May 31, 1960 W. S. WATTS 2,939,100

PLUGBOARDS FOR PATCHCORD SYSTEMS

Filed Nov. 2, 1955 2 Sheets-Sheet 1

Fig. 1

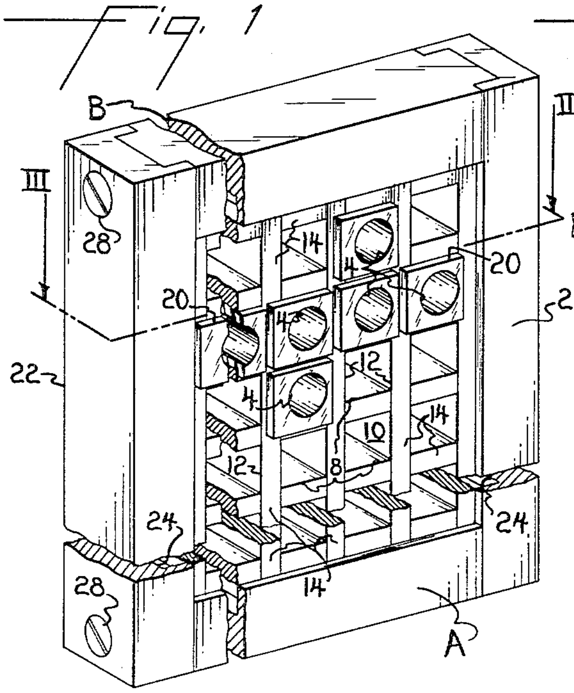


Fig. 2

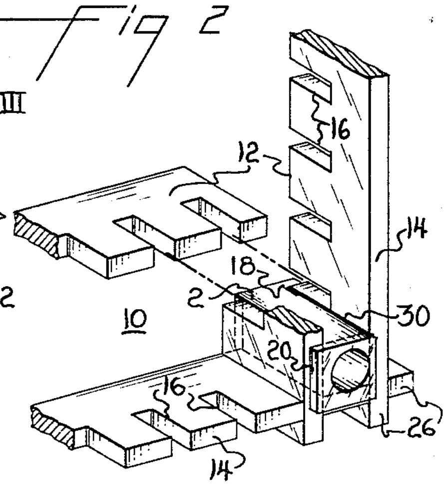


Fig. 3

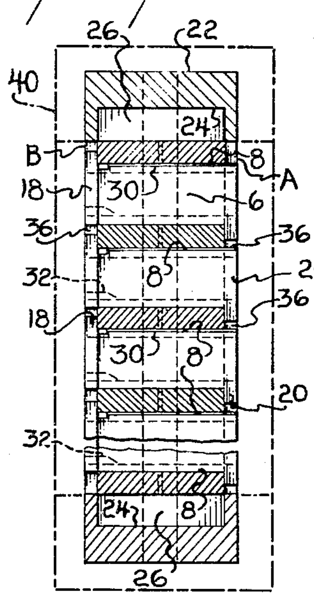


Fig. 4

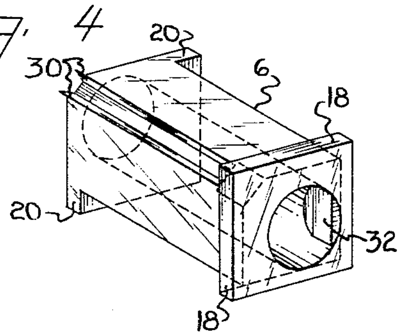
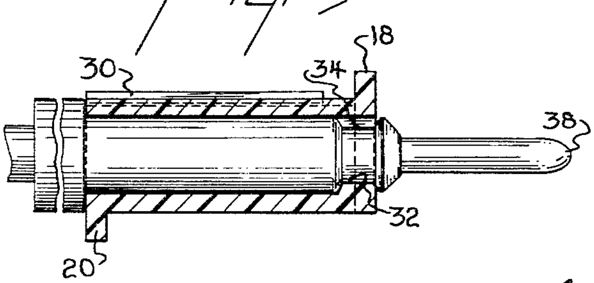


Fig. 5



INVENTOR.
William S. Watts
BY
Curtis, Morris + Safford

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Filed Nov. 2, 1955 2 Sheets-Sheet 2

Fig. 6

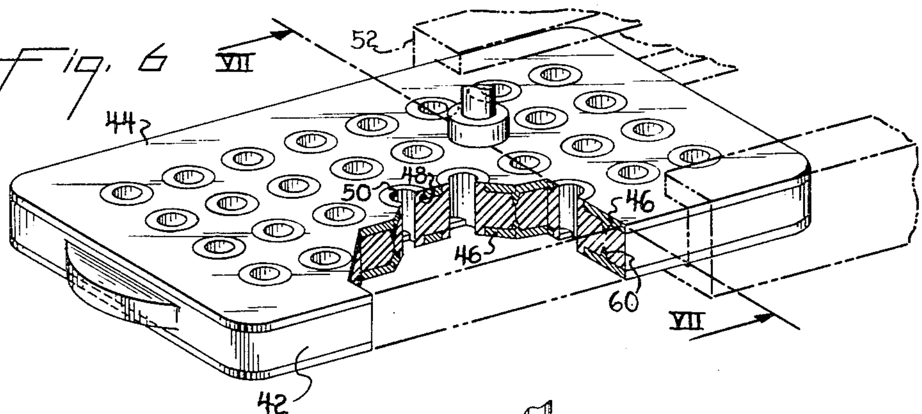


Fig. 7

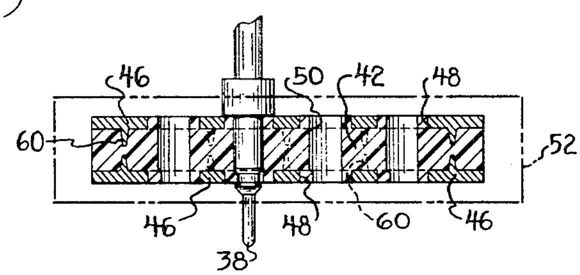


Fig. 9

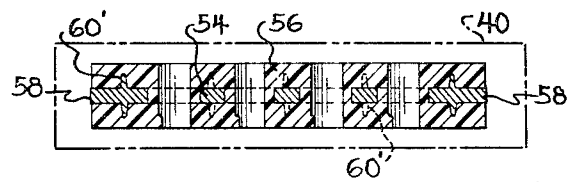


Fig. 8

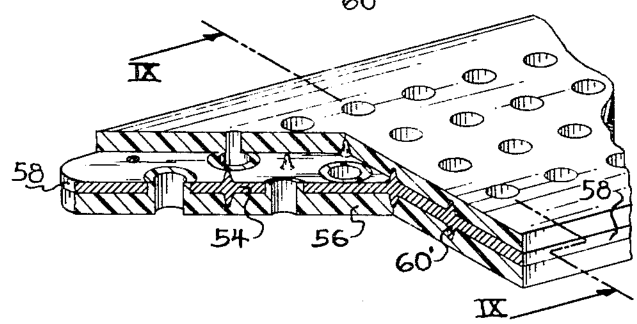
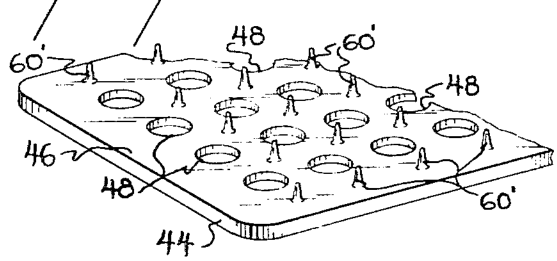


Fig. 10



INVENTOR.
William S. Watts
BY
Curtis, Morris & Safford

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PLUGBOARDS FOR PATCHCORD SYSTEMS

William S. Watts, Harrisburg, Pa., assignor to AMP Incorporated, Harrisburg, Pa.

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7 Claims. (Cl. 339—18)

This invention relates to patchcord systems utilized in connection with electrical accounting or computing machines or the like, and more particularly to the plug or contact boards of such systems.

It has become customary to install the control functions of such machines in a patchcord control system that conventionally includes a pair of contact or plug boards that carry the rows and columns of electrical contacts to be interconnected in a variable predetermined arrangement according to the manner in which the control components of the machine are to be operated. The contact-carrying boards, one of which is usually fixed relative to the machine while the other is moved into and out of cooperating relationship therewith, are positioned in and relatively manipulated by suitable mechanism as shown, for example, in the application, Serial No. 411,969, filed February 23, 1954.

The rows and columns of contact elements on one board typically constitute the terminals of electrical conductors leading from the sensing elements and the instrumentalities to be controlled in the machine, and on the other board provide rearrangeable interconnecting plugs or jacks through which the particular circuit connections on the first board may be made. In an average system, several hundred contact elements are located on each board in a minimum area with a minimum space between rows and columns. As a result, where the board is formed from insulating material current leakage can occur between contacts producing a more or less detrimental effect on the operation of the machine according to its character. For example, in an analog computer information is generally represented by voltage pulses or levels which are compared for resolution to a fixed reference level on a relative magnitude basis. Any significant leakage between contacts on the plugboard at the control station introduces an error function in the handling of the information which should be avoided. This current leakage, in contact boards as heretofore designed, may appear either as volume leakage through the body of the insulating or plastic material, or as surface leakage between the contacts and becomes more significant a factor should there be any flaws or imperfections within the molded structure of the board or upon accumulation of any film or foreign matter on the surface of the board.

One solution that has been proposed to shield the contacts in the patchcord control system against current leakage has been to form the boards of a conductive metallic material, such as aluminum, and providing insulation sleeves for the contact elements within the board apertures. Such an arrangement is disadvantageous, however, in that it is desirable to permit rearrangement of the electrical connections while the plugboards are interconnected and the contacts energized. With a metal board structure there then arises the danger, in making the change or rearrangement desired in the connections, of accidently grounding an energized plug or jack through the board with a possible result of damage to the electrical elements of the computer or machine and the introduction of erroneous information into the system controlled by the patchcord system.

Accordingly, it is an object of the present invention to provide in a patchcord system an improved shielded contact board construction.

Another object is to provide in a patchcord system an improved construction for shielded contact boards which eliminates the possibility of grounding energized contacts during rearrangement of the electrical connections afforded by the system.

Still another object is to provide in a patchcord system an improved shielded contact board which is simple in construction and facile to manufacture.

A further object is to provide for a patchcord system a prefabricated contact board employing a minimum of standard parts from which any size board may be constructed according to the conditions of a particular use.

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 is shown and described several 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:

Figure 1 is a perspective view of one embodiment of the contact board with certain parts being broken away to illustrate some of the details of construction;

Figure 2 is a fragmentary perspective view illustrating the method of assembly of the parts comprising the contact board shown in Figure 1;

Figure 3 is a sectional view taken along lines 3—3 of Figure 1;

Figure 4 is a perspective view of an insert or bushing utilized in forming the contact board of Figure 1;

Figure 5 is a sectional side view of the insert or bushing of Figure 4 illustrating the cooperation therewith of a plug or jack contact element employed within the patchcord system;

Figure 6 is a perspective view of another embodiment with certain parts being broken away to illustrate details of construction;

Figure 7 is a sectional view taken along lines 7—7 of Figure 6;

Figure 8 is a fragmentary perspective view of another embodiment of the contact board with certain parts being broken away to illustrate details of construction;

Figure 9 is a sectional view taken along lines 9—9 of Figure 8; and

Figure 10 is a fragmentary perspective view showing the details of an element used to form the contact board shown in Figure 8.

As described in the aforementioned application, each patchcord system includes a pair of contact-carrying panels or boards which are relatively movable for making the desired circuit interconnections. Conventionally, one of the boards is fixed in position in the patchcord system at the control station of the machine or device involved, the other board being detachably slidably mounted in a carrier frame which is manipulated by the control mechanism of the patchcord system. In either event it is to be understood that the principles of the present invention may be applied in the construction of the patchcord system.

With reference to the embodiment shown in Figure 1, the contact board 2 typically is of rectangular configuration and has a plurality of rows and columns of apertures 4 extending therethrough for rigidly supporting in closely spaced relationship the contact elements, such as the spring and plug contacts described in the respective applications, Serial No. 409,603, filed February 11, 1954, now Patent No. 2,882,508 issued April 14, 1959 to William S. Watts, and Serial No. 418,413, filed March 24, 1954, now Patent No. 2,903,670, issued September 8, 1959, to Gilbert C. Sitz. To provide for shielding and to prevent intercontact leakage while retaining the advantages inherent in a board of insulating material, each of the contact-receiving apertures 4 is formed in an individual block or bushing 6 of insulating material, such as nylon, which is disposed in electrical isolation from adjacent blocks within a pocket or section 8 of an electrically conductive grid, generally designated at 10, of any suitable metallic material.

As best shown in Figures 2 and 3, grid 10 is composed of a plurality of elongated flat strips 12 interconnected and arranged to present thin side faces 14 at the front and rear surfaces A and B of the board. The major width of strips 12 approximates the length and thus effectively shields the side faces of bushings 6 which define the contact board thickness. Surfaces A and B of board 2 is a composite of the end faces of insulating bushings 6 and strip side faces 14, the conductive surfaces of which preferably are inaccessible to engagement by the contact elements of the system as will be explained.

It will be understood by those skilled in the art that metallic grid 10 and insulating blocks or bushings 6 may take a variety of forms in cooperating to provide the rigid contact board 2. For example, a composite molded structure will suffice. To lend versatility in the manufacture of the board, however, it is preferred that grid 10 be formed from strips, each having a series of equally spaced slots 16 transversely extending one-half the strip width from a side face 14, which thus may be intermeshed in a series of halved lap joints at the grid crossover points, Figure 2. To secure the grid joints and the bushings within the grid, each bushing is provided at opposite ends with transverse lips or flanges 18 and 20, flange 18 projecting from two side faces of the generally hexadhedral body of the bushing and flange 20 from the opposite side faces, Figure 4. The width of strips 12 should then be equal to the length of bushings 6 between flanges 18 and 20 so that upon assembly of the parts, of the four strips forming each pocket 8, flange 18 will overlie the side face 14 of two adjacent strips on one face of the board while flange 20 engages the side faces of the remaining pair of strips on the opposite face of the board thereby locking both the grid joints and bushings in position. A frame 22 provided with grooves 24 for receiving the extremities 26 of strips 12 serves to maintain the rigidity of the contact board structure, the frame being suitably held together as by bolts 28.

To stabilize the position of the contact elements within the board the body of bushings 6 in cross-section should precisely fit the area of associated pockets 8. To take up design tolerances and to assure the desired snug fit bushings 6 are provided with a pair of resiliently deformable longitudinal ribs 30 which are compressed according to the relative differences in cross-sectional areas of the bushing and grid openings.

Where the contact board supports the plug elements of the system each bushing may be provided with a detent 32 extending inwardly at one end of aperture 4 that cooperates with an annular groove 34 of the plug to secure the plug in position as shown in Figure 5.

As thus constructed volume leakage through the board between the contacts is prevented due to the interposition of the conductive strips 12. As to surface leakage, it is contemplated that flanges 18 and 20 of one bushing do not project so far as to abut the sides of adjacent bushings, but define a series of narrow grooves 36 leaving portions of the contiguous strips 12 at side faces 14 exposed, thereby providing with respect to surface leakage a low resistance path of conductive metal surrounding each of the contact elements on both surfaces A and B of the board. The space between adjacent bushings should not be so larger, however, as to permit engagement of the conductive strips by the contact elements of the system. For example, the width of grooves 36 should be less in dimensions than nose 38 of the contact plug thus preventing accidental grounding of the contact element during insertion thereof in the board. It is to be understood, of course, that all of the conductive strips 12 are in electrical contact and in contact with the metallic frame 22 which may be grounded through the contact board carrying frame, shown in dotted lines 40 in Figure 3, of the patchcord system. Similarly, carrying frame 40 may be grounded through the associated machine to ground potential level. Hence, the voltage level of each of the contacts is variable only with respect to a fixed and definite reference level which may be set at ground potential. In general, however, it will be understood that with appropriate connections frame 22, together with conductive strips 12, may be maintained at any desired potential thereby to provide a variable reference voltage level for the contact elements.

The maximum number of contacts in any board will, of course, depend upon the characteristics of a particular use. Commonly, however, the variations in the number of contacts is a multiple of the smallest board desired. In the manufacture of the board, therefore, strips 12 may be formed as long as is required of the largest board contemplated to be produced. For smaller board sizes, the strips may simply be cut to length which, with standardized bushings, thus permits the prefabrication of any sized board without waste of material.

Where the conditions of a particular use require a shielding of the contact elements only as to either surface or to volume leakage, the contact board may take either of the simplified forms shown respectively in Figures 6 and 7 or Figures 8 and 9. In the embodiment of Figures 6 and 7 the base 42 of contact board 44 is of insulating material, and in any suitable manner has secured to each surface a plate or sheet 46 of conductive material. Holes 48 in the conductive sheets are aligned with contact receiving apertures 50 of the insulating base 42, the conductive sheets providing a low resistance path to ground through carrier frame 52 for leakage currents between the contact elements on the board surfaces. Similarly, in the embodiment shown in Figures 8 and 9, a conductive sheet 54 suitably disposed within the body of insulating base 56 provides a low resistance path to ground through contact with the carrier frame at edges 58 for leakage currents between contacts through the body of the insulating material.

Any method, such as molding processes well-known in the art, for forming the contact boards of Figures 6 and 7 will suffice. In the event a molded construction is preferred, contact plates 46 and 54 may be rigid members directly molded with the base material, or if desired, may be thin sheets of metal foil laminated to the base by bonding techniques conventional in the art. Outwardly projecting lugs 60 may be provided to assure in the molding operation a secure interlocking between the insulating base and conductive sheets.

I claim:

1. A multiple-contact board for a patchcord system comprising an electrically conductive grid, insulation means within the interstices of said grid to form therewith the body of said board, said insulation means extending partially over the conductive surfaces presented by said grid on at least one face of said board and having apertures therein for receiving the contact elements of the system, and said apertures being substantially centered within said interstices respectively.

2. A multiple-contact board for a patchcord system comprising a plurality of conductive strips assembled in the form of a grid, a plurality of bushings of insulating material fitting within the interstices of said grid to form therewith the body of said board, flange means on said bushings adapted to overhang the side edges of the respective contiguous portions of said strips for reducing the width of the conductive surface presented by said side edges on one face of the board, and apertures in said bushings for receiving the contact elements of the system.

3. A multiple-contact board for a patchcord system comprising a plurality of conductive strips assembled in the form of a grid, a plurality of bushings of insulating material fitting within the interstices of said grid to form therewith the body of said board, flange means on the ends of said bushings extending partially over the conductive surfaces presented by said grid on opposed faces of the board for locking the bushings within the grid, and apertures in said bushings for receiving the contact elements of the system.

4. A multiple-contact board for a patchcord system comprising a plurality of similar conductive strips, each having a series of spaced slots extending laterally from one side edge assembled in a lapped-joint grid arrangement, a plurality of bushings of insulating material fitting within the interstices of said grid to form therewith the body of said board, apertures in said bushings for receiving the contact elements of the system, and means for securing said strips and bushings in assembled relationship.

5. A multiple-contact board for a patchcord system comprising a plurality of similar conductive strips, each having a series of regularly spaced slots extending laterally from one side edge substantially one-half the strip width assembled into a grid having halved lap joints at the crossover points, a plurality of bushings of insulating material fitting within the interstices of said grid to form therewith the body of said board, complementary flange means on one end of said bushings adapted to overhang the side edges of the respective contiguous portions of said strips for reducing the width of the conductive surface presented by said side edges on one face of the board, flange means on the other end of said bushings for cooperating with said complementary flange means to lock said bushings within the grid and the grid joints in assembled relationship, apertures in said bushings for receiving the contact elements of the system, and a frame for receiving the end portions of said strips.

6. A multiple-contact board for a patchcord system comprising insulation means having a plurality of apertures therein extending through said board for receiving the contact elements of the system, and conductive metallic means spaced from the sidewalls of said insulation means defining said apertures and surrounding said apertures, said metallic means extending continuously through the thickness of said board for providing an electrical shield between contact elements in adjacent apertures.

7. A multiple contact board for a patchcord system comprising a plurality of conductive strips assembled in the form of a grid, a plurality of bushings of insulating material fitting within the interstices of said grid to form therewith the body of said board, said bushings having resiliently deformable means thereon adapted resiliently to engage said strips to effect a tight fit of said bushings within said interstices, and apertures in said bushings for receiving the contact elements of the system.

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