April 1, 1952 H. A. MILOCHE 2,590,996

RELAY

Filed Nov. 21, 1947

FIG. 1

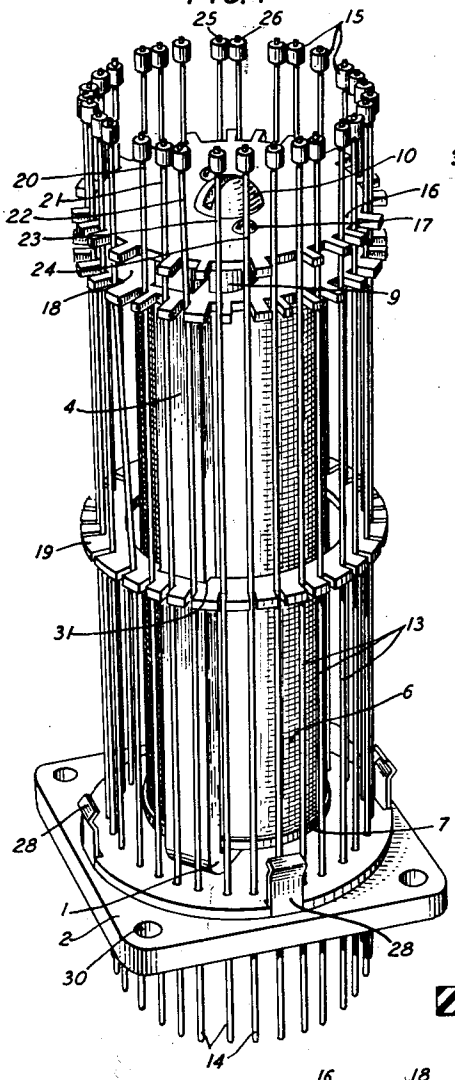


FIG. 2

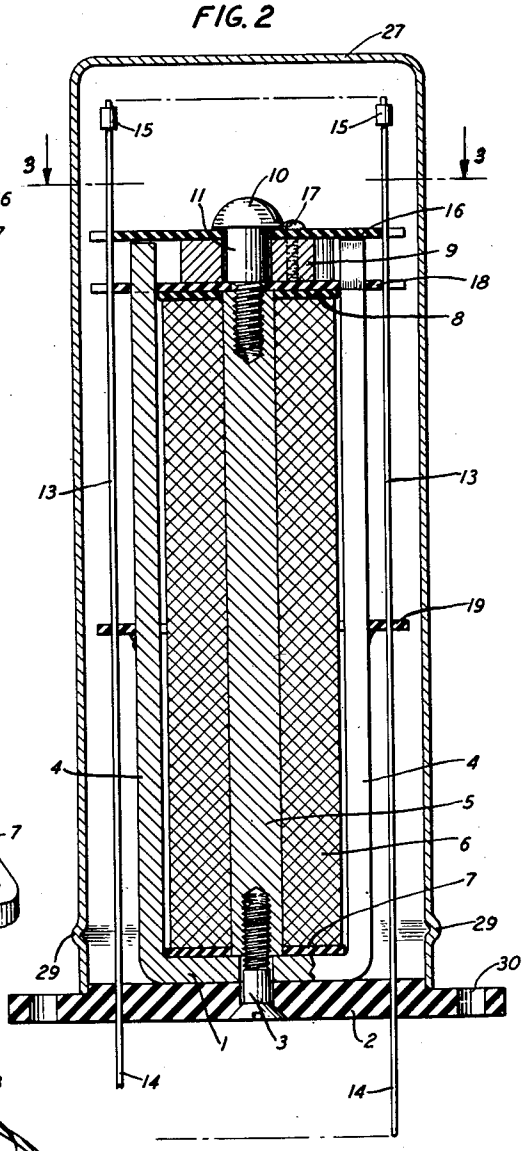
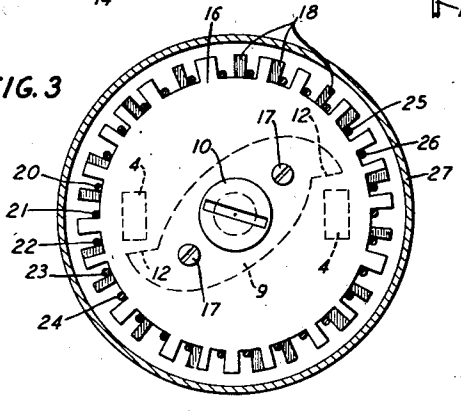


FIG. 3



INVENTOR
H. A. MILOCHE
BY
J. W. Schmied
ATTORNEY

Patented Apr. 1, 1952 2,590,996

UNITED STATES PATENT OFFICE

2,590,996

RELAY

Herman A. Miloche, Teaneck, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application November 21, 1947, Serial No. 787,348

5 Claims. (Cl. 200—104)

1

This invention relates to electromagnetic relays and more particularly to relays used in telephone switching circuits.

An object of the invention is to attain a high degree of efficiency, compactness, and economy of manufacture in an electromagnetic relay.

Another object is to simplify and reduce the mass of the moving parts of a relay.

Another object is to increase the efficiency of the magnetic circuit of a relay.

A further object is to provide ready interchangeability of parts in order that a relay may be readily adapted to meet a particular set of requirements.

The applicant has accomplished these objects by mounting the contacts springs, core, coil, armature, and cards so that their axes are all parallel. The contact springs are mounted circumferentially in a base member so as to extend parallel to and surrounding a core and coil structure, the armature is pivotally mounted about its center so as to be rotatable about the axis of the core, and the circular fixed and movable cards or spring-controlling members are mounted in planes parallel with the armature and are peripherally notched to engage the contact springs. By this novel design, the armature and movable card are rotatable through a small angle in a plane perpendicular to the axes of the contact springs and apply an actuating force on the movable contact springs tangential of the circular card, and, similarly, the resisting force on the fixed contact springs is exerted tangentially of the circular fixed card.

Since the diameter of the movable card is greater than the diameter of the path of the armature, a small rotary movement of the armature results in a magnified movement of the contact springs and thus but a small armature-to-core air gap is required to produce the requisite movement of the contact springs, and a highly efficient magnetic circuit is thereby obtained. This improved relay design has further permitted the employment of moving parts having little mass, thereby enhancing the speed of operation and release of the relay.

In an effort to reduce the number of components in order to simplify the relay and reduce the cost of manufacture and maintenance, the functions normally accomplished by armature backstops and armature support or biasing springs have been relegated to the cards and contact springs. A third circular card maintained in fixed relationship to the core, is properly apertured to pretension certain of the contact springs in a direction opposite to that in which they are to move upon operation of the relay, and these pretensioned springs therefore normally exert a force which serves to restore the armature to its unoperated position upon deenergization of the coil. The backstop function is performed by certain of the contact springs which are held by the fixed card and against which the edges of certain of the notches in the movable card rest when the relay is in an unoperated position.

2

As will be subsequently shown, the various elements of the structure are removably interattached in order that the coil and card may be readily changed to render the relay adaptable to meet a variety of requirements.

The invention may be more completely understood by reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a relay constructed in accordance with the invention;

Fig. 2 is a section through the axis of the relay shown in Fig. 1 with the cover in place; and

Fig. 3 is a section taken through 3—3 of Fig. 2, showing the interrelationship of the operating members of the relay.

Referring now particularly to Figs. 1 and 2, a substantially E-shaped core 1 of magnetic material, is affixed to an insulating base member 2 by means of a screw 3. The core 1 comprises two outer legs 4 and a center leg 5 all extending parallel one to the other. An energizing coil 6 having spoolheads 7 and 8 thereon is arranged to be removably mounted on the center core leg 5. A low-mass armature 9 is pivotally mounted on the center core leg 5 by means of a screw 10 having a shank 11 about which the armature 9 is rotatable. As may be seen in Fig. 3, the armature 9 is thereby pivotal about an axis through its center and has surfaces 12 which are matable with the outer core legs 4 upon energization of the coil 6.

A plurality of wire contact springs 13 are molded or otherwise secured in the base member 2, extend rearwardly therefrom to provide wiring terminals 14, and extend forwardly therefrom in approximate parallelism with the core legs 4 and 5. The contact springs 13 are equally spaced and circularly arranged in the base member and extend upwardly so as to describe a cylinder around the core and coil structure. Contacting elements 15 at the operating ends of each contact spring 13 are in the form of

small cylinders and may be plated at the contacting surfaces with precious metal.

The action of the contact springs 13 in making or breaking electrical circuits is controlled by three cards of insulating material. A movable card or operating member 16 is removably attached to the armature 9 by means of screws 17. This movable card 16, of circular configuration, is suitably apertured around its periphery to accept the springs 13 and is rotatable with the armature about an axis parallel with that of the core legs 4 and 5. A fixed card 18 mounted between the armature 9 and the upper coil spoolhead 8 has apertures suitably located therein through which the outer core legs 4 and the screw 10 may pass. The fixed card 18 is therefore fixedly positioned by the outer core legs 4, the upper coil spoolhead 8, and the shank 11 of the screw 10. A second fixed card 19 is removably supported on outer core legs 4 at a position approximately midway between the fixed card 18 and the base member 2, and is prevented from rotating by having notches 31 therein engageable with said outer core legs 4. The two fixed cards 18 and 19 are each of circular configuration and are suitably apertured around their peripheries to accept the contact springs 13.

The location and size of the apertures in the three cards 16, 18, and 19 determines whether the several contact springs 13 will serve to "make," "break," or "transfer" electrical circuits or a combination of these functions, which shall hereinafter be referred to as the "coding" of the relay. In the embodiment depicted in the accompanying drawings, each of these types of circuit control has been shown. For example, upon the operation of the relay, contacts 20, 21 and 22 will "transfer," contacts 23 and 24 will "make," and contacts 25 and 26 will "break" electrical circuits. In order that the contact springs shall operate in the desired manner, certain of the springs must be pretensioned in a direction opposite to that in which they are subsequently to move, and this is accomplished by means of the lower fixed card 19. Certain of the apertures in this card are located in exact vertical alignment with the point at which their associated contact springs pass through the base member 2, whereas certain other of the apertures are slightly offset along the circumference of the card so that their associated contact springs are tensioned against the direction of rotation of the movable card 16. The upper fixed card 18 is suitably notched so that the non-pretensioned springs are firmly held in affixed position, while those springs which are pretensioned are free to move the required distance in the direction of rotation of the movable card but are restrained from moving in the opposite direction. The movable card 16 is suitably notched so that upon its rotation certain of the springs are moved and certain others are unaffected by its movement.

The operation of the springs for each of the circuit-controlling functions will now be described with reference to Figs. 1 and 3.

Contact springs 20, 21 and 22 cooperate to transfer an electrical circuit from contacts 21 and 22 to contacts 21 and 20 upon operation of the relay. Spring 20 is pretensioned, restrained in the unoperated position of the relay by the fixed card 18, and is free to move slightly in the direction of rotation upon operation. Spring 21 is pretensioned, restrained in the unoperated position of the relay by the fixed card 18, and is moved by the movable card 16 upon operation of the relay. Spring 22 is not pretensioned and is firmly held by the fixed card 18. In the unoperated position of the relay, springs 21 and 22 are in contact. Upon operation, this contact is broken and spring 21 is moved into contact with spring 20, the latter of which is free to "give" slightly under the impact.

Contact springs 23 and 24 cooperate to make an electrical connection with each other upon operation of the relay. Both springs are pretensioned against the fixed card 18 but are free to move in the direction of rotation of the movable card. Upon operation of the relay, spring 24 is moved by the movable card 16 into contact with spring 23.

Contact springs 25 and 26 cooperate to break an electrical connection upon operation of the relay. Spring 26 is pretensioned against the fixed card 18 and is free to move in the direction of rotation of the movable card. Spring 25 is not pretensioned and is firmly held by the fixed card 18. Upon operation of the relay spring 26 is moved out of contact with spring 25 by movable card 16.

As may now be more clearly understood, the springs which are pretensioned also serve as armature biasing or restoring springs, exerting a pressure against the movable card and serving to return the armature to its unoperated position upon deenergization of the coil. Further since in the unoperated position of the relay all springs rest against the edges of their respective notches in the fixed card 18, the contact of the notches in the movable card 16 against certain of the contact springs 13 upon deenergization of the relay prevents the movable card from rotating beyond a certain point, and therefore serves as an armature backstop.

As has been seen, the coding of the relay is determined by the notching of the three cards 16, 18 and 19, each of which is removable upon the removal of the screws 10 and 17, and therefore the adapting of the relay to meet a particular set of requirements may be expeditiously accomplished by the installation of a suitable set of cards.

Since the armature and movable card rotate about a common axis and since the diameter of the card is appreciably greater than that of the path of the armature, but a relatively small movement of the armature is required to accomplish the requisite movement of the springs, thereby permitting a small armature-to-core air gap and thus providing a highly efficient magnetic circuit.

The circular cylindrical shape of the relay permits the use of an inexpensive tubular cover (Figs. 2 and 3) which may be supported by projections 28 (Fig. 1) on base member 2 engaging a slightly fluted portion 29 (Fig. 2) near the base of the cover 27.

Apertures 30 in base member 2 are provided for mounting the relay in position.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawings, is to be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a relay, a core, an energizing coil on said core, an armature rotatably mounted on said core and attractable thereto upon the energiza-

tion of said coil, a card of insulating material connected to and rotatable by said armature, a base member, a plurality of contact springs circularly mounted in said base member and engaging apertures in the perimeter of said card, a second card of insulating material having apertures in the perimeter thereof to hold certain of said springs stationary in relation to certain other of said springs, and a third card of insulating material having apertures in the perimeter thereof to pretension certain of said springs.

2. In a relay, a core, an energizing coil on said core, an armature rotatably mounted on said core and attractable thereto upon the energization of said coil, a first circular card of insulating material connected to and rotatable by said armature, a second circular card of insulating material supported by said core, a base member, a plurality of contact springs mounted in said base member and engaging apertures in the perimeter of each of said cards whereby upon the operation of said armature certain of said springs are moved in relation to certain other of said springs, and a third card of insulating material having apertures in the perimeter thereof to pretension certain of said springs.

3. In a relay, an E-shaped core, an energizing coil on the center leg of said core, an armature rotatably mounted on the center leg of said core and attractable to the outer legs of said core upon the energization of said coil, a first circular card of insulating material connected to and rotatable by said armature, a second circular card of insulating material supported by the outer legs of said core and adjacent said first card, a base member, a plurality of contact springs circularly mounted in said base member, extending substantially parallel to said core, and engaging apertures in each of said cards whereby upon the operation of said armature certain of said springs are moved in relation to certain other of said springs, and a third circular card of insulating material supported by the outer legs of said core and having apertures therein to accept said springs whereby certain of said springs may be pretensioned.

4. In a relay, a pair of contact springs, the contact end of one of said springs being movable, means for moving the movable one of said springs into and out of engagement with the other one of said springs as desired, said means comprising a core, an energizing coil on said core, an armature mounted on said core and attractable thereto upon energization of said coil, a movable card of insulating material connected to said armature and a projection on said card having a first edge engaging said movable spring, and means for fixing the unoperated position of said card comprising means for holding the other one of said springs stationary relative to said card and a second edge on said projection opposing said first edge and normally engaging said other one of said springs to position said movable card and to thereby serve as a backstop for said armature while said coil is deenergized.

5. In a relay, a pair of contact springs, the contact end of one of said springs being movable, means for moving the movable one of said springs into and out of engagement with the other one of said springs as desired, said means comprising a core, an energizing coil on said core, an armature rotatably mounted on said core and attractable thereto upon energization of said coil, a movable circular card of insulating material connected to and rotatable by said armature and a projection on said card having a first edge engaging said movable spring, and means for fixing the unoperated position of said card comprising a fixed circular card of insulating material having an aperture therein to hold the other one of said springs stationary relative to said movable circular card and a second edge on said projection opposing said first edge and normally engaging said other one of said springs to position said movable card and to thereby serve as a backstop for said armature while said coil is deenergized.

HERMAN A. MILOCHE.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,647,792	Gent	Nov. 1, 1927
2,248,584	Reynolds	July 8, 1941
2,422,861	Skrobisch	June 24, 1947
2,445,401	Langer	July 20, 1948