

Description

The invention relates to a terminal apparatus for an electrolytic device such as a battery, and more particularly relates to a terminal apparatus installed in a battery container wall, compressibly set against the opening in the battery container wall so as to seal against gas and/or electrolyte leakage.

A recurring problem in the battery industry is that of being able to seal a battery terminal where it leaves the battery container. Ideally, a battery terminal should be able to seal against leakage of electrolyte and/or gases contained within the battery, whose escape would be undesirable.

One common approach is to cast an alloy lead bushing with multiple latitude rings and then mold the plastic of a battery case around the lead bushing. The intent of this approach is to try to get the plastic to shrink around the lead to maintain a seal between the lead and the plastic. However, thermal cycling will allow the plastic to creep in relation to the lead, due to the differences in coefficients of thermal expansion of the plastic and the metal. Thus, the seal will frequently fail, allowing capillary seepage at the interface of the plastic and lead.

Another approach to the problem has been to take a premolded alloy lead bushing and subsequently roll form or swage the bushing into a cavity in the plastic. Initially, this results in a tight, intimate sealing surface between the lead and the plastic. However, as time goes on, thermal cycling will again cause the opposing sealing surfaces of the metal and the plastic to creep relative to one another, again eventually allowing capillary seepage to occur at the interface.

Moreover, the designs described above are intended to operate with very little pressure differential across the seal. Battery systems exist which will exert considerably more pressure across the seal. For example, sealed lead-acid, starved electrolyte recombinant systems, such as are manufactured by Gates Energy Products of Denver, Colorado, operate over a pressure differential range of anywhere from partial vacuum to over 1.3 atmospheres. In a situation such as this, a much more efficient seal is required between the lead and the plastic at the terminal interface to permit prolonged use of such a battery without failure due to capillary seepage. Battery terminals using previous approaches in the art are only marginally acceptable in this application, and a need exists for a type of battery terminal which is more successful at withstanding these relatively higher working pressures and extending the overall field life of this type of battery. Of course, if a new type of battery terminal were to be developed which could successfully withstand these higher working pressures

and increase the life of this kind of battery, then it should also prove itself to be superior in performance in those battery applications requiring lower working pressures.

The present invention meets this need and over-comes the shortcomings of the prior work in the field. One of the aims of the invention is to produce a battery terminal capable of handling battery pressure differentials across terminal seals ranging from partial vacuum to several atmospheres. Another aim of the invention is to produce a battery terminal that would be highly resistant to capillary seepage after repeated thermal cycling. Yet another aim of the present invention is to provide a method of manufacturing such battery terminals in a relatively simple manufacturing method that would not require overly sophisticated manufacturing equipment or inordinately high amounts of capital investment.

Metals can be plastically deformed by various processes such as extrusion, drawing, rolling or swaging. A plastically deformed metal becomes stronger and the conventional index of plastic deformation is called cold work. Cold work is the amount of plastic strain introduced during processing of a metal. The increase in hardness resulting from plastic deformation during cold work is called strain hardening. Both the tensile strength and the yield strength of a metal are increased, and accompany this increasing hardness. In the operation known as swaging, metal is force-shaped to the contours of a tool. With regard to the present invention, a swaging operation occurs using an essentially cylindrical, tapered punch, which is forced down through the center of two annular bushings whose internal diameters are less than the external diameter of the punch, resulting in the metal being forced to expand radially and thereby affect work hardening.

With the foregoing in mind, the present invention provides an assembly for sealing against leakage of a fluid between a terminal positioned through an opening in a wall of a container and said wall, said opening defining a substantially annular portion having two opposed faces, said assembly comprising:

a first bushing mounted within said opening and having a collar and a flange; and

a second bushing mounted within said first bushing and having a collar and a flange, said flange of said first bushing contacting one of said faces and said flange of said second bushing contacting the other of said faces, said first bushing and said second bushing being plastically deformed by expansion into intimate sealing contact with one another and with said annular portion, a terminal being capable of sealing insertion through said second bushing.

According to another aspect of the present invention, there is provided an electrolytic device comprising:

- a. a container comprising a wall of resilient, electrolyte-resistant material, said wall having an opening therein;
- b. a first outer substantially annular bushing having a collar mounted interior of said wall opening and an outside flange;
- c. a second inner substantially annular bushing having a collar mounted interior of said first bushing and an outside flange, said first bushing and said second bushing being forced into intimate sealing contact with each other and said wall, the first bushing and the second bushing being work hardened by said expansion to different degrees; and
- d. a terminal post inserted through said second bushing.

The present invention further provides an electrolytic device comprising:

- a. a container comprising a wall of resilient, electrolyte-resistant material, said wall having an opening therein, surrounded by an enlarged portion defining a nonconductive polymeric bushing having at least one raised ridge thereon;
- b. a first outside substantially annular bushing, having a collar mounted interior of said polymeric bushing and an outside flange;
- c. a second inside substantially annular bushing, having a collar mounted interior of said first bushing and an outside flange, said first bushing and said second bushing being expanded into intimate sealing contact with each other and said polymeric bushing providing residual linear and axial stresses on sealing contact surfaces to help maintain said seal; and
- d. a terminal post inserted through said second bushing.

According to the present invention there is also provided a method of making a battery terminal connection through an opening in the battery case wall comprising the steps of:

- a. fabricating a suitable electrolyte-resistant battery case wall, leaving at least one opening therein defining a substantially annular portion and two opposed faces;
- b. installing a first, outer annular bushing having a collar and a flange into the opening of the case wall;
- c. installing a second, inner annular bushing having a collar and a flange into a bore in the first bushing; and
- d. sealing the first bushing, second bushing and wall opening together by swaging such that the flange of said first bushing contacts one of said faces and the flange of the second bushing contacts the other of said faces.

Specific embodiments of the present invention are now described, by way of example only, with reference to the accompanying drawings, in which:-

FIG. 1, as shown in cross-section, is one preferred embodiment of the improved battery terminal, showing the inner and outer bushings, the polymeric wall opening in which the bushings are mounted, a battery post and a battery terminal cap;

FIG. 2 is a schematic cross-section which indicates the preferred assembly orientation of the inner and outer bushings, and the polymeric wall opening in which they fit;

FIGS. 3, 4 and 5 illustrate three slightly different alternative embodiments of the first preferred embodiment of the invention, in which the inner bushing, outer bushing and polymeric wall opening have been swaged together into intimate sealing contact;

FIG. 6, as shown in cross-section, is a second preferred embodiment of the improved battery terminal showing the inner and outer bushings, the polymeric wall opening in which the bushings are mounted, the battery post and a battery terminal cap;

FIG. 7 is a schematic cross-section which indicates the preferred assembly orientation of the inner and outer bushings, and the polymeric wall opening in which they fit; and

FIGS. 8 and 9 illustrate two slightly different alternative embodiments of the second preferred embodiment of the invention in which the inner bushing, outer bushing and polymeric wall openings have been swaged together into intimate sealing contact with each other.

Turning first to FIG. 1, there is shown generally at 10 one preferred embodiment of the improved battery terminal. At 14 there is a first outer bushing, which is shown in intimate sealing contact with the sealing surface of an opening of a polymeric wall 16. It should be noted here that although the wall 16 has been denoted as being polymeric, it can be any material that is resistant to electrolytes, and which a manufacturer can adapt to his process of fabricating a container for the electrolytic apparatus under consideration. At 12 there is shown a second inner bushing adjacent the interior of the first outer bushing, likewise in intimate sealing contact. Through the annular opening of inner second bushing 12 there has been inserted a battery post means 20, which in this particular illustration is shown to be a post rising from the center of the disc, which disc will be in electrical contact with the contents of the battery. At 22 there is shown a battery terminal cap means which covers a substantial portion of the battery terminal apparatus.

Turning now to FIG. 2, there is shown in greater detail one preferred method of fitting together

the components of the battery terminal responsible for effecting a seal. The first outer bushing 14 is fabricated into a generally T-shaped bushing, having a collar and an outside flange. The first outer bushing is preferably lead, and most preferably an alloy of lead. The outside diameter of the collar of the first outside bushing 14 is only slightly smaller than the inside diameter of the polymeric container wall opening shown at 16. The polymeric container wall opening 16 has radially enlarged portions which form a polymeric bushing, which itself is comprised of an upright lip portion 25, a downward lip portion 27 and an intermediate annular portion 29. The intermediate annular portion 29 has a vertical face 26, and two opposed lower and upper horizontal faces, 24 and 28 respectively. Preferably, at least one of the three faces on the intermediate annular portion 29 will have a raised thread or ridge around its periphery, and most preferably there will be one such raised ridge on each of the three faces of the intermediate annular portion, which is illustrated by 30. In this regard, one is directed to the disclosure of U.S. Pat. No. 3,704,173, issued to McClelland et al., which discussed and illustrates structures similar to these raised ridges used in the sealing of an electrolytic device terminal.

After having inserted the first outer bushing 14 into the wall opening 16, the second inner bushing 12 is inserted from the bottom such that the second inner bushing's outside diameter is in contact with the inside diameter of the first outer bushing. The second inner bushing is generally T-shaped in cross-section, having a collar 32 and a flange 34, similar to those of the first outer bushing 14, except that the collar and flange of the second inner bushing 12 will be somewhat differently dimensionally shaped to effectuate a sealing surface around the first outer bushing 14 and polymeric bushing of the wall opening 16, as can be seen by referring back to FIG. 1. The second inner bushing 12 is preferably unalloyed lead, but may be an alloy of lead if special requirements of the battery necessitate it.

Having preassembled the first outer bushing 14 and the second inner bushing 12 into the polymeric bushing formed in the opening of the container wall 16 to form a subassembly, the next step is the swaging operation. Swaging operations are well known to those skilled in the art, and the process here is quite simple, inasmuch as it merely calls for the insertion of a cylindrically shaped, tapered punch to be inserted into the annular opening of second inner bushing 12. As the taper is progressively moved into the interior of second inner bushing 12, contact is made between the punch and the bushing, progressively forcing the material of first bushing 14 and second bushing 12 radially outward

against the contours of the polymeric bushing and the wall opening of the polymeric wall 16. Since lead and most alloys of lead are soft, ductile material, first outer bushing 14 will readily conform to the contours of the polymeric bushing, and likewise second inner bushing 12 will conform to the contours of both the first outer bushing 14 and the remaining contours of the polymeric bushing 16. The final result is the bushing seal subassembly shown generally at 36 in FIG. 3. At FIG. 3, the first outer bushing 14 has been swaged such that it has fully conformed to the upright lip portion 25 and the intermediate annular portion 29, along with the attendant raised ridges on the vertical and upper horizontal faces 26 and 28 of the intermediate annular portion 29. (The sealing contact between first outer bushing 14 and upper horizontal face 28 of the intermediate annular portion 29 is effected by an annular die which constrains the outer portions of the battery assembly during the swaging process.) The second inner bushing has been forced by the swaging operation into intimate sealing contact with the interior diameter of the first outer bushing, and with the lower horizontal face 24 of the intermediate annular portion 29, along with its attendant raised ridge 30. Those skilled in the art will recognize that it is generally desirable to attach at least one lug onto the flange of at least one of the bushings, which lug will seat in at least one correspondingly molded pocket in the polymeric bushing or wall in which the flange of the terminal is seated, so as to resist torsional rotation of the bushing and terminal in the battery wall.

Turning now to FIG. 6, there is shown generally a second preferred embodiment of the improved battery terminal. At 44 there is a first outer bushing, which is shown in intimate sealing contact with the sealing surface of an opening in the polymeric wall 46. At 42, there is shown a second inner bushing adjacent the interior of the first outer bushing, likewise in intimate sealing contact. Through the annular opening of inner second bushing 42 there has been inserted a battery post means 50, which in this particular illustration is likewise shown to be a post rising from the center of a disc, which disc will be in electrical contact with the contents of the battery or cell. At 52 there is shown a battery terminal cap means which covers a substantial portion of the battery terminal apparatus.

Turning now to FIG. 7, there is shown in greater detail the preferred method of fitting together the components of the second preferred embodiment of the battery terminal. A first outer bushing 44 is fabricated into a generally T-shaped bushing, having a collar and an outside flange. The outside diameter of the collar of the first outside bushing 44 is only slightly smaller than the inside diameter of the polymeric container wall opening shown at

46. The polymeric container wall 46 has radially enlarged portions which form a polymeric bushing, which itself is comprised of an upright lip portion 54, a downward lip portion 56 and an intermediate annular portion 58. The intermediate annular portion 58 has a vertical face 62, and two opposed lower and upper horizontal faces, 60 and 64 respectively. Preferably, at least one of the three faces on the intermediate annular portion 58 will have a raised thread or ridge around its periphery, and most preferably there will be one such raised ridge on each of the three faces of the intermediate annular portion, which is illustrated by 30. After having inserted the first outer bushing 44 into the wall opening 46, the second inner bushing 42 is inserted from the bottom, such that the second inner bushing's outside diameter is in contact with the inside diameter of the first outer bushing. The second inner bushing is dual-flanged. That is, it has a first collar 48, a first outside flange 50, a second collar 51 mounted on a different circumference of the first flange and oriented substantially opposed to the first collar 48, and a second flange 52 mounted on the second collar 51. Again, the second inner bushing 42 is preferably unalloyed lead, but may be an alloy of lead if special requirements of the battery necessitate it.

As before, having preassembled the first outer bushing 44, and the second inner bushing 42 into the polymeric bushing formed in the opening of the container wall 46 to form a subassembly, the next step is the swaging operation. A punch and die brought to bear on the subassembly will progressively force the material of the first bushing 44 and second bushing 42 radially outward against the contours of the polymeric bushing in the wall opening of the polymeric wall 46. Referring back to FIG. 6, it can be seen that the first outer bushing 44 has been swaged such that it is fully conformed to the upper horizontal face 60 of the intermediate annular portion 58, along with the attendant raised ridge thereon. The second inner bushing has been forced by the swaging operation into intimate sealing contact with the interior diameter of the first outer bushing, and with the vertical face 62 and lower horizontal face 64 of the intermediate annular portion 58, along with their attendant raised ridges.

In either of the most preferred embodiments of the invention, fluid (meaning liquid or gas) would have to effect capillary seepage across a plurality of faces and ridges as shown by the cross sections of FIGS. 1, 3 and 6. This sealing interface will be maintained through repeated thermal cycles because alternating expansions and contractions of the polymeric and metallic materials in contact with each other will be overcome by the stresses produced by the work hardening, which has been effected by the swaging operation. More particu-

larly, since in the most preferred embodiments of the invention the first outer bushing is an alloy of lead, and the second inner bushing is unalloyed lead, the first and second bushings will undergo differing degrees of work hardening. When the inner bushing is lead and the outer bushing is lead alloy, we have found that the inner bushing will undergo significant work hardening while the outer bushing will undergo relatively less work hardening, and retain a great deal of its soft, resilient characteristics so that it will readily conform to small changes in movement of the polymer. As alloys, we particularly prefer alloys of antimony or antimony-tin, with the alloying metal present in a range of 1-10% by weight, and most preferably present in concentrations of 2-5% by weight.

Furthermore, it should be noted that the swaging operation, which has cold worked the metal, has caused the sealing surfaces of the polymer to be preloaded with stresses in two dimensions, and across three surfaces. Specifically, the sealing surface of the polymer is preloaded by stress in both the axial and lateral directions indicated by arrows 37 and 39 in FIG. 3. (This observation holds true for either preferred embodiment of the invention.) This preloaded stress is distributed across the vertical face and the two opposed upper and lower horizontal faces of the intermediate annular portion 29 of FIG. 2 or 58 of FIG. 7, along with its attendant raised ridges in the most preferred embodiments of the invention. This bi-dimensional, three-surfaced preloaded stress interface forms an exceptionally good barrier to fluid capillary seepage.

FIGS. 8 and 9 illustrate alternative means at 66 and 68 whereby the sealing distance, across which fluids would have to effect capillary seepage, can be increased. Conceivably, the types of channels or ridges shown at 66 and 68 could be produced in not only the vertical face alone, 66 of FIG. 8, or the horizontal faces alone, 68 of FIG. 9, but in the combined horizontal and vertical faces simultaneously as well.

Thereafter, in the assembly of the improved battery terminal, a post means 20 in FIG. 1, or 50 in FIG. 6, is inserted through the interior diameter of the second inner bushing, and a battery terminal cap means 22 in FIG. 1, or 52 in FIG. 6, is attached to the post means and the lead and lead alloy inner and outer bushings. The terminal cap means is most preferably of lead alloy, as it will have to bear the stresses of various clamping means used to connect the terminal of the battery to electrical circuits. The terminal cap means 22 can be cast on or burned on according to methods well known to those skilled in the art. For example, casting the terminal cap means onto the terminal post means at a sufficiently high temperature to cause at least partially molten portions of the cast molten material

to penetrate and seal off any remaining interstices between the battery post, second inner bushing, and first outer bushing.

It is thought that the improved battery terminal and method of the present invention and its intended advantages will be understood from the foregoing description, and it will be apparent to those skilled in the art that various changes may be made in the form, construction and arrangements of the parts thereof without departing from the spirit and scope of the invention or sacrificing all of its material advantages. It should be understood that various alternative embodiments are feasible, as illustrated in FIGS. 3, 4, 5, 8 and 9. For example, although not illustrated, an SAE-type terminal design could as easily be used in lieu of the post illustrated. The forms herein described are merely preferred embodiments, and the description herein should not be construed or interpreted as the only embodiment. Although this description has largely discussed application of this invention to the construction of lead terminals for electrolytic devices, this is only one major application of the technology and other applications to the production of other products, such as terminals for effecting fluid type seals in other types of containers are not intended to be precluded. Furthermore, the foregoing specification is also intended to form the necessary disclosure for a method of producing the improved battery terminal, as reflected in the title of this invention. The following claims should therefore be interpreted as broadly as is reasonable.

Claims

1. An assembly for sealing against leakage of a fluid between a terminal (20) positioned through an opening in a wall (16) of a container and said wall (16), said opening defining a substantially annular portion having two opposed faces (24, 28), said assembly comprising:
 - a first bushing (14) mounted within said opening and having a collar and a flange; and
 - a second bushing (12) mounted within said first bushing (14) and having a collar and a flange, said flange of said first bushing (14) contacting one of said faces (28) and said flange of said second bushing (12) contacting the other of said faces (24), said first bushing (14) and said second bushing (12) being plastically deformed by expansion into intimate sealing contact with one another and with said annular portion, a terminal (20) being capable of sealing insertion through said second bushing (12).
2. An assembly as claimed in Claim 1, wherein said wall (16) is a suitable electrolyte resistant, resilient polymeric material.
3. An assembly as claimed in Claim 1 or Claim 2, wherein the first outer bushing (14) is made of a conductive metal.
4. An assembly as claimed in Claim 1, wherein the first outer bushing (14) is made of lead.
5. An assembly as claimed in Claim 1, wherein the first outer bushing (14) is made of an alloy of lead.
6. An assembly as claimed in any preceding claim, wherein the second bushing (12) further comprises a second collar (51) mounted on a different circumference of the flange (50) and oriented substantially opposed to the collar (48), and a second flange (52) mounted on the second collar (51).
7. An assembly as claimed in Claim 1, wherein said first bushing (14) is made of an alloy of lead and said second bushing (12) is made of unalloyed lead thereby causing said first bushing to undergo relatively less work hardening effected by said expansion than said second bushing.
8. An assembly as claimed in Claim 1, wherein the second bushing (12) is made of a conductive metal.
9. An assembly as claimed in Claim 1, wherein the second bushing (12) is made of lead.
10. An assembly as claimed in Claim 1, wherein the second bushing (12) is made of an alloy of lead.
11. An assembly as claimed in Claim 5, wherein the alloy comprises lead with an antimony content of 1-10% by weight.
12. An assembly as claimed in Claim 5, wherein the alloy comprises lead with an antimony content of from 2-5% by weight.
13. An electrolytic device comprising:
 - a. a container comprising a wall (16) of resilient, electrolyte-resistant material, said wall having an opening therein;
 - b. a first outer substantially annular bushing (14) having a collar mounted interior of said wall opening and an outside flange;



to penetrate and seal off any remaining interstices between the battery post, second inner bushing, and first outer bushing.

It is thought that the improved battery terminal and method of the present invention and its intended advantages will be understood from the foregoing description, and it will be apparent to those skilled in the art that various changes may be made in the form, construction and arrangements of the parts thereof without departing from the spirit and scope of the invention or sacrificing all of its material advantages. It should be understood that various alternative embodiments are feasible, as illustrated in FIGS. 3, 4, 5, 8 and 9. For example, although not illustrated, an SAE-type terminal design could as easily be used in lieu of the post illustrated. The forms herein described are merely preferred embodiments, and the description herein should not be construed or interpreted as the only embodiment. Although this description has largely discussed application of this invention to the construction of lead terminals for electrolytic devices, this is only one major application of the technology and other applications to the production of other products, such as terminals for effecting fluid type seals in other types of containers are not intended to be precluded. Furthermore, the foregoing specification is also intended to form the necessary disclosure for a method of producing the improved battery terminal, as reflected in the title of this invention. The following claims should therefore be interpreted as broadly as is reasonable.

Claims

1. An assembly for sealing against leakage of a fluid between a terminal (20) positioned through an opening in a wall (16) of a container and said wall (16), said opening defining a substantially annular portion having two opposed faces (24, 28), said assembly comprising:
 - a first bushing (14) mounted within said opening and having a collar and a flange; and
 - a second bushing (12) mounted within said first bushing (14) and having a collar and a flange, said flange of said first bushing (14) contacting one of said faces (28) and said flange of said second bushing (12) contacting the other of said faces (24), said first bushing (14) and said second bushing (12) being plastically deformed by expansion into intimate sealing contact with one another and with said annular portion, a terminal (20) being capable of sealing insertion through said second bushing (12).
2. An assembly as claimed in Claim 1, wherein said wall (16) is a suitable electrolyte resistant, resilient polymeric material.
3. An assembly as claimed in Claim 1 or Claim 2, wherein the first outer bushing (14) is made of a conductive metal.
4. An assembly as claimed in Claim 1, wherein the first outer bushing (14) is made of lead.
5. An assembly as claimed in Claim 1, wherein the first outer bushing (14) is made of an alloy of lead.
6. An assembly as claimed in any preceding claim, wherein the second bushing (12) further comprises a second collar (51) mounted on a different circumference of the flange (50) and oriented substantially opposed to the collar (48), and a second flange (52) mounted on the second collar (51).
7. An assembly as claimed in Claim 1, wherein said first bushing (14) is made of an alloy of lead and said second bushing (12) is made of unalloyed lead thereby causing said first bushing to undergo relatively less work hardening effected by said expansion than said second bushing.
8. An assembly as claimed in Claim 1, wherein the second bushing (12) is made of a conductive metal.
9. An assembly as claimed in Claim 1, wherein the second bushing (12) is made of lead.
10. An assembly as claimed in Claim 1, wherein the second bushing (12) is made of an alloy of lead.
11. An assembly as claimed in Claim 5, wherein the alloy comprises lead with an antimony content of 1-10% by weight.
12. An assembly as claimed in Claim 5, wherein the alloy comprises lead with an antimony content of from 2-5% by weight.
13. An electrolytic device comprising:
 - a. a container comprising a wall (16) of resilient, electrolyte-resistant material, said wall having an opening therein;
 - b. a first outer substantially annular bushing (14) having a collar mounted interior of said wall opening and an outside flange;



- c. a second inner substantially annular bushing (12) having a collar mounted interior of said first bushing and an outside flange, said first bushing and said second bushing being forced into intimate sealing contact with each other and said wall, the first bushing and the second bushing being work hardened by said expansion to different degrees; and
- d. a terminal post (20) inserted through said second bushing.
14. A device as claimed in Claim 13, wherein the terminal post (20) has a base that is attached to a disc which is in electrical contact with the contents of the electrolytic device, the post and the disc being made of lead.
15. A device as claimed in Claim 13, wherein the first outer bushing (14) is made to undergo a greater degree of work hardening by expansion than the second inner bushing (12).
16. A device as claimed in Claim 13, wherein the second inner bushing (12) is made to undergo a greater degree of work hardening by expansion than the first outer bushing (14).
17. A device as claimed in any one of Claims 13 to 16, wherein the second inner bushing (12) is dual flanged.
18. A device as claimed in Claim 13, wherein the wall opening defines a sealing surface having at least one raised ridge (30).
19. An electrolytic device comprising:
- a container comprising a wall (16) of resilient, electrolyte-resistant material, said wall having an opening therein, surrounded by an enlarged portion defining a nonconductive polymeric bushing having at least one raised ridge (30) thereon;
 - a first outside substantially annular bushing (14), having a collar mounted interior of said polymeric bushing and an outside flange;
 - a second inside substantially annular bushing (12), having a collar mounted interior of said first bushing and an outside flange, said first bushing and said second bushing being expanded into intimate sealing contact with each other and said polymeric bushing providing residual linear and axial stresses on sealing contact surfaces to help maintain said seal; and
 - a terminal post (20) inserted through said second bushing.
20. A device as claimed in Claim 19, wherein said polymeric bushing is further comprised of:
- an upright lip portion (25);
 - a downward lip portion (27); and
 - an intermediate annular portion (29) having a vertical face (26) and two opposed upper and lower horizontal faces (28, 24).
21. A device as claimed in Claim 20, wherein at least one raised ridge (30) is present on the vertical (26), the upper horizontal (28) or the lower horizontal (24) face of the polymeric bushing.
22. A device as claimed in Claim 20, wherein one raised ridge (30) is present on the vertical (26), the upper horizontal (28) and the lower horizontal (24) face of the polymeric bushing.
23. A device as claimed in any one of Claims 19 to 22, wherein the second bushing is dual flanged.
24. A device as claimed in any one of Claims 19 to 23, wherein the outside flange of the first outside bushing has mounted thereon at least one lug, which at least one lug will be seated in at least one correspondingly molded pocket in the polymeric bushing, so as to resist torsional rotation of the bushing.
25. A method of making a battery terminal connection through an opening in the battery case wall comprising the steps of:
- fabricating a suitable electrolyte-resistant battery case wall, leaving at least one opening therein defining a substantially annular portion and two opposed faces;
 - installing a first, outer annular bushing having a collar and a flange into the opening of the case wall;
 - installing a second, inner annular bushing having a collar and a flange into a bore in the first bushing; and
 - sealing the first bushing, second bushing and wall opening together by swaging such that the flange of said first bushing contacts one of said faces and the flange of the second bushing contacts the other of said faces.

Patentansprüche

1. Anordnung zum Abdichten gegen das Auslaufen von Fluid zwischen einem Anschluß (20), der sich durch eine Öffnung in einer Wand (16) eines Behälters erstreckt, und dieser Wand (16), wobei die Öffnung einen im wesentlichen



- ringförmigen Bereich mit zwei entgegengesetzten Flächen (24, 28) begrenzt, wobei die Anordnung aufweist:
- eine in der Öffnung angebrachte und mit einem Kragen und einem Flansch versehene erste Buchse (14); und
 - eine in der ersten Buchse (14) angebrachte zweite Buchse (12) mit einem Kragen und einem Flansch, wobei der Flansch der ersten Buchse (14) eine der Flächen (28) und der Flansch der zweiten Buchse (12) die andere der Flächen (24) berührt, wobei die erste Buchse (14) und die zweite Buchse (12) durch Dehnung zum eng anliegenden Dichtkontakt miteinander und mit dem ringförmigen Bereich plastisch verformt sind, wobei ein Anschluß (20) dicht durch die zweite Buchse (12) hindurch einsetzbar ist.
2. Anordnung nach Anspruch 1, bei der die Wand (16) aus einem geeigneten elektrolytbeständigen elastischen Polymermaterial besteht.
 3. Anordnung nach Anspruch 1 oder Anspruch 2, bei der die äußere erste Buchse (14) aus einem leitenden Material besteht.
 4. Anordnung nach Anspruch 1, bei der die äußere erste Buchse (14) aus Blei besteht.
 5. Anordnung nach Anspruch 1, bei der die äußere erste Buchse (14) aus einer Bleilegierung besteht.
 6. Anordnung nach einem der vorhergehenden Ansprüche, bei der die zweite Buchse (12) ferner einen an einem anderen Umfang des Flansches (50) angebrachten und zu dem Kragen (48) im wesentlichen gegenüberliegend orientierten zweiten Kragen (51) und einen an dem zweiten Kragen (51) angebrachten zweiten Flansch (52) aufweist.
 7. Anordnung nach Anspruch 1, bei der die erste Buchse (14) aus einer Bleilegierung und die zweite Buchse (12) aus unlegiertem Blei besteht, wodurch die erste Buchse im Verhältnis eine geringere Kaltverfestigung durch das Dehnen erfährt als die zweite Buchse.
 8. Anordnung nach Anspruch 1, bei der die zweite Buchse (12) aus einem leitenden Material besteht.
 9. Anordnung nach Anspruch 1, bei der die zweite Buchse (12) aus Blei besteht.
 10. Anordnung nach Anspruch 1, bei der die zweite Buchse (12) aus einer Bleilegierung besteht.
 11. Anordnung nach Anspruch 5, bei der die Legierung Blei mit einem Antimongehalt von 1-10 Gewichtsprozent enthält.
 12. Anordnung nach Anspruch 5, bei der die Legierung Blei mit einem Antimongehalt von 2-5 Gewichtsprozent enthält.
 13. Elektrolytvorrichtung mit:
 - a. einem Behälter mit einer Wand (16) aus elastischem elektrolytbeständigem Material, wobei die Wand eine Öffnung aufweist;
 - b. einer im wesentlichen ringförmigen äußeren ersten Buchse (14) mit einem in der Wandöffnung angebrachten Kragen und einem Außenflansch;
 - c. einer im wesentlichen ringförmigen inneren zweiten Buchse (12) mit einem in der ersten Buchse angebrachten Kragen und einem Außenflansch, wobei die erste Buchse und die zweite Buchse in eng anliegenden Dichtkontakt miteinander und mit der Wand gebracht sind, und wobei die erste Buchse und die zweite Buchse durch die Dehnung in verschiedenen Graden kaltverfestigt sind; und
 - d. einen durch die zweite Buchse hindurchgeführten Anschlußpol (20).
 14. Vorrichtung nach Anspruch 13, bei der der Anschlußpol (20) eine Basis aufweist, die an einer Scheibe befestigt ist, welche in elektrischem Kontakt mit dem Inhalt der Elektrolytvorrichtung steht, wobei der Pol und die Scheibe aus Blei bestehen.
 15. Vorrichtung nach Anspruch 13, bei der die äußere erste Buchse (14) einem höheren Grad an Kaltverfestigung durch Dehnung ausgesetzt wird als die innere zweite Buchse (12).
 16. Vorrichtung nach Anspruch 13, bei der die innere zweite Buchse (12) einem höheren Grad an Kaltverfestigung durch Dehnung ausgesetzt ist als die äußere erste Buchse (14).
 17. Vorrichtung nach einem der Ansprüche 13 bis 16, bei der die innere zweite Buchse (12) zwei Flansche aufweist.
 18. Vorrichtung nach Anspruch 13, bei der die Wandöffnung eine Dichtfläche mit wenigstens einem erhabenen Steg (30) begrenzt.
 19. Elektrolysevorrichtung mit:



- a. einem Behälter mit einer Wand (16) aus elastischem elektrolytbeständigem Material, wobei die Wand eine Öffnung aufweist, die von einem vergrößerten Bereich umschlossen ist, der eine nichtleitende Polymerbuchse mit wenigstens einem erhabenen Steg (30) bildet;
- b. einer im wesentlichen ringförmigen äußeren ersten Buchse (14) mit einem in der Polymerbuchse angebrachten Kragen und einem Außenflansch;
- c. einer im wesentlichen ringförmigen inneren zweiten Buchse (12) mit einem in der ersten Buchse angebrachten Kragen und einem Außenflansch, wobei die erste Buchse und die zweite Buchse in eng anliegenden Dichtkontakt miteinander und mit der Polymerbuchse gedehnt sind, und die Polymerbuchse zum Unterstützen des Aufrechterhaltens der Abdichtung lineare und axiale Restspannungen auf die Dichtkontaktflächen aufbringt; und
- d. einem durch die zweite Buchse hindurchgeführten Anschlußpol (20).
20. Vorrichtung nach Anspruch 19, bei der die Polymerbuchse ferner besteht aus:
- a. einem aufwärts gerichteten Lippenteil (25);
- b. einem abwärts gerichteten Lippenteil (27); und
- c. einem ringförmigen Mittelteil (29), der eine vertikale Fläche (26) und zwei einander entgegengesetzte obere und untere horizontale Flächen (28, 24) aufweist.
21. Vorrichtung nach Anspruch 20, bei der wenigstens ein erhabener Steg (30) an der vertikalen (26), der oberen horizontalen (28) oder der unteren horizontalen Fläche (24) der Polymerbuchse vorgesehen ist.
22. Vorrichtung nach Anspruch 20, bei der ein erhabener Steg (30) an der vertikalen (26), der oberen horizontalen (28) oder der unteren horizontalen Fläche (24) der Polymerbuchse vorgesehen ist.
23. Vorrichtung nach einem der Ansprüche 19 bis 22, bei der die zweite Buchse zwei Flansche aufweist.
24. Vorrichtung nach einem der Ansprüche 19 bis 23, bei der mindestens ein Ansatz an dem Außenflansch der äußeren ersten Buchse angebracht ist, wobei der mindestens eine Ansatz derart in wenigstens eine entsprechend geformte Tasche der Polymerbuchse eingesetzt wird, daß er einer Verdrehung der Buchse entgegenwirkt.
25. Verfahren zur Herstellung einer Batteriepolverbindung durch eine Öffnung in der Batteriegehäusewand mit den folgenden Schritten:
- a. Herstellen einer geeigneten elektrolytbeständigen Batteriegehäusewand, wobei wenigstens eine Öffnung darin belassen wird, die einen im wesentlichen ringförmigen Bereich und zwei entgegengesetzte Flächen begrenzt;
- b. Einsetzen einer ersten äußeren ringförmigen Buchse mit einem Kragen und einem Flansch in die Öffnung der Gehäusewand;
- c. Einsetzen einer zweiten inneren ringförmigen Buchse mit einem Kragen und einem Flansch in eine Bohrung der ersten Buchse; und
- d. Gegeneinander-Abdichten der ersten Buchse, der zweiten Buchse und der Wandöffnung durch Aufweiten, derart, daß der Flansch der ersten Buchse eine der Flächen und der Flansch der zweiten Buchse die andere der Flächen berührt.

Revendications

1. Ensemble d'étanchéité contre les fuites d'un fluide entre une borne (20) placée à travers un trou dans une cloison (16) d'un récipient et à travers ladite cloison (16), ledit trou définissant une partie sensiblement annulaire ayant deux faces opposées (24, 28), ledit ensemble comprenant :
- une première douille (14) montée dans ledit trou et comprenant un collier et un rebord ; et
- une seconde douille (12) montée dans ladite première douille (14) et ayant un collier et un rebord, ledit rebord de ladite première douille (14) étant en contact avec l'une desdites faces (28) et ledit rebord de ladite seconde douille (12) étant en contact avec l'autre desdites faces (24), ladite première douille (14) et ladite seconde douille (12) étant déformées plastiquement par déploiement de manière à être en contact étroit d'étanchéité l'une avec l'autre et avec ladite partie annulaire, une borne (20) étant capable d'être introduite de manière étanche à travers ladite seconde douille (12).
2. Ensemble selon la revendication 1, dans lequel ladite cloison (16) est en un polymère élastique convenable, résistant à l'électrolyte.



3. Ensemble selon la revendication 1 ou 2, dans lequel la première douille extérieure (14) est réalisée en un métal conducteur.
4. Ensemble selon la revendication 1, dans lequel la première douille extérieure (14) est réalisée en plomb. 5
5. Ensemble selon la revendication 1, dans lequel la première douille extérieure (14) est réalisée en un alliage de plomb. 10
6. Ensemble selon l'une quelconque des revendications précédentes, dans lequel la seconde douille (12) comprend de plus un second collier (51) placé sur une circonférence différente du rebord (50) et orienté sensiblement à l'opposé du collier (48), ainsi qu'un second rebord (52) placé sur le second collier (51). 15
7. Ensemble selon la revendication 1, dans lequel ladite première douille (14) est réalisée en un alliage de plomb et ladite seconde douille (12) est réalisée en plomb non allié de manière que ladite première douille subisse un relativement moindre durcissement par déformation provoqué par ledit déploiement que ladite seconde douille. 20
8. Ensemble selon la revendication 1, dans lequel ladite seconde douille (12) est réalisée en un métal conducteur. 25
9. Ensemble selon la revendication 1, dans lequel ladite seconde douille (12) est réalisée en plomb. 30
10. Ensemble selon la revendication 1, dans lequel ladite seconde douille (12) est réalisée en un alliage de plomb. 35
11. Ensemble selon la revendication 5, dans lequel ledit alliage consiste en plomb ayant une teneur en antimoine de 1 à 10 % en poids. 40
12. Ensemble selon la revendication 5, dans lequel ledit alliage consiste en plomb ayant une teneur en antimoine de 2 à 5 % en poids. 45
13. Dispositif électrolytique comprenant : 50
 - a. un récipient comprenant une cloison (16) de matière élastique, résistante à l'électrolyte, ladite cloison comportant un trou ;
 - b. une première douille extérieure sensiblement annulaire (14) ayant un collier monté à l'intérieur dudit trou de la cloison, ainsi qu'un rebord extérieur ; 55
 - c. une seconde douille intérieure sensiblement annulaire (12) comprenant un collier placé à l'intérieur de ladite première douille, ainsi qu'un rebord extérieur, ladite première douille et ladite seconde douille étant introduites à force et en contact étroit d'étanchéité l'une dans l'autre et dans ladite cloison, la première douille et la seconde douille subissant un durcissement par déformation par ledit déploiement à des degrés différents ; et
 - d. un plot de borne (20) introduit à travers ladite seconde douille.
14. Dispositif selon la revendication 13, dans lequel le plot de la borne (20) comprend une base qui est fixée à un disque qui est en contact électrique avec les contenus du dispositif électrolytique, la borne et le disque étant réalisés en plomb.
15. Dispositif selon la revendication 13, dans lequel la première douille extérieure (14) est réalisée de manière qu'elle subisse un plus grand degré de durcissement par déformation par déploiement que la seconde douille intérieure (12).
16. Dispositif selon la revendication 13, dans lequel la seconde douille intérieure (12) est réalisée de manière qu'elle subisse un plus grand degré de durcissement par déformation par déploiement que la première douille extérieure (14).
17. Dispositif selon l'une quelconque des revendications 13 à 16, dans lequel la seconde douille intérieure (12) est à rebord double.
18. Dispositif selon la revendication 13, dans lequel le trou de la cloison délimite une surface d'étanchéité comprenant au moins une nervure (30) en relief.
19. Dispositif électrolytique comprenant :
 - a. un récipient comprenant une cloison (16) de matière élastique résistante à l'électrolyte, ladite cloison comportant un trou entouré d'une partie élargie constituant une douille de polymère non conducteur comportant au moins une nervure en relief (30) ;
 - b. une première douille extérieure sensiblement annulaire (14) comprenant un collier monté à l'intérieur de ladite douille de polymère, ainsi qu'un rebord extérieur ;
 - c. une seconde douille intérieure sensiblement annulaire (12) comprenant un collier monté à l'intérieur de ladite première douille.



- le, ainsi qu'un rebord extérieur, ladite première douille et ladite seconde douille étant déployées en contact étroit d'étanchéité l'une dans l'autre et dans ladite douille de polymère de façon à créer des efforts résiduels linéaires et axiaux sur les surfaces de contact d'étanchéité pour contribuer à conserver ladite étanchéité ; et
- d. un plot de borne (20) introduit dans ladite seconde douille.
20. Dispositif selon la revendication 19, dans lequel ladite douille de polymère se compose par ailleurs :
- a. d'un élément de lèvre (25) orienté vers le haut ;
- b. d'un élément de lèvre (27) orienté vers le bas ; et
- c. d'une partie annulaire intermédiaire (29) ayant une face verticale (26) et deux faces horizontales opposées supérieure et inférieure (28, 24).
21. Dispositif selon la revendication 20, dans lequel au moins une nervure en relief (30) est présente sur la face verticale (26), la face supérieure horizontale (28) ou la face inférieure horizontale (24) de la douille de polymère.
22. Dispositif selon la revendication 20, dans lequel une nervure en relief (30) est présente sur la face verticale (26), la face supérieure horizontale (28) et la face horizontale inférieure (24) de la douille de polymère.
23. Dispositif selon l'une quelconque des revendications 19 à 22, dans lequel ladite seconde douille est à rebord double.
24. Dispositif selon l'une quelconque des revendications 19 à 23, dans lequel au moins un ergot est placé sur le rebord extérieur de la première douille extérieure, ledit au moins un ergot étant logé dans au moins une poche moulée en correspondance dans la douille de polymère de façon à résister à une rotation de torsion de la douille.
25. Procédé de réalisation d'une connexion d'une borne de batterie à travers un trou de la cloison du bac de la batterie, comprenant les étapes de :
- a. fabrication d'une cloison convenable, résistante à l'électrolyte, du bac de la batterie en y laissant subsister au moins un trou délimitant une partie sensiblement annulaire et deux faces opposées ;
- b. installation d'une première douille annulaire extérieure comprenant un collier et un rebord dans le trou de la cloison du bac ;
- c. installation d'une seconde douille annulaire intérieure comprenant un collier et un rebord dans un trou de la première douille ; et
- d. rendre étanche la première douille, la seconde douille et le trou de la cloison les uns avec les autres par emboutissage de façon que le rebord de ladite première douille entre en contact avec l'une desdites faces et que le rebord de la seconde douille entre en contact avec l'autre desdites faces.