Aug. 30, 1955 G. A. MABERRY 2,716,737

ELECTRIC CABLE SAFETY CONNECTORS

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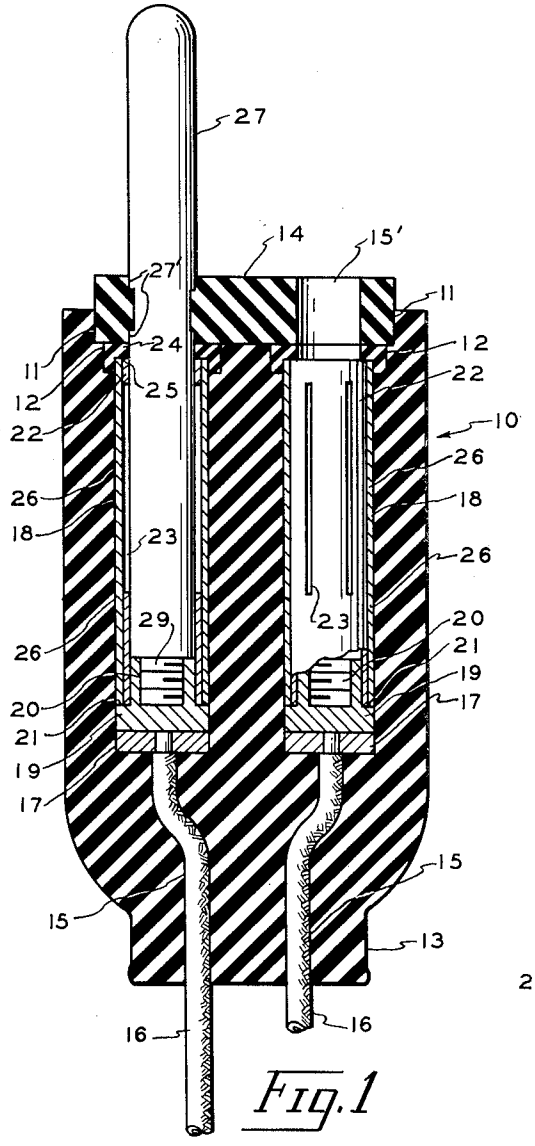

FIG. 1

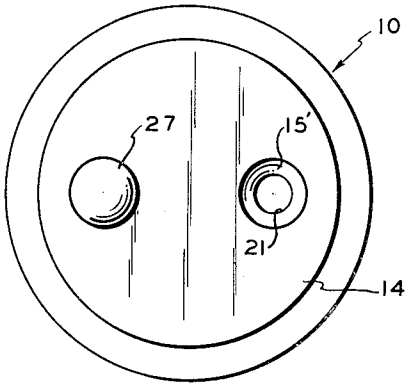

FIG. 2

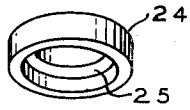

FIG. 3

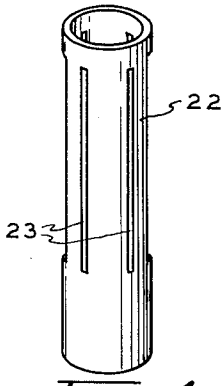

FIG. 4

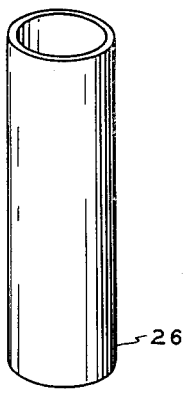

FIG. 5

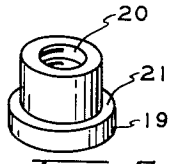

FIG. 6

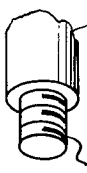

FIG. 7

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ELECTRIC CABLE SAFETY CONNECTORS

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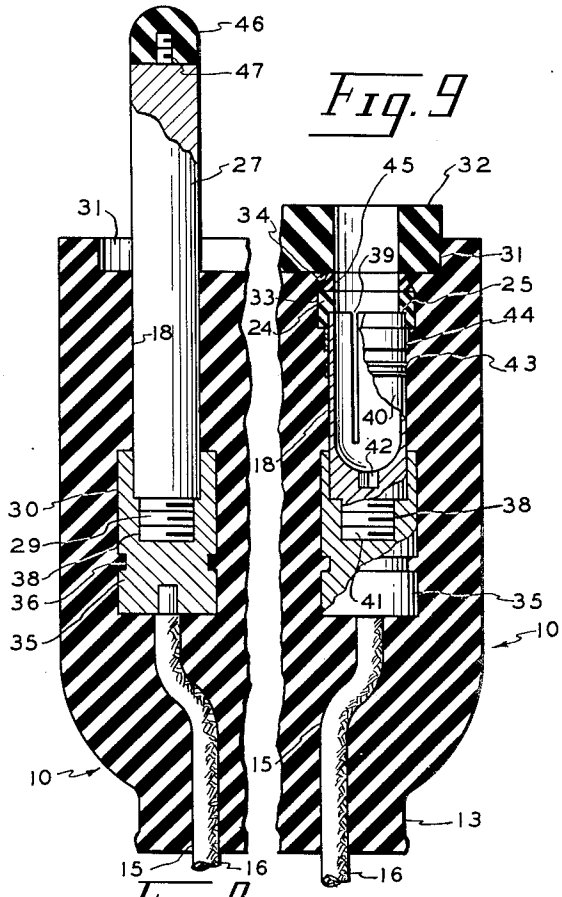

Fig. 9

Fig. 8

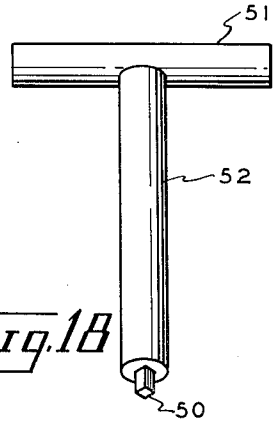

Fig. 18

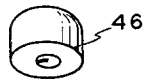

Fig. 10

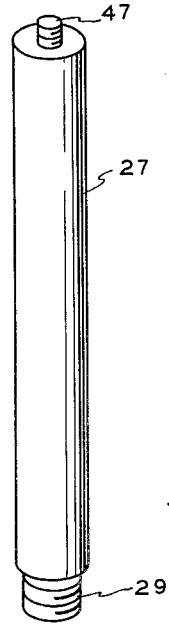

Fig. 11

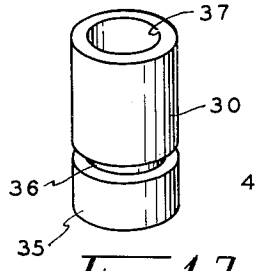

Fig. 12

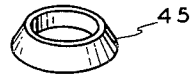

Fig. 13

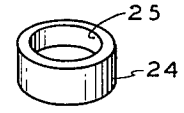

Fig. 14

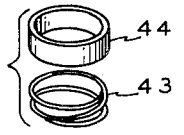

Fig. 15

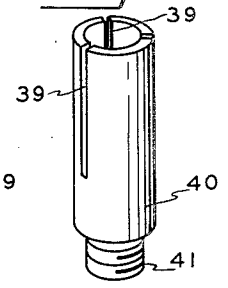

Fig. 16

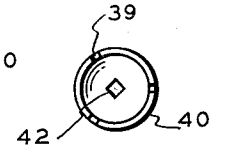

Fig. 17

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ELECTRIC CABLE SAFETY CONNECTORS

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Application June 17, 1952, Serial No. 293,896

7 Claims. (Cl. 339—31)

This invention relates to electric plug-in type connectors of the safety type for use on cables and adapted to carry considerable amount of current safely, be readily altered and repaired, and be polarized so that the complementary connector parts are not connected incorrectly.

At the present time, with known types of plug-in connectors, supply houses do not carry merely those elements that actually need replacing in the male and female plug components. Nor is it found that plugs are carried which can at times be utilized as male plugs, other times as female plugs, and still at other times as a combination of a male and female plug, in association with a juxtaposed plug part.

It is an object of the present invention to provide a plug-in type electrical connector which is basically constructed as a female component or male component but which may be converted completely or partly to the opposite component part.

Another object of the present invention is to provide a plug-in type connector for use in pairs where the connector component has both male and female terminals, and wherein the terminals are readily removable when damaged for replacement without sacrificing other parts of the connector.

A further object is to provide a plug of the nature above referred to which is housed in flexible rubber which contains reinforcing sleeves for the terminals whereby distortion of the housing due to rough handling will not necessarily affect the terminals.

A further object is to provide a closure means between the plug components to prevent arcing between the terminals as well as prevent ingress of water or other injurious matter.

A further object is to provide the free ends of the pin terminals with insulating ends whereby to prevent arcing at such point and prevent injury to the terminals and workman while manipulating them under electric current load.

Other objects, advantages and improvements according to the present invention will become apparent from the following specification, taken in connection with the accompanying drawing, in which:

Fig. 1 is a longitudinal sectional view of a plug-in type connector part according to the present invention, wherein the connector is constructed to show one half as the male terminal and the other half as the female terminal.

Fig. 2 is a top plan view of Fig. 1.

Fig. 3 is a perspective view of the centering insulator bushing.

Fig. 4 is a perspective view of the female terminal member or sleeve.

Fig. 5 is a perspective view of the outer or protective sleeve.

Fig. 6 is a perspective view of the terminal base or seat.

Fig. 7 is a perspective view of the inner end of a male contact terminal or pin.

Fig. 8 is a longitudinal sectional view of a part of a male plug-in connector according to a second embodiment of the present invention.

Fig. 9 is a longitudinal sectional view of a part of a female plug-in connector for juxtaposition with that shown in Fig. 8.

Fig. 10 is a perspective view of the insulating cap usable on the terminal pin of Fig. 11.

Fig. 11 is a perspective view of the male contact pin adapted for use in Figs. 1 and 8, for example.

Fig. 12 is a perspective view of the base or seat used in the embodiment of Figs. 8 and 9.

Fig. 13 is a perspective view of the spacer means as used in Fig. 9.

Fig. 14 is a perspective view of the insulating bushing or centering means for the sleeve terminal in Fig. 9.

Fig. 15 is an exploded perspective view of the supporting band and spring for the sleeve terminal in Fig. 9.

Fig. 16 is a perspective view of the sleeve terminal in Fig. 9.

Fig. 17 is a top view of the sleeve terminal; and

Fig. 18 is a perspective view of a wrench for inserting and removing the sleeve terminal in either embodiment.

Referring now to Fig. 1 in particular, there is here shown a body section **10** of a plug-in type electrical connector. This body is made preferably of flexible rubber, but may be of other suitable molded insulating material, and may be molded in one piece or formed in halves. At its inner end the body section has a hub portion **13**. It will be understood, of course, that there may be a duplicate complementary half body section, not shown. In each body section there is formed a pair of channels **15—15**. It will likewise be understood that a channel **15** in one half body section registers with the corresponding channel in the other half body section if and when the first half is superimposed on the latter half. Conductors **16—16** are positioned or molded in the channels **15—15**. Within each half body section **10** there is a pair of parallel bores **18—18**, also of semicircular cross section in the case of half body sections.

At the bottom of each of the bores **18** there is a metal washer **17** to which the inner ends of the respective conductors **16—16** are soldered. The washers **17—17** are positioned in the bottoms of the respective bores **18** and the conductors **16—16** during the process of molding or when the body halves are assembled and then vulcanized together. The remaining metal parts, to be now described, can be inserted through the bores **18—18**. A seat **19** and a protective sleeve **26** can be molded therein in situ. Washer **17** and seat **19** may be made as an integral member.

The base or seat **19** has an internally threaded counterbore **20** and its diameter is reduced from the top for over half the height to form a shoulder **21** thereon, as shown in Fig. 6. Within each bore **18** there is placed a conducting or female contact sleeve **22**, which may be of brass or copper rod suitably axially drilled, or may be a piece of tubing. Each female contact sleeve **22** has has its lower portion telescoped over seat **19** and rests on the shoulder **21**. In order to impart radial resiliency to these female contact sleeves, they are slitted lengthwise between points adjacent each end. Six of these slits **23**, equally arcuately spaced are shown, but more or less may be provided, as desired. The metal adjacent the slit is preferably turned in to resiliently engage an inserted pin terminal.

As will be seen in Fig. 1, at the left-hand side of the plug body **10**, a male contact pin **27** having a threaded lower end portion **29** is threadedly engaged with the threaded counterbore **20** of the base or seat **19**. The male contact pin **27** is surrounded by the female contact sleeve **22** and by the outer protective sleeve **26**, both of

which are supported at their lower ends by the shoulder 21 of the seat 19. Thus, in the form of the invention shown in Fig. 1, either or both sides of the plug may be converted from use as a female receptacle to use as a male plug merely by inserting the male contact pin 27 into screw threaded engagement with the threaded bore 20 of seat 19, permitting the female contact sleeve 22 to remain in place.

At its exposed or outer end, each half body section 10, for example, is formed with a first semi-cylindrical counterbore 11 and a second semi-cylindrical counterbore 12 of lesser diameter. Within the second counterbore 12 there is positioned, flush with the bottom of same, an insulating bushing 24 of hard fiber having an internal shoulder 25 embracing and properly centering the terminal sleeve and isolating the same. An outer protective sleeve 26, formed from a suitable piece of tubing, may be placed around the female contact sleeves 22—22 to resist their crushing by distortion of the body 10. Where the female contact sleeves 22—22 are molded into place during the uniting of the half body sections 10, this outer protective sleeve 26 will also prevent the rubber body material from protruding through the slots 23 in the female contact sleeves 22—22 and thereby reducing the contact area. In such case the female contact sleeve 22 will rest at its lower end on the top of the base 19, the outer protective sleeve 26 being received at its lower end around the reduced section of the base 19, and both sleeves being received at their upper ends against the internal shoulder 25 in the insulating bushing 24.

A disc separator 14 of hard or resilient rubber or other suitable insulating material is insertable in the counterbore 11 in the ends of the body 10 and over the insulating bushings 24—24, protruding sufficiently to be telescopingly received in a juxtaposed connector body. This disc separator has a pair of holes 15 therein, for access of the terminals. The left side Fig. 1 shows a terminal pin 27 inside the sleeve 22. This male contact pin 27 is made of a piece of rod, preferably brass, and has its upper end suitably rounded to hemispherical shape and its lower end reduced in diameter and threaded at 29. This threaded section 29 is adapted to be received within the internally threaded section 20 of the base 19 in the same manner as the sleeve at the right side of the figure. The pin 27 may be provided with interlocking shoulders 27' for the insulator 14.

On the tip of pin 27, shown in Fig. 1, may be threaded the insulator 46 shown in Figs. 9 and 10 to prevent arcing. As a modification, pin 27 may be of a diameter to be frictionally inserted into a terminal sleeve and protrude as shown in Fig. 1, the shoulders 52 on the pin interlocking with the insulating disc 14.

It will now be seen that there is here provided a safe plug-in type connector which may be used as a joint male and female connector by providing one female contact sleeve 22 and one male contact pin 27, as shown in Fig. 1, or as a straight female connector by omitting the male contact pin 27, leaving the two female contact sleeves 22, or as double male connector by providing two (2) male contact pins 27—27, one positioned within each of the female contact sleeves 22, the necessary changes being made very quickly.

In the modification of Figs. 8 and 9, to which the detail views of Figs. 10 to 17, inclusive, are subordinate, the general arrangement in the same insofar as the inner end 13, channels 15—15 in the half body sections 10, and the conductors 16—16 in the latter are concerned. The bores 18—18 in the body sections are enlarged at their lower ends for a purpose which will hereinafter appear.

Fig. 8 is directed to a male portion of the plug connector while Fig. 9 is for a complementary or socket portion. In Fig. 8 a pin terminal base or seat 35 is fixed in the body, it having a groove 36 to interlock with the insulation of the body. It is threaded at 29 to receive the threaded portion of the pin 27 which is of proper size to pass through the insulation and into the seat member.

As in the modification of Fig. 1, these bases 35 are molded in place by inserting them into the enlarged portion 30 of the bore 18 in one of the half body sections 10, for example, and placing the other half body section thereover and vulcanizing the two half body sections along the plane of separation or else the body may be molded in situ around the bases. The circumferential groove 36 in each base receives the material of the plug body sections and thus serves to hold the base in place

The conductors 16—16 extending through the channels 15—15 in the body sections 10—10 are connected by soldering to the bases 35—35, respectively. The bases 35—35 each have a first counterbore 37 therein extending from the top downward, and a second counterbore 38 concentrically positioned with respect to the first and of lesser diameter, this second counterbore being suitably screw threaded.

An insulator 46 is mounted on the free end of pin 27 to prevent arcing. In Fig. 9 the female contact member is herein also in the form of a sleeve 40, which is made from a suitable piece of brass rod by axially drilling same through most of its length. The sleeve 40 is provided with a number of longitudinal slots 39 in order to impart radial resiliency thereto. Three of these slots 39 equally arcuately spaced are shown, but it will be obvious that a greater or lesser number could be used, and they extend downwardly from the top of the sleeve for at least three-quarters of the length. The metal adjacent the slits may be inturned to grip the terminal pin. At its bottom the rod from which the sleeve is made is reduced in diameter by turning and threaded at 41. These threads are complementary to the threads in the second counterbore 38 within each of the bases 35—35. At the bottom of the bore within the sleeve 40 there is formed, as by punching, a socket 42, which may be square or hexagonal and the purpose of which will hereinafter appear.

Adjacent its upper end, the sleeve 40 is surrounded by a coiled tension spring 43 positioned in the bore 18, which enhances the gripping effect of the sleeve on the male contact pin 27 of a juxtaposed plug when the latter pin is inserted therein.

Above the spring 43 the contact sleeve 40 is likewise surrounded by a supporting metal band 44, also positioned in the bore 18. This band serves to prevent crushing and thereby reinforce the contact sleeve in case of unusual strain imposed thereon by the insulating body.

The upper end of the contact sleeve 40 is received in the insulating bushing 24 of hard fiber and rests against the internal shoulder 25 therein. This insulating bushing is positioned in an enlarged upper section 33 of the bore 18. The enlarged section 33 of the bore enables the contact sleeve 40, spring 43, and supporting band 44 to be removed outwardly of the bore 18.

The enlarged section 33 of the bore 18 forms a shoulder 34 at its top within the bore, between which and the insulating bushing 24 there is placed a hollow frustoconical spacer ring 45 of hard rubber forced into the flexible rubber body. This spacer ring fills the otherwise vacant space in the bore 18 at the open end of the contact sleeve 40, which space, as stated, is provided to allow the contact sleeve, along with the coiled tension spring 43, supporting band 44, and insulating bushing 24 to be removed. For replacement of the contact sleeve, a T wrench 50 having a polygonal end is inserted in socket 42 for this purpose.

In Figs. 8 and 9 the body members have counterbores 31 corresponding to 11 in Fig. 1. A disc separator 32 corresponding to 14 in Fig. 1 is inserted in one of the counterbores 31 to be telescopingly received in the counterbore of a complementary plug.

With further reference to the insulating cap 46, it is a safety device, cooperating with the insulating bushing

24 to prevent the metal parts from coming into contact in case two plug-in connectors should be turned in the reverse position in such manner as to permit two male contact pins of the juxtaposed connectors to contact each other. This is particularly important where the plug-in connectors are arranged for two or more conductors and the contact members are polarized.

It will be apparent that the male contact pin **27** can be removed, when damaged as by being burned, for replacement simply by unscrewing it by hand from the internally threaded lower counterbore **38** in the base **35**.

The plug parts may be polarized by using pins of different sizes and/or lengths and the contact sleeves made to correspond to the sizes of their respective pins.

While the device has been shown and the structure described in detail, it is obvious that this invention is not to be considered as being limited to the exact form disclosed, and that changes in detail and construction may be made therein within the scope of what is claimed, without departing from the spirit of this invention.

Having thus set forth and disclosed the nature of this invention, what is claimed is:

1. A plug-in connector comprising a body having parallel bores therein, a screw threaded base at the bottom of each of said bores, an inner metal sleeve positioned on one of said bases and extending along the corresponding bore, an outer sleeve for reinforcing purpose surrounding said base and said inner sleeve and also extending along said bore, and a male connector pin having an inner screw threaded end adapted to be received in said base, with the body of the pin projecting outwardly through said sleeve and the bore.

2. A plug-in connector comprising a body having parallel bores therein, a screw threaded base at the bottom of each bore, a sleeve positioned at one end on one of said bases and extending along the corresponding bore, an insulating bushing mounted in the body and receiving the other end of said sleeve, and a male connector pin having an inner screw threaded end adapted to be received in a said base with the body of the pin extending through said sleeve and outwardly of the bore.

3. A plug-in connector comprising a body having parallel bores therein, a screw threaded base at the bottom of each bore, an inner sleeve positioned on one of said bases and extending along the corresponding bore, an

outer sleeve surrounding said seat and said inner sleeve and also extending along said bore, an insulating bushing mounted in the body and receiving the other ends of said sleeves, and a male connector pin having an inner screw threaded end adapted to be received on said base with the body of the pin extending through said sleeve and outwardly of the base.

4. A plug-in connector comprising a body having parallel bores therein, a screw threaded base at the bottom of each of said bores, a sleeve positioned on one of said bases and extending along the corresponding bore, a male connector pin having an inner screw threaded end adapted to be received in said base with the body of the pin projecting through said sleeve and outwardly of the bore, and a separator disc positioned over the outer end of the plug and having at least two holes therein, one of which receives the male connector pin and the other of which registers with the other bore.

5. A plug-in connector comprising a body having parallel bores therein, a screw threaded base at the bottom of each bore, a sleeve positioned at one end on one of said bases and extending along the corresponding bore, a sleeve socket having an inner screw threaded end adapted to be received in a said base, and an insulating bushing mounted in the body and receiving the other ends of the said sleeve and socket.

6. The plug-in connector as set forth in claim 1 wherein the projecting end of the pin carries an insulating cap.

7. The plug-in connector as set forth in claim 1 wherein the plug body is of flexible rubber.

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