Nov. 10, 1964 J. A. TOEDTMAN 3,156,764

COMPRESSIBLE ELECTRICAL CONNECTOR WITH INTERNAL DEFORMABLE RIBS

Filed March 26, 1962

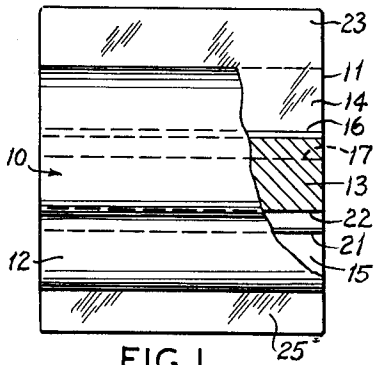


FIG. 1.

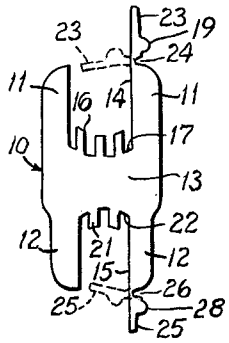


FIG. 2.

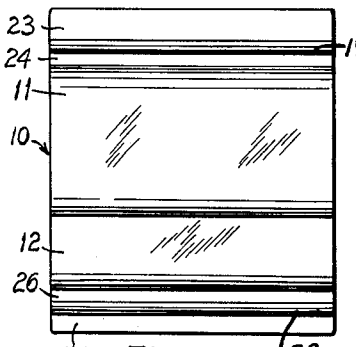


FIG. 3.

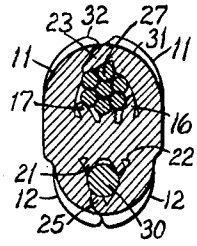


FIG. 4.

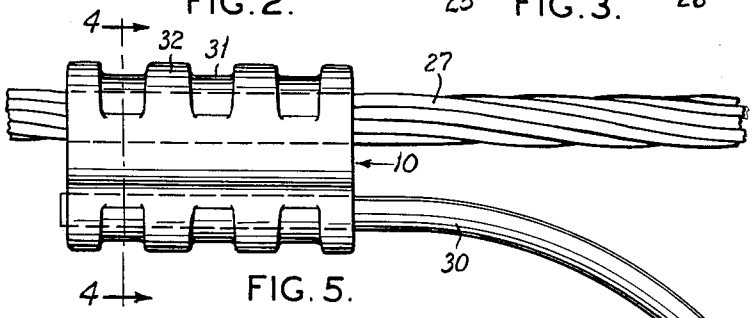


FIG. 5.

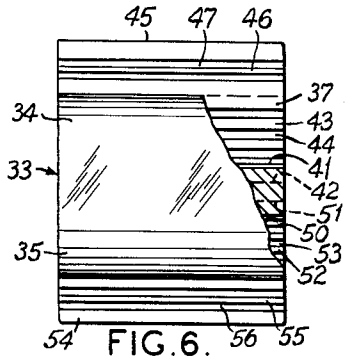


FIG. 6.

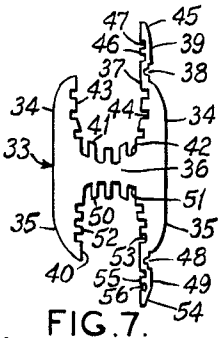


FIG. 7.

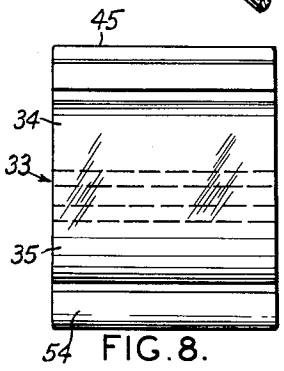


FIG. 8.

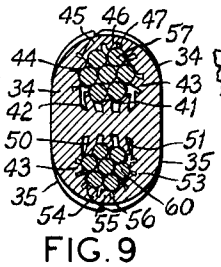


FIG. 9

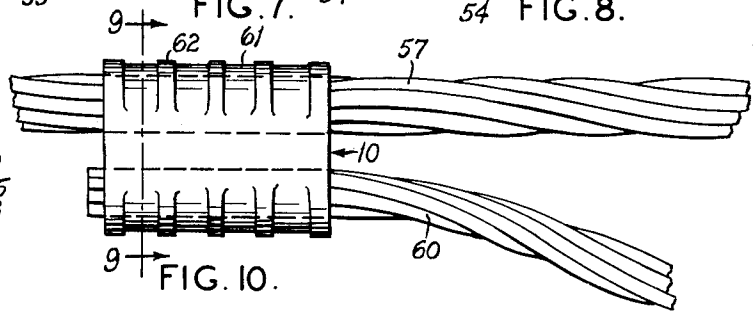


FIG. 10.

INVENTOR
JOHN A. TOEDTMAN
BY Cohn and Powell
ATTORNEYS

United States Patent Office 3,156,764 Patented Nov. 10, 1964

3,156,764

COMPRESSIBLE ELECTRICAL CONNECTOR WITH INTERNAL DEFORMABLE RIBS

John A. Toedtman, Warson Woods, Mo., assignor to Jasper Blackburn Corporation, St. Louis, Mo., a corporation of Missouri

Filed Mar. 26, 1962, Ser. No. 182,237
7 Claims. (Cl. 174—94)

This invention relates generally to improvements in a compressible electrical connector, and more particularly to an improved H-shaped tap connector.

It is an important object to provide a compressible electrical connector that enables a broader conductor range to be accommodated by a given fitting, thereby reducing the number of stock items required and yet requiring no new tools or dies and at no increase in cost.

An important objective is achieved by constructing the connector body of a malleable metal with a recess adapted to receive a conductor, and by forming the body with a formable means extending along the interior of the recess, the deformable means yielding under pressure to accommodate a conductor within a wide range of different sizes in the recess as the body provides an overlapping connection enfolding the conductor upon compression of the connector.

Another important object is afforded by the provision of a plurality of ribs, constituting the deformable means, extending into the interior of the recess, the ribs being deformable under pressure to accommodate the conductor in the manner and for the purpose mentioned above. As the ribs deform, the ribs wipe the conductor to provide a cleaning action on the contact surfaces, in addition to providing better contact areas generally.

Still another important object is realized in that the deformable ribs prevent excessive pressures from developing and thereby prevent damage to conductors by weakening strands or by causing a spreading or birdcaging of the strands immediately adjacent the ends of connector.

An important objective is provided in that the longitudinal ribs hold a quantity of compound or paste in a manner that such compound cannot be completely pushed out when the conductors are inserted, and that such compound is forced into the stradling of the conductors when the connector is compressed.

Another important object is achieved by the provision of a plurality of such deformable ribs along the bottom of the recess which constitute a yieldable floor for the conductor.

Other important advantages are realized by constructing the ribs along the recess bottom so their height is greater than their width in order to obtain an easy deformation of the ribs by the conductor upon compression of the unit and to obtain exact conformation of such ribs to the conductor.

An important object is afforded by constructing the body with a pair of said arms that form a recess, and by the provision of alternating grooves and ribs on the body defining at least a portion of the conductor recess, one groove being located along the bottom of the recess adjacent each associated arm, the side grooves causing the arms to bend inwardly toward each other at the bottom of the recess and thereby precluding any bulging of the arms in this region.

Another important objective is attained by providing a plurality of deformable ribs along the bottom and along each arm of the connector recess which are yieldable upon engagement under pressure with the conductor received in the recess to conform to the particular configuration and conductor size for the functional advantages discussed previously, the grooves formed in the side arms further enabling the arms to bend in and about the conductor more easily.

Yet another important objective is achieved by the provision of an integral tab on one of the arms of a pair defining a connector recess, the tab extending beyond the other of the arms and being reduced in cross section at its connection to the one arm so as to be bendable, the length of the tab being less than the width of the recess between the arms to assure entry of the tab into the recess in underlying relation to the other arm upon compression of the connector.

An important objective is realized by the provision of at least one deformable rib on the inside surface of the tab which is capable of deformation upon compressive engagement with the conductor, the resulting grooves adjacent the rib enabling easy bending action of the tab in conforming to the shape and size of the conductor.

It is an important objective to provide an H-shaped tab connector that is simple and durable in construction, economical to manufacture, highly efficient in operation, and which can be readily assembled and fixed to associated conductors.

The foregoing and other objects and advantages of the invention will more clearly appear from the following detailed description of a preferred embodiment and a modification thereof, particularly when considered in connection with the accompanying drawing, in which:

FIG. 1 is a side elevational view of the connector as seen from the left to FIG. 2;

FIG. 2 is an end elevational view of the connector before compression;

FIG. 3 is a side elevational view of the connector as seen from the right of FIG. 2;

FIG. 4 is a cross sectional view of the connector as seen along line 4—4 of FIG. 5;

FIG. 5 is a side elevational view of the connector of FIG. 2 compressed;

FIG. 6 is a side elevational view of a modified connector as seen from the left of FIG. 7;

FIG. 7 is an end elevational view of the modified connector before compression;

FIG. 8 is a side elevational view of the connector as seen from the right of FIG. 7;

FIG. 9 is a cross sectional view as seen along line 9—9 of FIG. 10, and

FIG. 10 is a side elevational view of the compressed connector of FIG. 7 compressed.

Referring now by characters of reference to the drawing, and first to FIGS. 1–5 inclusive, it is seen that the compressible electrical connector consists of a substantially H-shaped body generally indicated at **10** made of a malleable metal. The body **10** includes two pair of arms **11** and **12** extending outwardly from an intervening partition **13**. The arms **11** are spaced apart to provide a recess **14**. Similarly, the arms **12** are spaced apart to provide a corresponding recess **15**, usually of slightly smaller dimension.

The body **10** is provided with a plurality of longitudinal, alternately arranged series of deformable ribs **16** and grooves **17**. Specifically, the ribs **16** extend along the recess bottom and project into the recess **14**. It has been found advantageous to construct these ribs **16** so that their height is greater than their width to assure appropriate deformation and conformation in the manner which will become apparent upon later description of parts and assembly.

The inside surface of arms **11** are flat. However, at each side of the bottom of recess **14** immediately adjacent the inner surface of each arm **11**, there is provided one of the grooves **17** constituting a side groove. The

location of the side grooves 17 assures bending of the arms 11 in a desired manner subsequently described.

The body 10 is provided with a plurality of alternating deformable ribs 20 and grooves 21 extending along the bottom of the other recess 15. The ribs 21 extend into the interior of recess 15. Again, it has been found advantageous to construct these ribs 21 so that their height is greater than their width.

Correspondingly, the inside surface of arms 12 are flat, and one of the grooves 22 constituting a side groove is provided along each side of the bottom of recess 15 immediately adjacent each arm 12. It will be noted that because the recess 15 is slightly smaller to accommodate a smaller conductor, there are two ribs 21 extending along the recess bottom while there are three ribs 16 extending along the bottom of the slightly larger recess 14.

The ribs 16 in recess 14 and the ribs 21 in recess 15 constitute a deformable means providing a yieldable floor for the conductor received in each recess.

Attached integrally with one of the arms 11 is a bendable tab 23 extending beyond the end of the other arm 11. The tab 23 is provided with a reduced portion 24 at its connection with its associated arm 11 which assures that the tab 23 will bend inwardly toward the opposite arm 11. A ridge 19 is formed on the outside of tab 23 which is adapted to engage the compression tool to facilitate bending of the tab 23. The length of tab 23, or in other words the distance the tab 23 extends outwardly from its associated arm 11, is less than the width of the recess 14 between the arms 11. This structural arrangement assures that the tab 23 will enter the recess 14 when it is bent over and when the connector is compressed.

A similar tab 25 is attached integrally to one of the arms 12 at the same side of the connector as the other corresponding tab 23. Tab 25 extends outwardly beyond the end of the other arm 12. The tab 25 is provided with a reduced portion 26 at its connection to its associated arm 12 so that the tab 25 will bend inwardly toward the other arm 12. A ridge 28 is formed on the outside of tab 25 which is adapted to engage the compression tool to facilitate bending of the tab 25. This tab 25 is also of a lesser length than the width of the recess 15 between the arms 12 to assure that the bendable tab 25 will enter the recess 15.

To install the connector, a conductor 27 is inserted into recess 14 and the tab 23 is bent over the conductor 27 to hold it in place. As suggested above, the tab 23 enters the recess 14 inside of the opposite arm 11.

A smaller tap conductor 30 is disposed in the recess 15 and the tab 25 is bent over to hold such conductor 30 in place. Similarly, the tab 25 enters and closes the recess 15 inside of the opposite arm 12.

A compression tool of a suitable type (not shown) is fitted over the conductor body 10 and manipulated to exert a compressive pressure, thereby squeezing the body 10 to the condition as illustrated in FIGS. 4 and 5. It will be noted that the tool leaves a series of peripheral depressions 31 and resulting ridges 32 in the connector body 10.

Specifically, the tool bends the arms 11 toward each other to provide an overlapping connection enfolding the conductor 27 upon compression of the conductor. The ribs 16 are deformed under pressure by the conductor 27 to accommodate the particular size of the conductor 27. As the ribs 16 are deformed, the ribs wipe the contact surfaces with a cleaning action and conform precisely to the conductor configuration to provide an optimum contact.

As a result of the provision of side grooves 17 immediately adjacent each of the arms 11, the arms 11 bend toward each other at the bottom of the recess 14 and thereby preclude any bulging in this area of the recess bottom.

If a compound or paste (not shown) is utilized in the connector, the compound will be retained by the ribs 16 in the grooves 17. Moreover, such compound will be forced into the stranding of the conductor 27 for more effective action.

It will be importantly realized that as the ribs 16 yield or deform under pressure by the conductor 27 upon compression, the ribs 16 accommodate the conductor 27 and thereby prevent excessive pressure from developing on the conductor. Of course, it will be readily apparent that this deformation feature of the ribs 16 enables the insertion and effective connection of any conductor 27 within a wide range of sizes.

The securement of the tap conductor 30 is obtained in a manner similar to conductor 27 as described above. Briefly, the arms 12 are moved toward each other upon compression to provide an overlapping connection enfolding the conductor 30. The conductor 30 deforms the ribs 21 under pressure so that the ribs 21 accommodate the particular size of such conductor 30. Again, the ribs 21 conform to the particular shape and contour of the conductor 30, and particularly the ribs 21 wipe the surface of the conductor 30 with a cleaning action and conform precisely with the conductor to provide an effective contact. The yielding or deformation of the ribs 21 precludes any excessive pressure developing on the conductor 30.

The same advantageous result is obtained in that the deformation of the ribs 21 at the bottom of the recess 15 enables the effective connection of any conductor 30 within a wide range of sizes.

Because a side groove 22 is placed immediately adjacent each of the arms 12, the arms 12 bend toward each other at the bottom of the recess 15 and thereby preclude any bulging in this area.

If a compound or paste (not shown) is utilized in this portion of the connector body 10, such compound would be retained in the grooves 22 by the ribs 21 even upon insertion of the conductor 30. Upon compressive action, the compound would be forced against the conductor 30 for more effective usage.

With the particular construction of tabs 23 and 25 and their structural relationship with the widths of recesses 14 and 15 respectively, the tabs 23 and 25 will enter the recesses 14 and 15 within the oppositely related arms 11 and 12 so that such tabs 23 and 25 will be overlapped by one of the associated pair of arms upon compression of the connector.

A modified embodiment of the compressible electrical connector is illustrated in FIGS. 6–10 inclusive. In this embodiment, the connector includes a substantially H-shaped body generally referred to at 33, having two pairs of arms 34 and 35 extending outwardly from opposite sides of an intervening partition 36. The arms 34 are laterally spaced apart to provide a recess 37, and the arms 35 are laterally spaced apart to provide a recess 40 of slightly smaller dimension.

Provided along the bottom of recess 37 are a plurality of alternately arranged ribs 41 and grooves 42, the ribs 41 extending into the interior of recess 37. The ribs 41 correspond to the ribs 16 previously described in the embodiment of FIG. 2 in both structure and function. These ribs 41 are deformable and capable of accommodating a conductor within a range of sizes under pressure. It has been found advantageous to construct these ribs 41 so that their height is greater than their width to provide easy deformation and conformation to the contour of the conductor involved.

Again, one of the grooves 42 is provided at the bottom of recess 37 immediately adjacent each of the arms 34 so that the arms 34 bend inwardly toward each other at the bottom of the recess and thereby preclude bulging in this region when the connector body 33 is compressed.

Extending along the inside surface of each arm 34 are

a plurality of deformable ribs 43 and alternately arranged grooves 44, the ribs 43 deforming under pressure to accommodate a particular conductor and to conform to the conductor contour and surface. In addition, the grooves 44 enable the arms 34 to bend toward each other more easily and enable such arms 34 to provide a continuous overlapping contact when enfolded about the conductor.

An integral tab 45 extends outwardly from the end of one arm 34 beyond the end of the other arm 34. The tab 45 is provided with a reduced portion 38 at its connection to the arm 34 so as to be bendable toward the opposite arm 34. The outside surface of tab 45 is raised slightly to provide a ridge 39 adapted to engage the compression tool to facilitate bending of the tab 45. Again, it will be noted that the length of tab 45 is less than the width of the recess 37 between the arms 34 at its entrance so as to assure entry of the tab 45 into the recess 37 when bent over the conductor and compressed.

Extending along the inside surface of the tab 45 is a deformable rib 46 with corresponding grooves 47 at each side thereof. The rib 46 is deformable under pressure to further accommodate the particular conductor size and to conform to the conductor contour in much the same manner as the ribs 41 and 43 previously described. Also, the grooves 47 enable the tab 45 to bend more easily about the conductor when the connector body 33 is compressed in order to provide a better contact surface.

Extending along the bottom of recess 40 are a plurality of deformable ribs 50 and alternating grooves 51, the ribs 50 extending into the interior of recess 40. These ribs 50 are constructed so that their height is greater than their width to assure ready deformation under pressure to accommodate a conductor within a wide range of sizes located in the recess 40.

One of the grooves 51 is located at each side of the bottom of recess 40 immediately adjacent each arm 35, these side grooves 51 enabling the arms 35 to bend inwardly toward each other at the bottom of the recess and thereby precluding any bulging in this area.

Arranged along the inside surface of each arm 35 are a plurality of deformable ribs 52 and alternately arranged grooves 53 corresponding essentially to the ribs 43 and grooves 44 provided in recess 37. Specifically, the ribs 52 deform under pressure to accommodate the conductor received in the recess 40 and conform to the conductor contour. The grooves 53 enable the arms 35 to bend easily in these areas so that the arms 35 wrap or enfold the conductor very closely.

A similar tab 54 is formed integrally with one arm 35 and projects beyond the other end of the opposite arm 35. The tab 54 is provided with a reduced portion 48 so that it can be easily bent toward the opposite arm 35. The outside surface of tab 54 is raised slightly to provide a ridge 49 adapted to engage the compression tool to facilitate bending of tab 54. This tab 54 corresponds closely in structure and function to the tab 45 previously described. The length of tab 54 is less than the width of the recess 40 at its entrance between the arms 35 to assure entry of the tab 54 into such recess 40 when bent over the conductor and compressed.

Extending along the inside surface of tab 54 is a deformable rib 55 and laterally related grooves 56. The rib 55 deforms under pressure to accommodate the conductor size and to conform to the configuration of such conductor in much the same manner as the ribs 50 and 52 with which it cooperates in this regard. The grooves 56 allow the tab to bend more easily in these areas so that the tab 54 wraps very closely about the conductor.

When a conductor 57 (FIGS. 9 and 10) is located in the recess 37, the first step is to bend the tab 45 over the conductor 57 to hold it in place.

Then, a conductor 60 is disposed in the recess 40 and held in place by tab 54 which is bent over the conductor 60.

A suitable compression tool is located about the connector body 33, and the body 33 is compressed to secure the conductors 57 and 60 in place. It will be noted that upon this compressive action by the tool, the tool provides a series of alternately arranged depressions 61 and ribs 62 in the outer periphery of the body 33.

Under compression, the tab 45 will enter into the recess 37 and lie inside of the opposed arm 34 and the tab 54 enters the recess 40 and lies inside of the opposed arm 35. Then the arms 34 move toward each other, bending at the bottom of the recess 37 in the area of the side grooves 42 to provide an overlapping connection enfolding the conductor 57. The ribs 41, 43 and 46 are deformed under this pressure to accommodate the particular conductor size and to conform to the contour whatever it may be. It will be noted that the tab 45 lies closely adjacent the conductor 57 and is overlapped by the opposed arm 34. As stated previously, as a result of the grooves 44 and 47, the arms 34 and tab 45 bend easily and conform very closely to the periphery of the conductor 57 to provide a highly effective electrical contact.

Because the ribs 41, 43 and 47 are deformed under pressure by the conductor, it is seen that the particular recess 37 will accommodate a conductor 57 within a wide range of sizes and yet provide an extremely effective and secure contact for all sizes within such range.

Similarly, the arms 35 are moved toward each other under this compressive action, bending at the bottom of the recess 40 as permitted by the side grooves 51. The ribs 50, 52 and 55 are deformed under pressure by the conductor 60 to accommodate the particular size of the conductor and to conform to the peripheral contour. The arms 35 provide an overlapping connection enfolding the conductor, the tab 54 lying close to the conductor 60 and within the overlapping opposed arm 35, as is best seen in FIG. 9. The grooves 53 and 56 enable the arms 35 and tab 54 to bend easily to embrace the periphery of the conductor 60 very closely.

Because the ribs 50, 52 and 55 deform under pressure, it is seen that recess 40 will accommodate a conductor within a wide range of sizes, and that a highly efficient electrical connection is maintained for every size within such range.

In this modified embodiment of FIGS. 6–10, a compound or paste (not shown) may be utilized in the same manner as with the connector shown in FIGS. 1–5. When so used, the compound is retained in the grooves 42, 44 and 47 by the respective associated ribs 41, 43 and 46 when considering the recess 37. The same reasoning can be applied to recess 40 in that the compound is held in grooves 51, 53 and 56 by the respective associated ribs 50, 52 and 55. In each case, the ribs preclude the compound from being completely pushed out when the conductors 57 and 60 are inserted. Moreover, as the connector body 33 is compressed, the compound held by the ribs is forced into the stranding to provide a very superior result.

Although the invention has been described by making detailed reference to a preferred embodiment and a modification thereof, such detail is to be understood in an instructive, rather than in any restrictive sense, many variants being possible within the scope of the claims hereunto appended.

I claim as my invention:

1. A compressible electrical connector comprising:
   (*a*) a connector body made of malleable metal, said body being provided with a recess,
   (*b*) the body being provided with a plurality of deformable ribs extending into the interior of said recess, said ribs yielding under pressure of a conductor to accommodate a conductor within a wide range of different sizes in said recess as the body provides an overlapping connection enfolding the conductor upon compression of the connector.
2. The combination and arrangement of elements as

recited above in claim 1, but further characterized by the provision of a compound disposed in the recess and retained by the ribs in grooves between the ribs even upon insertion of the conductor.

3. A compressible electrical connector comprising:

(*a*) a connector body made of malleable metal having a pair of arms, the arms being spaced apart to provide a recess,

(*b*) the body being provided with a plurality of deformable ribs extending along the bottom of the recess between the arms and extending into the interior of said recess, said bottom ribs yielding under pressure of a conductor to accommodate a conductor within a wide range of different sizes in said recess as the arms provide an overlapping connection enfolding the conductor upon compression of the connector.

4. The combination and arrangement of elements as recited above in claim 3, but further characterized in that the said bottom ribs are narrow and are of a greater height than width so as to assure yielding of the ribs by the conductor under presssure applied to the connector and to assure conformation of the ribs to the contour of said conductor.

5. A compressible electrical connector comprising:

(*a*) a connector body made of malleable metal having a pair of arms, the arms being spaced apart to provide a recess adapted to receive a conductor,

(*b*) the body being provided with alternating grooves and deformable ribs extending along the interior of said recess, the ribs yielding under pressure of a conductor to accommodate a conductor within a wide range of different sizes in said recess as the arms provide an overlapping connection enfolding the conductor upon compression of the connector,

(*c*) one of said grooves constituting a side groove being located along the bottom of said recess between the arms and located adjacent each arm, said side grooves causing the arms to bend inwardly at the recess bottom and precluding bulging of said arms in this region.

6. A compressible electrical connector comprising:

(*a*) a connector body made of malleable metal,

(*b*) the body being provided with a recess,

(*c*) said body being provided with an integral tab extending beyond the recess, the tab being bendable over said recess, the length of said tab being less than the width of said recess to assure entry of the tab into said recess when bent,

(*d*) the body being provided with a deformable means extending into the interior of said recess which yields under pressure of a conductor to accommodate a conductor within a wide range of different sizes in said recess,

(*e*) the body and tab providing an overlapping connection enfolding the conductor upon compression of the connector.

7. A compressible electrical connector comprising:

(*a*) a connector body made of malleable metal,

(*b*) said body being of substantially H-shape in cross section having two pairs of arms, the arms of each pair being spaced apart to provide a recess adapted to receive a conductor,

(*c*) one of said arms of each pair including an integral tab extending beyond the other of said arms, the tab being reduced in cross section at its connection to said one arm to be bendable toward the other arm, the length of said tab being less than the width of said recess between said arms to assure entry of the tab into said recess when bent,

(*d*) the body being provided with internal alternating grooves and deformable ribs extending along the bottom between the arms of each recess and along the sides of the arms of each pair,

(*e*) said tabs being provided with an internally extending deformable rib,

(*f*) said ribs yielding under pressure of a conductor to accommodate a conductor within a wide range of different sizes in each recess as the arms of each pair and the associated tab provide an overlapping connection enfolding the conductor upon compression of the connector.

References Cited in the file of this patent

UNITED STATES PATENTS

2,327,651	Klein	Aug. 24, 1943
2,707,775	Hoffman et al.	May 3, 1955
2,884,478	Becker et al.	Apr. 28, 1959
3,053,930	Mallanik et al.	Sept. 11, 1962