

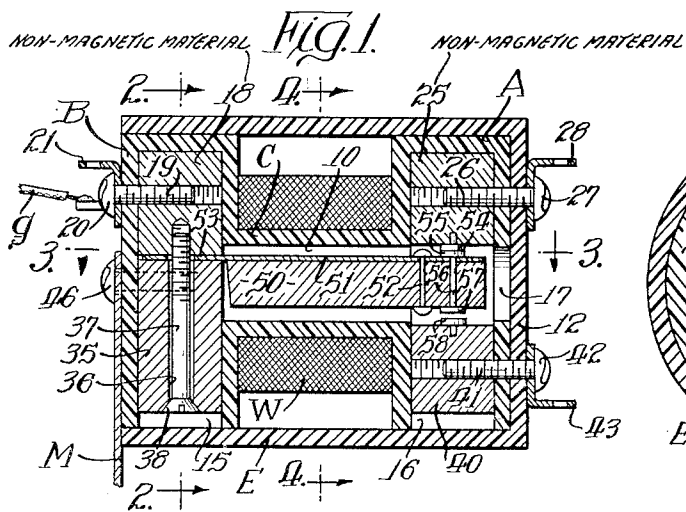
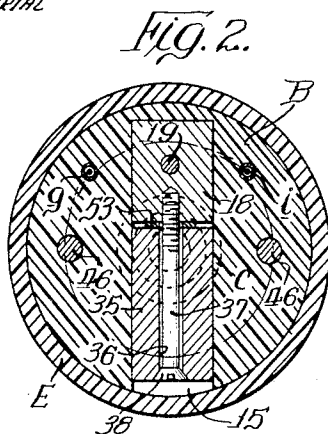
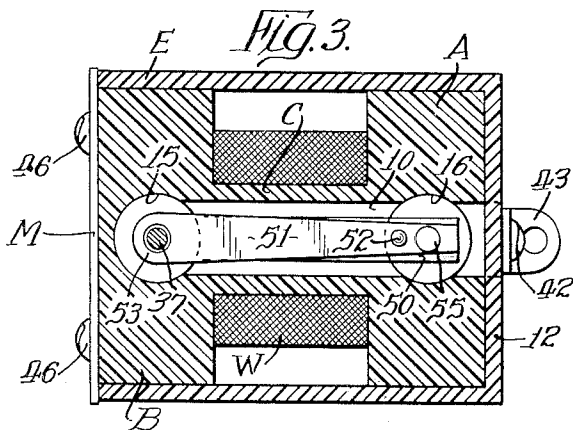
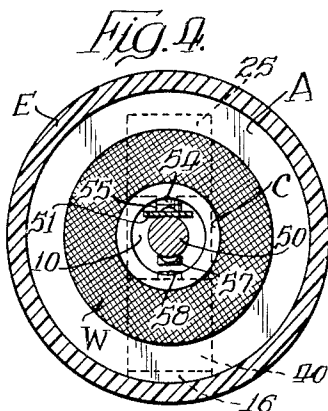
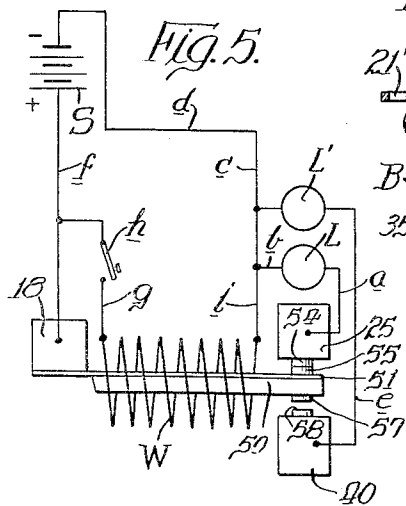
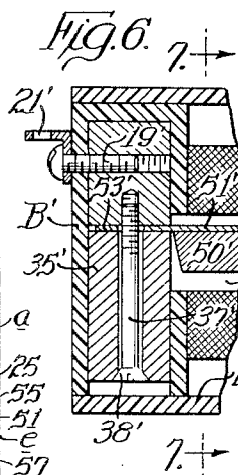
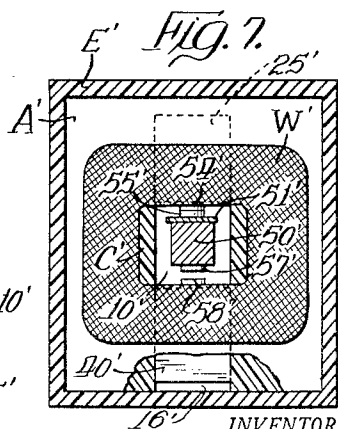
Nov. 18, 1952

G. F. DALY

2,618,754

ELECTROMAGNETIC RELAY

Filed July 21, 1950



INVENTOR.
George F. Daly
BY *Channing & Channing*

UNITED STATES PATENT OFFICE

2,618,754

ELECTROMAGNETIC RELAY

George F. Daly, Chicago, Ill.

Application July 21, 1950, Serial No. 175,115

5 Claims. (Cl. 307-143)

1

This invention relates to relays, particularly of the low voltage signal type, and has for its primary object the provision of an improved relay in which the working parts are contained within a hollow spool which is enclosed within a housing therefor so as to protect it from dirt, oil, and other surrounding matter.

It is a further object to provide a simple, efficient, and dependable relay which will take up less space than a comparable relay of conventional construction; a novel and improved electromagnetic relay in which the armature of the relay constitutes all or a major portion of the magnetic core of the relay; and a mounting for the essential parts of the relay in the general form of a hollow spool, together with an enclosing housing therefor; and a single means for securing the spool within the housing serving to hold also certain of the relay components within the spool.

Various other objects, advantages and features of the invention will be apparent from the following description when taken in conjunction with the accompanying drawing wherein a preferred embodiment is set forth for purposes of illustration in the manner following:

Figure 1 is a longitudinal vertical section through a relay constructed in accordance with this invention;

Fig. 2 is a transverse section therethrough, taken on line 2-2 of Fig. 1;

Fig. 3 is a horizontal section therethrough, taken on line 3-3 of Fig. 1;

Fig. 4 is a transverse section therethrough, taken on line 4-4 of Fig. 1;

Fig. 5 is a schematic diagram of the relay in a typical relay circuit;

Fig. 6 is a fragmentary vertical section of the relay when modified in the one respect of having its cross sectional contour square instead of round; and

Fig. 7 is a transverse sectional view, taken on line 7-7 of Fig. 6.

There is shown in Figs. 1-4 a form for the relay coil in the nature of a spool having front and rear cylindrical heads A and B interconnected by a hollow hub C having a longitudinally extending chamber 10. Such a spool structure is adapted to support the wire windings W constituting the coil of the relay, and to be accommodated within a cylindrical housing E closed by a wall 12 at its end which is proximate to the front head A. The rear spool head B normally lies substantially flush with the open end of the housing and occupies the full area thereof so as to provide a closure therefor.

2

Within the rear head B is provided a diametrically extending chamber 15 aligned with a like chamber 16 in the front head A, each chamber being closed at one end—the top as herein shown. These two head chambers communicate at points medially of their ends with the hub chamber 10, and oppositely of the hub an opening 17 is provided in the outer wall of the front head A. The cross sectional form of these head chambers is a matter of choice, but for simplicity in construction and illustration a round cross section is indicated.

Positioned within the upper end portion of the rear chamber 15 is a cylindrical terminal block 18 whose lower face depends slightly below the top face of the hub chamber 10. A screw 19 having a threaded shank is entered through the outer end of the rear head B to engage with a tapped hole in the terminal block therewithin and provide a securing means therefor. The head 20 of this screw engages a terminal fitting 21 which is carried on the outer wall of the rear head B.

Within the chamber 16 in the front head A is a second terminal block 25 also secured in place by the threaded shank of a screw 26 which is entered into a tapped hole therein, the screw head 27 which is disposed exteriorly of the housing wall 12 being engaged with a terminal fitting 28 to secure the same in place. The lower face of the terminal block is approximately aligned with the top face of the hub chamber 10.

There is also accommodated within the rear head chamber 15 a cylindrical clamping block 35 formed therethrough with an axial hole 36 for reception of the shank of a locking screw 37 whose head 38 is engaged with the block at its bottom end. The upper end portion of the screw shank which is threaded is entered into a tapped socket in the terminal block 18 thereabove to engage therewith, thereby to secure the clamping block 35 fixedly in place. Another cylindrical terminal block 40 is positioned in the front head chamber 16. The top face of this block is approximately aligned with the lower face of the hub chamber 10. A screw 41 which is extended through the wall 12 is entered into a tapped hole in the block 40 for screw-threaded engagement therewith, the screw head 42 remaining exteriorly of the housing to engage a terminal fitting 43 which is thereby secured to the housing end wall 12. At the rear end of the spool connection may be made with a mounting bracket M by means of screws 46 which pass therethrough to enter tapped holes in the outer wall of the head B.

Within the hub chamber 10 is extended a

magnetic armature in the general form of an elongated bar 50 of soft iron or the like. A leaf spring 51 which is connected by a rivet 52 to the top face of the armature bar extends lengthwise thereof and beyond its rear end at 53 to provide a hinge which is positioned intermediately of the upper and lower blocks 18 and 35 to be clamped fixedly in position therebetween when the anchoring screw 37 which passes therethrough is rotatively advanced to its final position. The leaf spring which is thereby secured fixedly in place provides a hinge-spring mounting for the armature bar such that its free end at the front has capacity to swing down and away from the normal up position of Fig. 1.

A contact 54 is carried on the lower face of the upper block 25 at a point oppositely of a coacting contact 55 which is carried at the top end of a pin 56 which extends vertically through the armature bar 50; and a contact 57 is also carried at the lower end of the pin 56 oppositely of a coacting contact 58 on the top face of the block 40. Through a lead *a* an electrical connection from the upper terminal block 25 is established with a lamp L, or other mechanism to be electrically energized (see Fig. 5), the lamp being in electrical connection through leads *b*, *c*, and *d* with one side of a current source S. The lower terminal block 40 is in electrical connection through a lead *e* with a second lamp L' (or other electrically energized mechanism) which connects electrically with the same current source S through the leads *c* and *d*. From the other side of the current source a lead *f* connects with the upper terminal block 18 which is in electrical connection with the armature bar 50. A lead *g*, which is tapped into the lead *f* and provided with a switch *h*, connects with one end of the coil W whose other end is connected with the lead *i* which is tapped into the lead *b*. The coil is thereby placed in circuit with the current source S. With the switch *h* in open position, the circuit remains closed through the armature 50, contacts 54 and 55 and leads *a*—*d* to energize the lamp L, but when the switch is operated to closed position, current flows through the coil W to lower the armature 50 and establish an alternate circuit through the leads *e*, *c*, and *d* to energize the lamp L'.

The structure of the coil spool may advantageously be produced in one piece from a plastic material having an insulation value which is adequate to prevent current leakage between the several current conducting parts. When assembled and in use, the relay components are maintained fixedly in position and completely protected within the chambers wherein they are located, and within the enclosing housing that is provided for the spool structure as a whole. The lower blocks 35 and 40 are desirably produced from magnetic material—soft iron, for example, whereas the terminal blocks 18 and 25 are of non-magnetic material. The cross sectional form of the relay may be variously contoured. A square structure is indicated in Figs. 6 and 7 wherein the various parts which correspond to those already described in connection with Figs. 1-4 bear the same reference characters with a prime added thereto.

Normally the armature spring 51 tends to urge the armature 50 in the up direction whereby to maintain the contacts 54 and 55 normally in engagement. However, when the current flows through the coil W it sets up in the chamber 10 a magnetic field having a flux whose major por-

tion flows through the magnetic blocks 40 and 35 to the armature 50 which is attracted to the magnetic block 40, thus separating the upper contacts 54 and 55 and bringing the lower contacts 57 and 58 into engagement. There is sufficient space, angular or otherwise, between the armature bar 50 and the magnetic block 35 to permit swinging movement of the armature through its operative range. The head 53 of the spring 51 may be fitted snugly within the space between the terminal block 18 and the magnetic block 35 to prevent sidewise movement of the armature, and the rivet and pin connections 52 and 56 between the spring and armature serve effectively to prevent one from swinging relative to the other.

The concentration of magnetic flux in the armature 50 is high inasmuch as this armature also serves as the core of the relay, being situated in the strongest part of the magnetic field. The force of attraction between the armature 50 and the magnetic block 40 is therefore relatively strong, even for a small current flowing through the coil W. The flux is intensified by the magnetic block 35 which provides a magnetic path around the rear end of the coil W to the armature 50, and as a result the armature is sensitively responsive to a very weak current when flowing through the coil.

The relay herein described has proved dependable in operation over a prolonged period of time and with no maintenance attention. In these respects it is advantageous over relays in which the working parts are exterior to the coil or winding. My present relay is also more efficient since the movable armature is disposed in a portion of the magnetic field where the magnetism is strongest, viz. along the axis of the coil.

I claim:

1. In an electromagnetic relay, a spool having spaced heads with diametrically extending chambers interconnected by a hub with an elongated axial chamber in communication with those in the heads, a coil wound upon the hub between the heads of the spool, an elongated armature extended longitudinally within the axial chamber of the hub, a pair of spaced terminal blocks positioned within one head chamber and separated oppositely of the hub chamber to accommodate therebetween one end of the armature, a terminal block fixedly secured in the other head chamber disposed wholly to one side of the armature, a magnetic block also positioned slidably within the head chamber last named and extended beyond the proximate end of the armature in lapping relation thereto, a leaf spring affixed to the armature and provided beyond one of the armature ends with an extension disposed between the terminal and magnetic blocks in the head chamber last named, screw means extended through the magnetic block and into the adjacent fixed terminal block for threaded engagement therewith and acting to secure the magnetic block thereto and clamp the leaf spring extension therebetween to provide for the armature a spring hinge mounting which urges the armature free end toward one of the two spaced terminal blocks adjacent thereto, a pair of contacts carried at the armature free end and other coacting contacts opposite thereto carried on the adjacent terminal blocks, and switch-controlled electrical circuit connections between a current source and the coil and between the armature and each set of contacts separately

for operation alternately of a pair of electrically energized devices.

2. In an electromagnetic relay, a spool having spaced heads with diametrically extended chambers interconnected by a hub with an elongated axial chamber in communication with those in the heads, a coil wound upon the hub, an elongated armature extended longitudinally within the axial chamber of the hub and into one of the head chambers, a pair of spaced contact-supporting blocks within the head chamber last named arranged to receive alternately contact from the proximate armature end when it is moved therebetween, a pair of blocks, arranged end to end, one fixed and the other movable toward the first, in the other head chamber, a leaf spring affixed to the armature and extending beyond one end thereof between the two blocks last named to be engaged thereby, screw means interconnecting the two blocks last named and the leaf spring portion therebetween and acting, when rotatively advanced, to advance one block toward the other to engage with pressure the leaf spring portion therebetween whereby to provide a tensioned mounting for one end of the armature whose opposite end is biased into engagement with one of the spaced contact-supporting blocks, and switch-controlled electrical circuit connections between a current source and the coil and between the armature and each contact-supporting block separately for operation alternately of a pair of electrically energized devices.

3. In an electromagnetic relay, a spool having spaced heads with chambers extending transversely of the spool axis and each opening out upon one side of the head, a hub interconnecting the two heads and formed with an elongated axial chamber in communication with those in the heads, a coil wound upon the hub, an elongated armature extended longitudinally within the axial chamber of the hub and into one of the head chambers, a pair of spaced contact-supporting blocks within the head chamber last named arranged to receive alternately contact from the proximate armature end when moved therebetween, a pair of blocks, one fixed and the other movable toward the first, in the other head chamber, a leaf spring affixed to the armature and extending beyond one end thereof between the two blocks last named to be engaged thereby, screw means interconnecting the two blocks last named and the leaf spring portion therebetween and acting, when rotatively advanced, to advance one block toward the other to engage with pressure the leaf spring portion therebetween whereby to provide a tensioned mounting for one end of the armature whose opposite end is biased into engagement with one of the spaced contact-supporting blocks, a housing closed at one end and open at the other providing an enclosure for the relay spool and a closure for the open ends of the head chambers, screw means traversing the closed end of the housing and entered into the contact-supporting blocks of the proximate head for threaded engagement therewith to secure the blocks fixedly in spaced positions therewithin and also secure the relay spool fixedly in position within the housing, and switch-controlled electrical circuit connections between a current source and the coil and between the armature and each contact-supporting block separately for operation alternately of a pair of electrically energized devices.

edly in position within the housing, and switch-controlled electrical circuit connections between a current source and the coil and between the armature and each contact-supporting block separately for operation alternately of a pair of electrically energized devices.

4. In an electromagnetic relay, a spool having spaced heads with chambers extending transversely of the spool axis and each opening out at one side of the head, a hub interconnecting the two heads and formed with an axial chamber communicating with those in the heads, a coil wound around the hub between the heads of the spool, a pair of spaced contact-supporting blocks in the chamber of one head, an elongated armature within the axial chamber of the hub having a spring mounting at one of its ends whereby its opposite end is free to move between the adjacent contact-supporting blocks, a housing closed at one end and open at the other providing an enclosure for the relay spool one of whose heads is disposed at the housing open end to provide a closure therefor, the housing also providing a closure for the open ends of the head chambers, and screw means traversing the closed end of the housing and entered into the contact-supporting blocks of the proximate head for threaded engagement therewith to secure the blocks fixedly in position therewithin and also secure the relay spool fixedly in position within the housing.

5. In an electromagnetic relay, a spool having spaced chambered heads interconnected by an axially hollow hub, the head chambers being disposed transversely of the spool axis and opening out upon one side of the spool, a coil wound around the hub between the heads of the spool, a pair of spaced contact-supporting blocks in the chamber of one head, an elongated armature within the hub having a spring mounting at one of its ends whereby its opposite end is free to move between the adjacent contact-supporting blocks, a housing closed at one end and open at the other providing an enclosure for the relay spool and for the open ends of the chambers of its two heads, one of the spool heads being normally disposed at the housing open end to provide a closure therefor, and screw means traversing the closed end of the housing and entered into the contact-supporting blocks of the proximate head for threaded engagement therewith to secure the blocks fixedly in position therewithin and also secure the relay spool fixedly in position within the housing.

GEORGE F. DALY.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,029,267	Leece et al.	Jan. 23, 1936
2,401,347	Hansen	June 4, 1946
2,471,594	Weightman	May 31, 1949
2,486,394	Eannarino	Nov. 1, 1949
2,570,315	Brewer	Oct. 9, 1951