May 18, 1965 R. A. PISCITELLO ETAL 3,184,703

MULTIPLE WIRE CONTROL CABLE CONNECTOR

Filed Nov. 2, 1962

FIG. 5

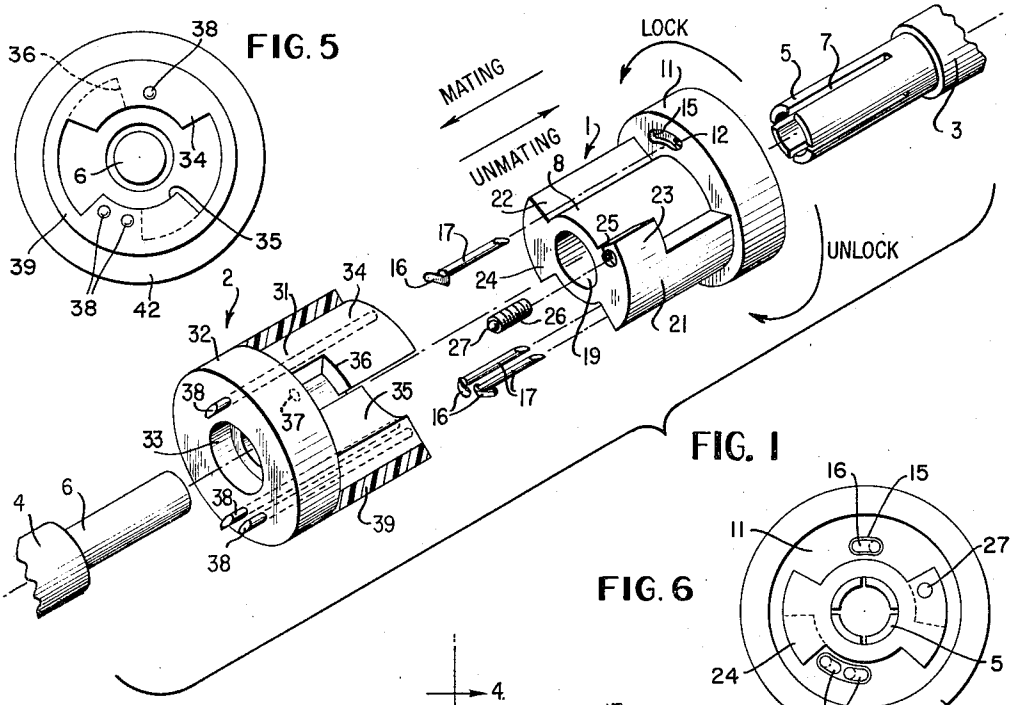


FIG. 1

FIG. 6

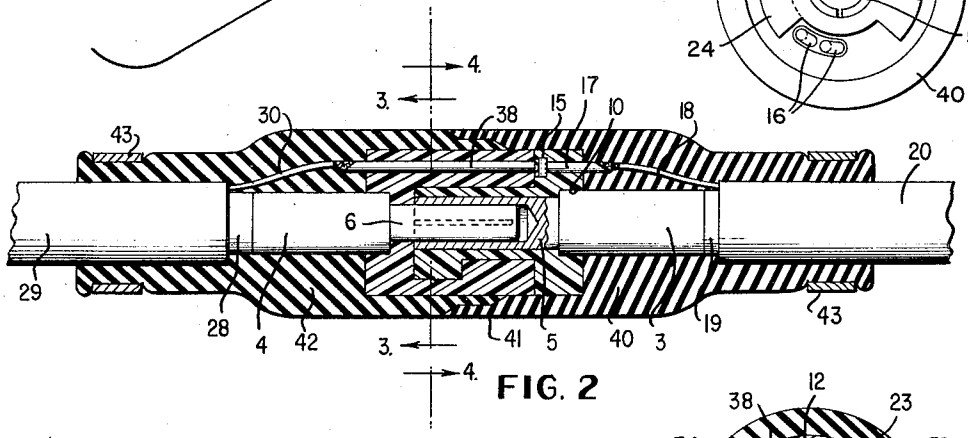
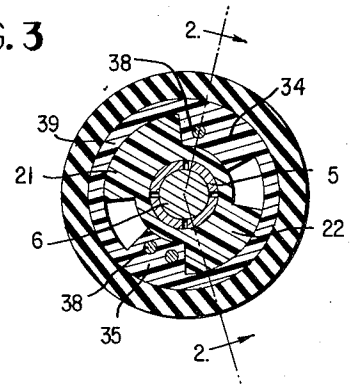


FIG. 2

FIG. 3



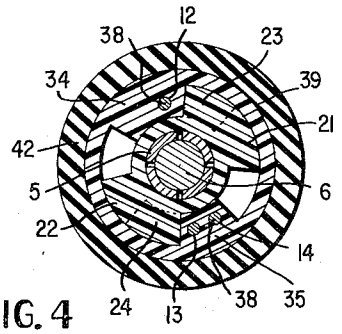


FIG. 4

INVENTORS.
ROBERT A. PISCITELLO
ARTHUR PETIT

BY

Diggins, O'Boyle & Harmon

ATTORNEY

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MULTIPLE WIRE CONTROL CABLE CONNECTOR

Robert A. Piscitello, New London, and Arthur Petit, Hadlyme, Conn., assignors to General Dynamics Corporation, New York, N.Y., a corporation of Delaware

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The present invention relates to cable connectors in general and more specifically to cable connectors adapted to electrically connect and physically lock the ends of two mating electrical cables along with a plurality of control wires which are separate from but carried by the individual cables. In the past, much difficulty has been encountered in constructing a cable connector of the type under consideration which would be quick and simple to operate, would provide a positive locking arrangement for the two halves of the connector and at the same time be waterproof to prevent shorting under adverse working conditions and rough handling. Other problems encountered in a construction of this type involve the provision of a suitable arrangement wherein it is impossible for the user to incorrectly mate the multiple control wires, i.e., select the wrong polarity, and to also make the electrical contact at the time of mating the two halves of the connector and in maintaining the electrical connection during the locking motion. The present invention provides a solution to the problem encountered by the prior-art devices of the same type in the provision of a novel connector structure which is highly efficient and foolproof in operation yet simple in construction.

The primary object of the present invention is therefore to provide an improved connector assembly for electrically connecting and locking cable members and multiple control wires carried thereby.

Another object of the invention is to provide a cable connector of the type described with different-sized mating parts to insure correct polarity between the mating electrical conductors.

Yet another object of the present invention is to present a cable connector suitable for multiple wire electrical cables which is adapted for quick and simple operation during coupling.

A further object of the present invention is to provide a multiple wire, electrical cable connector wherein the mating halves may be securely locked together by means of a simple twisting motion.

A further object of the present invention is to provide a multiple wire, electrical cable connector which has a simplified construction and which is waterproof.

A still further object of the present invention is to provide a multiple, electrical cable connector wherein electrical contact between the mating wires is made during the mating operation and which is maintained during the rotatable locking motion.

The means by which the foregoing objects and other advantages, which will be apparent to those skilled in the art, are accomplished are set forth in the following specification and claims and are illustrated in the accompanying drawings dealing with the preferred embodiment.

Reference is now made to the accompanying drawings in which:

FIGURE 1 is an exploded view of the various parts of the connector assembly in aligned position prior to mating;

FIGURE 2 is a cross-section of the cable connector in assembled condition taken along lines 2—2 of FIGURE 3 and including the waterproof insulated covering;

FIGURE 3 is a cross-section of the assembled connector taken along lines 3—3 of FIGURE 2;

FIGURE 4 is a cross-section of the assembled connector taken along lines 4—4 of FIGURE 2;

FIGURE 5 is an end view of the female socket member; and FIGURE 6 is an end view of the male socket member.

Referring now to the drawings, wherein like reference numerals are used to indicate identical parts in the various views, the illustrated embodiment of the invention comprises a first connector half or male member 1, shown clearly in FIGURE 1, and a second connector half or female socket member 2. As also shown in FIGURE 1, the cable end members 3 and 4 are provided with suitable female and male terminal portions 5 and 6 respectively. The male terminal 6 is in the form of an elongated prong and the female terminal 5 is in the form of a hollow socket which further includes elongated slots 7 for the purpose of providing a certain amount of flexibility to the socket member 5 and a force fit between the member 5 and the male connector member 1.

Referring now to the male connector half 1, the body portion thereof may be formed of any suitable insulating material and is preferably of a molded integral construction. While any suitable insulating material capable of being molded may be utilized for constructing the connector halves, it has been found that a material such as polyvinyl-chloride is preferred because of its high-dielectric characteristic. In construction, the male member 1 comprises a central hollow cylindrical portion 8 having a central bore 9 of substantially the same diameter as the outer diameter of the female cable terminal 5. As shown in FIGURE 2, the bore 9 has an enlarged diameter opening 10 at the right end as viewed in FIGURE 2 for the reception of the cable end member 3 of the same diameter. In the coupled position as shown in FIGURE 2, the female cable terminal 5 and a portion of the cable end member 3 fit snugly into the bore 9 and opening 10 with the end of the terminal 5 being flush with the flat face of the central portion 8. An enlarged integral cylindrical head 11 surrounds the outside of the cable end of the central portion 8 and extends along a small portion of the actual length of the portion 8. The cylindrical head 11 also includes three axially aligned holes 12, 13 and 14 which extend completely through the head 11 and are spaced between the outer cylindrical surface of the head 11 and the outer cylindrical surface of the central portion 8 of the connector half. The hole 12 is shown clearly in FIGURE 1 while the position of holes 13 and 14 are shown clearly in FIGURES 3 and 4. Adjacent the openings of the holes 12, 13 and 14 in the face of cylindrical head 11, arcuate slots or depressions 15 are provided for the reception of spring leaf contact members 16 carried by the electrical connector pins or posts 17 which are designed to be inserted into the holes 12, 13 and 14. One of the connector pins 17 along with its leaf contacts 16 is shown in position within the hole 12 in FIGURE 2. The leaf contact members 16 are received within the arcuate slots 15 and provide a resilient electrical contact surface for the male connector half 1. As shown in FIGURE 2, the pins 17 extend a short distance beyond the face of the head 11 on the cable side of the connector. The pins 17 may be composed of any electrically conductive metal and are in turn soldered to three control wires 18 which are carried by the cable 19 and embedded in the insulation 20 surrounding the cable. The remaining two contact pins 17 and leaf contact members 16 will be similarly placed in the holes 13 and 14 and likewise soldered to two additional control wires (not shown) which are also carried by the cable 19.

To complete the integral construction of the body of the male connector half 1, key members or guide ridges 21 and 22 are formed on the remaining outer surface of the central portion 8 of the connector half. As seen in FIGURES 1, 3 and 4, the key members 21 and 22 are substantially diametrically opposed on the outer surface of the portion 8 and constitute raised portions on the surface of the central portion 8. The key members 21 and 22 extend from the cylindrical head 11 to the opposite face of the portion 8, being flush therewith. The key members 21 and 22 constitute arcuate sections which have the same center of curvature as the central portion 8 and the head 11 with the thickness of the key members 21 and 22 being slightly less than the distance between the outer cylindrical surface of the portion 8 and the outer cylindrical surface of the head 11 for a purpose to be described. Each of the key members 21 and 22 further includes an offset locking lug portion 23 and 24, respectively, which extends circumferentially a short distance at right angles to the key members 21 and 22. The locking lug member 23 is clearly illustrated in FIGURE 1 and both of the locking lug members are shown in cross section in FIGURE 4. As also most clearly shown in FIGURES 3 and 4, the total arcuate length of the key member 21, including the offset lug portion 23, is slightly greater than the total arcuate length of the key member 22 including its offset lug portion 24. It will also be noted that the lug 23 extends circumferentially in the same direction from its key member as does the offset lug 24 from its associated key member. In addition to the structure thus far described, the locking lug 23 further includes a drilled and tapped opening 25 in its arcuate face for the reception of a threaded cylindrical hollow sleeve 26. The sleeve 26 is provided with a spring-pressed ball detent 27 and is designed to be screw-threaded into the hole 25 of the lug 23 in a well known manner. The details of the sleeve 26 and spring-pressed ball member 27 may be of any well known construction wherein a spring member within the tube 26 maintains a spring bias on the ball 27 to provide a locking detent. The sleeve member 26 will be screw-threaded into the hole 24 a sufficient distance to allow only a portion of the spherical surface of the ball 27 to protrude from the arcuate face of the lug 23.

The second cable member 28 includes the cable end member 4 and a male cable terminal 6 as described above and also includes an insulation layer 29 within which is embedded three control wires 30, one of which is shown in FIGURE 2. The control wires 30 are electrically separated from the cable 28 and are positioned to be electrically connected to the similar control wires 18 of the cable 19. As shown clearly in FIGURES 2, 3 and 4, the male cable terminal 6 is designed to be inserted within the socket member 5 so as to obtain a positive electrical connection between the cables 19 and 28.

Turning now to the details of construction of the female connector half 2, most clearly shown in FIGURE 1, the body of the female member is formed essentially from an integrally molded body of insulation material such as polyvinyl chloride. The body of the female connector half 2 comprises a central hollow cylindrical portion 31 which has an internal diameter substantially the same as the outside diameter of the central portion 8 of the male connector half. The outside diameter of the central portion 31 is substantially identical to the outside diameter of the key members 21 and 22 of the male connector half, with the radial thickness of the major portion of the member 31 being identical to the radial thickness of the key members 21 and 22. The central portion 31 further includes an enlarged cylindrical head 32 which is substantially identical to the cylindrical head 11 of the male connector half. The cylindrical head 32 further includes an enlarged diameter recess 33 for the reception of the cable end member 4 which may be force fitted into position as shown in FIGURE 2. The cylindrical body of the portion 31 is interrupted by two slots or keyways which results in the formation of two arcuate fingers 34 and 35. Each of the fingers 34 and 35 has a rectangular cutaway section in one of its side walls adjacent the cylindrical head 32 of such a size as to receive the locking lugs 23 and 24 of the key members 21 and 22 respectively when the male and female members are in the locked position. Only one of the cutaway areas 36 is illustrated in FIGURE 1 and is designed to receive the lug member 23 of the key 21 when the two halves are mated. It will be understood that the cutaway area of the finger 35 is substantially identical to the cutaway area 36 and is designed to receive the locking lug 24 of key member 22 in a similar manner. The cylindrical head 32 also is provided with a cylindrical dished-out depression 37 for cooperation with the ball detent member 27 when the halves are in locked position. The detent 27 and the depression 37 cooperate to retain the two halves of the connector in the locked position.

A second set of electrical connector pins 38 are fitted into suitably drilled holes in the female connector half and protrude a sufficient distance beyond the circular face of the cylindrical head 32 to be soldered to the control wires 30 of the cable 28. The connector pins 38 protrude a slight distance beyond the opposite face of the central portion 31, as shown in FIGURE 2, and are so positioned as to contact the leaf contacts 16 of the control wires 17 of the cable 19 when the connector halves are assembled. This relationship is clearly shown in FIGURE 2.

Around the outer cylindrical surface of the central portion 31 of the female connector a cover sleeve 39 is provided which has a continuous outer cylindrical surface flush with the outer surface of the head 32 and which is also flush with the outer surface of the cylindrical head 11 of the male connector half 1 when the connector is assembled. Although the cover sleeve 39 is illustrated as a separate element in FIGURE 1, it will be understood that this portion of the female connector may be molded integrally with the remaining body of the connector half and is merely illustrated as a separate element for ease of illustration and to facilitate the understanding of the structure of the connector half. The material of the sleeve 39 will, of course, also be an insulating material such as polyvinyl chloride. It would also be within the scope of the present invention to provide either a sliding removable fit between the sleeve 39 and the central portion 31 or to securely bond the sleeve 39 to the portion 31.

With specific reference now to FIGURES 2, 3 and 4, a separate external layer of insulating material is provided for each half of the connector assembly. This construction is commonly referred to in the art as an insulating boot and is usually composed of neoprene rubber or other similar insulating material capable of vulcanization. As seen in FIGURE 2, the rubber boot 40 surrounds the end of cable 20 and the cylindrical head 11 of the male connector half. The rubber boot 40 will be preformed and subsequently vulcanized to the cable and cable end after the control wires 18 have been properly soldered to the connector pins 17. In vulcanizing the rubber boot 40 to the connector half 1, an extended overlapping portion 41 is formed and will overlie the end portion of the rubber boot 42 which has been previously vulcanized about the female connector half 2 and the soldered connections between the control wires 30 and the connector posts 38. In this manner, a waterproof covering or envelope is formed about the assembled connector halves which will render the connector assembly completely waterproof under adverse conditions and rough treatment. To provide additional holding force between the rubber boots 40 and 42 and the cables 19 and 28, conventional clamping rings 43 may be tightly secured about the end of the respective rubber boots.

In describing the operation and utilization of the pres-

ent invention, it will first be understood that the male connector half 1 has been properly fitted with the connector posts 17 and leaf contacts 16 and the detent assembly 26, 27. The female connector half 2 is initially provided with the contact pins 38 in a similar manner. The female cable terminal 5 is then inserted within the bore of the central 8 of the male connector half and the control wires 18 of the cable 19 are soldered to the protruding ends of the connector posts 17. The male cable terminal 6 is likewise inserted into the central bore of the portion 31 and cylindrical head 32 of the female connector half with the control wires 30 being soldered to the protruding ends of the connector pins 38.

Both of the connector halves are now ready for application of the insulator boots 40 and 42. These rubber boots have been preformed to substantially conform to the configuration of the assembled connector halves and are then vulcanized by well known methods to a tightly bonded relationship about the assembled cable end and connector half and about the soldered connections of the control wires. After the rubber boots 40 and 42 have been vulcanized about the connector halves, the assembly is ready for use. In practice, it has been observed most expedient to form the lug members 23 and 24 of the same size to conform with identically shaped cutout portions 36 of the fingers 34 and 35. As described, the entire arcuate extent of the raised key 21 and lug 23 is slightly larger than the arcuate extent of the key member 21 and lug 24. Correspondingly, the cutaway portions of the cylindrical member 31 are of the exact size as the lug and key members respectively so that the male and female coupling halves may be mated in only one position whereby the proper connector pins 17 and 38 will make contact and the detent 27 will engage the depression 37 in the head 32. This relationship is borne out most clearly in FIGURES 3 and 4 wherein the lugs 23 and 24 are shown in the locked position and the variation in size of the key members and locking lugs are illustrated.

In the operation of coupling the two halves 1 and 2, it is merely necessary to align the lug members with the proper slots in body portion 31 and bring the two halves together in the direction indicated by the arrows in FIGURE 1. Electrical contact between the cable members is obtained immediately upon contact of the terminal 6 with the socket 5 and when the coupling halves are completely engaged the three contact posts 38 will contact the leaf contacts 16 for complete electrical connection of the control wires. The locking action is obtained by simply rotating the male connector half in a clockwise direction as illustrated by the arrows in FIGURE 1, until the locking lugs 23 and 24 are completely within the slots 36 of the female member and detent 27 has engaged the depression 37 of the female head member 32. Complete electrical contact is thus obtained at the completion of the axial movement of the connectors and is maintained during the rotational locking motion by virtue of the leaf contacts 16. At the same time, the overlapping portion 41 of the boot 40 will slide over the end of the boot 42 to complete the waterproof seal. The engagement of the lugs 23 and 24 with the slots 36 of the female member positively prevent axial relative movement between the connector halves while the detent 27 and depression 37 along with the frictional contact between the overlapping boot portion prevent rotational movement between the coupler halves.

It will thus be apparent to those skilled in the art that the present invention provides novel and useful improvements in multiple wire cable connector assemblies of the character described. The arrangement and types of structural components utilized within the invention may be subject to numerous modifications.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A multiple wire cable connector assembly comprising:

(*a*) separable male and female connector members,

(*b*) said male connector member including a central cylindrical portion adapted to receive the terminal of a first electrical cable,

(*c*) an enlarged cylindrical head on said central portion,

(*d*) a plurality of raised key members on the surface of said central portion and including circumferentially extending locking lugs,

(*e*) a first set of wire connector pins extending through said cylindrical head and adapted to be connected to control wires carried by said first cable,

(*f*) said female connector member comprising a hollow body having an internal diameter substantially the same as the outside diameter of the central cylindrical portion of said male connector,

(*g*) said hollow body including slotted portions for receiving the key members and locking lugs of said male connector member,

(*h*) said slotted portions of the hollow body of said female connector member including offset cutaway areas for receiving the locking lugs of said male connector member upon relative rotation between the connector members,

(*i*) a second set of wire connector pins extending longitudinally through the body of said female connector to control wires carried by said second cable,

(*j*) said first and second set of wire connector pins having mating contact surfaces exposed on abutting surfaces of said male and female connector members respectively and so positioned as to make contact when said connector members are in assembled positions,

(*k*) said contact surfaces of said first set of connector pins comprising arcuate spring leaf contacts whereby electrical contact between said first and second set of pins is made upon abutting of said connector members and maintained throughout the rotational locking movement,

(*l*) whereby said male and female connector members may be assembled in interlocking relation with the terminals of said first and second cables in electrical contact and said control wires electrically connected through said first and second sets of connector pins.

2. In a multiple wire cable connector assembly having first and second cable terminals, a first and second set of control wires carried by said terminals, male and female connector members adapted to be telescopingly engaged and locked by rotational movement, said male connector having a cylindrical portion including a plurality of circumferentially extending key members and locking lugs, said female connector having a hollow cylindrical body including slotted portions for receiving the key members and locking lugs of said male connector, said slotted portions including offset cutaway areas for receiving the locking lugs of said male connector member upon relative rotation between said connector members, means for assembling and locking said cable terminals and said control wires in electrical contact comprising:

(*a*) a socket carried by said first cable terminal and mounted in one of said male and female connector members,

(*b*) a prong carried by said second cable terminal and mounted in the other of said male and female connector members,

(*c*) a first set of pin connectors carried by said male connector member and electrically connected to said first set of control wires,

(*d*) a second set of arcuate spring leaf connectors carried by said female connector member and electrically connected to said second set of control wires,

(*e*) said first and second set of connectors having mat-

ing contact surfaces exposed on abutting surfaces of said connector members respectively and positioned to make contact throughout the locking motion when said members are in assembled position,

(*f*) whereby said connector members may be assembled in interlocking telescoped relation with the socket and prong of said first and second cable terminals respectively in electrical contact and said first and second set of connectors in electrical contact.

3. In a multiple wire cable connector assembly, having first and second cable terminals, a first and second set of control wires carried by said terminals, male and female connector members adapted to be telescopingly engaged and locked by rotational movement, said male connector having a cylindrical portion including a plurality of externally directed circumferentially located key members and locking lugs, said female connector having a hollow cylindrical body including slotted portions for receiving the key members and locking lugs of said male connector, said slotted portions including offset cutaway areas for receiving the locking lugs of said male connector member upon relative rotation between said connector members, means for assembling and locking said cable terminals and said control wires in electrical contact comprising:

(*a*) means for obtaining electrical contact between

said first and second cable terminals and said first and second sets of control wires upon axial telescoping of said connector members,

(*b*) means for maintaining electrical contact between said control wires throughout the rotational locking movement including arcuate spring leaf contacts connected to one of said first and second sets of control wires,

(*c*) and detent means carried by the abutting surfaces of said connector members for preventing rotational movement therebetween when rotated to the locking position.

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JOSEPH D. SEERS, *Primary Examiner.*