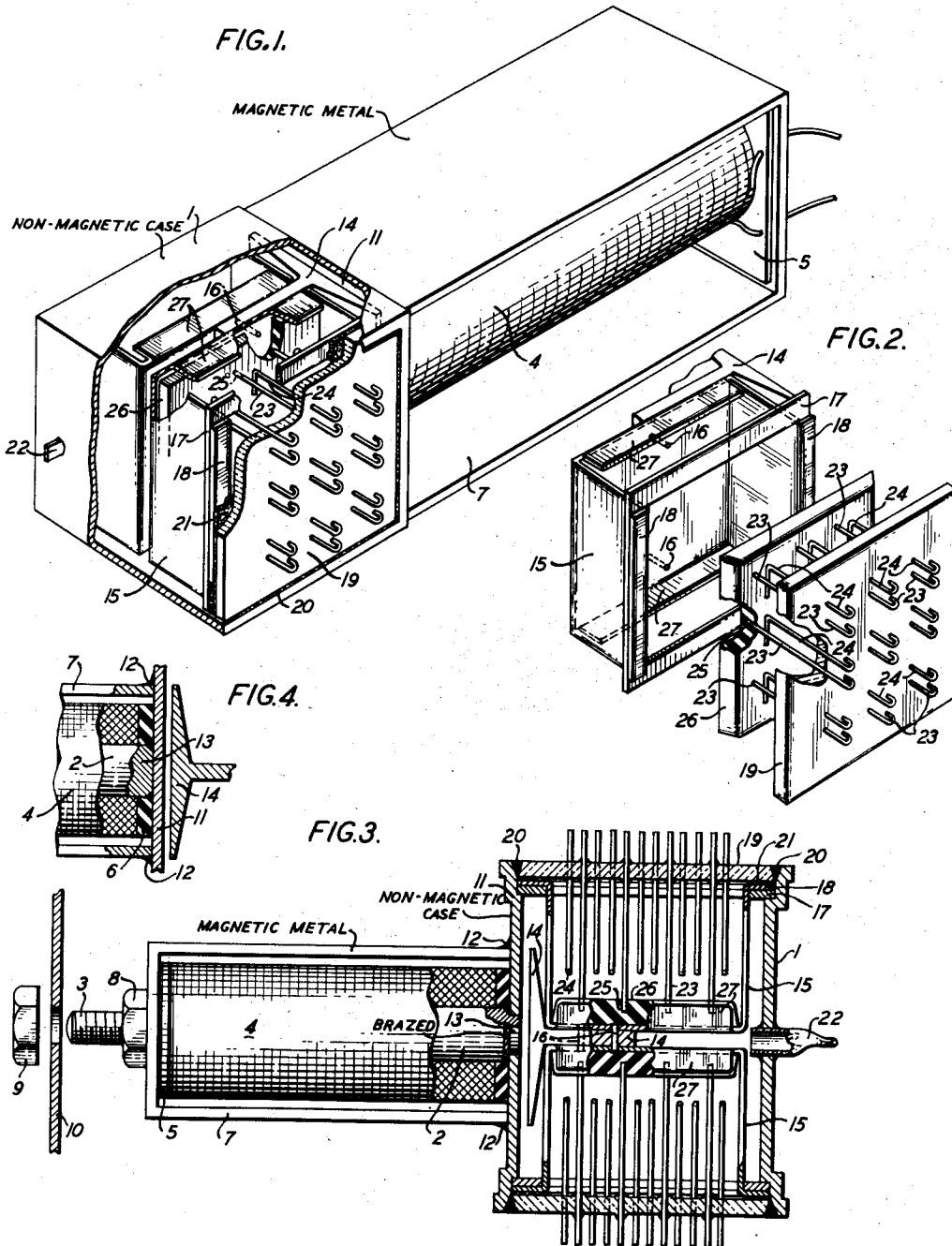


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ELECTROMAGNETIC RELAY

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ELECTROMAGNETIC RELAY

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1

This invention relates to general purpose electromagnetic relays and more particularly to improvements in and relating to such relays as regards the structure and functioning of moving parts thereof.

Generally speaking electromagnetic relays having all of their operating or moving parts and contacts totally enclosed are not new. Some relays have been characterized by flexible chambers which permit a certain amount of mechanical movement thereof to effect the necessary contact closure; others have been characterized by rigid chambers, the magnetic contents of which are subjected to external magnetic fields for operating thereof; still other relays have been provided with structures of similar well-known nature.

It is one object of the present invention to effect an improvement in the above general field of enclosed relays by reason of certain novel structural features with attendant functional advantages. Briefly from the structural viewpoint the invention provides a relay all of whose moving parts are enclosed within a hermetically sealable chamber, which chamber may be structurally exclusive of the source of magnetic influence provided to actuate such parts. The parts comprise an armature suspended and biased by a cantilever type spring suspension, which suspension is so constructed as to house or accommodate at least one card type of contact spring actuating member. One or more sides or confining portions of the said chamber each may comprise a replaceable mold of insulating material having rigidly fixed thereto or therein a plurality of cooperating relatively movable and relatively fixed contact springs. The relatively movable springs are in turn rigidly fixed to the aforementioned card member such that the combination of said springs, said card and said molded spring support comprises a replaceable unit which may be inserted into or removed from the hermetically sealable chamber as a replaceable unit or assembly. The card is housed in or accommodated by the cantilever spring armature suspension for movement thereby and the said molded spring support may be sealed to the chamber walls to provide the enclosing or confining wall thereof.

The aforementioned hermetically sealable chamber may be constructed mostly of non-magnetic metal and attached to the magnetic metal structure of an associated electromagnetic structure whereupon the said magnet may influence the armature without necessitating any magnetic structural contact therewith.

2

Incidental features of the invention, some of which have been mentioned briefly above and which will be fully disclosed hereinafter, are such as the novel cantilever suspension for the armature with its advantageous functional relation to the armature and to the card member, the versatility of the replaceability and changeability of contact spring combinations and the simplicity of construction features and maintenance requirements of the types of relays which may be provided with the invention.

A detailed disclosure of one embodiment of the invention is set forth below with reference to the drawing forming a part of that disclosure. General descriptions of the various figures of said drawing are as follows:

Fig. 1 shows a relay in perspective and partly broken away to enable ready reference to features of the invention embodied in said relay;

Fig. 2 is an exploded perspective view of parts of the relay of Fig. 1 showing the structural and functional relation between the card-contact spring-mold assembly and the armature cantilever spring suspension;

Fig. 3 is a plan view of a relay similar to that of Fig. 1, Fig. 3 being broken away at various areas to admit reference to structural details to be explained; and

Fig. 4 discloses a modification of the external electromagnetic structure of such relays as are shown in Figs. 1 and 3.

Referring to Fig. 1, a casing or chamber 1 of non-magnetic material is, if of metal, soldered or brazed or otherwise secured to the magnetic structure of an electromagnet external thereto as shown by Fig. 3 or 4. The electromagnet comprises a core 2 having a threaded extension 3. A winding 4 is positioned upon core 2 and confined thereon in a well-known manner by spool-heads 5 and 6. A U-shaped heel piece 7 is clamped into magnetic connection with core 2 by means of nut 8 on threaded end 3 of said core 2. The threaded end 3 of core 2 may in addition be adapted to provide mounting means for the relay, as shown in Fig. 3, such that by means of another nut 9 the relay may be secured to any suitable frame or mounting 10. The side or wall 11 of chamber 1 may be rigidly secured to the heel piece 7 by soldering or brazing or other suitable means at such areas as 12 of Figs. 3 and 4. If it is preferable to use non-metallic material for chamber 1, other known means of securing metals to non-metals may be used to secure same to the heel piece 7. In Fig. 3 the armature end 13 of core 2 is shown to penetrate the wall 11 of

3

chamber 1 and to be brazed thereto. Fig. 4 suggests that it is not necessary that the free end 13 of core 2 penetrate wall 11 of chamber 1 but may be completely external thereto.

A T-shaped armature 14 is suspended solely by one or more U-shaped cantilever type spring members 15. The armature 14 is fixed to said cantilevers 15 by means of pins 16 (preferably refer to Fig. 2) and is held normally in the position relative to core 2 as shown in Fig. 3. Cantilever 15 is fastened to a frame piece 17 by means of angle sections 18 of said cantilever being positioned behind and fastened to said frame 17. Of course, in order that the mobility of armature 14 will not be unduly impeded and that excessive magnetic force is not required to move same, the pin means 16 for fixing said armature 14 to the cantilever support 15, of say Fig. 3, may be arranged to permit both cantilevers to be freely movable towards a parallelogram shape. When two such cantilevers are used, as in Fig. 3, the pins 16 may be rigidly secured to armature 14 but freely extending through clearance holes in the cantilever to permit the latter to assume such parallelogram position with reference to the fixed support point, such as 17. Alternatively, pins 16 may be rigidly secured to armature 14 and only one of said cantilevers 15, the other cantilever 15 containing merely a clearance hole for its extremity of pins 16. It will be clear that if only one cantilever 15 is employed, as will be mentioned later, the pins 16 preferably should be rigidly fixed to both armature 14 and cantilever 15. It will further be appreciated that when the cantilevers 15 are moved to parallelogram position the amount of motion involved is slight when the armature abutting surfaces of cantilevers 15 recede slightly from the armature faces. Also, the cards 27 may be loosely fitted into the cantilevers 15 such that there will be no forcing or binding when the cantilevers 15 assume the shape of parallelograms.

At least one side of chamber 1 consists of a contact spring supporting mold 19 which may be fitted next to frame 17 and to the angle sections 18 of the cantilever 15 and sealed to the chamber 1 at 20, with perhaps a suitable gasket 21 interposed between said mold 19 and said frame 17 and angle sections 18 of said cantilever 15. The chamber 1 is provided with a sealable opening 22 by means of which said chamber 1 may be evacuated and, if desired, filled with an inert gas for contact protection.

Referring particularly to Fig. 2, the mold 19 may have imbedded therein suitable relatively movable contact springs 23 of the wire or flat type and cooperating relatively fixed contact springs 24. These springs need not be molded in the side or confining wall 19 but this is the preferred manner of so fixing said springs to insure a good seal. The free ends, such as 25, of the movable springs are in turn molded into, or otherwise fixed to, a card 26 which in turn is adapted to be seated into or housed in or accommodated by the cantilever suspension 15, as shown by Figs. 1 and 3. The cantilever suspension 15 may, if necessary, be provided, as shown, with upper and lower lips 27 which may be provided to add support to card 26.

The card 26-contact spring sets 23 and 24-mold 19 assemblies as shown in Fig. 2 are readily replaceable or may be readily changed to provide combinations of spring contacts other than 9 make pairs as used by example in Fig. 2. The effort required to replace such an assembly is

4

readily seen to be small in that seals 22 and 20 need merely be broken and a new assembly inserted and said seals remade in order to effect a different relay from the standpoint of functions accomplished thereby in a circuit.

The fact that the chamber 1 is hermetically sealable presupposes that the methods of fixing the contact springs to the mold 19 and the said mold 19 to the chamber walls be sealable methods, such as to make the chamber air-tight. However, if it is not desired to evacuate said chamber the contact springs need not be sealed to the mold, as shown here by the actual process of molding the wall 19, but may merely be positioned in and held by suitable slots or holes or openings in the said wall. Likewise the requirement of a hermetical seal between mold 19 and the chamber walls is an optional requirement determined by the intended use of the relay and other operational considerations.

The novel combined armature spring suspension and contact spring actuator mechanism 15 affords a substantially frictionless armature and contact spring movement in that the armature has no rubbing or sliding pivot areas but is freely suspended for translatory movement under the magnetic influence of the external electromagnetic circuit of the relay. The manner in which the cards 26 are held and actuated by the cantilever springs 15 obviates the necessity of the movable springs 23 carrying a load represented by the usual spring actuating card arrangement whereby the contact springs are required to effect movement of the card, or biasing thereof, under various conditions. In the disclosed arrangement the armature suspension unequivocally determines all positions of the card 26 thereby relieving the contact springs 23 and 24 from any such loads.

The armature 14 of such a structure as disclosed herein may, of course, be suspended by only one cantilever spring 15 if so desired. The latter may be desirable where only one side or wall of the chamber 1 is to be removable. It is preferred that in all cases at least two such springs 15 be used, as shown by Fig. 1 wherein only one side of the chamber 1 is removable, or as shown in Fig. 3 wherein two sides are removable. In addition it is not necessary for practice of the invention that the removable sides be contact spring-card assemblies since it may be advisable to have such a removable side merely for assembly, maintenance or adjusting reasons.

The operation of the relays of Fig. 1 or Fig. 3 is simply that upon energization of the winding 4 the magnetic circuit of the core 2 and heel piece 7 will attract armature 14, which movement, against the natural tension of springs 15, will move cards 26. Cards 26, having the free ends 25 of movable contact springs 23 imbedded therein or otherwise fixed thereto, will move said springs 23 into electrical contact with cooperating relatively fixed contact springs 24. Upon de-energization of winding 4, armature 14 will release under the natural tension of cantilever springs 15 to return the movable structure to normal as shown in Figs. 1 or 3.

There will be numerous modifications and embodiments of the invention suggested to those skilled in this art by this disclosure and, since it is not intended that the scope of the invention be limited to specific disclosures set forth herein, claims are appended which alone define the scope of the invention.

What is claimed is:

1. An electromagnetic relay comprising an electromagnet, an armature adapted to be attracted by said electromagnet, a substantially U-shaped cantilever spring having its ends fixed, said armature attached to said spring intermediate the ends thereof whereby said spring suspends and biases said armature, and a replaceable assembly including a pair of cooperating contact springs and supporting means for said springs and a control member attached to the movable spring of said pair, said cantilever spring adapted to engage said control member for actuation thereof.

2. An electromagnetic relay comprising an electromagnet, an armature adapted to be attracted by said electromagnet, a U-shaped cantilever spring having its ends fixed, said armature attached to said spring substantially midway between said fixed ends whereby said spring suspends and biases the said armature, and a replaceable assembly including a relatively movable contact spring and a cooperating relatively fixed contact spring and supporting means for said contact springs and a contact spring operating card attached to said movable contact spring, said U-shaped cantilever spring adapted to accommodate between the sides thereof said operating card for actuation of said card by said cantilever spring.

3. An electromagnetic relay comprising an electromagnet, an armature adapted to be attracted by said electromagnet, a substantially rectangular U-shaped cantilever spring strip having its ends fixed, said armature attached to said spring at the crosspiece thereof connecting the sides of said U-shaped spring, the spring suspending and biasing said armature and said armature, when attracted by said core, adapted to deform said substantially rectangular spring to a substantially parallelogram shape against the natural tension of said spring, and a replaceable assembly including a relatively movable contact spring and a cooperating relatively fixed contact spring and supporting means for said contact springs and a contact spring operating card attached to the said movable contact spring,

said U-shaped cantilever spring adapted to accommodate between the sides thereof the said operating card for actuation of said card by said cantilever spring.

4. An electromagnetic relay comprising an electromagnet, an armature adapted to be attracted by said electromagnet, a substantially rectangular U-shaped cantilever spring strip having its ends fixed, said armature attached to said spring at the crosspiece thereof connecting the sides of said U-shaped spring, the spring suspending and biasing said armature and said armature, when attracted by said core, adapted to deform said substantially rectangular spring to a substantially parallelogram shape against the natural tension of said spring, and a replaceable assembly including relatively movable contact springs and cooperating relatively fixed contact springs and supporting means for said contact springs and a contact spring operating card attached to the said movable contact springs, said U-shaped cantilever spring adapted to accommodate between the sides thereof the said operating card for actuation of said card by said cantilever spring.

5. Claim 4 wherein the armature and cantilever spring are enclosed in a hermetically sealable chamber situated within the magnetic influence of said electromagnet and the said contact supporting means is an insulated molding comprising a replaceable wall of said chamber.

6. Claim 5 wherein the said chamber is made of non-magnetic material and is attached to the magnetic structure of said electromagnet.

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