March 13, 1962 L. J. GRESHEL 3,025,370

RELAY

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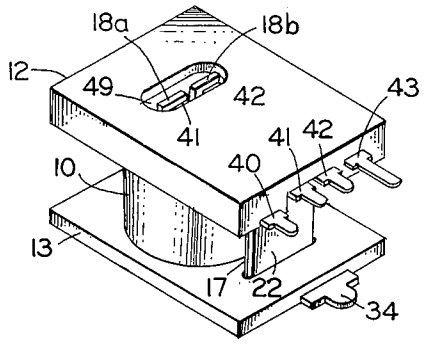
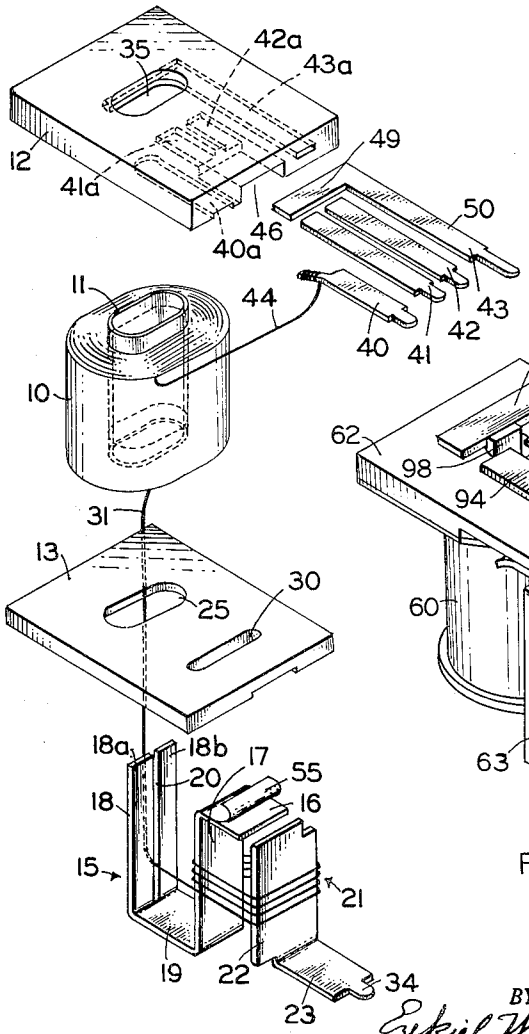


FIG. 1

FIG. 2



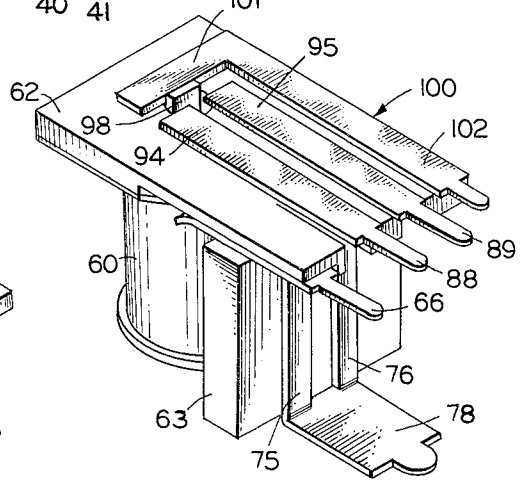


FIG. 3

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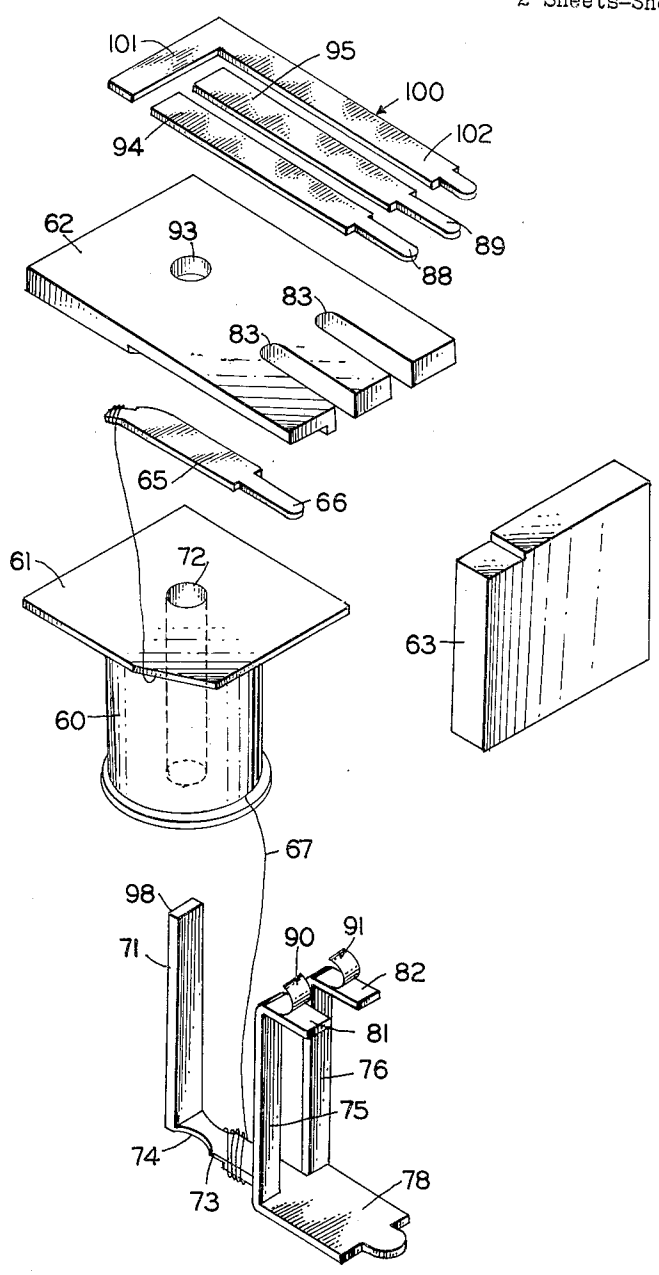
FIG. 4



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United States Patent Office 3,025,370
Patented Mar. 13, 1962

3,025,370
RELAY

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Filed Feb. 3, 1960, Ser. No. 6,394
9 Claims. (Cl. 200—87)

The present invention relates to a relay.

It is an object of the present invention to provide a durable relay of simple and inexpensive construction having relatively few components.

Another object of the present invention is to provide a relay particularly adapted for use in non-intricate transfer applications. In addition, this design is particularly useful for relatively small relays, and in relays having a high degree of efficiency.

In the present invention an armature of magnetic material is surrounded by and is coaxial or substantially coaxial with an energizable coil. The armature is connected at one end to a frame of metallic material having one terminal. The free end of the armature projects through the other end of the coil and normally contacts a second terminal, of nonmagnetic material. A third terminal or set of terminals adjacent the second terminal of nonmagnetic material and free end of the armature is formed of magnetic material. Portions or extensions of this terminal are closely positioned to the first mentioned terminal or the frame but are insulated from it so as to form a magnetic short but an electrically insulated junction. On energization of the coil, a magnetic circuit is completed through the first and third mentioned terminals and the armature. This tends to move the armature from its normal contact with the second nonmagnetic terminal to the third magnetic terminals.

These and other features of the present invention will be more clearly understood when considered in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a perspective view of the assembled invention in its preferred embodiment,

FIG. 2 illustrates an exploded view of the preferred embodiment illustrated in FIG. 1,

FIG. 3 illustrates a perspective view of a modification of the present invention, and,

FIG. 4 illustrates an exploded view of the modification of the invention illustrated in FIG. 3.

The bobbin coil **10** suitably wound on a hollow core **11** is sandwiched between and suitably secured at its upper and lower ends respectively to the terminal board **12** and base **13**. The terminal board **12** and base **13** are made of insulating materials and may, if desired, be varied in their shape. A combination armature and frame generally illustrated at **15**, is formed of a magnetic material such as a nickel-iron alloy. This armature and frame assembly may be formed of flat stock material bent into a U-shaped configuration with an outwardly extending flange **16** at the upper end of one leg of the U. In this arrangement, the flange **16** is continuous with leg **17** which in turn is connected through the bight **19** to the armature forming leg **18**. The armature forming leg **18** is longitudinally split by a vertically extending slot **20**. An L-shaped coil and armature terminal **21** is formed with one leg **22** in face to face relation with the outer surface of leg **17** and with the other leg **23** substantially or preferably continuous with the bight **19**. The leg **22** and leg **17** are permanently secured in a suitable manner in an electrically continuous junction. The armature and frame **15** and the coil and armature terminal **21** are secured to the base **13** with the leg **18** projecting upwardly through the hole **25** in the base and through the core **11** of the coil **10**. The legs **17** and

22 of the armature and frame **15** and terminal **21**, respectively, project upwardly through the slot **30** also formed in the base **13**. One terminal of the coil **10** may be electrically connected as illustrated at **31** to the frame which acts as a ground. The leg **23** projects outwardly of the base **13** and forms a ground terminal **34**.

The terminal board **12** is secured to the upper end of the coil **10** with the hole **35** fitting closely about the upper end of the core **11**. Secured to and preferably molded into the board **12** are the terminals **40**, **41**, **42** and **43**. Terminal **40** is positioned in an elongated slot **40***a* in the lower surface of the board **12** and is electrically connected by a wire **44** to the other end of the coil **10**. Thus, a circuit may be completed through the terminal **40**, and coil **10** and frame **15**. Twin terminals **41** and **42** are formed of a magnetic material such as an alloy of nickel and iron. These terminals **41** and **42** fit respectively into slots **41***a* and **42***a* formed in a recessed portion **46** on the lower surface of the board **12**. These terminals **41** and **42** project entirely through the slots **41***a* and **42***a* respectively and are closely spaced from the upper end of leg **18**. One half **18***a* of leg **18** is aligned with terminal **41** and the other half, **18***b* is aligned with terminal **42**.

In the normally deenergized condition of the coil, the halves **18***a* and **18***b* contact L-shaped terminal **43**. This terminal **43** has legs **49** and **50** which fit into the slot or recess **43***a* of the board **12**. Leg **49** extends transverse to the halves **18***a* and **18***b* of leg **18**, and in the normal unenergized condition of the relay, is in contact with these halves **18***a* and **18***b*.

The flange **16** of the armature and frame **15** projects upwardly into the recess **46** and is spaced close to the lower surface of the terminals **41** and **42**. This flange should be close to but still not electrically contacting these terminals **41** and **42**. An insulating tape **55** made of material such as "Teflon," may be used as insulation between terminals **41**, **42** and flange **16**.

In the modified embodiment of the present invention, the coil **60** is mounted on an insulating plate **61**. This in turn is secured to the upper terminal board **62**. Also rigidly secured to the terminal board is a spacer **63**. The terminal board **62** and spacer **63** are made of an insulating material and provide support means for the other components of the structure. One end of the coil **60** is connected to the terminal **65** made of a nonmagnetic metal and suitably secured to the lower surface of the terminal board **62**. The end **66** of the terminal **65** projects outwardly beyond the spacer **63**. The lower end of the coil is connected by a wire **67** to the frame assembly. This frame assembly includes an armature **71** of magnetic material projecting upwardly through the core **72** of the coil **60**. The lower end of the armature **71** is connected to a bight section **73** having scolloped side edges as illustrated at **74** for purposes of providing flexibility to the movement of the armature **71**. A pair of legs **75** and **76** extend upwardly from the bight **73** and are secured to the outer face of the spacer **63** by suitable means such as cementing or the like. An outwardly extending terminal **78** also of magnetic material such as a nickel iron alloy, is continuous with the legs **75**, **76** and projects outwardly beyond the spacer **63**. The upper ends of the legs **75** and **76** are bent over into lips **81** and **82**, which project into the slots **83** of the terminal board **62**. These lips **81** and **82** are positioned quite close to the terminals **88** and **89** and are spaced from them respectively by insulating strips **90** and **91** respectively which may, if desired, be made of an insulating synthetic resin material such as "Teflon" or the like. The terminals **88** and **89** are secured by suitable means to the upper surface of the terminal board **62**. These terminals **88** and **89** are formed of a magnetic mtaerial and have their inner ends partially extending over the opening **93**

which is aligned with the axis of core 72 and the coil 60. The inner ends 94 and 95 of the terminals 88 and 89 respectively, in the normal inoperative position of the relay are quite close to, but not touching, the upper end 98 of the armature 71.

The upper end 98 of the armature 71 normally contacts the nonmagnetic L-shaped terminal 100 when the coil 60 is not actuated. The L-shaped nonmagnetic terminal 100 has one leg 101 partially lying over the opening 93 and the other leg 102 extending forwardly of the relay.

When the coil 60 is energized by current passing through the terminal 65 to the grounded frame, a magnetic circuit is completed through the terminals 88 and 89, armature 71, bight 73, legs 75 and 76 and lips 81—82 and back to the terminals 88—89. This will cause the armature 71 to bend into electrical contact with the ends 94, 95 respectively of the terminals 88—89 thereby completing a circuit from the terminals 88, 89 to the lips 81, 82 respectively through the armature 71.

What is claimed is:

1. A relay comprising an annular coil with an axial opening, an armature and frame of magnetizable metal formed as a U-shaped member with one leg of the member formed as an armature and projecting through said axial opening, the other leg of said U-shaped member projecting upwardly and adjacent the outer surface of said coil, insulating means securing said armature and frame to said coil, a terminal secured to said frame, a second terminal of magnetizable material positioned with one end adjacent but normally spaced from the free end of said armature, means mounting said second terminal on said coil, said second terminal also closely spaced but insulated from the upper end of said other leg, and a third terminal of nonmagnetizable metal normally closed to the free end of said armature when said coil is deenergized, said armature adapted to be moved from contact with said third terminal into contact with said second terminal on energization of said coil whereby an electrical circuit may be completed between said first and second terminal.

2. A relay as set forth in claim 1 wherein said insulating means comprises an insulating terminal board extending normally to said axial opening with a hole in said board aligned with said opening and into which the free end of said armature projects.

3. A relay as set forth in claim 1 wherein said U-shaped member has an outwardly extending lip continuous with said other leg of said U-shaped member, said lip positioned in parallel adjacent electrically insulated but magnetically coupled relation with said second terminal.

4. A relay as set forth in claim 3 wherein a fourth terminal of magnetizable material is positioned parallel to and adjacent said second terminal with one end of said fourth terminal positioned adjacent but normally spaced from the free end of said armature, said armature adapted to close to said second and fourth terminals simultaneously.

5. A relay as set forth in claim 4 wherein said armature has a longitudinal slot therein dividing it into two longitudinal halves, each adapted to contact one of said second and fourth terminals.

6. A relay as set forth in claim 5 wherein said first mentioned terminal is formed of an L-shaped member with one arm forming the terminal end and the other arm secured in facing relation with the outer face of said other leg of said U-shaped member.

7. A relay comprising an annular coil with an axial opening, an insulated terminal board and an insulated base secured respectively at opposite ends of said coil with openings therein aligned with said axial opening, an armature and frame of magnetizable metal formed as a U-shaped member with one leg of the member forming an armature and projecting through said opening in said base and said axial opening in said coil, the other leg of said U-shaped member projecting upwardly and adjacent the outer surface of said coil, said frame also having a first terminal, a second terminal of magnetic material secured to said board with one end adjacent but normally spaced from said armature, said second terminal also closely spaced but insulated from the upper end of said other leg, and a third terminal of nonmagnetizable metal normally closed to the free end of said armature when said coil is deenergized, said armature adapted to be moved from contact with said third terminal into contact with said second terminal on energization of said coil whereby an electrical circuit may be completed between said first and second terminal.

8. A relay comprising an electrically energizable coil having an opening extending longitudinally therethrough, an elongated member of magnetizable metal projecting through said opening and adapted to be pivoted at one end for lateral movement in said opening, a frame of magnetizable metal engaging and electrically connected to one end of said member and having a ground terminal formed thereon, a terminal of magnetizable metal having a portion closely adjacent the free end of said member and adapted on energization of said coil to be electrically contacted by said member and a second portion of said terminal closely adjacent but spaced from said frame, and a terminal of nonmagnetizable metal normally closed to said member when said coil is deenergized.

9. A relay comprising an electrically energizable coil having an opening extending longitudinally therethrough, means forming a continuous magnetic flux path interlinked with said coil and adopted in part to form a part of an electrical circuit comprising, an elongated member of magnetizable metal projecting through said opening, a frame of magnetizable metal extending at least partially across and along one side of said coil and electrically and magnetically coupled to said elongated member, a terminal of magnetizable metal extending at least partially across the other end of said coil with a portion closely adjacent and adapted to be contacted by the free end of said elongated member, a terminal of nonmagnetic metal positioned at said other end of said coil normally contacted by said free end of said elongated member when said coil is deenergized, said coil on energization adapted to move said elongated member from engagement with said terminal of nonmagnetic material into engagement with said terminal of magnetic material at said other end.

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