

June 3, 1947.

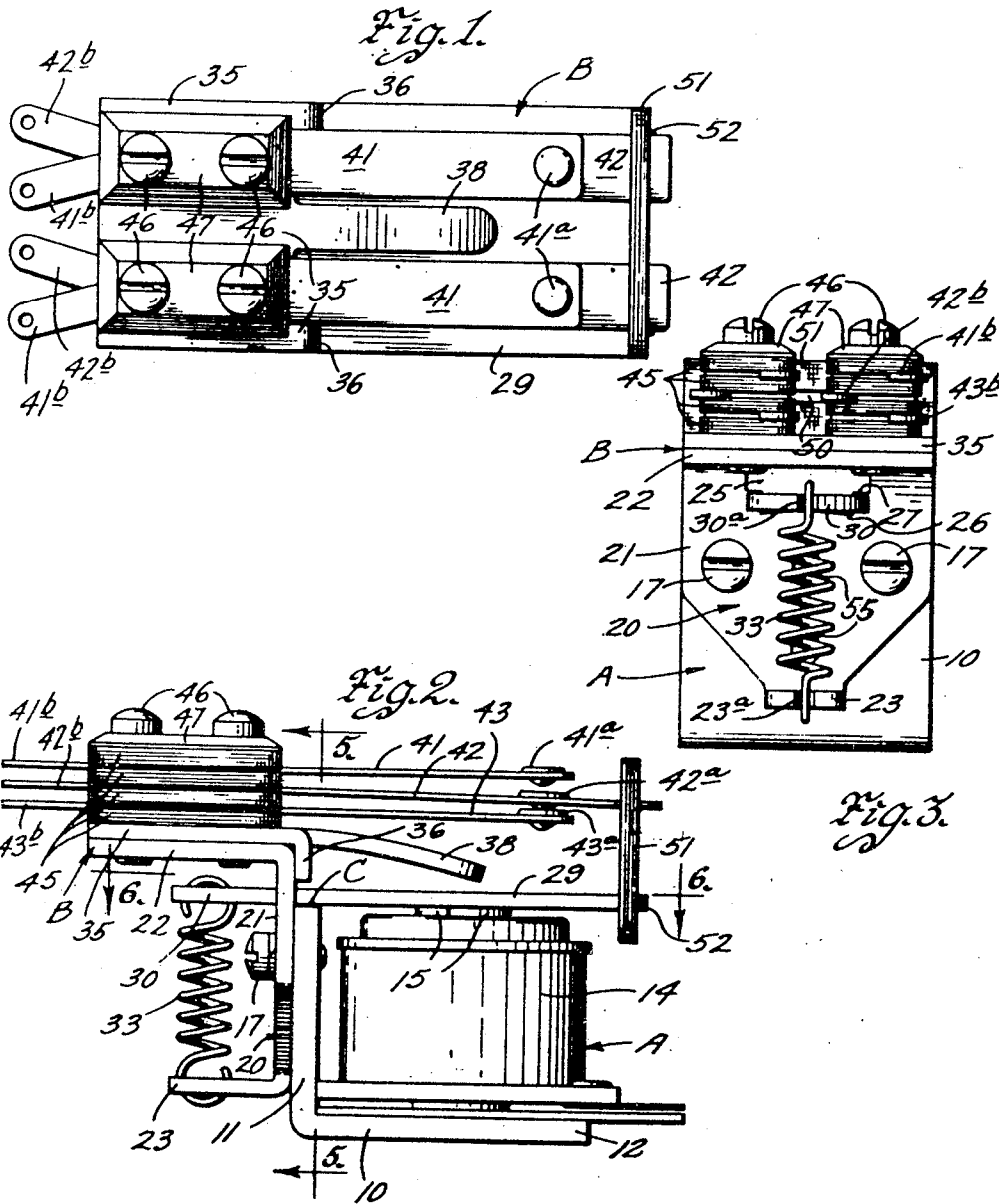
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2,421,641

RELAY

Filed May 20, 1943

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

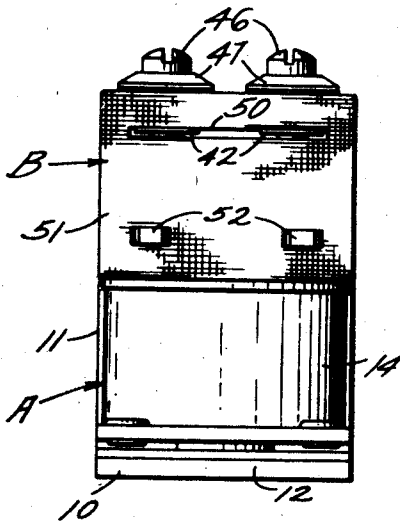


Fig. 4.

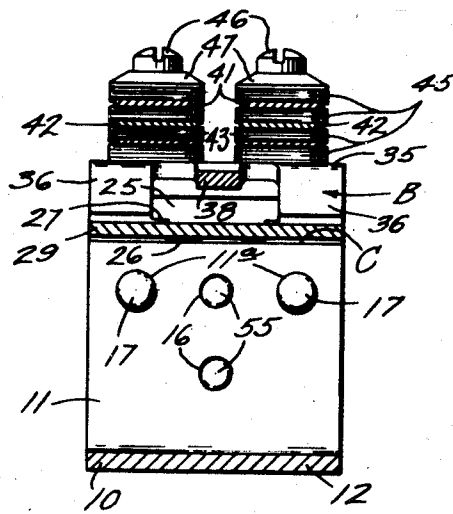


Fig. 5.

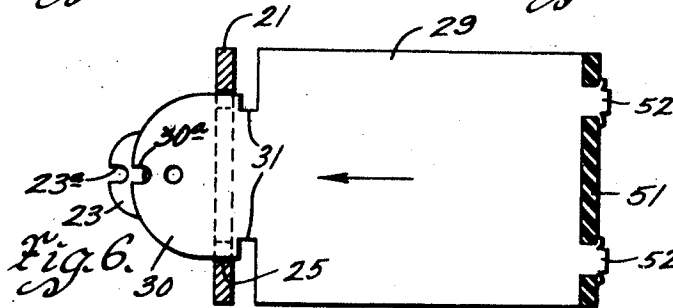


Fig. 6.

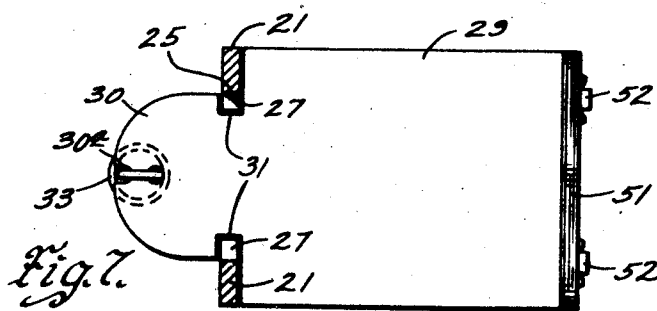


Fig. 7.

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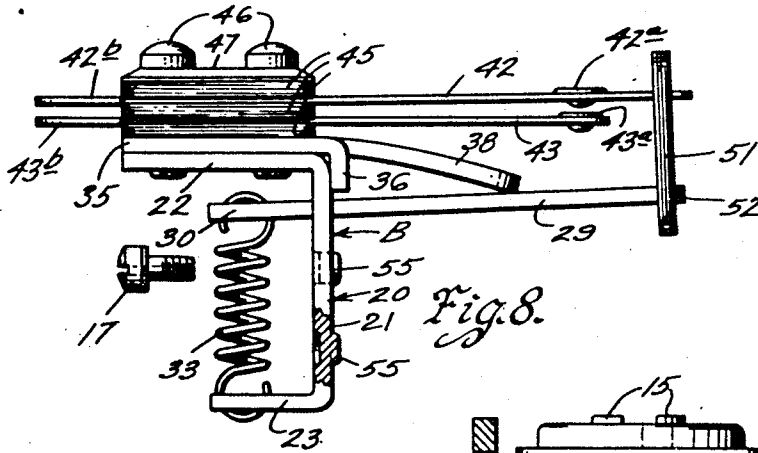
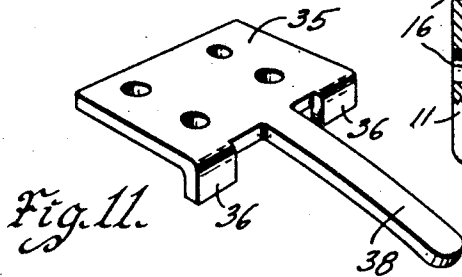
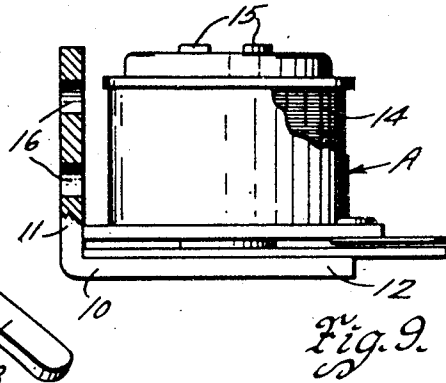
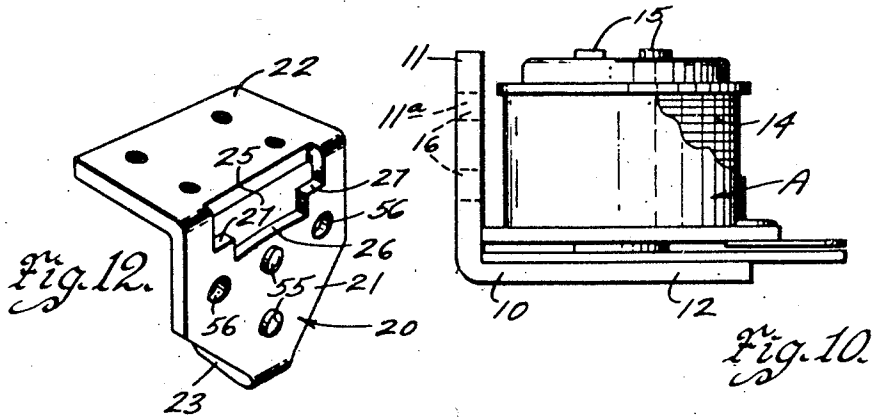
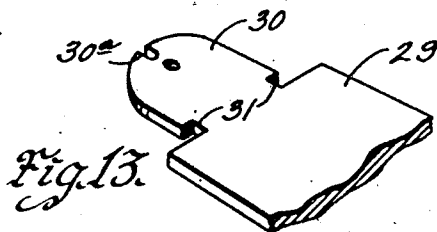
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,421,641

RELAY

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7 Claims. (Cl. 200—87)

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The present invention pertains to electromagnetic devices, and more particularly to relays of the type having an armature hinged or pivoted at one end and the opposite end being operably connected to and adapted for actuating a switch device.

In general, relays, as heretofore made, include a direct connection between the armature and the field piece, so that the armature is always in the magnetic field. Such an arrangement causes a temporary binding or sticking at the hinged end of the armature. This binding or sticking action is due to residual magnetism, caused by the armature being in direct contact with the field piece, in the path of the magnetic field currents. Thus it will be apparent that the presence of residual magnetism in a relay having the armature mounted directly on the field piece, causes a delayed action of the armature in moving away from the core, after the coil circuit is broken.

For certain uses, such a delayed action of the armature is objectionable, particularly where it is necessary or desirable to cause instantaneous actuation of the relay switch incident to breaking of the electrical circuit including the coil. I am aware of several relay structures heretofore devised with a view to eliminating such delayed action of the armature, but in the main such devices have not been found entirely satisfactory, and furthermore are relatively complicated in construction and costly to manufacture.

The primary object of the present invention is to provide an improved and novel relay structure wherein the armature is pivotally mounted in a manner to provide an air gap between the armature and the field piece, so as to preclude the residual magnetism in the magnetic field from acting upon the armature.

Another object is to provide an improved relay construction wherein the parts are initially made up in two main sub-assemblies to facilitate the assembly, adjustment and testing of the parts, and wherein each sub-assembly may be made up in several forms or sizes, so as to permit great economy in mass production of a relatively large number of relay devices of different operating characteristics and switch arrangements.

A further object is to provide a novel relay construction of the character indicated, which is of simplified design capable of easy and economical manufacture and which will retain uniform operating characteristics over a relatively long period of time.

Other objects and advantages of this inven-

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tion will be apparent from the following description, taken in connection with the accompanying drawings, in which:

Figure 1 is a plan view of the relay embodying the present invention.

Figure 2 is a side elevational view of the relay.

Figure 3 is a rear end elevation of the relay.

Figure 4 is a front end elevation.

Figure 5 is a vertical section through the relay, taken substantially as indicated at line 5—5 on Figure 2.

Figure 6 is a transverse, sectional view through one of the sub-assemblies of the relay, taken as indicated at line 6—6 on Figure 2, showing the armature in process of being assembled in its mounting bracket.

Figure 7 is a view similar to Figure 6, showing the armature in mounted relation, in correspondence with the relation of the parts as indicated at line 6—6 on Figure 2.

Figure 8 is a side elevational view of one of the sub-assemblies of the relay, including the armature and a modified form of stack switch.

Figure 9 is a side elevational view of the other sub-assembly, including the coil and its core, together with the field piece, with a part of the field piece shown in section to illustrate details of construction.

Figure 10 is a side, elevational view of the sub-assembly, similar to Figure 9, and showing a coil of different electrical characteristics.

Figure 11 is a perspective view of the combination retaining plate and stop for the armature.

Figure 12 is a perspective view of the mounting bracket for the armature and switch device; and

Figure 13 is a fragmentary perspective view of the rear end of the armature.

The electro-magnetic relay embodying the present invention and as illustrated in the drawings is composed of two main sub-assemblies as indicated at A in Figures 8 and 9 of the drawings, and as indicated at B in Figure 8 of the drawings.

The sub-assembly A includes a field piece 10 of ferrous metal, comprising an upright mounting leg 11 and a horizontal supporting foot 12. Rigidly connected to the horizontal foot of the field piece is a conventional coil 14, having a core 15. The upstanding leg 11 of the field piece is provided with two vertically spaced-apart apertures 16, located substantially at the middle of its width, which constitute indexing features, which will be hereinafter described. Said upright leg is also provided with a pair of horizontally spaced-apart threaded apertures 11a for receiving mounting

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screws 17, for rigidly connecting the sub-assembly B to the assembly A, as seen in Figure 2 of the drawings.

The other sub-assembly indicated at B, in Figure 8 of the drawings, includes a mounting bracket 20 of non-ferrous metal, such as brass. The bracket includes an upright leg 21 terminating at its upper end in a rearwardly extending, horizontally disposed shelf member 22 and the lower end of the leg 21 terminates in a rearwardly extending anchoring lug 23. The leg 21 of the mounting bracket is provided with a horizontally extending slot 25, the lower end of which is of reduced width as indicated at 26, forming a pair of spaced apart shoulders 27. Mounted in the slot of the bracket is an armature 29 formed as a single flat piece of ferrous metal, and having the rear end thereof formed with a tongue 30, of reduced width, for telescoping into the slot 25 of the mounting bracket. The inner end of the tongue is formed at opposite edges with notches as indicated at 31, for telescopic engagement with the shoulders 27 of the mounting bracket, when the armature is seated in the reduced slot 26, so as to lock the armature in position against longitudinal and transverse movements. The slots 31 in the armature are of sufficient size as to permit free hinged or pivotal movement of the armature relatively to the bracket 20. The outer end of the tongue 30 of the armature is connected by a coil spring 33 to the anchoring lug 23 of the bracket, so as to yieldingly urge the armature in an upward direction. The extreme outer ends of the tongue 30 of the armature and the anchoring lug 23 of the bracket are notched as indicated at 30a and 23a respectively for accommodating the end loop of the spring, so as to restrain the spring from turning, insuring at all times a uniform spring tension on the armature, so as not to vary the operating characteristics of the relay.

Mounted directly upon the shelf 22 of the bracket is a combination retainer and stop member 35 of generally rectangular form, having at its forward edge a pair of transversely spaced apart depending lugs 36, adapted to overlap the forward face of the upright leg 21 of the mounting bracket, in close relationship to the armature 29 when properly seated in the slot formed in the mounting bracket, so as to retain the armature in hinged relation to the mounting bracket, and in locked relation to the shoulders 27. Extending forwardly and centrally of the forward edge of the member 35 is a stop finger 38, which extends downwardly so that its outer free end is positioned to be engaged by the armature 29, for limiting the upward movement of said armature about its hinged connection with the bracket 20. The combination retainer and stop member 35 is preferably of non-ferrous metal to break the magnetic field currents and to eliminate any effect on the armature by stray magnetic currents set up in the field piece.

Mounted in superimposed relation on the member 35 and rigidly connected to the shelf member 22 are two stack switch devices, which as shown in Figure 2 of the drawings, each include a plurality of flexible, longitudinally extending conductor fingers, indicated at 41, 42 and 43, provided at their outer ends with contact buttons 41a, 42a and 43a respectively. The conductor fingers are mounted in spaced-apart relation between insulating blocks, as indicated at 45, and the stacks of blocks and conductor fingers are rigidly connected to the shelf member 22, with the member 35 interposed therebetween, by means of screws

46, beneath the heads of which is disposed a spring tension plate 47. It is to be understood that the screws 46 extend through suitable insulating sleeves which project through the entire switch stack assembly, so as to insure insulating the conductor fingers from each other in a manner well understood in the art.

The conductor fingers terminate at their rear ends in terminal portions 41b, 42b and 43b respectively, to provide suitable terminal connections to conductor wires of the electrical circuits in which the switch fingers are included. As seen in Figure 2 of the drawings, the central conductor finger 42 extends a substantial distance beyond the free ends of the other two conductor fingers, and extends freely into a horizontally disposed elongated slot 50 formed in an upright panel 51 of insulating material. The insulating panel is rigidly connected to the outer or free end of the armature 29 by being snugly fitted over a pair of tangs 52 formed at the outer free end of said armature. The tangs, when the panel 51 is mounted thereon, are then staked so as to permanently and rigidly secure the panel in fixed relation to the outer free end of the armature. This manner of connecting the panel to the armature is of a very simple order, and insures a substantial and rigid connection of the parts.

While I have herein shown in the drawings, dual stack switch devices, it will be apparent that a single switch device may also be employed, or I may employ a switch assembly composed of a greater or lesser number of switch fingers, disposed in superimposed relation and actuated through the panel 51. It will be apparent that as the armature is moved from its normally inoperative or de-energized position against the end of the stop finger 38, it causes the intermediate switch finger 42, through the medium of the panel 51, to move so as to break contact between the contact buttons 41a and 42a, and when the armature is in fully attracted position as seen in Figure 2 of the drawings, the contact button 42a is disposed in engagement with the contact button 43a.

In Figure 8, the sub-assembly B is the same as that seen in Figure 2, except I have shown a stack switch including only two switch fingers 42 and 43.

The mounting bracket 20 of the sub-assembly B has the upright leg 21 formed with a pair of vertically spaced-apart, forwardly extending nubbins 55, constituting indexing features, disposed in corresponding relation to the openings 16 of the upright leg 11 of the field piece.

The sub-assemblies A and B are thus unitary assemblies and may be readily connected together by registering and seating of the nubbins 55 in the apertures 16, for properly positioning the sub-assemblies relative to each other. The sub-assemblies may then be fixedly connected together by the mounting screws 17, which extend through apertures 56 in the leg 21 of the mounting bracket, and threaded into the pair of aligned apertures 11a in the upright leg 11 of the field piece. When the sub-assemblies are thus connected, the hinged end of the armature 29 is supported immediately above and in spaced-apart relation to the upper end of the leg 11 of the field piece, so as to provide an air gap therebetween, as indicated at C. By virtue of the air gap, the residual magnetism in the magnetic field does not affect the armature 29, so that the armature may move rapidly and freely out of engagement with the end of the core 15 by the

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action of the spring 33, when the circuit, including the coil 14 is broken. Thus it is possible to obtain rapid make and break of the switch fingers of the stack switch devices, without delayed action due to residual magnetism imposing friction and a binding and sticking action at the hinge connection.

It will also be apparent that great economies in manufacture may be effected by producing the relays in the form of two separate main sub-assemblies, as indicated at A and B, which makes it possible for the respective sub-assemblies to be expeditiously made up, adjusted, gauged and tested, independently of each other, and which sub-assemblies may be subsequently connected together without further testing or adjustment. Such gauging, adjustment and testing may be conveniently made with respect to the index features 16 and 55 of the respective sub-assemblies. Moreover by virtue of such construction and manufacture, the respective sub-assemblies may be made up in different forms, for example, quantities of sub-assemblies A may be made up with coils of different operating characteristics, as represented in Figures 9 and 10, and quantities of different sub-assemblies B may be made up with various arrangements of the stack switch devices, such as represented in Figures 2 and 8 of the drawings. From such stock of sub-assemblies, it is possible to select an assembly A and an assembly B from a wide variety of different sub-assemblies, so as to produce a relay of desired operating characteristics, including a desired switch arrangement. Thus great economies may be effected in mass production of relays of several forms or sizes, wherein a multiplicity of different relays may be readily produced by the selection and assembly of the proper sub-assemblies, so as to obtain relays of desired operating characteristics and switch arrangements.

Although I have herein shown and described a preferred embodiment of my invention, manifestly it is capable of modification and re-arrangement of parts without departing from the spirit and scope thereof. I do not, therefore, wish to be understood as limiting this invention to the precise form herein disclosed, except as it may be so limited by the appended claims.

I claim as my invention:

1. In an electro-magnetic relay including a coil and a core; the combination of a field piece of ferrous metal having an upright leg disposed adjacent the coil, a bracket of non-ferrous metal including an upright leg adapted to be connected to said leg of the field piece, a shelf portion extending horizontally from the upper end of the leg of the bracket, an armature hingedly connected at one end to said upright leg of the bracket and extending over the upper end of the upright leg of the field piece, and disposed in registration with the core, a stack switch mounted on the shelf portion and including a plurality of yieldable elongated conductor fingers extending over and out of range of movement of the armature, and an insulating member connected to the free end of the armature and operably connected to one or more of said switch fingers for controlling the make-and-break of said fingers incident to the movement of the armature.

2. In an electro-magnetic relay including a coil and a core; the combination of a field piece of ferrous metal having an upright leg disposed adjacent the coil, a bracket of non-ferrous metal including an upright leg adapted to be connected

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to said leg of the field piece, a shelf portion extending horizontally from the upper end of the leg of the bracket, an armature hingedly connected at one end to said upright leg of the bracket and extending over the upper end of the upright leg of the field piece, and disposed in registration with the core, a stack switch mounted on the shelf portion and including a plurality of yieldable elongated conductor fingers extending over and out of range of movement of the armature, an insulating member connected to the free end of the armature and operably connected to one or more of said switch fingers for controlling the make-and-break of said fingers incident to the movement of the armature, and a coil spring connected at one end to the hinge end of the armature and at its opposite end to a lug on said leg of the bracket for urging the armature away from the core.

3. In an electro-magnetic relay including a coil and a core; the combination of a field piece of ferrous metal having an upright leg disposed adjacent the coil, a bracket of non-ferrous metal including an upright leg adapted to be directly connected to said leg of the field piece, a shelf portion extending horizontally from the upper end of the leg of the bracket, an armature hingedly connected at one end to said upright leg of the bracket and disposed in registration with the core, a stack switch mounted entirely on the shelf portion and including a plurality of yieldable elongated conductor fingers extending over and out of range of movement of the armature, and an insulating member connected to the free end of the armature and operably connected to one or more of said switch fingers for controlling the make-and-break of said fingers incident to the movement of the armature.

4. In an electro-magnetic relay including a coil and a core; the combination of a field piece of ferrous metal having an upright leg disposed adjacent the coil, a bracket of non-ferrous metal including an upright leg adapted to be connected to said leg of the field piece, a shelf portion extending rearwardly from the upper end of the leg of the bracket, an armature hingedly connected at one end to said upright leg of the bracket, in spaced-apart relation to and above the upper end of said leg of the field piece to form an air gap therebetween, and disposed in registration with the core, a stack switch mounted on the shelf portion and including a plurality of yieldable elongated conductor fingers extending over and out of range of movement of the armature, and an insulating member connected to the free end of the armature and operably connected to one or more of said switch fingers for controlling the make-and-break of said fingers incident to the movement of the armature.

5. An electro-magnetic relay comprising two prefabricated main sub-assemblies; one of said assemblies including a field piece of ferrous metal having an upright leg, a coil and a core rigidly connected to the field piece; the other sub-assembly including a bracket having an upright leg and a shelf portion extending horizontally from the upper end of the leg thereof, an armature hingedly connected at one end to the upright leg of the bracket, a coil spring connected to the rear end of the armature and to a lug on said leg of the bracket, a stack switch mounted on said shelf portion and including a plurality of yieldable elongated conductor fingers extending above said armature, and an upright member of insulating material rigidly connected to the forward

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end of the armature and operably connected to one or more of said fingers for controlling the make-and-break thereof in response to movement of the armature; and means for connecting the upright leg of the field piece to the upright leg of the bracket for securing the two assemblies in cooperating relation.

6. An electro-magnetic relay comprising two prefabricated main sub-assemblies; one of said assemblies including a field piece of ferrous metal having an upright leg, a coil and a core rigidly connected to the field piece; the other sub-assembly including a bracket of non-ferrous metal including an upright leg and a shelf portion extending horizontally from the upper end of the leg thereof, an armature hingedly connected at one end to the upright leg of the bracket, a coil spring connected to the rear end of the armature and to a lug on said leg of the bracket, a stack switch mounted on said shelf portion and including a plurality of yieldable elongated conductor fingers extending above said armature, and an upright member of insulating material rigidly connected to the forward end of the armature and operably connected to one or more of said fingers for controlling the make-and-break thereof in response to movement of the armature; and means for connecting the upright leg of the field piece to the upright leg of the bracket for securing the two assemblies in cooperating relation.

7. An electro-magnetic relay comprising two prefabricated main sub-assemblies; one of said assemblies including a field piece of ferrous metal having an upright leg, a coil and a core rigidly connected to the field piece; the other sub-assembly including a bracket of non-ferrous metal

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including an upright leg and a shelf portion extending horizontally from the upper end of the leg thereof, an armature hingedly connected at one end to the upright leg of the bracket, a coil spring connected to the rear end of the armature and to a lug on said leg of the bracket, a stack switch mounted on said shelf portion and including a plurality of yieldable elongated conductor fingers extending above said armature, and an upright member of insulating material rigidly connected to the forward end of the armature and operably connected to one or more of said fingers for controlling the make-and-break thereof in response to movement of the armature; and means for connecting the upright leg of the field piece to the upright leg of the bracket for securing the two assemblies in cooperating relation; the upright legs of the field piece and bracket being formed and dimensioned to cause the armature to be supported closely above the upper end of the upright leg of the field piece to form an air gap therebetween.

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