

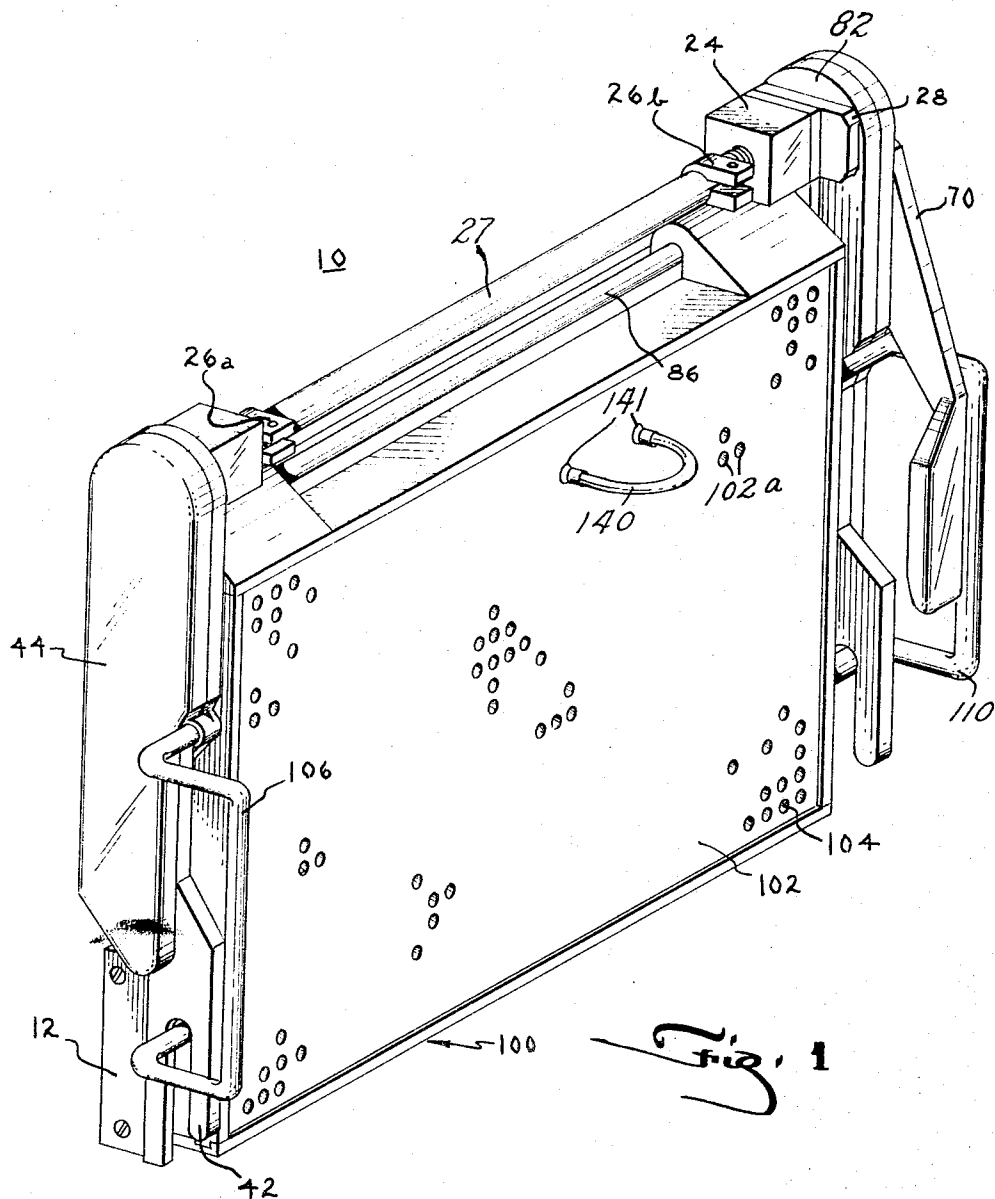
Oct. 17, 1967

L. C. FRIEND
MULTIPLE SWITCH

3,348,187

Filed Aug. 25, 1964

8 Sheets-Sheet 1



INVENTOR.
LINDSAY CARLTON FRIEND
BY *Curtis Morris Safford*

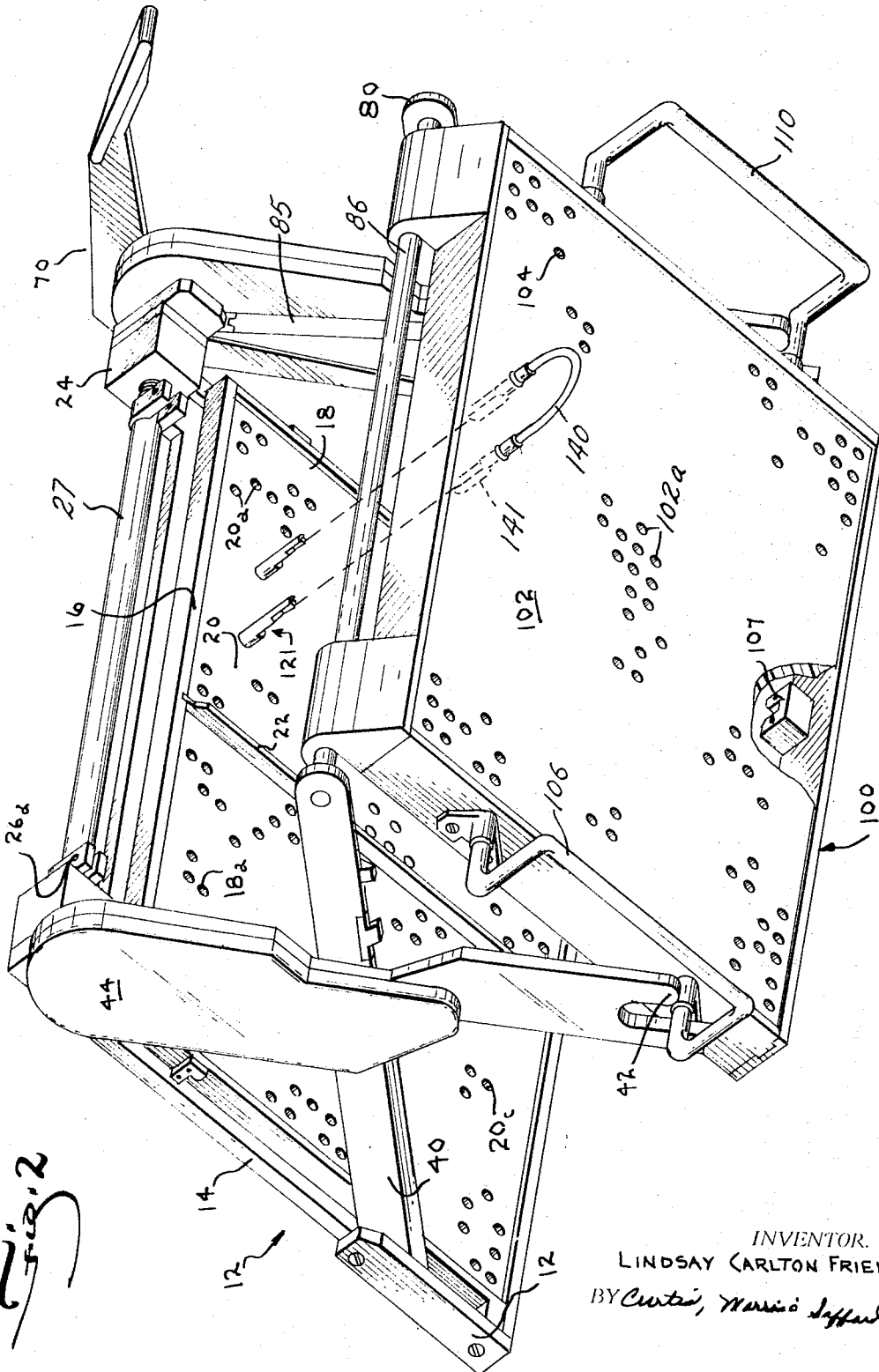
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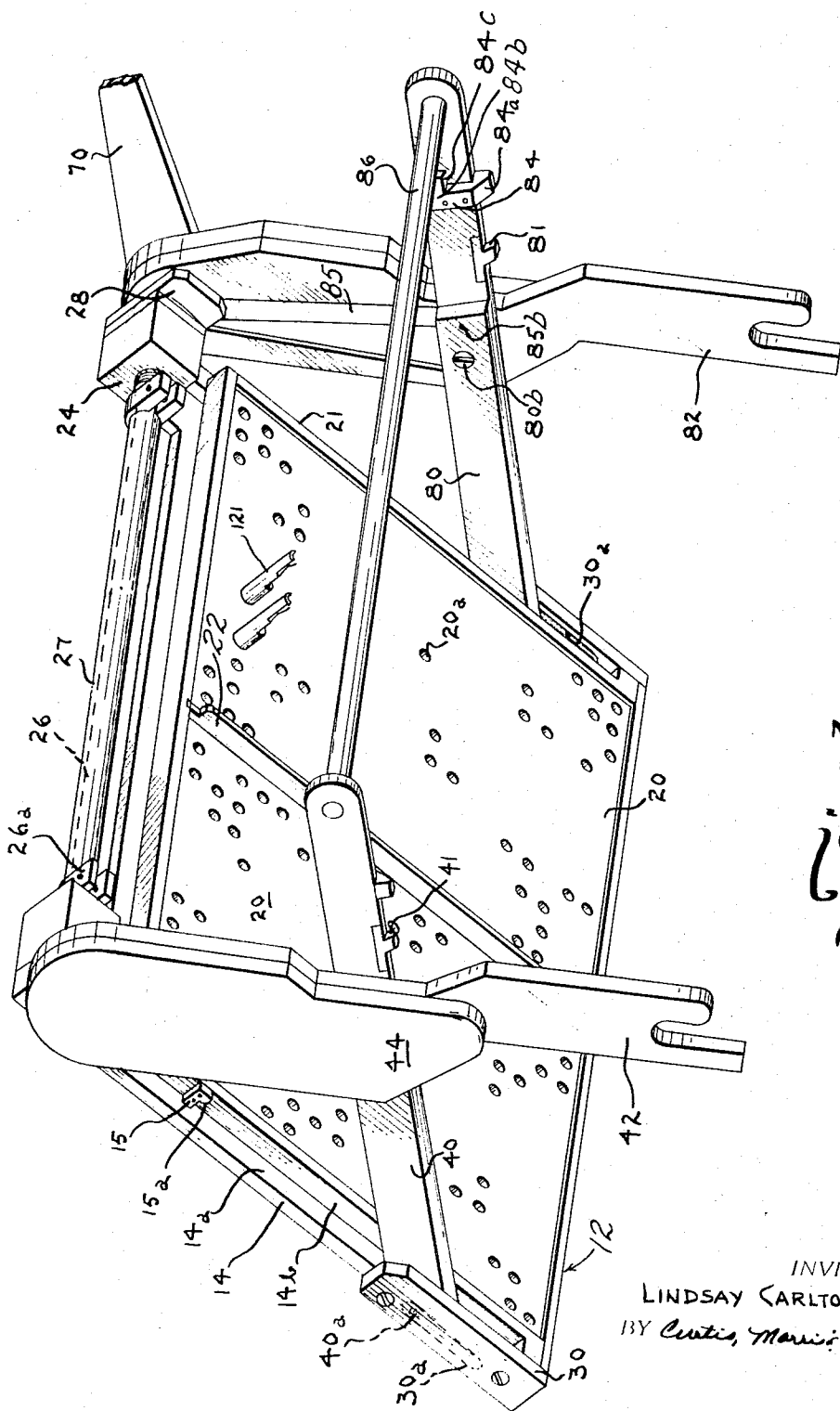


Fig. 3

INVENTOR.
LINDSAY CARLTON FRIEND
BY *Curtis, Morris & Safford*

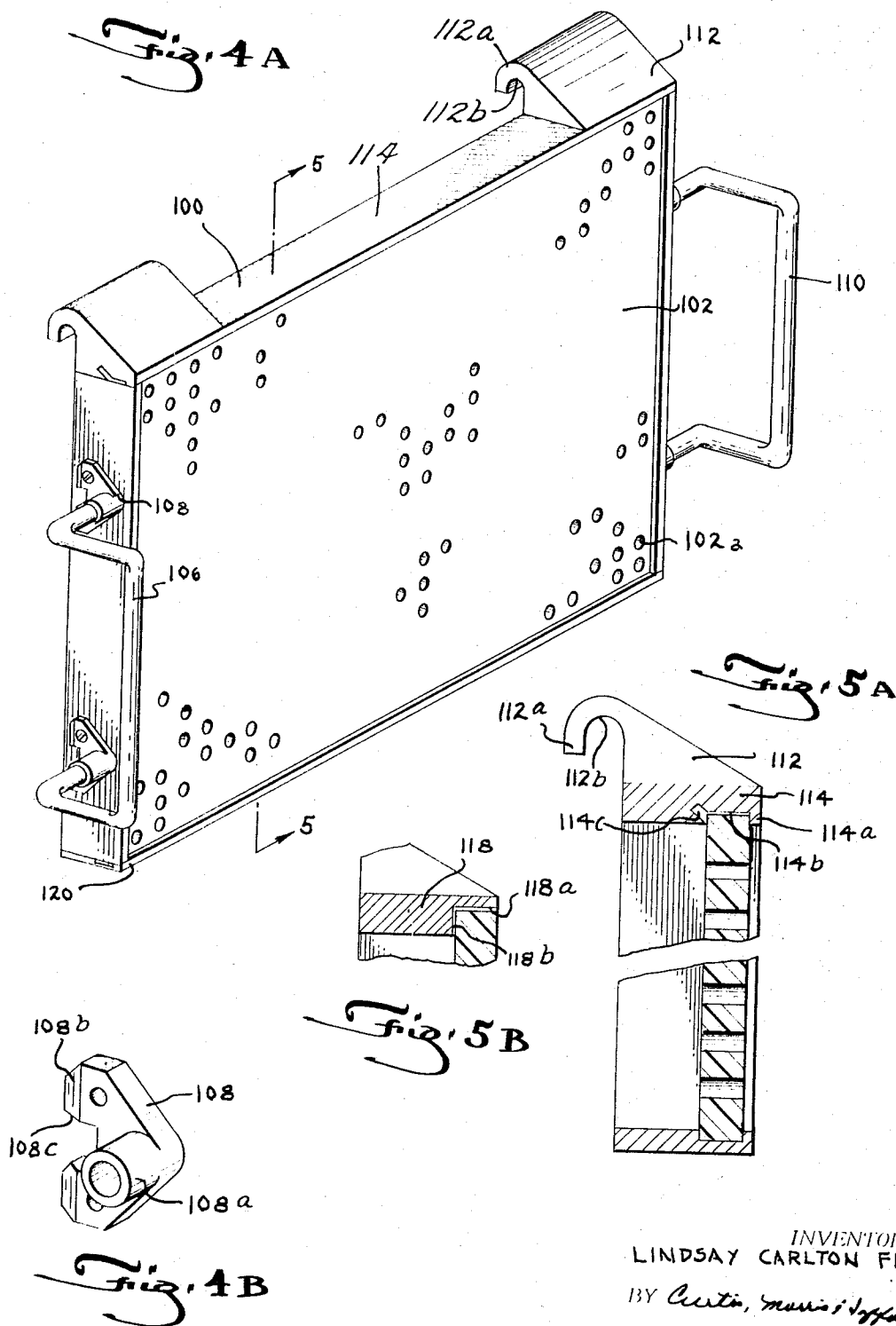
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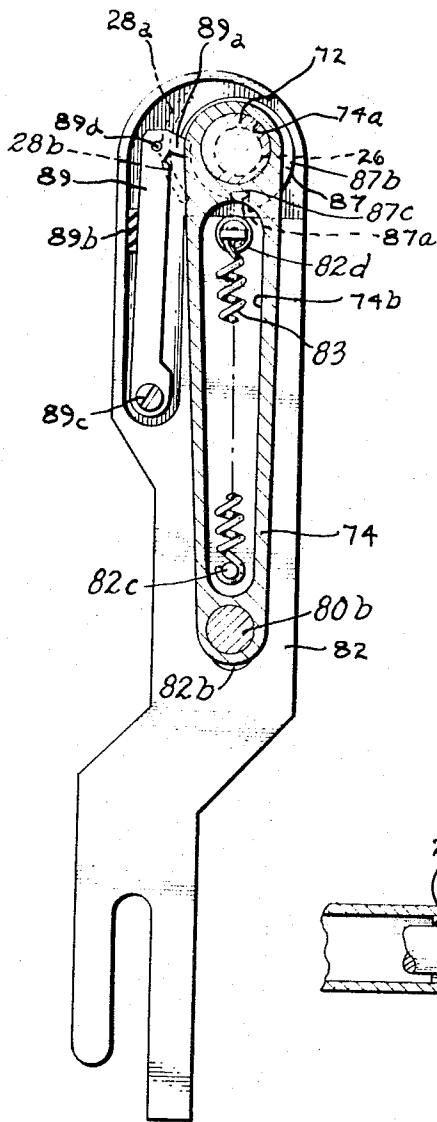


Fig. 6

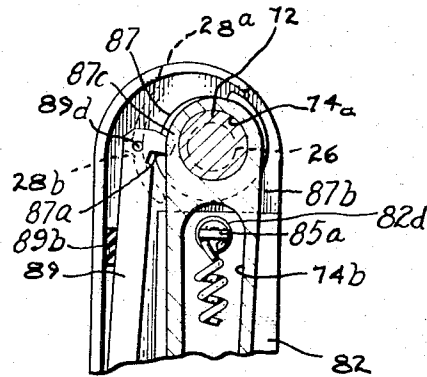


Fig. 7

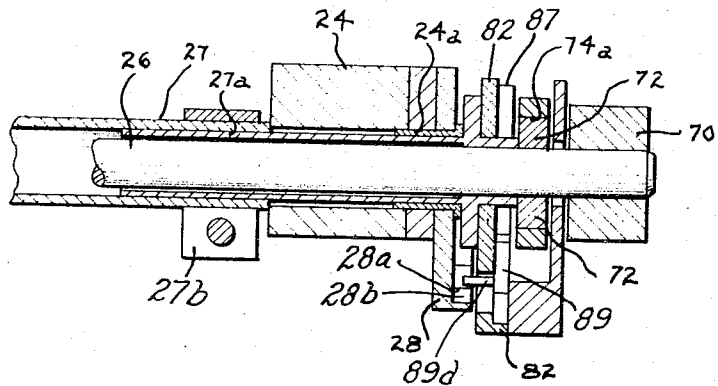


Fig. 8

INVENTOR
LINDSAY CARLTON FRIEND
BY *Curtis, Morris & Lyford*

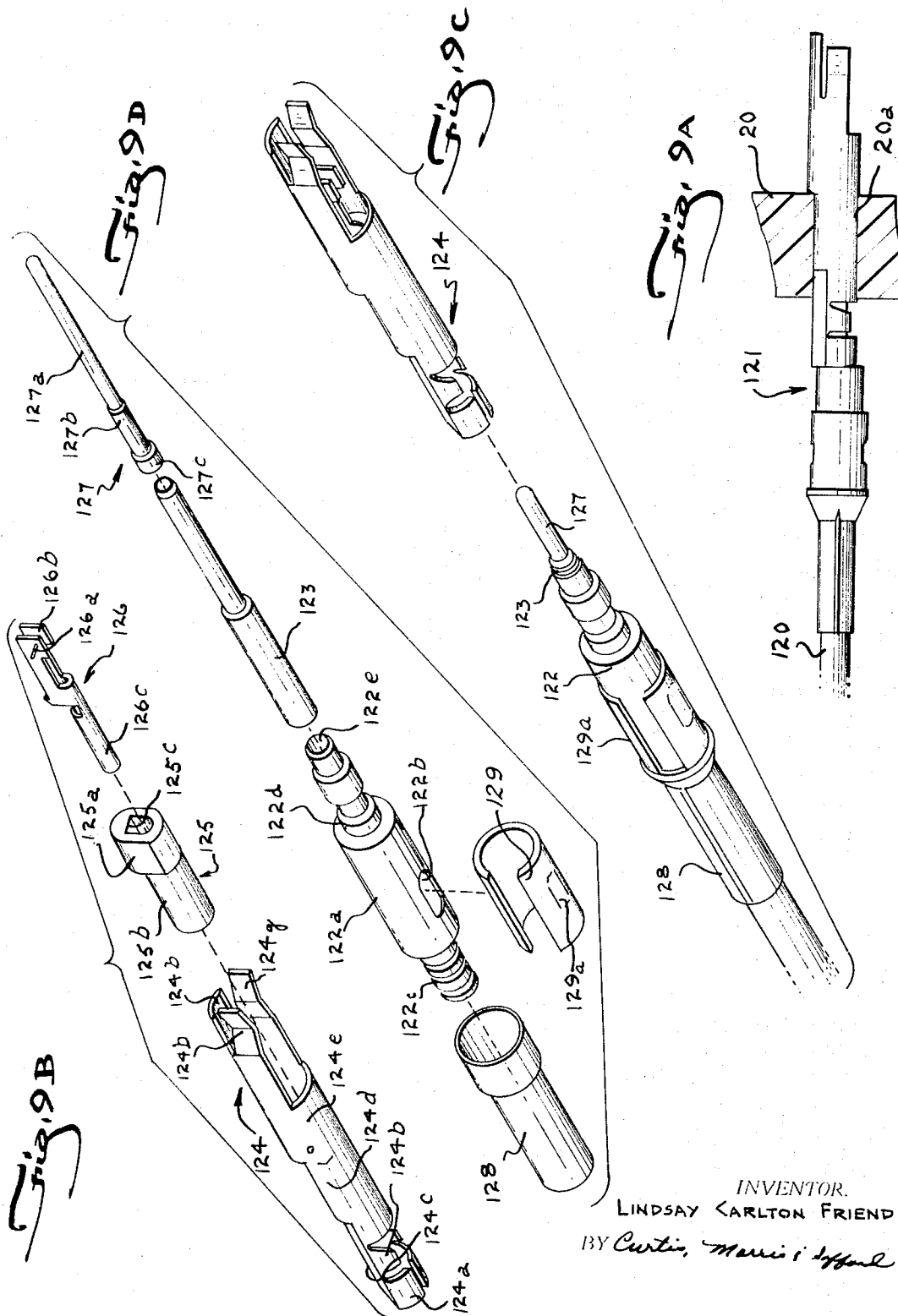
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MULTIPLE SWITCH

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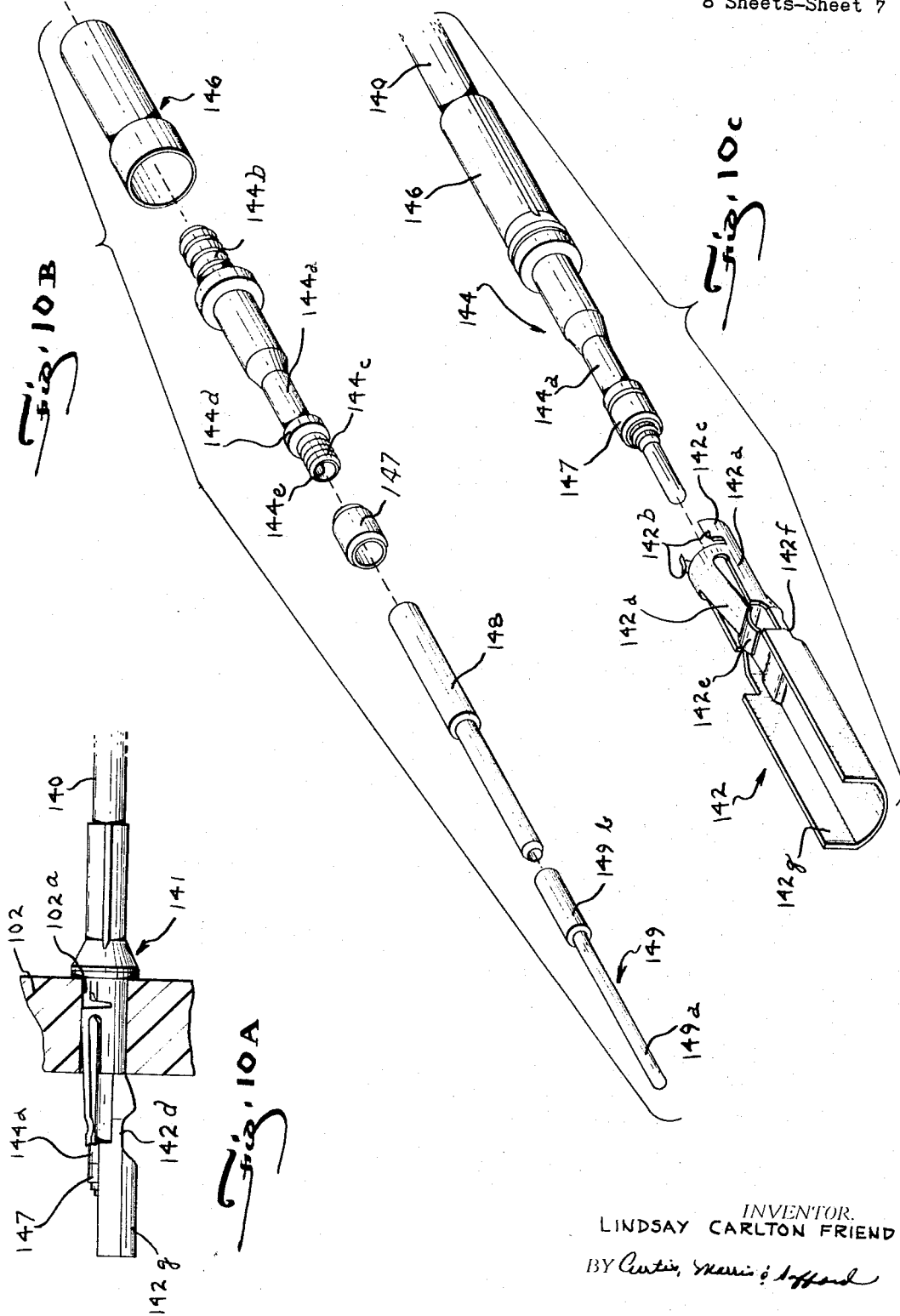
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MULTIPLE SWITCH

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8 Sheets-Sheet 7



INVENTOR.
LINDSAY CARLTON FRIEND
BY *Curtis, Harris & Doffner*

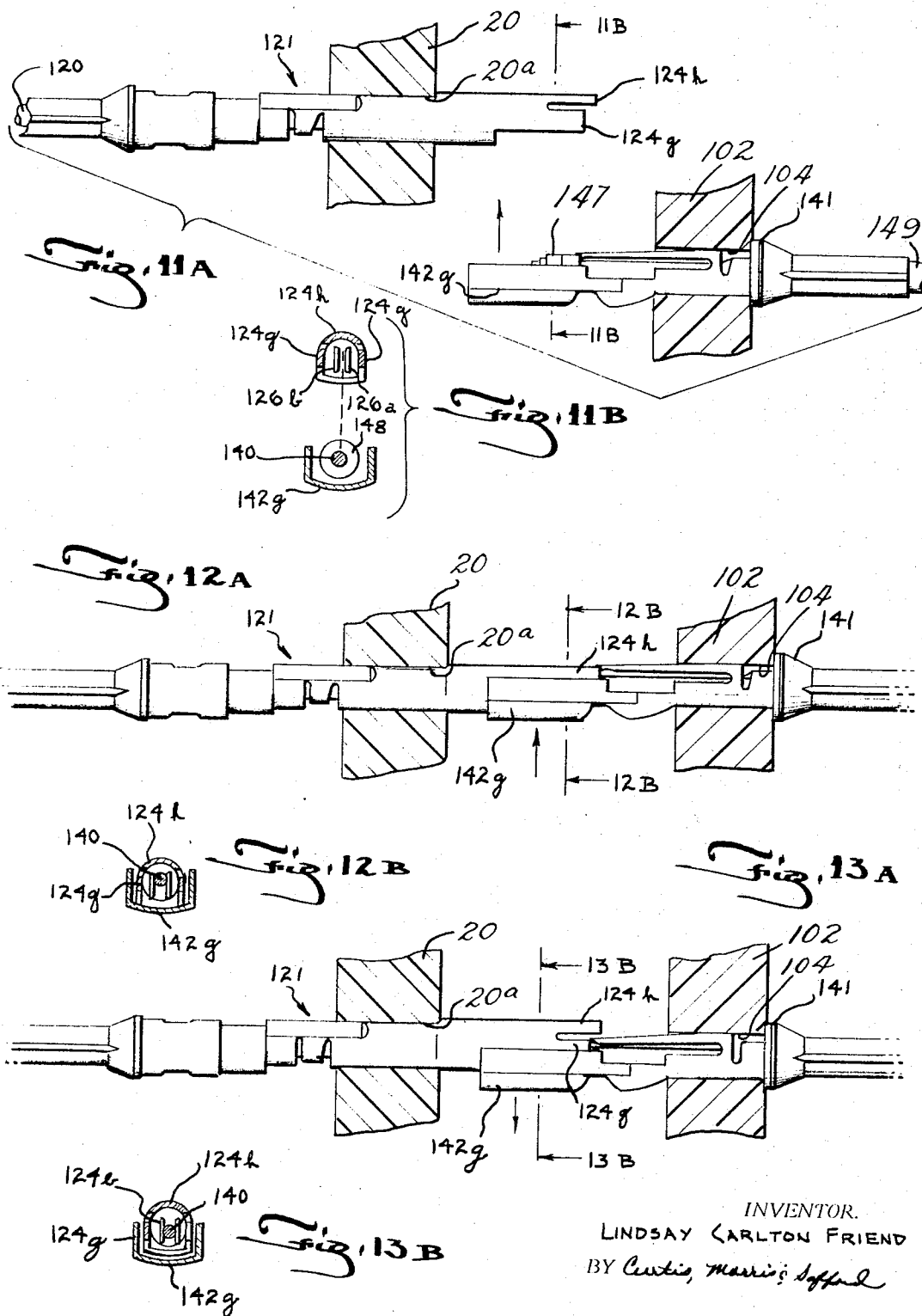
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L. C. FRIEND
MULTIPLE SWITCH

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8 Sheets-Sheet 8



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3,348,187

MULTIPLE SWITCH

Lindsay Carlton Friend, Camp Hill, Pa., assignor to AMP Incorporated, Harrisburg, Pa.
Filed Aug. 25, 1964, Ser. No. 391,934
13 Claims. (Cl. 339-18)

The present invention relates to an improved plug-board apparatus of the type particularly suited to accommodate coaxial and shielded signal paths.

Existing programming systems evoke technical criticism in several respects. A first point is that insertion and withdrawal of program boards is overly difficult for the typical employee user. A second point is that occasion for damage to contactor parts during program board change is all too possible.

With respect to existing shielded systems, increasing standards incident to an increase in environmental RFI have made partial shielding unacceptable for certain critical applications. As to coaxial systems of present design, the most often cited complaints are excessive expense and lack of simultaneous multiple closure, the typical system being no more than an array of high quality coaxial connectors which must be individually connected and disconnected to effect program change.

The present invention purports to provide a new plug-board system which answers the foregoing shortcomings and includes as a feature object the provision of a novel contactor and contactor mounting means which is tolerance accommodating to permit high density packaging of large numbers of coaxial and shielded connectors. A further object is to provide a self-aligning contactor and a self-aligning contactor board assembly for plugboards which assures a substantial wiping action for two conductive paths per contactor position.

A still further object is to provide a truly shielded and coaxial contactor assembly which permits multiple and simultaneous engagement and disengagement of individual signal paths each shielded and coaxial at the point of connection. Another object of the invention is to provide a front panel carriage assembly which facilitates rapid panel changes without contactor damage.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there are shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention, but are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIGURES 1 and 2 are perspective views showing the plugboard assembly of the invention in closed and open positions, respectively;

FIGURE 3 is a perspective view of the plugboard assembly of FIGURE 2 with the front board removed;

FIGURE 4A is a perspective view of the assembly front board;

FIGURE 4B is an enlarged perspective view of the front board handle bracket which serves to transmit board camming forces;

FIGURE 5A is a partial elevation showing in section details of the front board of FIGURE 4A;

FIGURE 5B is a partial elevation of an alternative construction of a front board shown in section;

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FIGURES 6 and 7 are elevational views of part of the board carriage mechanism of the assembly of FIGURES 1-3;

FIGURE 8 is a sectional view of the carriage driving mechanism;

FIGURE 9A is a side view showing the rear board contactor of the invention with lead attached and positioned in a sectioned board;

FIGURES 9B-9D are exploded perspective views of the contactor of FIGURE 9A depicting the components thereof;

FIGURE 10A is a side view showing the front board contactor of the invention with lead attached and positioned in a sectioned board;

FIGURES 10B-10C are exploded perspective views of the contactor of FIGURE 10A depicting the components thereof;

FIGURE 11A is a side view of front and rear board contactors secured in boards shown in section and in the initial position of travel following board closure;

FIGURE 11B is a sectional view of the contact paths of the contactors shown in FIGURE 11A;

FIGURE 12A is a side view of the contactor assembly of FIGURE 11A at a further position of travel;

FIGURE 12B is a sectional view of the contact paths of the contactors of FIGURE 12A;

FIGURE 13A is a side view of the contactor assembly of FIGURES 11A and 12A in the final position of travel in closure; and

FIGURE 13B is a sectional view of the contact paths of the contactors of FIGURE 13A.

General features

In overall operation the plugboard assembly of the invention is similar to that of any standard system; namely, there is provided a rear bay or board, a carriage and front board driving mechanism tied to the rear board and a front board which may be positioned in or on the carriage to be transported in a controlled motion of closure relative to the rear board. Thus, in FIGURE 1 the assembly of the invention 10 includes a rear board 12 having a carriage pivotally supported thereon comprised of arms and links which guide and support a front board 100. The rear board includes panels such as 20 shown in FIGURES 2 and 3, each apertured as at 20a to receive a rear board contactor assembly such as 121 in turn electrically terminated to leads on the back side of the rear board. These leads go to and come from electrical and/or electronic components which, when interconnected in a suitable and selected pattern, will perform a distinct program function. The interconnection is provided by pairs of contactors such as 141 connected via leads 140 and carried by the front board 100 by panels such as 102 in apertures such as 102a.

As will be made apparent, program changes may be effected by withdrawing contactors from a given board and reinserting such in a different pattern; or, separate pre-patched front boards may be used with a single rear board and carriage. This latter use is preferred where programs are frequently repeated and frequently changed; the former use being preferred where either repetition or change is infrequent.

From the detail to be hereinafter given and from FIGURES 2 and 3, it will be apparent that the carriage of the invention assembly "takes" the front board in a position well removed from any possible incidental engagement which might damage the contactors of either board. Further, by providing a bar such as 86 extending fully across the front of the assembly, initial installation of the front board is facilitated. One need only get the front board hooks generally centered on some portion of the bar and the carriage and drive therefor is adapted to ac-

comply with a proper seating and centering of the board prior to final closure movement. As will be more fully developed, the carriage includes means to hold the front board out in the position of FIGURE 2 until handle 70 is operated to effect closure. This feature permits the assembly to be maintained in a position ready for immediate closure, but quite obviously open. The carriage of the invention is driven by handle 70 through a first motion of closure to place the contactors of the front board in a spaced but overlapping position relative to the contactors of the rear boards. Upon further operation of handle 70, the driving mechanism of the carriage acts to effect final closure. Interlocks are provided to prevent either motion accidentally.

The handles 106 and 110 of the front board 100 are made to serve an additional function; namely, to provide points of force application for driving the front board home to its final position of closure. This feature eliminates the additional pin and hook components of prior art devices as well as the usually heavy board frame base plate necessitated by bottom or top cammed assemblies typical of the prior art.

From FIGURES 11A-13B it will be apparent that the contactors of the invention are of a somewhat more complicated structure than that of non-shielded or non-coaxial systems. This is occasioned by the use of electrically separated conductive paths for the inner and outer conductors of shielded or coaxial cable, which paths are extended between the rear and front boards to a region of separate contact for center paths substantially surrounded by conductive material also brought into separate contact for individual contactor positions. As a basic part of the invention each front board contactor is provided with a limited but defined "play" in the center conductive path to better assure mating of each of the individual contactors, notwithstanding a fixed mounting of the outer path. Additionally, both inner and outer paths of each contactor are provided with spring forced portions including wiping actions to maintain a low resistance path in the presence of wear and surface contamination.

The duality of each contact position sponsors a need met by the invention for a special and exact alignment of front and rear boards. As part of the invention assembly, means are provided which accomplish alignment through the use of relatively loose tolerance components linked together in a manner which controls mating only in the last motion of closure.

From the foregoing and particularly from the detailed description to follow, it should be apparent that the invention embraces features which may be used separately. For example the carriage mechanism and board alignment features may find uses in non-coaxial systems. The means provided to interlock the system against an improper sequence of closure or camming can be employed in single conductor apparatus as well as in coaxial systems, although it will be appreciated that the need of this feature is greater where alignment of components is more critical. The coaxial contactors of the invention may be employed in fixed patching systems or connectors wherein the equivalent of front and rear board members are held in a common frame.

Detailed description

Turning now to a specific description of the invention, reference is made to FIGURES 1-8 for the rear board, carriage and front board construction detail. As seen in FIGURE 3, the rear board 12 includes a frame preferably of metallic stock having side pieces such as 14 shown on the left side of FIGURES 2 and 3 and channeled as at 14a to accommodate the links of the carriage which nest therein upon closure as shown in FIGURE 1. Each side piece includes at the bottom thereof a plate 30 slotted as indicated by 30a to guide and hold a pin such as 40a affixed to the carriage lower link which rides

up and down as the carriage is operated. Secured to the top of the rear board frame is a carriage driving mechanism including an arm 70 connected to a shaft 26 which rides within and free of a further shaft comprised of an outer sleeve 27 supported by bearings within bearing and cam supports such as 24.

Again, referring to FIGURE 3, in the frame of the rear board are panels 20 apertured as at 20a to receive rear board contactors terminated on the back thereof to input and output leads. The panels 20 are preferably of molded plastic material with the apertures arrayed in a matrix to centers complemented in the assembly front board. In the center of the panels 20 and extending across the face thereof in a vertical sense is an aligning member 22 rigidly fixed to the rear bay frame. Upon closure of the front board a member 107, shown in FIGURE 2 rigidly affixed to the front board bottom, mates with 22 to center the front and rear panels and the contactors of the system. The mating surfaces of 107 and 22 are suitably beveled or tapered to preclude any slight mismatch from causing the parts to jam. The inner clearance between mating surfaces is made to a close tolerance to assure proper centering of the boards.

The front board construction is shown in FIGURES 4A-5C and includes panels such as 102 apertured as at 102a to receive contactors inserted therein which extend to engage the rear board contactors as generally described. A frame, preferably of metal stock is provided surrounding and supporting the panels 102. Because of the technique of camming utilized, the frame may be of a generally lighter construction than heretofore required, particularly as to the bottom piece 120. Attached to the frame top piece 114, at each end, are hook members 112 which extend back over the board rear face and include portions 112a curved to provide a recess 112b slightly larger in maximum width than the cross bar 86 of the carriage, but closing to a rounded diameter to fit such bar. The hooks 112 are of a width to visually present themselves to the user and to maintain a substantial surface area in engagement with the bar.

On each side piece of the front board frame are two brackets such as 108 shown relative to handle 106 and in detail in FIGURE 4B. Each bracket includes a portion such as 108a into which the handle is fitted and supported. Further included are spaced portions extending rearwardly to present a beveled surface 108b and defined therebetween a slot 108c adapted to be engaged by the corresponding lug of each lower carriage link; such as lug 41 of link 40 shown to the right in FIGURE 3. Through the engagement of the lugs on links 40 and 80 with the brackets, the front board is carried upwardly to effect a final contactor engagement as described hereinafter.

Referring to FIGURES 5A and 5B, the interior of the frame pieces is relieved as shown with respect to piece 114 to define a locking groove 114b between faces 114a and 114c which holds the panels 120 within the frame. Preferably, the panels are bonded to the frame pieces in the manner described in U.S. patent application Ser. No. 350,450 filed Mar. 9, 1964. An alternative mounting of the panel is shown in FIGURE 5B to more readily permit silk screening of the front face of the panel for programming instructions. In this embodiment a frame piece 118 includes a recess 118a receiving a panel which rests against an inner face 118b, such that the outer panel face is flush with the outer frame edge.

Now, as should be apparent, the lifting force to drive the front board 100 upwardly is applied via the brackets 108 from a point toward the center of the board rather than at the bottom or top thereof. Because of this, the main part of the frame carries tensional loads rather than compressional loads as in prior art devices. This permits a reduction in the thickness of the frame pieces with an incident saving in weight and cost.

The carriage of the assembly of the invention includes

crossed links 40-42, 80-82, as shown in FIGURE 3 on either side which are substantially identical except as to being reversed to face inwardly. The links 40 and 80 are secured as mentioned through pins such as 40a which float but are linked to vertical travel by a part of the rear board frame. The links are further connected by a common pin such as 80b shown in FIGURE 3, positioned at the link cross point and adapted to permit a vertical movement of 40 and 80 relative to links 42 and 82 when the carriage is closed in the position of FIGURE 1. Upper links 42 and 82 are pivotally supported on a tubular extension 27a of sleeve 27 secured therein by clamps such as 27b, as shown in FIGURE 8. The extension end is supported in a bearing 24a within 24 and is tied to an eccentric 72 secured to shaft 26. As shown in FIGURE 6, a lifting arm 74 includes a cam surface 74a in contact with the eccentric 72 and adapted to be driven upwardly and downwardly by rotation of arm 70. The arm 74 is secured for a limited sliding movement relative to 82 through an extension of pin 80b through a slot 82b to drive the link 80 vertically to, in turn, drive the front board and its contactors in the final movement of closure.

Within a recess 74b of arm 74 is a spring 83 operable in tension and tied between a pin 82c on link 82 and an arm 85 which rests within 82 on the opposite side thereof as shown in FIGURES 2 and 3. As shown in FIGURES 6 and 7 projection 85a of the upper end of 85 rides in a slot 82d. The lower end of 85 is tied by a pin 85b to the link 80 as shown in FIGURE 3. When the front board is closed spring 83 is loaded to exert a pulling force on 85a which force is applied to link 80 to bias the carriage and front board outwardly after an initial opening movement via drive from 70.

The structure including the eccentric shown as 72, arm 74, spring member 83, arm 85 and its attachment to the link 80 is reproduced in the opposite side of the assembly relative to links 40 and 42 and such is covered on both sides by plates such as 44. The sleeve 27 is connected thereto as is shown in FIGURE 8 to operate the left side mechanism in the same manner.

A travel limiting and locking mechanism is provided through a member 87 secured to the eccentric 72 and thus to shaft 26 for operation by movement of handle 70. The member 87 includes a stop surface 87a which engages the upper portion 89a of a latch member 89 upon operation of the carriage to the closed but not fully cammed position. This position is shown in FIGURE 7.

As the carriage is operated to drop or cam the front board downwardly to open contact, the member 87 rotates around to the position of FIGURE 7 with the latch member 89 riding upon a surface 87b to be held outwardly until a recess 87c is reached to permit the member 89 to snap inwardly as driven by a spring 89b about a pivotal connection 89c (shown in FIGURE 6) with arm 82. Projecting from the upper end of 89 and through a slot 82d is a pin 89d which cooperates with interior surfaces 28a and 28b in member 28. With the carriage closed and cammed, pin 89d is positioned and held by a face 87a of 87 in the recess formed by 28b to lock the carriage from outward movement prior to the front board being cammed downwardly to the open contact position. With the latch member seated as shown in FIGURE 7, the pin 89d is free for sliding movement along surface 28a and the carriage is free for opening movement. Thus, when the carriage is prepared for opening movement the front board and its contactors are locked in a disengaged position relative to the rear board contactors and no camming thereof can occur. Alternatively, when the contactors of the board are engaged there is a further interlock to be described which prevents accidental opening of the carriage.

As a further part of the alignment and interlock mechanism of the invention assembly, links 40-42 and 80 and 82 include guide members such as 84 shown secured to

link 80 in FIGURE 3. The forward edge of these members is beveled as at 84a to catch and guide the inner edge of the frame of the front board to a center position as the carriage is moved from the position of FIGURE 2 to the position of FIGURE 1. The thickness of each member is made so as to provide a relatively flat surface 84b which fits against the outer surface of the rear board frame piece 21 with the outer surfaces of the front board frame sides resting between the beveled portions of the guide members. On the rear of each guide member is a vertical projection such as 84c on member 84 which includes a forwardly oriented face adapted to cooperate with a vertical face shown to the right of FIGURE 3 as 15a of a locking member 15. The guide members are positioned so that the faces of members 84 and 15a clear upon initial closure movement but engage upon the front board being driven upwardly to close contact. It is preferred that the guide members such as 84 be of a resilient material, as for example Nylon.

Also carried by links 40 and 80 are lugs such as 41 and 81 which serve to develop the vertical camming forces which drive the front board of the assembly to close its contactors against the contactors of the rear boards. Each of the lugs is secured to its associated link in a position to engage a slot in the upper mounting bracket of the front board handles. This slot is shown as 108c in the bracket 108 of FIGURES 1-3 and 4A-4B. Upon closure of the carriage from the position of FIGURES 2 and 3 to the position of FIGURE 1 the slot faces are carried to engage and seat over the faces of the lugs 41 and 81. Then, as the final movement of the carriage driving mechanism is effected to pull links 40 and 80 upwardly, the lugs operate through an engagement with the brackets to carry the front board in its final and vertical motion to accomplish contactor closure. During opening of the assembly, the reverse function occurs with the bottom faces of lugs 41 and 81 driving the front board downwardly to break the existing contact paths and effect an opening of existing circuits.

Here, it is mentioned that one alternative of the invention contemplates a reversal of parts wherein the lugs are carried by the front board handle brackets and the slots are placed in the links 40 and 80. Additionally, it is contemplated that lugs or slots may be alternatively and/or additionally installed on the lower handle brackets relative to mating parts on the links. The use of both brackets and two lugs per front board side may be preferred in plugboard systems larger than that shown; i.e., where the camming load is significantly greater.

Heretofore, the terms coaxial and shielded have been employed as distinctive adjectives. The structural distinction is not clear since shielded cable is frequently coaxial and vice versa. The distinction lies in one of function with shielding serving primarily to protect a signal carried on an inner conductor from RFI and with signal paths being coaxial primarily to provide desirable transmission characteristics for higher signal frequencies. The invention assembly is adapted to provide both what may be termed a shielded connection and a coaxial connection in the zone of contact between the front and rear boards.

Turning now to a description of the invention contactors and taking first the rear board contactor, reference is made to FIGURES 9A-9D. The contactor is shown as 121 secured to a coaxial or shielded lead 120 and affixed in aperture 20a of rear board 20. The contactor 121 includes two parts, a forward shell 124 and a terminal 122. Shell 124 is separately shown in FIGURE 9B and is formed of spring stock brass or like material to include a rear part 124a having ears to receive and hold under spring pressure the contactor terminal through a surface contact with portion 122d thereof. Forward of 124a is a further portion 124b having ears adapted to be spread apart to lock the contactor shell 124 and thus terminal 122 against forward axial movement relative to board 20 as shown in FIGURE 9A. The lower support portion of 124a

and 124b is V-shaped to cooperate with a raised portion not shown in the end of aperture 20a to lock the shell against relative rotational movement in board 20. The raised portions are oriented from aperture to aperture to effect a proper and common orientation of all of the rear board contactors.

The shell 124 includes a generally cylindrical portion 124d adapted to fit within and be supported rather tightly by the surfaces of aperture 20a and a portion 124e of larger diameter which extends from the front face of 20. The change in diameter defines a transverse surface which locks the shell and thus the terminal of the contactor against rearward relative movement in board 20. As should be apparent from FIGURE 9A the shell is inserted from the forward opening of 20a therethrough with ears of 124b being then opened out to lock the assembly therein. Extending from portion 124e are portions 124f and 124g which form spring members flared at the ends as shown to define a point of contact with the outer conductive path of terminal 122; and a portion 124h which serves to extend the outer conductive shielding of the contactor. Within shell 124 is an insulating insert 125 having a portion 125a adapted to be staked by dimples or other means to the shell and a cylindrical portion 125b which extends back into shell portion 124d. The insert is bored as at 125c to receive and captivate an inner contact member 126 which includes spring arms 126a and 126b and a rear spring barrel 126c adapted to receive and contact the center conductive pin of the terminal 122. The ends of the arms are flared outwardly to permit an axial insertion of a front board contactor for post-patching and the bottoms of the ends are flared to permit the standard vertical closure of such; the flaring serving to guide the contact pin of the front board contactor home within the arms.

The construction of the contactor terminal 122 as shown in FIGURE 9D includes a central body shell 122a apertured on opposite sides as at 122b and having a rear shell extension 122c and a forward shell extension 122d; all defining a bore 122e extending through the piece. The apertures 122b permit the entry of dies to effect a crimp of the center pin to the center conductor of lead 120. Extension 122c serves in a standard manner to provide a surface for contact and support for the lead outer conductor crimped thereagainst by a ferrule and the forward extension 122d provides a surface for contact with the ears of 124a and 124b. The relief in the surface of 122d is to provide a wall thickness sufficiently thin to readily facilitate staking of a dielectric insert therein by means of a dimple or indentation.

Fitted within 122a in the position shown in FIGURE 9C is an insulating sleeve 123 which has an outer configuration to fit within the bore 122e and an interior bore to receive and support a center pin member 127. The pin includes a forward portion 127a of a dimension to fit within and contact the barrel 126c of 126. The rear 127b of the pin includes a bore to receive the center conductor of lead 120 and be terminated thereto by crimping through dies inserted through apertures 122b of shell 122a. A flared portion 127c facilitates entry of such conductor and operates to hold the pin against axial forward float by engagement with sleeve 123.

The contactor 121 further includes a ferrule 128 as shown in FIGURE 9D adapted to be positioned as in FIGURE 9C and crimped inwardly to terminate and connect the lead outer conductor to the contactor against the surface of 122c. Finally, there is provided a clip 129 which serves to provide shielding over the apertures 122b. Clip 129 includes an indentation 129a which is adapted to snap into the recess of one of the apertures and hold the clip in position.

With 122 assembled the center conductive path thereof is insulated and shielded along its length up to where the pin 127 emerges. A short length of sleeve 123 is made to protrude as shown in FIGURE 9C to assure that no combination of tolerances can permit the forward end of

122g to short against the rear end 126c. With 122 plugged into 124 an inner conductive path is extended from the lead inner conductor to pin 127 and then to 126 and the outer conductive path is extended from the lead outer conductor through 122c to the shell 122a, portion 122g and then through portion 124a to the forward end of the shell 124.

Turning now to the front board contactor reference is made to FIGURES 10A-10C. In FIGURE 10A the contactor 141 is shown terminated to a coaxial lead 140 and affixed within an aperture 102a of board panel 102. The contactor includes two parts in a shell and shield structure 142 and a terminal 144 adapted to be fitted and held therein. The shell 142 is preferably of one piece formed of spring stock conductive material to include a rear portion 142a adapted to frictionally fit within aperture 102a and be held therein against axial or rotating movement by sharpened points such as 142b carried on short span spacing ears 142c. Extending forwardly thereof is a cantilever supported spring 142d which is positioned down within the body of 142 in the path of insertion travel of the terminal 144. The forward end of 142d includes a curved portion 142e which is adapted to engage a portion of the terminal and latch the terminal down against an inwardly formed flat 142f of the shell and hold the terminal against rearward axial movement. As an important feature of the invention, this engagement in conjunction with the reduced diameter of 144 permits the contact pin thereof to move in a transverse sense pivoting about the terminal support point within 142c. The movement is limited to the width of the taper of the ends of springs 126a and 126b of the rear board contactor. This feature permits slight tolerance deviations to be accommodated throughout the front and rear boards with proper contact of inner and outer conductive paths.

Forwardly of 142d is a C-shaped channel 142g which extends out from board 102 to overlie the outer conductive portions of contactor 122 in the manner described relative to FIGURES 11A-13B.

The terminal 144 includes a shell 144a having an extension 144b at the rear end adapted to receive and contact the outer conductor of coaxial lead 140 under the crimp of a ferrule 146. At the forward end of 144 is a portion 144c which is serrated to receive and hold a contact ring 147 in the manner of FIGURE 10C. The ring 148 is preferably of brass plated to establish a good contact surface for engagement with the spring portions of 124f and 124g. Adjacent ring 147 is an enlarged portion 144d integral with 144a which serves to receive the spring portion 142e and to support the terminal against 142f. The section of 144a extending rearwardly therefrom is relieved as shown to permit the movement above described and then enlarged to fit within spring ears 142c and be supported thereby. The ears 142c and portion 142f tend to hold the terminal centered but permit movement to the extent necessary for the pin of the terminal to be guided with springs 126a and 126b and within springs 124f and 124g.

Fitted within a bore 144e in shell 144 is an insulating insert 148 of diameters to be entrapped therein to hold and position a pin 149. The pin includes a forward contact portion 149a and a sleeve portion 149b which receives the center conductor of lead 140 and is terminated thereto as by crimping prior to insertion of the pin with 148 and 144a.

The assembly forming 141 extends a center conductive path from the lead center conductor to pin 149 and an outer conductive path from extension 144b terminated to the lead outer conductor, through shell 144a to ring 147 and thus to shell 142.

Upon initial closure of the assembly the carriage positions the front board relative to the back board as shown in FIGURES 11A and 11B with the contactor 141 spaced below and in overlapping relationships to contactor 121. At this point through the board guiding

and alignment features described previously, the contactor conductive paths are in substantial vertical alignment as indicated by the dotted line in FIGURE 11B. As the front board is cammed upwardly the contactors close to the position of FIGURES 12A and 12B such that the pin 149 engages, spreads and wipes the inner surface of springs 126a and 126b and the ring 147 similarly engages, spreads and wipes the inner surface springs 124f and 124g. At this point a coaxial and shielded connection is established with the inner connection substantially covered by portions 142g of 141 and portion 124h of 121.

As an added feature, the final motion of the carriage drops the front board slightly to effect a relative movement of the contactors and cause the engaged contact surfaces to wipe back into a pre-wiped area as shown in FIGURES 13A and 13B. This assures a clean and low resistance connection of both paths.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.

I claim:

1. A plugboard device including a rear board having an array of first contactors secured therein and projecting outwardly therefrom, a front board having an array of second contactors secured therein and projecting outwardly therefrom in positions to mate with said array of first contactors in said rear board, a carriage including means connected to said rear board to support and position said front board with the second contactors facing the said first contactors in spaced apart relationship and further means to drive said front board and said second contactors relative to said rear board to drive said first and second contactors into and out of engagement under substantial force to effect good contact, the said front board including handle members secured to each side of said front board to facilitate handling of said front board and to facilitate insertion and withdrawal thereof from said carriage, said handle members being of a material of substantial rigidity and strength and being attached to said front board through a connection sufficiently rigid and strong to withstand substantial forces applied thereto and the said carriage including further means being positioned to effect said drive of said front board and second contactors by a direct engagement with said handle members.

2. The device of claim 1 wherein said carriage is pivotally linked to the rear board and includes means to hold said front board outwardly away from said rear board with the contactors disengaged and with the said further means disengaged from said handle members whereby to prevent contact engagement by said drive means when said front board is held outward of said rear board.

3. As an article of manufacture for use in a plugboard apparatus of the type including a rear board having a plurality of contactors secured therein and projecting outwardly thereof in a given position and spacing and a carriage to receive a front board inserted therein, said front board including panel means apertured to receive and support contactors therein to project outwardly therefrom in a position and spacing to mate with the contactors of said rear board, a support frame of substantial strength, rigidly secured to at least opposite edges of said panel means and handles positioned on each side of said panel means to permit insertion and withdrawal from the carriage and secured to said frame through brackets of substantial material strength rigidly secured to the outside edges of said frame, the said brackets having projecting surfaces positioned to be engaged by a drive linkage of a plugboard apparatus to drive said front board in final closure to effect engagement of front and rear board contactors.

4. A plugboard device having a rear board carrying contactors and a front board carrying contactors with the contactors of both of said boards being in spaced arrays to permit a mating thereof to provide closure of electrical circuits, a carriage including two pairs of links pivotally secured to the sides of the rear board to support said front board, one of said pairs of links engaging said front board to provide said support in a vertical sense and the other of said pair of links engaging said board to provide said support in generally a horizontal sense, relative to said rear board with the said two pairs of links being movable outwardly to a first position wherein said contactors are out of engagement in a nonoverlapping position and being operable to carry said front board inwardly to position said contactors in a spaced overlapping position but out of engagement, an operating arm affixed to said rear board to engage the said one pair of links and drive such vertically, a portion on each of said one pair of links engaging the front board to drive said front board vertically to a position to interconnect said contactors.

5. The device of claim 4 wherein said other pair of links includes means to hold said front board against outward displacement when said links are in an inward position and at the same time permit the said vertical drive thereof.

6. The device of claim 5 wherein said carriage includes means connected to each of said one pair of links including a bar member projecting inwardly therefrom, said front board including secured to the top thereof a pair of hook members of a configuration to fit over said bar member to permit said front board to hang on said bar member and thereby hang on said one pair of links when said carriage is in an outward position.

7. In a multiple switch device of the type adapted to make and break conductive paths, the combination of a rear board having arrays of contactors therein and a front board having arrays of contactors therein, carriage means pivotally secured to said rear board and movable toward and away from said rear board, said means including portions to receive and support said front board in a generally parallel spaced apart relationship relative to said rear board and operable to drive said boards in a first relative movement closing the space therebetween and in a second relative movement to drive said contactors toward each other and then together to make contact, said carriage means including pairs of links mounted on each side of said rear board and operable to engage first members affixed to the top of said front board to effect the first movement, and said carriage means further including means to drive said pairs of links to engage second members affixed to the sides of said front board to effect the second movement and there is included means to prevent outward movement of said links and of said first board during and following said second movement.

8. The switch of claim 7 wherein said second members are positioned between the top and bottom of said second board toward the center of the sides of said second board whereby as said second board is driven to effect a contact between the contactors of the first and second boards a portion of said board is loaded in compression and the balance of said board is loaded in tension.

9. A multiple switch adapted to be operated to close and open arrays of conductive paths including a first board having an array of first contactors extending therefrom, a second board having an array of second contactors extending therefrom in mating relationship relative to said first contactors, a carriage means including first links pivotally attached at the upper ends thereof to the first board and second links slidably attached to the first board at the lower ends thereof, the said second links on both sides of the first board joined by a bar member adapted to receive and support the second board in a position resting upon the outer ends of the said first links in a position out from the first board, said carriage being operable from the mentioned position to carry said second board inwardly and

upwardly to engage the second contactors with the first contactors.

10. A multiple switch adapted to be operated to close and open arrays of conductive paths including a first board having an array of first contactors extending therefrom, a second board having an array of second contactors extending therefrom in mating relationship relative to said first contactors and carriage means linking said boards and adapted to provide relative movement carrying the second board from a position outwardly displaced of said first board inwardly to a position wherein said contactors are in a spaced, noncontacting but overlapping relationship, first guide means on said carriage in a position thereon to engage and guide said second board into a generally centered position relative to said first board with engagement and guiding of said second board occurring only after substantial movement of said boards toward each other and second guide means affixed to each of said boards toward the center thereof with separate members each including intermating surfaces of close tolerance to provide a final centering of said second board relative to said front board at the final part of said movement whereby to position said contactors in relative alignment in said overlapping relationship preparatory for further movement to close contact.

11. The switch of claim 10 wherein said first guide means includes a pair of members spaced apart and having interiorly beveled faces positioned to engage the outside edges of said second board, said members being of a substantially flexible material whereby to yield in response to movement of said second board caused by said second guide means.

12. A multiple switch adapted to be operated to close and open arrays of conductive paths including a first board having an array of first contactors extending therefrom, a second board having an array of second contactors extending therefrom in mating relationship relative to said second contactors and carriage means connected to said first board and including a pair of upper links and a pair of lower links pivotally connected together and movable inward and outward relative to said first board, said upper links including means to engage and support said second board in a vertical sense and said lower links including means to engage said second board and hold said second board against inward movement in a horizontal sense so that the surfaces of said second board and said first board are substantially parallel, the said carriage means including means to control said movement to provide a first inward movement carrying the said second board toward said first board and including further means to hold the faces of said boards substantially parallel through said movement to a position where said contactors are in a spaced and overlapping relationship, driving means linked to said carriage to drive said upper links to provide an upward movement of said second board substantially at right angles to said first movement to drive said contactors together and interlock means linked to said carriage means to preclude operation thereof in an outward movement when said contactors are connected together and linked to said drive means to preclude

operation of said drive means prior to operation of said carriage means to effect said inward movement.

13. A multiple switch adapted to be operated to close and open arrays of conductive paths including a first board having an array of first contactors extending therefrom, a second board having an array of second contactors extending therefrom in mating relationship relative to said second contactors, carriage means linking said boards to hold and position said second board with the surface thereof substantially parallel to the surface of said front board and adapted to provide relative movement of said boards to move with the surfaces of said boards held substantially parallel until the contactors of each of said boards are in a spaced apart overlapping relationship and then operable to drive said boards substantially at right angles to said first movement to drive said contactors together and apart to effect closure and opening of the conductive paths, said carriage including a linkage pivoted on the sides of the rear board to swing outward and inward relative thereto to effect said first movement, bar means extending from the top of the linkage transversely to the plane of link movement to receive and support the front board when the said linkage is in an outward position, and hooks on said front board to engage said bar means to provide said support, members attached to the side of said front board and projecting outwardly therefrom to engage the lower part of said linkage, the said top and lower portions of said linkage which engage said front board through the hooks and projecting portions thereof being positioned when said linkage is out to receive and hold said front board hanging from said hooks and resting at the bottom against the lower part of said linkage in a plane substantially parallel to the plane of the first board and perpendicularly to the axis of inward movement whereby to facilitate damage free insertion of said second board into said carriage and movement of said second board by said carriage into a position preparatory to contact closure.

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MARVIN A. CHAMPION, *Primary Examiner*.

PATRICK A. CLIFFORD, *Examiner*.