July 20, 1965 T. K. C. HARDESTY ET AL 3,196,424

CABLE CONNECTOR WITH MONITORED LOCKING FEATURE

Filed Sept. 30, 1963

FIG. 1.

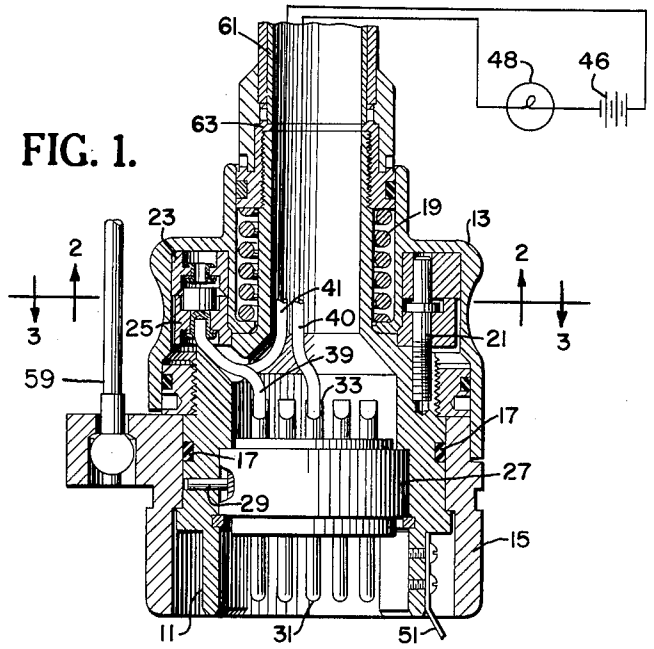


FIG.3.

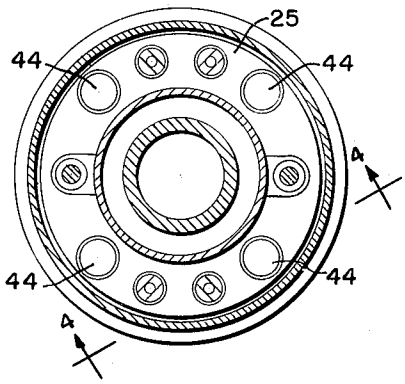


FIG.2.

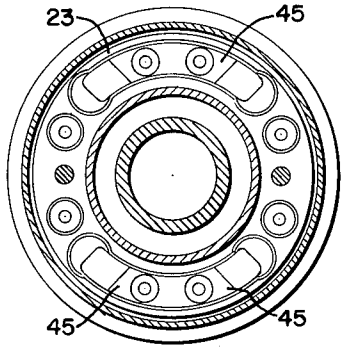


FIG.5.

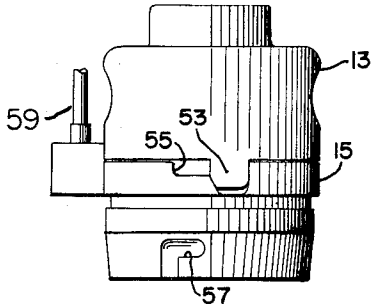
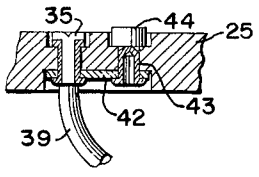


FIG.4



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CABLE CONNECTOR WITH MONITORED LOCKING FEATURE

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9 Claims. (Cl. 340—280)
(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to electrical cable connectors and more particularly to electrical connectors employing locking devices and remote indicators.

In the use of connector plugs for electrical cables, the assurance of a proper connection between mating parts is highly desirable. Normally the connection may be checked for a properly secured fastening by visual inspection or by checking the tightness of the set screws used for locking the plug to the receptacle unit. The problem of checking the connection of the mating parts in a cable connector is increased when the connecting junction is located in a remote place, e.g. outside of an aircraft.

In this invention a unique connector unit is provided which assures the proper connection of a connector to a receptacle or mating connecting member. The apparatus of this invention provides a connector in which both a visual local indication and a remote indication serve to show that a connector is properly connected to a mating unit. The remote indicator, which in a preferred embodiment of this invention is a light in the pilot's compartment in an aircraft, provides an indication of a proper connection of a connector plug to a receptacle or mating connector unit.

An object of this invention is to provide a monitored locking device for a cable connector.

Another object of this invention is to provide a remote indicating light to indicate the proper connection of a cable connector.

A further object of this invention is to provide a remote indicator for indicating the electrical continuity between a power source and external electrical circuits.

A still further object of this invention is to provide a visual indication on the connector to indicate a proper connection between mating parts of a cable connection.

Yet another object of this invention is to provide a cable connector with a monitored locking feature.

Another object of this invention is to provide a cable connector with a grounding clip.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIG. 1 of the drawings illustrates a sectional view of a connector assembly of this invention;

FIG. 2 of the drawings illustrates an upper terminal ring of the connector of this invention;

FIG. 3 of the drawings illustrates a lower terminal ring of this invention;

FIG. 4 of the drawings illustrates a sectional view of a portion of the lower terminal ring; and

FIG. 5 of the drawings illustrates a side view of the connector assembly showing the locking indicator.

Referring now to FIG. 1 of the drawings, a connector of this invention is shown having a housing **11**, a cap **13** and an outer ring **15**. The outer ring **15** is free to

rotate about housing **11**. A sealing means in the form of O-ring **17** is disposed between housing **11** and outer ring **15**. Axial movement is permitted between housing **11** and cap **13** with coil spring **19** biasing cap **13** against outer ring **15**. Guide pins **21** are threadedly mounted on housing **11** through holes in terminal ring **25**, fastening terminal ring **25** to housing **11**. Guide pins **21** slidably engage holes in terminal ring **23** such that axial movement is permitted between terminal rings **23** and **25** but rotational movement is prevented. Terminal ring **23** is fixedly secured to cap **13** such that cap **13** may move axially with respect to housing **11** but rotational movement between caps **13** and housing **11** is prevented by guide pins **21** projecting into the holes of terminal ring **23**.

Insert assembly **27** is held fixedly within housing **11** by pin **29**. Contact pins **31** mounted within insert assembly **27** are provided with terminal end portions **33** for connections to conductors within the cable. Monitor circuit conductors **39** and **40** are connected to the terminal portions **33** of contact pins **31**. Pins **31** connected to conductors **39** and **40** are electrically connected together through an external circuit when the connector plug is plugged into a receptacle or mating connector. Conductors **39** and **41** are connected to terminals of terminal ring **23**. Conductors **40** and **41** connect to battery **46** and monitor light **48** so that when the connector is properly connected to a receptacle or mating connector, conductors **39** and **40** will be connected together through an external circuit and conductors **39** and **41** will be connected together through contacts on terminal rings **23** and **25** causing light **48** to be lighted, indicating that a proper connection of the connector parts have been made. Grounding strips **51** are secured to housing **11** and project downward therefrom to provide for grounding the housing to a receptacle housing before the pins **31** make contact with the conductors within the receptacle or mating connector. Grounding strips **51** may be made of conductive material such as brass.

Referring now to FIGS. 2, 3 and 4 of the drawings in which terminal rings **23** and **25** are illustrated, terminal ring **25**, FIG. 4 is shown having soldered connection **35**. These grounding strips are conductively connected through housing **11** and metal collar **13** to copper woven shielding **61** disposed on the inner surface of the cable covering. This shielding extends the entire length of the cable to provide an RF shield for the cable. The soldered connection **35** provides for connecting monitor conductor **39** to terminal ring **25**. A metal strip **42** and a metal pin **43** provide electrical contact between conductor **39** and a contact plug **44**. Contact plugs **44** project above the surface of terminal ring **25**, FIG. 3, to contact with metallic conductor strips **45** of terminal ring **23**, FIG. 2, when the terminal rings are contacting each other as is the case when the connector is properly connected to a receptacle or mating connector. Conductor **41** is connected to terminal ring **25** in the same manner as conductor **39** at a solder connection adjacent to that of conductor **39** such that one of the contact strips **45** will connect conductors **39** and **41** together when terminal rings **23** and **25** are in contact.

Referring now to FIG. 5 of the drawings in which the connector assembly is shown, cap **13** is shown having a locking key on lug **53** which projects downward from the body of cap **13**. Outer ring **15** is provided with a slot **55** having a shoulder portion. Outer ring **15** also shows one of the ball detent grooves **57** having a vertical portion and a horizontal portion.

In operation, when the connector is plugged into a receptacle or mating connector, the ball detents in the receptacle or mating connector will be at the top of the vertical portions of grooves **57** and lug **53** will be resting on the shoulder portion or first step of slot **55**. At this

point, the terminal rings 23 and 25, FIG. 1, will be separated and there will be no continuity between conductors 39 and 41 and light 48 will be off. Outer ring 15 may now be rotated until lug 53 is aligned with the second step of slot 55 at which point lug 53 will drop into the second step of slot 55 by the force of spring 19 acting upon cap 13. The connector is now releasably locked to the mating connector. Terminal ring 23 will now be in contact with terminal 25, connecting conductors 39 and 41, and conductors 39 and 40 will be connected through an external circuit connected to the mating conductor. The indicator light circuit will thus be closed and indicator light 48 will be on. Portions of the slot 55 may be painted or otherwise marked to show that the connector is locked in place. The ball detents in the mating connector may be yieldably mounted such that the connector may be released by pulling cable 59 of outer ring 15. The areas of the cutout portion 55 above the shoulder or first step may be painted or otherwise marked to indicate that the connector is locked in place.

The mating connector or receptacle having ball detents may be one like that shown in patent application Serial No. 204,648, of Thomas K. C. Hardesty and Allen J. Sondheimer, filed June 22, 1962.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed as new and desired to be secured by Letters Patent of the United States of America is:

1. An electrical cable connector having monitored locking features comprising,

a housing having an upper portion connected to a cable and a lower skirt portion,

a pin insert assembly mounted within said housing,

a plurality of pins mounted in said pin insert assembly, said pins having a lower portion projecting downwardly through said pin insert assembly and an upper portion projecting upwardly through said pin insert assembly, said lower portions of said pins being adapted to contact conductors within a receptacle, said upper portions of said pins being adapted to connect the conductors within the cable,

an outer ring surrounding said lower portion of said housing, said ring having a lower skirt portion, said ring being rotatable with respect to said housing,

a cap surrounding said upper portion of said housing and axially moveable therewith, said cap having a lug projecting below the skirt of said cap,

spring means biasing said cap downwardly against said ring,

said ring having a cutout portion adapted to receive the lug portion of said cap, said cutout portion having a first step portion and a second step portion,

a first terminal ring having conducting strips on the underside thereof, said first terminal ring being fixedly attached to the underside of the top portion of said cap,

a second terminal ring having conductor plugs projecting above the surface thereof, said second terminal ring being fixedly attached to the upper side of the lug of said housing whereby contact strips will be separated from said conductor plugs when said lug engages the said first step of said ring and said contact strips will contact said conductor plugs when said lug engages said second step of said ring,

an indicating circuit comprising a lamp, a voltage source, an external circuit serially connected to said conductor plugs of said second terminal ring,

said ring having a groove for receiving a ball detent in a receptacle for releasably locking said connector to a receptacle, said groove being continuous and having a vertical portion and a horizontal portion at the upper end of the vertical portion of said groove whereby said lamp circuit is energized when said connector is plugged into a receptacle and said ring is turned until the lug of said cap engages said second step of cutout portion of said housing.

2. Apparatus as in claim 1 in which the area of the cutout portion above said first step is marked to indicate that said connector is in a locked position.

3. Apparatus as in claim 1 in which the area of the cutout portion above said first step is colored to indicate that said connector is locked.

4. Apparatus for releasably locking a male connector of an electrical cable to a receptacle comprising,

a housing surrounding conductor pin elements of said connector, said housing having a shoulder portion between said cable and said conductor pin elements, and a skirt portion extending beyond the end of said pin conductor elements,

a ring surrounding said skirt portion of said housing and rotatable thereto,

a cap surrounding the shoulder portion of said housing and axially movable thereto, said cap having a lower skirt portion with a lug projecting downward therefrom,

said ring having a recessed portion therein for engagement with said cap, said recessed portion having a first step and a second step, said first step having a depth less than the length of the lug of said cap and said second step having a depth greater than the length of said lug,

said ring having a groove for receiving a ball detent of the receptacle, said groove having a vertical portion extending to the bottom of said cap and a horizontal groove joining the top of said vertical groove, whereby said connector may be locked to the receptacle by pressing said connector into a receptacle and turning said ring until the ball of the receptacle is at the end of the horizontal groove in said ring and said lug is in said second step of said ring, and

means above said first step for indicating said connector is locked to the receptacle.

5. Apparatus as in claim 4 in which said last-named means is a surface having a desired color.

6. Apparatus as in claim 4 in which a first terminal means having a conducting strip is mounted on the inside of said cap and a second terminal means having conductors is mounted on the top of said housing, an indicating circuit including conductor means coupled to said conductor means whereby said indicating circuit may be energized when said first terminal means is in contact with said second terminal means, said first and second terminal means being in contact when said lug is engaged in said step of said ring.

7. A connector as in claim 1 in which conductive grounding strips project downward from the housing of said connector.

8. A connector in claim 4 in which conductive grounding strips project downward from said housing.

9. In an electrical cable coupling for connecting a plurality of electrical conductors, a monitored locking system comprising a first connector having a locking means for locking said first connector with a second connector whereby a plurality of electrical circuits may be completed, an indicator light remotely located from said coupling, a source of voltage, switch means positioned within said first connector operable by said locking means, and circuit means serially interconnecting said source of voltage, said light, and said switch means, said switch means being normally open and said switch means being closed when said first connector is engaged with and locked to said second connector thereby completing said series circuit and lighting said indicator light.

No references cited.

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