

PATENT SPECIFICATION

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Improvements relating to the Sealing of Cells

WE, UNION CARBIDE CORPORATION, of 270 Park Avenue, New York, State of New York, United States of America, a Corporation organised under the laws of the State of New York, United State of America, (assignee of Robert Carmichael and James Southworth, Jr.), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a seal closure for a cylindrical galvanic cell container having at least one open end and more particularly to a method and apparatus for applying such a seal closure. The seal closure is particularly suitable for sealing a galvanic cell container of the type employing an alkaline electrolyte.

This seal closure is achieved by radially compressing under a high external radial force a gasket of a hard synthetic plastics insulating material which is interposed between the container and a cover therefor. When this radial force is applied, the container is reduced in diameter and the gasket is compressed radially against the outside periphery of the cover thus forming a leak-proof seal by virtue of a high residual radial force which is exerted outwardly by the gasket against the container.

Heretofore, such radial seals have been obtained by positioning the gasket and cover on a step of a shouldered cell container or by placing such elements on top of the contents of a straight-sided cell container, and subsequently pushing or forcing the cell container with the gasket and cover in place through a die, thereby drawing down the cell container around the gasket and cover. This operation must be skillfully done, otherwise an undesirable vertical or axial

component of force may be produced in the seal closure. Furthermore, if non-uniform loads are used on the cell in forcing the container through the die, this can be detrimental to the quality of the cell since it is possible that these forces could cause the bottom radius of a thin walled cell container to be pushed into a rather sharp corner, thereby causing a dimensional change of the cell which could effect the quality and operational ability of the cell. Moreover, any excessive pressures can damage the contents of the cell, and there is even the possibility that the bottom of the container could be ruptured. If a misalignment occurs by any force in such a method it would jeopardize the radial seal effectiveness.

It is therefore the principal object of this invention to provide an improved method and apparatus for applying a radial seal closure to a cylindrical galvanic cell container.

Another object of the invention is to provide such a radial seal closure without impairing the quality of the cell or its contents.

Accordingly, the present invention provides a method of radially sealing a cylindrical galvanic cell having a cupped cell container and a cover therefor, the method comprising interposing a gasket between the inner wall of the cell container and the cover and radially compressing the gasket between the cover and the cell container by applying a substantially horizontal radial sealing force perpendicular to the axis of the cell and in the plane of the cover and gasket so that the container is compressed radially about a peripheral zone encircling the cover while simultaneously restraining vertical displacement of the gasket and cover by applying an axial force

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directly on the cover, the radial compression being effected by positioning the container with the gasket and the cover beneath an annular-shaped member having a plurality of collapsible segments integrally formed therewith and squeezing the segments so that they collapse and compress the container about the cover and gasket.

The present invention also provides an apparatus for radially sealing a cylindrical galvanic cell by the above method, which comprises an outer member and a one piece inner member in concentric engagement therein, a fastener for maintaining the outer member in translational relationship with respect to the inner member, a compression spring axially disposed between the upper end of the inner member and the top part of the outer member, the surface of the inner member being divided into a plurality of inwardly deflectable segments the lower part thereof being outwardly tapered, the outer member having a compatibly shaped and tapered inside surface which when said outer member is translated over said inner member causes the integrally formed segments thereof to deflect inwardly and thereby apply a radial pressure to the cell container engaged by said inner member.

An apparatus for effecting the seal closure according to the present invention is illustrated in the accompanying drawings wherein:

Fig. 1 is a partially sectioned elevational view of the apparatus of the present invention with a galvanic cell container in position prior to radial sealing;

Fig. 2 is an end view of the collet of the apparatus of Fig. 1; and

Fig. 3 is a sectional view taken along plane 3-3 of Fig. 2.

The apparatus comprises an annular collet 10 having an end 12 with an aperture 14 in the center thereof. The lower portion of the collet 10 has a tapered surface 16 which tapers outwardly from about the center of the collet 10 to a maximum diameter at a segmental face end 18. The collet 10 is positioned within a compatibly shaped recess 20 provided in a collet cam ring 22. Between the end 12 of the collet 10 and the top of the recess 20 a spring 24 is located.

As shown in Fig. 1, a cupped galvanic cell container 26 which is to be radially sealed is positioned directly beneath the collet 10 manually, semi-automatically or by automatic means. The cell container 26 is supported by a platen 28. A collet support ring 30 is used as an aid in positioning and aligning the galvanic cell container 26 during the radial sealing; it also serves as a stop for segmental face end 18 of the collet 10 to slide on when radial pressure is applied by the collet cam ring 22. A

pressure pad 32 is located within the collet 10 and is held in place by a travel screw 34. The travel screw 34 has threads 36 at one end which are screwed into a corresponding tapped hole 38 in the pressure pad 32.

Referring now in particular to Figs. 2 and 3, it will be seen that the collet 10 is divided into a plurality of inwardly deflectable segments 40 which are formed by slots 42. Apertures 44 are provided at the end of the slots 42 to aid the inward deflection of the segments 40. The entire circumference of the cell container 26 is engaged by the segments 40.

In order to provide a radial seal to galvanic cell container 26, it is necessary to initially set up the apparatus for the particular galvanic cell container 26 to be radially sealed. The travel screw 34 is used to adjust the relative position of the collet 10 with respect to the collet cam ring 22. With the spring 24 exerting an axial force against the collet 10 and the pressure pad 32, an hexagonal head 46 of the travel screw 34 is rotated to either advance the collet 10 further into the compatibly shaped recess 20 of the collet cam ring 22, or to release the spring force on the collet 10 and the pressure pad 32 thereby withdrawing the collet 10 from the compatibly aligned recess 20 of the collet cam ring 22. When the travel screw 34 is set up for a particular run it acts as a guide and as a limit stop for the collet cam ring 22. After the initial set-up is completed, the galvanic cell container 26 together with a gasket 48 and cover 50 is aligned beneath the apparatus. The cell container 26 may be either a straight-sided one or a shouldered container as shown in Fig. 1. Also the hard plastic gasket 48 is generally "L" shaped but it can be other than "L" shaped to suit the sealing of differently shaped cell containers. The gasket is preferably made of a hard synthetic plastics insulating material resistant to cold flow such as a nylon consisting of a hexamethylene diammonium adipate polymer. When a punch press slide (not shown) carrying the upper assembly of the apparatus travels downward, the segmental face end 18 of the collet 10 rests on the face of the collet support ring 30; the collet cam ring 22 continues its downward motion and causes the collet segments 40 to move inwardly and reduce the diameter of the container 26 thereby radially squeezing the gasket 48 between the rigid cell cover 50 and container 26. During this action the spring 24 is compressed and applies a pressure on the pad 32 which in turn holds the cover 50 and gasket 48 in proper alignment with the container 26. When the press releases its forces on the upward stroke the collet 10 is returned to its normal position by the action of the spring 24 and



collet



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travel screw 34. It is to be appreciated that the spring restrains the gasket and cover from any vertical displacement and eliminates the build up of vertical or axial components of forces in the closure while the radial seal is applied. This basic method of making a radial squeeze closure can also be produced by the action of a double slide press thus eliminating the need for a collet support ring 30. In one cycle of such a press the inner slide would actuate and control the vertical movement of the collet 10 and pressure pad 32 assembly so that in a downward dwell position it holds the cover and gasket in place in the container 26, whereupon the second or outer slide would move down with the cam ring 22 attached and cause the collet segments 40 to move inwardly and produce the desired radial squeeze seal. The upward stroke of the press would release all pressures, eject the cell container from the apparatus, and free the container for horizontal ejection.

To test the effectiveness of the invention in preventing and eliminating the vertical component of the external radial force, a quarter-inch diameter steel sphere was interposed between an empty galvanic cell container and the platen of the apparatus; a radial seal was then applied to the cell container. After the radial seal was formed, the container was inspected to determine if any noticeable dents or marks were formed in the bottom of the cell container. No marks or dents were found, thus indicating that any vertical component of the radial force and any other forces built up in a vertical axis direction is either negligible or practically non-existent when a radial seal closure is made according to the method and apparatus of the present invention.

WHAT WE CLAIM IS:—

1. A method of radially sealing a cylindrical galvanic cell having a cupped cell container and a cover therefor, the method comprising interposing a gasket between the inner wall of the cell container and the cover and radially compressing the gasket between the cover and the cell container by applying a substantially horizontal radial sealing force perpendicular to the axis of the cell and in plane of the cover and gasket so that the container is compressed radially about a peripheral zone

encircling the cover while simultaneously restraining vertical displacement of the gasket and cover by applying an axial force directly on the cover, the radial compression being effected by positioning the container with the gasket and the cover beneath an annular-shaped member having a plurality of collapsible segments integrally formed therewith and squeezing the segments so that they collapse and compress the container about the cover and gasket.

2. An apparatus for radially sealing a cylindrical galvanic cell by the method claimed in claim 1, which comprises an outer member and a one piece inner member in concentric engagement therein, a fastener for maintaining the outer member in translational relationship with respect to the inner member, a compression spring axially disposed between the upper end of the inner member and the top part of the outer member, the surface of the inner member being divided into a plurality of inwardly deflectable segments the lower part thereof being outwardly tapered, the outer member having a compatibly shaped and tapered inside surface which when said outer member is translated over said inner member causes the integrally formed segments thereof to deflect inwardly and thereby apply a radial pressure to the cell container engaged by said inner member.

3. An apparatus as claimed in claim 2 in which a pressure pad cooperating with the compression spring is disposed within the inner member and maintained in position by the fastener, to apply axial pressure to the cell cover and gasket.

4. A method for radially sealing a cylindrical galvanic cell, substantially as hereinbefore described.

5. An apparatus for radially sealing a cylindrical galvanic cell substantially as hereinbefore described with reference to the accompanying drawings.

6. A cylindrical galvanic cell when radially sealed by the method claimed in claim 1 or 4.

7. A cylindrical galvanic cell when radially sealed by means of the apparatus claimed in claim 2, 3 or 5.

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