

[72] Inventor **Frank Draper Babcock**
Eau Gallie, Fla.
 [21] Appl. No. **831,672**
 [22] Filed **June 9, 1969**
 [45] Patented **Apr. 6, 1971**
 [73] Assignee **Radiation Incorporated**
Melbourne, Fla.

3,310,710 3/1967 Joachim 317/100
 3,349,211 10/1967 Lien 200/167A(UX)
Primary Examiner—David Smith, Jr.
Attorney—Donald R. Greene

[54] **PRINTED CIRCUIT CARD HOLDER WITH
 CONTROL AND DISPLAY UNITS**
 7 Claims, 12 Drawing Figs.

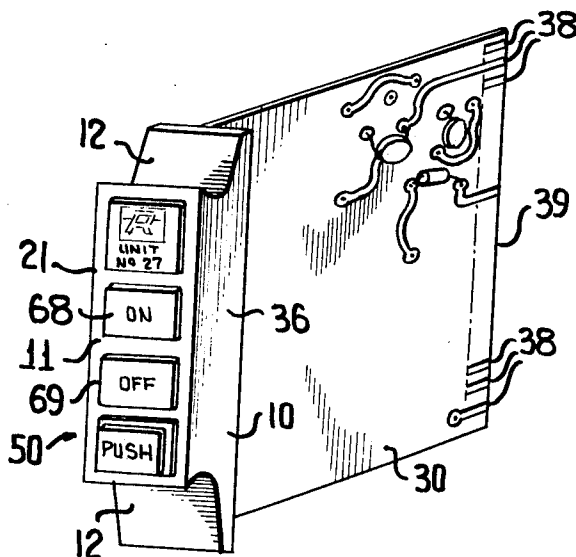
[52] U.S. Cl. 317/101
 [51] Int. Cl. H02b 1/62
 [50] Field of Search 317/101,
 101 (DH), 101 (CB); 174/68.5; 340/178, 178.1;
 211/41; 200/16, 167, 172; 16/(Inquired)

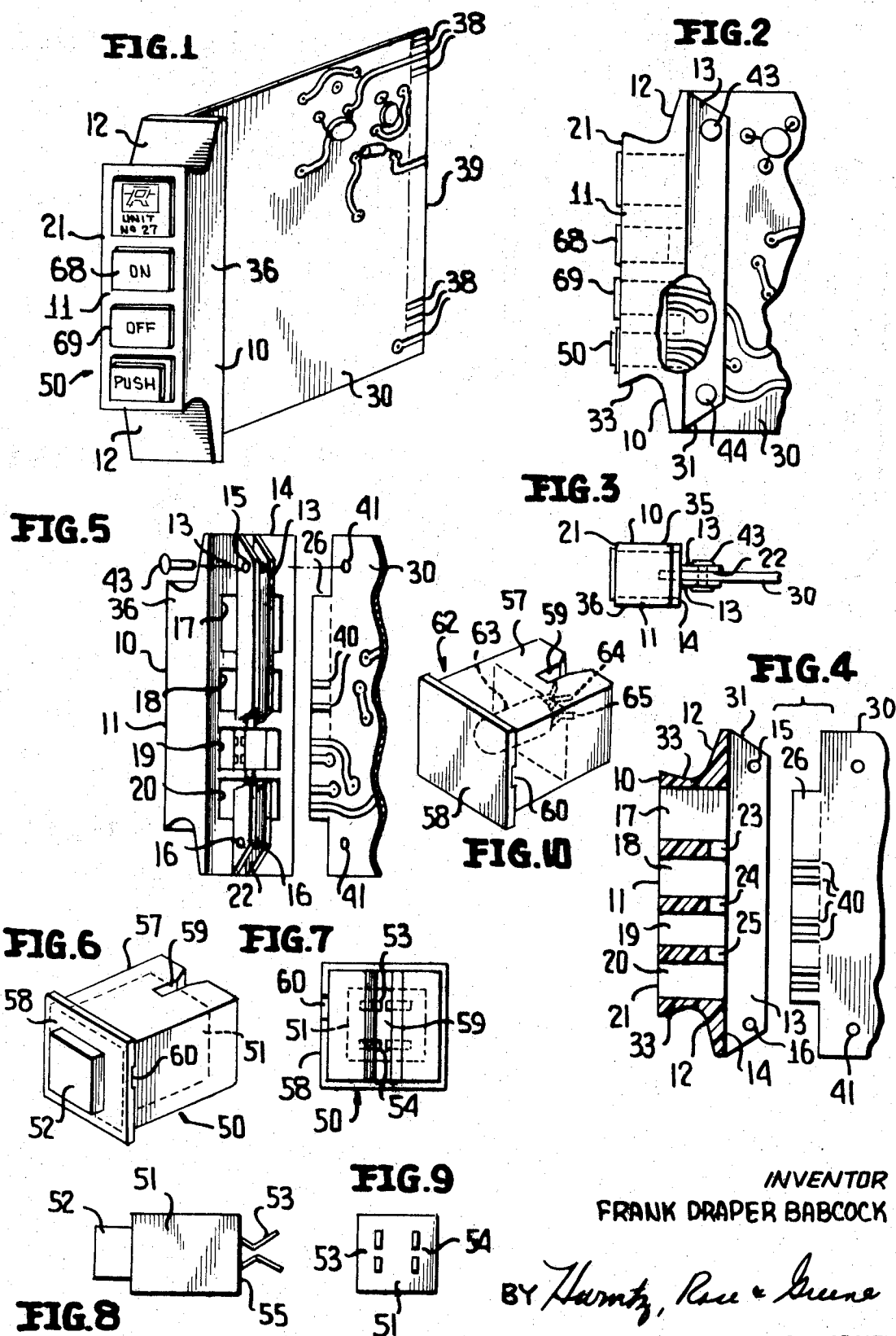
[56] **References Cited**

UNITED STATES PATENTS

2,976,428 3/1961 Parkhill et al 317/101C(UX)
 3,052,821 9/1962 Scoville 317/101
 3,272,951 9/1966 O'Brien 200/166 CPC(UX)

ABSTRACT: A handle for a printed circuit card is provided with a slot for accepting the card, with keyed contacts at the edge of the card projecting into the slot. The card is permanently fastened to the handle by rivets. A plurality of spaced, substantially parallel holes extend through the handle from its front surface to a point of intersection with the slot to expose the contacts on the card. Separate indicator units and control units are slidably received in respective ones of the holes and are frictionally retained therein with spring-loaded terminals of the units electrically contacting the keyed contacts on the printed circuit card. A further array of keyed contacts at the opposite edge of the card is adapted to mate with a female connector when the card is inserted into position in a card shelf, the handle being exposed with legends and indicator units visible thereon and with control units accessible for selective exercise of control on the operation of the circuit carried by the card.

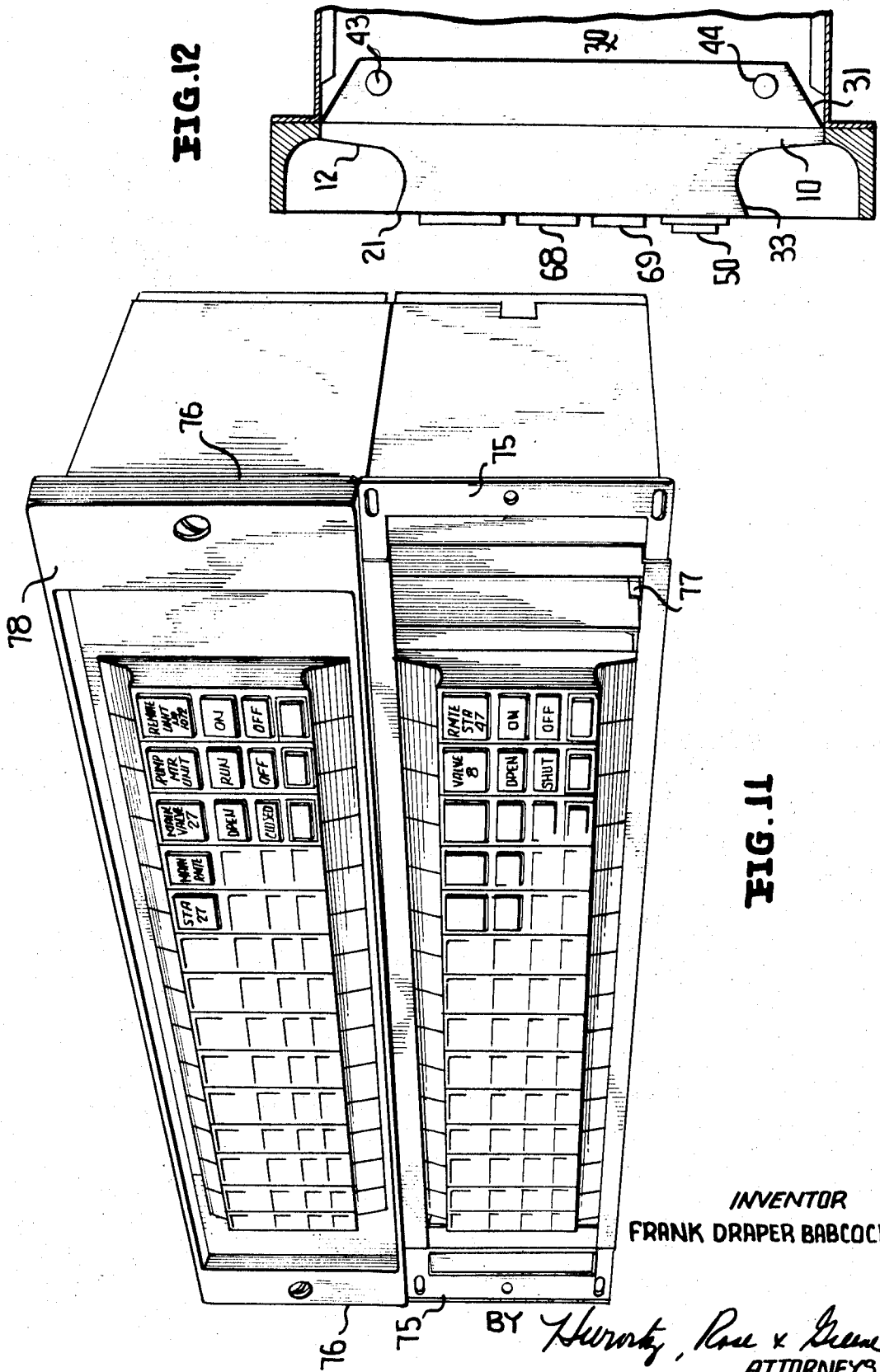




INVENTOR
FRANK DRAPER BABCOCK

BY *Hamby, Rose & Greene*

ATTORNEYS



INVENTOR
FRANK DRAPER BABCOCK

BY *Hurwitz, Rose & Green*
ATTORNEYS

PRINTED CIRCUIT CARD HOLDER WITH CONTROL AND DISPLAY UNITS

BACKGROUND OF THE INVENTION

The present invention relates generally to printed circuit boards or cards, and more particularly to devices to permit ease of handling of printed circuit boards for insertion in and removal from card racks, and to accommodate replaceable indication units and control units for direct electrical and mechanical connection to the printed circuit board associated with the device.

It has been typical practice to provide indicators and controls associated with the circuit on a particular printed circuit card at a location or locations remote from the card itself. For example, lamps for indicating the nature of the circuit operation or the present operational state (e.g., "on" or "off") of a particular portion of the network on a printed circuit card, and manual pushbutton switches for instituting a change of operational state of that portion of the network, might be located in banks or racks containing a multiplicity of similar indicating and control units associated with other cards for implementing and detecting an overall system operation. Electrical connection between these units and the respective cards is accomplished by soldering wires or leads of appropriate length between terminals with which the units and cards are in electrical contact.

The printed circuit card contains a plurality of spaced printed contacts adjacent one edge of the card and keyed to make electrical connection with the respective contacts of a mating female connector. This makes for ease of replacement of cards in large banks, since a defective card or a card whose function is to be updated need merely be withdrawn from the respective connector and a new card, of appropriate function, inserted in its place. Usually, the cards are located in a spaced parallel array in racks or shelves, the distance between cards being sufficient to permit accommodation of components such as transistors or diodes on adjacent cards without interference or obstruction. Each card may be provided with a handle to simplify handling and replacement of cards without touching the actual circuitry or components mounted on the card.

The indication units and control units may be of the plug-in type for insertion into sockets wired to the electrical connectors for the respective printed circuit cards, but quite often these units are permanently wired in their banks.

In these prior art arrangements, then, it has been necessary to provide separate panels for cards and for display and control purposes, leading to some delay in matching card with indication and/or control unit when failures occur in one or both. Moreover, the number of potential sources of failure increases in proportion to the number of wiring connections, solder joints, and so forth. Such problems, of course, are in addition to perhaps the most significant disadvantage of the prior art multicard arrangements, namely, that of time-consuming and costly initial installation and subsequent replacement.

SUMMARY OF THE INVENTION

According to my invention, a card handle or card holder is provided with a rear slot for receiving and retaining a printed circuit card, and with several holes running from front to rear and intersecting the slot. The holes are of appropriate size and shape to accept individual respective display units and control units therein, and the front of each of these units is exposed in the respective handle to permit an identifying designation or symbol with respect to the function or circuit relationship of the unit to be imprinted thereon.

Active units retained in a card handle are provided with slots that register with the slot in the handle, and that expose spring-loaded electrical contacts or connectors adapted to mate with printed contacts on the card when the card is fully inserted into the handle. Normally, the handle is fastened to the card after the card has been inserted fully into the slot at the rear of the handle. Each card is provided with what may be

termed front edge and rear edge printed contacts, the latter being standard for electrical connection with a mating female connector when the card is installed for use in a printed circuit card rack or shelf. The provision of front edge contacts on each card is essential to my invention to permit the aforementioned indication or control units to be pushed into the appropriate hole in the handle whereupon the spring-loaded contacts on the respective unit accept the matching contacts on the card.

This provides an electrical connection between the circuit printed on the card and the electrical elements in the unit. Mechanical retention of each unit is also assured in part by the clamping action of the spring contacts on the card contacts, and further by the provision of a tight or frictional fit between the sides of the unit and the walls of the hole into which it is to be inserted. Removal of an active unit from the handle is effected by withdrawing the handle and card assembly from its operational position in the card rack or shelf and pushing the unit out from the rear toward the front of the handle.

Passive units are provided in the form of blanks carrying appropriate legends identifying the function of the unit or its relationship to an associated piece of apparatus.

In addition to those advantages noted above, it will be observed that no tools are required for removal or replacement of a unit; no soldering or other auxiliary fastening procedure is required to establish electrical contact between printed circuit card and control or display unit; and the units are disposed immediately adjacent and in direct contact with the associated card.

A feature of my invention is that the printed circuit cards to which respective handles are attached are conveniently mounted in operational position in the shelf or rack in a clean, uncluttered panoramic assembly. The handles are juxtaposed along the shelf and are provided with gripping surfaces to permit ease of removal of the associated card without disturbing adjacent cards or elements mounted thereon. Moreover, each of the units retained in the handle is clearly visible and accessible to operating and maintenance personnel.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a complete printed circuit card handle assembly;

FIG. 2 is a fragmentary side view, partly in section, of the assembly of FIG. 1;

FIG. 3 is a fragmentary top view of the assembly of FIGS. 1 and 2;

FIG. 4 is a sectional view of the handle taken through its longitudinal plane of symmetry and showing a fragmentary portion of the printed circuit card to be inserted therein;

FIG. 5 is a fragmentary, exploded rear view of the handle card assembly;

FIG. 6 is a perspective view of a control unit for insertion into the handle of FIGS. 1-5;

FIG. 7 is a rear view of the control unit of FIG. 6;

FIGS. 8 and 9 are side and rear views of a switch constituting a part of the control unit of FIGS. 6 and 7;

FIG. 10 is a perspective view of an indicator unit for insertion into the handles of FIGS. 1-5;

FIG. 11 is a perspective view of a shelf assembly of printed circuit cards with handles; and

FIG. 12 is a section view taken through a shelf of FIG. 11.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 through 5, inclusive, an exemplary printed circuit card handle 10 has a substantially rectangular blocklike central portion 11 with contoured extensions 12 at either end. A pair of spaced parallel flanges or ribs 13 project perpendicularly from the rear surface 14 of handle 10, as is perhaps best viewed in FIGS. 3 and 5, and the flanges are provided with a pair of aligned holes 15, 16 at either end for a purpose which will be discussed presently. The central region 11 of handle 10 is provided with a plurality of holes 17, 18, 19,

20 (FIGS. 4 and 5) extending entirely through the block from front surface 21 to rear surface 14, the holes being of generally rectangular shape. As will subsequently become clear, more or fewer holes may be provided according to the specific printed circuit card with which the handle is to be associated.

A gap or slot 22 (FIGS. 3 and 5) formed by the space between flanges 13 is carried into the hole area at the rear surface 14 of the handle as slots 23, 24, 25 (FIG. 4) to accommodate a section 26 of a printed circuit card 30 to be fastened to the handle.

Preferably, handle 10 is composed of heat resistant or fire retardant opaque plastic material and is provided with a fine grain surface finish. In practice, the handle is of one-piece construction, formed in its basic shape by any well-known molding process and subsequently machined as may be required to provide specific hole and slot tolerances and to remove any burrs or sharp edges. Flanges 13 need not be continuous as shown, but may appear at the ends only, and may be tapered at either end, as at 31, to permit some sidewise adjustment of the printed circuit card 30 during insertion into and assembly with the handle, as will be discussed. The concave contours 33 at either end of central portion 11 and running smoothly into extensions 12 afford a gripping surface, as between thumb and forefinger, during installation and removal of the handle card assembly.

A typical handle produced in accordance with my invention had the following approximate dimensions, presented by way of example only: width (between side surfaces 35 and 36) of 1 inch; depth (between front surface 21 and rear surface 14) of 1.0 inch, flange depth of 0.5 inch; body length (from end to end) of 4.3 inches; length of central block region (11) of 3 inches; hole width of 0.75 inch; hole length of 0.550, except hole 17 whose length is 0.750 inch; 0.06 radius at corners of each hole; material thickness of 0.08 inch between adjacent holes; slot width (between flanges 13) of 0.062 inch; slot depth (into hole area of body) of 0.25 inch. The mating printed circuit card 30 for handle 10 is of completely conventional design, being provided with conductive circuit paths and conductive thru-holes and component mounting holes and with a region of keyed contacts 38 adjacent edge 39, except that card 30 is also provided with a further array of keyed contacts 40 at section or region 26 which is to be the handle end of the card. This region 26 is designed to mate and to be inserted into the slot extending into the body of handle 10 via slot 22 between flanges 13. When the card is so inserted, keyed contacts 40 are registered with those of holes 17-20 into which active control and display units are to be inserted, and holes 41 in the card are aligned with respective hole pairs 15 and 16 in flanges 13. The width of slot 22 is sufficient to accept the thickness of the insulative portion of board 30 and of the conductive regions overlying and adhering to the board surfaces. Typically, the printed circuit card is approximately 0.054 inch thick. After insertion of card 30 into handle 10 the two are permanently fastened together by rivets 43 and 44 (FIGS. 2 and 3) passing through holes 15 and 16 of flanges 13 and the aligned holes in the card.

As previously observed, a printed circuit card handle according to the present invention not only serves as a holder by which to conveniently grip the card for ease of insertion into and removal from a shelf comprising a bank of mating female connectors for keyed contacts 38 on a plurality of cards, without directly touching the card itself or the circuit paths or components thereon, but the handle also serves as an escutcheon and as a means for retaining functional control and display units in direct operative relationship with the network on the respective printed circuit card.

A typical control unit 50 is shown in FIGS. 6 through 9 inclusive. Required control may be exercised, for example, by a normally open, momentary pushbutton switch 51 of the single-pole, single throw type. Switch 51 has a finger- or thumb-operated pushbutton 52, which, when actuated, causes a closed circuit path to be completed between one or more pairs

of spring contacts, e.g. 53, 54 disposed at the rear of the switch. Preferably, these contacts are composed of beryllium copper with a finish of gold plate over nickel, and are so separated (typically, by 0.4 inch) on the switch body that they will mate with respective ones of the keyed contacts 40 on the printed circuit card when the overall control unit is pushed into its appropriate hole in handle 10. Contacts 53 and 54 may be similar to those available from Transatron Electronics Corp., Wakefield, Mass., designated as printed circuit contacts series 25003. The two contacts constituting a single contact pair (either 53 or 54) are approximately 0.04 inch wide, project about 0.3 inch beyond the rear surface 55 of the body of switch 51, and are spaced by a distance and possess a spring constant that a minimum withdrawal force of approximately two ounces is required to separate each contact pair from the mating contacts of a 0.054 inch thick printed circuit card.

The switch 51 is housed within a control unit casing 57 with pushbutton 52 projecting through a hole in front wall 58 and contacts 53 and 54 exposed at a slot 59 (typically 0.062 inch wide) in the rear of the housing, or projecting therefrom. Housing 57 is preferably composed of heat resistant or fire retardant opaque plastic material, and once the switch is placed inside and the cover plate (front wall) 58 is replaced the entire assembly may be maintained separable or inseparable, as desired. Slot 59 in housing 57 aligns with and matches the width of slot 22 in handle 10 when the overall control unit 50 is pushed into an appropriate hole, e.g., hole 20, of the handle. The control unit is dimensioned to encounter a tight (frictional) fit upon insertion into its respective hole, and this, in conjunction with the spreading open of the switch contact sets by the keyed contacts of board 30 as the unit is pushed into the hole to effect electrical connection between switch and printed circuit, ensures retention of the unit in the handle. Each active unit, such as control unit 50, is sufficiently long that its complete insertion into the hole results in a secure electrical connection with the mating contacts of the printed circuit board (FIGS. 1 and 2). Fasteners may also be used to retain a unit.

The front wall 58 of the unit may have an overhanging flange or lip relative to the sides of the unit to "bottom" against front surface 21 of the handle, or may simply "bottom" on (seat against) the printed circuit card. In either event, this assures that undue force will not be exercised to push the unit into place despite appropriate electrical connection occurring between switch and board contacts. Moreover, while removal of any individual unit from handle 10 may be accomplished by simply withdrawing the handle and printed circuit card assembly from the shelf in which the circuit card is normally operating, and then turning the assembly over and pushing the appropriate unit from the rear toward the front of the handle; a slot 60 (FIGS. 6 and 7) may be provided in the underside of the lip, if used, of front wall 58 to permit the unit to be pried loose from the handle without withdrawing the card handle assembly.

A typical display or indicating unit 62 is shown in FIG. 10. The housing 57 of display unit 62 is substantially the same as housing 57 of control unit 50, except that the interior is modified to accept and mount a miniature lamp 63. The pins or leads of lamp 63 are connected to spring contacts 64, 65 of the same type as those described above with reference to control unit 50. These contacts or terminals may be fixedly positioned relative to housing 57 and gap 59 by provision of slots (not shown) in which contacts 64, 65 are locked without interfering with the capability of the contacts to undergo spreading and retraction when pushed on and removed from the board. The housing of indicator unit 62 is composed of transparent or translucent plastic and either the lamp or the plastic may have an identifying color (e.g., red or green) to indicate the state of the circuit on the associated printed circuit card. For example, in the overall assembly shown in FIGS. 1 and 2, indicator units 68 and 69, displaying the legends "ON" and "OFF" respectively, might be provided with green and red lamps, respectively. As in the case of the previously described insertion and

removal of control unit 50, each indicator unit is simply pushed into the proper hole of handle 10, whereupon its contacts engage the proper contacts of board 30, and may be withdrawn by a reversal of that operation. The holes in the handle position the units and guide them into the contact area of the associated printed circuit card.

In the case of a switching unit as a control unit 50 for a particular circuit, actuation of the switch (i.e., turning it "on") completes a connection between otherwise isolated terminals (contacts) on the printed circuit board, and thereby establishes a circuit connection. For example, this may set a logic storage element to provide a signal to control operation of a particular segment of the circuit, and completion of a sequence of operating steps may provide an indicator signal back to an indicator unit 62 to light the respective lamp, as an indication of a particular operational state of the circuit.

The handle 10 may also accept a passive unit or a "blank" 70 (FIGS. 1 and 2), which may merely be a faceplate bearing any desired legend to be exposed to view when the blank is inserted into the desired hole, and having sufficient material projecting beyond the underside of the faceplate to ensure retention of the blank in the respective hole (e.g., 17) in handle 10.

An overall assembly of a plurality of printed circuit cards with attached handles in an operational shelf or rack is shown in FIG. 11, and a section through the shelf is shown in FIG. 12. Shelves 75 and 76 are merely two of several such shelves arranged in a vertical bay, for example, to mount a large number of printed circuit cards in electrical connection with a similar number of mating female connectors (not shown) mounted at the rear of each shelf. The cards are inserted into respective guides 77 at top and bottom of each shelf as may be observed by reference to shelf 75 from which the cover has been removed to show some of the detail of the frame. Each card is inserted and withdrawn by its respective handle, the handles 10 being in juxtaposed relationship along each shelf and providing sufficient spacing between cards to prevent interference between circuit components mounted on adjacent cards. A cover 78 is shown as retained on the frame of shelf 76, the cover having an opening of sufficient extent to expose every handle on that shelf, and thereby to visually display the legends on the units and the indicator units associated with each handle and to provide access to the control units.

I claim:

1. A printed circuit card holder for retaining a card having keyed terminals associated with the printed circuit carried by said card adjacent at least two edges of said card, said holder comprising:

an electrically insulative body member having four sides, opposite pairs of which are substantially parallel to one another, and having two ends;

a pair of electrically insulative ribs projecting in spaced parallel relation from and substantially perpendicular to one of said sides of said body and defining a slot therebetween of width sufficient to accept the thickness of said printed circuit card and the thickness of the printed circuit carried by said card, said slot extending partly into said body member at said side from which said ribs project;

a plurality of spaced substantially parallel holes extending

through said body member from the side opposite said side from which said ribs project and intersecting the portion of the slot extending into said body;

a printed circuit card in said slot and fastened to said ribs with the keyed terminals at one edge of said card exposed in at least some of said holes intersecting said slot; and control and display means mating with respective ones of said some of said holes and having electrical connectors electrically contacting keyed terminals at said one edge of said card for electrical interaction with the circuit carried by said fastened card.

2. The card holder according to claim 1 further including a surface contour at each of said ends to facilitate gripping of the holder for transfer of the associated card from one position to another.

3. The card holder according to claim 1 wherein said control and display means are slidably insertable into and slidably removable from said holes.

4. A printed circuit card holder for retaining a card having keyed terminals associated with the printed circuit carried by said card adjacent at least two edges of said card, said holder comprising:

an electrically nonconductive handle having a front edge and a rear edge;

a slot in said rear edge of said handle sufficiently wide to accept a printed circuit card;

a plurality of spaced-apart holes extending in a substantially parallel array through said handle from said front edge to said rear edge and intersecting said slot;

a printed circuit card fastened in said slot with the keyed terminals along one edge of said card projecting toward said front edge of said handle and exposed in at least some of said holes intersecting said slot; and

a plurality of control and display means slidably engaged in respective ones of said some of said holes, via said front edge of said handle for selective withdrawal from said front edge, and having electrical connectors electrically contacting the keyed terminals at said one edge of said card exposed in said holes for electrical interaction with the circuit carried by the fastened card, said control and display means being fixedly mounted relative to said card for electrical operation therewith and said electrical connectors continuously contacting the respective keyed terminals at said one edge of said card.

5. The combination according to claim 4 wherein said control means comprises switch means for selectively electrically connecting and disconnecting portions of the circuit carried by said card via the respective keyed terminals with which the electrical connectors of the respective control means make contact.

6. The combination according to claim 4 wherein said display means comprises indicator means for detecting and displaying the operating state of a portion of the circuit coupled to the respective keyed terminals with which the electrical connectors of the respective display means make contact.

7. The combination according to claim 4 wherein said control means comprises means for selectively modifying the operation of the circuit coupled to the respective keyed terminals with which the electrical connectors of the respective control means make contact.