

Feb. 21, 1956

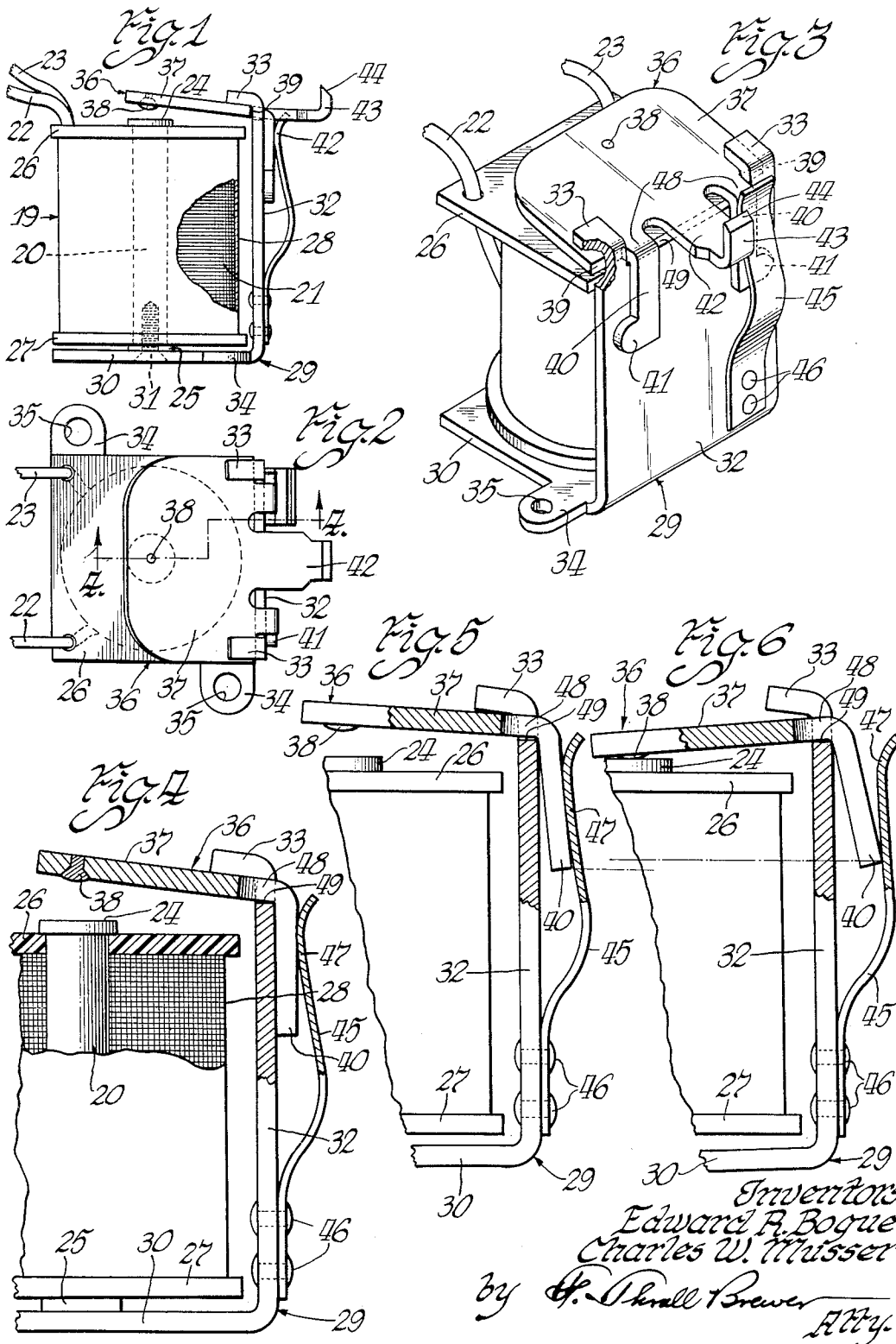
E. A. BOGUE ET AL

2,735,968

RELAY STRUCTURE

Filed Feb. 19, 1952

2 Sheets-Sheet 1



Inventors
Edward R. Bogue
Charles W. Musser
by *H. Phall & Brewer* Attys.

Feb. 21, 1956

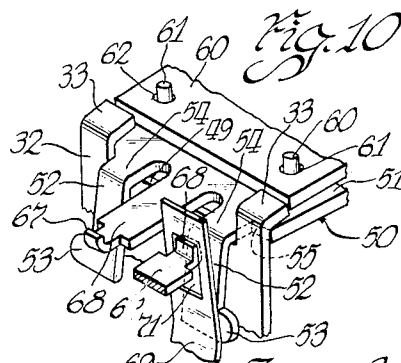
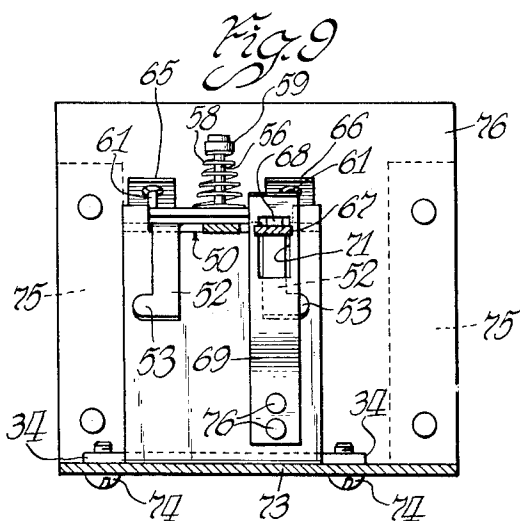
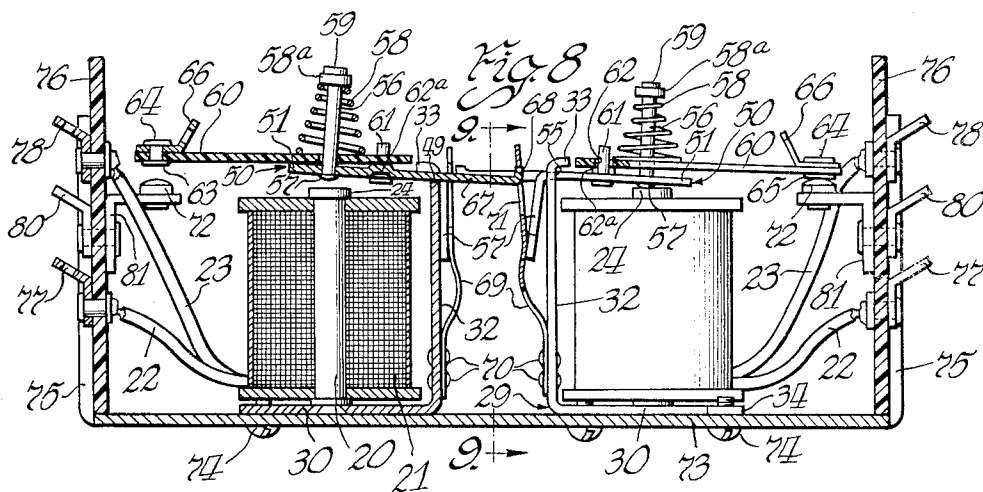
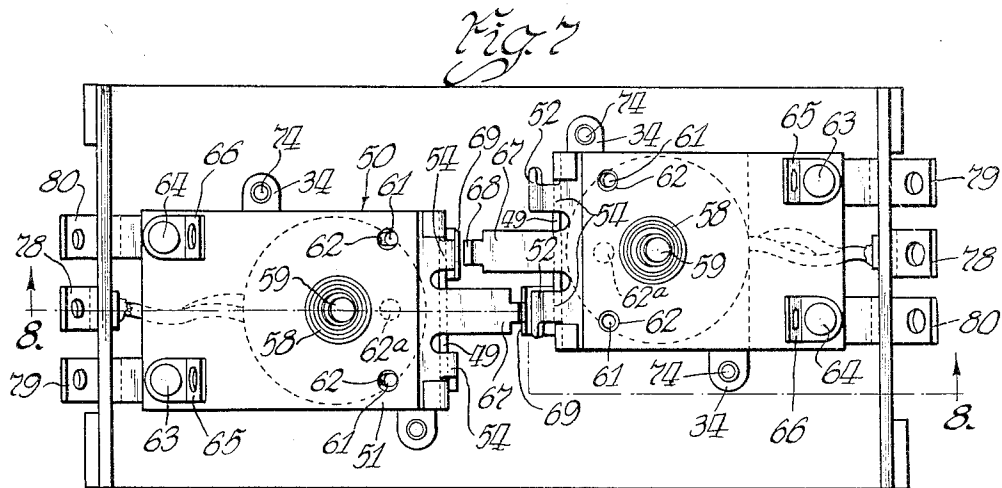
E. A. BOGUE ET AL.

2,735,968

RELAY STRUCTURE

Filed Feb. 19, 1952

2 Sheets-Sheet 2



Inventors
Edward R. Bogue
Charles W. Whisler

by *H. Orville Brewer*
Att'y.

1

2,735,968

RELAY STRUCTURE

Edward A. Bogue, South Bend, Ind., and Charles W. Musser, Niles, Mich., assignors to ETC, Inc., Niles, Mich., a corporation of Illinois

Application February 19, 1952, Serial No. 272,334

4 Claims. (Cl. 317—198)

Our invention relates to relay structures, and more particularly to the structures and arrangements of the mechanical and movable parts, assemblies and combinations utilized in electrical relays and the like.

An object of our invention is to provide a hinge type armature structure and a support therefor adapted to use on relays and the like, and which is designed for ease of manufacture and assembly in production, as well as for flexibility in its manner of use or adaptation for contact actuation.

A further object of this invention is to provide a spring biasing structure for a movable relay armature which varies the resistance to movement of the armature by an amount greater than the mere change of spring tension, as the armature moves toward and away from an associated electromagnet.

As another object our invention provides an armature structure and arrangement of parts adapted to use with a plurality of electrical relays in an interlocking relationship such that when one relay is operated another cannot be operated.

Our invention has for a further object the provision of a lost-motion connection in an electrical relay which compensates for wear of the contacts and parts and eliminates the necessity for close adjustments initiating and maintaining good operation.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings in which similar characters of reference indicate similar parts throughout the several views.

Referring to the two sheets of drawings:

Fig. 1 is a side elevation with parts broken and showing one form of an electromagnet and armature structure adapted to use in a relay of our invention;

Fig. 2 is a top plan view of the structure depicted in Fig. 1;

Fig. 3 is a perspective view of the structure illustrated in Figs. 1 and 2;

Fig. 4 is an enlarged fragmentary side elevation of the electromagnet and armature structure of Fig. 1, with parts in section substantially as indicated by the line 4—4 of Fig. 2 and accompanying arrows;

Figs. 5 and 6 are views generally similar to Fig. 4, but with movable parts of the structure in different positions than that indicated in Fig. 4;

Fig. 7 is a top plan view of an assembly which illustrates the adaptation of the electromagnet and armature structure of Figs. 1 to 6 to interlocking relays that are selectively operable, one at a time;

Fig. 8 is a longitudinal sectional view taken substantially on a line 8—8 of Fig. 7, and in the direction of the arrows;

Fig. 9 is a transverse sectional view taken substantially on a line 9—9 of Fig. 8, and in the direction of the arrows; and

Fig. 10 is a fragmentary perspective view of portions of the assembly illustrated in Figs. 7, 8 and 9.

2

In the form of the invention depicted for illustrative purposes in Figs. 1 to 6 inclusive, an electromagnet 19 includes a magnetizable core 20, which may be of soft iron, which core has a coil 21 wound thereon, and to which electrical connections are made through leads 22 and 23. The core 20 of the disclosed structure has enlarged ends 24 and 25 which retain discs of insulating material 26 and 27 for supporting and protecting the ends of the coil 21. The coil, as illustrated, has a suitable covering 28 of insulating material. A frame member 29 of magnetizable material is substantially L-shaped and has one leg 30 secured by a screw 31 to the enlarged end 25 of the core 20 so as to serve as a part of the magnetic path for the coil and as an armature support. The other leg 32 extends along the coil 21 and core 20 and has flanges 33 at opposite sides of its free end extending toward the end 24 of the core 20. Lugs 34 at diagonally opposed corners of the leg 30 of the frame member 29 have openings 35 destined to receive attaching means, such as screws or bolts, for securing the assembly to a suitable mounting in the manner illustrated in Figs. 7 and 8.

The leg 32 of the frame member 29 carries a movable armature 36 having a body portion 37 which is attracted toward the end 24 of the core 20 when the coil 21 is energized by current applied through the leads 22 and 23. When fully attracted, there is contact between the core end 24 and a headed contact insert 38 lodged in an opening in the body portion 37, as depicted in Fig. 6. The movable armature 36 is made of a suitable magnetizable metal, such as soft iron so that it and the frame form a magnetic path between the ends of the core 20 externally of the coil. The contact insert 38 need not be made of a magnetic metal, but should be capable of taking the wear of repeated contact with the core end 24. Edge regions 39 on opposite sides of the body portion 37 engage extended portions at opposite sides of the frame leg 32 which face generally toward the core 20 and are directly adjacent the flanges 33 on the support leg. Arms 40 extend angularly from regions of the body portion 37 which are inward of the edge regions 39 and are disposed to engage the face of the frame leg 32 away from the core 20. The ends of the arms 40 are widened as indicated at 41. The movable armature 36 also has a narrow extension 42 which lies in the general plane of the body portion 37 and is located between the arms 40. The narrow extension, in the form shown, is narrower toward its outer end and is bent to form an upturned flange 43 having an inclined or beveled edge 44 adapted to serve for actuating contacts, as by engagement with a contact spring, or may be utilized for other purposes, such as to serve a locking function as shown in and described in respect to Figs. 7 and 8.

One arm 40 is engaged by a spring 45 secured, as by rivets 46, to the face of the frame leg 32 away from the core 20. The spring 45 is curved at its extending end, as indicated at 42, to present a convex surface which engages the one arm 40. The effect of the convex spring surface is to shift the position of contact of the spring with the arm outwardly along the length of the arm and away from the edge regions 39, as the body portion 37 of the movable armature 36 swings toward the core end 24, as illustrated in Figs. 4, 5, and 6. When, as shown in Fig. 4, the body portion 37 of the armature is at its maximum distance from the core end 24, as determined by contact of the body portion with the flanges 33 on the frame leg 32 or by contact of the arms 40 on the movable armature 36 with the frame leg, or both, the spring 45 engages the arm 40 relatively near the fulcrums of the movable armature 36 on the frame leg, which is about where the edge region 37 (Fig. 1) contacts the frame leg or where portions 48 of the arms

3

40 contact an edge 49 of the frame leg (Fig. 4). As the body portions 37 moves to the core end 24, as illustrated in Figs. 5 and 6, the spring 47 contacts a region of the arm 40 farther away from the fulcrum and closer to the securing means 46 for the spring. Thus, when, as illustrated in Fig. 4, the distance between the body portion 37 and the core end is a maximum, and the attracting force between them, varying inversely as the square of the said distance, is a minimum, the resistance to movement of the body portion to the core end afforded by the spring is at a minimum, because the distance from the fulcrum of the movable element 36 to the contact of the spring 47 with the arm 40 is a minimum, and the distance from this contact to the spring-securing means 36 is a maximum. As the body portion 37 approaches the core end 24, as depicted in Figs. 5 and 6, the attracting force increases, and the spring resistance to this force increases with increase of distance from the fulcrum of the movable armature to the spring contact and decrease of distance from the spring contact to the spring-securing means 46.

When current to the coil 21 is interrupted so that core 20 no longer attracts the body portion 37 of the movable armature 36, the latter returns to the position of Fig. 4 under the action of the spring 45.

The flanges 33 on the frame leg 32 and the arms 40 on the movable armature 36 cooperates with the movable armature and the frame leg to form an advantageous supporting hinge connection for the movable armature on the frame leg, which supporting hinge connection is simple in construction and cheap and easy to manufacture, and yet is very reliable and durable in operation. The spring 45 helps to maintain the hinge connection of the movable armature 36 with the support leg. The core end 24 forms a stop for limiting the amount of hinging movement of the armature on the support leg in one direction, and thus serves to maintain the hinge connection when the armature moves against the force of the spring. In the disclosed relay structure, as may be readily observed, the structure may be arranged so that the spring 45 engages either of the arms 40, and the movements of the other arm may, if desired, be utilized for the operation of contacts or the like.

In the form of the invention illustrated in Figs. 7 to 10, two relays are employed in interlocking relation, both of which relays have basic structure quite like that shown and described in respect to Figs. 1 to 6, inclusive. For each relay here the corresponding parts in the various figures are designated by like reference numerals. In each device in Figs. 7 to 10, a movable armature 50 has a body portion 51 which is attractable by and toward the core 20 and which, as in the described relay, is restricted from movement away from the core 20 by the flanges 33 on the frame leg 32. Arms 52 on the movable armature 50 extend angularly from the body portion 51 and are engageable with the face of the frame leg 32 away from the core 20. Each arm 52 has an enlarged end 53. Portions 54 of the flanges are engageable with the edge 49 of the frame leg 32. Edge regions 55 on the body portion 51 are engageable with the face of the frame leg 32 which faces toward the core 20 directly adjacent the flanges 33. The movable armature 50 may be made of a suitable magnetizable material, such as soft iron.

A pin 56 is secured to, and projects upwardly from, the body portion 51 and has an enlarged end 57 which is engageable with the core end 24. A coil spring 58 surrounds the pin 56 and acts between a washer 58a retained by an enlarged end 59 on the pin 56 and a plate 60 of insulating material, yieldingly to bias the insulating plate toward a position of engagement with the side of the body portion 51 of the movable armature 50 away from the core end 24. The insulating plate 60 is guided and located relative to the body portion of the armature by the pin 56 and by studs which, in the present instance, comprise headed members 61 secured to and projecting through the

4

body portion 51 at spaced side positions and loosely received in opening 62 in the insulating plate 60. The insulating plate 60 is normally held in engagement with protuberances 62a adjacent the headed members 61 and on the face of the body portion 51 away from the core 20, which protuberances serve as bearings for movements of the insulating plate relative to the armature. The insulating plate projects beyond the end of the body portion 51 of the armature and carries contacts 63 and 64 which, as shown, are provided with connector lugs 65 and 66 to which suitable connecting leads may be attached. Each movable armature 50 has a narrow extension 67 which lies generally in the plane of the body portion 51 and is located between the arms 52. In the structure disclosed, the end of the extension 67 is somewhat narrower than the rest and has an upturned end portion 68.

In the dual relay combination illustrated in Figs. 7 and 8, two relays of generally similar construction are mounted in back-to-back relationship with one relay offset laterally from the other and with parts aligned and arranged so that when either relay is operated, the other is locked to prevent its operation. In the structural combination disclosed, a spring 69 on each relay is secured to the face of the frame leg 32 away from the core by suitable means, such as the rivets 70, and engages one of the arms 52, yieldingly to resist movement of the armature body portion 51 toward the core end 24 when the core is magnetized, and to move the armature body portion away from the core when the core is demagnetized. The spring 69 associated with one relay device has an opening 71 which is positioned to receive the end 68 on the narrow extension 67 on the movable armature 50 of the other relay when the movable element 50 of the one relay is moved toward the end 24 of its core, thereby to shift the spring 69 of said other relay from its normal position. Thus, as depicted in Fig. 8, the relay at the right has its movable armature 50 moved to the core end 24, and the spring 69 is shifted to overlie the end 68 on the narrow extension 67 of the movable armature 50 of the relay at the left. In the illustrative position of Fig. 8, the movable armature 50 of the left-hand device cannot be moved toward its associated core end 24 and so the contacts 63 and 64 of the left-hand relay cannot engage stationary contacts 72. However, contacts 63 and 64 of the right-hand relays are engaged with the associated stationary contacts 72. The result is that when the right-hand relay is actuated so as to close a circuit or circuits through its contacts 63, 64 and 72, circuits through the contacts of the other relay cannot be closed. Conversely, the relays being similarly constructed and arranged, a situation which is the reverse of that shown in Fig. 8 may also exist wherein the operated and locked relays are transposed.

The spring 58 and the loosely received pin 56 and headed members 61 provide a lost-motion connection between the movable armature 50 and the insulating plate 60, which connection compensates for variations of position and wear of the contact elements 63, 64 and 72.

The relays, as depicted in Figs. 7, 8 and 9, are secured to a base plate 73 by suitable attaching means, such as screws 74, which pass through that base plate and are threaded into the lugs 34 on the frame members 29. The base 73 has at its opposite ends flanges 75 to which insulating panels 76 are secured. The panels form mountings for connectors 77 and 78 to which the coil leads 22 and 23 are attached and for connectors 79 and 80 to which connections are made through brackets 81 to the contacts 72 which are carried by those brackets.

While we have illustrated a preferred embodiment of our invention, many modifications may be made without departing from the spirit of the invention, and we do not wish to be limited to the precise details of construction set forth, but desire to avail ourselves of all changes within the scope of the appended claims.

Having thus described our invention, what we claim

5

and desire to secure by Letters Patent of the United States, is:

1. An assembly comprising a magnetizable core, a substantially L-shaped frame of magnetizable material having one leg secured to one end of the core and another leg extending along the core in spaced relationship thereto so that the core and other leg have adjacent free ends, an armature having a body portion and an integral leg extending in angular relationship to one another from a vertex, means providing a hinge connection between the said free end of the core leg and the vertex of the armature with the said hinge connection, the latter mentioned core leg and the body and leg portions of the armature so related that the body portion of the armature is swingable toward and from the free end of the core and the armature leg is swingable angularly toward and from said other leg of the frame, and an elongated leaf spring having one end secured to the frame and its other end extending in the general direction of the core into overlapping relationship with the leg of the armature, said leaf spring being longitudinally shaped so as normally to engage the armature leg only at a position near the said hinge connection between the armature and frame, and the shape of the spring being such that the position of engagement between the armature leg and spring moves toward the end of the armature leg as the armature leg swings away from the leg of the frame.

2. An assembly as defined in claim 1, and wherein said

6

leaf spring has a convexly curved end portion normally engaging said armature leg.

3. An assembly as defined in claim 1, and wherein said leaf spring has a curved portion near the end which is secured to the frame and extends angularly toward the surface of the armature leg which faces away from the frame when the armature is in its normal position of rest.

4. An assembly as defined in claim 1, and wherein said armature leg and said leaf spring are so relatively disposed that the end of the armature engages the mid-portion of the spring when the armature body is toward the free end of the core.

References Cited in the file of this patent

UNITED STATES PATENTS

1,092,283	Morse	Apr. 7, 1914
1,169,273	Mason	Jan. 25, 1916
2,353,377	Vaughn	July 11, 1944
2,374,017	Iglehart et al.	Apr. 17, 1945
2,438,745	Fox	Mar. 30, 1948
2,540,976	Weinreich	Feb. 6, 1951

FOREIGN PATENTS

593,094	Great Britain	Oct. 8, 1947
627,958	Great Britain	Aug. 18, 1949