Aug. 14, 1962 F. J. SPARBER 3,049,690

QUICK DISCONNECT ELECTRICAL CONNECTOR

Filed June 5, 1961 2 Sheets-Sheet 1

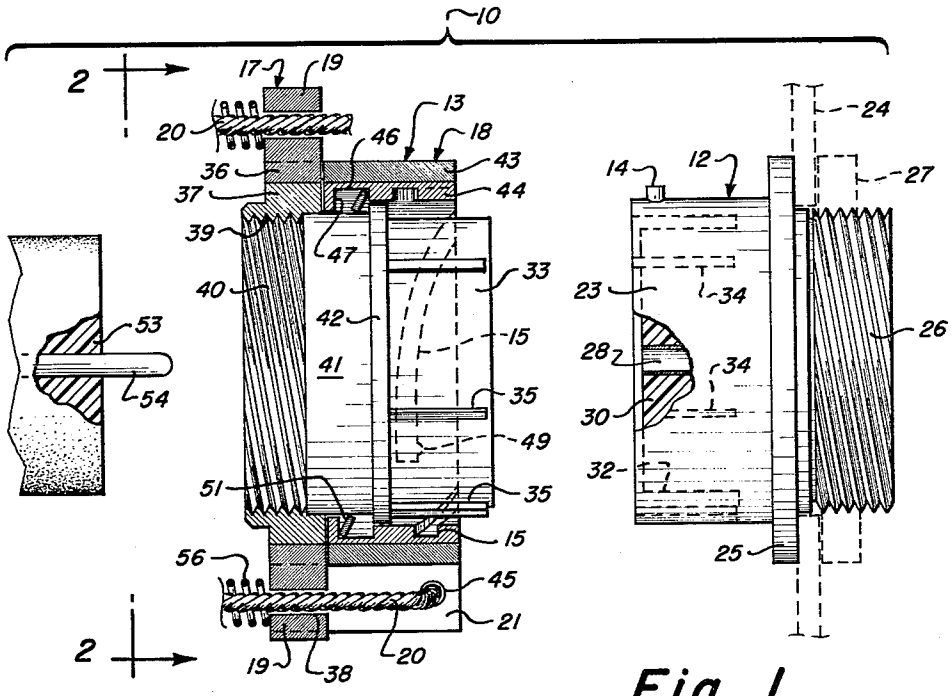


Fig. 1

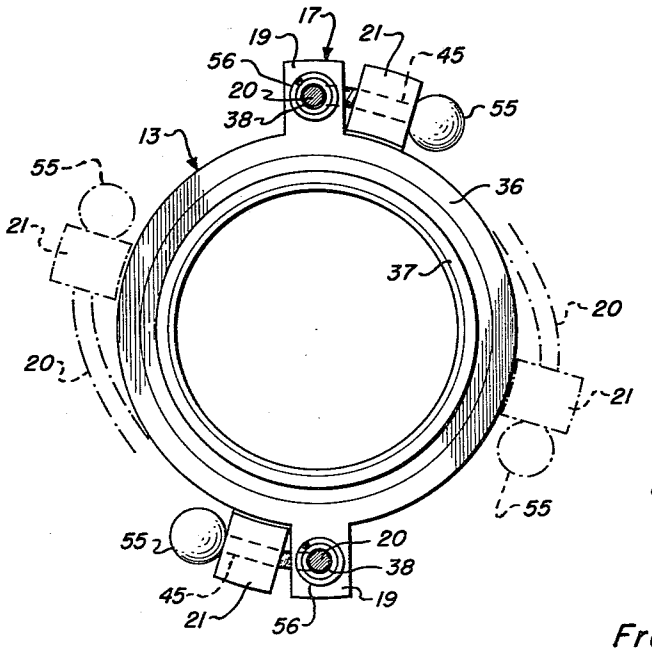


Fig. 2

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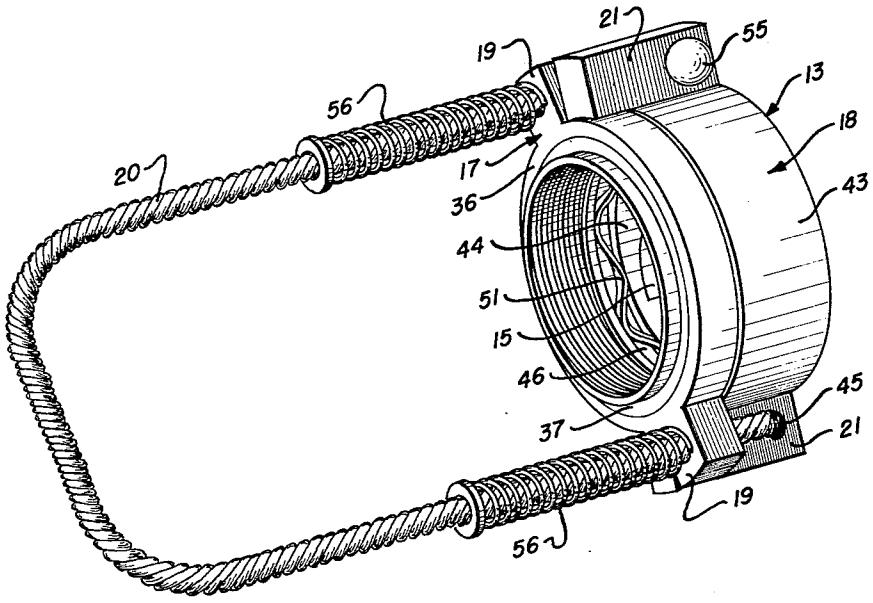


Fig. 3

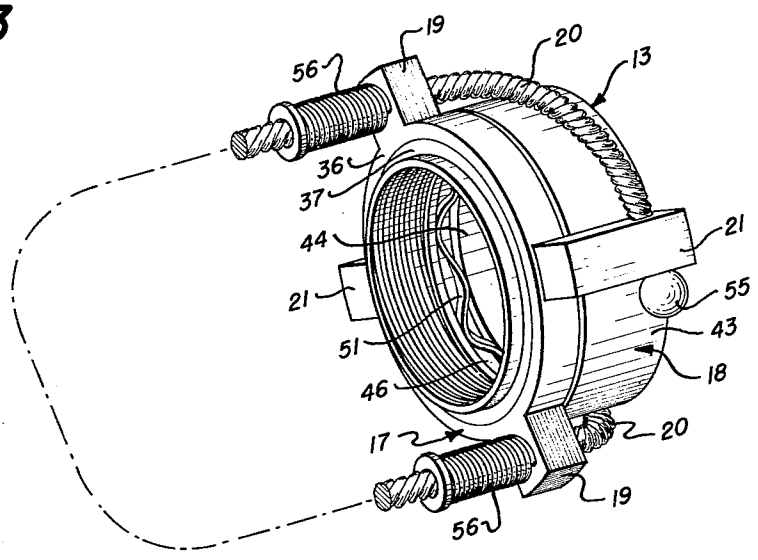


Fig. 4

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QUICK DISCONNECT ELECTRICAL CONNECTOR

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The invention relates generally to a quick-disconnect connector and more particularly to an electrical coaxial cable connector assembly provided with a lanyard device which is adapted to be operated from a remote position for rapidly and positively disconnecting the mating parts of the connector.

It is sometimes necessary, particularly in the aircraft field, to position electrical connectors in normally inaccessible places, such as, for example, a connector in an electrical circuit between the airplane and an externally mounted store, and on occasions it may be desirable to effect a very rapid and positive uncoupling of such connector. It is therefore a principal object of the present invention to provide a connector capable of being rapidly and positively uncoupled from a position remote from the connector.

Another object is to provide the connector with a lanyard device to effect the remotely controlled uncoupling operation.

A further object of the present invention is to provide a coaxial cable connector which, when coupled, is highly resistant to shock and vibrations.

A still further object is to provide the lanyard device with a mechanical advantage to ease the uncoupling operation.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description. The preferred embodiment illustrated is not intended to be exhaustive nor to limit the invention to the precise form disclosed. It is chosen and described in order to best explain the principles of the invention and their application in practical use to thereby enable others skilled in the art to best utilize the invention in various embodiments and modifications as are best adapted to the particular use contemplated.

In the accompanying drawings:

FIG. 1 is a longitudinal sectional view showing the mating parts of the connector in an uncoupled position;

FIG. 2 is an end view taken along line 2—2 of FIG. 1 showing the mating part containing the disconnecting device;

FIG. 3 is a perspective view of the preferred embodiment showing the disconnecting device in an uncoupled position; and

FIG. 4 is a perspective view similar to that of FIG. 3 but showing the device in the coupled position.

Described generally, the apparatus or device of the present invention comprises a coaxial cable connector 10, having a plug portion 12 and a receptacle portion 13. The two portions are adapted to be releasably retained together by what may be termed a bayonet-type joint which normally comprises a plurality of projections or pins 14 on the surface of the plug portion 12 and a like number of interrupted threads or helical grooves 15 on the inner surface of the receptacle portion 13. The receptacle portion 13 has a stationary section 17 and a movable or rotatable section 18. The stationary section 17 includes a pair of bored projections 19 which act as a

fixed fulcrum for a lanyard device 20 passing through the bores. The rotatable section 18 is positioned intermediate the stationary section 17 and the plug portion 12 and includes on the outer surface thereof a pair of wing-like members 21 to which the lanyard device may be attached and at the interior thereat the grooves 15.

With the mating portions attached, i.e., with the pins 14 seated within the grooves 15, the uncoupling of the device may then be attained by exerting a substantially linear force upon the lanyard device 20, which causes the movable section 18 to rotate with respect to the fixed section 17 and the plug portion 12 to effect the withdrawal of the pins 14 from the grooves 15.

Described in greater detail, the plug portion 12, as shown in FIG. 1, may be said to comprise a cylindrical tube 23 which may be attached to a panel or the like 24 in any suitable manner, such as, for example, by providing the tube 23 with an annular flange 25, which may abut one side of a panel 24, and a threaded surface 26 adjacent one end which may facilitate engaging a nut means 27 for rigidly securing the plug portion 12 to the panel 24. The tube 23 which may correspond generally to the outer conductor of a coaxial cable, is adapted to house in any suitable manner a centrally disposed conducting receptacle 28, which may correspond to the inner conductor of a coaxial cable. An insulating plug-like member 30 may surround the receptacle so as to electrically isolate the conductors from each other and also form a means of securing the conductor 28 to tube 23. An annular groove 32 is formed between the insulating member 30 and the tube 23 for receiving an annular mating part 33 of the receptacle portion 13, which may be prevented from relative rotational movement by providing the inner surface of tube 23 with a plurality of longitudinally extending slots 34 which are adapted to engage a like number of longitudinally extending projections 35 on the surface of mating part 33. A plurality of circumferentially spaced apart projections or pins 14 are positioned about the outer surface of tube 23 adjacent one end thereof for performing a mating function as will be described below.

The receptacle portion 13, which may correspond to the outer conductor of a coaxial cable, comprises three main parts—namely, the stationary section 17, the rotary section 18 and the mating part 33.

The stationary section 17 may be made up of two concentrically arranged cylinders or annular members 36 and 37, which may be joined together in any suitable manner, such as, for example, by a pressed fit or the like. The pair of projections 19 which are preferably circumferentially spaced 180° apart from each other, form a portion of cylinder 36 and each may be provided with a centrally located bore 38, which may be generally parallel to the longitudinal axis of the connector 10, for facilitating the passage of the lanyard 20. The inner cylinder 37 may be provided with a threaded inner surface 39 for engaging a threaded outer surface 40 of a cylindrical barrel-like member or insert 41 which includes the cylindrical mating part 33, an annular shoulder 42 intermediate the mating part 33 and the threaded surface 40; that is, the exteriorly threaded part 40 screws into the threads 39 at the inside of cylinder 37, to thereby pull the connector mating part firmly into position and so retain it. While the cylinder 37 is shown secured to insert 41 by threaded surfaces it will appear obvious to others skilled in the art when practicing the invention to use other securing means, such as, for example, pins extending through the cylinder 37 into the insert 41 or in any other suitable manner.

The rotatable section 18 which is adapted to abut against the stationary section 17 may be composed of a pair of cylinders or annular members 43 and 44 joined

together in a manner similar to cylinders 36 and 37. The cylinder 43 may have the same inner and outer diameters as cylinder 36 and have on the outer surface a pair of wing-like members which may be circumferentially spaced apart similarly to the projections 19. However, the wing-like members 21 are somewhat different in shape from the projections 19 in that they extend longitudinally on the surface of cylinder 43 and are provided with bores 45 adjacent one end of the wing-like projections 21 which are substantially perpendicular to the bores 38 in the projections 19. It may be desirable to have a portion of the wing-like members 21 extend over the surface of cylinder 37, thus acting as a stop against the projections 19 for the uncoupling rotary movement of section 18. To operatively couple the rotatable section 18 to the stationary section 17, as will be described in detail below, the inner cylinder 44 of the rotary section 18 may be provided with an annular recess 46 having one wall 47 thereof adjacent one end of cylinder 44 extending inwardly so as to be of nearly the same internal diameter as cylinder 37. The remainder of the cylinder 44 may have an internal diameter slightly greater than that of the end wall 47. A plurality of interrupted threads or helical grooves 15 corresponding to the number of pins 14 are formed in the inner surface of cylinder 44 and form a mating portion of the bayonet-type joint. The grooves 15 may each be provided with a small notch 49 near the inner end thereof so as to form a retaining seating surface for each of the pins 14 when the latter is inserted into the grooves 15 during the coupling operation to be described.

While the stationary section 17 and the rotary section are each shown as being built up from a pair of cylinders, it will be obvious to another skilled in the art when practicing the invention to use cylindrical members of one piece construction or of any other suitable design.

The stationary section 19 and the rotary section 18 may be coupled together to form a single unitary structure by positioning an annular retaining and compression spring, or the like, 51 of any desirable strength in the recess 46 and then mate the threaded portion 40 of insert 41 with threads 39 so as to draw the shoulder 42 into alignment with the recess 46. Thus the rotary section 18 is held in a secure yet freely rotatable manner adjacent the stationary section 19 by the cooperation between the spring 51 and the shoulder 42. Spring 51 also functions to hold the pins 14 in the seating notches 49. The rotatable section 18 is slightly longitudinally movable against the bias of spring 51 so that when the pins 14 travel through the groove 15 and near the notches 49 the forward end of tube 23 is adapted to abut the shoulder 42 causing the pins to act upon the side walls of the groove nearest the plug portion 12 and move the rotatable section 18 towards the plug portion 12 against the bias of spring 51. Such movement of the rotatable section 18 allows the pins 14 to reach the notches 49 where they will be forced into the notches 49 and held there by the action of spring 51 tending to return the rotatable section 18 to its normal position.

An insulating member 53, which is shown separate from the receptacle portion 13 for ease of illustration, is adapted to house a centrally located plug shaped conductor 54 corresponding to the inner conductor of a coaxial cable and may be positioned and secured within the insert 41 in any suitable manner so as to permit the plug shaped conductor 54 to mate with the receptacle 28 when the connector portions 12 and 13 are joined.

A looped lanyard 20, as best illustrated in FIGS. 3 and 4 and which may be formed from a light wire cable of any desirable length, may be operatively attached to the connector receptacle portion 13 by passing each end of the lanyard cable first through the bore 38 in the projection 19 and thence through bore 45 in the wing-like member 21. The lanyard may be maintained in the above described position by providing the cable ends with suitable holding means, such as, for example, swaged balls 55 or the like.

A pair of compression springs 56 may serve to maintain the wing-like projections 21 in an abutting relationship with the projections 19 when the connector 10 is in an uncoupled condition, thus easing the subsequent coupling operation by positioning the rotatable section 18 in its desired relationship to the stationary section 19 and the yanyard 20. These compression springs 56 may be placed in a surrounding manner about the lanyard cable 20 between the projections 19 and the loop portion of the lanyard cable 20. The ends of each spring nearest the loop portion may be secured to the lanyard cable 20 in any desirable manner such as a swaged ball, a crimped washer, soldering or the like. While a pair of springs 56 are shown as a return bias for the lanyard it will appear obvious to use a single spring about the lanyard loop portion with its ends abutting each projection 19.

With further reference to FIGS. 3 and 4, the receptacle portion 13 and the plug portion 12 are coupled together by aligning the pins 14 with outwardly open ends of the grooves 15 and the projections 35 with the slots 34. The projections 35 when within the slots 34 act as a holding mechanism for preventing the connector components from rotary movement except for the rotary section 18, which is then free to rotate so that when the pins 14 are started into the grooves 15 the section 18 is rotated, moving the wing-like member away from the projection 19 (as best shown in the dotted section of FIG. 2), thus causing the pins 14 to move into the grooves 15 until they reach the seating notches 49 where they are securely held by the bias of spring 51. The connector, when assembled as above, provides a highly stable electrical connection resistant to shock and vibrations.

To uncouple the connector all that is necessary is to exert a pulling force upon the lanyard 20, which effects rotary movement of the rotary section 18 with the projections 19 acting as a fixed fulcrum to rotate the grooves 15 so as to place their open ends in alignment with the pins 14 while at the same time causing axial separation of the plug and receptacle portions to effectively break the electrical connection. While FIGS. 2–4 illustrate rotary movement of section 18 in the order of 90° it will be understood that the grooves 15 may be designed so as to vary the amount of rotary movement necessary to uncouple the connector.

The pulling force upon the lanyard 20 need not be in the same direction as the longitudinal axis of the connector; in fact, such pulling force is still effective to cause uncoupling when the lanyard is pulled at an angle substantially perpendicular to the longitudinal axis of the connector 10.

The uncoupling principle of the invention imparts a highly advantageous feature to the connector field in that the speed with which the uncoupling operation can be achieved is substantially faster than the uncoupling devices known in the art. An example of the speed attained in connector uncoupling is that it takes approximately two seconds to uncouple the connector manually as opposed to an uncoupling time approaching 0.5 millisecond from load mechanically applied to the lanyard at a velocity near 100 feet per second. The mechanical advantage gained by using the projections 21 greatly decreased the amount of load upon the lanyard necessary to achieve connector uncoupling.

While the above description of the present invention is directed particularly to use of the connector for electrical applications, it will be obvious to others skilled in the art to use the principles of the invention in many diverse fields, such as, for example, in fluid conveying systems and the like.

As various changes may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be under-

stood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. A coupling device of the character described comprising the combination of a pair of annular mating portions with one having a pin projecting from an outer surface and the other having a helically disposed groove on an inner surface for receiving said pin to maintain the portions assembled and with one including a slot therein and the other including a projection for reception in said slot to orient said portions, one of said mating portions having a normally stationary section and a relatively rotatable section, said stationary section including a member having a pair of oppositely disposed lugs extending from an outer surface thereof with each lug having an aperture therethrough, said rotatable section having substantially the same outer diameter as said member and disposed in normally abutting relationship with said member and having on an outer surface thereof a pair of oppositely disposed wing-like projections each including an aperture therethrough and each having a segment thereof extending over said member for abutting a particular lug when said wing-like projections have been rotated to a relationship for disassembly of said mating portions, yieldable means operatively intermediate said stationary section and said rotatable sections for urging the latter toward said member, a lanyard extending sequentially and

continuously through said apertures of the lugs and the wing-like projections, means affixed to each of opposite ends of said lanyard for retaining said lanyard in said apertures, and compression spring means encircling said lanyard with ends thereof abutting said lugs on said member for continuously urging said wing-like projections toward said lugs on said member to a mating-portion-disassembly direction, said spring means being of length sufficient to facilitate the rotatable section to move the pin through substantially the length of said groove.

2. The device claimed in claim 1 wherein the apertures in said lugs are generally parallel to the longitudinal axis of said mating portions, and wherein the apertures in the wing-like projections are adjacent an end remote from the lugs and are generally perpendicular to the apertures in said lugs.

References Cited in the file of this patent

UNITED STATES PATENTS

410,417	Hix	Sept. 3, 1889
1,477,440	Grier	Dec. 11, 1923
1,920,524	Reed	Aug. 1, 1933
2,409,650	Wiggins	Oct. 22, 1946
2,710,384	Dupre et al.	June 7, 1955
2,984,811	Hennessey et al.	May 16, 1961