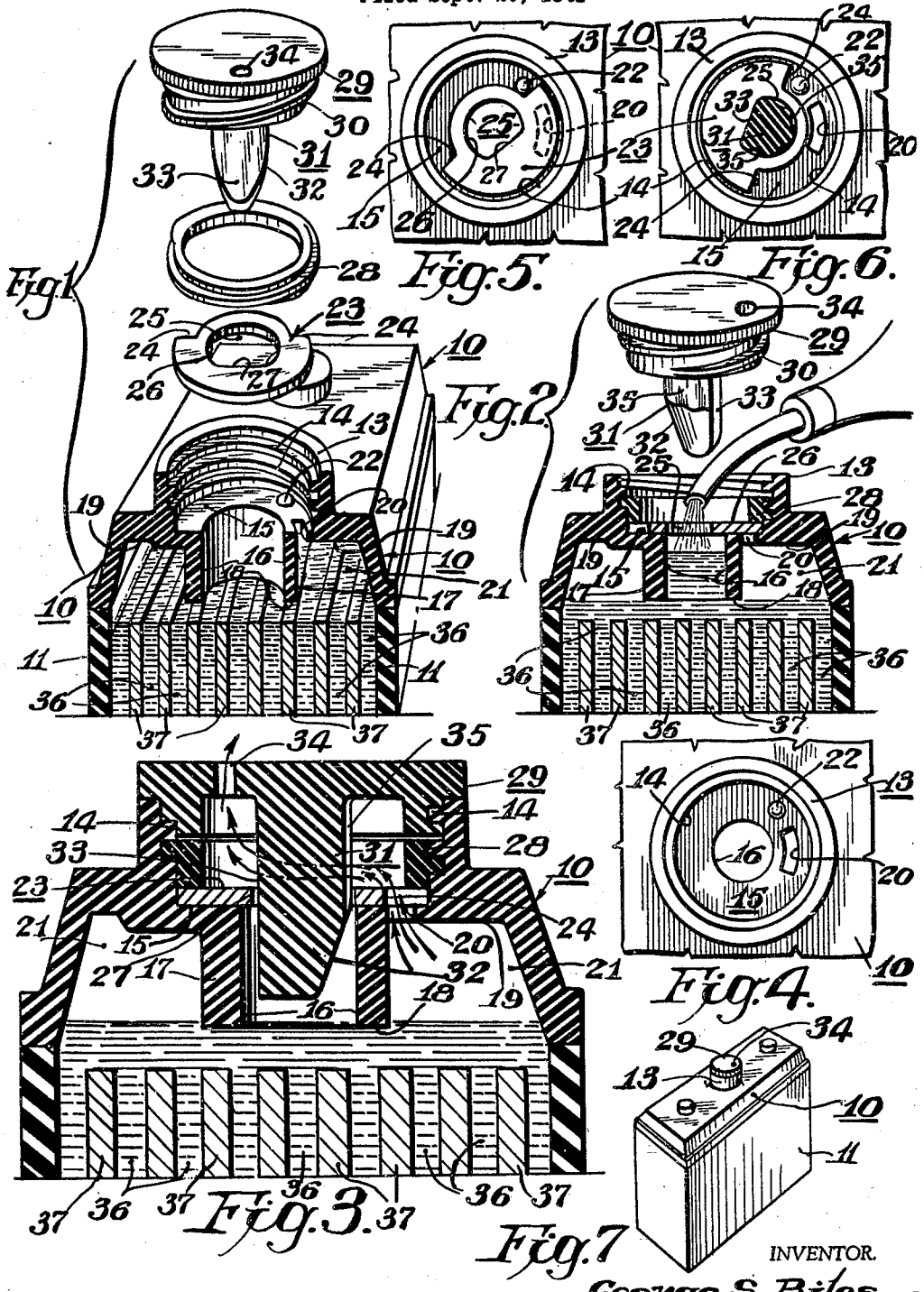
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NON-OVERFILL AND VENT CONSTRUCTION FOR STORAGE BATTERIES

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NONOVERFILL AND VENT CONSTRUCTION FOR STORAGE BATTERIES

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The present invention relates to batteries containing liquid electrolyte, such as for example lead storage batteries, and it relates more particularly to certain new and useful closures for the vent and filling openings in the covers of batteries.

An object of the present invention is to provide a simple, inexpensive durable and dependable closure for storage batteries whereby overfilling of the electrolyte-containing chamber will be prevented thereby to eliminate loss of electrolyte and corrosion of the outside terminals and connections. Another object of the present invention is to provide a closure which will permit venting of the electrolyte-containing chamber when said closure is in the closed position and which will prevent overfilling of said electrolyte-containing chamber when said closure is opened.

Other objects and purposes of the present invention will be apparent in the following specification and appended claims and in the accompanying drawing.

For the purpose of illustrating the invention there is shown in the accompanying drawing one form thereof which is at present preferred, since the same has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

Referring to the drawing in which like reference characters indicate like parts throughout:

Figure 1 represents a view partly in section and partly in perspective of one embodiment of the present invention as it appears when disassembled.

Figure 2 represents a fragmentary cross-sectional view of the embodiment shown in Figure 1 as it appears during a filling operation.

Figure 3 represents a fragmentary cross-sectional view similar to that of Figure 2 showing the battery as it appears after it has been filled and after the cap has been applied.

Figure 4 represents a plan view of a vent and filling opening embodying the present invention as it appears with the cap and the sealing washer removed.

Figure 5 represents a plan view similar to Figure 4 as it appears when the sealing washer is in its closed filling position.

Figure 6 represents a plan view similar to Figure 5 but showing the sealing washer in its opened venting position.

Figure 7 represents a perspective view on a reduced scale of a battery cell equipped with the present invention.

According to one embodiment of the present invention, I may provide a top cover 10 for a storage battery 11. While, in the accompanying drawings, said top cover 10 is shown as being fitted to a single cell of the usual three-cell storage battery, it is understood and intended that said cover 10 can be formed equally well for any number of cells without departing from the spirit of the present invention.

The top cover 10 may be formed of hard rubber, or Bakelite or other durable and acid-resistant material and is preferably formed as an integral unit by molding or pressing or other similar shaping operations.

In the top cover 10, I may provide an upwardly-extending socket 13 which is internally threaded as at 14 detachably to receive an externally threaded plug cap as will be hereinafter described.

Within said socket 13 I provide a generally horizontal annular shoulder 15 peripheral to a central filling opening 16.

Directly beneath said annular shoulder 15 and preferably an integral part thereof, I may provide a downwardly-projecting level-determining tube 17. The walls of said tube 17 have a relatively small radial dimension; the outside diameter of the tube 17 being less than the outside diameter of the annular shoulder 15. The lower edge 18 of the tube 17 extends for a convenient and predetermined distance (as for example one-half inch) below the under-surface 19 of the top cover 10. As will be hereinafter described, the lower edge 18 of the tube 17 extends within the battery cell a predetermined distance corresponding to the desired level of fluid within the cell.

A vent opening 20 is formed in the shoulder 15 radially outward of the outer periphery of the tube 17; said opening 20 thereby providing communication between the socket 13 and the upper portion 21 of the electrolyte-containing chamber.

An upwardly-extending stop 22 is formed at the outer periphery of the shoulder 15 generally adjacent to and counter-clockwise of the vent opening 20.

A valve 23 is seated upon the shoulder 15 and is adapted to be rotated thereupon. Said valve 23 is preferably of lead or relatively hard lead

alloy such as antimonial lead, or of other suitable material not attacked by the electrolyte.

A valve 23 has a generally circular outer periphery corresponding to the outer periphery of the shoulder 15. A recess 24 extends circumferentially about the outer periphery of said valve 23 for somewhat less than half the circumference thereof. The recess 24 has a sufficient radial dimension to uncover the vent opening 20 when the valve 23 is rotated to bring the recess 24 adjacent to the opening 20.

A central opening 25 is formed in said valve 23; said opening 25 having a generally circular wall 26 and a relatively smaller flat wall 27 preferably diametrically opposite the recess 24.

An externally threaded washer 28 is screw-threadedly engaged within the socket 13 directly above the valve 23, thereby to prevent removal of said valve 23 from the socket 13 while permitting rotation of said valve 23 upon the shoulder 15.

A cap 29 which is externally screw-threaded as at 30 is adapted to be screw-threadedly secured within the socket 13.

A central camming member or key 31 extends downwardly from said cap 29. Said camming member has a frusto-conical lower portion 32 of which a portion is cut away along a vertical plane to provide one flat vertical side 33 on said frusto-conical portion. The flatted frusto-conical portion is adapted to fit within the central opening 25 of the valve 23 with the flat side 33 keying with the flat wall 27.

The threads 14 and 30 are so formed that the cap 29 will seat itself firmly within the socket 13 in somewhat less than a half turn. The threads 14 and 30 are preferably square-cut to insure a firm grip of the cap 29 within the socket 13.

The opening 25 in the valve 23 and the flatted frusto-conical portion 32 of the camming member 31 are so related to each other that the portion 32 cannot enter said opening 25 to any appreciable extent unless the flat side 33 and the flat wall 27 are in registration. When these walls are not in registration, the cap 29 cannot be fitted within the socket 13 sufficently to permit interengagement of the threads 14 and 30. It can be seen that a clockwise rotation of the cap 29 (the threads 14 and 30 being conventional right-hand threads) will produce no result until the flat side 33 comes in registration with the flat wall 27 of the valve 23 at which time the frusto-conical portion 32 moves downwardly within the opening 25 thereby permitting the threads 30 of the cap 29 to engage with the threads 14 of the socket 13 whereupon a further movement of approximately one-half turn will seat the cap 29 firmly within the socket 13.

If the valve 23 is in the closed position shown in Figure 5 when the cap is removed, insertion of the cap will cause the frusto-conical portion 32 to enter the opening 25 and to key therewith so that the half turn during which the threads 14 engage with the threads 30, causes a corresponding rotation of the valve 23 to the open position shown in Figure 6 in which the vent opening 20 is unsealed. If, for any reason, the valve is in any position other than that shown in Figure 5, a right-hand rotation of the cap 29 will necessarily cause a rotation of the valve 23 until the portion 32 and the opening 25 are keyed together at which time the valve 23 is necessarily turned to the position shown in Figure 5 before the threads 30 of the cap 29 are engaged with the threads 14 on the socket 13.

A vent hole 34 is provided in the top of the cap 29 preferably diametrically opposed to the vent opening 20 in the shoulder 15.

When the cap 29 and the valve 23 are in the closed operating position shown in Figure 3, the upper portion 21 of the electrolyte-containing chamber is vented to the atmosphere through the openings 20 and 34 to permit the escape of gases generated during operation of the battery.

One or more upwardly-extending grooves 35 may be formed on the frusto-conical portion 32 to provide additional vent openings intermediate said portion 32 and the circular wall 26 of the central opening 25 of the valve 23. The stop 22 limits the movement of the valve 23 to its open or closed position. However, as shown in Figure 6, I prefer to position the stop 22 so that the cap 29 will be fully engaged and the vent opening 20 will be fully unsealed before the counter-clockwise end of the recess 24 contacts the stop 22. In this way, it is impossible to apply any shearing force to the stop 22 during tightening of the cap 29 as might break off said stop 22.

When the cap 29 is unscrewed the first rotation of somewhat less than half a turn will cause the valve 23 (which is keyed to the cap 29) to be turned counter-clockwise until the clockwise end of the recess 24 contacts the stop 22. When this occurs, any additional counter-clockwise rotation of the cap 29 will cause the frusto-conical portion 32 to move upward and outward from the opening 25 of the valve 23; the trailing edge of the flat side 33 exerting an upward camming force on the cap 29. Such additional rotation, therefore, serves merely to lift the cap 29 out of the socket 13; the valve 23 being held against upward displacement by the washer 28.

As hereinabove described, when the cap 29 is inserted within the socket 13, the valve 23 is in its open position in which venting of the upper portion 21 of the electrolyte-containing chamber is accomplished through the openings 20 and 34.

When the cap is unscrewed, the valve 23 is turned to its closed position in which it seals the vent opening 20 and produces an air-lock within the upper portion 21 of the electrolyte-containing chamber.

As is well known, the operation of a storage battery, such as for example a lead storage battery containing a sulfuric acid solution as the electrolyte, results in the loss of water due to evaporation and due to the fact that water, in the form of a fine spray, is carried off by the gases liberated during operation of the battery. Consequently, it is necessary to replace the water thus lost from time to time.

It is highly desirable that, during such filling operation, the cells be not over-filled since, if this happens, the level of electrolyte will be too high within the chamber and electrolyte will be sprayed out during operation causing not only loss of electrolyte but also corrosion of the battery terminals and connecting cables as well as of any additional electrical wiring or apparatus in the vicinity.

The present invention provides means for preventing such over-filling as will be apparent from the following description.

Assuming that the level of electrolyte 36 has, due to evaporation, dropped to the upper edges of the battery plates 37 as shown in Figure 1 so that the cell requires the addition of distilled water the cap 29 is unscrewed so that the valve 23 which was in its open venting position during normal operation of the battery, is now turned to

its closed position in which the vent opening 20 is sealed to create an air-lock within the upper portion 21 of the electrolyte-containing chamber.

Distilled water is then added by means of a tube or other pouring means through the central opening 25 of the valve 23 and the filling opening 16 as indicated particularly in Figure 2. As the water is added, the level of electrolyte 36 gradually rises until it reaches the lower edge 18 of the level-determining tube 17. The addition of more water now causes the liquid level to rise only within the tube 17 since the air-lock existing within the upper portion 21 of the chamber prevents the rise of liquid therein.

The person adding the water ceases such addition when he observes the liquid level rising within the filling opening 16. Should he fail to stop in time, any overflow will be practically pure water since there will be little or no diffusion or mixing of the water with the main part of the electrolyte within the small filling opening 16. Thus, such overflow will not be corrosive to the outside terminals and will not cause any loss of electrolyte.

After the required amount of water has been added, the cap 29 is then screwed in to force the valve 23 to its open position in which it unseals the vent opening 20 and breaks the air-lock existing within the upper portion 21 of the electrolyte-containing chamber. When this occurs, the liquid levels become equalized; the electrolyte 36 rising slightly above the lower edge 18 of the tube 17 while the liquid level within the filling opening 16 drops to the same final level.

In this fashion, the final height of the electrolyte 36 within the cell reaches its correct and predetermined position, preferably slightly above the lower edge 18 of the tube 17 and more or less approximately one-half inch below the undersurface 19 of the top cover 10. Thus, sufficient clearance is provided beneath the undersurface 19 of the top cover 10 to minimize the danger of escaping electrolyte.

The location of the opening 34 of the cap 29 diametrically opposite from the vent opening 20 tends to reduce loss of electrolyte in the form of spray, since the escaping gases must move upward through the vent opening 20 and around the camming member 31 before escaping through the hole 34; the tortuous path thus followed causing condensation of much of the spray upon the contiguous surfaces. The spray thus condensed drains back into the chamber through the vent opening 20 and through the grooves 35 on the frusto-conical portion 32.

While the battery is in use, the valve 23 is necessarily in its open venting position due to the positive interengagement of the member 31 with the valve 23 and when the cap 29 is removed the valve 23 is necessarily in its closed sealing position as the result of said positive inter-engagement.

Thus, it is apparent that my present invention affords an extremely simple and entirely positive and dependable mechanism for venting the battery during operation and for preventing overfilling of the cell.

While I have shown one illustrative form of engagement between the cap 29 and the valve 23, many other forms of keying between said cap 29 and said valve 23 are possible. In its broad aspects, my present invention is directed to any means for providing a positive engagement of the cap within the filling opening of the rotating valve.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

The invention having been hereinabove described, what is hereby claimed as new and desired to be protected by Letters Patent is:

1. A cell cover assembly for storage batteries or the like containing electrolyte, comprising a cell cover provided with an internally threaded generally cylindrical opening, a downwardly-extending level-determining tubular skirt member, a peripheral seating member at the uppermost portion of said tubular projection, said seating member having an upper plane seating surface and having an opening extending from said upper seating surface to a point in the uppermost portion of the cell and above the lower end of said tubular skirt member, a disc-like valve rotatably mounted upon and disposed wholly above said seating member and having a non-circular filling opening therein communicating with said tubular skirt member, said valve having a passageway adapted to be brought into registration with the opening in said seating member to permit venting of said cell and to be brought out of registration with the opening in said seating member to provide an overfill-preventing air-lock in the upper portion of said cell above the lower end of said tubular projection, a stop for limiting the rotation of said valve to its open venting position and its closed overfill-preventing position respectively, and an externally threaded cap adapted to be engaged within said cylindrical opening and having a portion thereof generally complementary to and adapted to fit within and to key with the non-circular filling opening of said valve thereby to turn said valve to its open venting position when said cap is engaged and to turn said valve to its closed overfill-preventing position when said cap is disengaged.

2. A cell cover assembly for storage batteries or the like containing electrolyte, comprising a cell cover provided with an internally threaded generally cylindrical opening, a downwardly-extending level-determining tubular skirt member, a peripheral seating member at the uppermost portion of said tubular projection, said seating member having an upper plane seating surface and having an opening extending from said upper seating surface to a point in the uppermost portion of the cell and above the lower end of said tubular skirt member, a valve rotatably mounted upon said seating member and having a non-circular filling opening therein communicating with said tubular skirt member, said valve having a peripheral recess therein adapted to be brought into registration with the opening in said seating member to permit venting of said cell and to be brought out of registration with the opening in said seating member to provide an overfill-preventing air-lock in the upper portion of said cell above the lower end of said tubular projection, a stop formed on said upper seating surface extending within said recess and limiting the rotation of said valve to its open venting position and its closed overfill-preventing position respectively, and an externally threaded cap adapted to be engaged within said cylindrical

opening and having a portion thereof generally complementary to and adapted to fit within and to key with the non-circular filling opening of said valve thereby to turn said valve to its open venting position when said cap is engaged and to turn said valve to its closed overfill-preventing position when said cap is disengaged.

3. A cell cover assembly for storage batteries or the like containing electrolyte, comprising a cell cover provided with an internally threaded generally cylindrical opening, a downwardly-extending level-determining tubular skirt member, a peripheral seating member at the uppermost portion of said tubular projection, said seating member having an upper plane seating surface and having an opening extending from said upper seating surface to a point in the uppermost portion of the cell and above the lower end of said tubular skirt member, a valve rotatably mounted upon said seating member and having a non-circular filling opening therein communicating with said tubular skirt member, said valve having a peripheral recess therein adapted to be brought into registration with the opening in said seating member to permit venting of said cell and to be brought out of registration with the opening in said seating member to provide an overfill-preventing air-lock in the upper portion of said cell above the lower end of said tubular projection, a stop formed on said upper seating surface extending within said recess and limiting the rotation of said valve to its open venting position and its closed overfill-preventing position respectively, an annular washer screw-threadedly engaged within said socket above said valve and preventing vertical displacement of said valve, and an externally threaded cap adapted to be engaged within said cylindrical opening and having a portion thereof generally complementary to and adapted to fit within and to key with the non-circular filling opening of said valve thereby to turn said valve to its open venting position when said cap is engaged and to turn said valve to its closed overfill-preventing position when said cap is disengaged.

4. A cell cover assembly for a storage battery or the like, comprising a cell cover provided with a generally cylindrical vent and filling opening, a tubular projection extending downwardly from said opening below said cover, a peripheral seating member at the uppermost portion of said downward projection, said seating member having an upper plane seating surface and having an opening extending from said upper seating surface to the upper portion of said battery at a point above the lower edge of said downward projection, a disc-like valve rotatably seated upon said seating member and having an opening therein communicating with said tubular projection, said last-mentioned opening being defined by a generally circular wall and by a plane wall forming a chord to said circular wall, said valve having a passage adapted to be brought into or out of registration with the opening in said seating member, a vented cap adapted to be detachably engaged within said first-mentioned filling opening, a downwardly-extending portion of said cap having a cross-sectional configuration corresponding to the configuration of the filling opening of said valve and being adapted to key within the filling opening of said valve, thereby to rotate said valve to its open venting position unsealing the opening in said seating member when said cap is engaged within said socket, and to rotate said valve to its closed position sealing the opening in said seating member when said cap is disengaged.

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