Nov. 26, 1940. L. W. RICHARDSON 2,222,723

CABLE CONNECTOR

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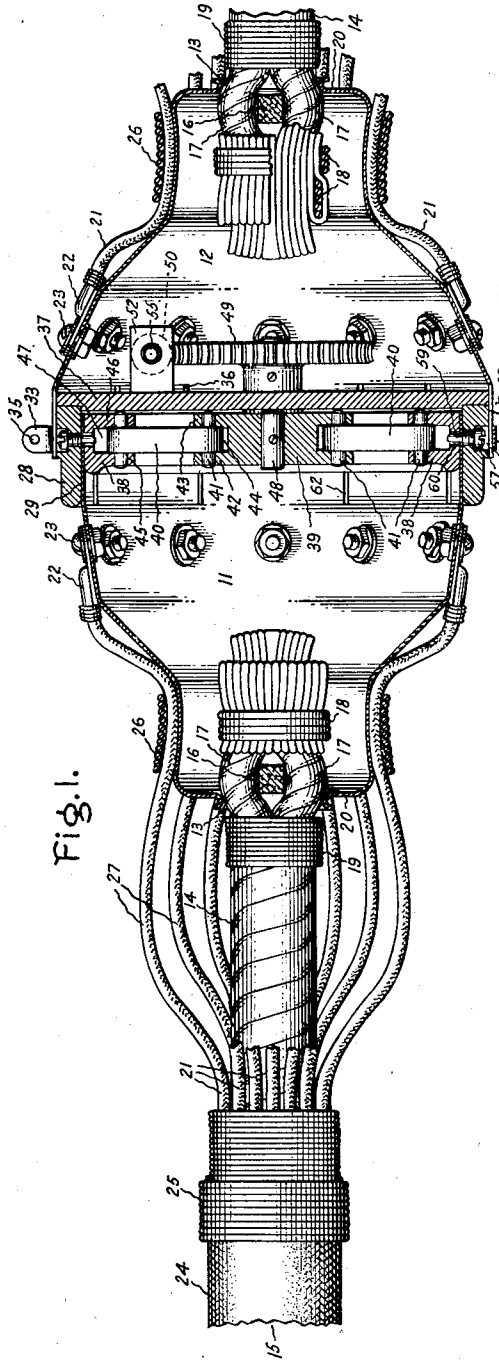


Fig. 1.

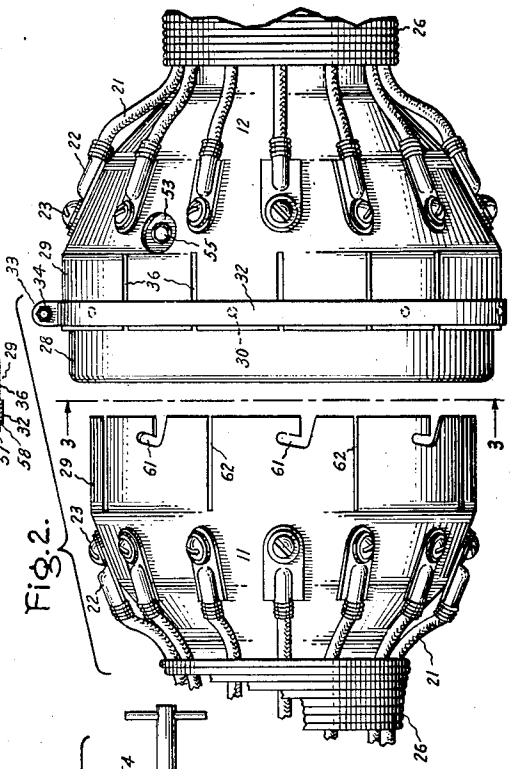


Fig. 2.

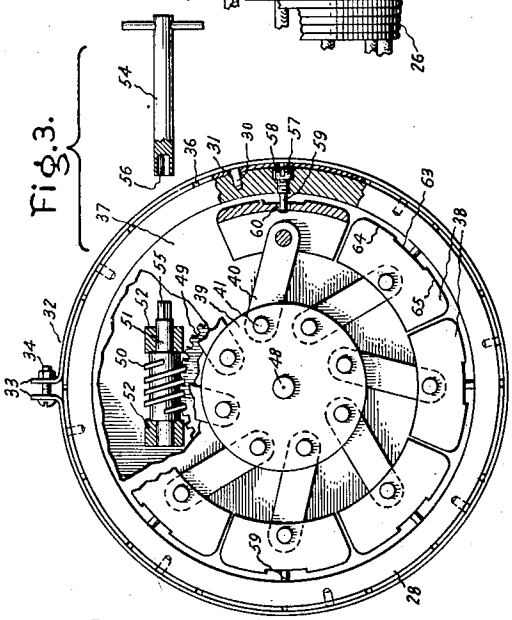


Fig. 3.

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CABLE CONNECTOR

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12 Claims. (Cl. 173—328)

The present invention relates to electrical connectors, and more particularly to cable connectors of the type permitting a quick separation of the cable sections joined by the connector.

It is an object of this invention to provide a cable connector which permits the ready separation of the terminal portions of cable sections and, at the same time, insures a joint of low electrical resistance.

It is a further object of the present invention to provide an electrical connector including a conducting ring having inner and outer contact surfaces against which the terminals of the cable ends are clamped, at least one of the terminals being forced against the contact surface by an expanding mechanism housed within the cable terminals.

The present invention is applicable to cable joints in general and is particularly adapted for use in connecting sections of litzendraht cable. Litzendraht cable is used in high frequency work and may as illustrated comprise a plurality of stranded insulated conductors arranged about the outer surface of a core of jute or similar material. This construction renders the cable quite large and heavy for a given current-carrying capacity, so that the circuit connections, which must be made from time to time to change circuit constants, are difficult to make and consume considerable time. It is also essential that the resistance of the joint be kept low in such installations. It is accordingly a further object of this invention to provide a quickly detachable cable connector having low electrical resistance and particularly adapted for joining the ends of litzendraht cable.

Further objects and advantages will become apparent as the following description proceeds, reference being had to the accompanying drawing, in which Fig. 1 is an elevational view in section showing a cable connector embodying the present invention; Fig. 2 is an elevational view showing the connector as it appears when the terminals have been separated, and Fig. 3 is an end view looking in the direction of the arrows 3—3 of Fig. 2 showing the expanding mechanism.

Referring to the drawing, the hollow terminals 11 and 12 of conducting material such as copper or a copper alloy are secured to the ends of the cable sections to be joined. Each terminal is substantially bell-shaped and has an opening 13 formed in its smaller end for the reception of a core 14 of a cable 15. Since the connections between the cable ends and each of the terminals are identical only one will be described. The end of the core 14 is received in the opening 13 of the terminal and a retaining bar 16 passed centrally through the core dividing it into two branches 17 which are bound together on either side of the bar by cords 18 and 19. The bar 16 engages the inner surface of the end wall 20 of the terminal and forms a force-transmitting connection between the cable and the terminal. A plurality of flexible insulated conductors 21 of the cable 15 have their bared ends secured to solder lugs 22 which are fastened in spaced relation around the circumference of the terminal 11 by suitable bolts 23.

In preparing a cable for the connection just described the outer insulation 24 is first removed for some distance from the cable end and the binding cord 25 applied. Next the core 14 is cut off considerably shorter than the flexible conductors 21, and the end bound securely by the cord 18. If desired, a part of the core may be turned back after some of the cord 18 has been applied. This construction which is clearly shown at the right-hand end of Fig. 1 prevents the binding cord from slipping off the end of the cable core. When the cable has been prepared as outlined above, the core 14 is inserted in the opening 13 of the terminal 11 which is slipped on the cable as far as the conductors 21 and the binding cord 25 will allow. The retaining bar 16 is inserted through the middle of the core and the binding cord 19 applied as close to binding cord 18 as possible. The cable is then withdrawn from the terminal until the retaining bar engages the wall 20 with which it cooperates to form a force-transmitting connection between the cable and the terminal. After the flexible conductors 21 have been secured to the terminal by lugs 22 and securing bolts 23, they are bound down against the outer surface of the terminal by a cord 26. Considerable slack is provided in the conductors 21 as indicated at 27 to increase the flexibility of the connection between the cable and the terminal and to facilitate the alinement of the terminals 11 and 12. With this slack the cable may be bent as required in connecting fixed points without stressing the conductors 21.

The connection between terminals 11 and 12 is accomplished through the use of an annular shaped ring 28 of conducting material. Each of the terminals is provided with a substantially annular shaped end portion 29 which is adapted to engage a wall of the conducting ring and be clamped thereagainst. The terminal 12, which

may be considered a fixed terminal, has a relatively permanent connection with the outer surface of the conducting ring. For effecting this connection a plurality of spaced outwardly projecting pins 30 are screwed into or otherwise secured to the conducting ring. A plurality of spaced openings 31 formed in the end of the terminal 12 are arranged to receive the pins 30 and lock the terminal 12 and ring together. A clamping ring or member 32 having its ends turned outwardly to form opposed ears 33 surrounds the end of the terminal 12. A bolt 34 passes through alined openings 35 in the opposed ears 33 and forms means for drawing the member 32 tightly around the terminal to press it into firm electrical contact with the conducting ring 28 and prevent the pins 30 and the walls of the openings 31 of the terminal from becoming disengaged. A plurality of axially extending slots 36 formed in the end of the terminal 12 allow it to conform to the surface of the ring 28 without buckling when the clamping member is applied so that an extended contact surface and a low resistance connection is insured.

The terminal 11 which may be considered as a movable or detachable terminal is arranged to be releasably held against the inner contact surface of the conducting ring by an expanding mechanism housed within the hollow terminals and supported by suitable means such as a plate 37 which is secured to one end of the conducting ring 28 by any suitable means (not shown). The expanding mechanism includes a plurality of shoes 38 which are arranged concentrically with the conducting ring 28 and connected with a rotatable operating member 39 by means of links 40. Each of the links is pivoted at one end to the operating member and at the other end to one of the shoes by means of pins 41. In a preferred construction, opposed walls 42 and 43 of the operating member 39 define an annular recess 44 which is adapted to receive the ends of the links 40. Alined openings in the walls provide bearing surfaces for the pins 41 while the walls 42 and 43 engage the sides of the links 41 and prevent them from rotating about their longitudinal axes. In a similar manner the walls 45 and 46 of each of the shoes 38 define a recess 47 which receives the outer end of one of the links 40.

In the present construction a gear drive is provided for rotating the operating member 39 to move the shoes 38 toward and away from the inner surface of the conducting ring 28. A suitable shaft 48 is journaled in the supporting plate 37 and has a worm wheel 49 non-rotatably secured on one end, while the operating member 39 is nonrotatably secured to the other end. A worm 50 is rotatably mounted on the plate 37 in operative engagement with the worm wheel 49 by a shaft 51 having its ends journaled in brackets 52 which are secured to the plate. An opening 53 for the reception of an operating key 54 is formed in the terminal 12 in alinement with the shaft 51 which has an extension 55 of angular cross-section adapted to engage the walls of a recess 56 formed in the end of the operating key. The shaft extension and recess cooperate to form a driving connection between the operating key and the shaft.

From the preceding description it is clear that rotation of the operating key 54 will rotate the member 39 through the worm gearing 49 and 50. The rotation of the operating member 39 is converted into radial movement of the shoes 38 by action of the links 40. The links 41 are long enough to force the shoes against the inner walls of the conducting ring 28 before the mechanism reaches its dead center position so that it is possible to apply considerable pressure by means of the shoes.

A plurality of screws 57 are arranged around the circumference of the conducting member 28 in suitable countersunk openings 58. Each screw has a projecting pin portion 59 which engages the walls of an opening 60 formed in the face of each of the shoes 38 to hold it in position and guide it when it is moved in a radial direction by a rotary movement of the operating member 39. The projecting pins also cooperate with the walls of slots 61 formed in the terminal 11 to form a bayonet type connection therewith. Suitable axially extending slots 62 are formed in the end portion of the terminal to increase its flexibility and allow it to conform readily with the inner surface of the conducting ring when it is clamped thereagainst by the shoes 38. As shown in Fig. 3, each of the shoes is provided with a recess 63. This recess divides the shoe face into bearing surfaces 64 and 65 and insures at least two pressure areas on the terminal for each shoe.

With the construction described above a cable connector is provided which is readily separable and which insures a joint of low electrical resistance. After the terminals have once been assembled on the cable sections and the fixed terminal 12 secured to the conducting ring, the connection is made by connecting the movable terminal to the conducting ring. This is accomplished by inserting the annular end portion of the terminal 11 between the shoes 38 and the inner wall of the conducting ring 28 and giving it a partial turn to complete a bayonet connection between the pins 60 and the slots 61. The shoes 38 are then expanded against the inner wall of the terminal by a rotation of the operating member 39 which is accomplished by turning the shaft 51 in the proper direction by means of the operating key 54. To break the connection it is only necessary to retract the shoes by rotating the key 54 in the opposite direction and release the bayonet connection by a slight rotation of the terminal 11 relative to the conducting ring.

A suitable support for the cable connector and an anchor point for the fixed terminal 12 may be provided by pressing the conducting ring into an opening in a suitable plate (not shown). The plate may be mounted on insulators in any desired manner to position the cable connector relative to the apparatus to be interconnected.

While the present invention has been described in connection with a litzendraht cable, it is obvious that its use is not limited thereto. It is apparent that many features of the invention may be utilized in any case where a quick detachable connection of low resistance is desired.

What I claim as new and desire to secure by Letters Patent of the United States, is—

1. In a quick detachable electrical connector, terminals adapted to have cable ends secured thereto, each of said terminals having a substantially annular wall portion, a conducting ring, means for clamping the annular wall portion of one of said terminals against said conducting ring to form a relatively permanent connection therewith, positive pressure applying means constructed and arranged to clamp the annular portion of the other of said terminals against said ring, and means for actuating said positive pressure applying means into and out of clamping engagement with the annular portion of the other

of said terminals to form a quick detachable connection between said ring and said other terminal.

2. An electrical connector comprising in combination a pair of hollow cylindrical terminal structures having end portions extending in overlapped relation, cable ends seecured to the opposite end portions of said terminal structures, a plurality of members housed within said terminal structures and supported from one of said terminal structures, and means operable from without said terminal structures for moving said members outwardly against the inner surface of one of said terminal stuctures to force the overlapped portions of said terminal structures together while said cable ends are secured to said terminal structures.

3. In an electrical connector, a pair of hollow terminals each having an annular wall portion, a conducting ring carried by one of said terminals, a plurality of shoes arranged concentrically with said ring and adapted to move toward and away from the inner wall thereof, the annular wall portion of said other terminal being positioned between said shoes and said ring and having a plurality of spaced axially extending slots formed therein, and means for positioning said shoes and said other terminal, whereby each shoe engages said other terminal between adjacent slots.

4. In an electrical connector, a first hollow terminal including an end wall adapted to be secured to a cable end, a second hollow terminal including a conducting ring and adapted to be secured similarly to another cable end, a plurality of pressure members within said terminals, and means operable through a side wall of one of said hollow terminals for moving said members outwardly against the inner surface of said first-named terminal to force said terminal against said conducting ring to connect said terminals together.

5. A quick detachable electrical connector, a first terminal adapted to be secured to a cable end, a second terminal including an annular ring adapted to be secured to another cable end, a mechanism associated with said ring including a plurality of shoes arranged concentrically with said ring, a rotatable operating member, and a plurality of links each having a pivoted connection with said operating member and one of said shoes for moving said shoes in a radial direction in response to rotary movement of said operating member to force said first-named terminal against the inner surface of said ring to connect said terminals together.

6. In an electrical connector, a pair of hollow cylindrical terminal structures having their end portions positioned in overlapped relation, an expanding mechanism housed within said terminal structures and supported from one of said terminal structures, worm gearing mounted within said terminal structures for expanding said mechanism against the inner surface of said other terminal structure to secure said terminals together, a driving shaft for said worm gearing, one of said terminal structures having an opening formed therein in alinement with said driving shaft, and means insertable through said opening for rotating said driving shaft.

7. In an electrical connector, a fixed terminal structure including a conducting ring, a plurality of shoes arranged concentrically with said ring and adapted to move toward and away from the inner surface of said ring, a plurality of pins extending radially between said ring and said shoes for guiding the radial movement of said shoes, a movable terminal having an annular wall portion received between said shoes and the inner wall of said ring, said movable terminal having slots formed therein adapted to receive said pins to mechanically interlock said movable terminal and said ring, and means for forcing said shoes against said movable terminal to clamp it against the inner wall of said conducting ring.

8. In an electrical connector, a fixed terminal structure including an annular conducting ring, a supporting means secured to said ring, a shaft journaled in said supporting means, an operating member secured to said shaft and adapted to be rotated thereby, a plurality of shoes arranged concentrically with said ring, a plurality of links each having one end pivotally connected to said operating member and the other end pivotally connected to one of said shoes to move said shoes in a radial direction in response to rotation of said operating member, a movable terminal having an end portion received between said shoes and the inner surface of said ring, and means for rotating said shaft and operating member to force said shoes against the end portion of said movable terminal to hold it in good electrical contact with said ring.

9. In an electrical connector, a fixed terminal structure including a conducting ring, a plate mounted on said ring, a shaft journaled in said plate, a rotatable operating member secured to said shaft, a plurality of shoes arranged concentrically with said ring, a plurality of links each having one end pivoted to said operating member and the other end pivoted to one of said shoes to move said shoes in a radial direction in response to rotary movement of said operating member, a plurality of pins extending radially between said ring and said shoes for guiding the radial movement of said shoes, a movable terminal having an annular wall portion received between said shoes and the inner wall of said ring, said movable terminal having slots formed therein adapted to receive said pins to mechanically interlock said movable terminal and said ring, and means for rotating said shaft and operating member to force said shoes against said movable terminal and clamp it against a wall of the conducting ring of said fixed terminal structure.

10. In a quick detachable electrical connector, a pair of hollow conducting terminals, one end of each of said terminals being adapted to be connected to a cable end, an annular conducting ring, one of said terminals having an annular wall portion surrounding said conducting ring, an interlocking connection between said ring and said terminal, a clamping member surrounding the annular wall portion of said terminal to press it against said ring and prevent the separation of said interlocking connection, a plurality of shoes arranged concentrically with said ring and adapted to be moved radially toward and away from the inner wall of said ring, a plurality of pins extending radially between said ring and said shoes for guiding the radial movement of said shoes, the other of said terminals having an annular wall portion received between said shoes and the inner wall of said ring, said other terminal having slots formed therein, the walls of said slots being adapted to engage said pins to form a force-transmitting connection between said other terminal and said ring, a support secured to one end of said ring, and means mounted on said support for moving said shoes radially to clamp the annular wall portion of said other terminal

releasably against the inner surface of said conducting ring.

11. In an electrical connector, a pair of hollow terminal structures having substantially cylindrical end portions positioned in overlapped relation, a plurality of circumferentially spaced pressure members housed within said terminal structures and supported from one of said terminal structures, force multiplying means mounted within said terminal structures for moving said members radially into and out of engagement with the inner surface of one of said terminal structures to force it against the other of said terminal structures to secure said terminal structures together and means for actuating said force multiplying means.

12. In an electrical connector, a pair of hollow terminal structures having end portions extending in overlapped relation, a plurality of pressure members supported within one of said terminal structures and arranged to move outwardly to force the overlapped portions of said terminal structures together, a rotatable operating member mounted within said terminal structures, and means including a plurality of arms extending in the plane of movement of said pressure members and interposed between said operating member and said pressure members for operating said pressure member in response to rotation of said operating member.

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