Oct. 10, 1961 A. COHEN 3,004,235

PLUGBOARDS FOR USE IN PATCHCORD PROGRAMMING SYSTEMS

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Fig. 12.

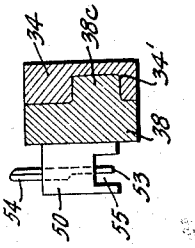


Fig. 1.

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Fig. 3.

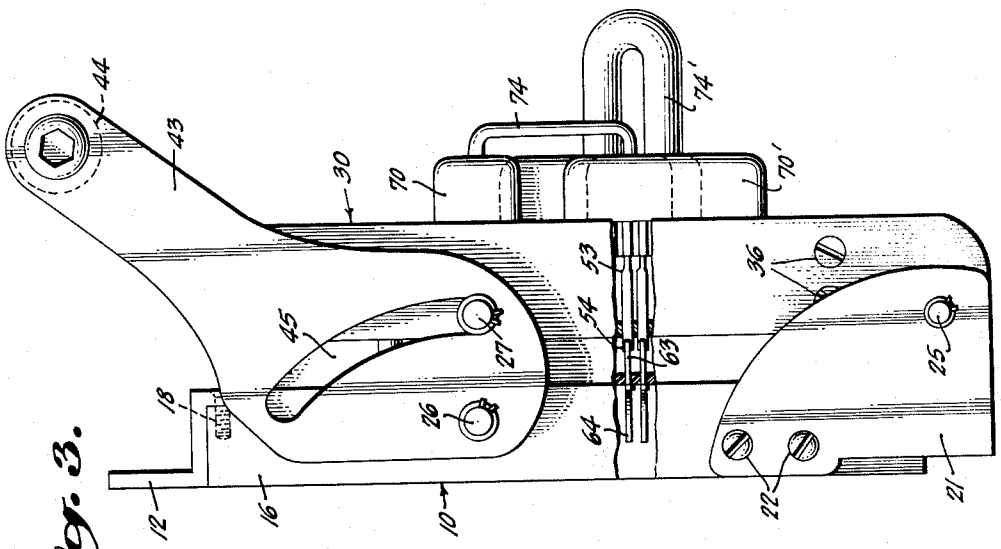
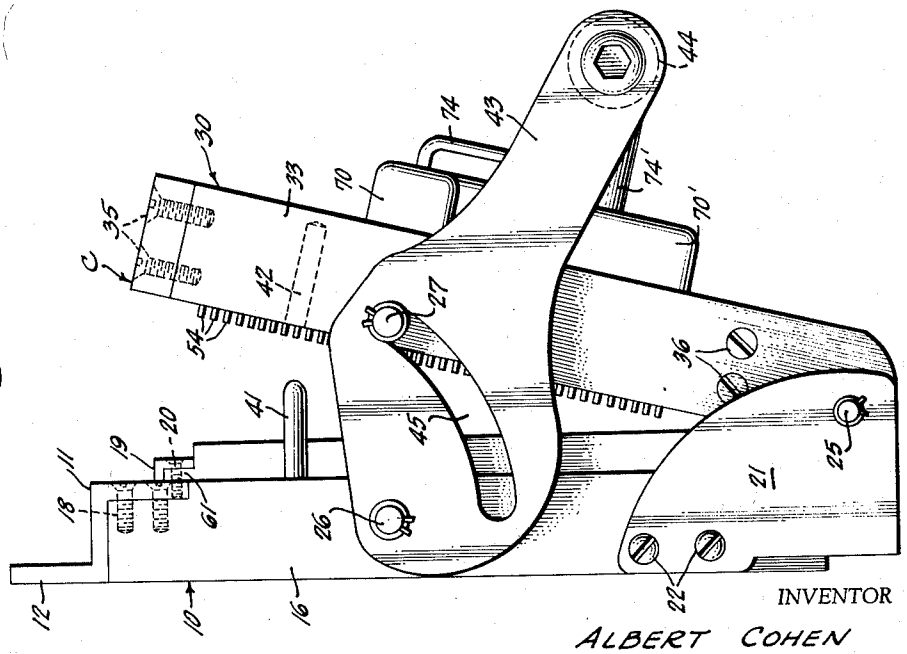


Fig. 2.



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Fig. 7.

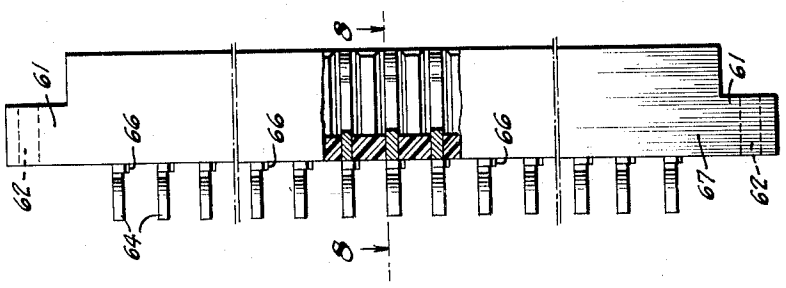


Fig. 6.

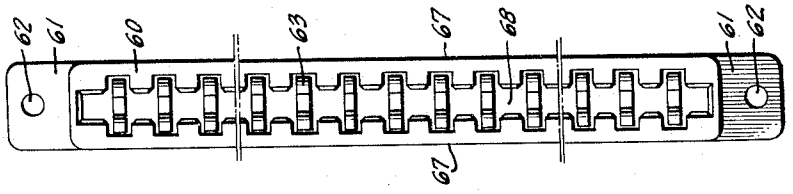


Fig. 5.

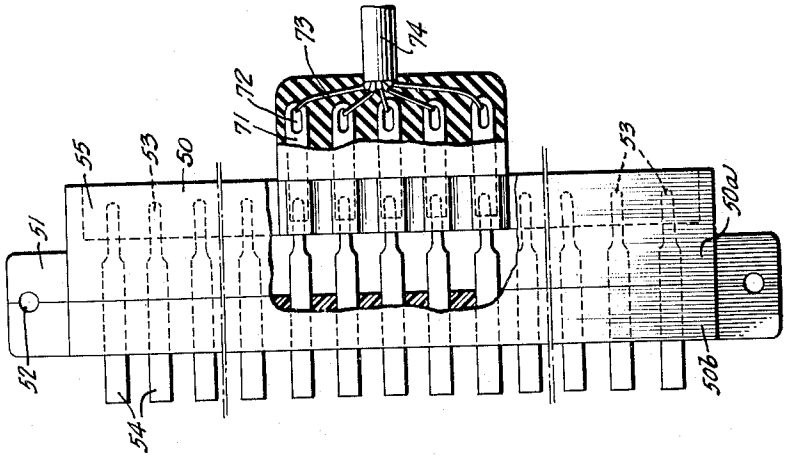
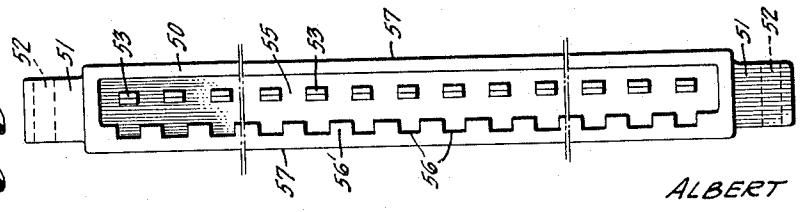


Fig. 4.



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Fig. 8.

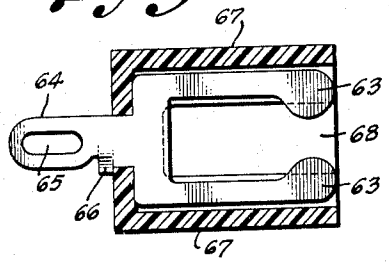


Fig. 9.

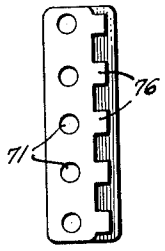


Fig. 10.

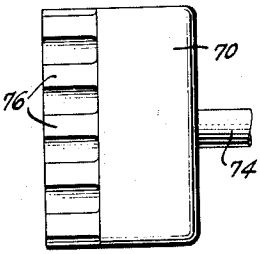
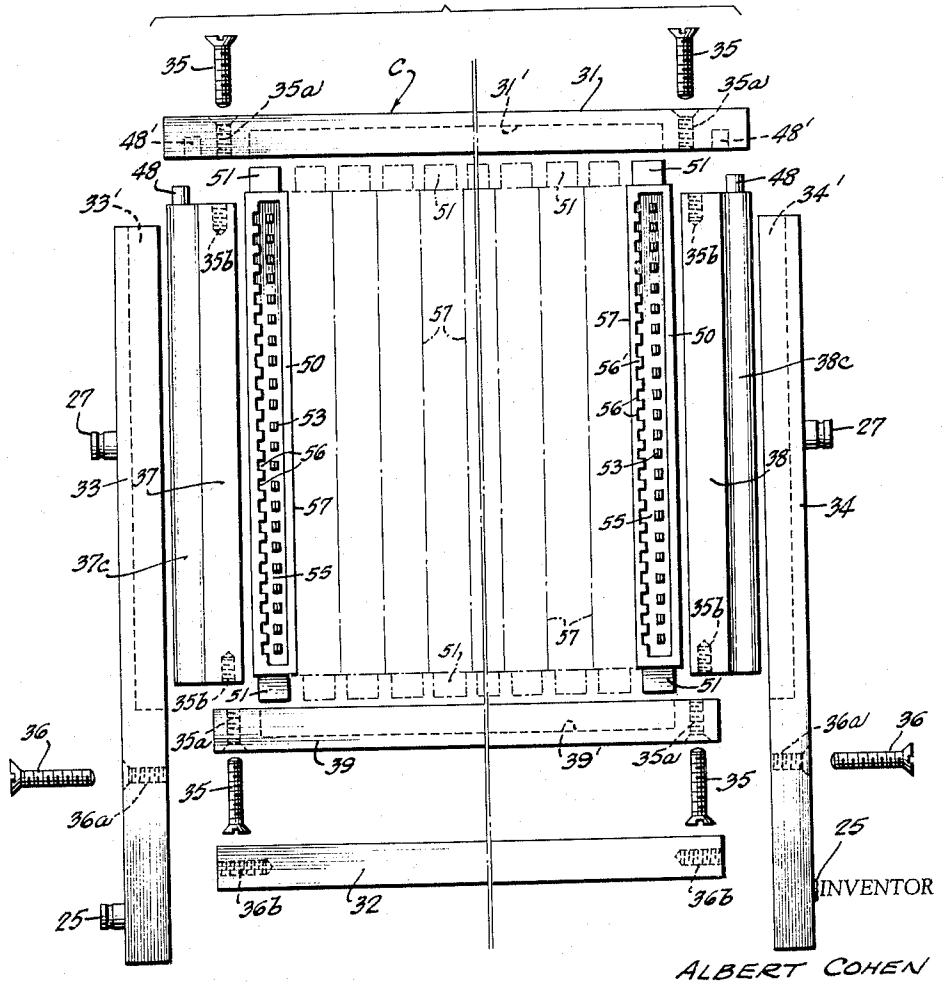


Fig. 11.



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United States Patent Office 3,004,235 Patented Oct. 10, 1961

3,004,235

PLUGBOARDS FOR USE IN PATCHCORD PROGRAMMING SYSTEMS

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Filed June 10, 1958, Ser. No. 741,155
6 Claims. (Cl. 339—18)

This invention relates to control panels for use in a patchcord programming system, and more particularly to plugboard connectors used in interchangeable connector systems.

It is the object of the present invention to provide plugboard connectors of low cost and rugged construction which may be used with maximum flexibility in programming in analog and digital computers, telemetering systems, automatic test equipment and other systems of automation which require rapid change programming.

It is another object of the invention to provide a reliable and compact plugboard composed essentially of standardized parts, and which may be made up economically in different sizes, depending upon specific needs, in view of the modular arrangement of the connectors, the contacts of which are so compactly arranged that a total of four hundred and forty contacts may be contained in an area of approximately eight inches by four and one-half inches.

It is a further object of the invention to provide a plugboard characterized by reliability in its functions of circuit making and breaking. The plug boards are designed to be manipulated as well as stored with minimum likelihood of damage to the contacts, and should any faults develop, replacement parts may be easily substituted without requiring lengthy time-consuming operations.

It is another object of the invention to provide patchcords of varying capacities which may range from one to twenty-two terminals in order to attain maximum flexibility by the programming system in accordance with the invention. These single or multiple patchcords are associated with a novel design of the plugboards so that secure connection of the patchcords with the plugboard is assured, thereby precluding any possibilities of faulty operation on this account.

Other objects and purposes will appear from the following detailed description of the invention, taken in conjunction wih the accompanying drawings, wherein

FIG. 1 is a perspective view of the plugboard employed in the patchcord programming system in accordance with the invention;

FIG. 2 is a left end view of the plugboard in its open circuit position;

FIG. 3 is a view corresponding to FIG. 2 with the plugboard in closed position;

FIG. 4 is a front elevation of a connector in accordance with the invention, as embodied in the removable portion of the plugboard;

FIG. 5 is a side view with certain parts in section of the connector shown in FIG. 4 in association with a patchcord plug;

FIG. 6 is a front elevation of a connector mounted in the fixed portion of the plugboard;

FIG. 7 is a left end view of FIG. 6 with certain parts in section to show the disposition of the individual electrical contacts in the connector;

FIG. 8 is a horizontal sectional view along line 8—8 of FIG. 7;

FIG. 9 is an end view of a patchcord plug which may be used in the system;

FIG. 10 is a front elevation of the plug shown in FIG. 9;

FIG. 11 is an exploded view of the components of

the movable framework of the plugboard for seating the removable portion of the latter including the series of connectors housed in the removable part of the plugboard; and

FIG. 12 is a horizontal sectional view along line 12—12 of FIG. 1.

As shown in the drawings, the plugboard in accordance with the invention is comprised of a stationary frame **10** and a movable frame **30** pivoted relatively to the frame **10** for selective cooperation with the electrical contacts in the frame **10**. Control panels which may be prepared with suitable patchcords are adapted to be mounted interchangeably in the movable frame **30** for the completion of desired control circuits when the frames **30** and **10** are brought into juxtaposition. Such plugboards are known in the art, as exemplified by the patent to Lake, No. 2,111,118, March 15, 1938.

The fixed portion of the plugboard is of rugged and economical construction resulting from the use of few frame members and consisting of spaced top and bottom structural members **11**, and lateral members **16** and **17**, which are interconnected by means of threaded bolts or other fasteners **18**. The fixed frame **10** may be mounted on a suitable bay by affixing the vertical flange **12** of upper member **11** to the bar by means of bolt fasteners extending through openings **13** in the flange.

The fixed frame **10** supports on the front thereof a plurality of connectors **60**, the details of which are shown in FIGS. 6 to 8. These connectors are formed of molded plastic material housing a plurality of contact terminals in the form of female sockets on the front face of the body, and male terminals **64** on the rear face of the body. End lugs **61** form integral molded extensions of the connectors which are provided with cylindrical recesses **62** therethrough. As shown in FIG. 1, the end lugs **61** are confined by the angular channel members **19** which are affixed to top and bottom structural members **11** of frame **10** by means of securing bolts **20**.

The connectors of the type shown in FIGS. 6 to 8 are standard units which are available in different sizes of six, ten, fifteen, eighteen and twenty-two contacts, especially adapted for use with printed circuits. Such connectors, which present a continuous longitudinal slot along the center thereof, are Patent No. 2,765,450, October 2, 1956.

As shown in FIG. 1, twenty connectors are juxtaposed closely with the sides **67** adjacent to each other so that with a dimension of approximately ⅜" in width and with an overall length of 4¼" for a connector having twenty-two terminals, a control panel of four hundred forty-four contacts may be attained within a small area approximating 8" x 4½".

As shown in FIG. 8, the individual contact terminals assume the form of bifurcated contacts **63** provided with enlargements at the open end, which are seated at superposed levels, for example **22**, of the connector **60**. These enlargements afford a wiping contact for any contactors which are inserted into the longitudinal opening **68** in the front of the connector. The rearward extensions **64** of these contact terminals are provided with openings **65** affording a convenient mode of connecting the wires of the programming system to the fixed control panel of the plugboard. Lateral lugs **66** on the individual contactors serve to retain the conductive members securely within the body of the contactor without shifting. In lieu of openings **65**, terminals with wire wraps, pins or open ends may be used, but these do not constitute part of the instant invention.

The movable frame **30** of the plugboard is pivotally connected to the lower end of the fixed frame **10**, and for this purpose, metallic ears **21** are affixed to the lower

ends of lateral members 16 and 17 of frame 10 by means of threaded bolts 22, and openings are provided at the forward end of these ears for receiving trunnions 25 extending from the lateral structural members of frame 30. These lateral members 33 and 34 of frame 30 are provided with inwardly facing guideways 33', 34', respectively, for slidably accommodating the interchangeable plugboards therein. The frame 30 is open at the top for the purpose of permitting the insertion and withdrawal of the removable plugboards C and a bottom stop for the latter is afforded by the horizontal member 32 which is connected to the lateral members 33 and 34 by means of bolts 36 extending through countersunk bores 36*a* in the latter and into threaded bores 36*b* in the ends of the bottom member 32 (FIG. 11).

A plurality of removable plugboards C are assembled for selective insertion into the movable frame 30. Since each is of the same construction, only one has been illustrated in the drawings.

The rectangular frame of the detachable plugboard C is formed of a top horizontal member 31, a bottom horizontal member 39 and vertical lateral members 37 and 38. The top member 31 is recessed along its bottom face 31' and the bottom member 39 is recessed along its top face 39' to accommodate the opposite end lugs of the connectors described below, and these connectors are maintained in closely juxtaposed position by means of pairs of bolts 35 extending through countersunk bores 35*a* adjacent to the opposite ends of horizontal members 31 and 39 and into threaded bores 35*b* in the opposite ends of the vertical lateral members 37 and 38. The latter are provided with guide protuberances 37*c* and 38*c*, which conforms to the guideways 33' and 34', respectively, for sliding movement therein.

Preferably, the top member 31 is of extended length to cover the lateral members 37 and 38 and aligning pins 48 projecting from the upper ends of the latter may cooperate with corresponding recess 48' adjacent the ends of top member 31 to assure an accurate alignment between the parts of the frame and the connectors embraced therein.

The connectors 50, which are housed within the removable control panel C, are shown in detail in FIGS. 4 and 5. Each connector is composed of conjoint parts 50*a* and 50*b*, formed with end lugs 51 of reduced depth at the opposite ends thereof through which may extend a cylindrical opening 52 for purposes of facilitating alignment and mounting. The sides 57 of the connector are juxtaposed closely in the frame and the end lugs are seated in the recesses 31' and 39' of the tops and bottom members 31 and 39 (FIG. 11). A longitudinal recess 55 is formed on one face of the connector 50 into which extend male contacts 53, preferably below the open face of the recess, as shown in FIGS. 5 and 12, thereby preventing distortion or injury to these contacts. The contacts extend through the opposite end of the connector as male contacts 54 for insertion into the female contacts 63 of the connectors 60 mounted in the fixed frame 10, as explained above. As in the case of the connectors 60, the number of contacts 53, 54 may range from six to twenty-two, depending upon the special circuit needs, and these are designed for cooperation with the connectors of corresponding size, which are mounted in the fixed frame 10, as explained above.

Patchcord plugs of special design are adapted for cooperation with the male contacts 53 in the movable frame 30. These plugs are shown in FIGS. 9 and 10 and may be of any size ranging from one up to twenty-two terminals which may be connected with single or multiple wires 73 contained in cable 74. The wires 73 are connected to socket or sleeve terminals 71 by means of the openings 72 and the lateral wall of the socket is provided with projections 76 adjacent the individual sleeved sockets. These projections are adapted for cooperative action with corresponding recesses or depressions 56 which alternate with projections 56' along one wall of the longitudinal recess 55 in connector 50, so that the plug may be inserted into the connector in only one position wherein the projections 76 of the plug mate with the recesses 56 in the connector.

As shown in FIG. 1, the pair of patchcord plugs 70, at the opposite ends of the cable 74, are inserted in the face of the movable control panel C at the same time as another patchcord 74' with a greater number of conductors therein and terminating in plugs 70', is connected to the board for the purpose of effecting desired circuit connections. Many control panels C may be prepared with the necessary patchcords therein for selective cooperation with the circuits leading from the fixed panel 10.

In order to control the completion and interruption of the circuits through the plugboard, a pair of cam levers 43 are pivotally mounted at one of the ends thereof on pins 26 extending from lateral members 16 and 17 of the fixed frame 10. An actuating handle 44 extends between the opposite ends of levers 43. A cam slot 45 is formed in each of the arms 43 in which travels a pin 27 extending from the lateral frame members 33 and 34 of the movable member. These elements constitute a simple mechanical system and a movement of the handle 44 in a counterclockwise direction, from the position shown in FIG. 2 to that shown in FIG. 3, results in a completion of the circuits between the contacts bridged by the patchcord plugs. Alignment pins 41 extending from the fixed frame 10 cooperate with corresponding recesses 42 in the movable frame 30 to assure an alignment between the parts in the course of their relative movement, sufficient clearance being provided to take care of the vertical component of the movement of the frame 30 with respect to frame 10.

The male contact terminals 54 extending from the control panel C are capable of entering the longitudinal openings 68 in the face of the connectors 60 to dispose the terminals 54 between the enlarged ends of the contacts 63 so that the circuit making operation is completed with certainty and reliability. Similarly, the circuits are readily interrupted by the rocking of the movable frame 30 in a clockwise direction, whereupon the control panel C may be slid from the top thereof in preparation for the use of another control panel.

The modular construction of the fixed and interchangeable control panels by juxtaposing any desired number of connectors of varying sizes, makes possible the fabrication of a plugboard at low cost and one which may be tailored easily to specific circuit needs since even the frame members may be formed of standardized channel formations of extruded aluminum or other metals. At the same time the arrangement of the movable and stationary contacts is such that they cooperate mutually to assure effective and reliable circuit-making and breaking actions without need for expensive contactor constructions.

The eventual servicing costs of the plugboard in accordance with the invention are nominal by virtue of the simple construction and assembly thereof and because of the easy replaceability of any connectors which may develop any faults in the course of time and extended use.

While I have described my invention as embodied in a specific form and as operating in a specific manner for purpose of illustration, it should be understood that I do not limit my invention thereto, since various modifications will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

I claim:

1. An interchangeable electrical plugboard comprising a rectangular frame formed of top and bottom members fitted with grooves and lateral members therebetween, a plurality of discrete and independent columnar

connectors each formed of an elongated body of insulating material having end lugs at the opposite ends thereof for seating within the grooves of said top and bottom members of said frame and with the sides of said connectors confined between said lateral members, each of said columnar connectors having a longitudinal recess in the front face thereof with a plurality of superposed contact prongs projecting from below the front face of said recess and beyond the rear face of said connector, each of said recesses being provided on the side thereof with projections and depressions corresponding to the number of contact prongs and adjacent thereto for facilitating the insertion of plugs thereinto.

2. An interchangeable electrical plugboard comprising a rectangular frame formed of top and bottom members fitted with grooves and lateral members therebetween, a plurality of discrete and independent columnar connectors each formed of an elongated body of insulating material having end lugs at the opposite ends thereof for seating within the grooves of said top and bottom members of said frame and with the sides of said connectors confined between said lateral members, each of said columnar connectors having a longitudinal recess in the front face thereof with a plurality of double-ended contact prongs projecting from below the front face of said recess and beyond the rear face of said connector, a plurality of rectangular notches formed on one side of said recess adjacent to each of said contact prongs, and a patchcord provided with female terminal plugs at the opposite ends thereof with one external side of each plug formed with rectangular projections for reception in the selected rectangular notches of said recesses simultaneously with the completion of the circuit between said plugs and the selected contact prongs.

3. A plugboard comprising a fixed rectangular frame formed of top and bottom members with lateral members therebetween and an open top movable frame pivoted to the lower edge of said fixed frame, a modular control panel confined in said fixed frame comprising a plurality of columnar connectors each formed of an elongated body of insulating material fitted with a plurality of superposed contact terminals on the rear face thereof and bifurcated contact sockets on the front face thereof with gaps between said sockets to present a continuous longitudinal slot on said last-mentioned face, an interchangeable electrical plugboard comprising a rectangular frame formed of top and bottom members fitted with grooves and lateral members therebetween adapted for mounting within said movable frame, a plurality of columnar connectors each formed of an elongated body of insulating material having end lugs at the opposite ends thereof for seating within the grooves of said last-mentioned top and bottom members of said last-mentioned frame and with the sides of said connectors confined between said last-mentioned lateral members, each of said columnar connectors having a longitudinal recess in the front face thereof with a plurality of double-ended contact prongs projecting from below the front face of said recess and beyond the rear face of said connector, said contact prongs projecting from the rear faces of the connectors adapted to enter said continuous longitudinal slots for engagement with said bifurcated contact sockets in response to the pivotal juxtaposition of the fixed and movable frames.

4. A device as set forth in claim 3 including a plurality of rectangular notches formed on one side of said recess adjacent to each of said contact prongs, and a patchcord provided with female terminal plugs at the opposite ends thereof with one external side of each plug formed with a plurality of rectangular projections for reception in the selected rectangular notches of said recesses adjacent to the contact prongs engaged by said terminal plug.

5. A plugboard of modular construction comprising a rectangular perimetric frame bounded by opposed side and end members for retaining a plurality of discrete and independent columnar connectors each formed of an elongated body of insulating material terminating in integral end lugs for seating in opposite end members of said frame, the opposite sides of said connectors having cooperating faces to enable compact juxtaposition and clamping thereof between the opposite side members of said frame, a plurality of aligned contacts in said connectors extending towards the opposite faces of said connectors with said alignment extending in transverse directions parallel to the side and end members of said perimetric frame, each of said aligned contacts on the front face of each connector extending into a recess extending longitudinally of the front face of said connector and terminating below the plane of said last-mentioned face, and alternate projections and depressions on the side of each recess in alignment with and in correspondence to each contact.

6. A switchboard comprising a mounting frame and a plurality of separate modular units mounted thereon, each unit formed of an elongated body of insulating material having a longitudinal recess in the front face thereof with a plurality of superposed contact prongs projecting from below the front face of said recess and beyond the rear face of said body, and said recess having projections and depressions on one side thereof corresponding to the number of contact prongs and adjacent thereto for facilitating the insertion of plugs thereinto, and a flexible cable terminating in a terminal plug having at least one female connector therein and provided on the exterior thereof with depressions and projections complemental to the projections and depressions, respectively, in the recess of said body, and of a number corresponding to the number of female connectors in said plug.

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