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Navy Case No. 77999

DEVICE FOR EXTRACTING AN INSERT FROM A CONNECTOR ASSEMBLY

STATEMENT OF GOVERNMENT INTEREST

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.

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention relates to a device to repair electrical connectors, and more specifically to a device to facilitate the extraction of connector inserts from underwater connector assemblies needing repair or replacement.

(2) Description of the Prior Art

Many applications, including acoustic arrays, employ standard Sea-Con brand MIN-BCR and FCR series connectors. These connectors, which are used widely throughout the Navy and private industry, are high density, machined connectors that are relatively expensive and have fragile plastic inserts. When used with acoustic arrays, the connectors are typically installed by mounting the connector shell into a bulkhead or flat panel. Necessary connections from wires fed through the shell from the rear are then made to contacts permanently molded into the connector insert. The connector insert, which

comprises a glass reinforced epoxy material, is then fitted with an O-ring and pressed into place in the connector shell from the front where it is retained with a snap ring.

At times, it becomes necessary to repair or alter the wiring at the connectors. The connectors, which are relatively small, have a the high number of contacts (up to 203) per connector and are often installed in a location where access to the connector is restricted. Therefore, the connector insert must be removed to repair or alter the wiring. However, due to the close tolerances of the connector shell and insert and to the O-ring seal between the insert and the shell, a significant force must be applied to the rear of the connector to extract the insert from the shell. Furthermore, the glass reinforced epoxy insert is very brittle making it susceptible to binding and fracturing during removal if it does not remain true in the bore of the shell.

Current procedures for removing connector inserts use dowels, drift pins or the like to tap out the connector insert from the rear. Because the rear of the insert has numerous contacts with wires soldered thereto, removal of an insert is a time consuming task which often is not very successful. The current procedures offer little assurance for the removal of the insert without damaging the wires or connections, breaking the insert or damaging the connector itself. Therefore, it is often necessary to have spare connectors and inserts on hand. In addition to the cost of storing and replacing the inserts, replacement of an insert is often a difficult, time consuming

process involving substantial rewiring work which may itself result in costly and time consuming wiring errors.

Thus, what is needed is a device to more readily and safely extract connector inserts from the shell without breaking the insert or damaging any connections to the insert.

SUMMARY OF THE INVENTION

Accordingly, it is a general purpose and object of the present invention to provide an extraction device to remove a connector insert from a connector shell.

Another object of the present invention is to provide a device which maintains even pressure on a connector insert to allow removal of the insert without binding or fracturing the insert.

A further object of the present invention is the provision of a device which remains true within a connector shell while maintaining an even pressure on the insert during removal of the insert.

These and other objects made apparent hereinafter are accomplished with the present invention by providing an extraction device adapted to push connector inserts from a connector assembly. A substantially cylindrical extraction device has an outer diameter which is tapered in steps, an inner diameter defined by a central bore extending longitudinally through the full length thereof and a slot running the length of the device providing access to the central bore.

To remove an insert from the connector assembly, any wires connected to the insert are slipped through the slot and into the central bore and the extraction device is slid into the shell from the rear. A force is then applied to the device to push the insert out the connector shell. The tapered diameter holds the device true within the shell and allows the insert to be removed without damaging the insert or the shell.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the invention and many of the attendant advantages thereto will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings wherein like reference numerals and symbols designate identical or corresponding parts throughout the several views and wherein:

FIG. **1** is a side view of a connector insert extraction device in accordance with the present invention;

FIG. **2** is an end view of an extraction device in accordance with the present invention; and

FIGS. **3A**, **3B** and **3C** illustrate various stages in the removal of a connector insert using an extraction device of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. **1** and **2**, there is shown a connector insert extraction device **10** in accordance with the present

invention. Extraction device **10** comprises a substantially cylindrical member **12** having an inner diameter **D4** defined by a bore **14** extending longitudinally through the full length thereof and an outer diameter which is tapered, in steps, over the length of the extractor. Preferably, extractor **10** is tapered in two steps to divide cylindrical member **12** into three integral sections: a base section **16** having an outer diameter **D1** over length **L1**, a guide section **18** defined by outer diameter **D2** for a length **L2** and an engagement section **20** having an outer diameter **D3** for a length **L3**. Additionally, the steps in the outer diameter from **D1** to **D2** and from **D2** to **D3** define radially extending, circumferential shoulders **22** and **24**. A slot **26** extending longitudinally through the full length of cylindrical member **12** allows the extractor to be slipped over wires connected to an insert which is to be removed.

The dimensions of extractor **10** are chosen to allow the extractor to remain true within a connector shell and to maintain an even pressure and uniform contact across the face of the insert. The insert can then be extracted by simply applying a linear force to extractor **10** to push the insert from the shell. This is shown more clearly with additional reference to FIGS. **3A - 3C** which illustrate various stages in the removal of an insert using an extraction device of FIGS. **1** and **2**.

Referring to FIGS. **3A - 3C**, there is shown an extraction device **10** as described in reference to FIGS. **1** and **2** and a connector **30**. In FIGS. **3A - 3C** connector **30** is shown with a portion of shell **32** cut-away to reveal a connector insert **34**

with wires **36** connected to contacts **38** extending from the rear face **34A** of insert **34**. The wires **36** are shown extending from connector **30** in a bundle **40**, although wires **36** need not be bundled. Typically, the shell **32** is mounted into a flat panel or bulkhead (not shown) after which wires **36** are fed completely through the shell. To complete the installation, the necessary connections of wires **36** to contacts **38** are made and insert **34** is fitted with an O-ring **42** and pressed into place in shell **32**. A circumferential flange **44** extending radially inward divides shell **32** into a rearward base section **46** and a forward insert section **48** and prevents insert **34** from being inserted too far into the shell.

To remove insert **34** from shell **32** using device **10**, wires **36** are slipped through slot **26** and into bore **14**, thereby allowing the device to be slid into the base section **46** of connector shell **32** (FIG. **3A**). Device **10** is slid into base section **46** of shell **32** until face **20A** of engagement section **20** abuts face **34A** of insert **34** (FIG. **3B**). A force in the direction of arrow **50** is then applied to device **10** to push insert **34** out of shell **32** (FIGS. **3B** and **3C**). As the force is applied to device **10**, the device continues to push insert **34** from shell **32** until circumferential shoulder **22** comes into contact with the shell and prevents further insertion of the device the shell **32**.

As can be seen in FIGS. **3A** and **3B**, the width **28** of slot **26** only needs to be wide enough to slip wires **40** therethrough and into bore **14**. Inner diameter **D4** (FIG. **1**) of device **10**, however, is chosen to be large enough to provide clearance for all the

contacts **38** and any wires **36** connected thereto along with any heat shrink tubing or the like protecting and isolating the connections. This clearance provided by diameter **D4** allows face **20A** to abut face **34A** without damaging the wires **36**, contacts **38** or any connections between the two. It has been found that for most standard BCR and FCR series connectors a slot width **28** of approximately 0.740 - 0.760 inches is sufficient to slip wires therethrough while an inner diameter **D4** of approximately 0.846 - 0.866 inches is necessary to provide clearance for the wires **36**, contacts **38** and connections.

From FIGS. **3B** and **3C**, it can be seen that outer diameters **D2** and **D3** (FIG. **1**) of sections **18** and **20** are chosen to correspond with the clearance available within shell **32**. To push insert **34** from shell **32**, diameter **D3** must be smaller than the diameter of the opening defined by the radially inward extending flange **44**. Preferably, diameter **D3** is chosen to provide slip fit clearance between engagement section **20** and flange **44**. Similarly, outer diameter **D2** is preferably selected so as to provide slip fit clearance within base section **42**, thereby allowing guide section **18** to slide in an axial direction within shell **32** while preventing movement of section **18** in a radial direction.

Preventing radial movement within shell **32** assures that device **10** remains true within the shell and that the force applied to the device will be substantially equally distributed across face **34A** of insert **34** when it is transferred to the insert. When a force in the direction of arrow **48** is applied to

device **10**, insert **34** will be pushed from shell **32** without binding and fracturing. It has been found that an outer diameter **D3** of approximately 0.976 - 0.986 inches and an outer diameter **D2** of approximately 1.065 - 1.075 inches will provide slip fit clearance and keep the device straight in the shell as it is pushed therethrough.

From FIGS. **3B** and **3C** it can seen that lengths **L2** and **L3** of sections **18** and **20** are chosen with regard to the dimensions of shell **32**. To fully push insert **34** from shell **32**, the combined length (**L2** + **L3**) of sections **18** and **20** should at least equal the length of the shell. Additionally, length **L2** should be long enough to ensure device **10** will remain true within the bore, yet be short enough to prevent shoulder **24** from striking and damaging flange **44**. Similarly, the length **L3** of section **20** should be short enough to ensure that enough of section **18** is within shell **32** to keep device **10** true within the shell and maintain an even pressure across face **34A** when a force is initially applied to the device. It has been found that a device with sections **18** and **20** having a combined length (**L2** + **L3**) of approximately 1.541 - 1.561 inches with section **20** having a length **L3** of approximately 0.630 - 0.650 inches will keep device **10** true within the shell and fully remove insert **34**.

The outer diameter **D1** of base section **16** is sized larger than the clearance within shell **32** to prevent the device from being inserted too far into the shell and to provide a surface to which a linear force can easily be applied. It has been found that an outer diameter **D1** of approximately 1.148 - 1.168

inches provides a large enough surface area to allow application of a force to remove the insert while preventing device **10** from being inserted too far. Additionally, length **L1** of section **16** should be long enough to provide an area to apply a force, yet be short enough to allow the device to be easily inserted when the connector is installed in tight spaces. It has been found that a device having an overall length (**L1** + **L2** + **L3**) of approximately 2.645 - 2.665 inches will allow access to tight spaces.

Thus, what has been described is a novel device for removing the insert from an underwater connector such as a Sea-Con brand MIN-BCR or FCR series connector that offers several significant advantages over prior art systems. The device allows the inserts to be quickly and easily extracted from the connector assemblies without damaging the insert, the connector or the wiring.

It will be understood that various changes in the details, materials, steps and arrangement of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention.

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DEVICE FOR EXTRACTING AN INSERT FROM A CONNECTOR ASSEMBLY

ABSTRACT OF THE DISCLOSURE

A substantially cylindrical extraction device adapted to push connector inserts from a connector assembly has an outer diameter which is tapered in steps, an inner diameter defined by a central bore extending longitudinally through the full length of the device. A slot running the length of the device allows wires extending from connector to be slid into the bore. Inserts are removed from the connector assembly by sliding the device into the connector from the rear and applying a linear force to the device to push the insert from the connector.

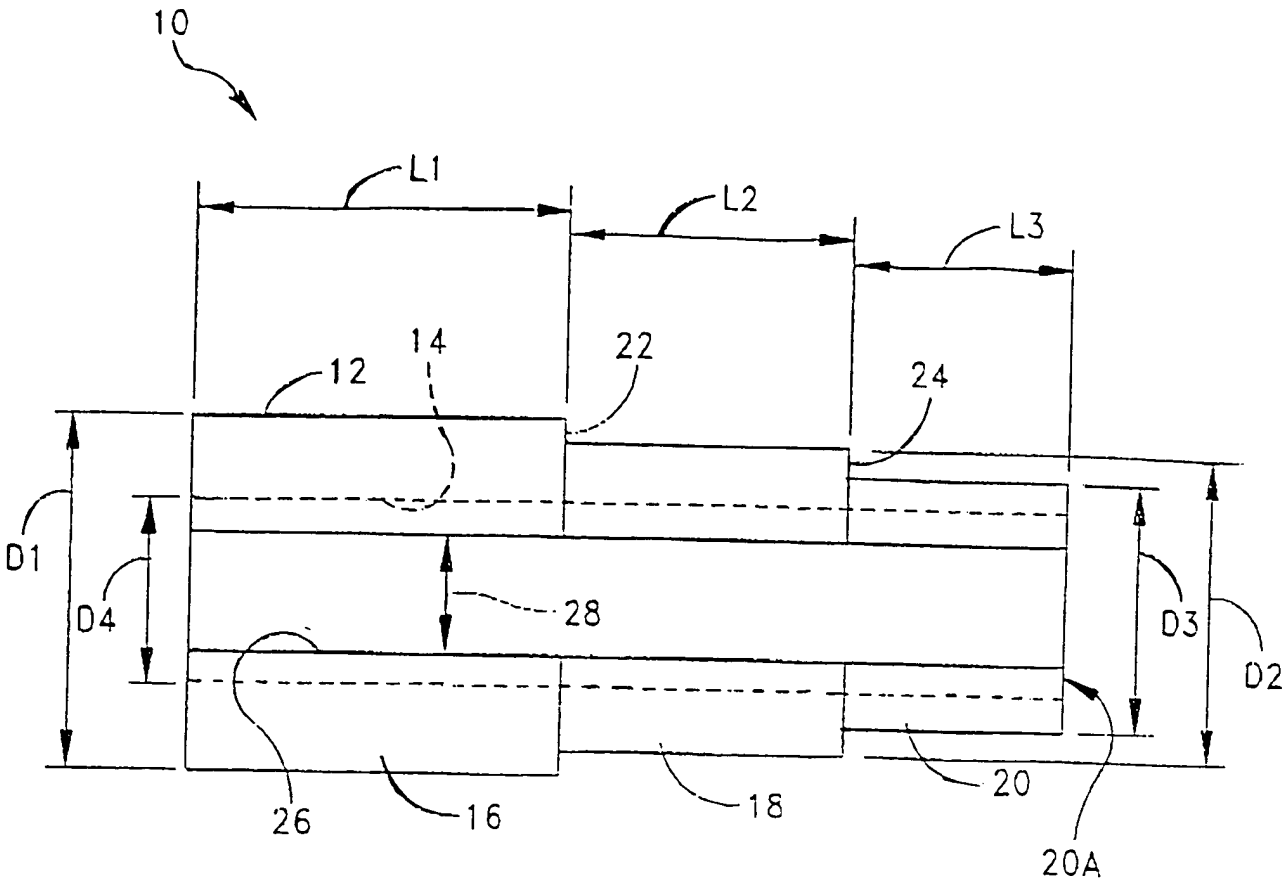
10
L1
L2
L3
12
14
22
24
D1
D4
28
D3
D2
26
16
18
20
20A

FIG. 1

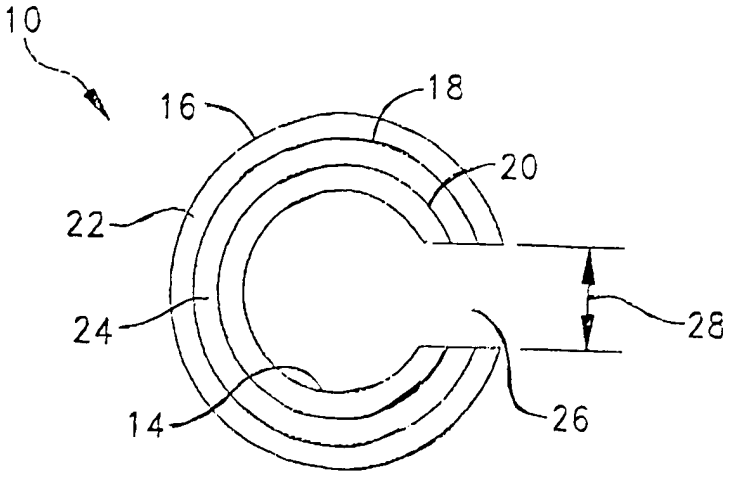
10
16
18
20
22
24
28
14
26

FIG. 2

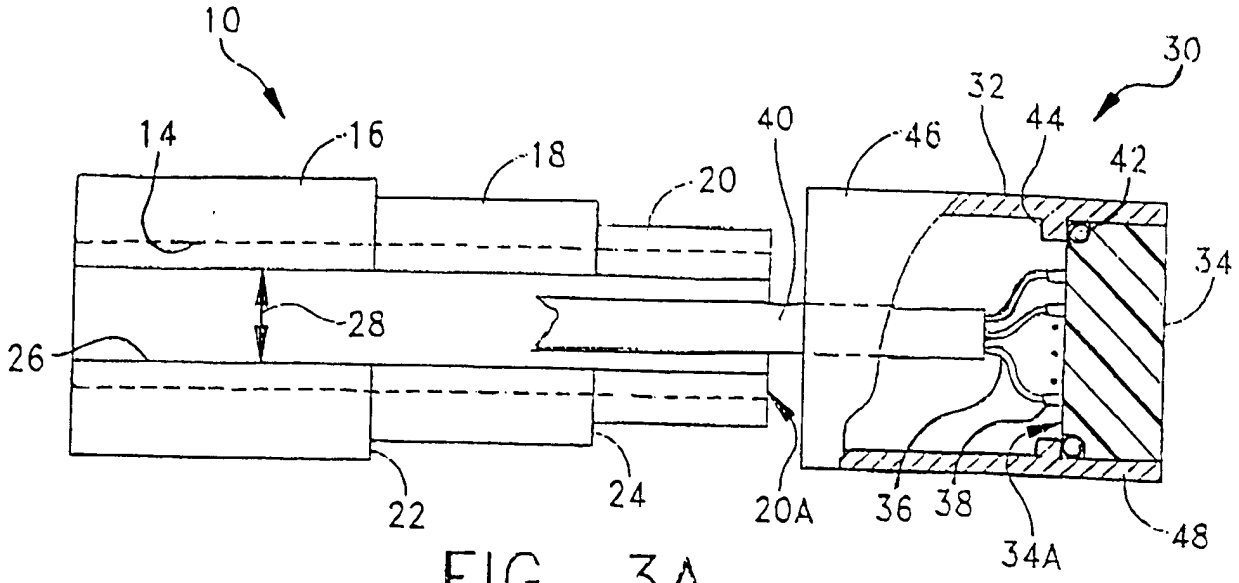

FIG. 3A

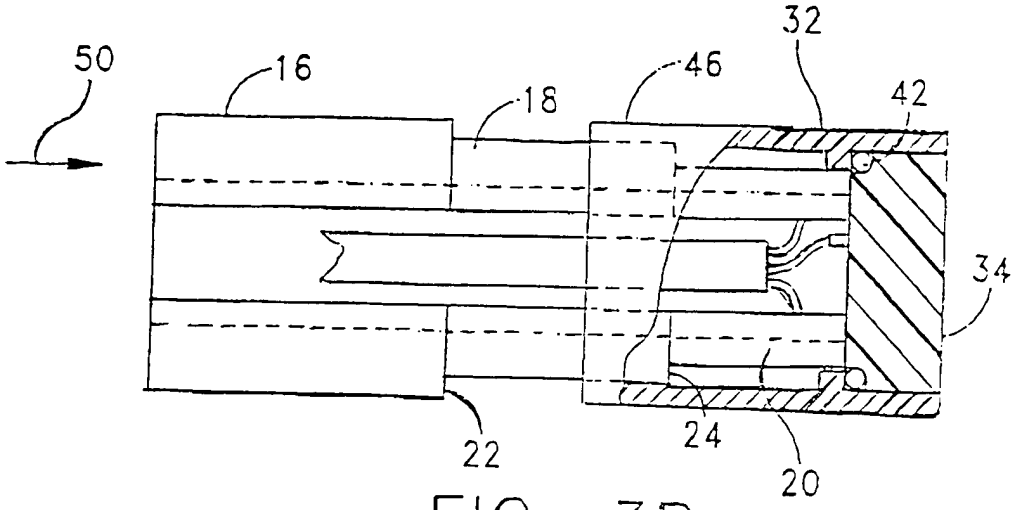

FIG. 3B

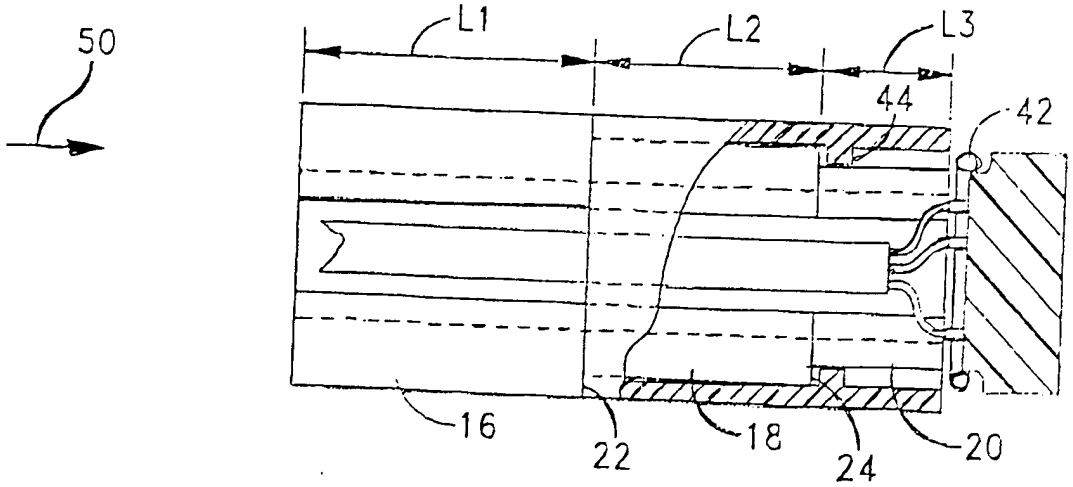

FIG. 3C