Feb. 4, 1969 D. R. DE TAR 3,426,315

COMPACT ELECTRICAL CONNECTORS

Filed May 16, 1966 Sheet 1 of 2

FIG. 1

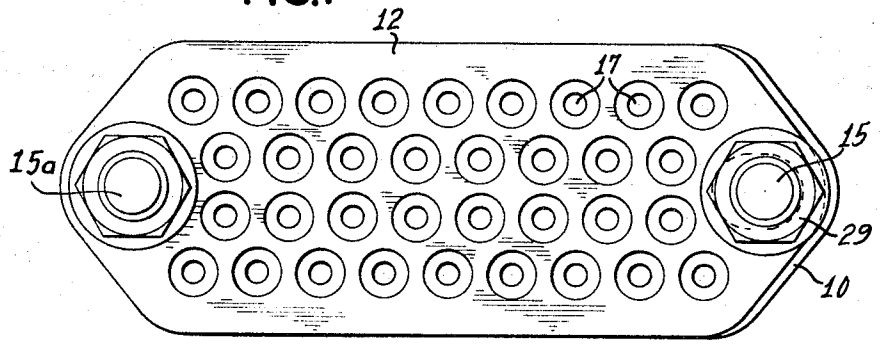


FIG. 2

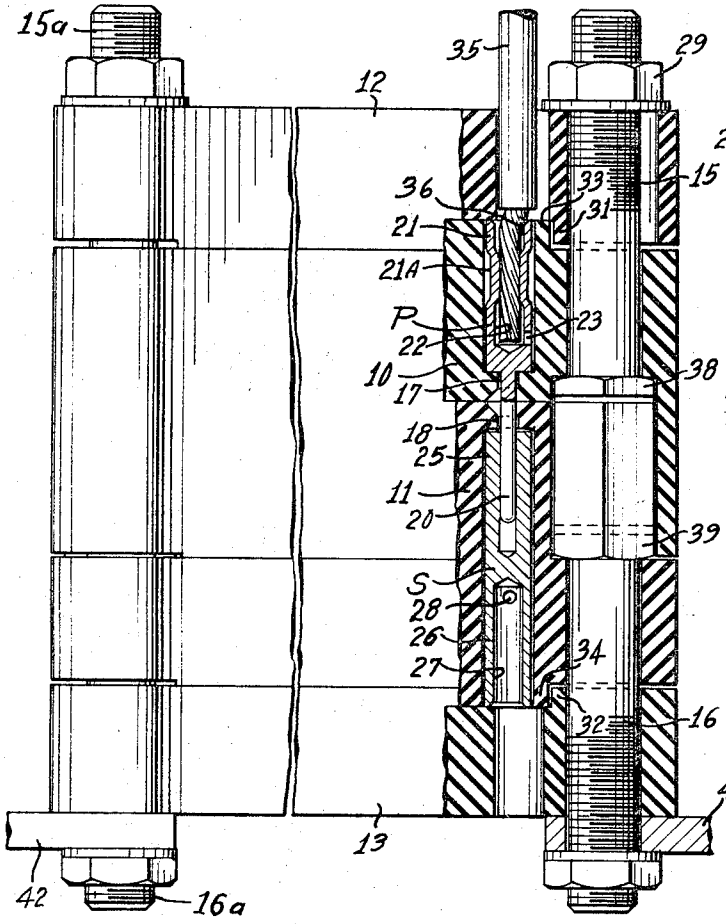


FIG. 3

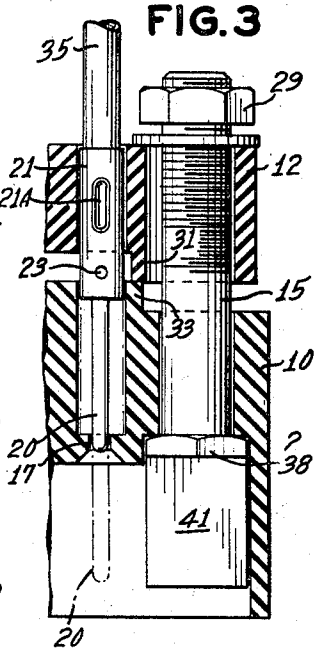
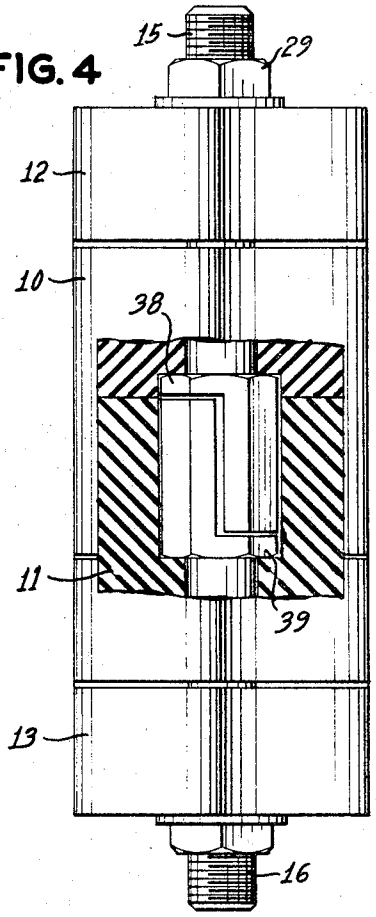


FIG. 4



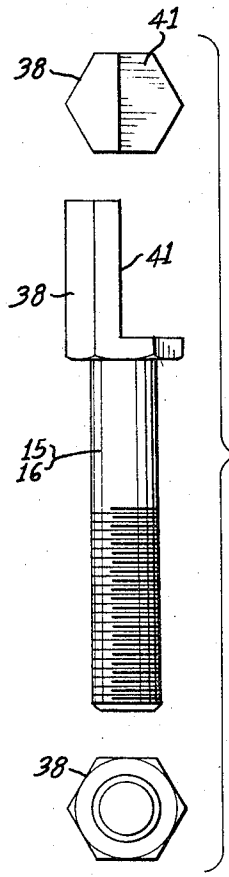


FIG. 5

FIG. 6

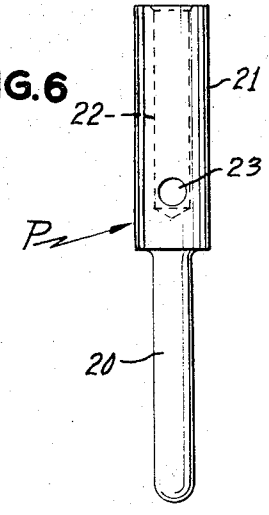
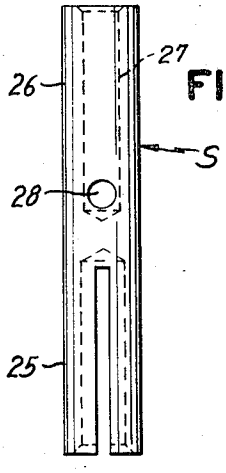


FIG. 7



United States Patent Office

3,426,315
Patented Feb. 4, 1969

3,426,315

COMPACT ELECTRICAL CONNECTORS

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Filed May 16, 1966, Ser. No. 550,235
U.S. Cl. 339—105 6 Claims
Int. Cl. H01r *13/58, 13/64*

ABSTRACT OF THE DISCLOSURE

An electrical connector having a plurality of removable contacts held in place by a retainer plate on the rear face of the connector body, said plate being secured in place by studs or bolts which also serve to polarize the connector.

This invention relates to compact electrical connectors, and more particularly to a subminiature connector having a plurality of removable contacts.

In recent years the trend in the connector industry has been to smaller or more compact connectors and to increasing use of crimp terminations for attaching the conductors to contacts which are removable from the connector body to facilitate assembly and realignment or replacement of contacts. Removable contacts in the past have ordinarily been secured in place by retaining springs which increases the required spacing between the contact members. Furthermore, special tools are required for inserting and removing the contacts.

One object of the present invention is to provide a compact connector having minimum spacing between contacts and novel means for retaining the contact members in the connector block so that they may be inserted and removed without the use of tools, and the delicate retaining springs are not required. For assembly or replacement of the contact members, access to the mating face of the connector body is not required and closed-contact entry is provided without recourse to costly contact designs.

In accordance with a feature of the invention, the contact members are mounted in closely spaced bores in the connector body and are retained in place by a unique contact-retainer plate secured to the rear face of the connector body and having holes corresponding in size and spacing to the bores in said body, so that the contact members may be inserted in place or withdrawn through the contact-retainer plate.

In accordance with another feature of the invention, the retainer plate is secured to the connector body by one or more threaded studs and a threaded nut on each stud, the retainer plate being movable to a position where a contact may be inserted or replaced, if desired, without removing the plate from the connector body.

In accordance with still another feature of the invention, the securing studs have their inner ends milled away to provide a key portion for insuring that the connector body is mated to the proper cooperating connector socket or plug, said stud being angularly adjustable in the connector body to provide two or more key matching positions. In this manner, provision may be made for a number of matching variations for different connectors.

In accordance with the invention, as applied to either a plug or socket multi-contact connector body, the contact members are loosely mounted in bores in the connector body of approximately the same diameter as that of the contact members. Means such as a shoulder in the bore limits the movement of the contact member toward the mating face of the connector block. A contact-retainer plate having a series of holes corresponding in spacing to the bores in the connector body is mounted on the rear face of the body in a position where the edges of the holes overlap the contact members to lock the same in the connector body. The retainer plate is secured to the connector body by one or more bolts or studs projecting through holes in the retainer plate. The bolt holes in the retainer plate are preferably sufficiently larger than the diameter of the bolt or stud so that the retainer plate may be shifted lengthwise to line up the holes in the plate with the bores in the connector body for assembly or replacement of the contact members.

If desired, the studs may also project from the mating face of the connector body to form a key for polarizing the connector or for preventing the same from being inserted into the wrong cooperating plug or socket. Preferably the stud is formed, for example with a polygonal section, so that it may be rigidly mounted in the connector body in any one of a plurality of angular positions. Thus the key portion of the stud can be turned to provide a number of matching positions so that, even where many connectors are used in a piece of equipment, there will be no possibility of mating a plug with the wrong receptacle. The threaded end of the stud or bolt is also used for mounting the connector on a panel or for attaching a hood or cable support to the connector body.

Other objects and advantages of the invention will appear from the following description of a typical embodiment thereof shown in the accompanying drawings, wherein:

FIG. 1 is an end view of a subminiature multicontact connector;

FIG. 2 is a side view partially in section of the connector shown in FIG. 1;

FIG. 3 is a fragmentary detail view of the connector showing the contact-retainer plate shifted lengthwise from the contact-locking position to a position where the contact members may be assembled or replaced in the connector body;

FIG. 4 is a side view of the connector shown in FIGS. 1 and 2 with a part of the plug and socket connector bodies broken away to expose the polarizing or keying portions of the fastening studs or bolts;

FIG. 5 is a detail view showing the top, side and bottom views of the stud or bolt; and

FIGS. 6 and 7 are detail views to an enlarged scale of typical plug and socket contact members that may be used in the connector embodying the invention.

Referring to FIGS. 1 and 2 of the drawings, a multicontact electrical connector is shown comprising a plug connector body **10** and a socket connector body **11** of suitable insulating material. Contact-retainer plates **12** and **13**, respectively, form a cap or cover for the rear or terminal face of the connector body in the embodiment shown. The contact-retainer plates **12** and **13** serve to retain the contacts in the connector body and are attached to the connector bodies by one or more threaded studs or bolts **15**, **15***a* and **16**, **16***a*.

Each of the connector bodies **10**, **11** is provided with a plurality of closely spaced bores adapted to receive the pin and socket contacts P and S. The end view, FIG. 1, shows the connector before the contact members have been inserted into the bores of the connector body and, as shown in the drawing, each bore is reduced in diameter at or near the mating face of each connector body, as indicated at **17** and **18**, to form a shoulder which positions the contact member in the bore. The small diameter of the reduced section of the bore serves to prevent the insertion of a pin contact P that would be large enough to damage the socket contact S. The reduced section of the socket contact bore eliminates the necessity for a costly socket contact design to provide closed contact entry.

As shown in FIGS. 6 and 7, the pin and socket con-

tacts P and S may be of the conventional type, except that they have no provision for a spring clip to hold the contact in the connector body. Accordingly, the contacts may be located in closely spaced, staggered rows to obtain maximum compactness of design, as shown in FIG. 1. The contact member P is provided with a rod-shaped contact stem **20**, which projects from the plug connector **10** when assembled therein, and a cylindrical shank **21** which is drilled or bored, as indicated at **22**, to receive the connecting wire **35**. A hole **23** through one side of the shank portion **21** is provided at the bottom of the recess **22** so that the position of the stripped end of the connecting wire may be observed before the contact member is crimped on the wire, as indicated at **21A**. The socket contact S, as shown, consists of a slotted contact portion **25** adapted to receive the contact pin **20** and a shank portion **26** having a hollow recess **27** to receive the connecting wire, which may be similar to the recess **22** in the contact member P as shown and provided with an opening **28** at the bottom of the recess.

Referring to FIGS. 2 and 3, the retainer plates **12** and **13** as shown are provided with a series of holes corresponding in size and spacing to the holes or bores in the connector bodies **10** and **11**. The retainer plates **12** and **13** are also provided with end flanges **31, 32** which are adapted to engage a shoulder **33, 34** at the rear faces of the connector bodies when the retainer plate is secured in position on said body by the studs **15, 16**. The mounting and arrangement of the retainer plate **13** for the socket connector is essentially the same as that of the retainer plate **12** for the plug connector and a detailed description of the latter will be sufficient to explain the novel construction of both members. After the contact member **21** has been inserted into a bore in the connector body, the retainer plate **12** is moved or displaced sidewise from the position shown in FIG. 3, and the fastening nut **29** tightened to secure the contact member **21** in place.

As shown in FIGS. 1 and 3, during assembly the contact-retainer plate **12** is shifted to a position in which the holes in the plate are aligned with the bores in the connector body **10**. This construction permits the assembly of the connector and the replacement or realignment of the contact members P and S whenever desired by merely loosening the securing means for the retainer plate. Preferably the length of the bolt or stud **15** is sufficient to allow the nut **29** to be loosened to the point where the flange **31** on the retainer plate clears the shoulder **33** on the connector body without removing the nut from the bolt. When the retainer plate is shifted lengthwise to the position shown in FIG. 2 and the nut **29** tightened, the pin contact P is securely locked in the connector body of the overlapping of the edge of the hole in the retainer plate on the outer end of the contact member. The bearing of the edge of the hole in the retainer plate against the conductor may pinch the bare wire at the point **36** but the electrical contact between the conductor **35** and the contact member P is preferably effected by crimping the sleeve **21** of the contact, as indicated at **21A**, FIGS. 2 and 3.

In accordance with another feature of the invention, the holding studs **15** and **16** may be extended beyond the faces of the connector bodies and utilized to polarize the plug and socket connectors or insure that a plug can be inserted only into the correct socket connector. As shown, the studs **15** and **16** are provided with enlarged polygonal heads which project to or beyond the mating face of each connector body. Since the studs are utilized for this additional function, the size of the connector body is kept to a minimum.

As shown in FIG. 4, the heads **38** and **39** are milled away slightly beyond the center line of the stud for a portion of the length in the illustrated embodiment. The heads **38** of the studs in the plug half of the connector and the heads **39** of the studs in the receptacle half of the connector are oriented so that the plug may be inserted into the socket connector. In order to provide a number of different patterns or matching positions, the stud may be fitted in the connector body so that it may be twisted and secured in two or more angular positions. As shown in FIGS. 4 and 5, for example, the head **38** of the stud is of hexagonal cross-section and is seated in a similarly shaped recess in the connector body, so that each stud can be assembled in six fixed angular positions. If two studs are used in each connector, there will be thirty-six different matching positions, and thirty-six connectors can be used on a piece of equipment with no possibility of mating a plug with the wrong receptacle.

The invention involves the use in some instances of the studs **15** and **16** for the additional function of keying a plug and socket to prevent the mating of a plug with the wrong socket, but this feature of the construction may be omitted if desired. Obviously the form and method of positioning the keying head may be accomplished in various ways and the keying feature may be applied to various types of connectors. The threaded ends of the studs **16** and **16A** are also shown as used for mounting the connector on a panel **42**. A hood or cable support may also be attached to the connector underneath the threaded nut of the studs **15** and **16**.

While a single embodiment of the invention has been described in detail for the purpose of explaining the underlying principles of the invention, various modifications will occur to those skilled in the art and may be made without departing from the scope of the invention. By way of example and not of limitation, other securing means which is the equivalent of that shown may be employed to fasten the retainer plate in place on the connector body. Thus the above-described construction is merely illustrative of the application of the principles of the invention.

What is claimed is:

1. In a multicontact electrical connector, in combination,

a plurality of contact members,

a substantially rigid connector body of insulating material provided with a plurality of bores extending through said connector body between the rear and mating faces thereof, and adapted to receive said contact members, said bores each having a shoulder adajacent the mating face of the connector body to limit the movement of said contact members toward the mating face thereof, and said connector body having an upstanding lug or shoulder on the rear face thereof,

a substantially rigid removable cap member forming a contact-retainer plate having a surface adapted to fit snugly against the rear face of the connector body and a projecting flange forming an abutment on the said surface of the plate, said retainer plate being provided with holes corresponding in size and spacing to the bores in the connector body, and

securing means for fastening said retainer plate on the back of said connector body in a position where sidewise movement of the plate is prevented by the engagement of the flange with said shoulder on said connector body, and the retainer plate held by said securing means in a position where the edges of said holes in the retainer plate overlap the contact members to retain said members in the respective bores.

2. An electrical connector according to claim **1**, in which said contact members are replaceable contacts assembled in and removable from the connector body, and the contact-retainer plate is ineffective to retain said contact members in position when said securing means is loosened and the retainer plate lifted off the connector body to a point where the flange clears said shoulder.

3. An electrical connector according to claim **1**, in which said securing means for the retainer plate comprises a threaded stud projecting from the rear of the

connector body and a threaded nut on said stud, the length of the projecting end of the stud being sufficient, when the nut is loosened, to release the flanged contact-retainer plate for sidewise movement of the retainer plate to a position where the holes in the plate are aligned with the bores in the connector body without removing the nut from the stud.

4. An electrical connector according to claim 1, in which said securing means for the retainer plate comprises a threaded stud in the connector body, said stud being provided with a polygonal head portion seated in a similar recess in the connector body and a matching key portion of a particular predetermined cross-section projecting from the mating face of the connector body, said stud being adjustable during assembly to vary the orientation of said key position and thereby prevent coupling the connector body to all complementary connector bodies except one having a key which matches the selected angular key position.

5. In a multicontact electrical connector, in combination,

a plurality of contact members,

a substantially rigid connector body of insulating material provided with a plurality of bores to receive said contact members, said bores extending through the connector body from the mating face to the opposite or rear face thereof, and arranged in staggered rows with minimum spacing,

a substantially rigid removable cap member forming a contact-retainer plate having a surface portion adapted to fit the rear face of said connector body and provided with transverse holes corresponding in size and spacing to the bores in said connector body, and

securing means including a stud projecting from the rear face of the connector body for fastening the contact-retainer plate on the connector body in a position where the edges of the holes in the plate overlap the contact members to retain said members in the connector body,

said contact members being of approximately the same diameter as the diameter of the bores in the connector body and being insertable in and removable from the connector body when the contact-retainer plate is shifted to line up the holes therein with the bores in the connector body.

6. An electrical connector according to claim 5, in which said stud is provided with a key portion at the mating face of the connector body to insure mating only with the correct cooperating connector socket or plug, said stud being angularly adjustable in the connector body to provide two ore more key-matching positions.

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U.S. Cl. X.R.

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