

Dec. 3, 1946.

C. ANTONY, JR., ET AL

2,411,861

ELECTRICAL CONNECTOR

Filed March 19, 1943

2 Sheets-Sheet 1

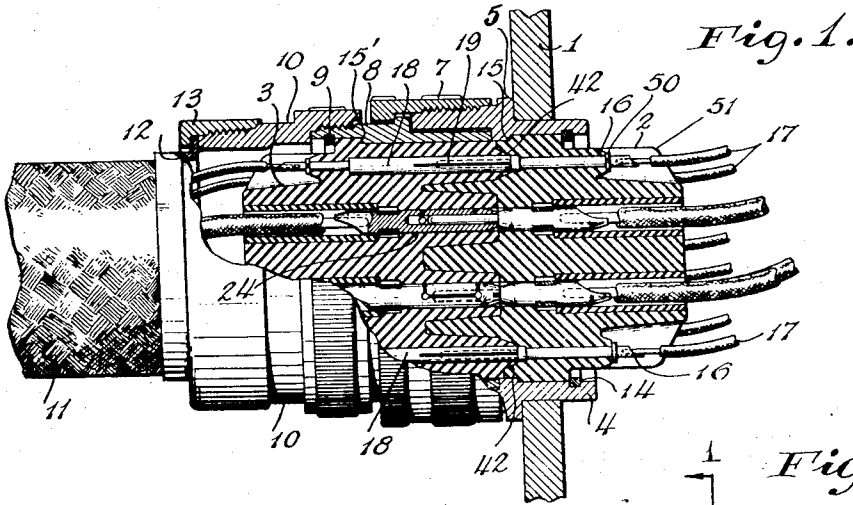


Fig. 1.

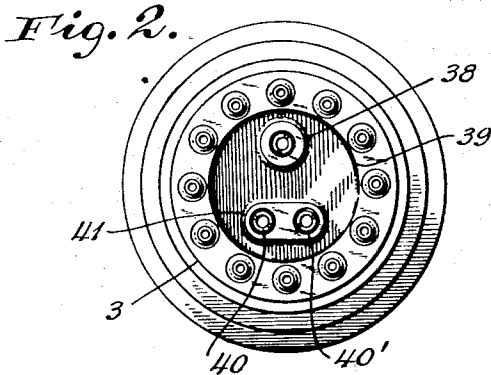


Fig. 2.

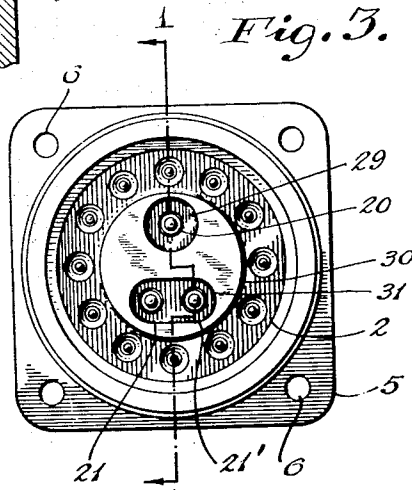


Fig. 3.

Fig. 4.

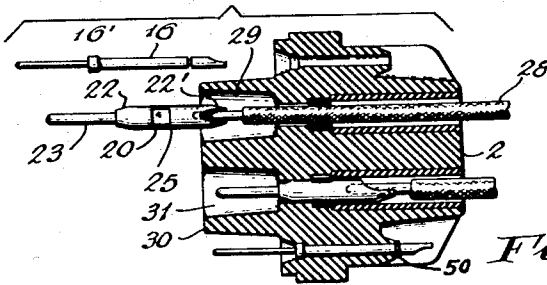


Fig. 5.

Fig. 6.

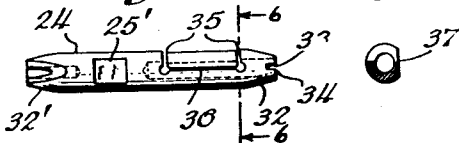


Fig. 7.

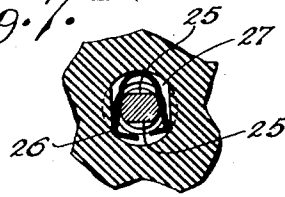
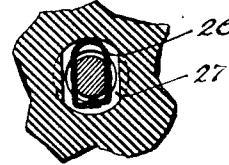


Fig. 8.



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2 Sheets-Sheet 2

Fig. 9.

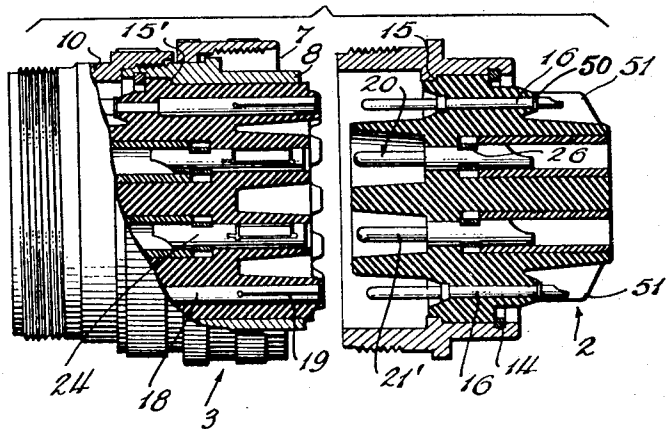


Fig. 11.

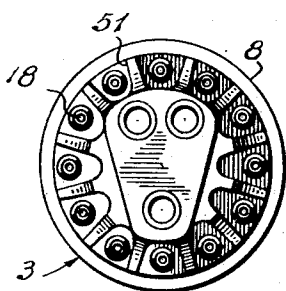


Fig. 10.

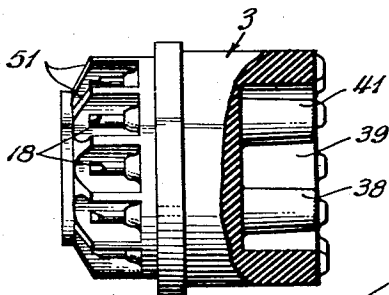
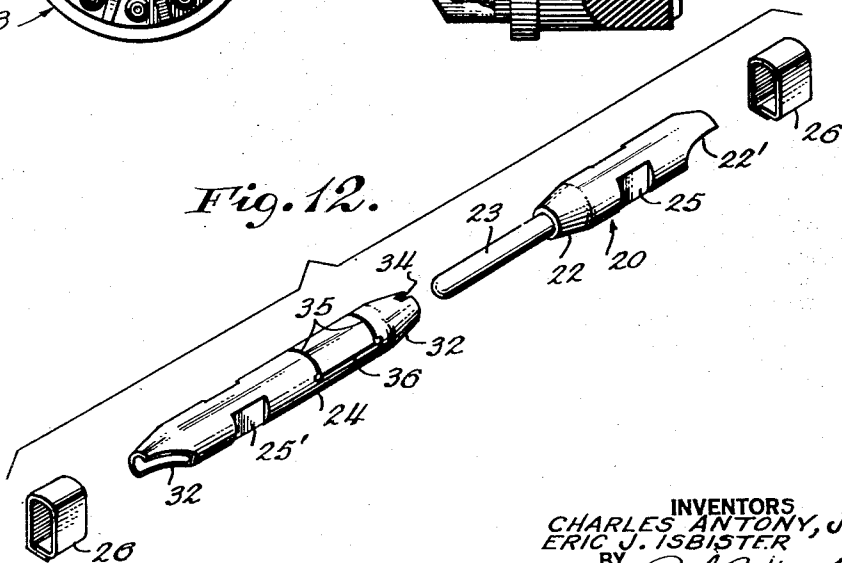


Fig. 12.



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ELECTRICAL CONNECTOR

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Application March 19, 1943, Serial No. 479,814

4 Claims. (Cl. 173—328)

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This invention relates generally to connectors and the invention has reference more particularly to a novel electrical connector suitable for use not only under ordinary conditions but being especially valuable for use at high voltages and high altitudes. High voltage electrical connectors as heretofore constructed have been generally unsatisfactory for high altitude uses. As the elevation becomes greater at which high voltage electrical equipment is used, the atmospheric pressure and hence the insulating qualities of the atmosphere against arcing decrease so that at high elevations, such as obtain in the use of aircraft in modern warfare, the insulation qualities of the atmosphere may drop to a small fraction of what they are near the surface of the earth, so that ordinary electrical connectors arc over at these high altitudes and become useless. Furthermore, ordinary connectors generally have exposed leads which are a source of leakage and arcing and also constitute a serious menace to those handling the apparatus.

A portion of the subject matter shown in the present application is disclosed and claimed in copending divisional application Serial No. 643,646 filed January 26, 1946.

The principal object of the present invention is to provide a novel electrical connector that is adapted for use not only at ordinary altitudes but also at high altitudes and will satisfactorily handle high voltages without danger of flash-over or deterioration.

Another object of the present invention is to provide a novel electrical connector comprising male and female portions wherein high voltage male and female contact members are readily removable as for attaching leads thereto.

Another object of the present invention is to provide an electrical connector employing novel spring means for removably securing contact members in place.

Still another object of the present invention is to provide an electrical connector wherein all high voltage contact members and leads are completely insulated, the connector being adapted to establish a plurality of circuit connections simultaneously and providing long creepage paths for high voltages to prevent flash-over.

Other objects and advantages will become apparent as the description proceeds.

Referring to the drawings,

Fig. 1 is a partial sectional view of the electrical connector of this invention taken on the line 1—1 of Fig. 3.

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Fig. 2 is an end view of the female portion of the connector.

Fig. 3 is an end view of the male portion of the connector.

Fig. 4 is a fragmentary sectional view of the male portion of the connector.

Fig. 5 is an enlarged elevational view of a female contact member.

Fig. 6 is a cross-sectional view of the structure of Fig. 5 as cut by a plane 6—6 indicated in Fig. 5.

Figs. 7 and 8 are enlarged fragmentary views illustrating the operation of the connector.

Fig. 9 is a part sectional view showing the connector disconnected.

Fig. 10 is a side view of the female portion of the connector.

Fig. 11 is an end view of the structure of Fig. 10, and

Fig. 12 is a perspective illustrating the contact members and associated springs.

Similar characters of reference are used in all the figures of the case to indicate corresponding parts.

Referring now to the drawings, in Fig. 1 reference numeral 1 designates a panel or other support to which the connector is shown attached. The connector comprises a male portion 2 and a female portion 3 shown as contained within a sleeve coupling comprising a cylindrical body portion 4 shown as having a reduced part inserted through an aperture in the panel 1, this body portion being provided with a flange 5 having apertures 6 through which suitable fastening means may be inserted for attaching the body portion to the panel or other support 1. The body portion 4 is externally threaded to receive a draw-up nut 7 that engages an inner sleeve member 8 within which the female portion 3 is retained as by a split ring 9. The sleeve 8 is also shown threaded for receiving an extension sleeve 10 to which the cable 11 is shown attached through a ferrule 12 and nut 13.

The male portion 2 of the connector is retained within the sleeve coupling cylindrical body portion 4 by means of a split ring 14. The male portion 2 and the female portion 3 are shouldered at 15 and 15', respectively, to prevent longitudinal movement of these portions within the members 4 and 8, respectively, toward one another. In other words, the shoulders 15 and 15' acting in conjunction with the split rings 9 and 14 serve to prevent longitudinal movement of the connector portions within their respective sleeve coupling portions.

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The male portion 2 of the connector is shown as having a plurality of mutually annularly spaced low voltage contact members or pins 16. The contact members 16 are enlarged at 16' (Fig. 4) which enlargements cooperate with U-washers 50 to retain the contact members in their apertures in the connector portion, i. e., an enlargement 16' engages one end of male portion 2 whereas washer 50 engages the other end thereof to removably retain the member 16 in place. If desired these contact members 16 could be moulded directly in the body of insulating material such as a condensation product comprising the body of the male portion 2. Any desired number of these low voltage contact members may be employed, twelve being shown in the structure of the drawings. Suitable leads 17 are adapted to be connected to the pins 16 as by solder. Longitudinal fins 51 formed on the portion 2 serve to isolate each contact pin 16 from adjoining pins.

The female portion has corresponding socket members 18 disposed annularly for receiving the several pins 16. The socket members or female elements 18 are shown as cylindrically recessed for receiving the pins 16 and are split at 19 along their recessed portions for obtaining a resilient grip upon the respective pins 16.

Positioned radially inwardly of the annular low voltage contact members 16 of the male portion 2 are a number of contact members or pins which are adapted to be insulated for high voltage. Three of these contact pins are shown numbered 20, 21 and 21' (Fig. 3), it being the purpose of the present construction to insulate high voltage pin or member 20 from pins 21 and 21' which may carry a low voltage or vice versa, and to insulate these contact pins from the low voltage pins 16. Pins 20, 21 and 21' are of similar construction so that the structure of only one of these pins will be explained in detail. Taking pin 20, for example, it will be seen that this pin (see especially Fig. 4) has an enlarged body portion provided with bevel ends 22 and 22' and that the contact portion of the pin is a reduced extension 23 thereof, i. e., the reduced extension 23 is adapted to engage in the corresponding female contact member 24 of the female portion 3. The pin 20 is provided with opposing flats 25 on opposite sides thereof (see also Figs. 7, 8 and 12) which flats form depressions from the cylindrical surface thereof and are adapted to cooperate with substantially U-shaped spring members 26 contained within a suitable recess 27 in the body of the male portion 2. The legs of the spring member 26 are allowed to move inwardly and outwardly within the recess 27, but this recess is so shaped that this spring member cannot move longitudinally within the recess 27.

With the pin 20 turned so that the spring 26 engages the flats 25 as shown in Fig. 8, the pin 20 is held against longitudinal movement within the male portion 2. However, if the pin contact member is turned 90°, the legs of the spring 26 are forced to ride out and up upon the cylindrical portion of the pin 20 whereupon this pin may be slid longitudinally out of the spring 26. Thus, there is provided a means for either holding the pin in place and against longitudinal movement within the male coupling portion 2, or by turning the pin member 20 as by applying a pair of pliers to the extension 23 thereof and turning this pin member through 90°, the same may be removed from the portion 2 by longitudinal pushing or pulling upon the pin member.

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Thus, a simple method is provided for enabling access to pin 20 for attaching the lead 28 to shank 22' of the pin member 20, and after the lead 28 has been attached as by soldering, it can be pulled back and the pin 20 turned through 90° thereby snapping the spring 26 into locked position as shown in Fig. 8, thereby firmly holding the pin 20 in its useful position. The pins 21 and 21' are similarly constructed as above noted.

It will be seen that the male contact pin portion 23 is set into a cylindrical recess 29 within a cylindrical extension 30 of the male connector member 2 to thereby provide a long creepage area for any leakage current which might tend to flow from this pin contact to adjacent pin contacts 16 for example. Similarly, contact pins 21 and 21' are set in a recess 31 to provide a long current leakage path between these contact pins and contact pin 20, for example, thereby preventing flash-over at high altitudes and at high operating voltages.

The female contact members or pins 24 are provided with bevel ends 32 and 32' and have opposing flats 25' similar to the flats 25 of male pin 20. Flats 25' also cooperate with springs 26 contained within the female connector portion 3 so that these female contact members or pins are retained against longitudinal movement when engaged by these springs. The outer end portions of the female pins 24 containing the sockets 33 for receiving the male portion 23 are shown provided with a slot 34 for receiving a screw driver whereby these pins may be readily turned as when engaging or disengaging these pins with respect to the springs 26. In order to provide a spring grip upon the male pin portion 23, the female portion is slit at 35 and 36 and flattened at 37 to provide a resilient spring grip portion.

The bevels 32 and 32' of the female pin and the bevels 22 and 22' of the male pin enable these pins to be readily pushed inwardly through the spring 26 when the same is collapsed as shown in Fig. 8. The female pin member 24 is largely contained within a circular boss 38 provided in a cylindrical recess 39 of the female member 3, the boss 38 being adapted to project into the recess 29 of the male portion 2. Similarly, female contact pins 40 and 40' adapted to receive the male pins 21' and 21, respectively, are largely contained within a boss 41 extending within the recess 39, the boss 41 being adapted to project into the recess 31 of the male portion 2. The cooperating male and female portions thereby serve to provide the long creepage paths above mentioned.

Female pins 40 and 40' are similar in construction to pin 24. It will be noted that the outer ends of the female socket pins 18 are surrounded by conical insulating bosses 42 (Fig. 1) which also serve to enlarge the current creepage paths for these low voltage contacts.

With the male and female portions assembled as shown in Fig. 1, all parts of the high voltage contact members or pins of the male and female portions are completely enclosed and long creepage paths are provided so that it is impossible for arc over to take place or shock to be given to operators. Owing to the use of the sleeve coupling surrounding the connector, once the unit is assembled, it is impossible for the same to become accidentally disconnected. The use of the spring members 26 and cooperating male and female pin contact members enables these members to be quickly and easily removed for the purpose of at-

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taching or detaching leads thereto which is a decided advantage in use.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described our invention, what we claim and desire to secure by Letters Patent is:

1. A connector element, comprising a body portion, a contact member movably mounted therein, and separate spring means for removably retaining said contact member in said body portion, said spring means comprising a U-shaped spring member adapted to engage flattened portions of said contact member, whereby said contact member may be removed from said body portion upon rotation of said contact member sufficiently to disengage said spring member therefrom.

2. In an electrical connector, a connector portion having an aperture therethrough, a contact member longitudinally insertable into and removable from said aperture, and spring means within said connector portion and projecting into said aperture for engaging said contact member to re-

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tain the same in place, said contact member having a depressed flat portion at the side thereof for engagement with the spring means.

3. In an electrical connector, a connector portion having an aperture therethrough, a contact member longitudinally insertable into and removable from said aperture, said contact member having opposite flats on the sides thereof, and spring means within said connector portion and adapted to project into said aperture for engaging said contact member flats to retain the same in longitudinal position within said aperture, said contact member being turnable to disengage said spring means from said flats to thereby enable removal of said contact member.

4. A connector element, comprising a body portion, a contact member with a length thereof having a non-circular cross-section with shoulders formed at the ends of the reduced radius portion of the non-circular length of said contact member, said contact member being rotatably mounted in said connector body portion, and spring means adapted to bear radially inward against the non-circular portion of said contact member for releasably retaining said contact member in said body portion against axial movement.

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