

Sept. 7, 1948.

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2,448,509

ELECTRICAL CONNECTOR

Filed May 14, 1943

2 Sheets-Sheet 1

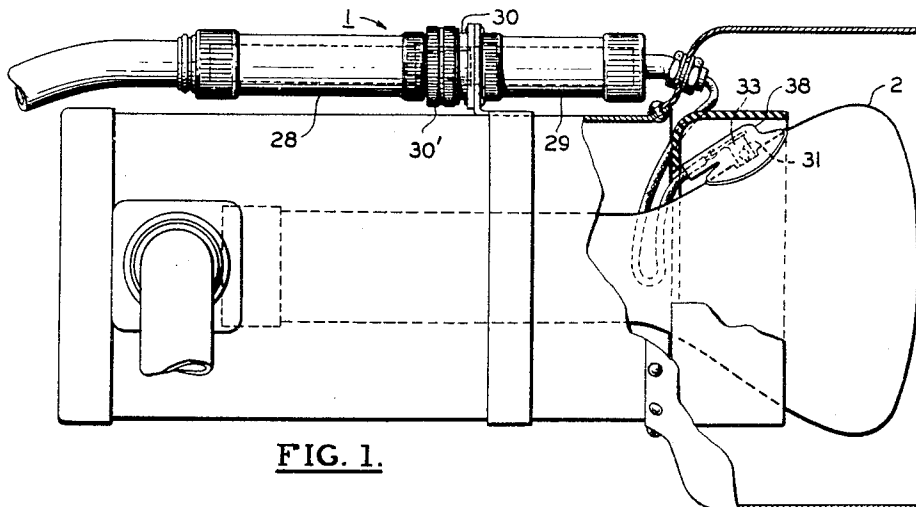


FIG. 1.

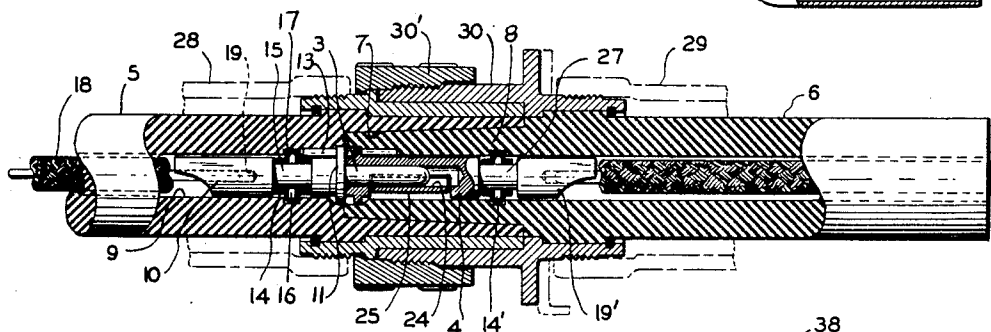


FIG. 2.

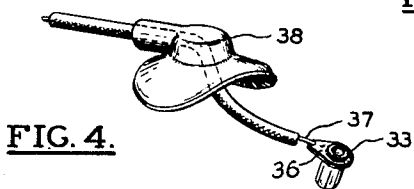


FIG. 4.

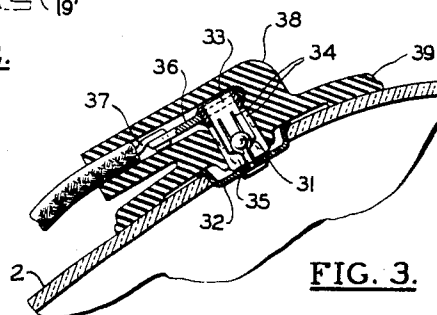


FIG. 3.

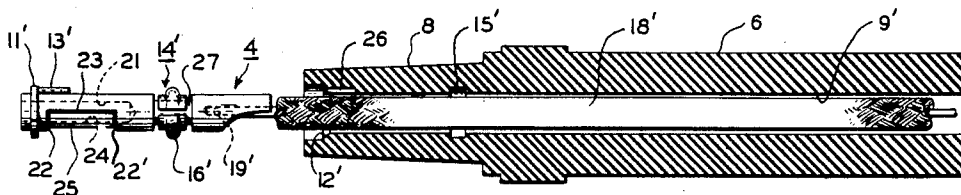


FIG. 5.

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2 Sheets-Sheet 2

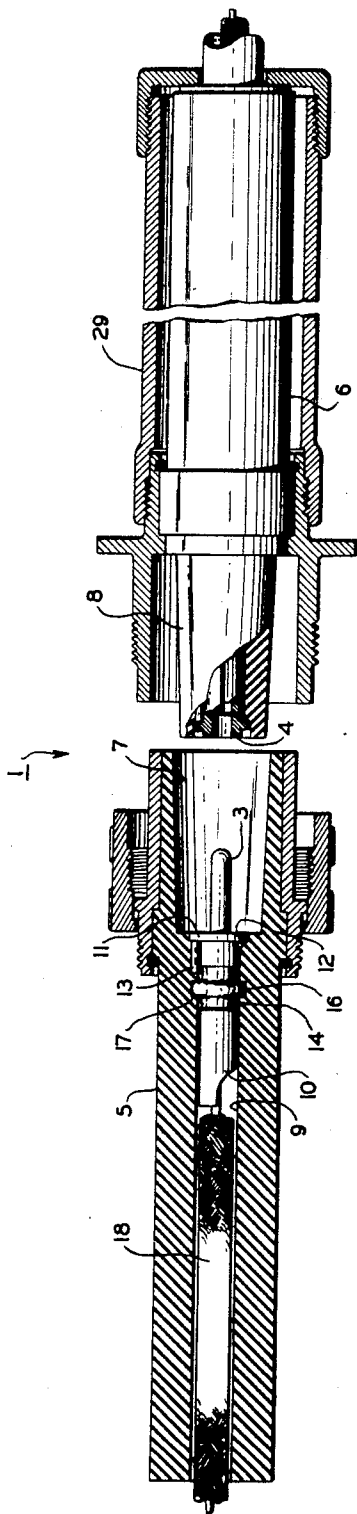


FIG. 6.

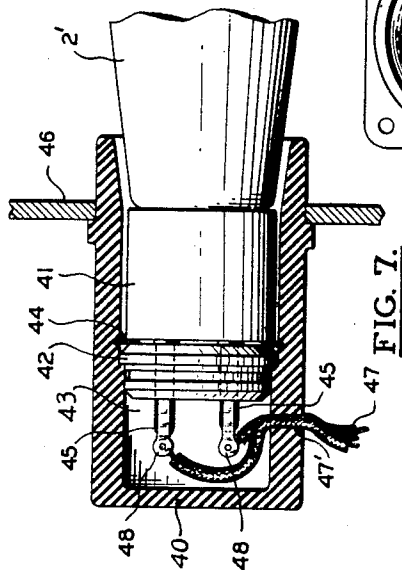


FIG. 7.

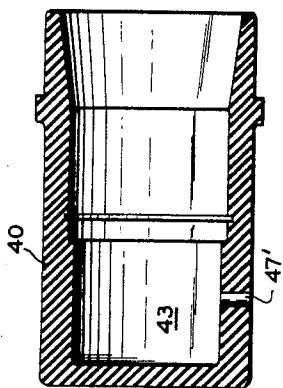


FIG. 8.

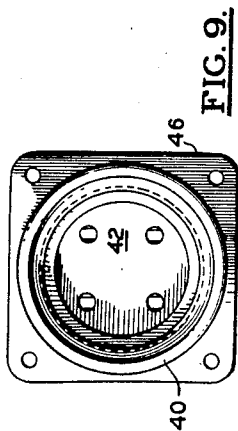


FIG. 9.

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UNITED STATES PATENT OFFICE

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ELECTRICAL CONNECTOR

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5 Claims. (Cl. 173—328)

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This invention relates, generally, to electrical connectors and the invention has reference, more particularly, to a novel connector especially adaptable for use at high voltages and high altitudes although it is equally adaptable for use under ordinary operating conditions. High voltage electrical connectors, as heretofore constructed, have generally been unsatisfactory for high altitude uses. As the elevation at which high voltage electrical equipment operates is increased, the atmospheric pressure and hence the insulating qualities of the atmosphere against arcing decreases 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 persons handling the apparatus.

The principal object of the present invention is to provide novel electrical connector structures adapted for use at high altitudes and high voltages as well as at ordinary altitudes.

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

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

Still another object of the present invention is to provide electrical connectors wherein the high voltage contact members and leads connected thereto are completely insulated.

Still another object is to provide a connector so constructed as to provide long current leakage paths thereby eliminating breakdowns at high altitudes and high voltages.

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

Referring now to the drawings,

Fig. 1 is an elevational view partly in section showing connectors of the present invention applied to a cathode ray tube.

Fig. 2 is a part sectional view of one form of connector used.

Figs. 3 and 4 are respectively sectional and per-

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spective views of another form of connector used.

Fig. 5 shows the female portion of the connector of Fig. 2 with the female contact member removed as for securing a lead thereto.

Fig. 6 is a part sectional view showing the joint of Fig. 2 in separated condition.

Figs. 7 and 8 are sectional views of a connector adapted for use with thermionic tubes and

Fig. 9 is an end view of the structure of Fig. 7.

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

Referring specifically to Figs. 1, 2, 5 and 6 of the drawings, one type of connector of the present invention is disclosed. This connector, designated as a whole by reference numeral 1, is shown used in connection with a cathode ray tube 2 for supplying high voltage to the latter. The connector 1 consists of male and female contact members 3 and 4 which are carried by insulating connector portions or housings 5 and 6 respectively. Male connector insulating portion 5 is provided with an inwardly tapered open mouth portion 7 that is adapted to receive a conforming tapered insulating projection 8 provided on the female connector portion or insulating housing 6. Communicating with the mouth portion 7 is a longitudinal inner passage 9 within male portion 5 for receiving the contact member 3. This contact member has its rear portion 10 enlarged, for conformably fitting into the cylindrical passage 9. This rear portion of the contact member 3 is provided with a stop flange 11 (see Fig. 6) abutting an angular bevelled shoulder 12 provided at the inner end of the mouth 7. The stop flange 11 serves to prevent accidental sliding of the connector 3 outwardly through the passage 9.

A bead or pin 13 formed on the flange 11 or on the enlarged portion of the contact member projects into a conforming longitudinal slot in the male insulating portion 5 and serves to prevent accidental turning of the contact member within the insulating portion 5. A split cylindrical spring member 14 is mounted within an annular recess 15 (see Fig. 2) provided on the enlarged rear portion of contact member 3. This spring member is formed with an outwardly bowed central portion 16 which is urged outwardly by the spring tension of the spring member into an annular groove 17 formed in the passage 9. The bowed or beaded portion 16, cooperating with groove 17, tends to retain the contact member 3 in desired position within the insulating male portion 5 of the connector. However, when it is

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desired to remove the contact member 3 for the purpose of attaching the lead 18 thereto, the contact member 3 may be gripped, as by pliers, and pulled outwardly through the open mouth 7. This action serves to compress spring member 14 somewhat, allowing bead 16 to ride out of groove 17 and enabling the contact member 3 to be pulled outwardly, in a manner similar to that illustrated in connection with the removal of the female member shown in Fig. 5.

The inner end of the enlarged portion of contact member 3 is recessed at 19 for receiving the conducting portion of the insulating conductor 18 which may be soldered in this recess upon the removal of the contact member 3 from the member 5 in a manner similar to that illustrated in Fig. 5. To re-insert the male contact member 3 in place after soldering the lead 18 thereto, it is merely necessary to push the enlarged rear portion of the contact member 3 into the bore 9 while turning the same slightly, thus causing the bevelled shoulder 12 to compress the bead 16 of spring member 14 so that this spring member moves into engagement within the groove 17 and, at the same time, the pin or projection 13 will enter the longitudinal groove that is provided therefor in the insulating body 5.

It will be noted from a glance at Fig. 6 that with the male contact member 3 thus assembled, a long current leakage path is provided between the enlarged portion of contact member 3 and the end of the insulating portion 5, so that there is no opportunity for a breakdown to ground even at high voltage and low atmospheric pressure, such as obtains at high altitudes.

The female insulating portion 6 of the connector has an internal bore 9' similar to the bore 9 of the male portion 5. The female contact member 4 extends within the bore 9' and has a longitudinal socket 21 for conformably receiving the male contact member 3. This contact member 4 is provided with spaced transverse slits 22, 22' and a communicating longitudinal slit 23, thereby forming a spring tongue 24 which is preferably flattened at 25 and pressed inwardly somewhat so as to resiliently grip and hold the male contact member 3. The female contact member 4 is also provided with an annular stop flange 11' which is adapted to butt against a bevelled annular shoulder 12', thereby serving to prevent accidental longitudinal displacement of the female contact member 4 inwardly of the connecting portion 6. Also, a pin or bead 13' is formed on the flange 11' of contact member 4 for engaging in a conforming longitudinal recess 26 provided in the member 6 to prevent the turning of the female contact member 4 within this member 6.

The body of the contact member 4 is provided with an annular groove 27 within which is mounted a split spring member 14' similar to the spring member 14 used in connection with the male contact member. However, the recess 27 is made somewhat longer than the spring member 14' as better shown in Fig. 5, to enable a slight outwardly endwise movement of the female contact member resulting from disconnection of the male contact member therefrom, thereby enabling a pair of pliers to be applied to the female contact member for effecting withdrawal of the same from the insulating portion 6.

The spring member 14' is provided with the outwardly beaded portion 16' which serves, by engaging within recess 15' of member 6, to normally retain the female contact member within the

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member 6. However, by pulling upon the outer end of the female contact member as by a pair of pliers, the bead 16' of spring member 14' is slipped out of the groove 15' enabling the removal of the female contact member as shown in Fig. 5, when attaching the insulating lead 18' thereto. The female contact member is recessed at 19' for receiving the conducting portion of the lead 18', which conducting portion may be soldered directly in recess 19'.

In use, it is merely necessary to insert the tapered projection 8 of the female member into the tapered mouth 7 of the male portion, whereupon the male contact member 3 enters the female contact member 4 and is gripped thereby through the action of the spring tongue 25 so that these members are held firmly together. However, they may be separated upon pulling connecting members 5 and 6 apart, the spring members 14 and 14' serving to prevent the accidental removal of either of the male or female contact members from their respective connector portions 5 and 6 during this separation of these connector portions.

With the connector portions assembled as shown in Fig. 2, an exceedingly long current creepage path is provided between the conforming tapered surfaces of the projection 8 and recess 7 so that the connector is capable of withstanding extremely high voltages at extremely low atmospheric pressures without flash-over. Note also that an extremely long creepage path is provided within connector portions 5 and 6 extending from the male and female contact members along the passages 9 and 9' to the outer ends of the connector portions 5 and 6. The connector is adapted to be housed in a suitable cylindrical casing as illustrated in Figs. 1, 2 and 6, if desired. This casing may take the form of pipe or tube sections 28 and 29 and a disconnectable coupling 30 therebetween.

With the construction shown in Figs. 1, 2 and 6, by unscrewing the coupling ring member 30', the same will abut the end of pipe section 28, thereby serving to separate the connector portions 5 and 6 and by the same means, as the coupling ring member 30' is drawn up or tightened, the male and female contact members are forced into engagement, as shown in Fig. 2.

Another type of connector is shown in Figs. 1, 3 and 4 for supplying high voltage to the collector plate or surface of the cathode ray tube 2. This connector comprises a male contact element having a ball head 31, which contact member is adapted to be carried as by a dished plate member 32 mounted on the tube 2 and extending through an aperture therein. Contact member 31 cooperates with a female contact member 33 consisting of a hollow cylindrical member provided with longitudinal slots 34 extending inwardly from the end thereof adapted to engage male contact member 31. The slots 34 form spring fingers 35 having enlarged lower ends which grip under the ball head 31 to retain the two contact members in assembled relation and against accidental disconnection due to jarring or jolting. Preferably, the contact member 33 is made from a unitary metal piece with the interior thereof bored out, thereby giving the spring fingers 35 great strength and ability to grip the ball head 31 of the male member.

A connector plate 36 is soldered or otherwise fastened to the outer end of the female member 33, to which connector plate an insulated lead 37 is adapted to be soldered. An insulating covering

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38, as of rubber, is adapted to surround the contact members, as especially illustrated in Fig. 3. This insulating covering is formed with an apron 39 which extends in surrounding relation to the dished plate member 32 and engages the outer surface of the tube 2 to prevent leakage of high voltage current from the plate 31 outwardly over the surface of the tube 2.

The female contact member 33 is adapted to be pulled through the covering 38, as better shown in Fig. 4, when it is desired to attach or detach the lead 37 thereto or therefrom, as the case may be. After attaching the lead to the member 33, the lead may be pulled back through the covering 38 so that the female contact member 33 enters the socket provided therefor in the covering 38, as illustrated in Fig. 3. With the covering in place, no bare leads or metal contacts are exposed, thereby preventing arc-over.

In Figs. 7 to 9, a connector is provided for a base of a thermionic tube, such as a tube 2', which may be similar to tube 2 of Fig. 1. In these figures, an insulating cup-shaped connector body 40 is adapted to receive the base 41 of the tube 2', which base is adapted to engage a socket member 42 retained within the interior recess 43 of member 40 as by a spring lock washer 44. With the socket pins 45 of the tube 2' engaged in the apertures of socket member 42, a long leakage path is provided between the socket pins and the chassis 46 carrying the insulating connector body 40. The insulated connector leads 47 extend through an aperture 47' in the body 40 and are connected to the terminals 48 of the socket member 42. In this way, the uninsulated ends of these leads 47 are thoroughly insulated against breakdown or arc-over.

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.

What is claimed is:

1. An electrical connector comprising, tapered recessed male and female insulating portions connected together along a long tapered surface, male and female contact members mounted within the recesses of said male and female portions near the low side of said surface, respectively, and spring means mounted on said contact members and engaging in said recessed portions for removably retaining said contact members in place, said spring means having bowed central portions for releasably engaging said recessed portions and said spring means central portions being yieldable upon application of predetermined pulls upon said contact members to effect the disengaging of said spring means from said male and female portions and the release of said contact members therefrom.

2. In an electrical connector, an insulating connector portion having an aperture there-through, a contact member longitudinally in-

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sertable into and removable from said aperture, said contact member having a recessed portion, and spring means arch shaped in section within said recessed portion and engaging the wall of said connector portion aperture to retain the contact member in longitudinal position within said aperture, said contact member and spring means being removable upon a predetermined pull being applied upon the end causing the yielding of said arch-shaped spring means thereof to overcome the tension of the latter.

3. An electrical connector, as defined in claim 2, wherein said recessed portion is made larger than said spring means to permit a certain amount of end play of said contact member to enable the application of gripping means thereto.

4. In an electrical connector adapted for high altitude use, the subcombination comprising an insulating connector portion having a bore there-through, a contact member positioned within said bore, pin-stop means on said contact member and cooperating with said bore to prevent relative turning of said contact member within said connector portion, and annular arch-shaped spring means cooperating with said contact member and said bore for retaining the former in place, said spring means being yieldable upon endwise pull on the contact member and remaining thereon after the extraction of said member from said connector portion.

5. An electrical connector as defined in claim 4, wherein said contact member is provided with an annular groove for receiving said spring means, and said insulating portion bore is provided with a groove for receiving a portion of said spring means.

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