

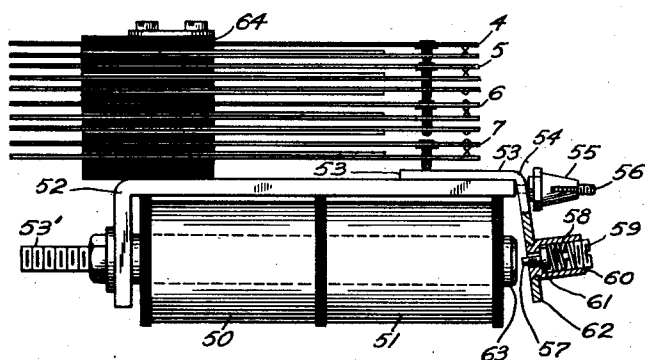
May 4, 1948.

M. B. STASZAK

2,441,041

TWO-STEP RELAY

Original Filed April 10, 1941



Inventor:
Michael B. Staszak
By C. C. Soper
Att'y.

UNITED STATES PATENT OFFICE

2,441,041

TWO-STEP RELAY

Michael B. Staszak, Chicago, Ill., assignor to
Kellogg Switchboard and Supply Company,
Chicago, Ill., a corporation of Illinois

Original application April 10, 1941, Serial No.
387,928. Divided and this application January
27, 1944, Serial No. 519,966

5 Claims. (Cl. 175—336)

1

This invention relates to two-step relays, and has for its object the provision of a new and improved two-step relay of simple and reliable construction.

A feature of the new and improved two-step relay mechanism is that the armature of the relay is provided with a spring-pressed stop which stops the armature movement at a definite point when the magnetic structure of the relay is only normally magnetized but yields to permit the armature of the relay to operate fully when the magnetic structure of the relay is additionally magnetized sufficiently to enable the spring associated with the definite stop to be overcome.

A further feature of the arrangement is that the stop-controlling spring of the two-step relay structure is readily adjustable to increase or diminish the tension applied to the said stop so as to require a greater or lesser additional magnetization of the relay structure to bring the armature from its first-step position to its fully-operated, or second step, position.

The foregoing and other objects and features of the invention will appear more fully as the description progresses.

This application is a division of applicant's previous application for Telephone line circuits, Serial No. 387,928, filed April 10, 1941, now Patent No. 2,344,653, granted March 21, 1944.

The accompanying drawing shows the physical structure of the new and improved two-step relay arrangement, together with an assembly of contact springs such as is employed with the two-step line and cutoff relay 2 of Figure 1 in the parent application.

Referring now to the drawing, the relay structure shown therein is of the type commonly used for telephone relays. The structure includes a core 63, of magnetic material, fastened to the L-shaped "heel" plate 52 by a nut threaded onto the screw-threaded portion 53' of reduced diameter. A pair of coil windings, 50 and 51, are shown between the customary spool heads on the core 63, separated by the usual coil separator, the coil construction shown being that of the usual two-section coil.

The main portion of heel plate 52 lies parallel to the core and coil structure, and is customarily of magnetic material to provide a ready return path for the lines of force acting upon the arma-

2

ture. The armature, generally L-shaped, is indicated at 54, and it has a spring-actuating portion 53, normally lying parallel with the main portion of heel plate 52, and a main armature portion 62, attracted by the associated free end of the core 63 when one of the windings 50 and 51 is carrying current. Armature 54 is held pivotally in place on stem 56 by retaining nut 55.

The structure shown is assumed to be that required for relay 2 of Figure 1 of the parent application, and it, therefore, has the specific combination of springs in the contact assembly 64 required for such relay 2. The contact-spring assembly 64 includes the armature springs 4, 5, 6, 15 and 7, being so called because they respond directly to the thrust imparted by movement of the armature. Each of the armature springs 4 to 7 has an associated back contact spring with which it is normally in engagement, while each 20 of the armature springs 6 and 7 has, in addition, a front-contact spring engaged by the armature spring when moved a sufficient distance away from its back-contact spring.

In the particular circuit arrangement of relay 25 2, in Figure 1 of the parent application, it is required that armature spring 7 move away from its back contact and into engagement with its front contact when the relay is operated through its first step to perform its line-relay function, while 30 armature springs 4, 5, and 6 are to remain unaffected at this time. It is further required that armature springs 4, 5, and 6 shall be actuated to break away from their respective back contacts, and that armature spring 6 shall engage its associated front contact, when the relay is actuated 35 through its second step to perform its cutoff-relay function.

In order to cause the relay to selectively perform its two functions as set forth, line winding 51 40 is arranged to produce only a mild magnetic energization of core 63, to thereby provide only a mild attraction of, or pull upon, the armature portion 62 when energized alone. When this occurs, the spring actuating portion 53, by operating the illustrated contact bushing member attached to armature spring 7, moves armature spring 7 out 45 of engagement with its illustrated back contact and into engagement with its illustrated front contact, but the armature movement is insufficient to cause movement of armature springs 4 to 6. 50

Positive means is provided to arrest the armature movement at this point. This result is accomplished by the plunger structure illustrated as attached to armature portion 62 of the armature structure 54.

The retainer 60 has a generally cup-like shape, as illustrated, with the diameter thereof reduced somewhat (near the bottom of the cup) to provide a reduced portion having a length substantially equal to the thickness of the armature portion 62. The reduced end may be driven into a hole provided in armature portion 62, against the shoulder following the reduced portion, and the parts may be staked together in the usual manner to hold parts 60 and 62 firmly in the illustrated assembled relationship. Part 60 is preferably of magnetic material to permit the magnetic circuit to pass therethrough from the exposed end of core 63 to the armature portion 62.

The plunger member 61 has a plunger portion 57 of reduced diameter which passes loosely through an opening in the bottom of the cup structure 60 and extends a desired distance beyond the exposed face of portions 60 and 62, to be the first part of the movable structure which engages the face of core 63. Plunger 61 is normally retained in its illustrated, shouldered position by the retaining spring 58, held under a desired state of tension by adjusting screw 59, threaded into the inside of the retaining cup 60 for longitudinal adjustment. By turning the adjusting screw 59 further in or further out than the illustrated position, the force applied by spring 58 to urge the plunger 61 against the bottom of the cup structure may be increased or decreased as desired.

In the operation of the relay structure, a normal or moderate amount of energization of the core 63, by the flow of current through line winding 51, causes a sufficient pull on the armature portion 62 to rotate the armature structure in a clockwise direction around the free end of heel plate 52, as a pivot, until the forwardly extending end of plunger portion 57 strikes the core 63. The armature structure is arrested in this position, with armature spring 7 operated, and springs 4 to 6 unmoved because spring 58 is regulated by screw 59 to have sufficient tension to prevent the relative movement of plunger 61 and armature portion 62 responsive to the normal attractive pull then being exerted on armature portion 62.

In the event that an increased or excessive amount of energization is imparted to core 63, through cutoff winding 50, spring 58 is no longer able to retain plunger 61 in its illustrated advanced position with respect to armature 62, whereupon armature 62 moves forwardly to contact the end of core 63. Armature springs 4 to 6 are fully actuated by the additional movement imparted to the armature 54 when the armature portion 62 is thus moved through its second step, against the tension of spring 58.

When the core portion 63 becomes demagnetized, upon the cessation of current flow in either energized one of the windings 50 and 51, the structure is caused to resume its illustrated normal position as a result of the usual tension of armature springs 4 to 7.

It will be understood of course that the relay operates initially through both steps (without hesitating in its step-1 position), when the core 63 is initially magnetized sufficiently for that purpose. This may occur when the winding 50 is the one initially energized in place of winding 51.

I claim:

1. A relay comprising an electromagnet having a core, a heel plate secured to one end of said core, a spring-restored armature fulcrumed on said plate and movable toward the other end of said core responsive to energization of the electromagnet, a cylinder carried by said armature and having its forward end apertured, a plunger movable in said cylinder and having a stem extending through said aperture and adapted to abut against said core when the armature is attracted part way, and yieldable means, interposed between the rear end of said piston and said plunger, for permitting further movement of said armature toward the core only in case the electromagnet is energized more strongly than is required to move the armature part way.

2. A two-step relay having a variable magnetic circuit including a movable armature, means for variably energizing said magnetic circuit to effect first-step and second-step movement of said armature, means for adjustably controlling the movement of said armature comprising a housing carried on said armature, means yieldably movable in said housing and arranged to abut against a relatively fixed portion of the relay structure responsive to the movement of the armature through its first step to prevent execution of the second-step movement except when the magnetic circuit is strongly energized, and means carried by said housing and arranged to adjust the yieldability of said movement.

3. In a relay, an armature and a variably energizable core, means biasing said armature to stand away from said core, said armature moving toward said core responsive to a given amount of energization of the core to execute a first-step movement, followed by a second-step movement when the core is energized more than said given amount, and means including a spring, normally under tension, first encountered by said armature at the end of its first-step movement for stopping the armature at that point, said armature being effective to move further against the tension of said spring when the core is energized more than said given amount to execute a second-step movement.

4. In a relay, an armature and a variably energizable core, means biasing said armature to stand away from said core, said armature moving toward said core responsive to a given amount of energization of the core to execute a first-step movement, followed by a second-step movement when the core is energized more than said given amount, means including a spring, normally under tension, first encountered by said armature at the end of its first-step movement for stopping the armature at that point, said armature being effective to move further against the tension of said spring when the core is energized more than said given amount to execute a second-step movement, and means for enabling the tension of said spring when not engaged by said armature to be adjusted, to thereby adjust the amount of core energization defining the line of demarcation between first-step and second-step operation.

5. In combination, an electromagnet and an armature operatively associated therewith, the armature having three positions, means biasing the armature to stand normally in its first position, energizing means for the electromagnet to cause the armature to move from its first position to assume its second and third positions successively, position-selecting means for the arma-

5

ture comprising a movable abutment carried thereon arranged to engage a part fixed with the electromagnet when the armature reaches its second position and to then yield or not dependent upon the extent to which the electromagnet is energized, and spring means mounted bodily on and carried by the armature and interacting between the armature and the movable abutment to prevent further movement of the armature relative to the electromagnet and the abutment unless the electromagnet is energized to a greater extent than is required to cause

6

the armature to move from its first position to its second position.

MICHAEL B. STASZAK.

REFERENCES CITED

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

UNITED STATES PATENTS

10	Number	Name	Date
	1,651,684	Erickson _____	Dec. 6, 1927
	1,981,259	Wertz _____	Nov. 20, 1934