June 13, 1950 I. L. AUERBACH 2,510,944

ELECTRICAL CONNECTOR

Filed Sept. 27, 1946

FIG. 1

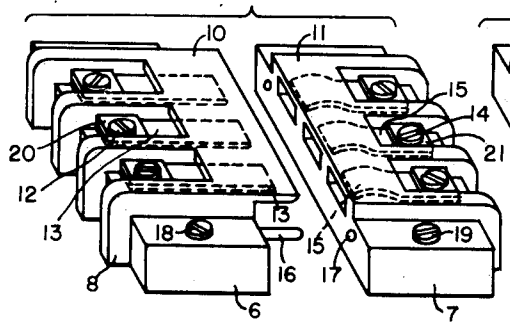


FIG. 3

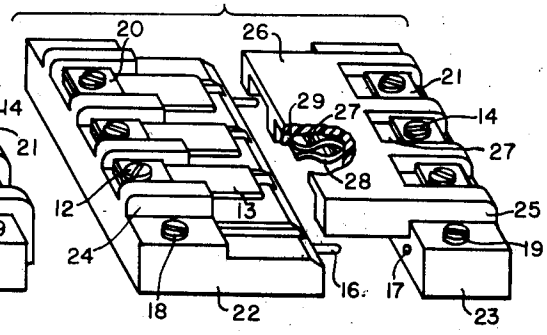


FIG. 2

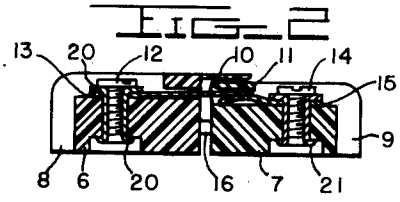


FIG. 4

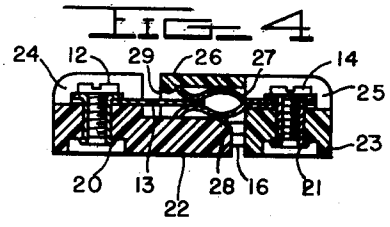
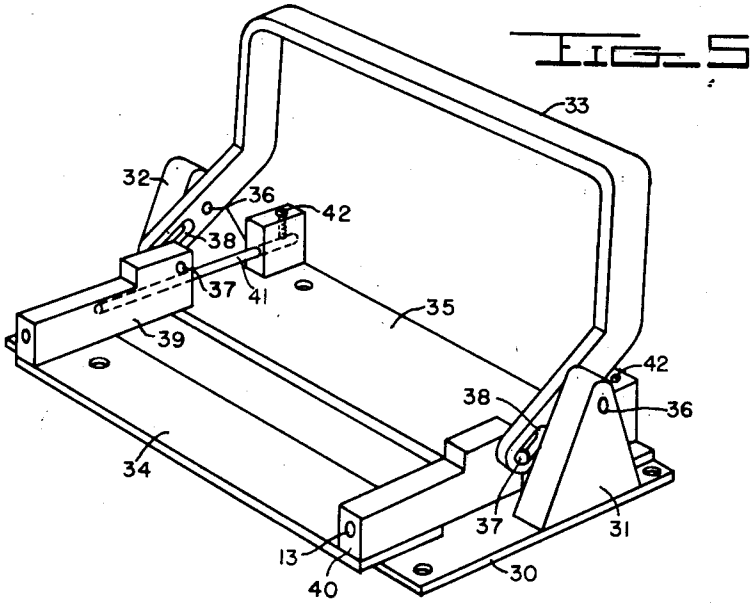


FIG. 5



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ELECTRICAL CONNECTOR

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7 Claims. (Cl. 173—328)

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This invention relates to electrical connectors and more particularly to an electrical connector embodying in one device the advantages of a terminal strip and the advantages of a plug connector.

Nearly all electrical and electronic apparatus require connection to externally located apparatus if it be only the source of electric power. It is further desired in some types of equipment to have small sections of the whole removable to facilitate rapid replacement, trouble shooting, and repair. More specifically, radio equipment assembled in a console is usually composed of a number of separate chassis which can be removed from the console; and in many designs a small section of a single chassis can be exchanged by simply unplugging from the rest of the chassis. In the foregoing examples provisions must be made for making the required electrical connections between the removable part and its associated equipment. This has usually been accomplished by multi-conductor cables and plugs joining either at the front of the removable unit by threaded couplings or at the base in such a manner that the plugs are connected by the replacement of the unit. There are several disadvantages incident to such connection, the conductors are not available for test measurements unless the plugs are disconnected, and then the circuits are not energized. Even with the plugs disconnected the contacts are difficult to reach and the circuits difficult to trace. Furthermore, in many types of electrical connectors there is an undesirable resistance between corresponding contacts. It would be an advantage in many types of equipment to disconnect one circuit from another located on the same chassis without unsoldering or unscrewing a number of terminals.

It is an object of this invention to provide an electrical terminal strip which may be joined with a similar terminal strip to constitute an electrical connector.

It is another object of this invention to provide pairs of connectable terminal strips having very low contact resistance yet easily connected or disconnected.

It is another object of this invention to provide pairs of connectable electrical terminal strips with solderless connections having the electrical and physical isolation characteristics of soldered connections.

It is another object of this invention to provide pairs of connectable electrical terminal strips which may be manufactured with some standard number of terminals and easily cut to

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accommodate no more than a lesser number of conductors as a means of saving space and eliminating unused terminals.

It is another object of this invention to provide pairs of connectable terminal strips easily accessible to test leads.

Other objects, advantages and novel aspects of the invention lie in certain details of construction as well as the cooperative relation of the component parts and will be apparent from the following description and accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

In the drawings:

Fig. 1 is a perspective view of one embodiment of the invention.

Fig. 2 is a cross-sectional view of the embodiment in Fig. 1 taken through any pair of corresponding terminals.

Fig. 3 is a partially cut away perspective view of another embodiment of the invention.

Fig. 4 is a cross-sectional view of the embodiment in Fig. 3 taken through any pair of corresponding terminals.

Fig. 5 is a perspective view of a device for mechanically engaging or disengaging the embodiments in the preceding figures.

Briefly, this invention provides pairs of terminal strips which can be joined together and which may be simply constructed from flat insulating blocks, preferably molded to a desirable shape, each supporting an equal number of metal springs, each metal spring providing a contact surface for a terminal, and in addition, engaging a corresponding metal spring from the other block upon the joining together of said pair of blocks. Thus a means of plug-in connection between terminal strips is provided.

The invention may be better understood by reference to Fig. 1 in detail, which shows a perspective view of one embodiment of the invention as seen from slightly above and to one side. Two insulating blocks 6 and 7 comprise the bulk of the device and should be made of some insulating material, preferably one of high dielectric that can be molded to the shapes here shown. Each block is essentially a long, generally rectangular, strip, the length being determined by the number of terminals desired. The shape of the two blocks departs from the rectangular in the manner shown in the drawing in order that each may be more suitable for its purpose. The male connector terminal block 6 has a flat spring 13 for each terminal, each spring may be at-

tached to the block by a sleeve 20 inserted vertically into a suitable hole in the block and having a flange at its upper end to retain said spring. This function will be disclosed more completely below in reference to Fig. 2. Upon the inner periphery of said sleeves 20 threads may be cut suitable to receive the terminal screws 12. Said retaining flange of said sleeves 20 is preferably square and sized to closely fit between the barriers 8 described below so that they cannot turn with the terminal screws 12. Said screws 12 provide a means of connecting wires to the terminal block. The holes provided in the block for each sleeve 20 may be used with longer screws 18 to mount said block. By using the same holes for mounting, a long block may be cut to any desired length and the end terminal screw 12 replaced by a mounting screw 18. The end metal spring 13 could also be removed before inserting the mounting screw 18. It is desirable to mold the block with raised ridges or barriers 8 located transverse the long axis of the block between the terminal screws 12. Said barriers 8 will prevent shorts between adjacent terminals that might otherwise be caused by one or more loose wires or occur during the connection or disconnection of a conductor to a terminal and will further provide a higher dielectric between terminals to improve the voltage rating of the device. Each metal spring 13 attached to the male block 6 has sufficient length to protrude from one edge of the block. It is this side of the male block 6 that is abutted to the female block 7 to electrically connect the two blocks. When so abutted each spring 13 will penetrate a suitable orifice in the female block 7 and engage a second metal spring 15 mounted on said female block 7. The springs may be made of any suitable conducting material preferably of beryllium copper, plated with silver. The male block 6 and the female block 7 are shown separated in Fig. 1, as here shown the male block 6 is shaped so as to have a ledge 10 projecting from its top, parallel to its base and overhanging the portion of each spring 13 which protrudes from the block. This ledge is designed to protect the projecting male springs from contact with foreign objects when the blocks are not joined together. It should be noted that the barriers offer similar protection to the terminals whether or not the blocks are engaged. Said ledge 10 may also act as a guide for the male springs while the two blocks are being joined together. The female block 7 is in general similar to the male block 6. Each spring 15 is mounted by a flanged-sleeve 21 threaded for the terminal screws 14, and the same holes can be used for the mounting screws 18 as for the terminal screws 14. However, the metal springs 15 are curved at one end as will be more clearly indicated below in reference to Fig. 2. These terminals are also separated by barriers 9, the tops of said barriers 9 at the abutting side of said block 7 are joined by a retaining lip 11 so as to leave a suitable orifice between each pair of barriers for the insertion of the male spring 13. The barriers 8 of block 6 are higher than the barriers 9 of block 7, the height relationship being such that the lower surface of the ledge 10 on block 6 will pass over the upper surface of the lip 11 of block 7 when the two blocks are joined together. A guiding stud may be projected outwardly and normal to the abutting surface of the male block 6 beyond the ends of the spring contacts 13 about every half dozen terminals. Suitable holes 17 are similarly provided in the abutting surface of the female block 7 to receive the guiding studs 16. Said studs not only guide the male springs into the female block but also insure that said springs are inserted into the proper contacts. It should be understood that the embodiments have been illustrated with three terminals only to simplify disclosure. The blocks may be made in any length which may easily be cut into shorter lengths to accommodate the number of terminals desired and the space available.

The cross-sectional view shown in Fig. 2, to which reference is now made, is taken transverse to the long dimension of Fig. 1, through any pair of corresponding terminal screws 12 and 14. The blocks 6 and 7 are here shown almost completely joined together in order to demonstrate the engaging of their respective springs 13 and 15. This view illustrates the height relation of the barriers 8 of block 6 and the barriers 9 of block 7, and as well, the relative size of the ledge 10 in respect to the barriers 8 and the lip 11 in respect to the barriers 9. As shown, the lower or engaging edge of the ledge 10 is chamferred, as is the lower engaging edge of the lip 11, thus permitting the blocks to be joined together without binding or catching. Each hole in the male block for the terminal screws 12 is fitted with a metal sleeve 20 threaded upon its inner periphery to receive said screws 12. Each said sleeve 20 has a retaining flange at its upper end to hold the spring 13 and is peened at its lower end to anchor it securely in the block 6. The threaded sleeve is preferred to a threaded hole in the block, it being simpler to add a threaded sleeve than cut threads in the block and the threads so obtained are more durable. The portion of the female contact spring 15 which resides under the lip 11 is curved so that the center of its curvature presses against the underside of the said retaining lip. This pressure insures a good contact with the corresponding male spring and keeps contact surface of the said female spring clean when the blocks are not joined together. The curvature brings the end of the spring back down to the surface of the block so that upon insertion, the male spring 13 will pass between the female spring 15 and the lip 11 and not catch against the leading edge of said female spring 15, or go beneath. The screws 14 of the female block 7 screw into metal sleeves identical to the sleeves 20 used in connection with the male block 6.

Referring to Fig. 3, another embodiment of the invention is shown differing from Fig. 1 only in the shape of the blocks and the use of two female springs instead of one. In this embodiment the male block 22 has no ledge projecting above the male springs 13 but the block itself projects below the male springs. Sufficient clearance is provided between the block and the projecting springs for the lower female spring 28. The barriers 24 of the male block 22 are similar to those of Fig. 1 except they are not joined together at the top. The female block 23 may have two abutting surfaces in this embodiment, the lower one may abut the portion of the male block projecting below the springs, the upper one abuts the barriers 24 of the male block so that the material of the block rather than air is the insulation medium between the springs. Said upper abutting surface is the end of a ledge 26 projecting from the barriers 25 of the female block and overhanging the projecting ends of the female springs 27 and 28. It may be observed

in Fig. 3 that said ledge 26 includes a projection of the female barriers so as to enclose said female springs 27 and 28 upon three sides. Grooves corresponding to the projections of said barriers are shown in the portion of male block 22 projecting below the insertable end of the male springs 13, and upon joining of the blocks said grooves will receive the lower edges of the projections of said barriers 25. By means of said barrier projections fitting in said grooves, a dielectric better than air is provided between the different springs when the blocks are joined. The lower female spring 28 rides upon the projection of block 22 when the blocks are engaged to increase the contact pressure of the springs. The female springs are preferably a pair of similarly curved metal springs, flat at one end through which a hole may be made for mounting same with the terminal screw 14. Said springs 27 and 28 are mounted back to back so that they press against each other at the center of their curvatures. The male spring 13 inserts between said female springs upon the joining of the two blocks 22 and 23.

The layout of the metal springs used in the second embodiment may be more easily understood from the cross-sectional view in Fig. 4, to which reference is now made. The male and female block are here partially joined to demonstrate the engaging of the springs. It will be noted that the female springs 27 and 28 fit snugly between the lower projection of the male block 22 and the upper projection 26 of the female block 23. This insures a firm contact with the inserted male spring 13. The upper projecting ledge 26 has a bead 29 along the lower edge of its abutting surface between the barrier projections. This bead 29 permits insertion of the male spring 13 without binding or catching. The relative dimensions of the barriers 24 and 25, the blocks 22 and 23, and the projecting ledge 26 are more clearly indicated in this figure. The pressure between the female springs 27 and 28 keeps them clean when the blocks are not joined. Also, the insertion of the metal spring makes a long wiping contact which further cleans the contact surfaces. These connectors have been found by measurement to offer a contact resistance of the order of .0008 ohm.

Fig. 5 shows a device which may be used to connect and disconnect a pair of terminal connectors such as exemplified in the first four figures. The use of this device would liken the invention to a multi-pole single throw knife switch. The device operates with a movable platform 34, having pins 37 protruding laterally one each from two side members 39 and 40 of the said movable platform 34. Said pins are engaged in elongated slots 38 at the ends of the U-shaped handle 33. Said U-shaped handle 33 may be pivoted upon its parallel members. Said parallel members are pivotable mounted by means such as rivets 36 to a pair of stanchions 31 and 32 suitably mounted vertically upon opposite sides of a base plate 30. Moving said handle 33 counterclockwise about its pivots 36 will slide the movable platform 34 to the right along the base plate 30. A stationary platform 35 is mounted on the right side of the base plate 30. Moving the handle 33 as described slides the movable platform 34 toward the stationary platform 35. Both said platforms are equipped with suitable holes to accommodate the mounting screws 18 and 19 of a pair of terminal connector blocks as shown in Fig. 1 or Fig. 3. By so attaching a pair of said blocks, the male block

to one said platform and the female block to the other said platform, manipulating the handle 33 will engage or disengage the spring contacts of the said blocks. Aligning rods 41 are suitably mounted in the vertical side members of the stationary platform 35 and held in place by set screws 42. Said rods 41 are of a suitable length to penetrate longitudinal holes 43 in the vertical side members 39 and 40 of the movable platform 34 and thus prevent any misalignment of contacts upon the engaging of a pair of connector terminal blocks mounted upon said platforms 34 and 35.

Although only limited and specific embodiments of the present invention have been shown and described, it may be modified without departing from the principles thereof and any such modifications, are, therefore, deemed to be within the scope of the invention as defined by the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. An electrical connector comprising a pair of generally rectangular shaped insulating blocks, a first multiplicity of flat metallic spring like contact members disposed at equal intervals along the longitudinal axis in transverse relation thereto of one of said blocks, and a second multiplicity of metallic spring like contact members similarly disposed in transverse relation with respect to the longitudinal axis of the other of said blocks, the contact members associated with one of the blocks being so formed as to electrically engage the corresponding contact members of the other of said blocks on abutment of the corresponding longitudinal sides of said blocks, each of said contact members having a portion thereof exposed for external electrical connection, a transverse raised rib like portion separating adjacent contact members of each of said blocks, and a longitudinal retaining member integral with one end of each said rib like portion on said other block and disposed over the engaging end of the contact members of said other block.

2. An electrical connector comprising, a pair of generally rectangular insulating blocks, a first plurality of exposed electrical terminals disposed at equal intervals along the longitudinal axis of one of said insulating blocks, a second plurality of exposed electrical terminals disposed in a similar manner on the other of said insulating blocks, a first plurality of flat metallic spring like contact members each associated with one of said first plurality of electrical terminals and extending transversely beyond one longitudinal side of said one of said blocks, a second plurality of flat metallic spring like contact members each associated with one of said second plurality of electrical terminals, the contact members associated with one of the blocks being so formed as to electrically engage the corresponding contact members of the other of said blocks on abutment of the corresponding longitudinal sides of said blocks, a transverse raised rib like portion separating adjacent contact members on each of said blocks, and a longitudinal retaining member integral with one end of each said rib like portion on said other block and disposed over the engaging end of the contact members of said other block.

3. An electrical connector comprising a pair of generally rectangular shaped insulating blocks, a first multiplicity of flat metallic spring like con-

tact members disposed at equal intervals along the longitudinal axis in transverse relation thereto of one of said blocks, said contact members extending beyond one longitudinal side of said block, and a second multiplicity of metallic spring like contact members similarly disposed in transverse relation with respect to the longitudinal axis of the other of said blocks, said second multiplicity of contact members being curved at one end and extending at said curved end to one longitudinal edge of said other of said blocks, a multiplicity of transverse rib like portions located on each of said blocks and arranged to separate the adjacent contact members thereon, a connecting means associated with each of said contact members, and a longitudinal retaining member integral with one end of the rib like portions of said other of said blocks, said longitudinal retaining member being located over the curved ends of said last named multiplicity of contact members and in physical contact therewith, whereby a multiplicity of rectangular openings are provided in the longitudinal side of said other of said blocks into which said first named multiplicity of contact members of said one of said blocks are adapted to be inserted upon abutment of the corresponding longitudinal sides of said blocks.

4. An electrical connector comprising a pair of generally rectangular shaped insulating blocks, a first multiplicity of flat metallic spring like contact members disposed at equal intervals along the longitudinal axis in transverse relation thereto of one of said blocks, said contact members extending beyond one longitudinal side of said block, and a second multiplicity of metallic spring like contact members similarly disposed in transverse relation with respect to the longitudinal axis of the other of said blocks, said second multiplicity of contact members being curved at one end and extending at said curved end to one longitudinal edge of said other of said blocks, a multiplicity of transverse rib like portions located on each of said blocks and arranged to separate the adjacent contact members thereon, a connecting means associated with each of said contact members, and a longitudinal retaining member integral with one end of the rib like portions of said other of said blocks, said longitudinal retaining member being located over the curved ends of said last named multiplicity of contact members and in physical contact therewith, whereby a multiplicity of rectangular openings are provided in the longitudinal side of said other of said blocks into which said first named multiplicity of contact members of said one of said blocks are adapted to be inserted upon abutment of the corresponding longitudinal sides of said blocks, a longitudinal lip integral with one end of the rib like portions of said one of said blocks and projecting therefrom over and beyond the extension of said first multiplicity of contact members, said lip being so disposed as to fit over said retaining member upon abutment of said blocks.

5. An electrical connector comprising a pair of generally rectangular shaped insulating blocks, a first multiplicity of flat metallic spring like contact members disposed at equal intervals along the longitudinal axis in transverse relation thereto of one of said blocks, said contact members extending beyond one longitudinal side of said block, and a second multiplicity of metallic spring like contact members similarly disposed in transverse relation with respect to the longitudinal axis of the other of said blocks, said second multiplicity of contact members being curved at one end and extending at said curved end to one longitudinal edge of said other of said blocks, a multiplicity of transverse rib like portions located on each of said blocks and arranged to separate the adjacent contact members thereon, a connecting means associated with each of said contact members, and a longitudinal retaining member integral with one end of the rib like portions of said other of said blocks, said longitudinal retaining member being located over the curved ends of said last named multiplicity of contact members and in physical contact therewith, whereby a multiplicity of rectangular openings are provided in the longitudinal side of said other of said blocks into which said first named multiplicity of contact members of said one of said blocks are adapted to be inserted upon abutment of the corresponding longitudinal sides of said blocks, a longitudinal lip integral with one end of the rib like portions of said one of said blocks and projecting therefrom over and beyond the extension of said first multiplicity of contact members, said lip being so disposed as to fit over said retaining member upon abutment of said blocks, a series of guiding rods projecting normal to the abutting edge of said one of said blocks and corresponding holes in the abutting edge of the said other of said blocks suitable to receive said rods whereby upon abutment of said blocks their respective contact members cannot be misaligned.

6. An electrical connector comprising, a pair of generally rectangular shaped insulating blocks, a multiplicity of flat metallic contact members disposed at equal intervals along the longitudinal axis in transverse relation thereto of one of said blocks, a multiplicity of pairs of metallic spring like contact members similarly disposed on the other of said blocks, each of said pairs of contact members consisting of similar metal strips curved at one end and flat at the other and placed back to back so that the curved portions of each exerts a pressure against the other, a transverse raised rib like portion separating the adjacent contact members of each of said blocks, a longitudinal retaining member integral with one end of each said rib like portion on said other block and disposed over the curved ends of the contact members of said other block, corresponding longitudinal sides of said pair of blocks being so shaped that upon abutment of said sides the said multiplicity of flat contact members of one of said blocks will insert between the curved ends of the said multiplicity of pairs of contact members of the other of said blocks.

7. An electrical connector comprising, a pair of generally rectangular shaped insulating blocks, a multiplicity of flat metallic contact members disposed at equal intervals along the longitudinal axis in transverse relation thereto of the first of said blocks, said first block being so cut away at the top of one longitudinal edge thereof as to leave one end of said multiplicity of transverse contact members free of said block, a multiplicity of pairs of metallic spring like contact members similarly disposed on the second of said blocks, each of said pairs of contact members consisting of similar metal strips curved at one end and flat at the other and placed back to back so that the curved portions of each exerts a pressure against the other, a transverse raised rib like portion separating the adjacent contact members of each of said blocks, said rib like portions on the second of said blocks being elongated so as to extend beyond one longitudinal edge thereof, the

extending portions being joined tgether at their tops so as to enclose said pairs of spring like contact members, said contact members also extending beyond the same longitudinal edge so as to reside within said enclosure, a transverse groove extending from each said raised rib on said first block along the said cut away portion of said block which extends below the contact members thereon, whereby said grooves will receive the lower edges of said rib extensions of said second block upon abutment of said blocks along corresponding longitudinal sides such that said multiplicity of flat contact members of said first block will insert between the curved ends of said multiplicity of pairs of metallic spring like contacts of said second block.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
305,897	Cox	Sept. 30, 1884
618,054	Case	Jan. 24, 1899
813,158	Linke	Feb. 20, 1906
994,516	Hubbell	June 6, 1911
1,162,361	Huddleston	Nov. 30, 1915
1,942,063	Kinnard	Jan. 2, 1934
1,967,021	Gary	July 17, 1934
2,032,301	Newman	Feb. 25, 1936
2,290,491	Obszarny	July 21, 1942
2,312,634	Frank	Mar. 2, 1943
2,326,327	Brewer	Aug. 10, 1943
2,430,011	Gillentine	Nov. 4, 1947

FOREIGN PATENTS

Number	Country	Date
558,603	England	Jan. 12, 1944