

March 28, 1950

H. M. BASCOM
ELECTRICAL CONNECTOR

2,502,307

Filed March 18, 1947

2 Sheets-Sheet 1

FIG. 1

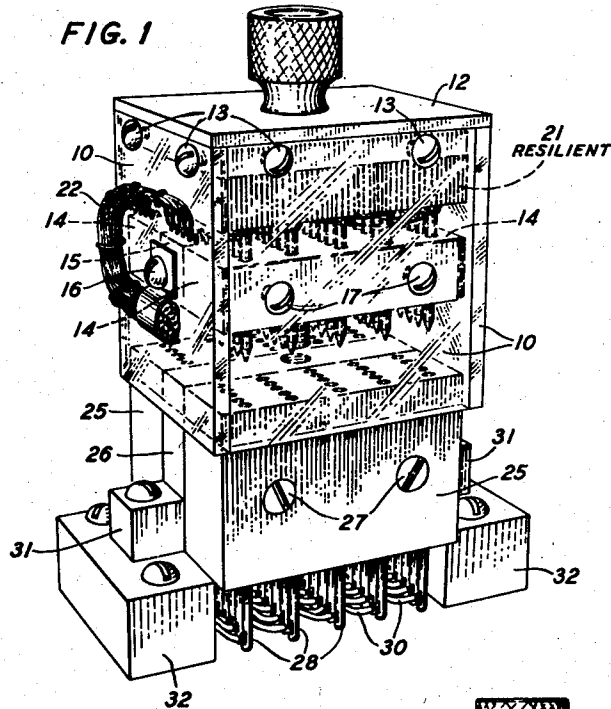


FIG. 2

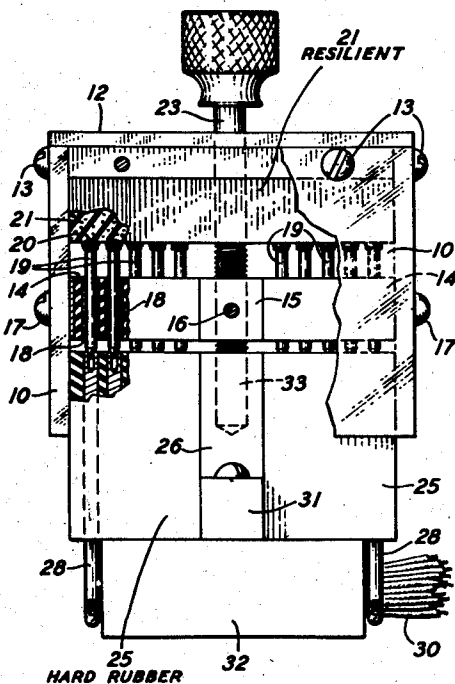
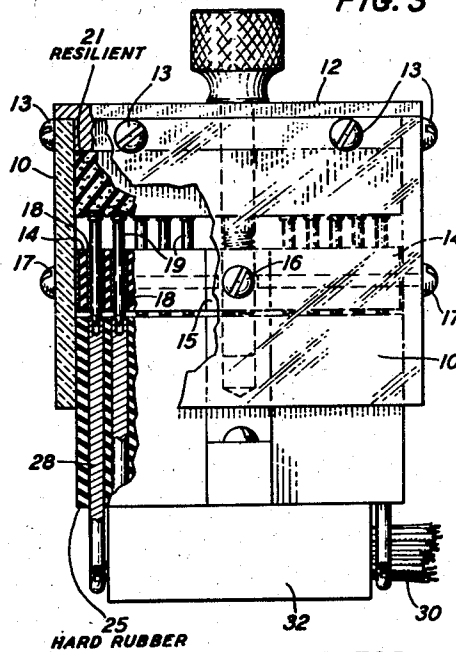


FIG. 3



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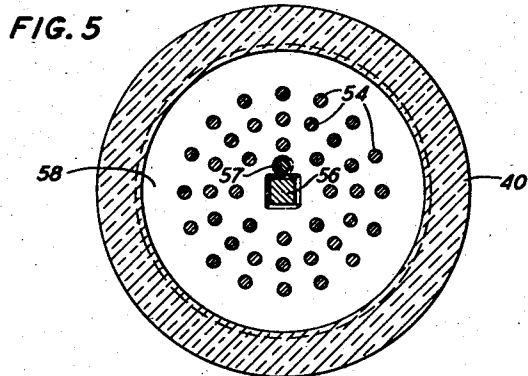
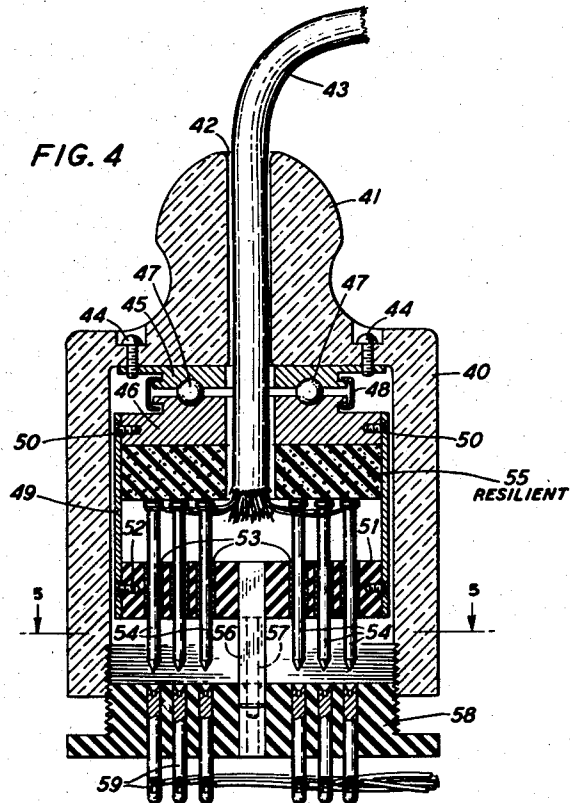
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ELECTRICAL CONNECTOR

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1 Claim. (Cl. 173-328)

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This invention relates to electrical connectors, of the jack and plug type, which are normally maintained locked in cooperative association by a latching mechanism, and particularly to electrical connectors in which cooperating contact elements are maintained in engagement under constant pressure.

Electrical connectors are commonly used in electrical installations and constitute practical media whereby electrical connections between two or more devices or circuits may be completed and interrupted in an expeditious manner. In many installations it is essential that precautions be taken lest the connections effected by the jack and plug terminals be disturbed by the accidental disassociation of the plug from the jack which may be caused, for example, by vibration. Such a requirement is met by the utilization of various forms of clamping devices which function to securely maintain the connector units in mutual association. To insure reliable electrical contact between the cooperating contacts of plug and jack terminals of this type the use of coil springs has been resorted to which serve to urge the corresponding plug and jack contacts into intimate engagement under pressure. While such a method of insuring reliability of contact is effective, the incorporation of the coil springs in the structure of one or both of the cooperating contacts of the jack and plug results in a contact or terminal structure which is highly complex and therefore proportionately expensive and difficult to maintain.

It is the object of this invention to simplify and otherwise improve two-part multiterminal connectors of the type in which reliability of electrical contact between the cooperating terminals thereof is of prime importance and in which such contact is assured by the use of pressure producing instrumentalities.

This object is attained in accordance with a feature of the invention by providing the terminals of one or both units of a two-part connector with a common resilient backing which serves to force the cooperating terminals together under pressure when the two units are operatively associated with each other.

Another feature of the invention contemplates, in a plug design, a terminal carrier which comprises a separate and independent housing for each of a multiplicity of rod type plug terminals in which the terminal is free to move longitudinally in the direction of the resilient backing when engaged by a corresponding jack or socket terminal.

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A further feature of the invention resides in the use of screw means for interlocking the plug and socket elements of a two-part connector together and for simultaneously variably increasing the pressure between engaged plug and jack terminals.

Still another feature of the invention resides in a simplified over-all plug design which enables a large number of terminals to be accommodated in a relatively small space; which renders the terminals readily accessible; and which permits the engagement of the plug with a cooperating socket in such a manner as to insure an accurate alignment of the cooperating terminals thereof. These and other features of the invention will be readily understood from the following detailed description when read with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a multiterminal plug embodying features of this invention, showing it partly disengaged from a cooperating jack or socket;

Fig. 2 is a side elevation of a two-part connector partly in section, and illustrates the condition which prevails before the interlocking means has been operated to apply pressure to the engaged terminals thereof;

Fig. 3 is a view generally similar to that of Fig. 2 and illustrates the condition which maintains after the interlocking, pressure applying means has been operated;

Fig. 4 is a sectionalized plan view of an alternative form of plug and jack type connector embodying the features of the invention and;

Fig. 5 is a section taken along the line 5-5 of Fig. 4 looking in the direction of the arrows.

The plug illustrated in Figs. 1, 2 and 3 comprises a container or shell within which the essential elements of the plug are mounted or housed. The container or housing consists of four side pieces or walls 10 of transparent material and a relatively heavy metal cover 12. The body of the cover 12 is rectangular in shape and fits snugly within the container with suitable flanges abutting the upper edges of the four walls thereof. The cover 12 is removably supported between the container walls by means of screws 13. Thus the four walls 10 and the cover 12 constitute a box-like structure or housing with one end open.

Mounted substantially midway of the cover 12 and the open end of the container and in parallel spaced relation to the cover is an assembly consisting of two insulating blocks 14 and an interposed metallic rectangularly sec-

tioned bar 15. If desirable the blocks 14 may be made of hard rubber or of some resilient material. In the event hard rubber is used the two blocks 14 and the bar 15 will be mounted as a rigid unit to the container walls 10 by means of screws 16 and 17. The screws 16, two in number, pass through suitable apertures in a pair of oppositely disposed walls 10 and are screwed into suitably threaded axial holes in the metal bar 15. An insulating block 14 is fixed to each side of the bar 15 by means of screws 17 which pass through suitable apertures in two opposite container walls 10 and in the blocks 14 and then screw into threaded holes in the bar 15. Thus the assembly consisting of the two insulating blocks 14 and the interposed metal bar 15 is rigidly supported within the container in parallel spaced relation to the cover 12.

Each block 14 has embedded therein a plurality of rows of spaced metal tubes 18 arranged in parallel alignment. Viewing Figs. 2 and 3, the tubes 18 are vertically disposed in the insulating blocks 14 and are molded therein or otherwise fixed thereto. Each tube 18 is adapted to slidably accommodate a cylindrical rod-like terminal 19. The internal diameter of the tube 18 and the diameter of the terminal 19 are such that the terminal is snugly accommodated by the tube but is free to move longitudinally therein. The upper end of each of the terminals 19 is enlarged to provide a head 20 and the lower ends are conically contoured. The enlarged heads 20 of the terminals 19 provide means whereby wires may be soldered or otherwise secured thereto. If the blocks 14 are to be made of resilient material the tubes 18 may be dispensed with and the terminals 19 molded directly therein.

Cemented or otherwise bonded to the under-surface of the cover 12 is a rectangular pad 21 of resilient material, such as semi-soft rubber, which is so dimensioned as to completely cover the under-surface of the cover 12 and to provide a space between it and the upper-surface of the terminal carrier assembly comprising the blocks 14 and the metal rod 15. The height of this space relative to the length of the rod-like terminals 19 is such as to preclude the possibility of the terminals dropping out of their respective tubular guides 18 should the plug be up-ended, and the terminals are of such length as to insure the conical ends thereof projecting below the blocks 14 when the enlarged heads thereof abut the under-surface of the resilient pad 21.

Though the semi-soft rubber pad 21 has been described as being cemented to the under-surface of the cover 12 it is not essential that the pad be so fixed. If desirable it may be inserted between the walls 10 of the container independently of the cover so as to rest upon the enlarged heads of the terminals 19.

The left wall 10, viewing Fig. 1, is provided with a series of apertures through which the conductors of cable 22 may be threaded into the plug interior for connection to the upper ends of the terminals 19. It is apparent that when such connections are to be made the cover 12 and the resilient pad 21 are removed so as to expose the enlarged heads of the terminals. If desirable each terminal 19 may be withdrawn from its tubular guide 18 in order to facilitate the making of soldered connections thereto and then returned to its tubular guide after the connection has been made thereto.

The cover 12, resilient pad 21 and the metal bar 15 are each provided with a centrally disposed

cylindrical hole, these holes aligning themselves, when the plug assembly is completed, for the accommodation of the bolt 23 which serves a purpose to be indicated hereinafter.

The jack or socket member which functions with the plug described above consists of two insulating blocks 25 of hard rubber fixed to either side of a metal member 26 by means of countersunk screws 27. Each block 25 has molded therein a plurality of rows of spaced rod-like terminals 28 which project below the bottom surface of the blocks 25 and are flush with the upper-surface thereof. The upper ends of the terminals 28 are cup-shaped so as to readily admit the conical ends of the plug terminals 19 and thereby insure an adequate area of contact therebetween while the lower, or protruding ends thereof provide facilities whereby soldered connections of the wires 30 may be made thereto.

The over-all dimensions of the jack or socket are such that the socket fits snugly inside the open end of the plug container and permits the latter to telescopically slide thereover when circuit connections are to be made by way of the plug and jack connector elements.

The metal member 26 is provided with two oppositely disposed integral foot-like projections 31 which provide means for mounting the socket on any suitable supports such as the blocks 32. The blocks 32 are vertically dimensioned so as to insure adequate clearance between the lower ends of the terminals 28 and the support, if any, upon which the blocks 32 may be fixed.

The metal member 26 is provided with a centrally disposed threaded hole which, when the plug is set upon the socket aligns itself with the cylindrical holes in the plug elements 15, 21 and 12 for the accommodation of the bolt 23.

When circuits are to be interconnected through the media of the plug and jack, the open end of the plug is slipped over the socket, it being obvious that when thus assembled the terminal carrier 14 and the cover 12 with its associated resilient pad 21 are in parallel alignment with the terminal supporting socket members 25. The tubular guides 18 are equal in number to the socket terminals 28 and are disposed in the same pattern so that the tubes 18 and the socket terminals are in vertical coaxial alignment. Since each tube 18 accommodates a rod-like plug terminal 19, it follows that such terminals are in coaxial alignment with the socket terminals 28 when contact between the conical tips of the former and the cup-shaped ends of the latter is effected. This condition of the two-part connector is shown in Fig. 2 wherein contact pressure between the plug and socket terminals is determined solely by the weight of the plug unit. After having been thus assembled the contact pressure between plug and socket terminals is increased, by passing the bolt 23 through the holes in the cover 12, pad 21 and terminal carrier 14 and screwing it into the threaded hole in the socket member 26. The plug is thus forced downwardly, the socket terminals 28 tending to drive the plug terminals 19 upwardly in their respective guide tubes 18 against the resilient pad 21. This condition of the plug and socket elements is illustrated in Fig. 3 wherein the enlarged heads of the plug terminals are shown as having compressed the pad 21 at the points of contact therewith. Obviously, the pad 21 in tending to resume its natural contour constantly forces the plug terminals 19 in the direction of the corresponding socket terminals 28 with the result that engagement between the plug

and socket terminals is maintained under constant pressure and reliable electrical contact is assured.

While the drawing discloses the resilient terminal backing applied to the plug unit only, it is to be understood that this feature may be embodied also in the socket without departing from the spirit of the invention.

The plug design shown in Fig. 4 distinguishes from the design previously described primarily in general contour and in the method employed in associating it with a cooperating jack or socket. The plug comprises a cylindrical shell 40 having an integrally formed hand grip 41 and within which the essential elements of the plug are housed. The shell portion 41 is provided with a centrally disposed bore or duct 42 through which a cable 43 may be threaded into the interior of the shell.

Fixed to the underside of the upper portion of shell 40 by means of a plurality of circularly disposed screws 44 is an annular or ring-shaped element 45 which cooperates with a similar element 46 in forming a race in which the ball bearings 47 are housed. The two elements 45 and 46 are held in spaced relation and relatively rotationally movable by means of a ring-shaped cage 48. An elongated metal tube or sleeve 49 is fixed to the rim of the element 46 by means of screws 50 and near its lower edge supports a circular terminal carrier 51. The carrier 51 is held in position by means of screws 52 and has molded therein a plurality of metal tubes 53. Each tube 53 constitutes a guide or positioning tube for a rod-like terminal 54 which are identical in design to the plug terminals 19 shown in Figs. 1, 2 and 3. The internal diameter of the tube 53 and the diameter of the terminal 54 are such that the terminal fits snugly in the tube but is free to slide longitudinally therein. The upper ends of the terminals 54 are provided with enlarged heads which facilitate the soldering of the wires of cable 43 thereto.

Cemented or otherwise fixed to the under-surface of the annular element 46 is a ring-shaped pad 55 of semi-soft rubber or other suitable resilient material which constitutes a backing for the enlarged heads of the plug terminals 54. The elements 45 and 46 and the resilient pad 55 are provided with centrally located holes which are in alignment with the duct 42 in the plug shell 40 so as to allow the cable 43 to pass therethrough.

A square sectioned guide rod 56 is molded in the terminal carrier 51 and projects downwardly from the center thereof. A locating pin 57 also molded in the carrier 51 is located immediately in back of the rod 56. The purpose of the rod 56 and the pin 57 will be described presently. The shell 41 is provided with an internal thread at its lower end which enables the shell to be screwed on to a cooperating socket member 58.

The socket 58 is cylindrical in shape and otherwise corresponds to the socket disclosed in Figs. 1, 2 and 3. It supports the terminals 59 which correspond to the terminals 28 of the previously described socket.

The rod 56 and pin 57 project well below the conical ends of the terminals 54 so that when the plug is to be associated with the socket 58 these elements fit into corresponding suitable recesses or holes in the socket prior to the engagement of the external thread of the socket with the internal thread of the plug. Thus the terminals 54 of the plug are accurately positioned rela-

tive to the socket terminals 59 and rotational movement of the socket relative to the assembly housed within the sleeve 49 is precluded. The shell 41, however, is free to turn and as it is screwed onto the socket the plug terminals 54 become seated in the cup-shaped ends of the socket terminals 59 and electrical continuity between the wires of the cable 43 and those connected to the terminals 59 is established. As the shell 41 is screwed further onto the socket 58 the latter is pulled into the shell so that the terminals 59 thereof force the plug terminals 54 firmly against the resilient backing 55. Thus the plug and socket terminals are maintained in engagement under constant pressure supplied by the resilient pad 55.

When soldered connections are to be made to the plug terminals 54 it is necessary only to remove the screws 52 and withdraw the terminals 54 and the carrier 51 thus exposing the enlarged heads of the terminals to which the connections may be made.

As described in connection with Figs. 1, 2 and 3, the elements 51 and 58 of the connector shown in Figs. 4 and 5 may also be made of resilient material.

What is claimed is:

The combination of an externally threaded socket comprising a plurality of stationary pin-type terminals and having a pair of mutually displaced slots and a plug for cooperation therewith comprising an internally threaded hollow cylindrically shaped shell, a terminal carrier revolvably supported within said shell, a plurality of pin-type terminals supported by said carrier and individually movable in a longitudinal direction when engaged endwise by corresponding terminals of said socket incident to the screwing of said shell onto said socket, means opposing the said longitudinal movement of said individually movable plug terminals comprising a rigidly-backed annular pad of resilient material fixedly mounted with respect to said terminal carrier and so disposed relative thereto that said movable terminals are moved in the direction of said pad and make endwise contact therewith when said shell is screwed onto said socket, and means for insuring the correct positioning of said carrier with respect to said socket and for locking it against rotation relative thereto comprising a pair of mutually displaced rods fixed to said carrier and projecting therefrom below the outer edge of said shell so as to engage the said slots in said socket prior to the engagement of said shell with said socket incident to the cooperative association thereof.

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