

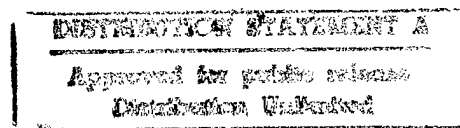
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NOTICE

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1 Navy Case No. 77999

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3 DEVICE FOR EXTRACTING AN INSERT FROM A CONNECTOR ASSEMBLY

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5 STATEMENT OF GOVERNMENT INTEREST

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

10

11 BACKGROUND OF THE INVENTION

12 (1) Field of the Invention

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

17 (2) Description of the Prior Art

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

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

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

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

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

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

6

7 SUMMARY OF THE INVENTION

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

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

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

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

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

8

9                    BRIEF DESCRIPTION OF THE DRAWINGS

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

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

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

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

24

25                    DESCRIPTION OF THE PREFERRED EMBODIMENT

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

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

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

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

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

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

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

1 contacts 38 and any wires 36 connected thereto along with any  
2 heat shrink tubing or the like protecting and isolating the  
3 connections. This clearance provided by diameter D4 allows face  
4 20A to abut face 34A without damaging the wires 36, contacts 38  
5 or any connections between the two. It has been found that for  
6 most standard BCR and FCR series connectors a slot width 28 of  
7 approximately 0.740 - 0.760 inches is sufficient to slip wires  
8 therethrough while an inner diameter D4 of approximately 0.846 -  
9 0.866 inches is necessary to provide clearance for the wires 36,  
10 contacts 38 and connections.

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

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



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

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

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

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

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

17 It will be understood that various changes in the details,  
18 materials, steps and arrangement of parts, which have been  
19 herein described and illustrated in order to explain the nature  
20 of the invention, may be made by those skilled in the art within  
21 the principle and scope of the invention,  
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5 ABSTRACT OF THE DISCLOSURE

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

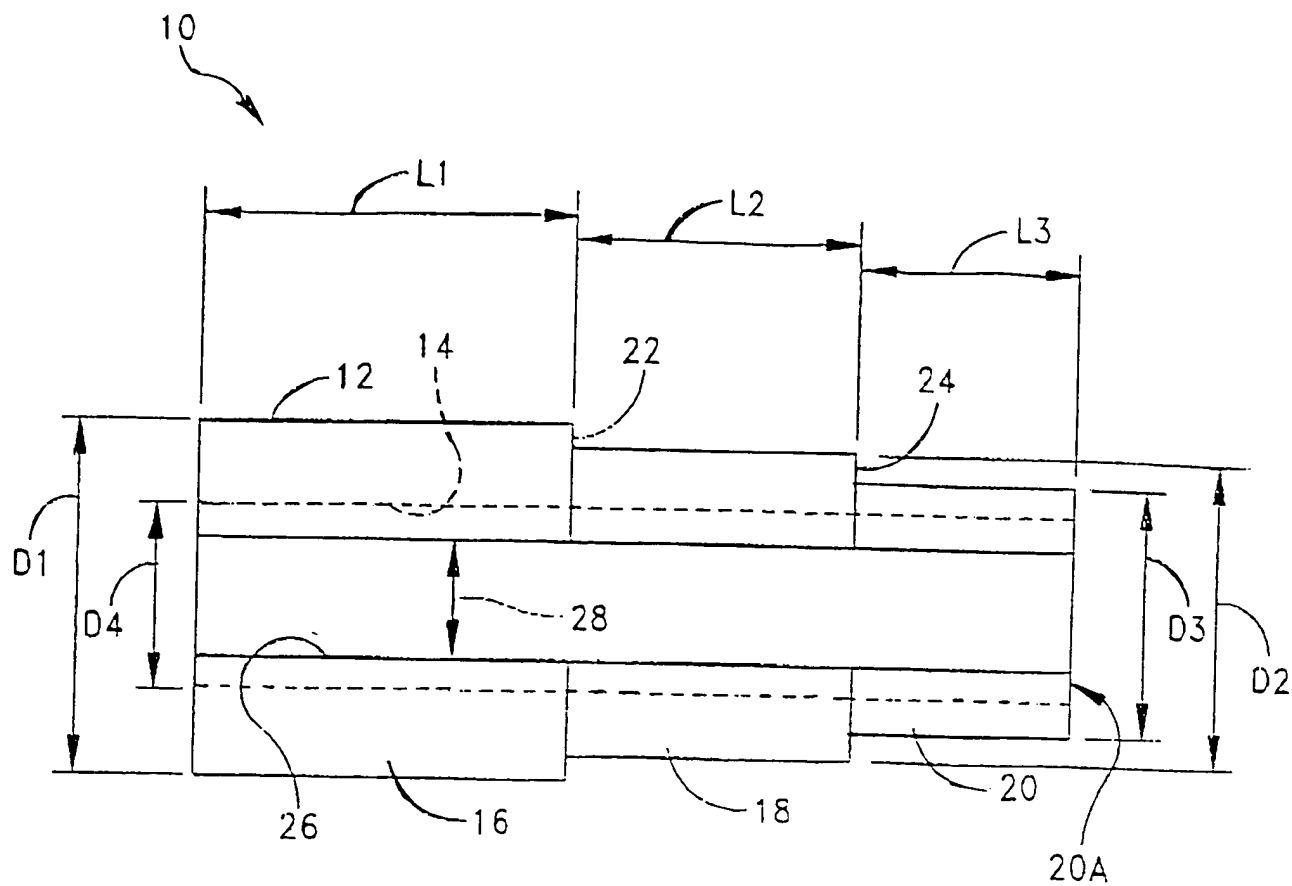


FIG. 1

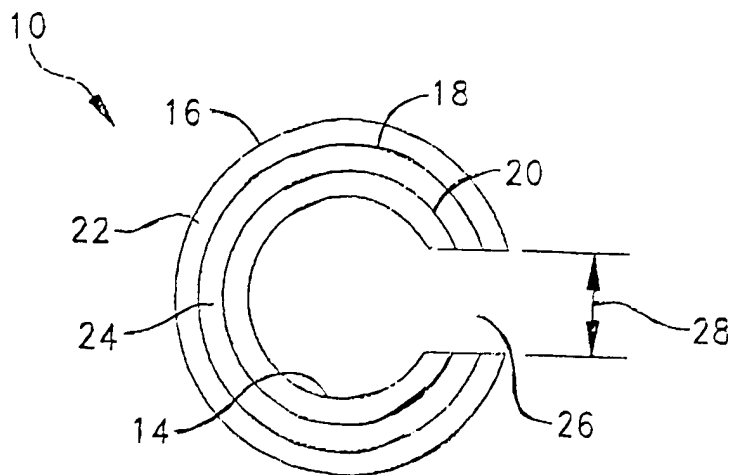


FIG. 2

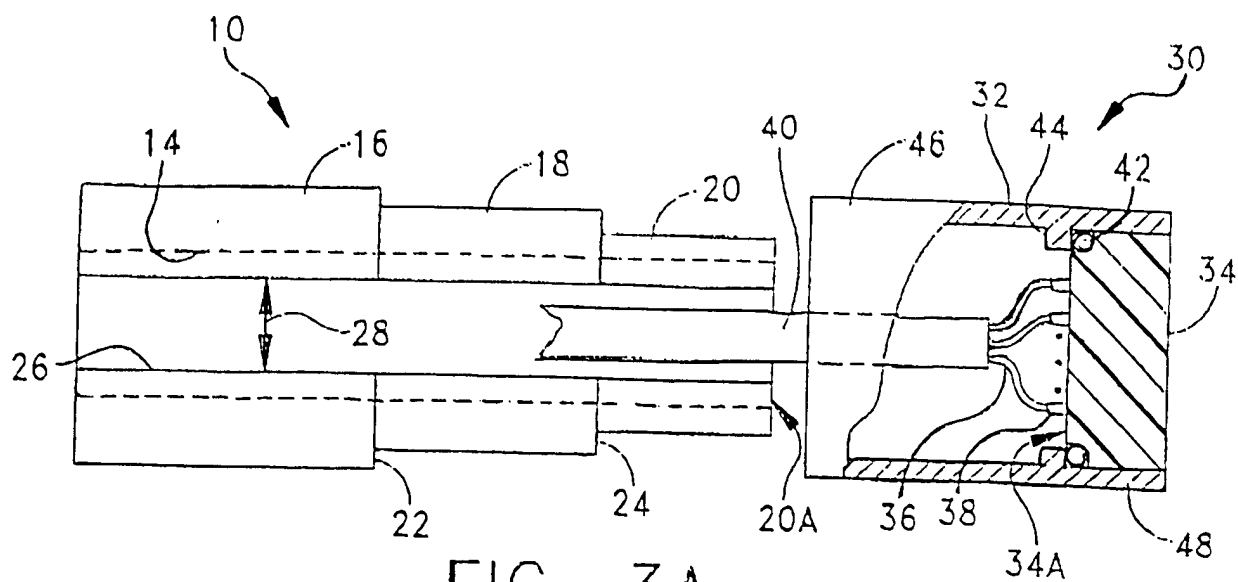


FIG. 3A

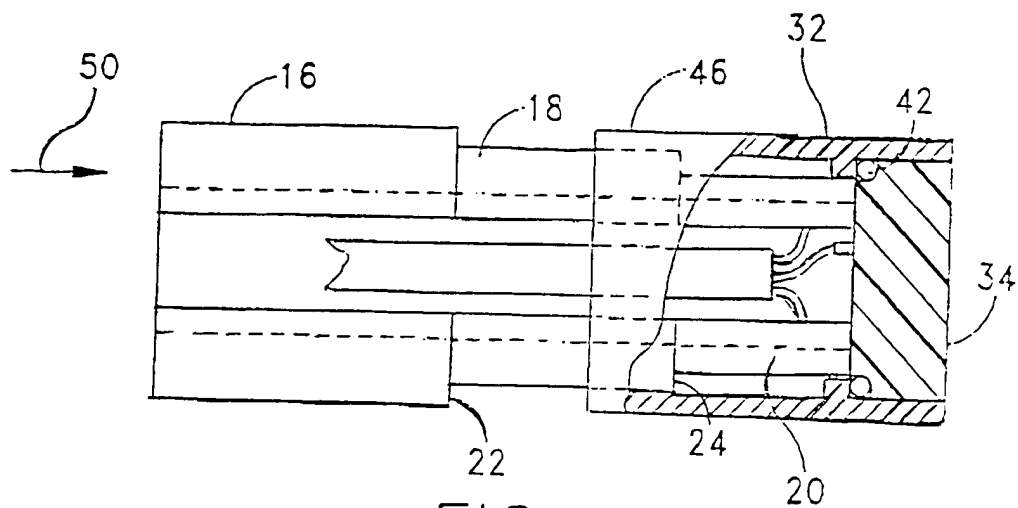


FIG. 3B

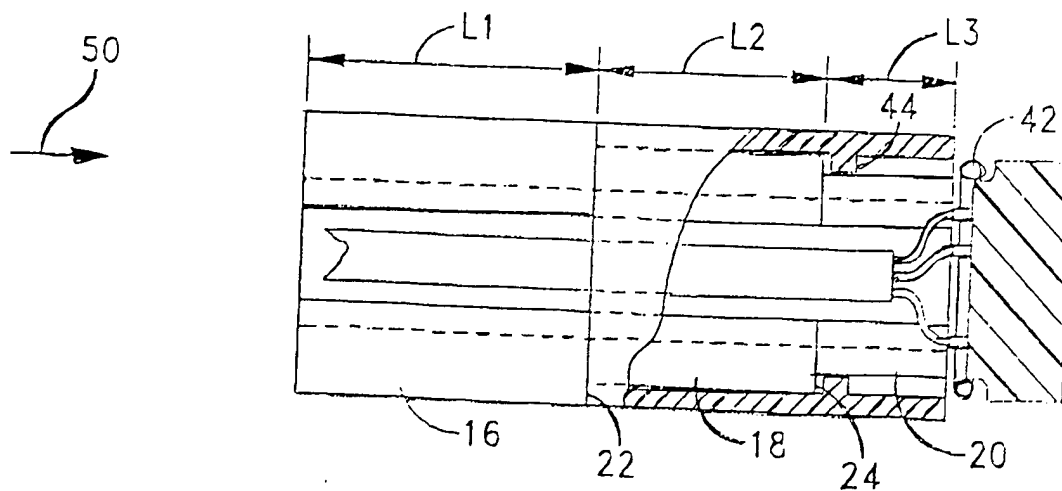


FIG. 3C