Jan. 18, 1966 W. R. BAUER ETAL 3,230,330

ELECTRICAL RELAY WITH PANEL AND TERMINAL PLUG

Filed April 9, 1963 2 Sheets-Sheet 1

FIG-1

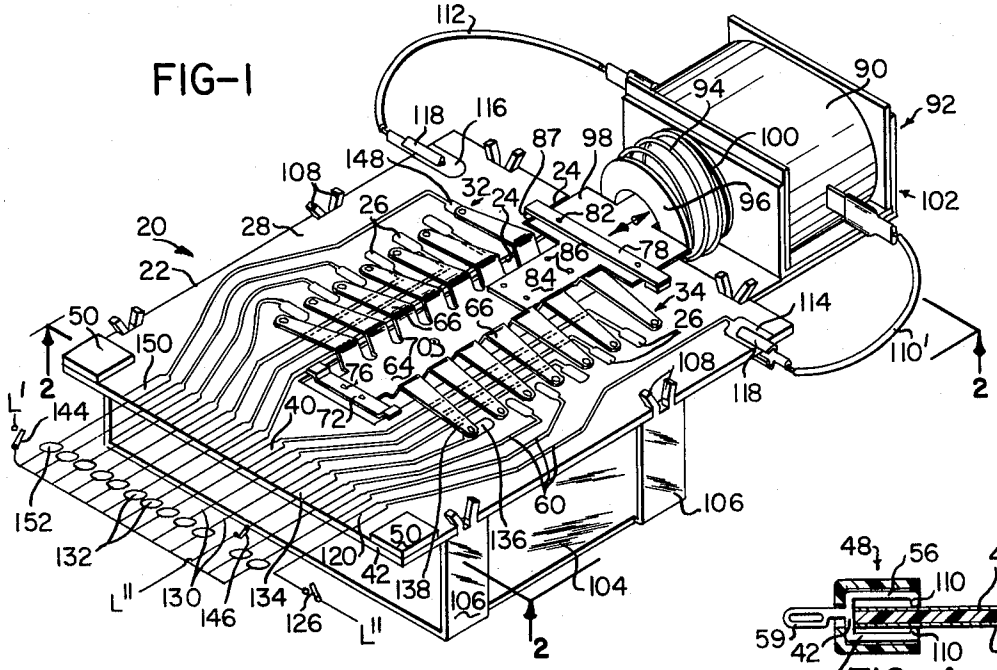

FIG-4

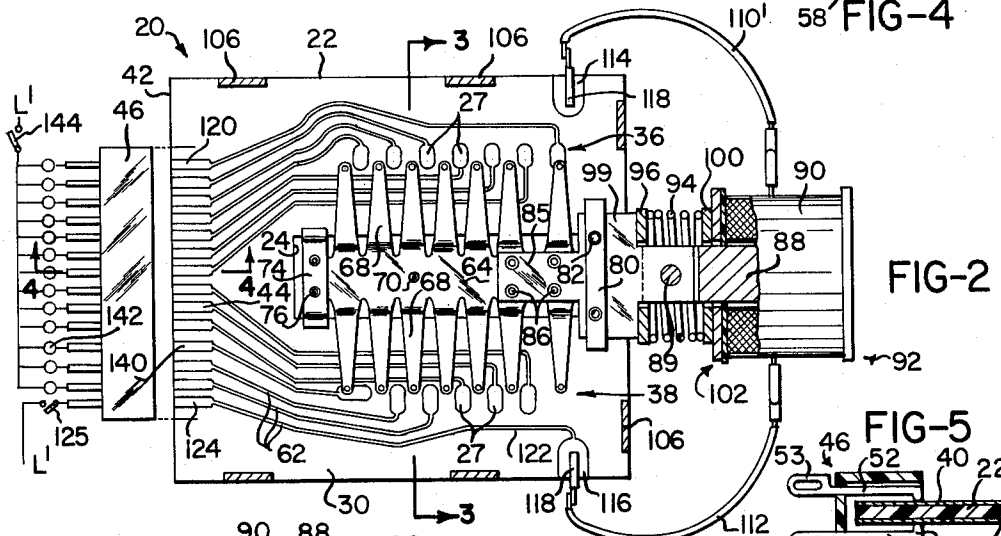

FIG-2

FIG-5

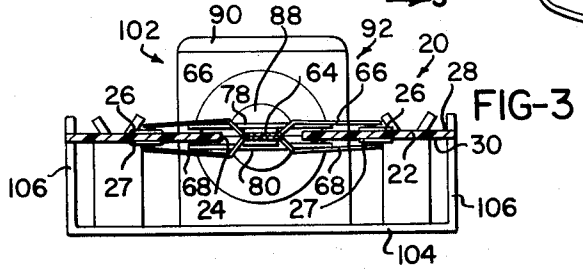

FIG-3

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ELECTRICAL RELAY WITH PANEL AND TERMINAL PLUG

Filed April 9, 1963 2 Sheets-Sheet 2

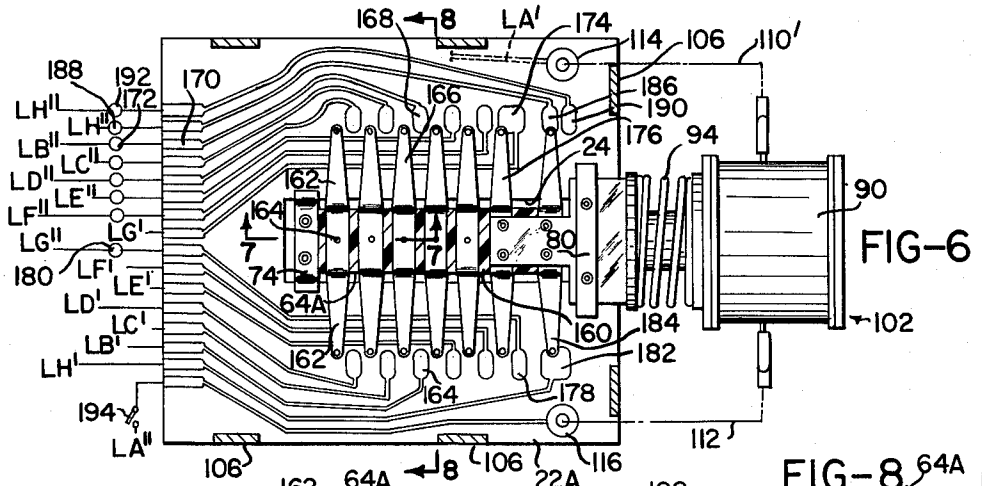

FIG-6

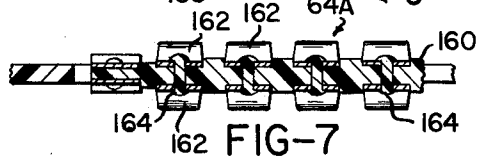

FIG-7

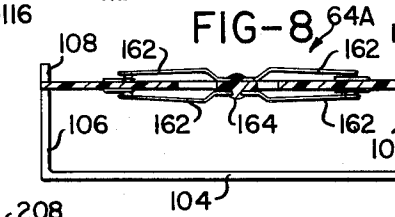

FIG-8

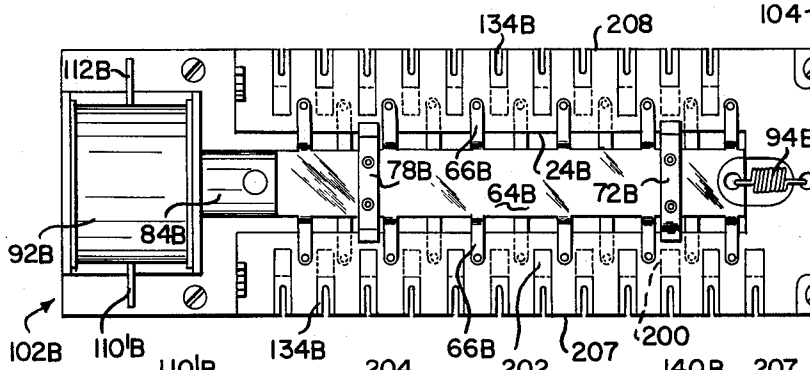

FIG-9

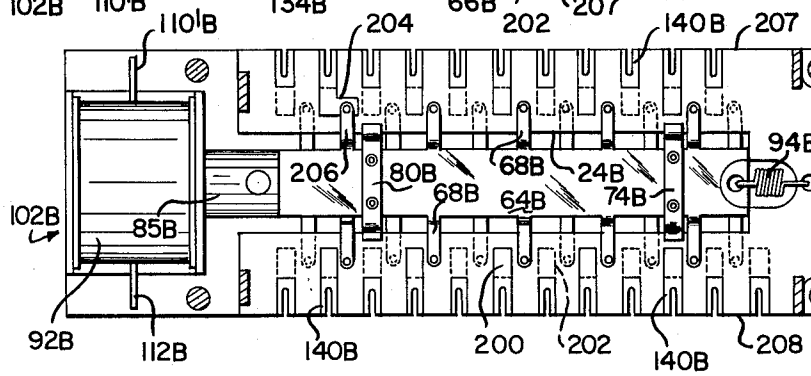

FIG-10

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3,230,330

ELECTRICAL RELAY WITH PANEL AND TERMINAL PLUG

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Filed Apr. 9, 1963, Ser. No. 271,778
12 Claims. (Cl. 200—104)

This invention relates to a multiple circuit relay.

The relay of this invention is capable of use to control a plurality of circuits, simultaneously to energize and deenergize the circuits. Also, it is capable of deenergizing simultaneously one group of one or more circuits and simultaneously energizing another group of one or more circuits and vice versa. The invention is also capable of controlling groups of one or more circuits, which circuits may be connected to entirely different source of supply, different voltages, frequencies, etc.

The relay of this invention is of simple and inexpensive construction, yet is capable of controlling many and complex circuits, as will become apparent.

The invention also is capable of providing a basic relay frame construction, to which may be attached many varied panel-like circuit supports, so that multiple circuit relays with entirely different circuits may be manufactured merely by applying panel-like circuit supports with different circuits to the basic frames.

The reciprocal finger supports also may be changed in function while maintaining their general shape to cooperate with the general shape of the panel-like supports. In this manner, multiple circuit relays with entirely different circuit controls may be manufactured merely by applying different, but similarly shaped, reciprocal finger supports to such relays.

Many other advantages are evident from this description, the appended claimed subject matter, and/or the accompanying drawings in which:

FIGURE 1 is a perspective view of a relay embodying this invention.

FIGURE 2 is an upward view along the plane 2—2—2 of FIGURE 1.

FIGURE 3 is a cross section along line 3—3 of FIGURE 2.

FIGURE 4 is a cross section of a connector member which may be telescoped over the edge of the panel of FIGURES 1, 2 and 6.

FIGURE 5 is a view of a connector member somewhat similar to that shown in FIGURE 4, but having a different connector construction.

FIGURE 6 is a view of a relay somewhat similar to that shown in FIGURE 2, but showing a panel-like support with a different circuit arrangement and different finger construction.

FIGURE 7 is an enlarged cross section along the line 7—7 of FIGURE 6.

FIGURE 8 is a cross section along the line 8—8 of FIGURE 6.

FIGURE 9 is the top view of another embodiment of this invention.

FIGURE 10 is the bottom view of the embodiment shown in FIGURE 9.

Certain words indicating direction, relative position, etc., are used herein for the sake of clearness and brevity. However, it is to be understood that such words apply only to the specific disclosure in the drawings and that the actual devices may have entirely different direction, relative position, etc. Examples of such words are "upper," "lower," "vertical," "downward," etc.

Relays **20**, according to this invention, may be manufactured so they are suitable for selectively energizing and deenergizing a plurality of electric circuits which may

be used to control various operations. These relays may be manufactured efficiently so individual relays may be tailored to control an individually designed set of multiple circuits.

For example, the relay **20** may have an electrically insulating panel-like support or card **22**, which, if desired, may be rectangular in shape, or of any other desired shape. Supports or cards **22** may be individually tailored to provide individually designed sets of multiple circuit controls, as will become evident. These "individually" tailored supports or cards may be reproduced in any desired quantity so any desired quantity of corresponding "individual" relays may also be produced.

A plurality of contacts **26** and **27**, and other contacts, elsewhere designated, may be secured on opposite surfaces or faces **28** and **30** of the support **22**. These contacts **26** may be in the form of a pair of rows **32** and **34** on the surface **28** and a pair of rows **36** and **38** on the other surface **30**. These rows may be on each side of the opening **24**, as shown in the drawings.

A plurality of terminal connectors **40** and **44** and other terminal connectors elsewhere designated, may be secured respectively on said opposite surfaces **28** and **30** along an edge construction, such as edge **42** of the panel **20**.

The connectors **40** on one surface **28** may be placed directly above or below the other connectors **44** on the other surface **30**, in which case the plural electric line terminal plug **46**, FIGURE 5, may be used. However, the terminal connectors **40** on side **28** of the panel-like support may be laterally staggered with respect to the connectors **44** on the other side **30** of the panel-like support, in which case a plural electric line terminal plug **48** of the character shown in FIGURE 4 may be used.

In either case, the plugs **46** or **48** may be received in lateral alignment grooves or ridges, such as are provided by corner guides **50** on one or both sides **28** or **30** of the panel-like member **20** for the purpose of laterally aligning plug **46** and/or **48** when such plug is telescoped over the edge **42** of the panel **22**. This insures that the connector prongs **52** and **54**, of the plug **46** and the connector prongs **56** and **58** of plug **48** are properly aligned laterally to engage the proper connectors **40** or **44**, to establish the desired circuits.

A plurality of electrical conductors **60** on surface **28**, and conductors **62** on surface **30**, may electrically connect the connectors **40** and **44**, as the case may be, with respective contacts **26** and **27**, as the case may be, or with other connectors and contacts elsewhere identified.

The panel-like support **22** may be made of electrically insulating material which has electrically non-conductive sides **28**, and **30**, edges **42**, etc. The contacts **26**, **27**, the terminal connectors **40**, **44**, and the electric conductors **60**, **62**, and other similar members elsewhere identified, may be printed on the respective sides **28** and **30**.

For example, either one or both surfaces **28** or **30** may be coated with a layer of film of electric conducting material, such as copper, a copper alloy, and the like. The copper coating may be covered with silver plating, if desired. Thereafter, such electrically conducting film may be covered or printed with a protective cover with a circuit design where it is desired to form the various circuit conductors, contacts, terminals, etc. This will form a conductive circuit pattern. The remaining unprotected coating is then removed or etched by acid and the like, leaving the ribbon-like printed circuits, contacts, connectors, etc., which are to provide electrical conduction as elsewhere described. Any other method of attaching these members to the surfaces **28** and **30** may be used in lieu thereof.

A reciprocal finger support **64** may be reciprocably mounted between the rows of contacts **32**, **34**, **36** and **38**

in or adjacent the opening 24. This finger support may have a plurality of sliding contact fingers or bridging members 66 and 68 extending in opposite directions from said opening 24 into contact with the contacts 26, 27, etc. Fingers elsewhere identified may also be provided and may be carried by support 64.

As shown in FIGURES 1–5, the reciprocal member or bridging members 64 may be made of two sheets of conductive material which may be properly cut and stamped from electrically conducting sheet metal to form the shapes, shown, which sheets may be bolted, or riveted or otherwise connected together, as at 70. The member 64 may be slidable or movable in or adjacent the opening 24, and may be supported in any suitable manner. For example, slidable members 72 and 74, the ends of which slide along the edges of the opening 24, may be secured together and to member 64 by bolts 76.

In a similar manner, the reciprocal member 64 may be slidably supported at its other end in any suitable manner. For example, bars 78 and 80 may be bolted at 82 to armature connecting members 84 and 85 which likewise are bolted at 86 to the member 64. Bars 84 and 85 may have sliding feet 87 slidingly to engage surfaces 28 and 30 of panel 22.

The connector members 84 and 85 may be connected by pin 89 to an armature 88 of a magnetic coil 90 of the solenoid 92.

The solenoid 92 may be connected in the relay to produce a relative movement between the contact fingers and the contacts. In this embodiment, the panel-like support 22 is made stationary, and the reciprocal member 64 is made reciprocal between selected positions. For example, the member 64 may be spring biased leftwardly by the spring 94, one end of which engages a washer 96, which in turn engages the wide plates 98 and 99 of the connector 84, 85. The other end of the spring 94 engages any suitable part of coil 90, such as a washer 100. The connectors 84 and 85 may be made of electrically insulating material, to prevent electrical connection from the reciprocal member 64. The coil 90 may be supported on a bracket construction 102, which may be cantilevered from the panel 22, or which may be supported on, or form a part of, a base member 104, if desired. The coil 92, the armature 88, etc., may be standardized for quantity production, and they also may be sub-standardized for individual or individual group production, as is evident from this disclosure.

The panel 22 may be supported on the base 104 which has upwardly directed brackets 106 which may be secured to the panel 22 by the upset fingers 108. Panels 22 may be standardized for quantity production, or they may retain their general shape but may be substandardized as to printed circuitry, for individual, or individual group production, as is evident from this disclosure.

The terminal plugs or bars 46 and 48, FIGURES 4 and 5, may be made of insulating material, such as plastic, within which the connector prongs are secured during the molding operation. These prongs 52, 54, 56, and 58 may be provided with extensions or rings 53, 55, and 59, to which electric lines may be connected. The other ends 110 of the prongs engage the terminal connectors 30, 44, etc., to provide an electrical connection for controlling the various circuits.

The plugs 46 or 48 may be telescoped over the edge 42 (or any other suitable edge construction) with the ends of the plug engaging suitable lateral guidance to insure proper alignment between the proper prongs 52, 54, etc., and the proper connectors 40, 44, etc. This lateral guidance may be obtained by any suitable construction, such as by the engagement of part of the ends of the plugs with the side edges 50' of the corner members 50.

The coil 90 may have electrical leads 110' and 112. These leads may be connected with contacts 114 and 116, which contacts may also be printed on the panel 22. If desired, the leads 110 and 112 may be provided with resilient forks 118 which may straddle the edges of the panel 22 to establish a firm contact with the respective contacts 114 and 116. The contact 114 may have an electrical conductor 118 extending to a terminal connector 120. The contact 116 may have an electrical conductor 122 extending to the terminal connector 124. By this construction the solenoid 102 may be supported from the base 102, and the specific control connections 118, 120, 122 and 124 may be individually varied along with any other variation in the circuitry printed on the card 22 or in the finger construction as is evident from this disclosure.

The terminal connector 120 may be connected by suitable plug connection to the switch 126 which may control the connection to line L''. The switch 126 may be opened and closed by any suitable manual or automatic means. When the switch 126 is closed, the finger support 64 is pulled rightward, in FIGURES 1 and 2, and when the switch 126 is opened, the finger support 64 is moved leftward to the illustrated position of FIGURES 1 and 2. The other side of the coil 90 is connected by line 112, conductor 122, terminal connector 124 and a suitable plug connection of plug 46 to line L'. If desired, or if it is required by code, the line L' may also have a switch 125, similar to switch 126, which will open and close simultaneously with switch 126 or independently open and close to establish any desired type of energization and deenergization of coil 90.

The connectors 40 may be connected by suitable plug construction, such as 46 or 48, with electrical lines 130. These lines may be connected to electrically controlled or actuated devices 132, such as relays, motors, etc., which in turn may be connected to line L', as indicated in FIGURE 1. A common lead from line L'', in FIGURE 1, may pass through the connector 134, common contact 136, and finger 138 to energize all of the fingers from line L''. The action of the solenoid 102 does not pull the finger 138 off the contact 136, so that the finger 138 is continuously energized from line L''. In this manner, all of the connectors 40 are also energized from line L'' with a make and break action so that the lines 130 are deenergized when the solenoid 102 is deenergized, and are energized when the solenoid 102 is energized. A contact 138, FIGURE 2, is electrically connected to a connector 140. Connector 140 may be connected to a signal light or the like 142, which in turn may be connected to line L'. Light 142 will be illuminated as long as a master switch 144 and 146 remain closed. The similar master switch 146 may be provided for the line L'', which is connected to the connector 134. If desired, all of the power lines may be provided with the master switch construction, which simultaneously opens all of the power connections to the relay construction so that nothing can be energized that is connected with the system.

A contact 148 may be connected to a terminal connector 150, which in turn may be connected to a device such as light 152, or the like, which will be energized when the system has been connected to the power sources, but the solenoid 102 has not been energized. However, when the solenoid 102 is energized, then the signal light 152 or other device will be deenergized. However, this device 152 need not to be signal light, but may be any other device to be controlled and be energized when the solenoid 102 is energized and vice versa.

FIGURES 6, 7 and 8 show a construction somewhat similar to that of FIGURES 1–5, but the construction is such that many circuits may be energized or deenergized in a more complex manner, and, in fact, circuits of different voltages, different sources of supply, etc., may be governed by the relay of FIGURES 6, 7 and 8. However, the general frame construction 104, 106, the solenoid 102, the general shape of the panel, the general shape of the reciprocal finger support 66, need not be changed to accomplish these varied results. This permits standardized quantity production for individual or individual group semi-quantity production.

FIGURE 6, which is somewhat similar to FIGURE 5, illustrates how the same general relay frame construction may be used to control a large variety of circuits. In FIGURES 6, 7 and 8, the solenoid **102**, the solenoid leads **112** and **110'**, and contacts **116** and **114** may be substantially identical. The panel-like support or card **22A** may be substantially of the same shape as the card **22**, except that the circuits printed thereon may be entirely different. Such card may have the longitudinal opening **24**, and there is some similarity between the reciprocal finger support **64A**, of FIGURE 6, in comparison to the finger support **64**, of FIGURE 5. If desired, the relay may be supported on a base **104**, and brackets **106**, substantially identical with those disclosed in connection with FIGURES 1–5. The panel-like support **22A** may have the circuits shown thereon printed in the same manner as described in connection with the panel **22**, but the circuits may have different shapes and different connections as will become apparent.

The reciprocal finger support **64A** may have a central electrically insulating plate **160**, to which the double fingers **162** may be secured preferably by electrically insulating rivets **164** when desired, although, under certain conditions, the rivets **164** may be electrically conducting if the desired circuits so permit. It is to be seen that each double finger **162** and others to be identified, may be electrically isolated from all other electrical double fingers, and under certain conditions, each finger of the double fingers themselves may be electrically separated from each other, in a manner which is obvious, but which is not illustrated. The insulating plate **160** may be supported by bars **72** and **74** and bars **78** and **80**. By this construction, it is possible to lead in a circuit such as LB' to contact **164**, which in turn will energize double finger **166**, when the solenoid **102** is energized. This in turn will energize contact **168** and connector **170**, which in turn will energize a device **172** to be controlled and from thence to line LB''. Thus some of the sliding fingers **162** or **166**, for example, are transverse to, completely spaced from, and straddle some of the conductors. For example the fingers **166** are transverse to, completely spaced from and straddle the conductors which are connected to the outside electrical connections at LE', LF', LG'', LG', LF'' and LE''. In this manner, the circuit which is connected to the power lines LB' and LB'' may be of an entirely different voltage or different frequency from any of the other circuits, including the control circuit of the solenoid **102**. It is thus to be seen that a plurality of circuits may be controlled, each of which, if desired, may have a different power source, different voltage, and/or frequency. For example, there may be power intakes LC', LE', LF', LH', each of which may be controlled in a somewhat different manner.

For example, circuits LC', LD', LE', and LF' may be controlled in a similar manner as circuit LB' so that their controlled devices will be energized when the solenoid **102** is energized, and deenergized when the solenoid **102** is deenergized.

Circuit LG' is fed into a double contact **174**, so the double contact **174** keeps the double finger **176** continuously energized, but this finger only contacts the contact **178** when the solenoid is energized and hence the device **180** is only energized when the solenoid is energized to place the double finger **176** on contact **172**. However, if desired, another contact can be placed to the left of contact **178** with a proper conductor and connector so it can energize another device in a manner as is shown in connection with line LH'. Line LH' energizes the large double size contact **182** and continuously energizes the double finger **184**. The double contact **184** may engage the contact **186**, when the solenoid **102** is deenergized, and this will energize the device **188**. However, when the solenoid is energized, then the device **188** will be deenergized when the double finger **184** moves over to the other contact **190**, which then will energize the device **192**.

The solenoid **102** may be controlled by a line switch **194**, which is in line LA'', which then is connected to contact **116**, line **112**, solenoid **102**, line **110**, contact **114**, and line LA' on the other side of the panel support. The fork contacts similar to contacts **118**, FIGURES 1 and 2, may be used at **114** and **116** of FIGURE 6, if desired.

The other side of the panel **22A** may have a circuit construction similar to that shown in FIGURE 6, although it may be varied as desired, to control various circuits in a very flexible manner, as is evident.

The relays of FIGURES 1–8 may have the base **104**, bracket **106**, solenoid **102** more or less standardized for all of the relays to be manufactured, if desired. Certain other parts, such as the panel **22**, finger support **64**, fingers **66** and **68**, etc., may be standardized or may be sub-standardized to provide individual relays or individual groups of relays, as is now apparent from this disclosure.

FIGURES 9 and 10 show another embodiment of the invention is which the coil **92B** of solenoid **102B** may correspond in function with the coil **92** and solenoid **102**. The reciprocal finger support **64B** may correspond to the support **64**. The fingers **66B** and **68B** may correspond to the fingers **66** and **68**. The armature connector **84B** and **85B** may correspond in function to connectors **84** and **85**. The sliding support bars **72B** and **74B** may correspond to the support bars **72** and **74**. Likewise the sliding support bars **78B** and **80B** may correspond to the bars **78** and **80**. The spring construction **94B** may have the same function as the spring **94**, although it is secured to the reciprocal finger support **64B** at the opposite end, and the spring **94B** is a tension spring. The elongated opening **24B** may correspond to elongated opening **24**.

The connectors **134B** and **140B** may have substantially the same construction as connectors **134** and **140**. However, these connectors **134B** and **140B** may have their own conducting members and contact members built into them, by merely providing short extensions **200** which may be engaged by the corresponding finger when a connection is desired, and to be omitted, as shown at **202** when a connection is not desired. One or more of these contacts and extension may be a common power lead, such as **204**, which may be continuously contacted by the finger **206**, continuously to energize the finger support **64B** from a power line connected to connector **204**. The solenoid coil **92B** of the solenoid **102B** may be of the same function, but in this case, the lead-ins **110'B** and **112B** have been shown as being connected directly to the coil, instead of being connected through connector lines as in the other emobdiments. In the embodiments of FIGURES 9 and 10, the connectors are along the longitudinal edges **207** and **208** rather than on the end edge of the panel support. Connector plugs corresponding to plugs **46** and **48** may be used.

A master relay according to this invention may energize a plurality of slave relays also made according to this invention, vastly to increase the number of circuits controlled by the master relay.

It is thus to be seen that a new and useful multiple circuit relay has been provided. Certain other parts of the relay may be made basic and may be reproduced without substantial change. Other parts may be changed in minor details to provide individual or tailored design. The relays may therefore be manufactured in quantity production methods whether the relays are all substantially the same, or whether some specialized individual, or groups of individual relays are to be produced.

While the form of the invention now preferred has been diclosed as required by the statutes, other forms may be used, all coming within the scope of the claims which follow.

What is claimed is:

1. An electrical relays comprising: a frame including a base having a plurality of upwardly directed panel supporting brackets and an upwardly directed solenoid sup-

porting bracket construction extending upwardly from said base; an electrically insulating panel secured on said panel supporting brackets and having a straight elongated opening; a plurality of contacts secured on at least one surface of the opposite surfaces of said panel in the form of a row on each side of said opening; a plurality of terminal connectors on said one surface along an edge of said panel; a plurality of electrical conductors secured on said panel on said one surface and electrically connecting said connectors to said contacts; a straight reciprocal finger support reciprocally mounted between said rows of contacts adjacent said opening and having a plurality of sliding contact fingers extending from said reciprocal support and extending from said opening into contact with said contacts; and a solenoid secured on said solenoid supporting bracket construction and connected to said finger support and causing reciprocal movement of said finger support to cause relative movement of said fingers with respect to said contacts.

2. A relay according to claim 1 in which: said plurality of contacts are secured on opposite surfaces of said panel in the form of a pair of rows on each surface with a row on each side of said opening; a plurality of terminal connectors are on opposite surfaces along an edge of said panel; a plurality of said electrical conductors are secured on said panel on said opposite surfaces; said straight reciprocal finger support has sliding fingers extending from said opening along both of said opposite surfaces into contact with said contacts.

3. A relay according to claim 1 in which a straight plural electric line terminal plug is slidably and removably attached to said edge of said panel and has connector prongs attachable to a plurality of electric lines on one side of said plug and conductively engaging respective terminal connectors on the other side of said plug and along said edge of said panel.

4. A relay according to claim 3 in which said panel supporting brackets extend upwardly from a plurality of edges of said base and are attached to a plurality of edges of said panel, and which said solenoid and said solenoid supporting bracket are located along an edge of said panel which is opposite to said first-named edge of said panel.

5. A relay according to claim 4 in which corner guide means are provided along said first-named edge of said panel to guide the ends of said terminal plug to insure proper contact between said prongs and said respective terminal connectors.

6. A relay according to claim 4 in which said panel supporting brackets have upset fingers extending over said plurality of edges of said panel to secure said panel to said supporting brackets.

7. A relay according to claim 1 in which solenoid energizing connectors are provided along other edges of said panel with conductors connecting said solenoid energizing connectors with respective terminal connectors on said first-named edge of said panel, and in which electrical leads are connected to said solenoid and have resilient forks straddling said other edges of said panel to establish firm contact with said solenoid energizing connectors.

8. A relay according to claim 1 in which some of said sliding contact fingers are transverse to, completely spaced from, and straddle some of said conductors.

9. A relay according to claim 1 in which said reciprocal finger support has electrical insulation means electrically to isolate certain of said sliding contact fingers from other of said contact fingers.

10. A relay according to claim 1 in which a contact on said panel remains in contact with a sliding finger when said solenoid is energized and when it is de-energized.

11. A relay according to claim 1 in which a sliding finger moves from one contact to another contact when said solenoid is energized.

12. A relay according to claim 1 in which said contacts, connectors, and conductors are printed on said panels.

References Cited by the Examiner

UNITED STATES PATENTS

2,378,663	6/1945	Striker	200—16
2,917,601	12/1959	Hatchett	200—104
2,988,607	6/1961	Tabet	200—11

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