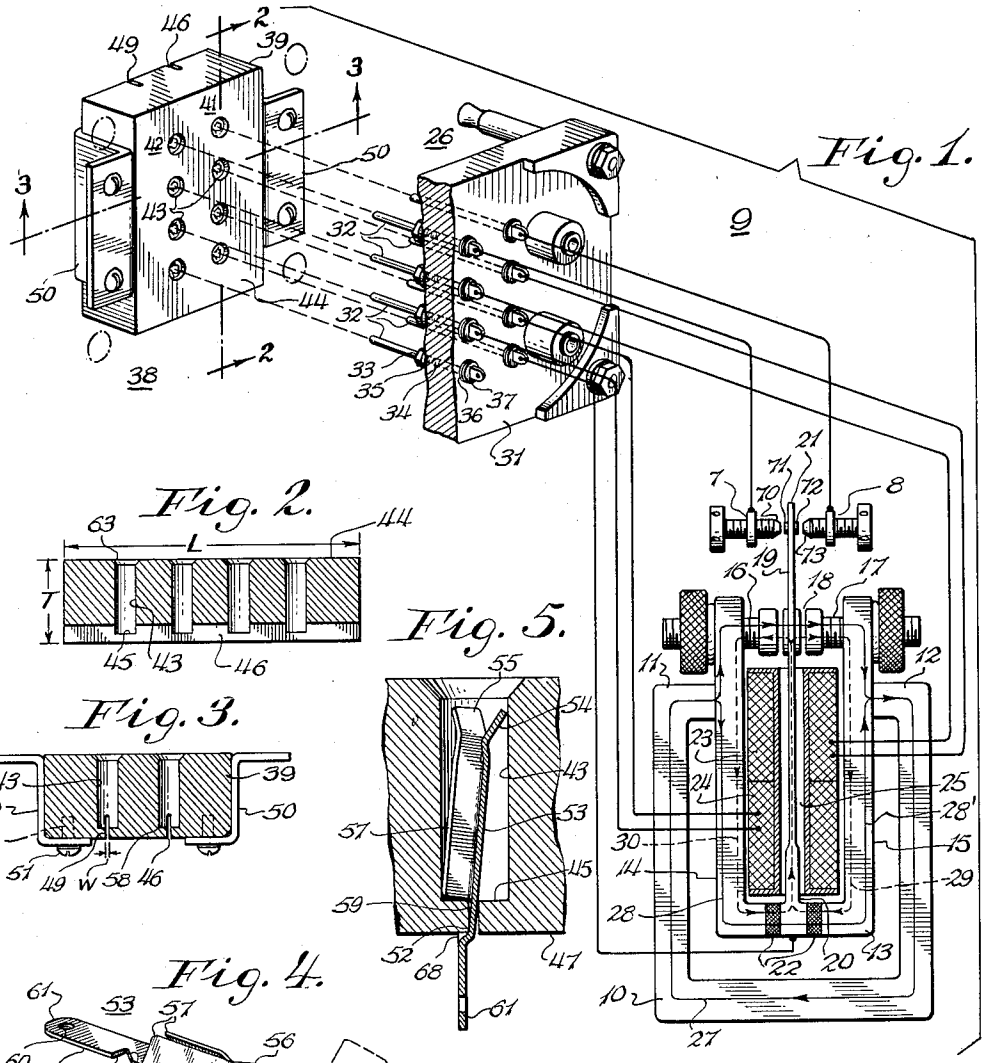
Feb. 7, 1956 R. S. LEVENSON 2,734,179

CONNECTION BLOCK FOR AN ELECTROMAGNETIC POLOR RELAY

Filed Feb. 24, 1953



INVENTOR
ROBERT S. LEVENSON
BY
ATTORNEY

United States Patent Office 2,734,179 Patented Feb. 7, 1956

2,734,179

CONNECTION BLOCK FOR AN ELECTRO-MAGNETIC POLAR RELAY

Robert S. Levenson, New York, N. Y., assignor, by mesne assignments, to Metropolitan Telephone Supply Corp., Brooklyn, N. Y., a corporation of New York

Application February 24, 1953, Serial No. 338,532

2 Claims. (Cl. 339—217)

The present invention relates to polar relays used in high speed polar telegraph and allied circuits, and, more particularly, to connection block structure for polar relays and the method of making same. Such relays are designed to operate on current reversals of the order of 30 milliamperes. Operation at this current level plus the fact that telegraph and allied equipment are involved make good electrical connections in the relay circuit indispensable. Consequently, the relay is subjected to surveillance, repair and systematic cleaning by maintenance personnel to assure uninterrupted operation of the relay circuit.

One troublesome feature of the prior art relay structure revolves about the effort required to maintain good electrical connections at the base of the relay. The relay terminal board, i. e., the connection block, of the prior art structure is made of laminated slabs of dielectric material. The electrical contact terminals embedded in the block are long, flat spring fingers. Electrical contact with the relay components is brought about by sliding a pin terminal along the flat surface of the spring finger. The effectiveness of this type of electrical connection depends solely upon the quality of the sliding contact between the surfaces of a cylindrical body (the pin terminal) against a flat body (the spring finger). Operation of the whole relay circuit is hampered or prevented, if for any reason there is a poor electrical connection along this single line of contact.

Furthermore, the laminated block design of the prior art structure has the tendency of collecting dirt and grit. It therefore is necessary to clean and service such relays wherever they may be to avoid arcing and voltage breakdowns. When the relay is inaccessibly located, extensive precautions must be observed to minimize arcing because of grit accumulations in the laminated block. The laminated block structure also limits the voltage load safely carried by the relay. In addition, the laminated structure is relatively expensive to manufacture.

The present invention is directed to overcoming the drawbacks associated with the prior art relay design. A polar relay and, more particularly, a connection block therefor built in accordance with the present invention assures good electrical connections at the relay base. The invention calls for a relay base and a relay connection block each made of a unitary slab of high dielectric material. Each contact terminal embedded in the connection block is furnished with three spring fingers oriented to provide a three-sided electrical contact with the engaging pin terminal. A three-sided electrical contact offers the advantages of multi-contacts. Hence, a defect in one contact will not adversely affect the electrical connection of the circuit.

Furthermore, the relay connection block built pursuant to the present invention is adaptable to mass production manufacture by unskilled labor. This latter feature is attributed to the simple design afforded by the unitary slab and to the locking arrangement employed to hold the contact terminal in the block. Moreover, dirt

accumulation is reduced, and as a result arcing is prevented. The present invention also provides a construction of increased ruggedness; consequently, the relay can withstand greater shock loads. Further advantages are realized by the present invention; such as: the voltage load of the relay is increased, the cost of manufacture and maintenance costs are decreased. In addition, the locking technique employed to hold the contact terminal in the block permits removal of the terminal for repair without requiring the disassembly of the block.

It is, therefore, an object of this invention to improve the electrical connections in a polar relay circuit whereby good electrical connections are maintained for relatively long periods without the need of frequent or periodic maintenance of the relay circuit.

A further object is to provide a three-sided electrical contact between the pin terminals and spring finger terminals in a polar relay circuit.

A further object is to provide a polar relay connection block adaptable to mass production manufacture by unskilled labor whereby the costs thereof are reduced substantially.

A further object is to provide a polar relay structure less susceptible to collecting foreign matter whereby arcing and voltage breakdowns are minimized.

A further object is to provide a method of fabricating a polar relay connection block of a single slab of dielectric material.

A further object is to provide a relay structure having improved mechanical and electrical ruggedness.

Further objects and advantages of the present invention will become apparent from the following specification and figures in which,

Fig. 1 is a composite view, partly in section, illustrating a polar relay embodying the features of the present invention;

Fig. 2 is taken along line 2—2 of Fig. 1;

Fig. 3 is taken along line 3—3 of Fig. 1;

Fig. 4 is a perspective view of a spring finger terminal;

Fig. 5 is a sectional view of a spring finger terminal embedded in a connection block;

Fig. 6 is a longitudinal view, partly in section, of a crinkling jig; and

Fig. 7 is another view of the crinkling jig.

Referring to the figures, polar relay **9** employs an U-shaped permanent magnet **10** having poles **11, 12**. A return pole piece **13** of magnetic material has parallel extending arms **14, 15** interposed poles **11, 12**. Adjustable pole screws **16, 17** are threadedly engaged to and carried by arms **14, 15** respectively. Pole screws **16, 17** extend in alignment laterally from respective supporting arms **14, 15** and form a working air-gap **18** between their adjacent ends. An armature **19** is supported at one end **20** by return pole piece **13**. Armature **19** extends through gap **18** and terminates at a free end **21**. A pair of electrical insulators **22, 22** electrically isolate armature **19** from return pole piece **13** at supporting end **20**. A pair of electrical contacts **7, 8** straddle armature **19** close to its free end **21**. Contacts points **70, 71, 72** and **73** are of sufficient length to prevent an electrical short of the armature **19** with either pole screw **16, 17** upon an electrical closed circuit of armature **19** with either contact point **70, 73**. A pair of accurately balanced current conducting windings **23, 24** surrounds armature **19**. Axial hole **25** of windings **23, 24** is large enough to permit free lateral vibration of armature **19** therein. A multi-terminal base **26** carries a plurality of pin terminals **32** to which electrical connections are made with armature **19**, contacts **7, 8**, and windings **23, 24**.

The magnetic paths of the polarizing flux are illustrated by solid lines **27, 28, 28'**. Assuming that windings **23, 24** are connected to create additive magnetic flux, the mag-

netic paths of such flux are shown by dashed lines 29, 30. The magnetic influence of the current in windings 23, 24 on armature 19 depends on the current directions in the windings 23, 24. When the current passes through the relay windings, the operating flux set up by the windings adds to the polarized flux in one part of air gap 18 and subtracts from the polarized flux in the other part of air gap 18. Armature 19 moves laterally into the portion of gap 18 of greater flux density until electrical contact is made by one pair of electrical contact points 70, 71 or 72, 73. When the current is reversed, armature 19 is attracted toward the opposite direction.

Relay base 26 is made of a unitary slab 31 of high dielectric material to which a plurality of pin terminals 32 are embedded. Each terminal 32 is threadedly embedded to slab 31 by means of a nut 33 engaging the threaded portion 34 of pin terminal 32, washers 35, 36 and shoulder 37.

Connection block 38 has a unitary slab 39 of high dielectric material of suitable thickness T. Two rows 41, 42 of aligned, cylindrically shaped recesses 43 extend inwardly from front engaging surface 44 and terminate at rear or bottom inner wall 45. Recesses 43 are arranged along two aligned rows 41, 42 to facilitate manufacture of connection block 38. This feature will be illustrated hereinafter.

A right-angled slot 46 extends along rear surface 47. Slot 46 is in alignment with the common center line of row 41. The width W of slot 46 is substantially less than the diameter of recesses 43. Slot 46 extends in depth beyond inner wall 45. As a result a row of continuous openings exists between surfaces 44, 47. Each opening is the combination of a recess 43 and a constricted portion formed by slot 46. The constriction starts at inner wall 45.

A second slot 49 is provided in a similar relationship with respect to row 42 of recesses 43.

Mounting brackets 50 are fixed to slab 39 by means of bolts 51 engaging threaded holes 69.

A spring finger terminal 53 of thin electrical conducting material is spring-locked in each recess 43. Terminal 53 has an engaging front end of center finger 54 and astriding side fingers 55, 56. Rear edges 57 of side fingers 55, 56 are pressed against rear inner wall 45, note Fig. 5. Center finger 54 extends into and through the constricted portion of the opening and continues beyond rear surface 47. A rear portion 52 of center finger 54 is contiguous to wall 59 of the correlated slot and contiguous to rear surface 47. A hole 60 is provided at the rear to which an electrical connection could be made. Terminal 53 has a cut-out 62 predeterminedly located to be at corner 58 when the terminal is embedded in its correlated recess 43. Cut-out 62 facilitates crinkling terminal 53 during the manufacture of the connection block 38. Cutout 62 also improves the holding or locking characteristic of the crinkle, because cut-out edge 68 presses against surface 47. The crinkle in conjunction with the holding or stop characteristic produced by edges 57 pressing against rear wall 45 spring-locks terminal 53 in its correlated recess 43.

The three spring fingers 54, 55, 56 lie in planes oriented to form a three-sided electrical contact terminal. Each finger presents a separate contacting surface upon engagement with pin terminal 32.

Terminal 53 can be removed very easily from its correlated recess 43 to permit repair or replacement without the need of disassembling the connection block 38 or disturbing the other electrical connections of the relay circuit. By wiggling exposed rear end 61 until the locking action of the crinkle is destroyed, terminal 53 may be withdrawn from its correlated recess 43.

In the manufacture of connection block 38, it is preferable to start with a long stock of solid dielectric material of suitable thickness and width. The stock is cut by conventional means to desired length L. The cut slab 39 is placed into a conventional drill jig. Two parallel extending rows 41, 42 of aligned holes 43 are drilled into slab 39 a suitable depth from front surface 44. In one embodiment, eight holes each 5/16" were drilled 5/8" deep into a slab 1 1/16" thick. The holes are then countersunk 63. Slab 39 is turned over and holes 69 are drilled a suitable depth from rear surface 47 after which said holes are threaded for the purpose of attaching brackets 50 to slab 39 by means of bolts 51. Two parallel extending right-angled slots 46, 49, each in alignment with the common center line of a correlated row 41, 42 of holes 43, are cut along rear surface 47. Slots 46, 49 are cut by conventional means, i. e., milling machine. The width of slots 46, 49 are substantially less than the diameter of holes 43. In the same embodiment referred to above, the width of slots 46, 49 was 1/32". The depth of slots 46, 49 should be greater than the undrilled dimension of the slab, i. e., the distance between rear bottom wall 45 and rear surface 47.

Thus each hole 43 and its correlated slot form an opening extending through slab 39 between front and rear surfaces 44, 47.

A prefabricated contact terminal 53 is inserted into each hole 43. Terminal 53 may be made by a conventional punch press process, which process is not shown here because it is not deemed to be part of the instant invention. Exposed ends 61 are extracted from slots 46, 49 until edges 57 press against the bottom surfaces or rear inner wall 45 of the correlated hole 43. The rear portion of center finger 54 of terminal 53 is thereby flexed slightly and as a result creates sufficient lateral pressure against the adjacent wall of the correlated slot to hold terminal 53 in place until it is permanently locked in its correlated hole 43.

Connection block 38 is then inserted in a crinkling jig 64 with rear surface 47 facing upward. Jig 64 consists of a pair of laterally moving press bodies 67, a solid right-angled anvil 65 hinged at 74 and a seat into which connection block 38 is held during the crinkling of ends 61. The seat is formed by sides 76, 77 and bottom 78. The seat is arranged to hold block 38 so that anvil 65, when swung to position 75 to rest upon surface 47, extends between the two rows of exposed ends 61.

Anvil 65 is swung into position 75. The anvil width 66 is slightly less than the distance between adjacent walls 59 of slots 46, 49. Press bodies 67 are brought together in the direction of arrows 79 to bear pressure against exposed ends 61, which ends are thus pressed against adjacent walls 59, rear surface 47 and adjacent walls of anvil 65 and thereby deformed. Bevels 80 prevent press bodies from shearing ends 61. The ends 61 hold their deformed shape upon withdrawal of press bodies 67 and removal of block 38 from jig 64. Cutout 62 is suitably located along center finger 54 so that its upper edge 68 appears slightly above rear surface 47 before crinkling. Deformation or crinkling of center finger 54 is made easier by the presence of cutout 62. Furthermore, upper edge 68, after deformation, rests upon rear surface 47 and thereby contributes to the locking action provided by the crinkle.

It is intended that all matter set forth in the above description and shown in the accompanying figures shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A connection block for an electromagnetic polar relay device comprising a one piece block of dielectric material having front and rear surfaces separated by a predetermined thickness, said block having two straight rows of cylindrically shaped and aligned openings extending inwardly from said front surface to an inner bottom wall, said block having a pair of right-angled slots of predetermined width less than the diameter of said openings, each of said slots being aligned with the common center line of a correlated row of openings, said slots extending into said block from said rear surface a distance greater than the distance of said inner bottom wall

to said rear surface, and a three-fingered contact for each of said openings, said contact having a center finger and a pair of astriding side fingers within the correlated opening with each finger lying in a plane making an angle less than ninety degrees with respect to the plane of the adjacent finger, whereby a three-sided sliding electrical connection is achieved upon mating of said fingers with a pin terminal, said side fingers having rear edges pressed against said inner bottom wall of a correlated opening, said center finger extending past said inner wall and through a correlated slot and having portions thereof contiguous with a wall of said slot and with said rear surface, said center finger having a cutout at the contiguous portions thereof, an edge of said cutout being juxtaposed to and pressed against said rear surface whereby said contact is locked in position.

2. A connector block for effecting electrical connections with a plurality of rod-shaped terminals comprising, a one-piece body of insulating material, and a plurality of electrical conducting contacts embedded in said body, said body having front end and rear end surfaces and a plurality of end-to-end passages each being adapted to receive a contact, said passages consisting of a plurality of aligned rows of cylindrical-shaped openings extending inwardly from said front end and terminating at a bottom wall intermediate said surfaces, and a plurality of right-angled grooves of width less than the diameter of said openings, each groove being aligned with the common center line of a correlated row of openings, said grooves extending inwardly into said body from said rear end surface a distance greater than the distance between said bottom wall and said rear end surface, said

contacts each consisting of a thin flat length of resilient conducting material having a terminating end, a center finger extending forwardly from said terminating end within the cylindrical opening of its correlated passage and a pair of side fingers substantially integral with and straddling said center finger, said side fingers being folded along the edges thereof common with said center finger at an acute angle whereby said fingers form a three-sided disengageable receptacle for effecting an electrical connection with a rod-shaped terminal, said side fingers having rear edges extending transversely to the lengthwise dimension of said contact and abutting said bottom wall of a correlated opening, said contact terminating end protruding rearwardly beyond said bottom wall and through a correlated groove, said terminating end being bent over and having a recessed edge forming a cut-out predeterminedly located to engage said rear end surface whereby each contact is locked in a correlated passage.

References Cited in the file of this patent

UNITED STATES PATENTS

2,053,102	Palmer	Sept. 1, 1936
2,082,493	Hartman	June 1, 1937
2,211,726	Knutson	Aug. 13, 1940
2,318,912	Alden	May 11, 1943
2,377,265	Rady	May 29, 1945
2,525,210	Del Camp	Oct. 10, 1950
2,529,502	Kelly	Nov. 14, 1950
2,533,933	Heath	Dec. 12, 1950
2,575,161	Deakin	Nov. 13, 1951