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D. L. ROLPH ET AL

3,202,878

PLUGBOARD APPARATUS WITH LATERAL MOVEMENT CONNECTING MEANS

Filed Sept. 21, 1961

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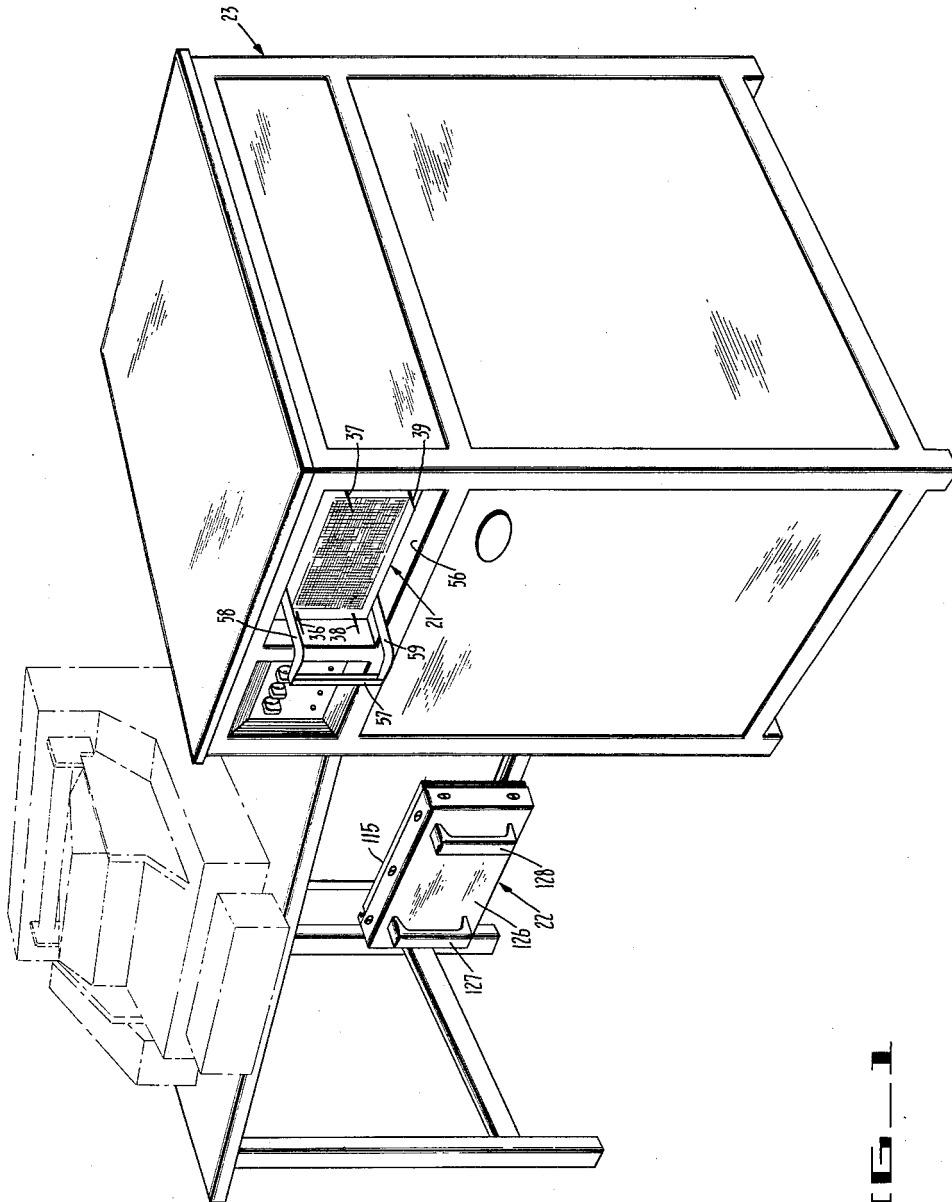


FIG-1

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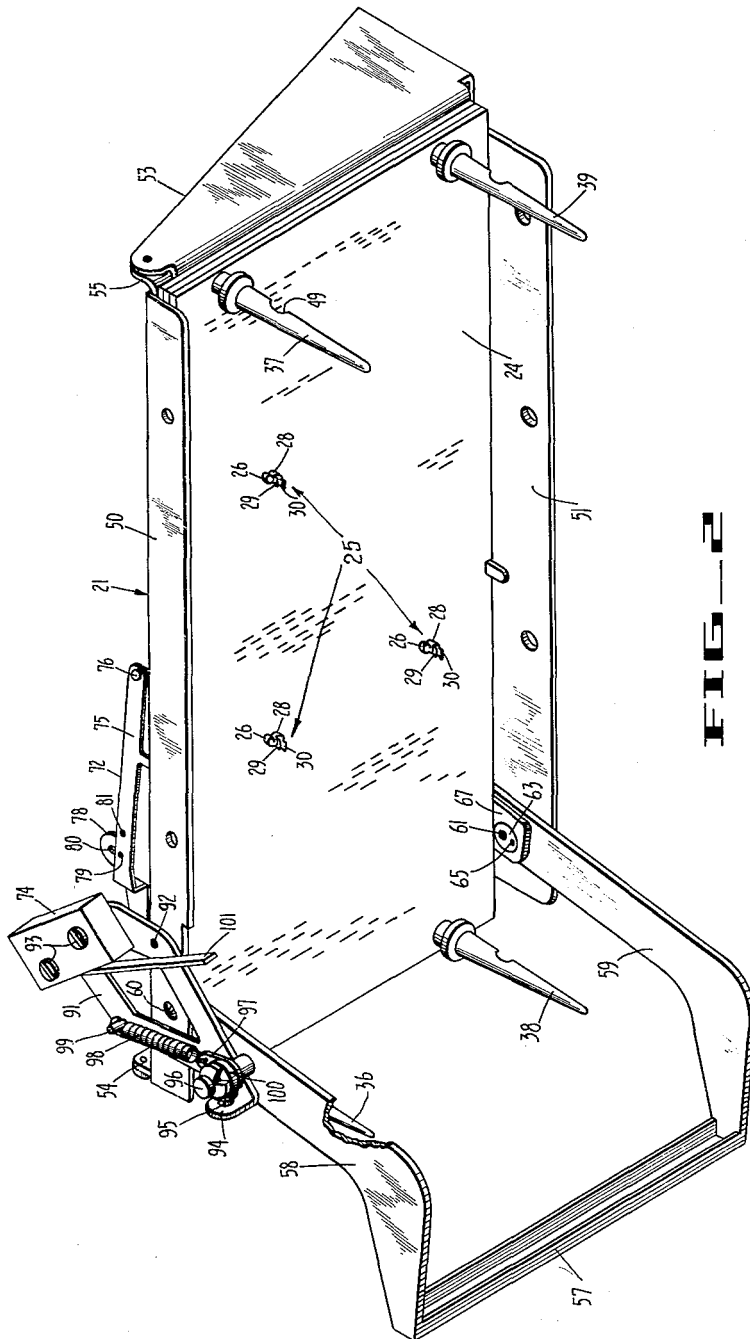


FIG-2

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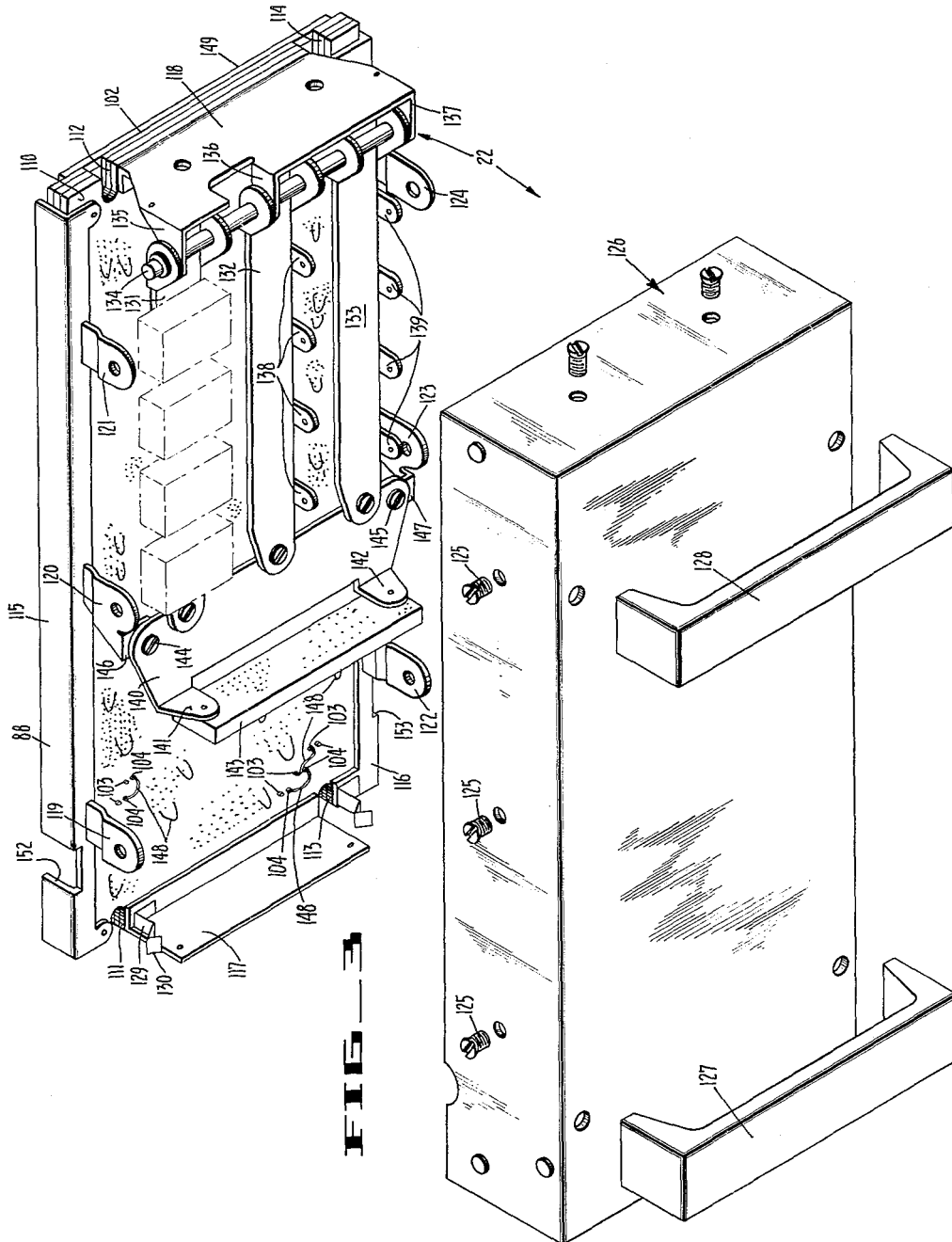
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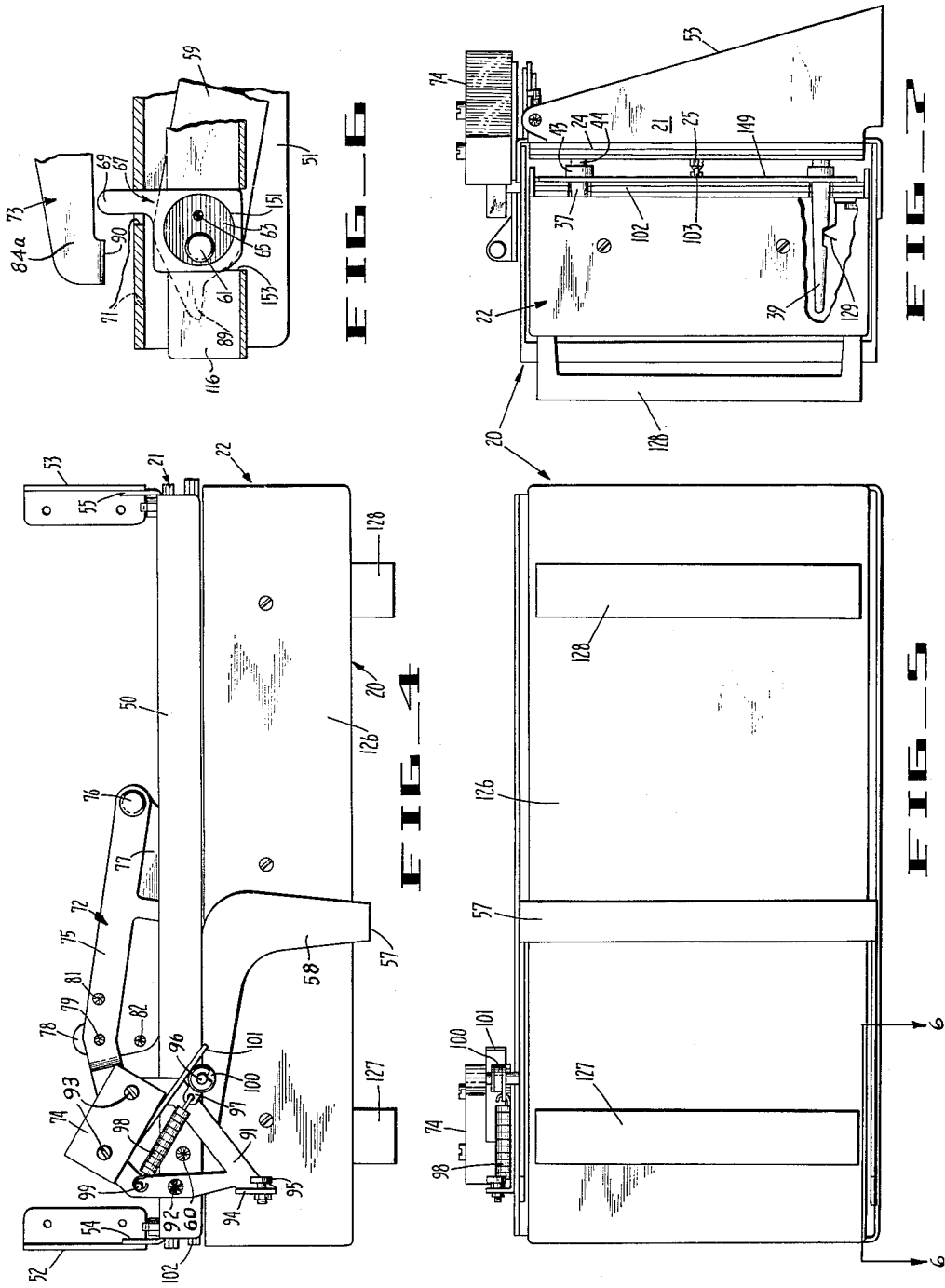
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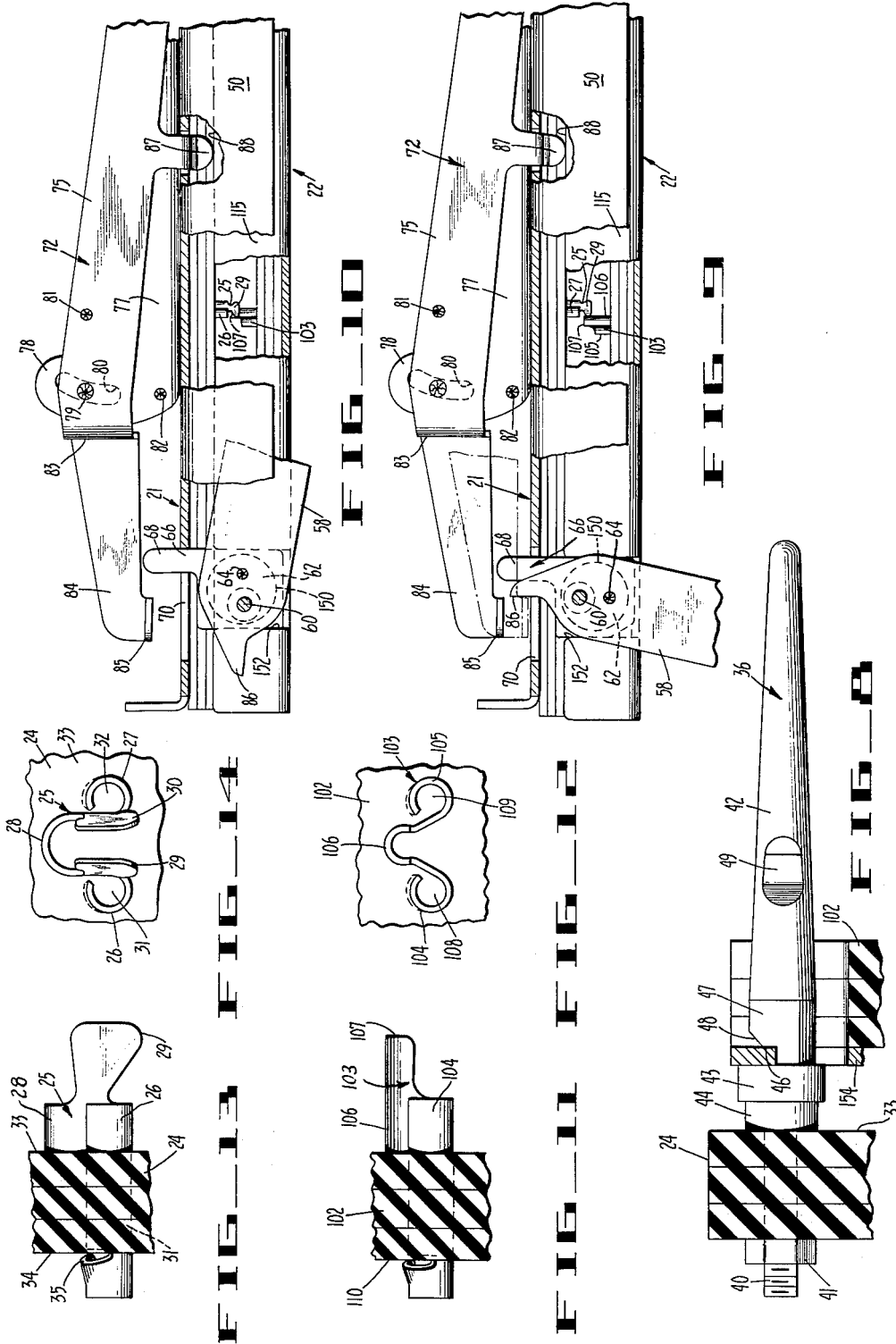
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**PLUGBOARD APPARATUS WITH LATERAL  
MOVEMENT CONNECTING MEANS**

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13 Claims. (Cl. 317-99)

This invention relates to electrical connectors and, more particularly, to electrical connectors of the type commonly called plugboards in which a plurality of contact-supporting plugboard units are brought together so that spaced conductor members on one plugboard unit are brought into conducting contact with corresponding spaced conductors on the other plugboard unit.

The object of the invention is to provide an improved plugboard type of electrical connector suitable for use as an electrical connecting means between office machines used in combination to produce required records.

The plugboard of this invention provides a convenient means of electrical connection between a plurality of electrical or electromechanical machines such, for example, as an electrical typewriter and an electromechanical calculator.

Features of the invention reside in the structures and arrangements of terminal contact members supported in the terminal contact-supporting plugboard units.

Another feature resides in a lever system handle means for controlling the relative movement of the terminal contact-supporting plugboard units.

Another feature resides in the means provided for ensuring that electrical power is permitted to be extended through the plugboard units only when the cooperating terminal contacts in the plugboard units are properly connected to other required terminal contacts.

The plugboard may be used to advantage as an electrical connecting means between a modified electric typewriter and a modified electromagnetic calculator such, for example, as the modified typewriter and calculator disclosed in the D. L. Rolph et al. Patent No. 2,864,554, issued December 16, 1958, entitled "Printing Calculating Apparatus Switch Means" and assigned on its face to the same assignee as the present application.

In the present invention, the plugboard may be mounted in a convenient portion of a desk in which the modified calculator apparatus is stored, and on a portion of which the modified typewriter apparatus is supported. The place selected for locating the plugboard is not critical, but there is considerable advantage in locating it where one portion of the plugboard may readily be separated from, or applied to, the other part of the plugboard to facilitate making changes in the conducting paths of conductors in the electrical system extending between the modified typewriter apparatus and the modified calculator.

The terminal contact means provided in the plugboard units are so constructed and arranged that a plurality of conductors may be readily connected to a single terminal contact and jumper wires may be readily employed in forming electrical conducting means between a terminal contact means on one part of a plugboard unit and another terminal contact means on the plugboard unit.

In the drawings:

FIG. 1 is a view in perspective of an office desk con-

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structed and arranged for supporting a modified typewriter and for housing a modified calculator with an upper portion of the desk arranged to support the plugboard of this invention. In this setup of the apparatus, a modified calculator would be supported within the right-hand portion of the desk as shown in FIG. 1, and the modified typewriter apparatus is supported as shown in phantom on a table portion of the desk and to the left of the locations of the modified calculator and the plugboard of this invention. An outer plugboard unit with its front cover is shown removed from its normal position to permit disclosure of a terminal contact board portion of the inner plugboard unit;

FIG. 2 is a view in perspective of a terminal contact board portion of the inner plugboard unit shown in FIG. 1;

FIG. 3 is an exploded view in perspective of the front cover of the outer plugboard unit of this invention and an outer plugboard unit normally supported within the front cover;

FIG. 4 is a top view in reduced scale of the complete plugboard of this invention;

FIG. 5 is a front view of the complete plugboard of this invention;

FIG. 6 is a fragmental top view, partly in section, of a fragmentary portion of the plugboard, taken along the lines 6-6 in FIG. 5;

FIG. 7 is an end view of the plugboard shown in FIGS. 4 and 5, with a portion of the front cover broken away to permit a view of one of the guide and latch pins and cooperating latch springs employed in guiding one plugboard unit relative to the other, and latching one plugboard unit relative to the other;

FIG. 8 is an enlarged view relative to other figures in the drawings and partly in section and shows in detail one of the guide and latch pins above-mentioned in connection with FIG. 7;

FIGS. 9 and 10 are partial top views, partly in section, of a fragmentary portion of plugboard and showing a latch arrangement in two positions: FIG. 9 shows the female terminal contact of the inner plugboard unit in register, but not in engagement, with the male terminal contact of the outer plugboard unit; FIG. 10 shows the male and female terminal contacts when in full engagement;

FIG. 11 is an enlarged view of one of the male terminal contacts carried in one of the plugboard units;

FIG. 12 is an end view of the male terminal contact shown in FIG. 11;

FIG. 13 is an enlarged view of the female terminal contact carried in the other of the plugboard units; and

FIG. 14 is an end view of the female terminal contact shown in FIG. 13.

The male terminal contact shown in FIGS. 11 and 12 is operable to be brought into partial register with the female terminal contact shown in FIGS. 13 and 14, and the parts on which the terminal contacts are mounted are then relatively moved to make a portion of one terminal contact engage, with considerable pressure, a portion of the other terminal contact. For example, a portion of the male terminal contact shown in FIG. 12 is brought into partial register with a portion of the female terminal contact shown in FIG. 14, and the supports on which the terminal contacts are mounted are relatively moved so that a

portion of the male terminal contact shown in FIG. 12 will frictionally engage and spread apart portions of the female terminal contact shown in FIG. 14. In the relative movement of the terminal contact parts shown in FIGS. 12 and 14, the supports on which the terminal contact parts are mounted are guided in their movements by guide pins, such as shown in FIG. 8. The guide pins, such as shown in FIG. 8, in addition to guiding the movements of one terminal contact-supporting plate relative to another, also serve in cooperation with springs to releasably hold the terminal contact-supporting plates against accidental or unintentional displacement from each other.

The terminal contact-supporting plates are manually moved relative to each other to bring the female terminal contacts on one plate into partial register with the corresponding male terminal contacts on the other plate. Subsequently, one terminal contact-supporting plate is moved laterally relative to the other terminal contact-supporting plate, so that portions of the male terminal contacts on one terminal contact-supporting plate will enter portions of the female terminal contacts on the other terminal contact-supporting plate and develop spring-pressure in portions of both terminal contacts to maintain the terminal contacts in considerable pressure engagement. A lever system involving cams, springs and a spring-fingered arm is provided to move the terminal contact-supporting plugboard units laterally relative to each other. The terminal contacts in the plugboard units are so constructed and arranged that plug-equipped jumper wires may be readily plugged into the back of the terminal contacts to cross-connect the terminal contacts as desired to set up a required program circuit condition.

The plugboard apparatus 20 of this invention, as shown in FIGS. 4, 5 and 7, comprises an inner plugboard unit 21 and an outer plugboard unit 22, the outer plugboard unit 22 being adapted to fit over the inner plugboard unit 21. Each plugboard unit serves as a mounting means for terminal contact members which provide terminal means for conductors of an electrical system. When the plugboard units 21 and 22 are properly brought together (FIGS. 7 and 10), the female terminal contact members 25, located in inner plugboard unit 21, are in good electrical contact with the corresponding male terminal contact members 103 located in outer plugboard unit 22.

#### *The inner plugboard unit 21*

The inner plugboard unit 21, as shown in FIG. 1, is normally mounted in a support, for example, the desk 23, and preferably in such position as to be readily accessible for application thereto of the outer plugboard unit 22. The inner plugboard unit 21 per se, as shown in FIG. 2, comprises an apertured strip 24 of insulating material in which are mounted in spaced relation a relatively large number of female electrical terminal contacts 25, a few of which are shown in somewhat enlarged dimensions in FIG. 2 and shown in still further enlarged dimensions in FIGS. 13 and 14. Each female terminal contact 25 comprises two spaced, open-seamed, tubular portions 26 and 27 (FIG. 14) of a length somewhat greater than the thickness of the insulating material, and are joined on the operative face of the material (toward outer unit 22) by a yoke portion 28. A pair of resilient ear portions 29 and 30 extend forwardly from the yoke portion 28, the ear portions 29 and 30 being sufficiently resilient and converging toward each other forwardly of the apertured strip 24, so that a nose portion 107 (FIG. 11) of male terminal contact 103 in the outer plugboard unit 22 may be inserted between the ear portions 29 and 30 and held therein in good frictional contact. The ear portions 29 and 30 (FIG. 14) of the female terminal 25 spread slightly apart during the inserting of the male terminal contact 103. Sufficient spring-pressure is developed in the ear portions 29 and 30 to normally maintain the male terminal contacts in one plugboard unit in electrical con-

nection with its corresponding female terminal contacts in the other plugboard unit. The tubular portions 26 and 27 of the female terminal contact 25 extend through spaced circular apertures 31 and 32 (FIGS. 13 and 14), respectively, formed in the insulating strip 24. The tubular portions 26 and 27 extend from the front 33 to the back 34 (FIG. 13) of the insulating strip 24, with a portion 35 on each tubular portion 26 and 27 being sprung out transversely against the back 34 of the apertured strip 24, as shown in FIG. 13, to prevent the electrical terminal 25 from being unintentionally withdrawn from the apertured strip 24.

The sprung-out portion 35 on each tubular portion 26 and 27 is preformed by transversely cutting a tubular portion of the terminal contact and displacing part of the tubular portion outwardly. When the tubular portions 26 and 27 are thrust through the circular apertures 31 and 32 (FIG. 14) in the apertured strip 24, the portions 35 will be cammed inwardly to permit passage of the tubular portions 26 and 27 through the insulating support and will then spring out against the back 34 of the apertured strip 24 as the portion 35 emerges from the aperture. Since the portion 35 bears against the back 34 of the apertured strip 24, ready or accidental withdrawal or dislodgement of the terminal contact from its supporting apertured strip of insulating material is prevented.

It is to be noted that each female terminal contact 25 is a bifurcated contact structure and the ear portions 29 and 30 make a wiping and pressure engagement with the nose portion 107 of a male terminal contact 103 (FIG. 11) on the outer plugboard unit 22. The open-seamed tubular portions 26 and 27 (FIG. 14) on each female terminal contact provide convenient jacks into which may be inserted pin-type terminals of jumper wires or other conductors.

Guide pins 36, 37, 38 and 39 (FIGS. 1 and 2) are supported in the apertured strip 24, as shown for example, in enlarged scale in FIG. 8 which illustrates the manner of securing the guide pin 36 which has a threaded end portion 40 extending through an aperture in the apertured strip 24 to receive a nut 41. The guide pin has a tapered finger portion 42, an annular shoulder portion 43, a reduced shank portion 44 bearing against one face 33 of the apertured strip 24 and a slot 46 formed in the base portion 47 of the finger portion 42 adjacent to the annular shoulder portion 43. The slot 46 is chamfered at 48 to guide a portion of the outer plugboard unit 22 into place and a notch 49 is cut in the finger portion 42 for providing a latch arrangement, as will be later explained.

The inner plugboard unit 21 has apertured flanged upper and lower mounting strips 50 and 51 (FIG. 2), respectively, and left and right end apertured mounting brackets 52 and 53 (FIGS. 2 and 4), respectively; the mounting strips and mounting brackets being secured to the edges of the apertured strip 24 of insulating material and serving in the nature of a frame for the apertured strip 24. Apertured ear portions 54 and 55 (FIG. 4) extend from the upper mounting strip 50 and are riveted, or otherwise secured, to upper end portions of the left and right end mounting brackets 52 and 53, respectively. By virtue of the mounting strips 50 and 51 (FIG. 2) and the end mounting brackets 52 and 53, and suitable screws or other fastening means not shown, the inner plugboard unit 21 is secured in place in the desk 23 in the position shown in FIG. 1, with the guide pins 36, 37, 38 and 39 extending forwardly in the space 56 formed in the desk 23. In FIG. 1, the inner plugboard unit 21 is in a position to receive the outer plugboard unit 22, and a lever system, or handle, means is provided on the inner plugboard unit 21 to shift the outer plugboard unit 22 from left to right to ensure good electrical engagement between female terminal contact members on the inner plugboard unit 21 and the corresponding male terminal contact members on the outer plugboard unit 22. The lever system handle means providing for the aforesaid engagement comprises a han-

dle member 57 (FIG. 2) with the lever arm members 58 and 59 pivotally supported on rivets 60 and 61, which are secured in the upper and lower mounting strips 50 and 51, respectively. Rotatively and eccentrically supported on the rivets 60 and 61 are the circular plates 62 and 63, respectively, which are apertured to receive the pins 64 and 65, mounted in, and extending from, the lever arms 58 and 59, respectively. Apertured to accommodate and rotatively supported on the plates 62 and 63 are cleaver-shaped cam plates 66 and 67 (FIGS. 6 and 10), respectively. The handle portions 68 and 69 of the cam plates extend through apertures 70 and 71 in the upper and lower mounting strips 50 and 51, respectively, of the inner plugboard unit 21.

The extending of the handle portions 68 and 69 through the apertures 70 and 71, respectively, is to prevent undue rotation of the cam plates 66 and 67 when the lever system handle 57 and the circular plates 62 and 63 (FIG. 2) are rotated. When the lever system handle 57 and circular plates 62 and 63 are rotated, the cam plates 66 and 67 are moved against sides of the slots 152 and 153 (FIGS. 3, 9 and 10) to cause lateral movement of the outer plugboard unit 22.

Latch means 72 and 73 (FIGS. 2, 4, 6 and 10) are provided on the inner plugboard unit 21 to latch the handle member 57 in a position shown in FIGS. 1 and 2, which is the position it should occupy when the outer plugboard unit 22 is separated from the inner plugboard unit 21. It is important that the handle member 57 be maintained in this position during separation of the outer plugboard unit 22 from the inner plugboard unit 21, since the handle member 57 with its lever system controls a power switch 74 (FIG. 2), through which electrical power from a source not shown may be supplied to the electrical terminal contacts in the inner and outer plugboard units 21 and 22. The latch means 72 and 73 are alike in structure, with the exception of the direction of turning of ear portions 85 and 90 on the end of finger portions 84 and 84a (FIGS. 6 and 10). For example, the latch finger 75 of the latch means 72, as shown in FIGS. 2, 9 and 10, is pivotally supported on a pin 76 (FIG. 4) supported in, and extending from, a bracket 77 mounted on the upper mounting strip 50 of the inner plugboard unit 21. The range of movement of the latch finger 75 is limited by virtue of a slot 80 (FIGS. 9 and 10) formed in an extended portion 78 of the bracket 77 and a pin 79 mounted in the finger 75 and extending into the slot 80. A pin 81 in the finger 75, pin 82 in the bracket 77, and a spring, not shown, but extending between and attached to the pins 81 and 82, serve to urge the finger 75 toward the upper mounting strip 50. The finger 75 extends alongside the bracket 77 and has an offset 83 (FIGS. 9 and 10) terminating in a continuing finger portion 84, bearing at its outer end an integral and angularly extending lug 85, arranged to extend into the path of movement of a pointed end portion 86 provided on the end portion of the arm 58 of the lever system handles 57. When the outer plugboard unit 22 is moved into engagement with the inner plugboard unit 21, the latch finger 75 is thrust rearwardly by virtue of engagement of a curved lug 87 (FIGS. 9 and 10) on the finger 75 by an edge portion 88 of the outer plugboard unit 22, the rearward thrusting of the latch finger 75 being against the action of a restoring spring, not shown, but attached to the pins 81 and 82 above-mentioned. It will be seen in FIG. 9 that if the outer plugboard unit 22 should be withdrawn from the inner plugboard unit 21, the spring attached to the pins 81 and 82 would move the latch finger 75 toward the upper mounting strip 50; so that the lug 85 would then be in the path of movement of the end portion 86 of the arm 58 and counter-clockwise movement of the arm 58 will be prevented as shown in phantom in FIG. 9, the dot-dash lines indicating the relative position of the finger portion 84 and the lug 85 of the latch finger 75 and the end por-

tion 86 of the arm 58 when the latch finger is permitted to move to a latching position.

The engagement of the outer plugboard unit 22 against the inner plugboard unit 21 will remove the lug 85 of the finger portion 84 out of the path of movement of the end portion 86 of the arm 58 and permit the movement of the arm 58 to the position shown in FIG. 10. This is accomplished, as previously mentioned, by edge 88 of outer plugboard unit 22 causing the rearward thrust of lug 87 which is an extension of latch finger 75. The arm 59 is shown in FIG. 6 and terminates at one end in an end portion 89 which will be latched against movement by virtue of the latch means 73, which corresponds to the latch means 72 and has a lug 90 extending into the path of movement of the end portion 89 of the arm 59 when the outer plugboard unit 22 is removed from the inner plugboard unit 21.

A frame 91 is secured by rivets 92 (FIGS. 2 and 4), or other suitable fastenings, to the upper mounting strip 50 of the inner plugboard unit 21. The switch 74 is mounted on the frame 91 by mounting means 93 passing through the switch 74 and into the frame 91. One end of the frame 91 terminates in an upwardly extending lug 94 in which is adjustably supported a screw member 95 serving as a backstop for a post 96 secured in, and extending from, the arm 58. Supported on the post 96 is an apertured link 97, to one end of which is attached one end of a spring 98, the other end of the spring 98 being anchored to a pin 99 secured to, and extending from, the frame 91. The spring 98 (FIG. 2) provides an over-center throw arrangement for the handle member 57. When the handle member 57 is thrown to the right from the position shown in FIGS. 1 and 2 to the position shown in FIGS. 4 and 5, the spring 98 will maintain the wheel 100 on the post 96 against the operating lever 101 of the Micro-Switch 74 to keep the power on through the plugboard units 21 and 22 of the plugboard apparatus. When the handle member 57 is in the position shown in FIGS. 4 and 5, the handle member 57 extends across a casing of the outer plugboard unit 22 and tends to prevent complete removal of the outer plugboard unit 22 from engagement with the inner plugboard unit 21. When the handle member 57 is rotated clockwise from the position shown in FIGS. 4 and 5, the operating lever 101 of the switch 74 is released, causing the switch 74 to open, thereby shutting off the power. Subsequently, as the handle member 57 is further rotated clockwise, the male terminal contacts 103 on the outer plugboard unit 22 are brought out of contact with their corresponding female terminal contacts 25 on the inner plugboard unit 21. Since the male terminal contacts 103 on the outer plugboard unit 22 are not now in contact with the corresponding female terminal contacts 25 on the inner plugboard unit 22 and the power switch 74 is open, it is obvious that the outer plugboard unit 22 may be safely withdrawn from the inner plugboard unit 21 without the development of electrical arcs between the terminal contacts as the plugboard units are being withdrawn from each other.

#### *The outer plugboard unit 22*

The outer plugboard unit 22, as shown in FIG. 3, comprises an apertured strip 102 of insulating material in which are mounted in spaced relation a relatively large number of male electrical terminal contacts 103 shown in enlarged dimensions in FIGS. 11 and 12. Each male terminal contact 103 comprises two spaced open-seamed tubular portions 104 and 105 (FIGS. 11 and 12) of a length somewhat greater than the thickness of the insulating material, and are joined on the operative face of the material (toward inner unit 21) by a yoke portion 106. A nose 107 extends rearwardly from the yoke, which nose is constructed to fit between the ear portions 29 and 30 (FIGS. 13 and 14) of the female contact 25 in the inner plugboard unit 21, the ear portions 29 and 30 of female contact 25 spreading apart to receive the nose portion 107 with good frictional contact when the outer



plugboard unit 22 is brought into contact with the inner plugboard unit 21. The tubular sections 104 and 105 of the male terminal contact 103 extend through spaced apertures 108 and 109, respectively (FIG. 12), formed in the apertured strip 102 of insulating material. Portions of the tubular sections 104 and 105 on the terminal contact 103 are transversely slotted and distorted as the tubular sections are thrust through apertures in the strip 102 of insulating material and the distorted portions then spring out against the front 110 (FIG. 11) of the apertured strip 102 of insulating material, as these portions of the tubular sections emerge from the apertures in the apertured strip 102 of insulating material. Guide apertures 111, 112, 113 and 114 (FIG. 3) are provided in the strip 102 of insulating material to accommodate the guide pins 36, 37, 38 and 39 (FIG. 2), respectively in the inner plugboard unit 21.

The outer plugboard unit 22 has apertured flanged upper and lower mounting strips 115 and 116 (FIG. 5), respectively, and left and right end apertured mounting brackets 117 and 118, respectively, the mounting strips and mounting brackets being secured to the edges of the apertured strip 102 of insulating material and serving in the nature of a frame for the apertured strip 102.

Apertured brackets 119, 120 and 121 (FIG. 3) extend from, and are mounted in, the upper mounting strip 115 and corresponding apertured brackets 122, 123 and 124 extend from, and are mounted in, the lowest mounting strip 116. By virtue of the apertured brackets 119, 120, 121, 122, 123 and 124 and suitable screws 125, or other fastening means, a cover 126 is mounted in place to house the terminal-carrying parts of the outer plugboard unit 22. Handle members 127 and 128 are attached to, or provided on, the cover 126 to facilitate handling of the outer plugboard unit 22 when the outer plugboard unit 22 is being applied to, or removed from, the inner plugboard unit 21.

The left end apertured mounting bracket 117 (FIG. 3) serves as a support for a latch spring 129 constructed and arranged to have a V-shaped end portion 130 engage in the notch 49 provided in the guide pin 36 (FIGS. 2 and 7) when the outer plugboard unit 22 is applied to the inner plugboard unit 21. The right end apertured mounting bracket 118, in addition to serving as a support for a latch spring, not shown, but corresponding to the latch spring 129, and arranged to engage in the notch 49, shown in guide pin 37, also serves to support mounting bars 131, 132 and 133 (FIG. 3). The mounting bars are pivotally supported on a pintle 134 supported in apertured ears 135 and 137 extending from the right end mounting bracket 118. These mounting bars 131, 132 and 133 have sets of apertured projections, such as 138 and 139, shown on bars 132 and 133, respectively, and arranged to support electrical relays or other electrical components not shown. The mounting bars 131, 132 and 133 are attached by means of rivets or other suitable fastening means to an apertured tie bracket 140 extending across end portions of the mounting bars 131, 132 and 133 and having angularly extending apertured arms 141 and 142 serving as a support for an electrical terminal block 143 which may comprise a suitable apertured insulating support bearing terminals of the same general type as shown in FIGS. 11 and 12 and minus the nose portion 107. The tie bracket 140 may be held against undesired movement by screws 144 and 145 (FIG. 3) or other suitable fastening means, which extend through the tie bracket 140 and into apertured angularly extending rests 146 and 147 on the apertured attachment strips 120 and 123, respectively. By releasing the screws 144 and 145 from holding engagement with the rests 146 and 147, the assembly, comprising the mounting bars 131, 132 and 133, the tie bracket 140 and electrical terminal block 143, may be swung outwardly from the position shown in FIG. 3 by virtue of the hinged connection of the parts to the right end mounting bracket 118

through the pintle 134. When the parts shown above the cover 126 in FIG. 3 are assembled in the cover 126, the outer plugboard unit 22 is complete and may readily be manually applied to, or removed from, the inner plugboard unit 21. Removal of the cover 126 from the apertured attachment strips 119 to 124, inclusive, permits access to the electrical relays or other components mounted on the mounting bars 131, 132 and 133, and also to the electrical terminal block 143 to change any jumper wire connectors 148. By swinging out the assembly of parts comprising the mounting bars 131 to 133, inclusive, access may be had to jumper wires plugged into terminals on the apertured strip 102 and lying beneath the mounting bars 131 to 133, inclusive. Since the female electrical terminal contacts 25 in the inner plugboard unit 21 have tubular portions 26 and 27 (FIG. 14) extending through the apertured strip 24, jumper wires may be readily brought into electrical connection with the terminal contacts by inserting cord tips, or even skinned wire portions of the jumper wires, in the tubular portions 26 and 27 of required terminal contacts. When the plugboard units 21 and 22 have been properly made up and arranged for a required program of operation, the precise program having been set by the application of jumper wires to the terminals and terminal contacts in the inner and outer plugboard units, the outer plugboard unit 22, including its cover 126, is manually placed with an end portion under the handle 57, the handle 57 being in the position shown in FIG. 1. The upper mounting strip 115 on the outer plugboard unit 22 then extends under the upper mounting strip 50 (FIG. 2), and the guide pins 36, 37, 38 and 39 on the inner plugboard unit 21 extend through the apertures 111, 112, 113 and 114 (FIG. 3), respectively, formed in the apertured strip 102 in the outer plugboard unit 22. In this case, as shown in FIG. 7, an apertured flat bar 149, mounted on the inner face of the apertured strip 102, rests against the shoulder portions 43 of the guide pins 37 and 39. Latch springs 129 mounted on parts of the outer plugboard unit 22, as shown in FIG. 3, have end portions 130 operating to engage in notches 49 (FIG. 8) formed in the guide pins.

The apertured flat bars 149 and 154 (FIGS. 7 and 8), secured to end portions of the inner face of the apertured insulating strip 102, in cooperation with the chamfered portions 48 and the slots 45 formed in the guide pins 36, 37, 38 and 39 have the effect of urging the outer plugboard unit 22 toward the inner plugboard unit 21 when the outer plugboard unit 22 is moved laterally from left to right relative to the inner plugboard unit 21 and to the final position shown in FIG. 4. To release the outer plugboard unit 22 from contact-making position with the inner plugboard unit 21, the outer plugboard unit 22 must be laterally moved from right to left to clear the apertured flat bars 149 and 154 from the slots 46. In order to do this, the handle 57 must be rotated about its pivot 60, i.e., clockwise from the position shown in FIGS. 4 and 5. The guide pins 36, 37, 38 and 39 function to guide the outer plugboard unit 22 into place, and in cooperation with the latch springs 129, have a tendency to keep the outer plugboard unit 22 from undue dislodgement from the inner plugboard unit 21. In the disengaged condition, as shown in FIG. 9, the nose portion 107 of a male terminal contact 103 on the outer plugboard unit 22 is offset toward the left from the ear portions 29 and 30 of a female terminal contact 25 on the inner plugboard unit 21. It will be understood that, for each female terminal contact 25 on the inner plugboard unit 21, there is a corresponding male terminal contact 103 on the outer plugboard unit 22 also, and in order for a male terminal contact 103 to fully engage and make good electrical contact with a corresponding female terminal contact 25 on the inner plugboard unit 21, the nose portion 107 must be laterally moved in between the ear portions 29 and 30 and press the ear portions 29

and 30 slightly apart. To attain this lateral movement of the nose portions 107 of the male terminal contacts 103 relative to the female terminal contacts 25, the handle 57 on the inner plugboard unit 21 is moved from the position shown in FIGS. 1 and 2 to the position shown in FIGS. 4 and 5. This is permissible when the outer plugboard unit 22 is pressed toward the inner plugboard unit 21; the outer plugboard unit 22 is then in register with the inner plugboard unit 21. The edge portion 88 (FIGS. 9 and 10) on the upper mounting strip 115 of the outer plugboard unit 22 engages and moves the curved lug 87 on the latch finger 75 to move the latch finger 75 so that the lug 85 is out of the path of movement of the nose portion 86 of the arm 58. Also, by virtue of a similar arrangement for the latch means 73 (FIG. 6), the lug 90 is moved out of the path of movement of the end portion 89 on the arm 59. The arms 58 and 59 (FIGS. 6 and 10) are pivotally supported on the rivets 60 and 61, respectively, which are secured in the upper mounting strip 50 and the lower mounting strip 51, respectively. Eccentrically and rotatably supported on the rivets 60 and 61 are the round plates 62 and 63, respectively, which are apertured to accommodate pins 64 and 65, respectively, mounted in, and extending from, the arms 58 and 59, respectively. The cam plates 66 and 67 consist of apertures 150 and 151 so that the plates 62 and 63 rotate inside of and independently of cam plates 66 and 67 (see FIGS. 6, 9 and 10). However, as aforementioned, the plates 62 and 63 are eccentrically supported on rivets 60 and 61 so that, when the arm 58 of the lever system handle 45 is rotated counter-clockwise from the position shown in FIG. 9 to the position shown in FIG. 10, the plates 62 and 63 are caused to be eccentrically rotated about rivets 60 and 61 by the pins 64 and 65. The eccentric rotation of the plates 62 and 63 cause the cam plates 66 and 67 to move to the right (FIGS. 9 and 10) when the arms 58 and 59 are rotated from the position shown in FIG. 9 to the position shown in FIG. 10. The rightward movement of the cam plates, which are located in slots 152 and 153 in the upper and lower mounting strips 115 and 116 of the outer plugboard unit 22, cause the outer plugboard unit to move to the right so that the nose portion 106 of the male terminal contact 103 is laterally thrust between the ear portions 29 and 30 of the female terminal contact 25. As the arms 58 and 59 are rotated counter-clockwise, the female wheel 100 (FIG. 4) is moved relative to the operating lever 101, and after the terminal contacts 103 and 25 are brought into substantially good electrical connection, one with the other, the wheel 100 is moved far enough to the right to cause the power switch 74 to close. In this position, as shown in FIG. 4, the spring 98 has passed over dead center in its movement from the position shown in FIGS. 1 and 2, and is operating to hold the handle 57 in the position shown in FIGS. 4 and 5, and the wheel 100 pressing against the operating lever 101 to keep the power switch 74 closed. Clockwise movement of the arms 58 and 59 of the lever system handle 45 from the position shown in FIGS. 4 and 5 to the position shown in FIG. 2 will result in the spring 98 being passed over dead center to such position that it will urge the handle 57 to the position shown in FIG. 2. In this case, the outer plugboard unit 22, with its cover 126, may be manually and easily withdrawn from the inner plugboard unit 21 since the terminal contacts on the outer plugboard unit 22, are out of contact with the terminal contacts on the inner plugboard unit 21. With the removal of the outer plugboard unit 22 from the inner plugboard unit 21, the latch means 72 and 73 will move under urge of their springs, not shown, but located between and attached to, the pins 81 and 82 (FIG. 4), and the lug 85 on the latch finger 75 (FIGS. 9 and 10) will be in the counter-clockwise path of movement of the end portion 86 of the arm 58, and the lug 90 (FIG. 6) on the latch means 73 will be in the counter-

clockwise path of movement of the end portion 89 of the arm 59. This condition prevails as long as the outer plugboard unit 22 is removed from the inner plugboard unit 21. The handle 57 is latched against movement from the position shown in FIGS. 1 and 2, and the power will be cut off through the switch 74.

The apertured strips 24 and 102 of insulating material forming the insulating supports for the terminal contacts in the inner plugboard unit 21 and outer plugboard unit 22, respectively, are shown in the drawing as being laminated strips of insulating material since perforations to accommodate the terminals may be more readily and precisely made in the laminations than in a relatively thick unlaminated board; and the laminated structure does not become warped or permanently distorted as a relatively solid strip of insulating material would become with the strain of attachment of the terminal contacts and with aging of the insulating material. The terminal contacts supported in the strips of insulating material may be made of beryllium copper or other good conducting material and the terminals may be gold plated to prevent corrosion or oxidation and to facilitate mounting of the terminals in the apertured insulating supporting strips.

What is claimed is:

1. A plugboard apparatus comprising a pair of insulated plates adapted to mate with one another, a set of electrical terminal contacts on the mating faces of said plates, one set having laterally spaced ear portions on each terminal contact, the other set having a nose portion on each terminal contact formed to enter between and into contact with the spaced ear portions on the one set of terminal contacts, means for positioning one of said plates immediately adjacent the other, means for moving the positioned plate parallel to the mating faces of said plates whereby the nose portions on the other of said sets of terminal contacts will laterally enter between and into contact with the ear portions on the one set of electrical terminal contacts.

2. A plugboard apparatus comprising a pair of insulated mounting plates, a set of terminal contacts on one face of each plate, terminal contacts on the first of said plates having a pair of laterally convergent ears on each terminal contact, terminal contacts on the second of said plates having a nose on each terminal contact adapted to enter between and into frictional contact with the ears on the respective one of the terminal contacts on the first plate, guide means on one of said plates adapted to position the other immediately adjacent thereto but with the respective contacts laterally removed from one another, and means to move the other of said plates laterally to cause engagement of the respective contacts, whereby the noses of the terminal contacts on said second plate will laterally enter between and into contact with the ears of the terminal contacts on the first of said plates.

3. A plugboard apparatus comprising two apertured supports of insulating material, a set of spaced ear-equipped terminal contacts supported on one of said apertured supports, a set of spaced nose-equipped terminal contacts supported on the other of said apertured supports, and means for moving one of said apertured supports perpendicularly relative to the other whereby the terminals of said supports lie in the same plane and then moving said one of said apertured supports laterally relative to the other so that nose portions on said nose-equipped terminal contacts will come between and in engagement with the ear portions of said ear-equipped terminal contacts.

4. A plugboard apparatus having a fixed plugboard, terminal contacts on said plugboard, a movable plugboard, a set of terminal contacts on said movable plugboard, each of said contacts comprising a pair of spaced tubular portions extending through apertures formed in the respective plugboards, a yoke joining the adjacent

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ends of the tubular portions of each contact and adapted to engage the face of the respective plugboard, a pair of opposed converging ears on the contacts of one of said plugboards and noses on the contacts of the other of said plugboards, said noses having a width greater than the space between said converging ears whereby the noses will enter between and into frictional contact with the opposed ears of a corresponding terminal contact in said one plugboard when said movable plugboard is adjacent to said fixed plugboard and is moved laterally relative to said fixed plugboard, guide means on said fixed plugboard for guiding said movable plugboard in a direction perpendicular to the face of said fixed plugboard, a movable handle system supported on said fixed plugboard for moving said movable plugboard laterally relative to said fixed plugboard, a power switch controlled by said handle system for controlling the application of electrical power to said terminal contacts, and means operable by said handle system to close said power switch only when said movable plugboard has been moved laterally with respect to said fixed plugboard.

5. A plugboard apparatus comprising a fixed plugboard unit, terminal contacts on said fixed plugboard unit, a movable plugboard unit, a set of terminal contacts on said movable plugboard unit adapted to engage the terminal contacts on said fixed plugboard unit, a cover for and containing said movable plugboard unit, spaced handles on said cover to facilitate manual removal and application of said movable plugboard unit to said fixed plugboard unit, a handle system supported on said fixed plugboard unit for moving said movable plugboard unit laterally along said fixed plugboard unit when adjacent thereto, a power switch controlled by said handle system to control the application of electrical power to said terminal contacts, said handle system extending across the outside of said cover and said movable plugboard unit while said power switch is closed.

6. In a plugboard apparatus having a fixed plugboard unit and a movable plugboard unit, terminal contacts on adjacent faces of said plugboard units comprising a pair of tubular portions extending through their respective plugboards, a yoke joining the ends of said tubular portions of each contact along the adjacent faces of said plugboards, a pair of opposed converging ears extending from the yokes of terminals on one of said plugboards and away from their plugboard, noses on the yokes of the terminals on the other of said plugboards and away from their plugboards, said noses having a width greater than the space between said converging ears whereby they spread apart the ears of the respective mating terminal when engaged therewith, guide means on said fixed plugboard for guiding said movable plugboard perpendicularly to a position immediately adjacent to said fixed plugboard and with the respective contacts adjacent to but disengaged from each other, a handle system supported on said fixed plugboard unit for moving said movable plugboard unit laterally along said fixed plugboard unit to bring the respective contacts into engagement, a power switch supported on said fixed plugboard unit and operable by said handle system to control the application of power through said terminal contacts only when said contacts are in engagement, latch means to hold said handle system against movement when said movable plugboard unit is separated from said fixed plugboard unit, and means to hold said handle system against undue movement when said movable plugboard unit is in full engagement with said fixed plugboard unit.

7. A terminal contact comprising a pair of spaced tubular portions, a yoke portion joining one end of each of said tubular portions and a pair of opposed con-

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verging ear portions extending outwardly from said yoke portion, said ears each including a rounded under portion extending away from said yoke portion in a direction perpendicular to a single common plane passing through the axis of each said tubular portion whereby said ears will be spread apart by a nose moved between said rounded underportion in a direction perpendicular to the axis of said yoke.

8. A terminal contact comprising a pair of spaced tubular portions, a yoke portion joining one end of each of said spaced tubular portions and a nose portion integral with and extending outwardly from said yoke portion and along the axis of said yoke portion, said nose having a semicircular cross section whereby said semicircular portion of said nose will spread apart a pair of outwardly converging ears upon lateral movement thereof into engagement with said ears.

9. Cooperating terminal contact members for a pair of mating plugboards operable to be brought together in an electrical circuit comprising in the case of each terminal contact member a pair of spaced tubular portions constructed for mounting in spaced apertures formed in an insulating support and a yoke adapted to abut one face of such insulating support joining the ends of said spaced tubular portions, converging ears extending from the yoke of one of said terminal contact members to form a pair of opposed contacts and a nose portion extending from the yoke of the other of said terminal contact members and means for moving said one of said terminal contact members perpendicularly relative to said other of said terminal contact members whereby said nose portion enters laterally between and into contact with said ears.

10. A female terminal contact comprising a pair of parallel spaced open-seamed tubular portions adapted to extend through a pair of spaced apertures in an insulating support and form receptacles for wire conductors, a semi-circular yoke adapted to abut perpendicularly one face of such insulating support joining the adjacent ends of said tubular portions, a pair of opposed converging ear portions extending outwardly from said yoke portion along the axis of said yoke portion, said ears each including a rounded under portion extending away from said yoke portion in a direction perpendicular to a single common plane passing through the axis of each said tubular portion whereby said ears will be spread apart by a nose moved between said rounded underportion in a direction perpendicular to the axis of said yoke.

11. A male terminal contact comprising a pair of parallel spaced open-seamed tubular portions adapted to extend through a pair of spaced apertures in an insulating support and form receptacles for wire conductors, a semicircular yoke adapted to abut perpendicularly one face of said insulating support joining said tubular portions, and a nose portion integral with and extending outwardly from said yoke portion and along the axis of said yoke portion, said nose having a semicircular cross-section whereby said semicircular portion of said nose will spread apart a pair of outwardly converging ears upon lateral movement thereof into engagement with said ears.

12. A female terminal contact comprising a pair of spaced parallel open-seamed tubular portions, a semicircular yoke extending between the adjacent ends of said tubular portions, the axis of said yoke being substantially parallel to the axis of said tubular portions, a pair of opposed converging ear portions extending outwardly from said yoke portion, said ears each including a rounded under portion extending away from said yoke portion in a direction perpendicular to a single common plane passing through the axis of each said tubular portion whereby said ears will be spread apart by a nose moved be-

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tween said rounded underportion in a direction perpendicular to the axis of said yoke.

13. A male terminal contact comprising a pair of spaced parallel open-seamed tubular portions, a semicircular yoke extending between adjacent ends of said tubular portions, the axis of said yoke being substantially parallel to the axis of said tubular portions, and a nose portion integral with and extending outwardly from said yoke portion and along the axis of said yoke portion, said nose having a semicircular cross section whereby said semicircular portion of said nose will spread apart a pair of outwardly converging ears upon lateral movement thereof into engagement with said ears.

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## References Cited by the Examiner

## UNITED STATES PATENTS

2,111,118	3/38	Lake	317-99
2,417,369	3/47	Luhn	339-228
2,922,135	1/60	Hoberg et al.	339-258
2,937,357	5/60	Kennedy	339-258
3,001,171	9/61	Schultz	339-258

## FOREIGN PATENTS

299,053 3/54 Switzerland.

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