

Oct. 27, 1953

J. H. MOGLER
CROSSBAR SWITCH

2,657,275

Filed May 24, 1950

2 Sheets-Sheet 2

FIG. 3

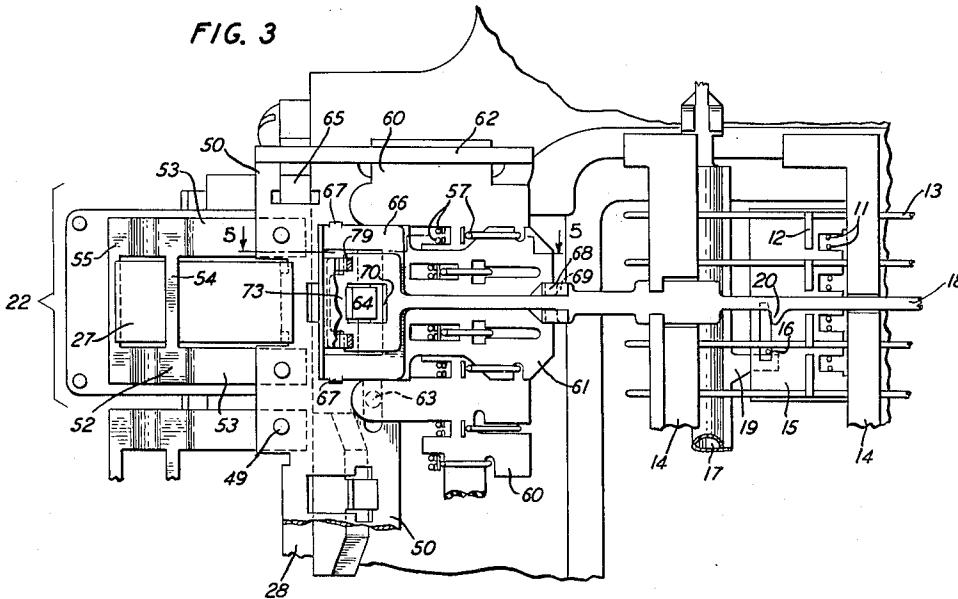


FIG. 4

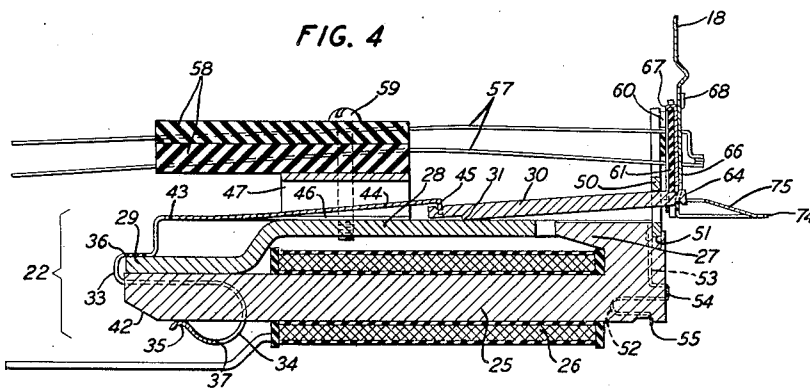
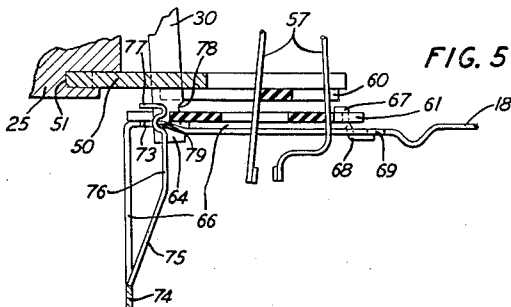


FIG. 5



INVENTOR
J. H. MOGLER
BY
R. O. COVILL
ATTORNEY

UNITED STATES PATENT OFFICE

2,657,275

CROSSBAR SWITCH

John H. Mogler, Denville, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application May 24, 1950, Serial No. 163,847

12 Claims. (Cl. 179—27.54)

1

This invention relates to electromagnetic apparatus and more particularly to electromagnetic switching apparatus of the cross-bar type.

An object of this invention is to provide means for easily and removably interassociating certain of the elements of a switch structure.

In general, a cross-bar switch mechanism is made up of a large number of individual elements. Certain of these elements must be maintained in fixed relation with others of these elements, and yet it is advantageous and desirable that assembly be simple and economical and disassembly be readily accomplishable. Thus, cross-bar switches are generally provided with a plurality of electromagnets and a plurality of armatures which must be suitably associated one with the other, and many such switches utilize a return pole-piece common to a plurality of these electromagnet elements.

Therefore, a feature of this invention is a spring device for performing the plural functions of removably affixing a plurality of electromagnet cores and a plurality of armatures to a return pole-piece and of biasing the armatures to their unoperated positions.

Similarly, in many types of cross-bar switch mechanism, select and hold operating tapes are provided which must be associated with the armatures of the electromagnets, and, in addition, the operating elements or cards for the off-normal contact springs must be connected to these armatures.

Therefore, another feature of this invention is a spring device for securely but removably affixing an off-normal contact spring moving card and cross-bar switch operating tape to the armature of a select or hold electromagnet.

The invention may be more fully understood from the following detailed description of a preferred embodiment thereof, when read with reference to the accompanying drawings, in which:

Fig. 1 shows a front view of a portion of a cross-bar switch embodying the features of the invention;

Fig. 2 is a partially cut-away side view of a portion of the structure shown in Fig. 1 taken through 2—2 of Fig. 1;

Fig. 3 is an enlarged view of a portion of the structure shown in Fig. 1, partially cut away to demonstrate the cooperative relationship between certain of the parts;

Fig. 4 is a sectional view of a portion of the preferred embodiment of the invention taken through 4—4 in Fig. 2; and

Fig. 5 is a sectional view taken through 5—5 in Fig. 3.

2

In Fig. 1 of the drawings, a portion of a suitable cross-bar switch structure is depicted. This switch may be of the general type disclosed in Patent 2,447,010 granted August 17, 1948, to H. C. Harrison, or may be of any other suitable construction. In general, the switch comprises a plurality of sets of movable contacts and a plurality of sets of fixed contacts. Means are provided selectively to bring any one of the sets of movable contacts into electrical engagement with its corresponding set of fixed contacts. In the disclosed exemplary type of switch, the movable contacts 11 comprise flexible wire springs, each spring being fixedly mounted at the rear of the switch and extending forwardly in a horizontal plane. A pair of these movable contacts 11 is arranged to engage each fixed contact 12. Since, as an example, a so-called "four-wire" switch has been disclosed, four pairs of the moving contacts 11 comprise one set of moving contacts, and these contact springs lie in a common vertical plane. A plurality of additional sets of moving contacts 11 lie in the same vertical plane, and a plurality of such columns of moving springs may be provided as is illustrated in Fig. 1.

The fixed contacts 12 are in the form of lugs welded to and extending perpendicularly from horizontal wires 13. By this manner of construction, the requisite multiplying of the fixed contacts 12 is obtained. One wire 13 is provided for each horizontal row of pairs of moving contact springs 11, and tabs 12 are affixed to the wires 13 to cooperate with the individual pairs of moving contact springs. One set of moving springs 11 and their cooperating lugs 12 will hereinafter be referred to as a "cross-point." The several wires 13 are molded or otherwise fixed in insulation members 14 which extend vertically in Fig. 1 and are fixed in position in any suitable manner.

Each set of moving contact springs 11 is provided with an operating element 15 of insulating material which may be of any suitable configuration and supported in any suitable manner, the essential requirement being that when an element 15 is moved to the left (in Fig. 1 or 3) the pairs of moving contact springs 11 associated therewith will be deflected to the left to engage electrically the respective fixed contact lugs 12.

Each operating element 15 is provided with a select finger 16. The fingers 16 are fixed at the rear of the switch and extend forwardly in parallelism with the moving contact springs 11. The fingers 16 extend through slotted apertures in the operating element 15 but terminate short of the plane in which the horizontal wires 13 lie. It will

3

be seen that upon movement to the left of a select finger 16, the associated operating element will also be moved to the left.

The selective operation of the contacts at any one cross-point is accomplished by a two-fold movement of a selected one of the select fingers 16. This movement is accomplished by a translatory movement of a select tape 17 and by a subsequent translatory movement of a hold tape 18. These select and hold tapes may be either rigid or flexible. A select tape 17 is provided for each vertical column of cross-points and a hold tape 18 is provided for each horizontal row of cross-points. As may best be seen in Fig. 3, each select tape 17 has integral therewith a plurality of tabs 19, one per cross-point in the associated column of cross-points; and each hold tape 18 has integral therewith a plurality of tabs 20, one per cross-point in the associated horizontal row of cross-points.

Upon the vertical movement of one of the select tapes 17, the several lugs 19 thereon engage the associated select fingers 16 and raise the ends of the fingers vertically in the slots in the operating elements 15. In this position, the select fingers 16 are engageable by the lugs 20 on the hold tapes 18. Therefore, upon the subsequent movement to the left of one of the hold tapes 18, the lug 20 thereon which is engaging a select finger 16 will move that finger to the left to operate the selected cross-point. The select tape 17 may then be restored to normal and the cross-point will remain operated until the hold tape 18 is released, in the normal fashion.

The select tapes 17 and the hold tapes 18 may be positioned and guided in any suitable manner. Thus, in Fig. 1 of the drawings, the hold tapes 18 are guided in slots in the insulation members 14.

It is to be understood that the depicted and above-described operation of a selected cross-point and the configuration of the elements involved is typical, but only exemplary, and the features of this invention, hereinafter to be described, may be advantageously employed with any suitable type of cross-bar switch and certain features may be embodied in any suitable type of electromagnetic switch mechanism.

The select tapes 17 and the hold tapes 18 are moved, in the customary fashion, by select magnets 21 and hold magnets 22, respectively. In the disclosed embodiment of the invention, the banks of select magnets and hold magnets are substantially identical, and the configuration thereof and the manner of association with the operating tapes will be described with reference to the hold magnets 22.

A hold magnet 22 is provided for each hold tape 18. Referring to Figs. 2 and 4, each hold magnet comprises a core 25, which may be laminated, and a coil 26 surrounding a portion of that core. The forward end of the core 25 is extended perpendicularly and reversely as at 27 (Fig. 4).

The return pole-piece 28 for the magnetic paths of the several hold magnets 22 comprises a plate of magnetic material and is common to a number of the magnets 22. It is provided with an offset tail portion 29 and the forwardmost edge of the return pole-piece extends so as to lie in spaced proximity to the extensions 27 of the cores 25 to provide suitable air gaps in the magnetic paths.

An armature 30 is provided for each electro-

4

magnet 22, and is positioned so as to be bridgeable across the air gap between the portion 27 of the core 25 and the return pole-piece 28. Each armature 30 has a cut-out portion at the rear underside thereof to provide a knife edge 31 about which the armature may pivot. The armature back stop will be described hereinafter.

A single, unitary means is provided to perform the functions of firmly affixing all of the cores 25 to the return pole-piece 28 and yet permitting the ready removal of any one of those cores, of positioning the several armatures 30 on the return pole-piece 28, and of biasing the several armatures 30 to their unoperated position, i. e., serving as armature-return springs. This means is the spring 33. The spring 33 extends substantially coextensively with the return pole-piece 28 and a portion of the spring 33 engages the tail portion 29 of the return pole-piece 28.

One portion of the spring 33 extends forwardly (Fig. 4) in spaced parallelism with tail portion 29 and then curls back upon itself to form a circular portion 34. The extreme end of this portion may be bent outwardly to provide a smooth pressure surface 35. This portion of the spring 33 is provided with a plurality of slots or apertures. Thus, in the preferred embodiment of the invention, a first plurality of these slots extend from a point 36 (Fig. 4) at a point near the rearmost edge of the pole-piece portion 29 to a point 37 in the circular portion 34. Each of these slots is of substantially the same width as the cores 25 and one such slot is provided for each core. As may best be seen in Figs. 2 and 4, each core 25 extends through one of the apertures in the spring 33 and is firmly held against the tail portion 29 of the return pole-piece 28 by the pressure exerted thereon by the surface 35 of the spring 33. In this manner, the core is firmly held in position, lateral movement thereof being prevented by the side portions 33 (Fig. 2), and unwanted motion in the other directions being inhibited by the surface 35 of resilient spring 33 clamping the core 25 to the return pole-piece tail portion 29.

To permit the necessary lifting of the circular portion 34 of the spring 33 and to provide individual and substantially independent clamping of the several cores 25, additional slots 41 (Fig. 2) may be cut in the spring 33. The cores may also be more easily inserted in the apertures in the spring 33 and the surface 35 may be more readily cammed to its tensioned position if the ends of the cores 25 are chamfered as at 42 (Fig. 4).

The upper portion (Fig. 4) of spring 33 is offset and then extends forwardly in plane with the upper surface of the return pole-piece 28. This portion of the spring is provided with a plurality of slots to form a plurality of fingers 43. Alternate ones of these fingers 43 are slightly longer than the remaining ones of these fingers. One of these longer fingers is provided for each core, extends forwardly as at 44, and has a hooked portion 45 which engages a lateral notch at the rear of the associated armature 30 (Figs. 2 and 4). The forward portions 46 of the shorter ones of the fingers 43 are firmly clamped to the return pole-piece 28 by a member 47 (Fig. 4). Since the alternate ones of the fingers 43 are clamped, the longer ones of the fingers 43 will exert a force toward the return pole-piece to cause the armatures 30 normally to pivot about their edges 31 to the unoperated position as shown in Fig. 4. It is obvious that member 47

must be provided with suitable slots through which the forward portions 44 of the longer fingers 43 may freely pass.

A plate 50 is provided to serve the function, among others, of a back stop for the several armatures 30. The plate 50 is of substantially the same length as return pole-piece 28 and comprises a flat strip of non-magnetic material. A plurality of notches are cut along one edge of the plate 50 (Figs. 3, 4 and 5). One such notch is provided for each core 25 and the width of the notches is substantially the same as the width of the cores 25. When plate 50 is in position, these notches are inserted in transverse slots 51 in the front portions 27 of the cores 25. This interlocking arrangement may best be seen in Figs. 3, 4 and 5 of the drawing.

The cores 25 and the plate 50 are maintained in proper interrelationship by means of spring clips 52. These clips may best be seen in front view in Fig. 3, in side view in Fig. 4 and in top view in Fig. 2. The clips 52 each comprise two legs 53 fastened together with two cross-pieces 54 and 55, with the portions of the legs between the two cross-pieces being bent in an exaggerated S-curve to provide a spring tension. The legs 53 lie adjacent the sides of the core 25. The first cross-piece 55 engages a transverse notch cut across the width of the core 25 and cross-piece 54 presses against the forwardmost end of the core 25. The two legs 53 are attached to the plate 50 by pins 49 (Fig. 3) or by any other suitable means.

The plate 50 is provided with an aperture for each armature 30 and the tips 64 of the armatures 30 extend therethrough (Figs. 2, 3 and 4). The forward portion 44 of the longer spring 43 forces the armature normally to rest against the edge of the associated aperture whereby plate 50 serves as a back stop for the several armatures.

Plate 50 is further maintained in position by being provided with apertures engaging extensions 65 (Figs. 1, 2 and 3) of the return pole-piece 28.

A group of sets of off-normal contacts are provided for each electromagnet. The off-normal contacts associated with each select or hold magnet are actuated upon the operation of the associated magnets to serve any requisite circuit functions. As may best be seen in Figs. 4 and 5, these off-normal contacts may comprise a plurality of pairs of wire springs 57 which may be molded or otherwise mounted in blocks of insulating material 58. These blocks, as well as block 47, may be mounted on the return pole-piece 28 in any suitable fashion, as by the use of screws 53.

The actuation of each group of springs 57 is controlled by a fixed card 60 and a moving card 61, both of insulating material. The fixed card 60 (Figs. 3, 4 and 5) extends coextensively with plate 50 and is affixed thereto in any suitable manner. For example, in Fig. 3, projections at each end of the fixed card 60 may engage apertures in flanges 62 of plate 50 and a plurality of projections 63 may engage slots near the edge of plate 50.

A moving card 61 is provided individual to and associated with each of the armatures 30. Each moving card 61 and the fixed card 60 are suitably apertured and slotted in accordance with the particular contact coding desired. In Fig. 3, as an exemplary arrangement, four sets of contacts are provided for each electromagnet with two of the sets making contact and the other

two sets breaking contact upon movement of the associated armature and moving card.

A single means is employed, individual to each electromagnet, to perform the functions of affixing both the moving card 61 and the operating tape 17 or 18 to the tip 64 of armature 30. This means comprises spring clip 66 which may be seen in front view in Figs. 1 and 3, in top view in Fig. 2, and in sectional side view in Figs. 4 and 5. Each spring clip 66 comprises two portions extending substantially perpendicularly one to the other. One of these spring clip portions lies adjacent the face of the moving card 61 and is suitably conformed to provide several points at which the card 61 and the clip 66 may be fastened together and yet to prevent the clip from interfering with the relationship between the moving card and the off-normal contact springs 57. Thus, in Figs. 1 and 3, this first or base portion may be seen to be substantially Y-shaped. A plurality of tangs 67 are provided which are bent over firmly to grasp the moving card 61. One such tang 67 at the base of the Y may best be seen in Figs. 4 and 5 and additional tangs 67 at the arms of the Y may best be seen in Figs. 2 and 3.

The extreme of this base portion of the spring clip 66 is offset and bifurcated to provide fingers 68 (Figs. 3, 4 and 5). The operating tape, now assumed to be the hold tape 18, extends through the slots between the fingers 68 and is provided with extensions 69 which engage fingers 68 of the spring clip 66.

The end of the operating tape 18 is enlarged and is provided with an aperture 70 (Fig. 3). The tip 64 of the armature 30 passes through the aperture 70 and the cross-piece 73 (Figs. 3 and 5) at the extreme end of the tape 18 engages a slot or notch in the tip 64 of the armature 30.

The other portion of the spring clip 66 extends perpendicularly to the base portion and comprises two legs and a cross-piece 74. Depending from the cross-piece 74 is an offset portion 75 which, in turn, has two legs 76 and a cross-piece 77 (Figs. 2 and 5).

A notch in the moving card 61 engages a transverse slot 73 (Fig. 5) in the tip 64 of the armature 30. As has been described, the cross-piece 73 at the extreme end of the tape 18 engages a notch in the opposite surface of the tip 64 of the armature 30. The cross-piece 77 of the spring clip 66 also engages the tip 64 of the armature 30 on the same side thereof as does the cross-piece 73 of the tape 18. The legs 76 of the offset portion 75 of the spring clip 66 engage shoulders 79 at the end of the operating tape 18 (Figs. 3 and 5). The legs 76 may be curved, as shown, at the point of contact with the shoulder 79 to provide sockets whereby relative lateral shifting of these parts may be avoided. Since the spring 66 is firmly affixed to moving card 61, the moving card 61 and the operating tape 18 are firmly attached to the tip 64 of the armature 30 by spring clip 66. As may be seen, the arrangement is such as to provide a structure which may readily be assembled or disassembled and yet one in which the cooperating elements are firmly retained in their proper relative positions.

It is to be understood that the above-described arrangements are but illustrative of an application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. In a cross-bar switch, an electromagnet comprising a core, a return pole-piece and an armature, a plurality of contact springs, a card for actuating said contact springs, an operating tape, a unitary spring engaging said core, said return pole-piece and said armature to retain both said core and said armature on said return pole-piece, and a spring clip engaging said armature, said card and said operating tape to retain both said card and said operating tape on said armature.

2. In a cross-bar switch, an electromagnet comprising a core, a return pole-piece and a flat armature having two end portions, a plurality of contact springs, a card for actuating said contact springs, an operating tape, a unitary spring engaging said core, said pole-piece and one of the end portions of said armature to retain said core and said armature on said pole-piece, and a spring clip engaging said card, said operating tape and the other of the end portions of said armature to retain both said card and said operating tape on said armature.

3. In a cross-bar switch, an electromagnet comprising a core, a return pole-piece and an armature, a plurality of contact springs, a card for actuating said contact springs, an operating tape, a unitary spring for retaining both said core and said armature on said return pole-piece, and a spring clip retaining both said card and said operating tape on said armature, said unitary spring comprising a body portion engaging said return pole-piece, an apertured portion on one side of said pole-piece having a reverse bend engageable with said core and a portion on the other side of said pole-piece engageable with said armature.

4. In a cross-bar switch, an electromagnet comprising a core, a return pole-piece and an armature, a plurality of contact springs, a card for actuating said contact springs, an operating tape, a unitary spring for retaining both said core and said armature on said return pole-piece, and a spring clip retaining both said card and said operating tape on said armature, said spring clip comprising a first and a second portion at right angles one to the other, said first portion being provided with elements engaging opposite sides of said card and a bifurcated projection engageable with said tape, said second portion being provided with an offset portion for clamping said tape to said armature.

5. In a cross-bar switch, an electromagnet comprising a core, a return pole-piece and a flat armature, a plurality of contact springs, a card for actuating said contact springs, an operating tape, a unitary spring for retaining both said core and said armature on said return pole-piece, and a spring clip retaining both said card and said operating tape on said armature, said unitary spring comprising a body portion engaging said return pole-piece, an apertured portion on one side of said pole-piece having a reverse bent engageable with said core and a portion on the other side of said pole-piece engageable with said armature, said spring clip comprising a first and a second portion at right angles one to the other, said spring clip first portion being provided with elements engaging opposite sides of said card and a bifurcated projection engageable with said tape, said spring clip second portion being provided with an offset portion for clamping said tape to said armature.

6. In an electromagnet, a core, a return pole-piece, an armature, and a unitary spring engaging said core, said return pole-piece and said armature to retain both said core and said armature on said return pole-piece.

7. In an electromagnet, a core, a return pole-piece, an armature, and a unitary spring retaining both said core and said armature on said return pole-piece, said spring comprising a body portion engaging said return pole-piece, an apertured portion on one side of said pole-piece having a reverse bend engageable with said core and a portion on the other side of said pole-piece engageable with said armature.

8. In an electromagnet, a core, a return pole-piece, an armature, and a unitary spring retaining both said core and said armature on said return pole-piece, said spring comprising a body portion engaging said return pole-piece, an apertured portion on one side of said pole-piece having a reverse bend engageable with said core and a trifurcated portion on the other side of said piece, the middle one of said trifurcations having a hook portion engageable with said armature.

9. In a switch, a return pole-piece, a plurality of cores, an armature individual to each of said cores, and a spring engaging said return pole-piece, said cores and said armatures to retain all of said cores and all of said armatures on said return pole-piece.

10. In a switch, a return pole-piece, a plurality of cores, an armature individual to each of said cores, and a spring retaining all of said cores and all of said armatures on said return pole-piece, said spring comprising a body portion engaging said return pole-piece, a plurality of apertured portions on one side of said pole-piece, individual ones of said apertured portions each having a reverse bend engageable with individual ones of said cores, and a plurality of projections on the other side of said pole-pieces, each of said projections being engageable with individual ones of said armatures.

11. In a cross-bar switch, an armature, a plurality of contact springs, a card for operating said contact springs, an operating tape, and a spring clip engaging said armature, said card and said operating tape to retain both said card and said operating tape on said armature.

12. In a cross-bar switch, an armature, a plurality of contact springs, a card for operating said contact springs, an operating tape, and a spring clip retaining both said card and said operating tape on said armature, said spring clip comprising a first and a second portion at right angles one to the other, said first portion being provided with elements engaging opposite sides of said card and a bifurcated projection engageable with said tape, said second portion being provided with an offset portion for clamping said tape to said armature.

JOHN H. MOGLER.

References Cited in the file of this patent
UNITED STATES PATENTS

Number	Name	Date
771,323	Perret	Oct. 4, 1904
2,353,377	Vaughn	July 11, 1944
2,362,551	Harrison	Nov. 14, 1944
2,538,819	Bellamy	Jan. 23, 1951