June 3, 1947. T. OBSZARNY 2,421,642

ELECTROMAGNET RELAY CONSTRUCTION

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Fig. 1.

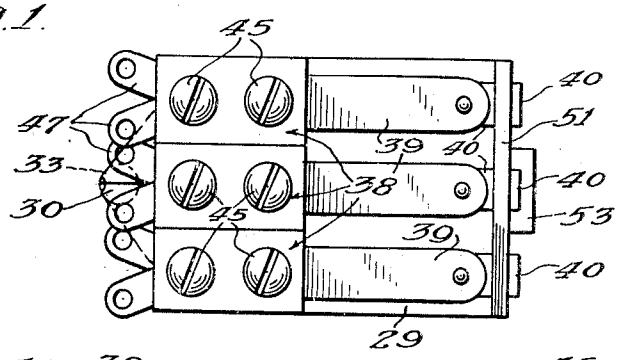


Fig. 2.

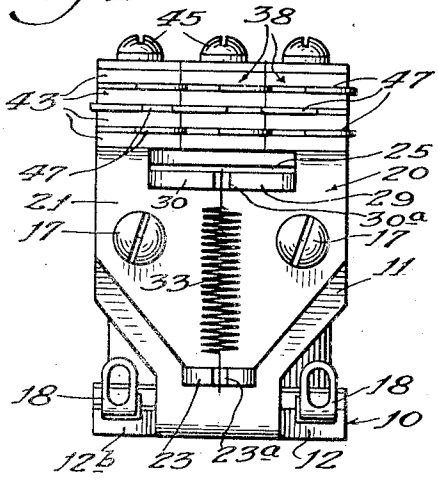


Fig. 3.

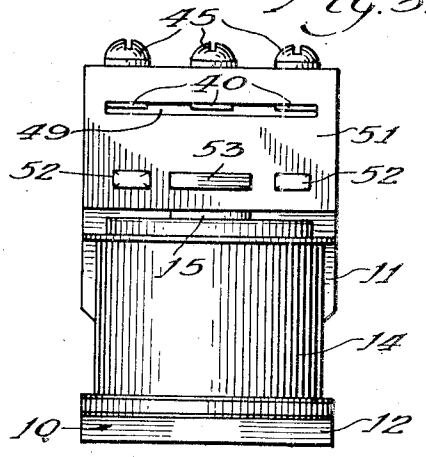
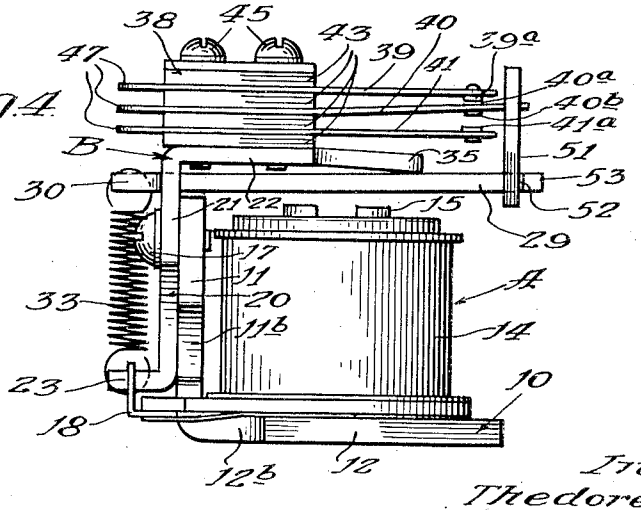


Fig. 4.



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Fig. 5.

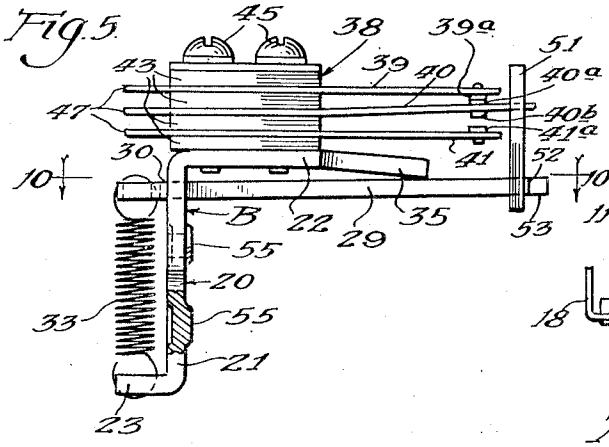


Fig. 6.

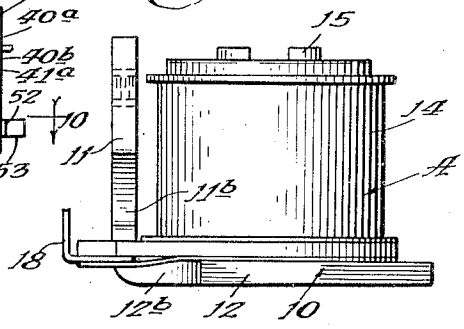


Fig. 8.

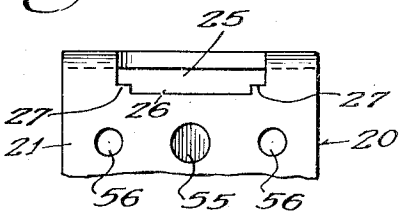


Fig. 7.

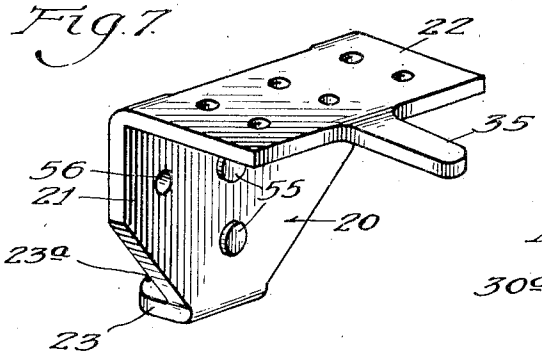


Fig. 9.

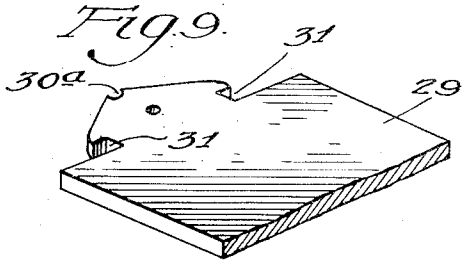


Fig. 11.

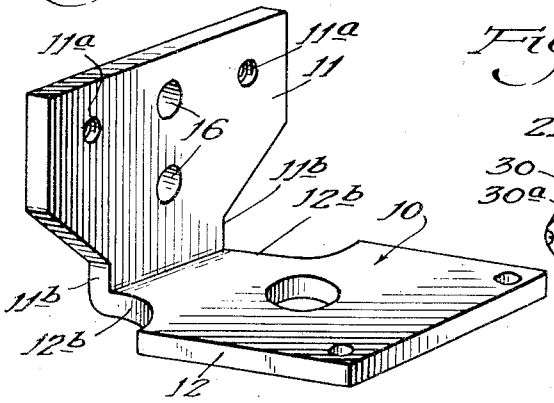
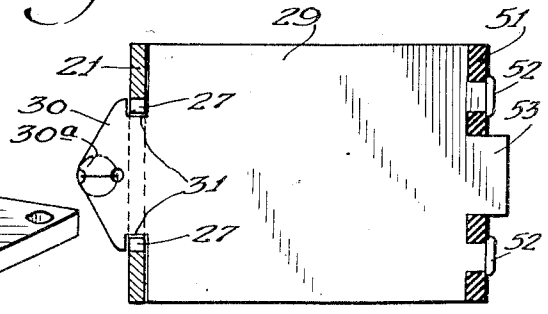


Fig. 10.



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ELECTROMAGNET RELAY CONSTRUCTION

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Application June 15, 1944, Serial No. 540,373

3 Claims. (Cl. 200—87)

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This invention relates to electro-magnetic devices, such as relays. Devices of this general class are adapted to an extremely wide field of use, and have been produced in numerous sizes and constructional arrangements. One of the present day's most common, inexpensive and widely used relay is of the type having an armature hingedly mounted at one end, and the opposite end being operably connected to and adapted for actuating a switch device mounted to extend above and over the armature. Relays of this type, due to inherent constructional characteristics, do not as a rule lend themselves for practical use where minimum space requirements are an important factor, nor to manufacture by mass production methods.

One of the objects of this invention is to provide a novel and improved electro-magnet of the character indicated, which is of extremely compact and simplified construction, requiring a minimum amount of space, and which is capable of being economically manufactured by mass production methods.

Another object is to provide certain novel and important improvements in electro-magnets of the character indicated, and which lend themselves for embodiment in relay structures wherein the parts are initially made up in two main sub-assemblies to facilitate final assembly, and also the adjustment and testing of the parts, and wherein each sub-assembly may be made up in various forms and/or sizes, permitting great economy and mass production of a relatively large number of relays of different operating characteristics and switch arrangements.

A further object is to provide a novel constructional arrangement of a support for the switch device, together with the provision of novel stop means for limiting upward movement of the armature, and which lend themselves to the production of an inexpensive, relatively compact relay.

Still another object is to provide an improved electromagnet having a field piece formed with novel constructional features for accommodating the terminals, at the ends of the wire of the coil, in a compact convenient arrangement, and which insures adequate protection for the terminals against possible injury or damage when connected in an electrical circuit.

Other objects and advantages of this invention will be apparent in the following description, taken in connection with the accompanying drawings in which:

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

Figures 2, 3 and 4 are rear, front and side elevational views respectively of the relay embodying the present invention.

Figure 5 is a side elevational view of one of the sub-assemblies of the relay, including the armature and switch device.

Figure 6 is a side elevational view of the other sub-assembly, including the coil and its core, together with the field piece.

Figure 7 is a perspective view of the mounting bracket for the armature and switch device.

Figure 8 is a fragmentary rear view of the upper portion of the mounting bracket.

Figure 9 is a fragmentary perspective view of the hinged end portion of the armature.

Figure 10 is a horizontal sectional view through the armature sub-assembly, taken substantially as indicated at line 10—10 on Figure 5, and

Figure 11 is a perspective view of the novel field piece construction.

The novel constructional features embodying the present invention may be utilized individually or collectively in an electro-magnet or relay device, and are especially adaptable for embodiment in a relay construction as illustrated in the drawings, which is composed of two main sub-assemblies indicated at A, in Figure 6 of the drawings, and as indicated at B in Figure 5 of the drawings.

The sub-assembly A includes a field piece 10 of ferrous metal, comprising an upright leg 11 and a horizontal leg or foot 12. Rigidly connected to the horizontal foot or leg of the field piece is a coil 14 having a core 15. The upstanding leg 11, as seen in Figure 11 of the drawings, is provided with two vertically spaced apart apertures 16, located substantially at the middle of its width, and which, as will hereinafter be described, constitute indexing features. Said upright leg is also provided with a pair of horizontally spaced apart threaded apertures 11a for receiving mounting screws 17 which serve to rigidly connect the sub-assembly B to the sub-assembly A as seen in Figures 2 and 4 of the drawings.

The lower portion of each side of the upright leg 11 of the field piece, adjacent its connection to the horizontal leg 12, is cut away or notched as indicated at 11b, and these notches register with notched portions 12b, formed in each side of the horizontal leg of the field piece. The purpose of notching the two legs of the field piece is to accommodate the terminal clips 18, con-

nected to the ends of the wire of the coil 14. As may be clearly seen in Figures 2, 4 and 6 of the drawings, the notched portions of the field piece permit disposition of the terminals 18 within the width of the legs of the field piece in a position so that the terminals 18, may be depressed slightly downwardly, into the notched portion 12b of the horizontal leg of the field piece, to afford maximum convenience for connection of the terminals to conductor wires of an electrical circuit, rearwardly and outside of the upright leg 11, while at the same time insuring disposition of the terminals in compact relation to the coil in a manner so as to preclude possibility of damage or injury thereto. In relays of the general type, the terminals usually project from the forward end of the relay, that is the end opposite the upright leg, in a position where they are subject to damage or injury by abutment with other objects, and which may result in breaking of electrical circuit connections. The present constructional arrangement eliminates the possibility of such injury to the terminals.

The other sub-assembly indicated at B, as represented in Figure 5 of the drawings, includes a mounting bracket 20, of non-ferrous metal, such as brass, comprising an upright leg 21, terminating at its upper end in a forwardly extending, horizontally disposed shelf member 22, while the lower end of said 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, adjacent the upper end thereof, as clearly seen in Figure 8 of the drawings. The lower portion of said slot is of reduced width, as indicated at 26, forming a pair of spaced apart shoulders 27. Mounted in seated relation in the slot 26 of the bracket is an armature 29, formed of a single flat piece of ferrous metal, having the rear end thereof terminating in a tongue 30 of reduced width for telescoping into the slot 25 and seating in the slot 26 of the mounting bracket. The inner end of the tongue is formed at opposite sides 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 portion 26, so as to lock the armature in position against longitudinal and transverse movement and providing a hinge mounting for the armature. The slots 31 in the armature are of a size as to permit free rocking movement of the armature relative to the mounting bracket 20.

The outer or rear end of the tongue 30 of the armature is connected by a coil spring 33 to the anchoring lug 23, at the lower end of the leg 21 of the bracket. This spring serves to yieldingly urge the free end of the armature in an upwardly direction. The extreme outer ends of the tongue of the armature and the anchoring lug 23 of the bracket are notched, as indicated at 30a and 23a respectively for accommodating the end loops of the spring so as to restrain the spring from turning and permitting positioning of the spring in close relation to the leg 21 of the mounting bracket, while also insuring uniform spring tension on the armature so as to preclude variation in the operating characteristics of the relay.

The forward portion of the shelf 22 has integrally formed therewith an elongated finger 35, which is bent slightly downwardly, as clearly seen in Figures 4 and 5 of the drawings, the outer end of the finger serving as to stop to limit the upward movement of the free end of the armature 29, about its hinge connection with the leg 21 of the mounting bracket. The stop finger, being formed as an integral part of the mounting bracket and formed of non-ferrous metal, serves to break the magnetic field currents and eliminates any effect on the armature by stray magnetic currents set up in the field piece in a manner well understood in the art.

Mounted on the shelf member 22, and extending forwardly of the leg 21, are three stack switch devices 38, each of which include a set of three flexible, longitudinally extending conductor fingers 39, 40 and 41, provided at their outer free ends with cooperating contact buttons 39a, 40a, 40b, and 41a. The conductor fingers are mounted in spaced apart relation to each other, at their mounting ends, between insulating blocks as indicated at 43, and the stacks of blocks, with the conductor fingers interposed therebetween are rigidly connected to the shelf member 22 by means of screws 45. It is to be understood that the screws 45 extend through suitable insulating sleeves (not shown) 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 screws 45, and preferably the ones nearest the leg 21 of the mounting bracket, are of such length that their terminal ends, as seen in Figure 5 of the drawings, project a short distance below the under side of the shelf 22 so as to serve as stops and maintain the armature 29 seated in operative relation in the reduced slot 26, of the mounting bracket 20, and limit the upward movement of the hinge end of the armature in the mounting bracket.

The rear ends of the conductor fingers are each formed with terminal portions 47 for connection to conductor wires of electrical circuits. As clearly seen in Figures 4 and 5 of the drawings, the free end of the central conductor finger 40, of each switch device, extends a substantial distance and is projected beyond the free ends of the other two conductor fingers, and is projected into a horizontally disposed slot 49, formed in an upright panel 51 of insulating material. Said panel 51 is mounted on the outer or free end of the armature 29 by being snugly fitted over tangs 52 and 53, with the tangs 52 staked so as to permanently and rigidly secure the panel in fixed relation to the outer or free end of the armature.

While I have herein shown in the drawings three separate stack switch devices, each including three conductor fingers, it will be apparent that a lesser number of stack switches may be employed and with different numbers and arrangements of conductor fingers. It will also be manifest that as the armature is moved from its normally inoperative or deenergized position, against the end of the stop finger 35, said armature through the medium of the panel 51, causes the switch finger 40 of each switch device to separate the contacts 40a and 39a and complete engagement between contacts 40b and 41a. By virtue of the construction described, wherein the stack switches are mounted on a forwardly and horizontally extending shelf, it is possible to reduce the general overall dimensions of relays of the type embodying the present invention, and permits obtaining a more compact construction which adapts itself for use where minimum space requirements is an important factor, as compared with relays of this general type as heretofore manufactured. It will also be apparent that the novel switch mounting shelf and armature stop

eliminates the use of auxiliary elements heretofore employed for the purpose of providing an armature stop, and also means for maintaining the hinge end of the armature in seated hinged relation to the mounting bracket. It will therefore be seen that in addition to the saving in cost by elimination of such elements as heretofore employed, and the cost of assembling same in a relay, there also results the additional and important advantage of a reduction in height of the relay device.

The mounting bracket **20** of the sub-assembly B, has its upright leg **21** formed with a pair of vertically spaced apart forwardly extending nubbins **55**, constituting indexing features, adapted for cooperating registering relation with the index apertures **16**, formed in the upright leg **11** of the field piece.

The sub-assemblies A and B are thus unitary assemblies, and may be readily connected together in proper cooperative relation by registering and seating the nubbins **55** of the bracket **20**, in the apertures **16** in the field piece **10**, and then fixedly connecting the sub-assemblies together by the mounting screws **17** which are adapted to be projected through a pair of horizontally spaced apart apertures **56** formed in the upright leg of the mounting bracket and engaged in the threaded, aligned apertures *11a* in the upright leg **11** of the field piece. In such connected relation of the two assemblies, the armature may be supported in spaced apart relation to the upper end of the vertical leg **11** of the field piece, so as to provide an air gap therebetween. This is highly desirable when the relay is to be operated by alternating current so as to preclude residual magnetism in the magnetic field from effecting operation of the armature **29**, and thus the armature is permitted to move rapidly and freely out of engagement with the core **15** under influence of spring **33** when the circuit including the coil **14** is broken. Thus it is possible to obtain rapid make and break of the contacts of the switch finger without delayed action due to residual magnetism imposing a binding or sticking action at the hinged connection of the armature. When the relay is to be operated by direct current, the conventional copper shading ring is eliminated and it may be preferable to dimension the field piece and armature and/or its mounting bracket so that in actuating position of the armature, that is, when the coil is energized and the armature is seated on the core, the portion of the armature adjacent its hinged end, will seat directly upon the upper end of the field piece. This will permit obtaining full magnetic efficiency of the magnetic field so that the relay can be operated within specific ranges of current.

In addition to the above stated advantages of the novel constructional features embodying the present invention, it will be apparent that still further economies in manufacture are effected when the relays are produced in the form of two separate main sub-assemblies as indicated at A and B, which makes it possible for the two 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. Thus the respectve sub-assemblies may be made up in different forms, that is, the assembly A may be made up in quantities with coils of different operating characteristics, and quantities of the sub-assembly B may be made up with different arrangements and numer of stack switch devices so that it is possible to select

from stock an assembly A and an assembly B from a wide variety of different sub-assemblies so as to obtain relays of desired operating characteristics and switch arrangements, as disclosed in my copending application Serial No. 487,729, filed May 20, 1943.

Although I have herein shown and described the novel constructional features embodying the present invention in association with a relay formed of two main sub-assemblies, it will be manifest that said novel constructional features may be readily embodied in various electro-magnets and other relay constructions without departing from the spirit and scope of the invention. I do not, therefore wish to limit this invention to the precise embodiment herein disclosed, except as it may be so limited by the appended claims.

I claim as my invention:

1. In an electro-magnetic relay comprising a field piece having a horizontal leg and a vertical leg connected thereto, a coil fixedly mounted on one end on said horizontal leg, a bracket of non-magnetic material rigidly connected to the upper end of the vertical leg, an armature hingedly supported at one end on said bracket and disposed in registration with the core of the coil, a switch device operably connected to the free end of the armature; the improvement comprising a shelf portion extending forwardly from the bracket, above said armature and coil, and serving as a mounting for said switch device, said shelf portion terminating in a forwardly projecting finger positioned over the armature and serving to limit upwardly movement of the free end of the latter.

2. In a sub-assembly of an electro-magnetic relay, the combination of an armature, a mounting bracket of non-magnetic material including an upright leg formed with a rocking mounting seat for the rear end of the armature, said leg terminating at its upper end in a forwardly projecting shelf adapted to be extended over the main portion of the armature, the lower end of said leg being provided with an anchor lug, a spring connecting said lug and the rear end of the armature, a switch device seated on the shelf, screws for securing said switch device to the shelf and projecting therebelow at a position above the armature to confine the latter in seating relation to said bracket, and means on the free end of the armature, operably connected to the switch device for actuating the latter incident to movement of the armature.

3. In a sub-assembly of an electro-magnetic relay, the combination of an armature, a mounting bracket of non-magnetic material including an upright leg formed with a rocking mounting seat for the rear end of the armature, said leg terminating at its upper end in a forwardly projecting shelf adapted to be extended over the main portion of the armature, the lower end of said leg being provided with an anchor lug, a spring connecting said lug and the rear end of the armature, a switch device seated on the shelf, screws for securing said switch device to the shelf and projecting therebelow at a position above the armature to confine the latter in seating relation to said bracket, the forward end of the shelf terminating in a downturned finger position to be engaged by and serving as a stop for the armature for limiting its upwardly movement relatively to the bracket, and means on the free end of the armature, operably connected

to the switch device for actuating the latter incident to movement of the armature.

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