

IMPROVED CONNECTOR INSERT

TO ALL WHOM IT MAY CONCERN

BE IT KNOWN THAT ROBERT A. ROUSH, citizen of the United States of America, employee of the United States Government and resident of Norwich, County of New London, State of Connecticut has invented certain new and useful improvements entitles as set forth above of which the following is a specification:

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PATENT TRADEMARK OFFICE

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1 Attorney Docket No. 80266

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3 IMPROVED CONNECTOR INSERT

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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 therefore.

10

11 CROSS REFERENCE TO OTHER PATENT APPLICATIONS

12 Not applicable.

13

14 BACKGROUND OF THE INVENTION

15 (1) Field Of The Invention

16 The present invention relates generally to the field of
17 electrical connectors and more particularly, to an improved
18 electrical connector having an integrated face seal which is
19 especially useful in wet environments.

20 (2) Description Of The Prior Art

21 Typically, electrical connectors are constructed from a
22 plurality of parts that are separately fabricated and then
23 assembled together into complete connectors. If the connector
24 is designed for outside use or use in harsh environments, it is

1 especially important that the connector be effectively sealed to
2 prevent moisture, dust, or other contaminants from reaching the
3 interior of the connector where they can cause corrosion or
4 otherwise prevent proper operation of the connector. The need
5 for an effective seal preventing moisture is especially great
6 when the vehicle is in water, such as a ship or submersible
7 vehicle.

8 Most environmental connectors are relatively complex in
9 design so as to reliably seal the connection. Many
10 environmental connectors utilize a RIM (reaction injected
11 molded) face seal, generally made from neoprene. A common
12 problem with these connectors results from the need to use
13 separate seals in conjunction with the connectors. The
14 additional seals result in increased tolerance stack-up. Also,
15 existing seals tend to degrade over time. This results from the
16 seals, generally made from polyurethane, cold-flowing around the
17 receptacle's pins over time.

18 Another problem associated with complex electrical
19 connectors results from the handling and assembling of the
20 individual components. Because the individual parts are often
21 manufactured separately, there is an increased likelihood that
22 certain parts will not fit together properly. This results in
23 imperfectly-made connectors and in an excessive number of

24

1 rejects, thus increasing both manufacturing and labor costs as
2 well as installation time.

3 Accordingly, what is needed is an electrical connector
4 which effectively isolates a receptacle's pins even in a wet
5 environment. The connector should not need additional seals
6 which increase the tolerance stack up. The connector should be
7 made of a material which will not cold-flow over time. Lastly,
8 the connector should be easy to manufacture and install.

10 SUMMARY OF THE INVENTION

11 In accordance with the present invention, an electrical
12 connector for creating a connection with a plurality of
13 receptacle pins located on a male receptacle is disclosed.. The
14 electrical connector includes a first end and a second opposed
15 end, a plurality of passageways extending through the electrical
16 connector from the first end to the second end, and at least one
17 integral face seal. The integral face seal includes a plurality
18 of openings having a first end and a second end corresponding to
19 the plurality of passageways and a plurality of integral semi-o-
20 rings located on the first end of the plurality of openings.
21 The plurality of integral semi-o-rings are adapted to
22 frictionally engage the plurality of receptacle pins thereby
23 isolating the plurality of receptacle pins from one another and

1 creating a water-proof seal. The electrical connector is molded
2 contiguously.

3 In another embodiment, the electrical connector is molded
4 from an o-ring material which is resistant to cold-flow. In a
5 preferred embodiment, the o-ring material is neoprene or Buna-N
6 rubber. Furthermore, the improved electrical connector is
7 preferably constructed using reaction injection molding
8 techniques.

9

10 BRIEF DESCRIPTION OF THE DRAWINGS

11 These and other features and advantages of the present
12 invention will be better understood in view of the following
13 description of the invention taken together with the drawings
14 wherein:

15 FIG 1 is partial cross-sectional view of an electrical
16 connector according to the prior art; and

17 FIG 2 is a partial cross-sectional view of one embodiment
18 of an electrical connector according to the present invention.

19

20 DESCRIPTION OF THE PREFERRED EMBODIMENT

21 FIG 1 illustrates the existing connector design 10
22 currently used in by the U.S. Navy and others. The connector
23 design 10 utilizes an electrical connector housing 12 and a
24 separate face seal 14. The electrical connector housing 12 has

1 a plurality of passageways 16 extending from a first end 18 to a
2 second end 20.

3 The face seal 14 is a separate component from the
4 electrical connector housing 12. Both the electrical connector
5 housing 12 and the face seal 14 are constructed from epoxy,
6 generally polyurethane. The face seal 14 includes a plurality
7 of openings 22 corresponding to the plurality of passageways 16
8 in the electrical connector housing 12.

9 In practice, the face seal 14 is placed between the
10 electrical connector housing 12 and a corresponding electrical
11 receptacle (not shown) having receptacle pins. Upon passing
12 through the openings 22 of the face seal 14 to the plurality of
13 passageways 16 in the electrical connector housing 12, the
14 plurality of openings 22 on the face seal 14 frictionally engage
15 the pins on the electrical receptacle creating a seal.

16 The prior art connection 10 described above results in
17 increased tolerance stack-up since the face seal 14 is placed
18 between the electrical housing 12 and the electrical receptacle.

19 By adding the RIM, one will add to an existing stack-up
20 (controlled by MILSPEC) which is unsatisfactory. It will
21 interfere with sealing capabilities of the design. Also, since
22 the electrical connector housing 12 is made of polyurethane and
23 the face seal 14 is made of neoprene, the resulting seal
24 degrades over time because the polyurethane cold-flows around

1 the electrical receptacle's face. This allows water into the
2 connector which can result in the connection short-circuiting or
3 performing poorly.

4 The improved electrical connector 30 as shown in FIG 2, is
5 according to the present invention. It combines the electrical
6 connector housing 32 and the face seal 34 into one contiguous
7 piece. In a preferred embodiment, the electrical connector 30
8 is made from an o-ring type material which is resistant to cold-
9 flow. The properties of the o-ring type material are listed in
10 MIL-SPEC (military specifications). In one embodiment, the o-
11 ring material is 60 Shore A Durometer Buna-N rubber. In another
12 embodiment, the o-ring material is neoprene.

13 The electrical connector housing 32 includes a plurality of
14 passageways 38 extending from a first end 40 to a second end 42.

15 The face seal 34 includes a plurality of openings 36
16 corresponding to the plurality of passageways 38 within the
17 electrical connector housing 32. In a preferred embodiment,
18 each opening 44 on the face seal 34 also includes a molded-in o-
19 ring 44 on at least the first end 40. The improved electrical
20 connector 30 may also include additional face seals such as 14
21 of FIG 1 having multiple o-rings 44 on multiple ends.

22 In practice, the improved electrical connector 30 mates
23 with a receptacle (not shown) in the same manner as described
24 above, except that a separate face seal 14, FIG. 1, is not

1 needed. The improved electrical connector 30 creates a
2 waterproof seal and isolates the pins of an electrical
3 receptacle from one another, even in wet environments, without
4 the need of a separate face seal. Because of the material used,
5 the openings 22, FIG. 1, in the prior art face seal 14 tends to
6 cold-flow away from the pins on an electrical receptacle when
7 connected, thus degrading the quality and weatherproofness of
8 the seal, ultimately resulting in poor performance. Cold-flow
9 or creep is the tendency of a material to very slowly flow away
10 from a high stress area. When constructed out of an o-ring type
11 material, the improved electrical connector 30 will not cold-
12 flow or creep. Furthermore, the improved electrical connector
13 30 does not suffer from tolerance stack-up since the face seal
14 34 is an integral part of the electrical connector housing 32.

15 In a preferred embodiment, the improved electrical
16 connector 30 is constructed using reaction injection molding
17 techniques. However, other known methods of forming rubber
18 components may be used which are within the realm of a person of
19 ordinary skill in the art.

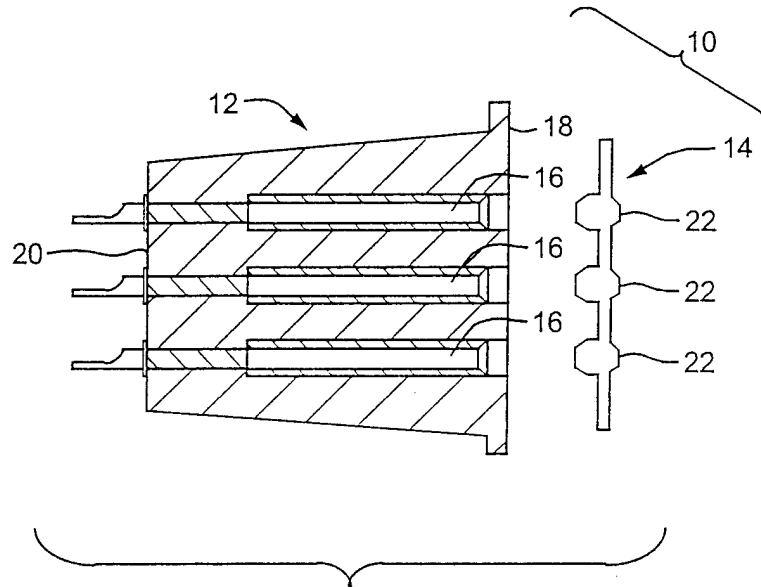


FIG. 1
(PRIOR ART)

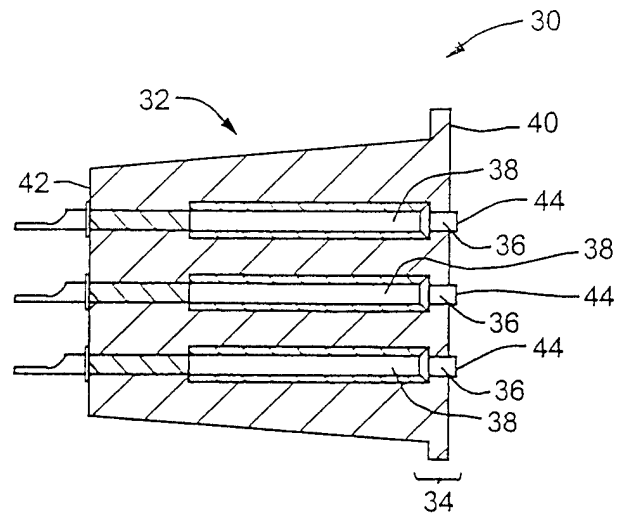


FIG. 2

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2 IMPROVED CONNECTOR INSERT

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4 ABSTRACT OF THE DISCLOSURE

5 An improved electrical connector having an electrical
6 connector housing and at least one face seal, wherein the
7 improved electrical connector is a single molded connector
8 housing. The electrical connector housing includes a plurality
9 of passageways extending from a first end to a second end. A
10 face seal includes a plurality of openings corresponding to the
11 plurality of passageways within the electrical connector
12 housing, each passageway having a semi-o-ring on at least one
13 side of the face seal. In a preferred embodiment, the improved
14 electrical connector is made from an o-ring type material such
15 as, but not limited to, neoprene or Buna-N rubber. The improved
16 electrical connector does not need additional seals to create a
17 waterproof seal, and therefore does not suffer from increased
18 tolerance stack-up. Furthermore, when constructed from an o-
19 ring type material, the improved electrical connector does not
cold flow around a receptacle's pins.



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