April 25, 1967 H. HERMAN 3,316,520

ELECTRICAL INTERCONNECTING DEVICES

Filed Sept. 23, 1964 4 Sheets-Sheet 1

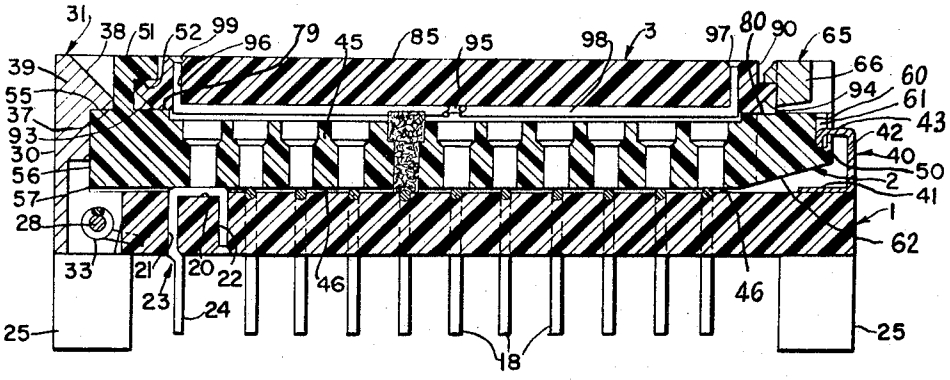


FIG. 1.

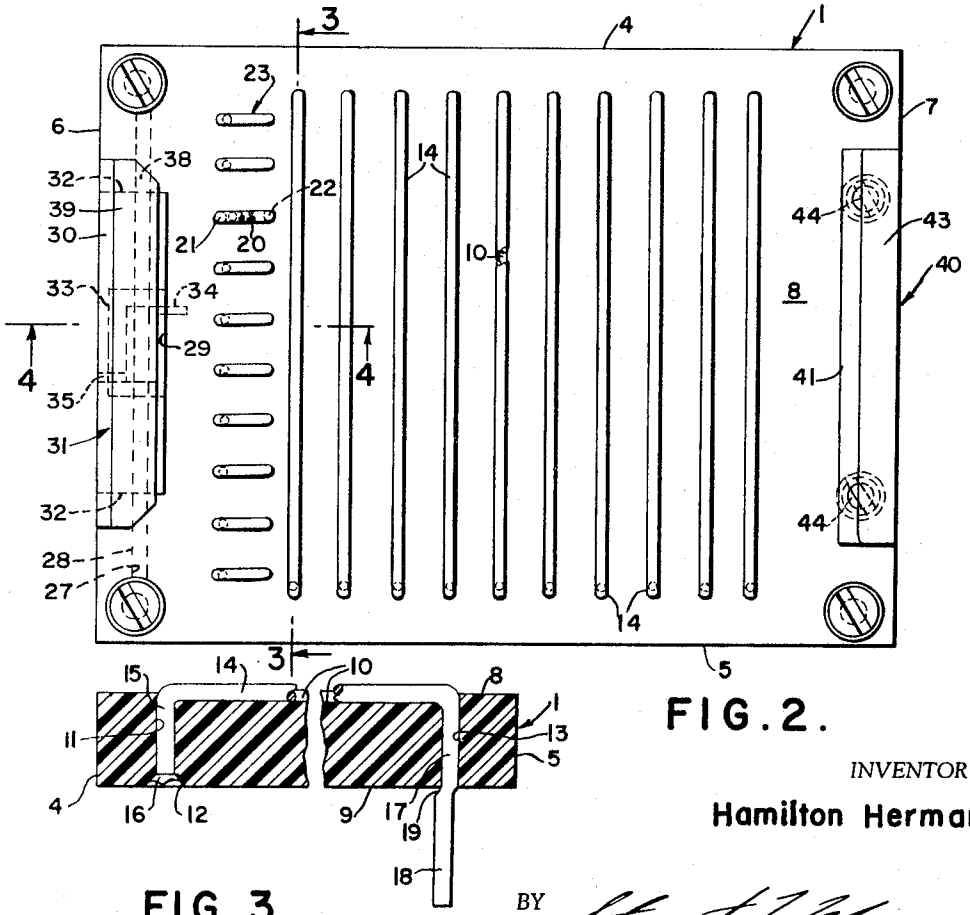


FIG. 3.

FIG. 2.

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ELECTRICAL INTERCONNECTING DEVICES

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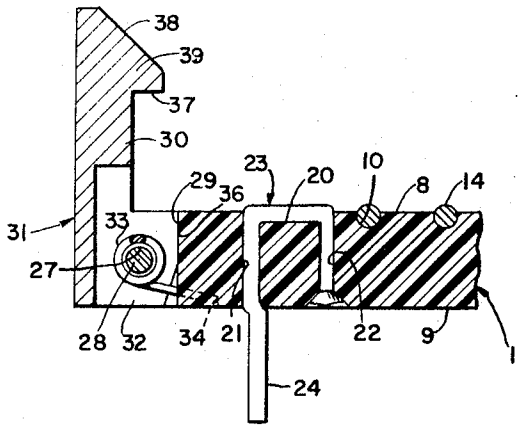


FIG. 4.

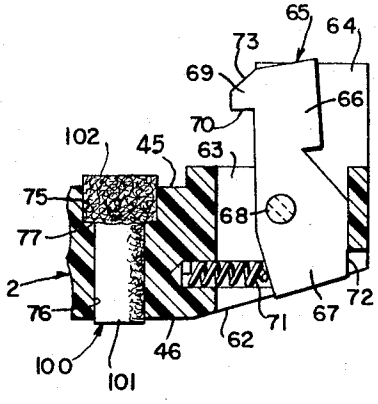


FIG. 6.

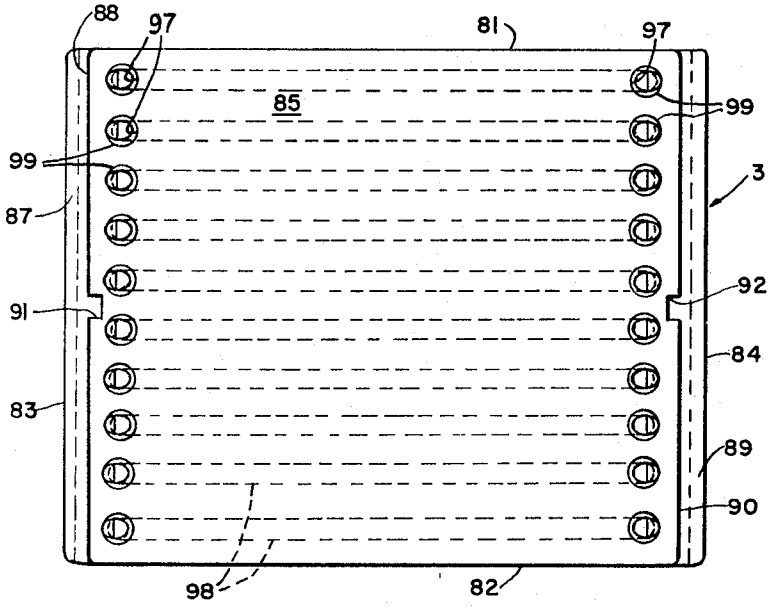


FIG. 8.

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ELECTRICAL INTERCONNECTING DEVICES

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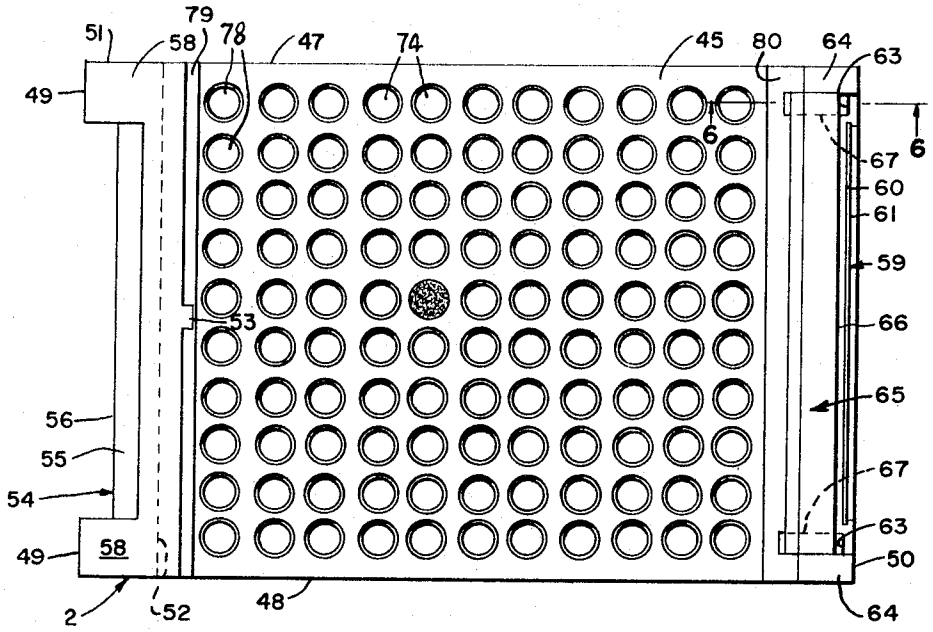


FIG. 5.

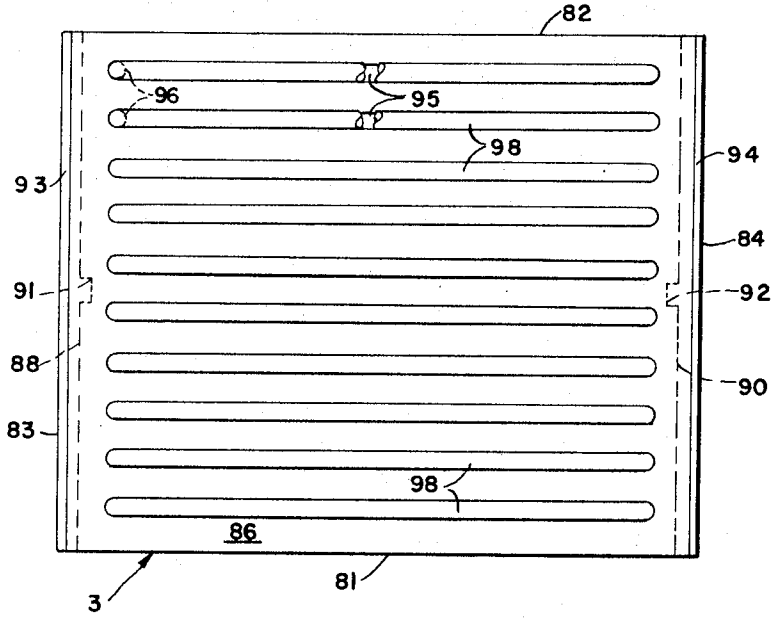


FIG. 7.

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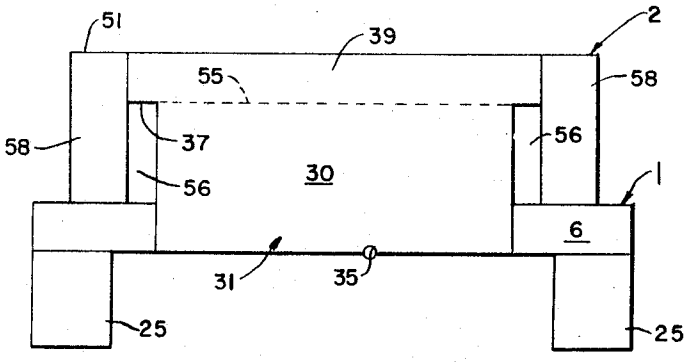


FIG. 9.

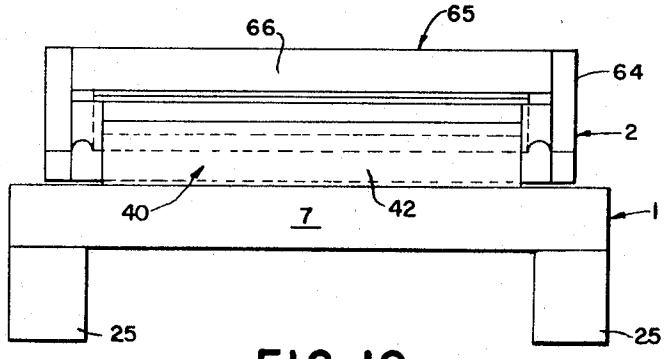


FIG. 10.

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3,316,520

ELECTRICAL INTERCONNECTING DEVICES

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Filed Sept. 23, 1964, Ser. No. 398,656
5 Claims. (Cl. 339—18)

This invention relates to electrical interconnecting devices and particularly to devices of the type which are commonly referred to as pinboards, plugboards, and cross-connecting devices. Though of broader application, the invention has special advantages when employed in a matrix configuration.

Electrical interconnecting devices of the type referred to have long been known and are widely used in connection with the programming of computers, machine tools and test equipment, electrical control systems for automatic machinery of various types, and the construction of "breadboard" and prototype assemblies. Despite commercial acceptance, however, prior-art devices of this general type have presented a number of disadvantages and shortcomings. Thus, such devices have been unduly complicated and expensive, have been so constructed that manual programming or selection of the connections to be made could not be accomplished easily, have frequently had excessive resistance at the cross-connections, have been characterized by unduly short operating life because of sliding engagement between electrically conductive parts and because of the use of intricate and fragile components, and have not provided wide flexibility of use, the products frequently being more or less "tailor-made" to fit the purchaser's requirements.

A general object of this invention is accordingly to devise an improved electrical interconnecting device free from such disadvantages.

Another object is to provide an electrical interconnecting device wherein the conductive elements to be interconnected are simple wires secured to insulating support members in a novel manner making it possible to produce the device at a relatively low cost.

A further object is to devise a unit of the type described wherein simple wires, carried by separate insulating supports, are selectively interconnected by axially compressible, resilient connector pins which are held in engagement with the wires in such fashion that the end portions of the pins have maximum contact with the surfaces of the wires.

Yet another object is to provide a device of the type described wherein simple wires are employed as the conductive elements to be interconnected and lead terminals are made integral with such conductive elements.

A still further object is to devise an improved and simplified arrangement for maintaining wires, employed as conductive elements for interconnection, securely seated in cooperating grooves in an insulating support.

Though not limited thereto, the invention is especially applicable to interconnecting devices of the type described and claimed in copending application Ser. No. 398,532, filed concurrently herewith by Siegfried Godel, and entitled, "Electrical Interconnecting Devices" and assigned to the same assignee as is the present application. By way of illustration, one such device comprises an insulating base which carries at its upper surface a first group of mutually parallel elongated conductive wires, and a programming board secured above the base and provided with a plurality of apertures each opening toward one of the wires carried by the base. A plurality of axially compressible connector pins are disposed each in a different one of the apertures of the programming board, and a member is secured above the programming board to maintain the pins under compression and thus in firm contact with the wires supported by the base. In preferred embodiments of the invention, the member secured above the programming board is an insulating member carrying a second set of wires extending across the first set when the programming board and upper member are properly assembled. In preferred forms, the supporting surfaces carrying the wires are provided with parallel grooves, and the main body portions of the wires are each seated in one of the grooves, the end portions of the wires at each end of the main body being accommodated by through bores in the supporting member and laterally deformed, at the side of the supporting member opposite the grooves, to cause the end portions to be stressed in tension so that the main body portion is held firmly seated in its groove. Advantageously, one end portion of each wire is extended beyond the lateral deformation to provide a terminal to which a lead can be connected. Each connector pin is advantageously in the form of a mass of intertangled resilient wire, much finer than the wires used as the elements to be interconnected, the ends of such pins being compressively deformed by the wire conductive elements so that contact is maintained over a maximum area.

In order that the manner in which the foregoing and other objects are achieved in accordance with the invention can be understood in detail, particularly advantageous embodiments of the invention will be described with reference to the accompanying drawings, which form part of this specification, and wherein

FIG. 1 is a longitudinal cross-sectional view of a cross-connecting matrix pinboard device in accordance with one embodiment of the invention;

FIG. 2 is a top plan view of the base member of the device of FIG. 1;

FIG. 3 is a fragmentary transverse sectional view taken on line 3—3, FIG. 2;

FIG. 4 is a fragmentary sectional view taken on line 4—4, FIG. 2;

FIG. 5 is a top plan view of the intermediate member of the device of FIG. 1;

FIG. 6 is a fragmentary sectional view taken on line 6—6, FIG. 5;

FIG. 7 is a bottom plan view of the upper member of the device of FIG. 1;

FIG. 8 is a top plan view of the member shown in FIG. 7; and

FIGS. 9 and 10 are, respectively, opposite end elevational views of the device of FIG. 1.

The embodiment of the invention illustrated in FIGS. 1–10 comprises a base member indicated generally at 1, a programming board or intermediate member 2, and an upper member 3. It will be understood that the device as illustrated in FIG. 1 can be mounted in any position. However, for simplicity of explanation, member 1 will be considered as the lowermost member and member 3 the uppermost member.

Considering FIGS. 1 and 2, it will be seen that base 1 is in the form of an integral rectangular plate of synthetic resinous material, advantageously a methyl methacrylate polymer. Base 1 is in the form of an elon-

gated rectangle, having long sides **4** and **5** and short sides **6** and **7**. The upper surface **8** and the lower surface **9** of the base are parallel and flat, extending for the full width and length of the base. Also shown in FIGS. 3 and 4, a plurality of straight grooves **10** are provided in the upper surface **8** of base **1**, grooves **10** being mutually parallel and parallel to the short sides **6** and **7**. Grooves **10** are of equal length and have semi-circular transverse cross sections. At one end of each groove **10**, there is provided a through bore **11** which extends at right angles to surfaces **8** and **9** and includes a flared mouth **12** where the bore opens through surface **9**. At the other end of each groove **10**, base **1** is provided with a through bore **13**.

Each groove **10** accommodates the main body portion of an electrically conductive wire **15** having a circular cross section of a diameter substantially equal to the diameter of the semi-circular transverse cross section of the groove. Each wire **14** has an end portion **15** bent at right angles to the main body of the wire and extending through the corresponding bore **11**. The tip **16** of portion **15** of the wire is deformed, as during a cutting operation, to engage the flared, frusto-conical mouth portion **12** of bore **11** and thus lock the wire firmly to base **1**. At its other end, each wire **14** includes a portion **17**, extending through the corresponding bore **13**, and a portion **18** which projects below surface **9** as a terminal to which an electrical lead can be connected in any suitable manner, as by soldering. At the juncture between portions **17** and **18**, the wire is offset laterally, at **19**, to provide a shoulder engaged beneath surface **9** to lock the wire firmly in place. Since portions **15** and **17** are held in tension, by reason of engagement of tip **16** and shoulder **19** with the base, it will be clear that the main body portion of the wire is firmly seated in the groove **10**.

In this embodiment, there are ten of the wires **14** and these wires constitute a first group of elongated, mutually parallel, electrically conductive elements secured to base **1** and exposed at the upper face **8** thereof. Since this embodiment is constructed in matrix fashion, the mutually parallel wires **14** can be considered to establish the X axis of the matrix, with this axis extending transversely of the base and parallel to the upper face of the base.

From FIG. 2, it will be noted that the group of wires **14** is offset toward side **7** of the base, so that a substantial portion of surface **8** is left free between the wires **14** and the other side **6** of the base. Within this space, there are provided ten short, mutually parallel, straight grooves **20**, FIG. 2, through bores **21** and **22** being provided at the ends of each groove **20**. Each groove **20**, with its associated bores **21** and **22**, accommodates a lead-connection wire indicated generally at **23**, FIG. 2, and including an end portion retained in the bore **22**, a straight portion seated in the groove **20**, a portion extending through groove **21**, and a terminal portion **24** projecting below base **1**. All of the wires **23** are secured to base **1** in the same fashion hereinbefore described with reference to the wires **14**. From FIG. 2, it will be seen that the portions of the wires **23** seated in grooves **20** extend at right angles to the portions of wires **14** seated in grooves **10**. Also, the grooves **20** are spaced apart by the same distance as are grooves **10**.

To provide for rigid mounting of the unit on the equipment with which the device is to be employed, four stand-off insulators **25** are employed, each being secured to the lower surface of base **1**, as by screws **26**, FIG. 2.

Adjacent side **6**, a cylindrical through bore **27** is provided in base **1**, bore **27** extending parallel to side **6** and to surface **8**. Bore **27** accommodates a cylindrical shaft **28**, as best shown in FIGS. 1 and 4. At side **6**, base **1** is provided with a rectangular notch **29**, see also FIG. 4, which accommodates the shank **30** of a catch member **31** which is journaled on shaft **28** for pivotal movement about the axis of the shaft. Shank **30** is provided with a pair of spaced ears **32** having aligned bores through which shaft **28** extends, the ears **32** projecting from the shank toward the bottom of notch **29**. A torsion spring **33** surrounds shaft **28** between the ears **32**, one end of the torsion spring being engaged in a notch **34**, FIG. 4, provided in a lower surface of body **1**. The other end of spring **33** is engaged in a notch **35**, FIG. 9, in the bottom edge of shank **30** of catch member **31**. Spring **33** is oriented to resiliently bias the catch member **31** in a clockwise direction, as viewed in FIG. 4. Such action causes edge portions **36** of ears **32** to engage the bottom of notch **29**, as seen in FIG. 4, maintaining the catch member **31** in its normal, active position, with the shank of the catch member projecting at right angles to surface **8**.

At its end opposite base **1**, catch member **31** is provided with a shoulder **37** which is directed toward base **1**, and an upwardly and outwardly slanting cam surface **38**, the shoulder and cam surface being formed on an inwardly extending thicker portion **39** of the catch member, so that the shoulder **37** faces a point within the confines of the rectangular base member **1**.

At side **7**, there is rigidly secured to the upper surface of base **1** a stationary catch member **40**. Catch member **40** is elongated, extending along side **7**, and is of generally channel-shaped cross section, including a horizontal web **41**, a vertical web **42**, and an upper horizontal web **43**, the latter being turned downwardly at its free edge, as seen in FIG. 1. Secured by screws **44**, stationary catch member **40** opens toward side **6** and is disposed with the outer surface of web **42** in alignment with side **7**. Accordingly, the turned down tip of upper web **43** projects toward base **1**.

As best seen in FIGS. 1, 5 and 9, the intermediate member or programming board **2** is an integrally formed, relatively thick, rectangular plate of electrical insulating material, again advantageously a methyl methacrylate polymer. Member **2** includes a flat upper face **45** which extends throughout the main body portion of the member, and a flat lower face **46** which extends for the full width and most of the length of the member. In plan, member **2** is in the form of an elongated rectangle defined by long sides **47** and **48** and short sides **49** and **50**, the former being divided with the two portions thereof spaced apart by a distance substantially equal to the length of grooves **10** in base **1**.

Adjacent edge **49**, member **2** is of greater thickness than in the main body portion defined by surface **45** and includes a portion **51** (FIG. 1) which projects upwardly from surface **45**. At its inner side, portion **51** is provided with a groove **52** which extends transversely of member **2** and opens toward the opposite side **50** of the member. Considering base **1** as being horizontal, groove **52** extends horizontally when the device is assembled. Groove **52** is of U-shaped transverse cross section and extends in a straight line, so that the side walls of the groove are parallel to surface **45** while the bottom wall of the groove is at right angles to surface **45**. The portion constituting the upper wall of the groove is provided with a centrally disposed projection **53** which extends parallel to surface **45** and is of rectangular plan configuration.

At its side opposite groove **52**, the portion **51** is provided with a notch **54** which extends for the full height of portion **51** and is deeper at the top of portion **51** than it is therebelow, so that the notch provides an upwardly facing shoulder **55** which is flat and parallel to surface **45**. Notch **54** includes a bottom wall portion **56** which extends downwardly from shoulder **55** and joins the lower surface **46** of member **2** in a right angle corner indicated at **57**, FIG. 1. Notch **54** is shorter than the length of sides **49** and **50** and is centered with respect to side **49**, so that the ends of the notch are closed by rectangular

portions 58, FIGS. 5 and 9. As seen in FIG. 9, the length of notch 54 is just adequate to accommodate the upper portion 39 of the latch member 31.

The distance between shoulder 55 and corner 57 is such that the portion of member 2 defined by the surfaces at 55, 56 and the portion of surface 46 immediately below shoulder 55 can be accommodated beneath the shoulder 37 provided by catch member 31, as will be clear from FIG. 1.

At the end of member 2 adjacent side 50, the body of member 2 is cut away to provide a notch 59 which is centered with respect to side 50 and is of a length adequate to just accommodate the stationary catch member 40. As seen in FIG. 1, notch 59 includes a vertical wall 60, spaced from side 50, and a second wall, at right angles to wall 60, this second wall being provided with an upwardly opening groove 61 disposed and dimensioned to accommodate the turned down edge portion of the upper web 43 of catch member 40. The lower surface 46 of member 2 does not extend completely to side 50. Instead, the body of member 2 is cut away to provide an upwardly and outwardly slanting surface portion 62 in the nature of a chamfer or bevel.

At each end of notch 59, there is provided in member 2 an aperture 63, each aperture 63 opening at its upper end through the top face of member 2 and, at its lower end, through the surface 62, the two apertures being identical and of rectangular transverse cross section. At each end of sides 50, member 2 is provided with an upwardly projecting, rectangular ear 64 formed integrally with the body of member 2.

Between ears 64, there is disposed a pivoted catch member 65, FIGS. 5, 6 and 10. Catch member 65 includes an upper elongated portion 66 which is only slightly smaller in length than the space between ears 64, and a pair of legs 67 which depend from the ends of portion 66, each leg 67 being disposed within a different one of the apertures 63. Member 65 is pivotally mounted on member 2, as by a pair of aligned screws 68 each extending through the outer wall of a different one of the apparatus 63 and through a cylindrical opening in the corresponding one of the legs 67, the screws 68 having threaded tips engaged in the body of member 2, and plain shaft portions disposed in the openings in the legs. At its top, portion 66 has an overhang 69 which projects toward side 49 of member 2 and provides a downwardly facing shoulder 70. For each leg 67, there is provided a helical compression spring 71 disposed in a suitable opening in the body of member 2 and engaging the lower edge portion of the leg 67 which is directed toward side 49. Springs 71 serve to bias the legs 67 in a counterclockwise direction, as viewed in FIG. 6, to cause edge portions 72 of the legs to engage the adjacent wall of the corresponding aperture 63. Overhang 69 provides an upwardly and outwardly slanting flat cam surface 73.

As seen in FIG. 5, the main body portion of member 2 is provided with a group of one hundred apertures 74 arranged in matrix fashion, there being ten spaced rows of ten such apertures extending parallel to the long sides 47 and 48 of member 2 and ten spaced rows of the apertures extending parallel to short sides 49 and 50. All of the apertures 74 are identical, being generally cylindrical in configuration, with an enlarged upper portion 75 (FIG. 6), opening through surface 45, and a smaller shank portion 76, opening through lower surface 46. In each aperture, the upper and lower portions are joined by an upwardly facing transverse annular shoulder 77, which may be beveled if desired.

Member 2 is also provided with an additional row of ten apertures 78 located in the area of surface 45 adjacent portion 51. Apertures 78 are equally spaced from each other, and from the adjacent apertures 74, the spacing between apertures 78 being equal to the spacing between apertures 74. Apertures 78 are each identical to apertures 74 in size and configuration.

Member 2 includes two flat, coplanar upper surface portions 79 and 80 which are spaced slightly above the main upper surface 45. Surface portion 79 constitutes the lower side wall of groove 52. Surface portion 80 extends beneath shoulder 70 of catch member 65.

Upper member 3 (FIG. 8), is an integrally formed, flat transparent body of synthetic resinous material such as methyl methacrylate polymer. Rectangular in plan, member 3 has long sides 81 and 82, short sides 83 and 84, a flat upper face 85, and a flat lower face 86. Along side 83, the upper portion of member 3 is cut away for the full length of side 83 to provide a nose portion 87 the upper surface of which is spaced below face 85, there being a shoulder 88 at the root of nose portion 87. At side 84, the upper portion of member 2 is similarly cut away to provide a nose portion 89 and there is a shoulder 90 at the root of nose portion 89. At its center, shoulder 88 is provided with a rectangular centering notch 91 which opens toward side 83, and shoulder 90 is similarly provided with a centering notch 92. As seen in FIGS. 1 and 7, the bottom surface 86 of member 3 is beveled at side 83 to provide an upwardly and outwardly slanting surface 93. A similar bevel is provided adjacent edge 84, providing an upwardly and outwardly slanting surface 94.

At is lower surface 86, member 3 is provided with ten identical, parallel grooves 95 which are parallel to the long sides 81 and 82 of member 3. At each end of each groove 95, there is provided a through bore 96 having an enlarged frusto-conical mouth portion 97 at surface 85. Each groove 95 accommodates a straight, elongated, cylindrical, electrically conductive wire 98, the ends of each wire 98 being bent at right angles to the body of the wire and each disposed in a different one of the corresponding bores 96. The tips of the ends of the wires are deformed transversely, as by a snipping operation, to provide an enlargement 99 in the accommodating mouth 97, so that the portions of the wires disposed in bores 96 are in tension and the main bodies of the wires are thus securely held in grooves 95. At the ends of grooves 95 adjacent side 83 of member 3, all of the bores 96 are aligned in a plane parallel to side 83. Similarly, all of bores 96 at the other ends of the groves 95 are aligned in a plane parallel to edge 84. The grooves 95 are of such length, and are so positioned, that each groove is capable of overlying all of the apertures 74, plus one of the apertures 78, in a line of such apertures parallel to the long sides 47 and 48 of member 2. If desired, mouth portions 97 may be covered with an insulating tape or otherwise filled with insulating material to prevent contact with the exposed ends 99 of wires 98.

In this embodiment, a plurality of identical interconnecting pins 100 capable of being accommodated in the apertures 74 and 78 are employed. Each connecting pin 100 is in the form of an intertangled body or mass of fine, resilient, electrically conductive wire shaped by compression into a generally cylindrical configuration. The very fine wire constituting the body of each pin 100 can be intertangled in random fashion, or the body can be formed from a mass of knitted wire. Each pin 100 includes a shank portion 101, FIG. 6, of a diameter to fit snugly within the shank portion 76 of one of the apertures, and an enlarged head portion 102 of a diameter to fit snugly within the enlarged top portion 75 of one of the apertures. In relaxed condition, the head portion 102 of each pin 100 is longer than are the enlarged upper portions 75 of the apertures, while the shank portions 101 of the pins are materially longer than the shank portions 76 of the apertures.

Advantageously, the connector pins 100 can be formed from individual right cylindrical blanks of the intertangled wire material, such blanks being placed in a die cavity of the general configuration of the apertures 74,

78, with the axial dimension of the die cavity being materially greater than that of the aperture. The head 102 of the connecting pin is then formed by what is essentially a compression molding operation, with the molding pressure applied axially.

Considering preparation of the device for use, base 1, programming board or intermediate member 2, and upper member 3 are separate from each other, base 1 being mounted on the equipment with which the device is to be used, and suitable connections being made in conventional fashion to the various lead terminals 18 and 24. Conveniently, connector pins 100 can be inserted in all of the apertures 78 in member 2, without regard to the interconnections to be made between the various ones of wires 14 and wires 98. Additional connector pins 100 are inserted in the proper ones of apertures 74, in accordance with the desired interconnections.

Member 3 is now snapped into member 2 by first inserting one of the nose portions 87, 89 into groove 52 in portion 51 of member 2. This is accomplished by holding member 3 at an angle to the plane of member 2, the angle being allowed by the appropriate chamfer or bevel 93, 94, shifting member 3 axially toward portion 51 until the nose portion is disposed in groove 52, and then pivoting the member 3 toward member 2. The corresponding edge 83, 84 accordingly comes into engagement with cam surface 73 of catch member 65, causing that catch member to be pivoted in a clockwise direction, as viewed in FIG. 6, to allow the nose portion to engage beneath shoulder 70. With member 3 so installed, portions of the lower surface 86 thereof adjacent beveled surfaces 93 and 94 are in respective engagement with the surface portions 79 and 80 of member 2.

Member 2 is then manipulated manually to bring groove 61 beneath the upper web 43 of stationary catch member 40. To accomplish this, member 2 is held at such an angle to the upper face of base 1 that the chamfer or beveled surface 62 is parallel to the plane of the base, member 2 then being shifted longitudinally toward the stationary catch members 60 until the downturned edge of web 43 is aligned with groove 61. Member 2 is then pivoted toward the base, shoulder 57 coming into engagement with the cam surface 38 of pivoted catch member 31. Further movement of member 2 toward the base causes catch member 31 to be pivoted in a counterclockwise direction, as viewed in FIG. 1, against the biasing action of spring 33. Finally, member 2 comes to rest in the position seen in FIG. 1, with catch member 31 being returned to its normal position, by the action of spring 33, with shoulder 37 engaged over shoulder 55. Accordingly, member 2 is held in place by stationary catch member 40 and pivoted catch member 31, the lower face 46 of member 2 being in direct engagement with the wires 14 and 23.

Since member 2 directly engages the wires supported by base 1, the catch members employed are effective to maintain base 1, member 2 and member 3 in firm mutual engagement. From FIG. 1, it will be noted that the upper surface 45 of the main body portion of member 2 is spaced below the lower face 86 of member 3 by a distance slightly greater than one half the diameter of wires 98, so that wires 98 are actually spaced slightly above the tops of apertures 74 and 78.

As member 2 reaches the final position seen in FIG. 1, the lower ends of the connecting pins 100 come into engagement with the appropriate ones of wires 14 and 23. At this time, pins 100 are free to shift axially in their accommodating apertures. Accordingly, since the pins are in relaxed condition, and therefore longer than the apertures, the pins project above the open tops of the apertures by a distance which is substantially greater than the ultimate spacing between surface 45 and wires 98. Typically, this distance may be twice the ultimate spacing between surface 45 and wires 98, or even greater. When member 3 is now installed, the wires 98 engage the upper end faces of pins 100, forcing the pins downwardly, so that the pins are all ultimately uniformly compressed, in an axial direction, between the upper surface 8 of base 1 and the lower surface 86 of member 3, with the appropriate ones of wires 14, 23 and 98 impressed into the resilient mass of the corresponding pins. Since each wire 14, 23 and 98 projects from the member which carries it by a distance equal to one half of the diameter of the wire, it follows that one half of the wire will be imbedded in the pin 100 which engages it.

Accordingly, when the device has been assembled in the fashion seen in FIG. 1, those pins 100 which have been installed in the programming board or intermediate member 2 are effective to establish good electrical connections between all of the wires 23 and all of wires 98, and between the selected ones of wires 98 and 14.

It is to be noted that, in assembling the device, members 2 and 3 are snapped into place substantially without relative movement laterally of the connector ends 100. Accordingly, frictional sliding action is substantially minimized. With the device in assembled condition, member 2 cannot be shifted materially in any lateral direction, due to the engagement of the downturned edge of web 43 of stationary catch member 40 in groove 61. Member 3 cannot be shifted longitudinally of the device, since member 3 is held firmly between the bottom wall of groove 52, on the one hand, and the vertical edges of ears 64, on the other hand. Movement of member 2 in a direction parallel to its short sides is prevented by engagement of the downturned edge of web 43 in groove 61, while similar movement of member 3 is prevented by engagement of centering projection 53 in the corresponding one of notches 91 and 92, plus engagement of member 3 with ears 64.

The assembled combination of members 2 and 3 can be removed from the base simply by manually pivoting catch 31 in a counterclockwise direction, as viewed in FIG. 4, and then pivoting the combination of members 2 and 3 until member 2 is disengaged from the stationary catch member 40. Similarly, member 3 can be removed from member 2 by manually pivoting latch member 65 in a clockwise direction, as viewed in FIG. 6, and then pivoting member 3 away from member 2 and withdrawing member 3 from engagement in notch 52.

While a certain advantageous embodiment has been chosen to illustrate the invention, it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. In an electrical interconnecting device of the type described, the combination of

a base of electrical insulating material having an upper surface portion;

an intermediate member of insulating material having upper and lower surface portions;

an upper member of insulating material having a lower surface portion;

a first group of electrically conductive wires secured to said base and exposed at said upper surface portion thereof in mutually parallel relation,

said first group of wires having elongated portions lying in a common plane parallel to and projecting upwardly from said upper surface portion of said base;

a second group of electrically conductive wires secured to said upper member and exposed at said lower surface thereof in mutually parallel relation,

said second group of wires having elongated portions lying in a common plane parallel to and projecting downwardly from said lower surface portion of said upper member;

releasable means for securing said intermediate member to said base with said lower surface portion of

said intermediate member facing said upper surface portion of said base,

said intermediate member being provided with a plurality of spaced apertures;

releasable means for securing said upper member to said intermediate member with said lower surface portion of said upper member facing said upper surface portion of said intermediate member,

the wires of said second group extending across the wires of said first group when said intermediate and upper members are so secured by said releasable means,

said apertures being so located that, when said intermediate and upper members are so secured by said releasable means, each of said apertures is disposed at a point where a wire of said second group crosses a wire of said first group; and

a plurality of connector pins each disposed in a different one of said apertures to establish an electrical connection between the corresponding wires of said first and second group,

each of said connector pins comprising an axially compressible body the ends of which are deformable and have transverse dimensions materially greater than the diameter of said wires,

said connector pins each being axially compressed between said base and upper member, when said intermediate and upper members are secured by said releasable means, with said wires extending across the respective end faces of the corresponding pin, and with the end faces of said pins being subjected to localized compressive deformation such that each of said end faces embraces the projecting wire with which it is engaged.

2. A device in accordance with claim 1 and wherein each of said connector pins is in the form of intertangled, fine, resilient, electrically conductive filamentary material,

the diameter of the wires of said first and second groups being large as compared to the transverse dimension of said filamentary material.

3. A device in accordance with claim 1 and wherein the relaxed lengths of said connector pins is such that, when said intermediate and upper members are so secured by said releasable means, the end faces of said pins are in respective engagement with said upper surface portion of said base and said lower surface portion of said upper member.

4. In an electrical interconnecting device of the type described, the combination of

a rigid base of electrical insulating material having a flat upper surface portion,

said surface portion being provided with a plurality of bores extending therethrough and each opening into an end of a different one of said grooves;

a first group of electrically conductive wires each having an elongated main body portion and two end portions,

each wire of said first group being disposed with its main body portion seated in one of said grooves and its end portions each extending through a different one of the ones of said bores associated with said one groove,

said each portions being transversely deformed at the lower surface of said base and said end portions being stressed in tension to maintain said main body portions seated in said grooves,

the transverse dimensions of said wires being such that said wires substantially fill said grooves and project above the plane of said flat upper surface portion of said base;

an intermediate member of insulating material, said intermediate member having a flat upper surface portion, a flat lower surface portion and a plurality of spaced apertures extending between said upper and lower surface portions;

an upper member of rigid insulating material, said upper member having a flat lower surface portion provided with a plurality of mutually parallel grooves,

the body of said upper member being provided with a plurality of bores extending therethrough and each opening into an end of a different one of said grooves at the lower surface portion of said upper member;

a second group of electrically conductive wires each having an elongated main body portion and two end portions,

each wire of said second group being disposed with its main body seated in one of said grooves at the lower surface portion of said upper member and its end portions each extending through a different one of said bores associated with such groove,

the end portions of said wires of said second group being transversely deformed at the upper surface of said upper member and said end portions being stressed in tension to maintain said main body portions seated in said grooves,

the transverse dimensions of said wires of said second group being such that said wires substantially fill said grooves at the lower surface portion of said upper member and project below the plane of said flat lower surface portion of said upper member;

releasable means securing said intermediate member to said base with said flat lower surface portion of said intermediate member overlying said flat upper surface portion of said base;

releasable means securing said upper member to said intermediate member with said flat lower surface portion of said upper member overlying said flat upper surface portion of said intermediate member,

said wires of said second group crossing said wires of said first group when said members are so secured by said releasable means,

said apertures of said intermediate member each being disposed at a point of crossing of said wires when said members are so secured; and

a plurality of axially compressible conductive connector pins each extending through a different one of said apertures in said intermediate member and each having its ends engaged respectively with one wire of said first group and one wire of said second group.

5. In a device of the type described, the combination of

a rigid base of electrical insulating material, said base having a flat upper surface portion,

said flat upper surface portion being provided with a plurality of mutually parallel elongated grooves,

the body of said base being provided with a plurality of bores extending therethrough, each of said grooves being intersected by a different pair of said bores;

a plurality of electrically conductive wires each having an elongated main body portion, a first end portion and a second end portion,

each of said wires being disposed with its main body portion seated in one of said grooves, its first end portion extending through one of said bores and being laterally deformed at its tip to engage beneath said base, and its second end portion extending through another of said bores and projecting beyond said base to provide a terminal portion,

the second end portion of each of said wires being transversely deformed to engage beneath said base,

said end portions being stressed in tension in said bores to maintain said main body portions seated in said grooves;

a body of insulating material having a flat surface portion and a plurality of apertures opening therethrough;

means securing said body to said base with said flat lower surface portion of said body overlying said flat upper surface portion of said base and each of said apertures opening toward one of said wires;

a plurality of axially compressible conductive connector pins each disposed in a different one of said apertures; and

means secured to and overlying said body of insulating material for maintaining said connector pins in compression.

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