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[54] **MULTICONDUCTOR CABLE CONNECTOR**

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[52] **U.S. Cl.** ..... **339/49,** 339/90 R

[51] **Int. Cl.** **H01r 13/54,** H01r 25/00

[58] **Field of Search** 339/47, 49, 75, 77, 339/89, 90, 91, 154, 156–164, 176, 170, 273, 274, 238, 189, 32, 33; 285/65, 68, 70, 305, 29, 26, 71, 72, 312, 370, 396

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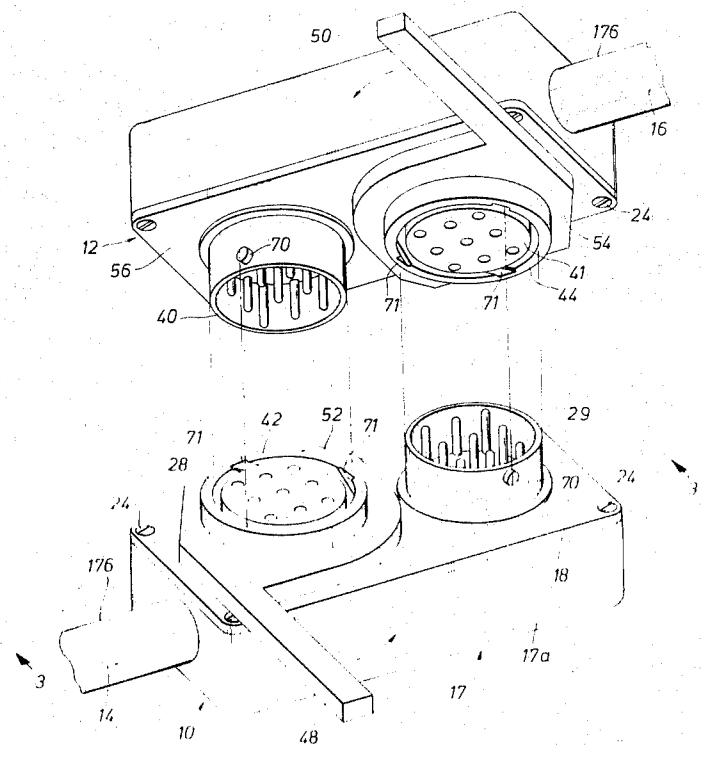
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[57] **ABSTRACT**

A multiple wire electrical cable connector device is disclosed. The device includes two connector assemblies, with each assembly adapted to be connected to the end of a multiple wire electrical cable. Each connector assembly is of the same construction and includes both a male and a female connector so that any two connector assemblies can be connected together to connect electrically the conductors in the cables to which they are attached. The male and female connector of each assembly is mounted in a face plate in side by side position to mate with a male and female connector in another assembly. A locking ring is provided for each engaging male and female connector that, when rotated to one position, allows the two connectors to be moved apart or brought together and, when rotated to another position, will lock the two mating connectors and hold them from moving apart. In the device disclosed, a lever arm is attached to each locking ring that extends out from between the face plates when the locking ring is in the unlocked position, but which, when moved to a position between the plates, will lock the two pairs of mating connectors together and, in turn, lock the two connector assemblies together.

7 Claims, 5 Drawing Figures



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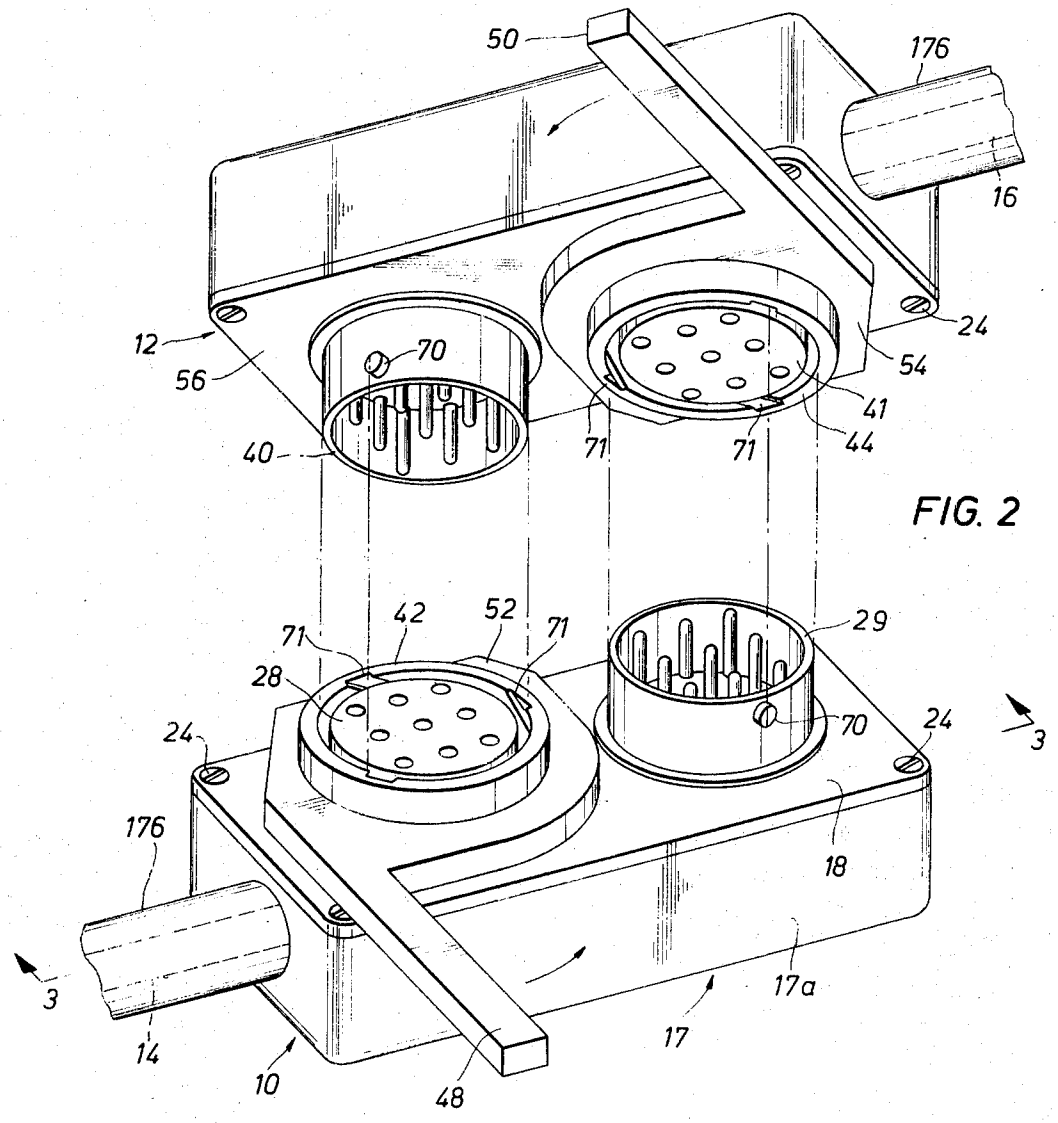


FIG. 2

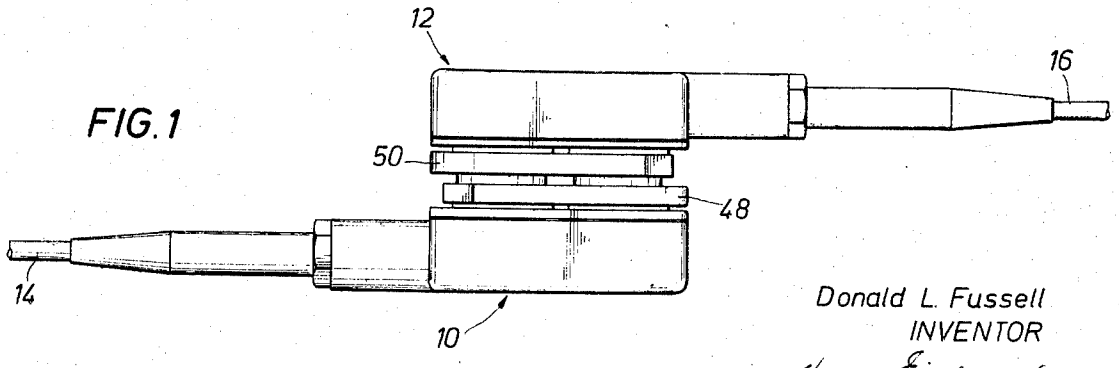


FIG. 1

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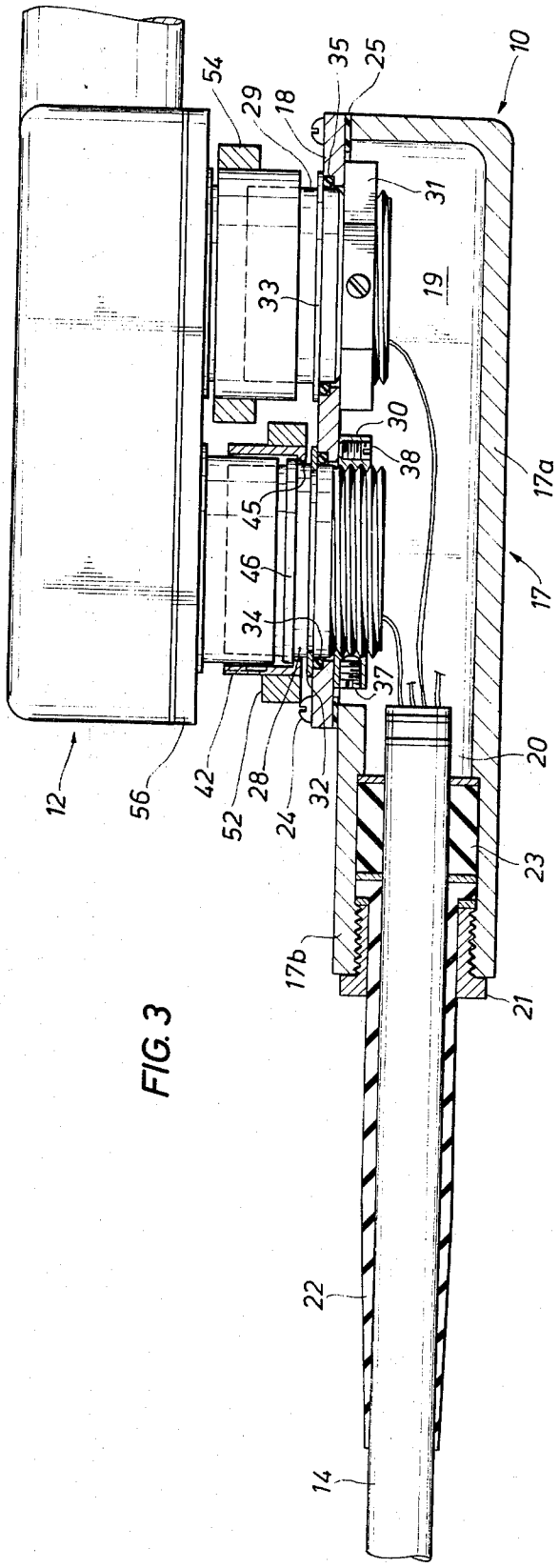


FIG. 3

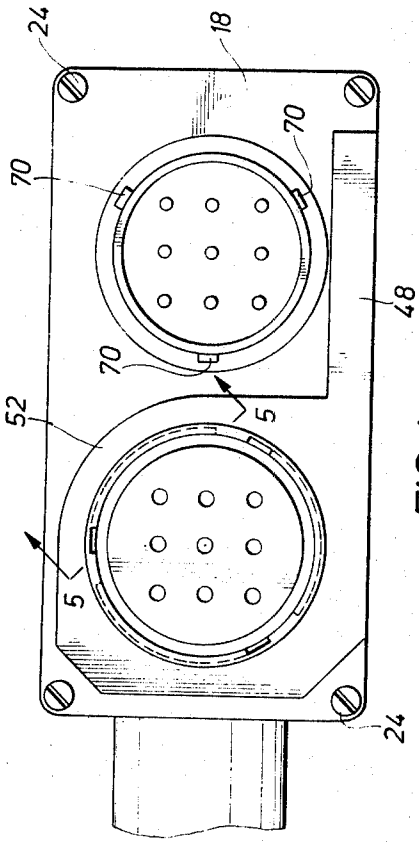


FIG. 4

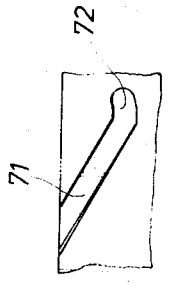


FIG. 5

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MULTICONDUCTOR CABLE CONNECTOR

This invention relates to a connecting device for multiple wire electrical cables.

Commonly, electrical cables have a male connector at one end and a female connector at the other. Where a plurality of individual lengths of such electrical cable are used to connect two devices that are spaced apart, the cables have to be arranged end to end so that the adjacent ends of the cables have mating connectors, i.e., a male connector and a female connector. This can be accomplished when the cables are strung initially, however, in some operations, such as in seismic work, a plurality of cables will be strung over the ground and then one or more of the cables at the end nearest the truck will be moved to the other end as the seismic operations move to another position. This creates a problem since it is necessary to maintain the cables in the same end to end relationship or provide adapters for connecting between male-to-male or female-to-female connectors should a cable be switched end to end when moved.

Consequently, it is desirable to have a universal type connector that can be used on multiple wire electrical cables, such as those that are used in seismic operations, so that it makes no difference which end of the cable is adjacent the end of the next adjacent cable, because either end can be connected to the next cable. This problem has been solved in one manner by providing both a male and a female connector attached to each end of the cable. This arrangement generally was the result of an effort to increase the number of circuits that could be connected together in one hookup. Usually, there is a maximum of sixty-one pins in commercially available connectors. Thus, there was a limit on the number of channels that could be operated where the cable was equipped with a conventional pin type connector at one end and a socket at the other end. By using both a pin and a socket, i.e., male and female connector at each end of the cable, the number of wires in the cable could be increased to twice what it has been previously, and also a universal type connector was provided for the cable. These Y-type connections simply consisted of splitting the insulation on the cable a short way back from the end, and connecting half of the wires in the cable to a male connector and the other half to a female connector. The ratio, of course, could be adjusted if all the pins and sockets were not required to be used. Such an arrangement, however, was not completely satisfactory. The two connectors were unconnected to each other and would bang together as the cable was moved from place to place. Also, the locking mechanism used to hold the connectors together was exposed and subject to being moved to an unlocked position when the connected cables were moved along the ground or through brush.

It is an object of this invention to provide an improved connecting device for multiple wire electrical cables that allows up to twice the number of channels available with the conventional pin and socket type connector to be used, and also provides a universal type connection whereby cables equipped with this connecting device can be connected to other such cables regardless of which end of the cable happens to end up adjacent the end of the next cable.

It is an additional object of this invention to provide such a connecting device for multiple wire electrical cables that includes two connector assemblies, each of which is identical to the other, and which, in turn, are connected to the ends of the cables, which connector assemblies can be quickly and easily connected together to connect together the two cables and which can be quickly and easily disassembled when the two cables are to be disconnected.

It is a further object of this invention to provide such a connecting device that includes two connector assemblies for connecting to the ends of electrical cables that includes two lever arms that are positioned for easy access when the two connector assemblies are brought together and which are moved to a position where they will be protected from any snag, such as a rock or tree branch that they might catch on, when the arms have been moved into position to lock the two connector assemblies together.

These and other objects, advantages, and features of this invention will be apparent to those skilled in the art from the consideration of this specification, including the attached drawings and appended claims.

In the drawings:

FIG. **1** is a side view, in elevation, of the preferred embodiment of the connecting device of this invention;

FIG. **2** is an isometric view of the connecting device of FIG. **1**, with the two connector assemblies in position to be brought together for connecting two cables together;

FIG. **3** is a partial sectional view taken along line **3—3** of FIG. **2**, with the connector device assembled, as shown in FIG. **1**;

FIG. **4** is a plan view of one of the connector assemblies of the device with the lever arm used to rotate the locking ring in the position it would assume when the mating connectors are locked together; and

FIG. **5** is a sectional view taken along line **5—5** of FIG. **4**, showing the internal groove of the locking ring that cams the two mating male and female connectors into engagement, and that holds them in engagement when the locking ring is in its holding position.

The connector device includes two connector assemblies, **10** and **12**, that are connected to the ends of multiple wire electrical cables **14** and **16**, respectively. Since connector assemblies **10** and **12** are of identical construction, only one will be described in detail.

Therefore, referring to FIG. **3**, where connector assembly **10** is shown in cross section, the construction and details of this connector assembly will be described.

The connector assembly includes housing **17**, which is generally rectangular in cross section. Portion **17***a* of the housing is molded all in one piece, but has one side open that is closed by face plate **18**. This leaves hollow space **19** in which the individual wires are located that extend out the end of the outer sheath of the cable and are connected to the various pins and sockets of the connectors to be described later. The inside of the housing is insulated electrically if the housing is not made of a non-conductive material. The housing has tubular portion **17**b that is integrally attached to portion **17***a*. Portion **17***b* provides opening **20** through which cable **14** can be inserted into hollow space **19** of the housing. Gland nut **21**, handle **22**, and washer and grommet assembly **23**, are slipped over cable **14** before the cable is inserted into housing **17**. After it is in position, gland nut **21** is screwed into the threaded end of tubular portion **17***b* to anchor the cable in housing **17** and to provide a handle for supporting the weight of

connector assembly **12** when the end of the cable is picked up.

Face plate **18** is connected to housing **17** by mounting screws **24.** Gasket **25** is positioned between the face plate and portion **17***a* of the housing to isolate hollow space **19** from the ambient atmosphere.

Female connector **28** and male connector **29** are mounted in side by side relationship in face plate **18.** Both connectors have threaded portions that extend through openings in the face plate, as shown in FIG. **3.** Both connectors have annular grooves above the threaded portion to receive snap rings **32** and **33.** The snap rings engage the outer surface of the face plate and limit the distance each connector can enter the openings in the face plates. Lock nuts **30** and **31** on the threaded portion of the connectors engage the inner surface of the face plate and hold the connectors in the openings. O-rings **34** and **35** are compressed between the snap rings and shoulders provided around the openings through the face plate to provide a seal between the connectors and the face plate. Lock screws are provided to anchor the lock nuts to the threaded portions of the connectors and to the face plate. As shown in FIG. **3,** lock screw **37** anchors lock nut **30** to the threaded portion of connector **28,** and lock screw **38** anchors the lock nut against rotation relative to face plate **18.** A similar arrangement of lock screws holds lock nut **31** against rotation relative to the face plate and connector **29.**

Connector assembly **12** is constructed in the same manner as assembly **10.** It has male connector **40** and female connector **41** that will mate with the female and male connectors **28** and **29** of assembly **10.**

A locking ring is mounted on one of the mating male and female connectors for rotation to a position to hold the two mating connectors in engagement. In the embodiment shown, locking ring **42** is mounted for rotation on female connector **28** of connector assembly **10,** and locking ring **44** is similarly mounted on female connector **41** of assembly **12.** The mounting arrangement is the same for both locking rings. This is best seen in FIG. **3,** where locking ring **42** is shown in cross section. The ring is tubular in shape and has inwardly extending flange **45.** It is slipped over the threaded end of the connector and moved upwardly into engagement with outwardly extending flange **46** on the connector. Snap ring **32** is then placed in the groove provided to receive it, and the locking ring is mounted on the connector with freedom to rotate around the longitudinal axis of the connector with some, but limited, axial movement. It is the rotation of the ring that is used to lock and unlock the two mating connectors together, as will be described below.

Means are attached to each locking ring for rotating the locking ring between a first position where the connectors are unlocked and movable apart and a second position where the connectors are held in engagement with each other by the locking ring. In the embodiment shown, locking ring **42** and locking ring **44** are attached to lever arms **48** and **50,** respectively. The lever arms have the same shape. The arms are attached to hubs **52** and **54** that have openings to receive the locking rings. The arms are integrally attached to the hubs and extend radially therefrom, generally transverse the axis of rotation of the locking rings. The hubs are attached to the locking rings in any convenient manner, such as by welding.

As shown in FIG. **2,** the lever arms extend outwardly from between face plate **18** and the corresponding face plate **56** of assembly **12.** After the two male and female connectors have been moved into engagement, lever arm **58** is moved in the direction of the arrow on FIG. **2,** and lever arm **50** is moved in the opposite direction to a position between face plates **18** and **56,** as shown in FIG. **1.** The lock rings are arranged so they will lock the connectors together when the arms are moved to the position of FIG. **1.** This is also the position of arm **48** in FIG. **4.** Thus, when the connector device is assembled, the lever arms will be protected from being accidentally moved to the unlocked position as the cables are moved through brush or pulled along the ground. To disconnect the two cables, the two lever arms are moved about 90° to the positions shown in FIG. **2.** The space between the face plates is sufficient to allow a finger to extend into the space to engage the ends of the lever arms and pull them out from between the face plates for movement to the unlocked position.

The locking rings lock the male and female connectors together through pins **70,** three of which are usually provided on the outside of the male connector, as shown in FIG. **4.** The pins are usually spaced apart 120°. These pins enter three inclined grooves on the inside surface of the locking rings, such as groove **71** shown in FIG. **5.** The connectors are so positioned that pins **70** will enter the grooves of the locking rings when lever arms **48** and **50** are in the position shown in FIG. **2.** Then as the lever arms rotate the locking rings approximately 90° to the locked position of FIG. **1,** the inclined surfaces of grooves **71** will cam or pull the two connectors together. Lower end **72** of groove **71** turns toward the outside of the locking ring, so that the pins **70** will have to move downwardly again before they can move out of groove **71.** This portion of the groove then acts as a detent to hold the pin in the groove.

Pin type connectors are provided with internal mating grooves (not shown) so that the pins will always engage the proper socket. In this connector assembly, when the connectors are mounted in the face plate they are properly oriented so that their position, with respect to the face plate, is always the same and, therefore, when the two connectors on one assembly are connected to the connectors of another, the proper pin will enter the proper socket.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set Forth, together with other advantages which are obvious and which are inherent to the apparatus and structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of this invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. A multiple wire electrical cable connecting device, comprising: a pair of connector assemblies, each assembly including a face plate and a male connector and a female connector mounted therein to connect to a fe-

male connector and a male connector respectively mounted in the face plate of the other connector assembly, a locking ring mounted on one of the mating male and female connectors for rotation to a position to hold the two mating connectors in engagement, and means attached to each locking ring for rotating the locking ring between a first position where the connectors are unlocked and movable apart and a second position where the connectors are held in engagement with each other by the locking ring.

2. The connecting device of claim **1** in which the locking ring rotating means comprises two lever arms each of which is attached at one end to one of the locking rings and extends generally radial therefrom in a direction transverse the axis of rotation of the locking ring to which it is attached.

3. The connecting device of claim **2** in which the lever arms extend outwardly from between the face plates when the mating connectors are moved into contact and the locking ring is in its unlocked position and that move to a position between the plates to rotate the locking ring to hold the two mating connectors from moving apart.

4. The connecting device of claim **3** in which the locking rings are mounted on the female connectors and the lever arms are in parallel, side by side position when the locking rings are holding the mating connectors from moving apart.

5. The connecting device of claim **1** in which the face plate of each connector assembly forms one wall of a hollow housing having an opening through which the end of a multiple wire electrical cable can be inserted for connecting the connectors to the wires of the cable.

6. A multiple wire electrical cable connecting device, comprising a pair of connector assemblies, each connector assembly comprising a housing having an opening through which the end of a multiple wire electrical cable can be inserted into the housing, a male connector and a female connector mounted in one side wall of the housing to mate with a female and a male connector in the side wall of the housing of the other connector assembly, a locking ring carried by one of the male and female connectors for rotation relative thereto for locking the connector on which it is mounted to the mating connector on the other assembly, and an arm attached to the locking ring and extending outwardly from between the housings of the two connector assemblies for rotating the locking ring between its locked and unlocked position.

7. The cable connecting device of claim **6** in which the arms attached to the locking rings extend outwardly from between the housings when the mating connectors are unlocked to each other and move into a position between the housings when the locking rings are rotated into position to lock the mating connectors together.

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