

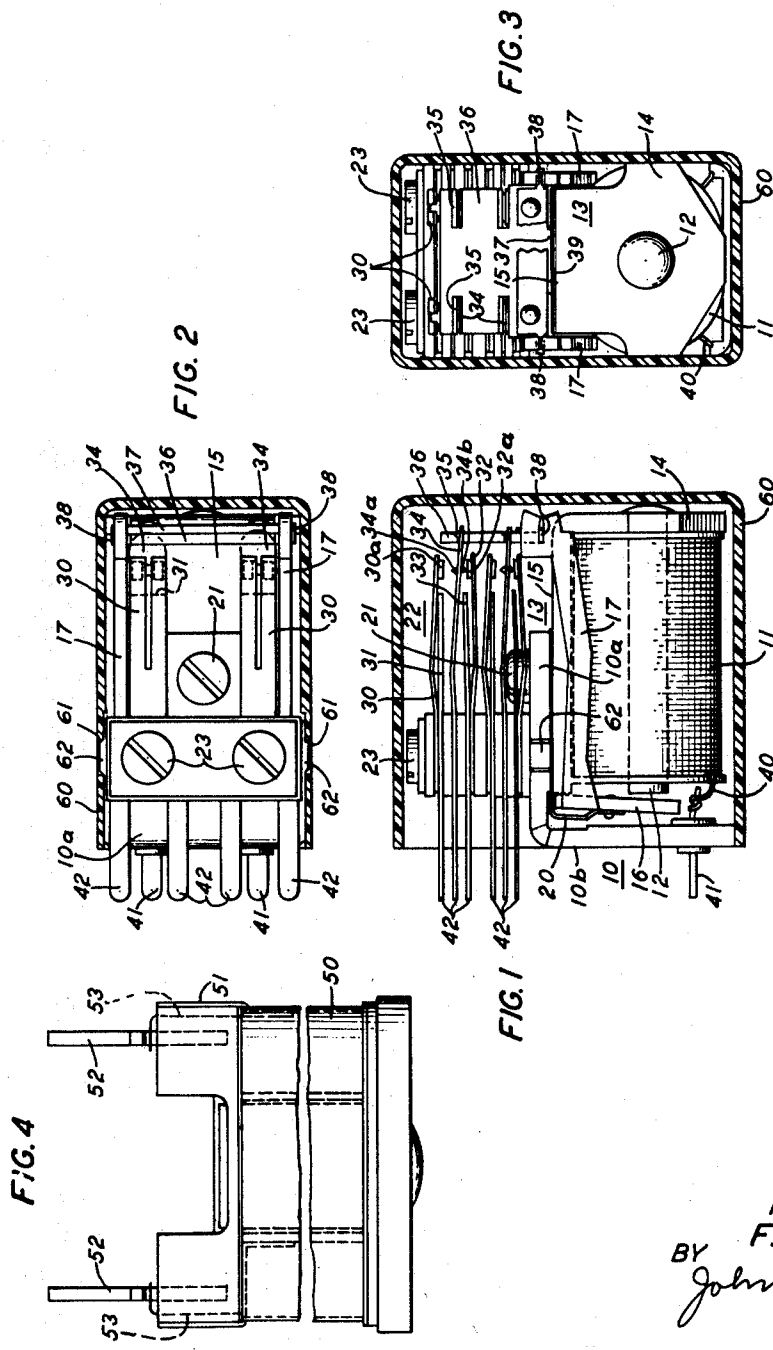
July 13, 1965

F. A. ZUPA

3,194,919

MINIATURE ELECTROMECHANICAL RELAY HAVING A MAGNETIC YOKE
WHICH REDUCES THE LOSS OF FRINGE FLUX

Filed May 21, 1962



INVENTOR
F. A. ZUPA
BY *John C. Morio*
ATTORNEY

1

3,194,919

MINIATURE ELECTROMECHANICAL RELAY HAVING A MAGNETIC YOKE WHICH RE- DUCES THE LOSS OF FRINGE FLUX

Frank A. Zupa, New York, N.Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N.Y., a corporation of New York

Filed May 21, 1962, Ser. No. 196,354

6 Claims. (Cl. 200—104)

This invention relates to relays, and more particularly to miniature relays. The term miniature is here intended to include relays that require about $\frac{3}{4}$ to one square inch mounting area and that occupy a volume of approximately 1 cubic inch. For example, one relay in this category is $1\frac{1}{4}$ inches long and has a 1 inch by $\frac{3}{4}$ inch mounting area. Another slightly larger relay is about $1\frac{3}{8}$ inches long with a $\frac{5}{8}$ inch by $1\frac{1}{8}$ inches mounting area.

The kind of relay herein of interest has a straight core, a cylindrical coil around this core, and an L-shaped yoke attached to one end of the core and extending along the coil to the other end. An armature is hinged at the free end of the yoke and has extensions for operating the springs of a contact spring pile-up. Thus, the relay presently of interest is generally like known relays often called telephone relays. However, the relays herein contemplated are unique as to particular features, including both part details and arrangements of elements.

An object of this invention is to improve the operation of relays while reducing their size without sacrificing desirable characteristics found in larger relays.

A particular object of the present invention is to improve the magnetic circuit of relays whereby more flux for armature operation is made available without an increase of operating power.

One feature of the invention resides in an arrangement whereby the contact operating means cooperates mechanically with a portion of a magnetic circuit member to serve as a backstop that inhibits contact "bounce."

Another feature lies in a bracket that serves both as a basic mounting for the relay and, by virtue of being of magnetic material, as a useful auxiliary element in the magnetic circuit.

A further feature involves the operating coil assembly and includes improved means for making external connections.

Other and further objects and features of this invention will appear more fully and clearly in the ensuing description of an exemplary embodiment thereof taken in connection with the appended drawings, in which:

FIG. 1 is a view in side elevation of the relay with only its housing in section;

FIG. 2 is a similar, top view of the relay;

FIG. 3 is an end view looking toward the left in the other two figures; and

FIG. 4 is a partial view of a coil end showing a different coil assembly than that shown in FIGS. 1 and 2.

The basic mounting element of this relay is the L-shaped bracket 10 having branches 10a and 10b to which all other parts are connected directly or indirectly. For example, the coil 11 is mounted on a core 12, which is secured to the branch 10a of the bracket 10 by the yoke 13. The yoke 13 is L-shaped with its shorter leg 14 secured to one end of the core and its longer leg 15 extending along one side of the coil to the coil's other end. The leg 15 is the one that is secured to the branch 10a.

The armature assembly comprises an armature 16 and contact operating arms 17. These parts may be and advantageously are integral. The armature is secured to and held against the end of the yoke by the spring hinge 20, which is L-shaped with a long arm sandwiched be-

2

tween branch 10a of the bracket 10 and the long leg 15 of the yoke 13. The short arm of the spring hinge is secured by rivets, or the like, to the armature 16. The arms of the hinge 20 may have an included angle of 90 degrees, or more, or less, depending upon whether it is desired to leave the armature floating, urged away from the core, or urged toward it. The return bias on the armature is provided by the movable contact springs of the switch assembly, as will be subsequently described. The yoke leg 15, the spring hinge 20, and the branch 10a of the bracket 10 are secured together by the screw 21.

The contact spring assembly 22, comprising a plurality of contact springs, spring stops, and insulating spacers, is secured to branch 10a of the bracket 10 by the screws 23. Various arrangements of springs, stops, and contacts may be made, depending upon the use to which the relay is to be put. The arrangement shown in the drawings will suffice to illustrate the assembly. Four switches of the transfer type are shown, two side by side in two tiers.

Each switch comprises a fixed spring 30 with its stop spring 31, a fixed spring 32 with its stop spring 33, and a movable spring 34 between the fixed springs. The movable spring 34 has contacts 34a and 34b on either side to mate respectively with the contacts 30a and 32a on the fixed springs 30 and 32. These fixed springs are bifurcated and have a contact on each furcation. The movable springs carry a contact of sufficient extent to mate with both contacts of the cooperating fixed spring. The contacts may be of a precious metal or of a suitable alloy. The springs may be of nickel-silver and the stops of brass.

As shown in FIGS. 1, the fixed spring 30 is bent toward the movable spring 34 and rests against the stop 31. The movable spring 34 is biased downwardly and holds the fixed springs 32 away from its stop 33. All of the movable springs 34 have their outer ends in the slots 35 of an operating card 36 of insulating material, such as phenol fiber or polytetrafluoroethylene known as "Teflon." This card may be secured to a support or bracket member 37 that projects beyond the side edges of the card and has its ends secured to the operating arms 17. The arms 17 are slotted at their ends to receive the ears 38 that project from the bracket member 37. These slots are closed slightly after insertion of the ears to ensure that the card is properly secured. The card 36 has a central portion 39 that extends beyond the member 37 and rests on the surface of the leg 15 of the yoke 13 adjacent to its union with the leg 14. When the relay is deenergized to allow the contacts to return to their illustrated positions, the card extension 39 serves as a stop when it strikes against the yoke. The movable contact springs 34 are the return springs for the whole assembly including the armature. A card having integral ears of insulation to cooperate with the operating arms may also be used if desired. Because the card which is made of yieldable material comes to rest against the essentially rigid yoke, impact shock is absorbed and thereby inhibits "bounce" or false contact reoperation.

As has been noted, the bracket 10 is the basic mounting element of the relay. To reiterate, the coil 11 is on the core 12, which is secured to the short leg 14 of the yoke 13. The armature hinge spring 20 is secured between the yoke leg 15 and the branch 10a of the bracket 10 by the screw 21. The motor assembly is thus secured to the bracket 10. The contact assembly is also secured to this bracket by the screws 23, as indicated in the drawing.

The bracket 10 is advantageously made of steel which provides a strong support and also serves as an important element of the magnetic circuit. The L-shaped spring hinge that mounts the armature has a thin section and

advantageously is of nonmagnetic material. The hinge holds the armature snugly against the end of the yoke but the resulting "gap" is still of relatively high reluctance. As a consequence, a portion of the flux in the yoke 13 fringes in the region around the hinge and is thereby lost with respect to the gap between the armature 16 and the core 12. The bracket 10, however, captures the fringing flux and directs the captured flux back to the core 12 by way of the armature 16 so that the flux heretofore lost now re-enforces the flux in the gap between the armature 16 and the core 12 thereby increasing the force acting on the armature 16. Tests of such relays have shown an increase of about eight percent in tractive force on the armature when the magnetic bracket was used rather than one of insulation or nonmagnetic material.

A motor means, similar to that herein disclosed and claimed, is disclosed but not claimed in a related application of applicant's assignee, designated as application Serial No. 196,355 filed May 21, 1962, in the name of C. F. Spahn, Jr., now abandoned.

The coil 11 may be provided with flexible leads of stranded wire, one of which is shown at 40 in FIG. 1 connected to a terminal 41. Alternatively, as shown in FIG. 4 the coil assembly may include terminals secured directly to the coil head. The coil proper, designated as 50, is wound on a spool of insulation having a thick head 51 on one end. The terminals 52 are rectangular in section and are forced fitted, as by driving, into slightly undersized rectangular orifices in the spool head. The coil wire ends are brought through the head in the openings 53 and secured to the terminals 52, respectively. These wire ends are bared of insulation, wrapped around the terminals and soldered to them.

The required switching circuit connections are made to the projecting ends 42 of the contact springs or stops. The relay is advantageously enclosed in a cover 60 which may be of a suitable molded plastic material. The cover may be provided with slotted orifices 61 which fit over ears 62 on the mounting bracket 10 to secure the cover in place.

What is claimed is:

1. A relay comprising an actuating coil, magnetic circuit elements including an axial core within the coil, and an L-shaped member secured to the core, extending across one coil end and along a coil side to the other coil end; an armature hinged at the end of the L-shaped member and extending across said other end of the coil, said armature being hinged by means of an L-shaped spring secured to the armature and to the L-shaped member, an L-shaped bracket of magnetic material having one branch secured with the spring to the L-shaped member and the other branch extending in spaced, substantially parallel relation to the armature, said armature having an extension, and means connected to the extension for operating an electrical contact array.

2. A relay comprising a coil, a core of magnetic material within the coil, an L-shaped yoke of magnetic material and having a first leg secured to one end of the core and a second leg extending along side of the coil to the other end of said coil, an armature, an L-shaped spring hinge having arms secured respectively to the second leg of the yoke and to the armature to hold the armature with one end snugly against the adjacent end of the yoke, said armature extending across the other end of the coil and core, an L-shaped bracket of physically strong magnetic material having one branch secured to the second

leg of the yoke and the other branch extending across the core and coil ends outside of the armature and generally parallel therewith, and a contact array comprising fixed and movable contacts secured respectively to fixed and movable contact springs, operating arms extending from the armature and movable thereby, said arms flanking the coil and bearing between their outer ends an operating card of insulating material, said card connected to the ends of the movable contact springs, said movable springs being biased to urge the card against the yoke and the armature away from the core.

3. A relay as in claim 2 in which the operating card is of a yieldable material capable of absorbing shocks when it strikes the rigid yoke upon return travel of the contact springs after deenergization of the operating coil.

4. A relay comprising an L-shaped bracket of magnetic material having a first and a second branch, an L-shaped yoke having one leg secured to the first branch of the bracket and the other leg secured to an end of a magnetic core, an operating coil on the core and against said other yoke leg, the free ends of the core and coil being contiguous and spaced from the second branch of the bracket, an armature hinged to the free end of said one leg of the yoke by an L-shaped spring hinge having one arm secured to said one leg and the other arm secured to the armature, said armature extending between the free ends of the core and coil and the second branch of the bracket, a contact spring pile-up secured to said bracket, and means extending from the armature to adjacent the contact springs for displacing a contact spring operator connected to selected contact springs.

5. A relay comprising a coil assembly, magnetic circuit elements including a core within the coil and a member secured to the core at one end and extending along a coil side to adjacent the other core end, an armature hinged to said member and extending across said other core end, an L-shaped bracket of magnetic material having a branch extending along and secured to the hinged end of said member and the other branch extending in spaced, generally parallel relation to the armature; and means connected to the armature for operating an electrical contact array.

6. A relay as in claim 5 in which the coil assembly comprises a headed spool of insulating material, rectangular section terminals force fitted in rectangular orifices in a head of the spool, a coil on the spool between the heads and having its wire ends passed through an opening in said spool head and secured electrically and mechanically to said terminals.

References Cited by the Examiner

UNITED STATES PATENTS

55	753,918	3/04	Rorty	200—104
	1,269,563	6/18	Henderson	200—87
	2,385,994	10/45	Johnston	200—166
	2,461,360	2/49	Vincent	200—104
	2,488,669	11/49	Knos	200—104
60	2,528,086	10/50	Schenck	200—166
	2,824,924	2/58	Graybill et al.	200—104
	2,916,580	12/59	Seele	200—87
	3,076,880	2/63	Ehrismann	200—104

65 BERNARD A. GILHEANY, *Primary Examiner*,
ROBERT K. SCHAEFER, *Examiner*.