Title: CONNECTOR SYSTEM HAVING CORROSION REDUCTION PROPERTIES

Abstract: The present invention provides systems and structures for reducing corrosion in connectors. The present invention employs channels in either the cavity of the connector or the body of the terminal. The channels are configured to receive a corrosive resistant material. When the connector and terminal are connected to one another, the corrosive resistant material is deployed so as to coat the connector and terminal and reduce corrosion. In some embodiments, a connector terminal for connecting a cable to the terminal is also included. The connector terminal may include bores extending from a top to a bottom surface and channels in the bottom surface. When the terminal, terminal connector, and connector are connected together, the corrosive resistant material is squeezed into the bores and channels of the terminal connector so as to also coat the terminal connector.
BACKGROUND OF THE INVENTION

1. Field of the Invention.

This present invention relates generally to battery cable systems and clamping systems and particularly to a system for further reduction and improvement of maintenance and cost by controlling corrosion and other damaging factors that affect the electrical and mechanical performance of cables, terminals, nuts, clamp load joints and other components.

2. Description of Related Art.

Today’s battery cable systems typically have corrosion at the battery connections, which result in the corrosion attacking the connection, crimp between the battery cable and electrical terminal, or “wicking” up the cable. This corrosion problem results in voltage drop, reduced electrical conductivity and reduction in the vehicles starting/charging/lighting performance. The state of the art today is corrosion washers/spray/coatings between the terminal and battery cable connection. The terminal crimp area between the wire and terminal is protected by heat shrink with sealant. While this typical approach helps to reduce the corrosion, it does not significantly eliminate the corrosion so as to prevent reduction in electrical performance.

Mechanical clamping for wheels, starter motors, alternators, frames cross members, mounting brackets typically use a threaded stud a nut. The threads corrode from various environmental conditions including humidity, road salt, etc. This corrosion makes it difficult, if not impossible, to disassemble the component nut from the stud. Removal in these conditions can cause mechanical damage to the threaded stud, as well as other electrical components.

In light of these disadvantages with current electrical clamping systems, components and techniques are needed to prevent corrosion and facilitate assembly and removal of electrical nuts and clamps.

BRIEF SUMMARY OF THE INVENTION

The present invention provides systems and structures for use in mechanical connections to resist rust and corrosion. In one embodiment, the present invention provides a connector, such as a nut, that contains a threaded cavity for connection to a threaded rod. The
connector further includes one or more channels located in the cavity of the connector. The channels are capable of containing a corrosive resistant material, such as grease. When the connector is threaded onto the threaded rod, the corrosive resistant material is spread onto the threads of both the connector and the threaded rod. In some embodiments, the channels are located in the threaded rod, as opposed to the connector.

As an alternative, in some embodiments, the cavity of the connector can be filled with the corrosive resistant material. In this embodiment, when the connector is threaded onto the threaded rod, the corrosive resistant material is squeezed out of the cavity and onto the channels located in the cavity. Here again, the corrosive resistant material is spread onto the threads of both the connector and the threaded rod.

In some embodiments, the present invention may also provide a terminal connector for connecting a cable to the terminal. In this embodiment, the terminal connector may include bore holes extending between a top and bottom surface. The terminal connector may also include grooves on the bottom of the terminal connector. In this embodiment, during assembly, the connector is placed on the terminal (threaded rod) and the connector is threaded onto the terminal. As the connector is advanced along the threaded rod, some of the corrosive resistant material is squeezed out of the cavity of the connector, into the bore holes of the terminal connector and into the grooves of the terminal connector, such that the corrosive resistant material substantially covers the connector, terminal, and terminal connector.

The present invention also provides a connector system for connecting one or more cables either to each other or to a terminal or both. This embodiment discloses a terminal connection system that reduces instances of corrosion associated with an electrical connection. The system includes a terminal connector, which comprises a crimp portion and a terminal portion. The end of a cable is placed in the crimp portion, and the crimp portion engages and holds the cable. The crimp portion of the terminal connector is an over molded, gas tight crimp, which over molds the wiring and substantially prevents air and moisture contact with the wire. To further prevent corrosion, a corrosive resistant material may be applied to the wire and/or terminal connector. Further, the wire and/or terminal connector may be may be coated in tin, zinc, or lead plating or other corrosive resistant metal.

The terminal connector and at least a portion of the cable are housed in a junction housing. The junction housing may include a flange for receiving the cable. The flange may have strain relief properties. Further, the flange can be adhered or otherwise sealed to the cable by use of an adhesive, heat shrinking, or the like. The junction housing further includes
an opening that allows for access to the internals of the junction housing. The opening allows access to insert a nut or other device for connecting the terminal connector to a terminal. The opening also allows access for cleaning of the internal cavity of the housing. Further, the opening may be used to inject anticorrosive gel into the junction housing.

[0010] During installation, the terminal connector is inserted into the junction housing. A terminal, such as the terminal of a battery or a connection to an electrical circuit, is inserted in a hole in the terminal portion of the terminal connector. A connector is then placed on top of the terminal to secure the terminal connector in place. The junction housing may also include a lead plating located proximate to the opening. This lead plating also aids in reducing corrosion and promoting electrical contact. Further, the junction housing may include a protective cover, such as a cap, for covering the connector. The protective cover is sized to fit snugly over the connector. In some embodiments, the protective cover may include corrosive resistant material to aid in prevention of corrosion.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0011] Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

[0012] FIGS. 1A and 1B are respective top and side view of junction housing according to one embodiment of the present invention for connecting one or more cables either to each other or to a terminal;

[0013] FIG. 2 is a side view of a terminal connector and cable clamp configuration according to one embodiment of the present invention;

[0014] FIGS. 3A-3C are respective top, side, and cross-sectional views of a connector according to one embodiment of the present invention;

[0015] FIGS. 4A-4B are respective side and cross-sectional views of a connector according to another embodiment of the present invention;

[0016] FIGS. 5A-5C are respective views of an operation of connecting the connector of FIGS. 4A-4B to a terminal according to one embodiment of the present invention;

[0017] FIGS. 6A-6C are respective top, bottom, and side views of a terminal connector according to one embodiment of the present invention; and

[0018] FIGS. 7A-7D are respective views of an operation of connecting the connector of FIGS. 4A-4B and a terminal connector of FIGS. 6A-6C to a terminal according to one embodiment of the present invention.

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DETAILED DESCRIPTION OF THE INVENTION

[0019] The present inventions now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the inventions are shown. Indeed, these inventions may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

[0020] The present invention provides various embodiments and methods for aiding in the prevention of corrosion of electrical terminals, such as battery terminals or the like.

[0021] With reference to FIG. 1A, a first embodiment of the present invention is illustrated. This embodiment discloses a terminal connection system that reduces instances of corrosion associated with an electrical connection. As illustrated, the embodiment includes a junction housing 10 for receiving one or more cables 12. The junction housing can be used to connect one cable to a terminal. Further, the junction housing, such as illustrated in FIG. 1A, may be used to connect two separate cables to each other and/or to a terminal. This embodiment would be employed in situations where two or more batteries are connected in series or parallel, with cabling used to connect the batteries.

[0022] FIG. 2 illustrates an exemplary cable used with the present invention. As illustrated, the cable is a standard electrical cable comprising either of a unitary or stranded wire. The wire is connected to a terminal connector 14, which in this embodiment comprises a crimp portion 14a, formed in a hex shape, and a terminal portion 14b. As apparent to those skilled in the art, the end of the cable 12 is placed in the crimp portion 14a of the terminal connector 14, and the crimp portion 14a engages and holds the cable.

[0023] The crimp portion of 14a of the terminal connector is an over molded, gas tight crimp, which over molds the wiring and substantially prevents air and moisture contact with the wire. To further prevent corrosion, a corrosive resistant material may be applied to the wire and/or terminal connector 14. Further, the wire and/or terminal connector may be may be coated in tin, zinc, or lead plating or other corrosive resistant metal.

[0024] The corrosive resistant material can be any material, such as a gel, powder, or liquid that provides anti-corrosive and/or lubricant properties. For example, the corrosive resistant material could be grease or other type of lubricant. In one embodiment, the corrosive resistant material is a lubricant or anticorrosive material from Elisha Dynamic Coat or DeNOVUS E-2000 or RG-2400-AK or 04-JF30-001 anti-corrosive gel manufactured by
Elisha Products LLC. These types of materials, in addition to having anti-corrosive and/or lubricant properties may also have conductive properties. The corrosive resistant material may prevent corrosion, act as a lubricant, and/or promote electrical conduction.

[0025] Returning to FIG. 1A, the terminal connector 14, not shown, and at least a portion of the cable 12 are housed in the junction housing 10. The junction housing 10 may include a flange 16 for receiving the cable 12. The flange may have strain relief properties. Further, the flange can be adhered or otherwise sealed to the cable 12 by use of an adhesive, heat shrinking, or the like.

[0026] With further reference to FIG. 1, the junction housing 10 further includes an opening 18. The opening allows for access to the internals of the junction housing. In particular, the opening 18 allows access to insert a nut or other device for connecting the terminal connector 14 to a terminal, not shown. The opening also allows access for cleaning of the internal cavity of the housing. Further, the opening may be used to inject anticorrosive gel into the junction housing 10.

[0027] As illustrated in FIG. 1A, during installation, the terminal connector is inserted into the junction housing 10. A terminal 20, such as the terminal of a battery or a connection to an electrical circuit, is inserted in a hole in the terminal portion 14b of the terminal connector. With reference to FIG. 1B, a connector 22 is then placed on top of the terminal 20 to secure the terminal connector in place. For example, as illustrated in FIG. 1A, the terminal 20 may be a threaded rod. In this embodiment, the connector 22 is a threaded nut that mates with the terminal 20. In other embodiments, the connector 22 could be a threaded rod and the terminal 20 could be a threaded nut. Still, in other embodiments, the connector 22 could be a clamp that clamps on to the terminal 20.

[0028] With regard to FIGs. 1A and 1B, the junction housing 10 may also include a section of the housing that is not overcoated with insulation, as the insulation may trap moisture. In this open section, the junction housing includes lead plating 50 located proximate to the opening 18. This lead plating also aids in reducing corrosion and promoting electrical contact. Further, the junction housing may include a protective cover 24, such as a cap, for covering the connector 22. The protective cover is sized to fit snugly over the connector 22. In some embodiments, the protective cover may include corrosive resistant material to aid in prevention of corrosion. As with the connector 20 discussed later in FIGs. 3A-3C, the connector could include channels for maintaining the corrosive resistant material.

[0029] As will be discussed in greater detail below, the present invention provides various methods and structures for the delivery of corrosive resistant materials to terminals.
The structures of the present invention are typically in the form of channels located in various terminal structures. They provide space for retaining the corrosive resistant material. When the terminal component is used, such as by inserting other components therein, the corrosive resistant material is released from the channels and coats the various electrical components.

For example, as illustrated in FIG. 1A, the junction housing 10 may further include channels 26 located in the housing. The channels are illustrated as extending longitudinally along the length of the junction housing. However, it is understood that any configuration of the channels is contemplated. The channels 26 are filled with corrosive resistant material. In this embodiment, when a connector, such as connector 14, is inserted into the junction housing 10, the corrosive resistant material coats the terminal and the wire strands of the cable, as well as the terminal 20, thereby protecting same from corrosion.

The junction housing of FIGs. 1A and 1B may also be designed to accommodate sense wires used to monitor and test the integrity of electrical cables. Specifically, current "smart" cables, are constructed with small sense wires, typically twenty (20) gage, that are used to measure the voltage drop in a battery cable. The junction housing 10 of the present invention is structured to accommodate these sense wires. In particular, the sense wire or wires are crimped into crimp portion 14a of the terminal connector 14 and covered with an insulation such as Santoprene to create a cover mold.

The junction housing further includes wire channels, not shown, located either on the inside or outside of the junction housing. The sensing wires are located in these wire channels to thereby protect the sense wires and prevent the wires from shorting out with the remaining electrical components.

In some embodiments, other wiring or cabling may also accompany the electrical cable 12. For example, fiber optic cabling may be either an integral part of or collocated with the electrical cable 12. In these embodiments, the wire channels may accommodate the fiber optic cabling.

As discussed above, the present invention uses a connector 22 and terminal 20 that are threaded for connecting electrical cabling to a terminal, such as a battery terminal. Further, as discussed above, the present invention discloses the use of grooves or channels 26 for retaining corrosive resistant gel. FIGs. 3A-3C disclose an embodiment comprising connector 30 in the form of a threaded nut for connection to a terminal 20 in the form of a threaded rod. For example, as illustrated in FIG. 1B, the threaded nut may be a connector 22 for connecting to a terminal 20 in the form of a threaded rod.
As illustrated, the connector 30 of this embodiment comprises a housing 32 extending longitudinally. Located in the housing is a series of threads 34 extending along the longitudinal axis for connecting the connector 30 to a threaded rod. The connector further includes one or more channels 26. The channels 26 are illustrated in this embodiment as extending along the longitudinal axis of the connector 30. This is only one embodiment of the channels' orientation. For example, the channels may be in the form of a spiral that extends on the longitudinal axis of the connector. In some embodiments, the channels may be one or more circular rings having a diameter extending substantially perpendicular to the longitudinal extending axis of the connector.

As illustrated in FIGs. 3A-3C, the channels 26 are filled with a corrosive resistant material 38. As will be understood, when the connector 30 is threaded onto a terminal, such as a threaded rod, the corrosive resistant material located in the channels 26 is applied to the threads of the terminal to thereby coat the threads of the threaded rod.

FIGs. 4A and 4B illustrate an alternative embodiment for the connector 30. In this embodiment, the connector 30 has the same structure as that of FIGs. 3A-3C. However, in this embodiment, instead of initially placing the corrosive resistant material in the grooves or channels 26, the central cavity 36 of the connector 30 is filled with the corrosive resistant material 38. In this embodiment, when the connector 30 is placed on the threaded rod, the corrosive resistant material 38 is forced into the grooves or channels 26. Here again, the corrosive resistant material coats the threads of the connector 30 and threaded rod.

In particular, as illustrated in FIGs. 5A-5C, the corrosive resistant material 38 is forced upward by the force of the threaded rod 40, as the connector 30 is threaded on to the threaded rod 40. The excess lubricant is forced into the channels 26 adjacent to the central cavity 36, flowing back in the opposite direction and filling the channels 26.

The above embodiment illustrates channel 26 located in connector 30. It is understood, however, that in alternative embodiments, the channels could be in the terminal 20, such as grooves in a threaded rod. This embodiment would operate similarly to the above-described embodiment.

FIGs. 6A-6C illustrate a unique configuration of the terminal connector 14, according to one embodiment of the present invention. As illustrated, the terminal portion 14b of the terminal connector comprises a longitudinally extending body 42. The body comprises top 44a and bottom 44b surfaces. The bottom surface 44b is configured to mate with a terminal 20. The top surface 44a of the connector terminal is configured to mate with a connector 22.
[0041] As illustrated in FIG. 6A, in one embodiment, the terminal connector comprises one or more bores or vias 46 extending between the top and bottom surfaces. These bores are used to retain corrosive resistant corrosive resistant material. The bore 46 may either be pre-filled with corrosive resistant material or the corrosive resistant material may be applied during connection.

[0042] As illustrated in FIGS. 6B and 6C, either in addition to or alternatively, the terminal connector 14 may also include channels 48 located in either one or both the top and bottom surfaces 44a and 44b of the terminal connector. The grooves or channels 48 are configured to retain corrosive resistant material applied either at manufacture or during installation.

[0043] FIGS. 6A-6C illustrate an embodiment in which both the bores 46 and grooves or channels 48 are present in the terminal connector 14. In this embodiment, the bores are in fluid communication with the grooves or channels 48. When corrosive resistant material is applied to the terminal connector, the corrosive resistant material may enter the bores 46 and fill the grooves or channels 48.

[0044] As an example, FIGS. 7A-7D illustrate the assembly of a connector 30 according to FIGS. 4A and 4B to a terminal connector 14 according to FIGS. 6A-6C. As illustrated, the terminal connector 14 is first located on a terminal 20. When the connector 30 is threaded onto the terminal 20, the corrosive resistant material 38 is pushed from the central cavity 36 into the channels 26. As the connector continues to thread onto the terminal, some of the corrosive resistant material is forced out of the connector and into the bores 46 of the terminal connector 14. The corrosive resistant material further enters into the channels 26 of the terminal connector. In this manner, the terminal 20 and the terminal connector 14 are both coated in the corrosive resistant material, thereby protecting them from corrosion.

[0045] The present invention has been described in terms of use with an electrical contact component. However, other uses are contemplated. Essentially, the present invention may be used in any application where a connector is used in which rust, corrosion, or the like is likely to occur. For example, the present invention may be used for lug nuts for tires, frame rail hardware, battery connections, alternator connections, brake components, general construction, marine, agriculture, etc.

[0046] Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific
embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.
THAT WHICH IS CLAIMED:

1. A connector system having corrosion reduction properties, said system comprising:
   a first connector portion having a cavity; and
   a second connector portion having an elongated portion for fitting into the cavity of said first connector portion,
   wherein one of said first and second connectors comprises one or more channels located in said portion, wherein said channel is sized to accommodate a corrosive resistant material.

2. A connector system according to claim 1, wherein the corrosive resistant material is located in the channel prior to mating of the first and second connector portions together.

3. A connector system according to claim 1, wherein the corrosive resistant material is located in the cavity of said first connector portion prior to mating of the first and second connector portions together, such that when said first and second portions are mated together portions of the corrosive resistant material that is not coated on either said first or second portions is deposited in the channel.

4. A connector system according to claim 1, wherein the cavity of said first connector portion extends along a longitudinal extending axis of the first connector portion, and the channel extends along the longitudinal extending axis of the first connector portion.

5. A connector system according to claim 1, wherein the elongated portion of said second connector portion extends along a longitudinal axis, and the channel extends along the longitudinal extending axis of the elongated portion of said second connector portion.

6. A connector system according to claim 1, wherein the cavity of said first connector portion comprises threads and the elongated portion of said second connector portion comprises threads.

7. A connector system according to claim 1, wherein one of said first and second connector portions is an electrical terminal and the other is a connector, wherein said system further comprises a terminal connector for connecting an electrical cable to the terminal, said
terminal connector having a top surface for contacting said second connector portion and a bottom surface for contacting said first connector portion, wherein said terminal cable comprises one or more channels to accommodate the corrosive resistant material.

8. A connector system according to claim 7, wherein said terminal connector comprises one or more channels on the bottom surface and one or more bore holes extending between the top and bottom surfaces of said terminal connector.

9. A connector system having corrosion reduction properties, said system comprising a housing for accommodating one or more electrical cables, wherein said housing includes an internal cavity for housing the electrical cables, wherein the internal cavities comprises one or channels sized to accommodate a corrosive resistant material.

10. A connector system according to claim 9, wherein said housing comprises a molding for receiving an electrical cable and at least partially sealing about the electrical cable.

11. A connector system according to claim 9, further comprising a plating material on electrical wire in the electrical cable.

12. A connector system according to claim 9, wherein said housing comprises an opening for allowing a connector to connect to a terminal located in said housing.

13. A connector system according to claim 12, wherein said housing further comprises a cap for covering the connector.

14. A connector system according to claim 12, wherein said cap comprises and inner cavity filled with the corrosive resistant material.
# INTERNATIONAL SEARCH REPORT

## A. CLASSIFICATION OF SUBJECT MATTER

H01R13/52  H01R11/28

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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figure 3 | 1,3, 6,10,13, 14 |

Further documents are listed in the continuation of Box C. See patent family annex.

* "A" document defining the general state of the art which is not considered to be of particular relevance
* "E" earlier document but published on or after the international filing date
* "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
* "O" document referring to an oral disclosure, use, exhibition or other means
* "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered without reference to the document or field of endeavor

"Y" document of particular relevance; the claimed invention cannot be considered without reference to the document or field of endeavor

"K" document member of the same patent family

Date of the actual completion of the international search: 17 March 2006

Date of mailing of the international search report: 27/03/2006

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