requirements and design parameters.

Referring now to the drawings and particularly to FIGURES 1 to 5, a relay of a flat pack configuration made in accordance with the present invention is provided with a cover 20 open at one end and a header or support means 25 disposed in and closing the open end of the cover to provide a generally conventional relay case construction with the desired configuration, or is a cuboid

with one dimension substantially smaller than its other two dimensions. The support or header means 25 is releasably retained in the cover 20 by any suitable means well known in the art. In this instance, for example, a detent 26 extends from each of the ends of the support or header means 25 and into an indent 21 provided therefor in each corresponding side of the cover 20 adjacent its open end. Another support or header means 23 is disposed in the cover 20 adjacent its closed end and spaced from the header means 25. The support or header means 23 and 25 preferably have multiple overlying parts, as will be further discussed, which are clamped together by clips 24, and 27, respectively, or by any other suitable binding or retaining means.

An E-shaped combination core and frame piece 30 of a flat plate or relatively thin magnetic material is provided with a pair of legs or leg portions 31 which are spaced from and are substantially parallel to one another, and a bight portion 32 connecting corresponding ends of the leg portions together. The remaining free ends of the leg portions 31 are clamped in and thereby connected to the support or header means 23 while the bight portion 32 is similarly connected to the support or header means 25. Thus, the support or header means 23 and 25 are joined to each other by the frame piece or plate 30 which together form a relatively flat stator structure. It will be noted that the indents 26 which extend from the ends of the support or header means 25 are provided by the bight portion 32 of the frame piece 30.

Also referring to FIGURE 6, the frame piece 30 is provided with a central leg or leg portion 33 which extends from the bight portion 32 and is spaced between the leg portions 31. A coil 34 is mounted on the central leg portion 33 which forms a core therefor to provide the relay with electromagnet means for operating an armature 50. The ends of the winding of the coil 34 are connected to terminals 35 which extend through and are supported by a guide member 28 of dielectric material which is one of the elements or components of the support or header means 25 and is disposed between one side (the lower side as viewed in the drawings) of the bight portion 32 and the cover 20.

The formed stator structure is provided with armature biasing means comprising a pair of leaf type springs or spring means 36 and spring follower members 37. Each of the springs 36 is connected at one end to one of the leg portions 31 adjacent the bight portion 32 and is free at its other end. Each of the followers 37 extends through and is movable in an opening in one of the leg portions 31 and is engaged by or connected to the free end of the spring 36 connected to the same leg portion.

A plurality of switches or switch means 40, each having a pair of spaced spring contact arms 41 and 42 and a fixed contact arm 43 substantially parallel to each other and to the arms of the other of such switches, are disposed in a spaced series laterally across the formed stator structure. Although eight of such switches 40 are shown in the drawings, it should be understood that this quantity has been chosen arbitrarily and can be increased or decreased within the scope of the present invention. Each pair of spring contact arms 41 and 42 is supported by insulating or dielectric means or material 46 of the support or header means 25 disposed on the opposite side of the frame piece 30 from the guide member 28, and extends therethrough each providing an exposed terminal at one end outside of the relay cover or case 20 and a free contact portion at its other end adjacent to the support or header means 23. Each of the fixed contact arms 43, being of a U-shape, is supported by dielectric or insulating material or means 47 of the support or header means 23, and extends therethrough to provide a free contact end disposed between the free contact ends of a corresponding pair of spring contact arms 41 and 42. It should be noted, as best shown in FIGURES 3 and 5, each pair of spring contact arms

41 and 42 are bent or deformed to converge toward their free ends and, if unrestricted, would assume a position biasing the contacts thereof into engagement with the contacts of the corresponding fixed contact arm 43. The bight portion 44 of each fixed contact arm 43 extends past the frame piece 30 between the closed end of the cover 20 and the support or header means 23, and has a portion 45 extending along the cover 20 and through a corresponding one of a plurality of recesses or grooves 29 in the guide member 28 to provide an exposed terminal. The cover 20 preferably is made of a suitable nonconductive material, such as a plastic, or may be suitably insulated.

It now should be seen that all of the switch means 40 are disposed in a plane (the mean plane through the arm 43 and between arms 41 and 42) which is spaced from, along the smallest dimension of the relay, and substantially parallel to the plane of the electromagnet means (core arm portion 33 and coil 34), and that terminals for the coil 34 and all the contact arms 41, 42 and 43 of all the switches 40 are exposed at one end of the relay.

The armature 50, as shown in FIGURES 1, 3, 5 and 7, is made of a flat plate or relatively thin magnetic material of a U-shape to provide a pair of leg portions 51 each being adjacent to and overlying the opposite side of a different one of the frame piece leg portions 31 from the spring member 36 connected thereto. The leg portions 51 are connected together by a bight or bight portion 52 which has a central tongue or tab portion 53 extending therefrom and into a recess in the support or header means 23 which has a surface or stop portion 48 provided by the insulating or dielectric material 47.

A transverse leaf spring member 54 is retained in the support or header means 25 between the frame piece bight portion 32 and the insulating or dielectric material or means 46. The leaf spring member 54 is connected to the ends of the leg portions 51 opposite from the bight portion 52 thereby providing a hinge means and with spring members 36 and their followers 37 biases the armature 50 away from the frame piece 30 to a position wherein the tongue or tab portion 53 abuts the stop surface 48. The resulting opening in the armature 50 defined by the leg portions 51, bight portion 52 and spring member 54 is larger than the coil 34 which extends therein. It should be realized that the armature 50 is disposed on a plane generally parallel to and between the planes of the switches 40 and frame piece 30 when the coil 34 is energized, and moves slightly out of parallelism when the coil is de-energized.

A pair of laterally spaced brackets or support members 55 are connected each to a different one of the armature leg portions 51 and extends therefrom in a direction away from the frame piece 30 terminating in a free end. A lateral or transverse insulated pusher rod or actuating means 56 extends between all of the spring contact arms 41 and 42, and is supported at its ends by the free ends of the brackets 55.

In operation, with the coil 34 de-energized the leaf spring member 54 with the spring members 36 and their followers 37 bias the armature 50 away from the combination core and frame piece 30 and thereby the tongue or tab portion 54 disposed in engagement with the stop surface 48. With the armature 50 in this position, the pusher rod 56 is positioned to engage all of the spring contact arms 42 holding the contact ends thereof away from the contact ends of the corresponding fixed contact arms 43. At this time, the pusher rod 56 is displaced from the spring contact arms 41 permitting the contact ends thereof to be biased into engagement with the contact ends of the corresponding fixed contact arms 43.

Energizing the coil 34 creates a flux which causes the armature 50 to move against the bias of springs 36 and 54 to a position where the armature bight portion 52 engages or lies substantially flush against the frame piece leg portions 31 and 33. This movement of the armature

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50 displaces the pusher rod 56 away from the spring contact arms 42 and toward the spring contact arms 41 to reverse the make/break condition of the switches 40. The spring contact arms 42 are now free to bias their contact ends into engagement with the contact ends of the corresponding fixed contact arms 43. The pusher rod 56, in response to movement of armature 50, engages and drives the spring contact arms 41 moving the free contact ends thereof away from the contact ends of the corresponding fixed contact arms 43. When the coil 34 is again deenergized, the spring members 36 and 54 again will bias the armature 50 to its original position and the actuator or push rod 56 will release contact arm 41 and drive contact arms 42 to again reverse the make/break condition of all of the switch means 40.

The relay of FIGURES 1 to 7 may embody various modifications, several of which are shown in FIGURE 8. The support or header means 23 and 25 are connected to opposite ends of the frame piece 30 supporting the coil 34 and having spring members 36 with follower members 37, as previously discussed. Modified switches 40A are each provided with spring contact arms 41A and 42A corresponding to spring contact arms 41 and 42, respectively. The spring contact arms 41A and 42A, in this instance are bent to diverge toward their free ends and, if unrestricted, each would assume a normal position spaced from the free contact end of a fixed contact arm 43A corresponding to a fixed contact arm 43.

The exposed terminals 35 and those provided by the contact arms 41, 42 and portion 45 of the contact arm 43 all extended axially through the support or header means 25 to provide a plug-in type connection at one end of the relay of FIGURES 1 to 7. Coil terminal members 35A with the exposed terminal portions of contact arms 41A and 42A also extend axially through the header means 25 but are bent 90° so the relay of FIGURE 8 may be mounted flat on a printed circuit board or the like. A modified cover 20A is connected to the relay in the same manner as the cover 20 but has a plurality of openings 22A in its closed end. The openings 22A are aligned with the fixed contact arms 43A which extend therethrough and are bent to parallel the bent portions of the spring contact arms 41A and 42A. The support or header means 25, in this instance, is provided with a modified guide member 28A which lacks the recesses or grooves 29 as they are no longer required.

The armature 50 is provided with a pair of modified brackets 55A, corresponding to brackets 55, each being connected to a different one of the armature leg portions 51. In place of the pusher rod 56, a pair of actuator members 57 and 58 are supported at their ends by the free ends of the brackets 55A. The members 57 and 58 are spaced from and are parallel to one another and engage the spring contact arms 41A and 42A, respectively, each on the side thereof opposite from the fixed contact arm 43A. Accordingly, when the coil 34 is de-energized, member 57 urges the spring contact arms 41A into engagement with the corresponding fixed contact arms 43A. When the coil 34 is energized, however, the member 58 urges the spring contact arms 42A into such engagement.

Another form of or modified relay, made in accordance with the present invention, is shown in FIGURES 9 and 10 with its coil 69, corresponding to coil 34, energized. A support or header means 61, corresponding to the support or header means 25, is releasably connected in and closes the open end of a cover 60, corresponding to the cover 20.

An E-shaped combination core and frame piece 65 of a flat plate or relatively thin magnetic material, corresponding to the combination core and frame piece 30, is provided with a pair of spaced leg portions 66 connected together at their common ends by a bight portion 67. A central or core leg portion 68 is spaced between the leg portions 66 and extends from the bight portion 67 for mounting the coil 69 and together to provide

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electromagnet means for operating an armature 80. The leg portions 66 are substantially shorter than the core leg portion 68 which is connected at its free end to the support or header means 61 while the bight portion 67 is retained in and thereby connected to another support or header means 70, corresponding to the support or header means 23, disposed adjacent the closed end of the cover 60.

Therefore, the frame piece 65 connects the support or header means 61 and 70 to each other which together form a substantially flat stator structure.

In place of the two leaf spring members 36, a U-shaped leaf spring 71 is provided which has a bight portion 73 retained in the support or header means 70 on one side of the frame piece 65, and a pair of leg portions 72 which extend from the bight portion toward the support or header means 61. The spring leg portions 72 each overlies and extends past the end of a different one of the frame piece leg portions 66. The support or header means 70 includes dielectric or insulation member or means 74 which is spaced from one side of the frame piece 65.

A plurality of switches 75, corresponding to switches 40, are provided each having a single or, as shown, a double leaf spring contact arm 76 and a pair of fixed contact arms 77 and 78 all substantially parallel to one another. Each spring contact arm 76 is supported by and extends through the dielectric or insulation member 74 and has a free contact end adjacent the support or header means 61. Each spring contact arm may be U-shaped or, as shown, is provided with an L-shaped terminal conductor 79 connected at one end thereto and at its other end extending through a corresponding one of a plurality of recesses or grooves 62, corresponding to recesses or grooves 29, to provide an exposed terminal. The fixed contact arms 77 and 78 are supported by and extend through the support or header means 61 each providing an exposed terminal at one end and being free at its other end to provide a contact portion on the side of the spring arm contact end opposite from the contact portion of the other fixed contact arm. The support or header means 61 also supports a pair of terminals 63 (only one is shown), corresponding to terminals 35, for the coil 69.

As discussed relative to the other forms of relays, the switches 75 are disposed on a plane substantially parallel to and spaced from the plane of the frame piece 65. The relay of FIGURE 9 has all the exposed terminals at one end as does the relay of FIGURES 1 to 6, but the cover 60, the spring contact arms 76 and the exposed terminals can be modified to provide a relay connectable as the relay of FIGURE 8. Each switch 40 or 40A has two spring contact arms 41 and 42 or 41A and 42A for alternately engaging a single fixed contact 43 or 43A. Each switch 75 conversely is provided with a single spring contact arm 76 for alternately engaging two fixed contacts 77 and 78, and is capable of the same switching functions as switches 40 and 40A. It should be understood that one or more of the switch means 40, 40A or 75 may be of a single make/break configuration.

The relay of FIGURES 9 and 10 is provided with a U-shaped armature 80 of a flat plate of or relatively thin magnetic material having a bight portion 82 adjacent the end of the core leg 68, and a pair of leg portions 81 extending from the bight portion and being pivotally connected at the other ends thereof in the support or header means 70 between the frame piece bight portion 67 and the dielectric member 71. The leg portions 81 overlie the frame piece leg portions 66 and are spaced from one another to permit the coil 69 to extend therebetween.

A bracket member 83 is connected to each armature leg portion 81 beyond the end of the frame piece leg portion 66 which the armature leg portion overlies. Each bracket member 83 has a pair of legs 84 and 85 which

are parallel to and spaced from each other. Leg 84 is a guide leg which is positioned to contact one side of the armature leg portion 81 to which the bracket is connected while the leg 85 is a support leg parallel to and spaced from the other side of the same armature leg portion.

To bias the armature 80 and to actuate the spring contact arms 76 when the armature is operated, a card member 90 of dielectric material is provided. The card member has two slots 91 and 92 in each of its ends, a series of spaced openings 93 between its ends and a central slot 94 in its bottom edge as viewed in the drawings. The armature leg portions 81 and the mounting legs 85 extend through the corresponding slots 91 and 92, respectively, to mount the card 90 on the armature 80 in engagement with the ends of the guide or positioning legs 84. The core leg portion 68 of the frame piece 65 extends through the slot 94 while the leg portions 72 of spring 70 engage the card edge on each side of the slot 94 to bias the card 90 and armature 80 away from the frame piece 65. The spring contact arms 76 extend through the corresponding openings 93 so the card 90 connects the spring contact arms 76 and armature 65 for movement in unison. The support or header means 61 has a recess providing a stop surface 64 for the bight portion 82 when the spring biases the armature 80 and the coil 69 is de-energized. When the coil 69 is energized, the armature 80 lies flat on the frame piece 65.

Although several embodiments of the invention have been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes may be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

I claim:

1. A flat cuboid electromagnetic relay having a smallest dimension substantially smaller than the other two dimensions thereof, comprising:
 - a pair of header means each spaced from the other;
 - a plate like frame piece of magnetic material connected at opposite ends each to a different one of said header means, and having a central leg portion extending from one of the opposite ends towards the other;
 - a substantially flat coil disposed on said central leg portion and having a plurality of terminals supported by one of said header means;
 - a plurality of switch means each having first contact means supported by one of said header means and second contact means supported by the other of said header means;
 - said switch means being disposed in a plane substantially parallel to the plane of said frame piece and spaced therefrom in a direction along the smallest dimension of the relay;
 - a plate like armature means of magnetic material disposed between said switch means and said frame piece, pivotally connected at one end to one of said header means and free at its opposite end for movement between two terminal positions;
 - spring means biasing said armature means toward one of its terminal positions and said armature means being magnetically biased against said spring means toward its other terminal position when said coil is energized;
 - means connected to said armature means for actuating all of said switch means in response to movement of said armature;
 - a cover having a closed end adjacent one of said header means and being open at its opposite end which is closed by said other header means to form an enclosure for said relay; and
 - each of said contact means and terminals extending through at least one of the closed ends of said formed

enclosure providing exposed electrical connection means.

2. The relay in accordance with claim 1, wherein:
 - said frame piece has a bight portion at one of its connected ends and a pair of lateral leg portions each extending from a different end of said bight portion toward the other connected end of said frame piece;
 - said central leg portion extending from said bight portion and being spaced between said lateral leg portions;
 - means connecting said bight portion to one of said header means and at least one of said leg portions each at its end opposite from said bight portion to the other of said header means;
 - said coil extending between said central leg portion and each of said lateral leg portions; and
 - said armature means having a bight portion forming the free end thereof and a pair of leg portions extending from opposite ends of said bight portion and along opposite sides of said coil, each overlying a different one of said lateral leg portions.
3. The relay in accordance with claim 1 wherein:
 - said frame piece limits the pivotal movement of said armature means in one direction to define one terminal position, and
 - said header means adjacent the free end of said armature means providing an abutment engaged by the free end thereby limiting pivotal movement of said armature means in the other direction to define another terminal position.
4. The relay in accordance with claim 2 wherein:
 - each of said first contact means is at least one fixed contact arm and each of said second contact means is at least one spring contact arm;
 - corresponding fixed and spring contact arms having over-lapping free ends in engagement to provide a closed circuit and defining a gap therebetween to provide an open circuit; and
 - said means for actuating said switch means including a pair of brackets each connected to a different one of said leg portions of said armature means an insulated means connected at its ends to said brackets.
5. The relay in accordance with claim 4, wherein:
 - at least one of said first contact means is a pair of space fixed contact arms each with a free end; and
 - the corresponding spring contact arm extending between said fixed contact arms and being operable to move its free end into engagement with the free end of a different one of said fixed contact arms by movement of said armature means between its terminal positions.
6. The relay in accordance with claim 4, wherein:
 - at least one of said second contact means is a pair of spring contact arms each with a free end disposed on the side of said fixed contact arm opposite from the free end of the other, and movable into and out of engagement with the free end of said fixed contact arm each oppositely to the other.
7. The relay in accordance with claim 4, and said means for actuating said switch means, comprising:
 - a pair of brackets each connected at one end to a different one of said leg portions of said armature means and being free at its other end adjacent said switch means;
 - insulated operator means extending across all of said switch means and being connected to the other ends of said brackets;
 - said insulated operator means being positioned to engage and deflect all of the spring contact arms on the side thereof in the direction of its movement causing the free ends of the deflected arms to disengage the free ends of the corresponding fixed contact arms; and
 - said deflected spring contact arms when said operator means moves away therefrom causing the free ends

thereof to engage the free ends of the corresponding fixed contact arms.

8. The relay in accordance with claim 4, and said means for actuating said switch means, comprising:

a pair of brackets each connected at one end to a different one of said leg portions of said armature means and being free at its other end adjacent said switch means;

insulated operator means extending across all of said switch means and being connected to the other ends of said brackets;

said insulated operator means being positioned to engage and deflect all of the spring contact arms on the side thereof in the direction of its movement causing the free ends of the deflected arms to engage the free ends of the corresponding fixed contact arms; and

said deflected spring contact arms when said operator means moves away therefrom causing the free ends thereof to disengage the free ends of the corresponding fixed contact arms.

9. The relay in accordance with claim 4, and said means for actuating said switch means, comprising:

a card member of dielectric material having a plurality of opening therethrough each located for alignment with a different one of said spring contact arms when said card member is connected to said armature means;

a pair of bracket means each being connected to a different one of said leg portions of said armature means, and engaging and retaining said card member connected to said armature means for movement in unison;

said spring contact arms each extending through a different opening aligned therewith and being moved by said card member causing the free end thereof to engage and disengage the free end of the corresponding fixed contact arm in response to movement of said armature means.

10. The relay in accordance with claim 2, wherein: said frame piece, pair of header means and coil form a substantially flat stator structure having electromagnetic means and supporting said switch means; said armature means and said means for actuating said switch means form an armature structure pivotally connected at one end to a corresponding end of the formed stator structure for movement between two terminal position; and

said spring means comprising at least one leaf type spring connected at one end to the formed stator structure, and being free at its other end which engages and biases said formed armature structure to one of the terminal positions.

11. The relay in accordance with claim 10, wherein said leaf type spring comprises:

a bight portion retained by the same header means to which said armature is pivotally connected for connecting said leaf type spring to said formed stator structure; and

a pair of leg portion extending from opposite ends of said bight portion and in the same direction on opposite sides of said coil.

12. The relay in accordance with claim 10, and said spring means further including another leaf type spring connected at one end to said formed stator structure, and being free at its other end which engages and biases said stator structure to said one of the terminal positions;

the connected ends of said leaf type spring being connected to the same end of said frame piece and extending therefrom substantially parallel to one another on opposite sides of said coil.

13. The relay in accordance with claim 1, wherein: each of said contact means extends through said header means by which it supports; said closed end of said cover having a plurality of opening therethrough;

one of said contact means providing exposed electrical connecting means by passing through said header means closing the open end of said cover; and said other contacting means providing exposed electrical connecting means by passing through said openings in the closed end of said cover and the other header means adjacent thereto.

14. The relay in accordance with claim 1, wherein: one of said contact means providing exposed electrical connecting means by passing through said header means closing the open end of said cover; and the other of said contact means extending through said other header means, between said closed end of said cover and said other header means to the side of said frame piece opposite from said switch means, and through said header means closing the open end of said cover to provide exposed electrical connecting means.

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