

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO COVERS FOR CELLS OR BATTERIES

(71) We, GOULD INC., a Corporation of the State of Delaware, U.S.A., of 10 Gould Center, Rolling Meadows, Illinois 60008, United States of America, 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 secondary cells and batteries.

Various forms of so-called dry-charge type and water activatable lead-acid batteries have been proposed, for example U.S. Patent Specification No. 3,948,680 gives a general discussion of such batteries as well as certain improvements therein.

Generally speaking, one of the steps in making dry-charge batteries, as well as batteries of certain other types, requires removal of the electrolyte and/or other liquid, such as a rinse solution, after the battery is formed. Typically, this is done by simply inverting the battery and draining the liquid out the vent holes in the battery cover. To facilitate removal of substantially all of the free electrolyte or other liquid, the inverted battery may be rocked slowly from front to back by a rocking mechanism so the liquid flows back and forth over the vent hole where some drains out each cycle, until it is substantially all removed. In one conventional rocking operation the front of the inverted battery is tilted up about 15° where it dwells for a short period and then the back of the battery is rocked up 15° where it dwells before the front is again tilted up to complete one cycle. A typical draining operation may involve 15 complete rocking cycles in 4 minutes with approximately half the duration of each cycle being dwell time.

Even with the use of such rocking mechanisms, however, the configuration of some battery covers, when inverted, is such that too large a volume of free electrolyte or other fluid still remains in the battery cells after the normal draining time. Typically such battery covers include a plurality of

vent holes disposed in a recessed channel-like portion of the cover which presents a raised step on the inside of the cover when the battery case is inverted. This raised step acts as a dam and some of the electrolyte or other fluid tends to collect at the foot of the step during the draining process. While it is desirable to leave less than 5 cc of electrolyte per cell in an automotive size battery after draining, covers having the vent holes disposed in recessed channels typically retain 20 cc or more electrolyte after rocking for a normal period or even an extended duration. Moreover, while increasing the rocking speed or employing a greater rocking angle facilitates the removal of retained fluid from such covers, it is still quite difficult, time-consuming and/or requires more expensive equipment to get the retained fluid down below the 5 cc level.

According to the present invention there is provided a cover for a case of an electric storage cell or battery, the cover having an inner surface engageable with portions of the case for closing the cell or the cells of the battery, a fill and vent opening extending therethrough, and a rib on its inner surface for directing liquid to the fill and vent opening when the cell or battery is inverted and rocked from side to side.

The ribs on the inner surfaces of the battery covers serve to direct liquid to the fill or vent opening therein when the battery cases are inverted and rocked from side to side, thereby facilitating substantially complete draining of the liquid from the batteries. Furthermore, the ribs can concentrate and funnel liquid over both a stepped cover portion and collars surrounding the fill and vent hole of battery covers having fill and vent holes located in recessed channels and collars extending into the battery case. A series of ribs on the inner surface of the covers can serve to collect and concentrate the retained liquid progressively in smaller and smaller channels leading directly to the fill and vent openings.

Battery covers embodying the invention

will now be described, by way of example, with reference to the accompanying diagrammatic drawings in which:

Figure 1 is a perspective view of a battery having a cover embodying the invention;

Figure 2 is a fragmentary plan view, to an enlarged scale, of the inner surface of a battery cover illustrating three different embodiments of the invention;

Figures 3a, 4 and 5 are full sections, and Figures 3b and 3c are fragmentary sections, on lines 3a—3a, 4—4, 5—5, 3b—3b and 3c—3c, respectively of Fig. 2;

Figs. 6, 9 and 11 are views of the inner surfaces of portions of further covers embodying the invention; and

Figs. 7, 8, 10 and 12 are respective fragmentary sections on lines 7—7 and 8—8, 10—10 and 12—12 of Figs. 6, 9 and 11.

There is shown in Fig. 1 an inverted battery 10 including a case 11 and a cover 12 having fill and vent holes 13 therein from which liquid, such as forming electrolyte or rinse solution, is being drained into a trough 14 as the battery is rocked from side to side by a suitable rocking dumper, shown schematically here at 15. The battery case 11 and cover 12 may be made of hard rubber or thin-wall plastic material such as, for example, polypropylene or ethylene-propylene copolymers and in the illustrated embodiment the vent holes 13 are disposed in a recessed, channel-like trough 16 formed in the cover 12. The battery 10 also includes positive and negative terminals 17 and 18, respectively, extending through the cover 12 in recessed areas 19 and 20 adjacent the rear corners of the battery.

The battery 10 is preferably of the lead-acid secondary type capable of activation by the addition of electrolyte or water after being stored in substantially dry condition. It will be understood that such dry-charge type and water activatable batteries, after fabrication and the addition of a forming electrolyte, have been initially charged and then substantially all of the forming electrolyte has been drained from the battery. In certain instances separate rinse solutions containing treating agents may be added and then drained from the battery. For further details concerning such dry-charge type batteries, reference may be made to the aforementioned U.S. Patent No. 3,948,680.

Referring now to Figs. 2 and 3a it will be seen that the inverted cover 12 includes a shallow peripheral groove 21 into which the side walls of the case 11 fit and are sealed and an upstanding flange 22 overlaps the side walls of the case. While the battery 10 shown in Fig. 1 is a six-cell automotive size battery, the present invention is not limited to the particular number of cells or the battery size. Only half of the cover 12 has been shown in Fig. 2 and it will be under-

stood that this portion of the cover 12 includes intermediate grooves 23 which cooperate with separator walls (not shown) in the case 11 to divide the battery 10 into separate cells. Three such cell areas are shown in Fig. 2. As shown in Figs. 2, 3a and 8 the underside of the cover 12 also includes a plurality of tapered fingers 24 for guiding the walls of the case 11 into the grooves 21 and 23.

When the cover 12 is inverted, as shown in the drawings, the recess or channel 16 in which the vent holes 13 are located forms two raised step-like shoulders 25 and 26 in each of the cell areas. In the cover 12 illustrated, the vent holes 13 also include integral collars 27 and vent hole extensions 28 which project into the battery case 11. The vent hole extensions 28 permit more accurate visual inspection of the level of electrolyte in the battery cells and the collars 27, in addition to reinforcing the cover 12 at the vent holes 13, may be internally threaded for receiving the vent caps (not shown). Alternatively, the inner surface of the collars may be smooth to receive push-in type vent caps. As shown in Fig. 3a, the terminal post 18 is molded into a reinforcing integral boss 29 in the cover and, prior to placement of the cover on the case 11, the posts 17 and 18 are hollow for reception of upstanding elements (not shown) connected to the respective positive and negative plates of the battery.

Means are provided on the inside of the cover 12 to facilitate removal of the forming electrolyte or other liquid from the battery 10 when it is inverted and rocked from side to side as in Fig. 1. It should be understood that, as used herein, the expression "side by side" means the same as front to back and, while this is across the width of the battery 10, it is the long direction of each of the individual cell areas. Simply for orientation purposes, the side of the battery 10 and cover 12 containing the posts 17 and 18 will be referred to herein as the back side and, of course, the other side is the front of the battery.

Referring now to Fig. 2, it will be seen that the cover 12 is formed with a plurality of integral guide vanes or ribs 30 for concentrating and directing the flow of liquid toward the vent holes 13. As more particularly shown in Figs. 3a and 3c, the ribs 30 for the uppermost cell area (as seen in Fig. 2) comprises a pair of upstanding guide vanes 31 extending from adjacent one side of the cover 12, over the step 25 and into the collar 27, opposite the vent hole extension 28. As the front of the inverted battery 10 (left side of cover 12 in Fig. 2) is tilted down, the fluid flows into the V-shaped area between the vanes 31. Then as the front of the battery is rocked up, a substantial portion of

the fluid is channelled between the vanes 31, over the step 25 and collar 27 and into the vent hole 13. During subsequent rocking cycles, the electrolyte or other liquid in the cell flows back and forth over the inside of the cover 12 defining the cell area. Each time the front is lowered, most of the liquid collects at the V-shaped entrance between the vanes 31 and then it is concentrated and directed up over the step 25 and collar 27 when the front is raised. After 15 cycles of alternating 15° tilts in about 4 minutes all but a very small amount (less than 5cc) of the electrolyte is drained from the cell.

In the embodiment shown in Fig. 3a, the vanes 31 do not extend completely to the front wall of the cover 12. This leaves a small channel indicated at 32 for the liquid to flow into the area between the vanes 31.

An alternative embodiment is shown in Fig. 4 where the vanes 33 do extend all the way to the front edge of cover but at this point, indicated by 34, they have a very low profile. In this embodiment it will be understood that as liquid flows to the left (as seen in the center cell area of Fig. 2) it is first concentrated outside the vanes 33 and then spills over at 34 into the area between the vanes.

Means can also be provided for concentrating and directing the reverse flow of liquid over the step 26 and around the vent hole extension 28. As shown in Fig. 5 and the lowest cell area of Fig. 2, the cover 12 includes an integral guide vane or rib 35 which extends substantially diagonally across the back side of the cell area from adjacent the back edge of the cover 12 to the step 26. When the back of the battery 10 is tilted down, fluid flows around the rib 35 and then as the back is raised the liquid is directed by the rib over the step 26, and around the forward directing means 30, illustrated here, in the form of ribs 31 like in Fig. 3a. It will be appreciated that a rib similar to the rib 35 could also be formed in the back side of the central cell area shown in Fig. 2, or in the right-hand portion of the individual cell areas shown in Figs. 6, 9 and 11 discussed hereafter. Such a rib is not necessary, however, in the uppermost cell area of Fig. 2 since the recessed portion 20 containing the post 18 forms a platform 36 higher than the shoulder 26 when the cover is inverted (see Fig. 3a).

Referring now to Figs. 6-8, another embodiment of the guide means 30 is illustrated. As shown here, a single rib 37 is integrally moulded in the cover in the front portion of the cell area extending from the front edge of the cover 12 to the collar 27 surrounding the vent hole 13. To prevent liquid concentrated in the rib 37 from flowing past one side of the vent hole, an upstanding barrier 38 is integrally formed between the vent hole extension 28 and the

portion of the cover defining the side wall of the cell area (see Fig. 8). In the embodiment shown in Figs. 9 and 10, the rib 39 is similar to the rib 37 in Figs. 6 and 7 but it does not extend to the edge of the cover as in the case of rib 37.

Yet another embodiment of the invention is illustrated in Figs. 11 and 12. In this embodiment, the concentrating means 30 includes a series of three integrally formed ribs 40, 41, and 42 which together define progressively smaller channels 43 and 44 leading to the vent hole 13. Thus, fluid is first concentrated in the larger channel 43 and directed over the step 25. Flow from the channel 43 past the vent hole 13 is obstructed by the upstanding rib 41 and the fluid is directed through a notch 45 into the smaller channel 44. Reverse flow in channel 44 is prevented by the rib 42 and the fluid passes over the collar 27 and out the vent opening 13.

The hereinbefore described embodiments provide simple yet effective means for removing substantially all of the liquid from a battery 10 which it is inverted and rocked from side to side. The liquid concentrating means 30 in the form of one or more ribs directs liquid over the step 25 and collar 27 and out the vent hole 13. An additional rib 35 may be employed in the back side of the cell area to direct the reverse flow of liquid over the step 26 and around the vent extension 28. A plurality of ribs 40, 41 and 42 may be provided to funnel the liquid into smaller and smaller channels 43, 44 leading to the vent hole 13.

WHAT WE CLAIM IS:—

1. A cover for a case of an electric storage cell or battery, the cover having an inner surface engageable with portions of the case for closing the cell or the cells of the battery, a fill and vent opening extending therethrough, and a rib on its inner surface for directing liquid to the fill and vent opening when the cell or battery is inverted and rocked from side to side.
2. A cover as claimed in claim 1, wherein each fill and vent opening has a collar for projection into the cell or battery and the rib directs the flow of liquid towards and over said collar.
3. A cover as claimed in claim 1 or claim 2, having a plurality of fill and vent openings disposed in a recessed, channel-like portion of the cover which presents a raised step on the inner surface of the cover when the case is inverted, and the rib extends from adjacent one edge of the cover and over the raised step.
4. A cover as claimed in any of the preceding claims, having an integral portion for projection into the cell and extending from part of the circumferential edge of each of



the fluid is channelled between the vanes 31, over the step 25 and collar 27 and into the vent hole 13. During subsequent rocking cycles, the electrolyte or other liquid in the cell flows back and forth over the inside of the cover 12 defining the cell area. Each time the front is lowered, most of the liquid collects at the V-shaped entrance between the vanes 31 and then it is concentrated and directed up over the step 25 and collar 27 when the front is raised. After 15 cycles of alternating 15° tilts in about 4 minutes all but a very small amount (less than 5cc) of the electrolyte is drained from the cell.

In the embodiment shown in Fig. 3a, the vanes 31 do not extend completely to the front wall of the cover 12. This leaves a small channel indicated at 32 for the liquid to flow into the area between the vanes 31. An alternative embodiment is shown in Fig. 4 where the vanes 33 do extend all the way to the front edge of cover but at this point, indicated by 34, they have a very low profile. In this embodiment it will be understood that as liquid flows to the left (as seen in the center cell area of Fig. 2) it is first concentrated outside the vanes 33 and then spills over at 34 into the area between the vanes.

Means can also be provided for concentrating and directing the reverse flow of liquid over the step 26 and around the vent hole extension 28. As shown in Fig. 5 and the lowest cell area of Fig. 2, the cover 12 includes an integral guide vane or rib 35 which extends substantially diagonally across the back side of the cell area from adjacent the back edge of the cover 12 to the step 26. When the back of the battery 10 is tilted down, fluid flows around the rib 35 and then as the back is raised the liquid is directed by the rib over the step 26, and around the forward directing means 30, illustrated here, in the form of ribs 31 like in Fig. 3a. It will be appreciated that a rib similar to the rib 35 could also be formed in the back side of the central cell area shown in Fig. 2, or in the right-hand portion of the individual cell areas shown in Figs. 6, 9 and 11 discussed hereafter. Such a rib is not necessary, however, in the uppermost cell area of Fig. 2 since the recessed portion 20 containing the post 18 forms a platform 36 higher than the shoulder 26 when the cover is inverted (see Fig. 3b).

Referring now to Figs. 6-8, another embodiment of the guide means 30 is illustrated. As shown here, a single rib 37 is integrally moulded in the cover in the front portion of the cell area extending from the front edge of the cover 12 to the collar 27 surrounding the vent hole 13. To prevent liquid concentrated by the rib 37 from flowing past one side of the vent hole, an upstanding barrier 38 is integrally formed between the vent hole extension 28 and the

portion of the cover defining the side wall of the cell area (see Fig. 8). In the embodiment shown in Figs. 9 and 10, the rib 39 is similar to the rib 37 in Figs. 6 and 7 but it does not extend to the edge of the cover as in the case of rib 37.

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The hereinbefore described embodiments provide simple yet effective means for removing substantially all of the liquid from a battery 10 which it is inverted and rocked from side to side. The liquid concentrating means 30 in the form of one or more ribs directs liquid over the step 25 and collar 27 and out the vent hole 13. An additional rib 35 may be employed in the back side of the cell area to direct the reverse flow of liquid over the step 26 and around the vent extension 28. A plurality of ribs 40, 41 and 42 may be provided to funnel the liquid into smaller and smaller channels 43, 44 leading to the vent hole 13.

WHAT WE CLAIM IS:-

1. A cover for a case of an electric storage cell or battery, the cover having an inner surface engageable with portions of the case for closing the cell or the cells of the battery, a fill and vent opening extending there-through, and a rib on its inner surface for directing liquid to the fill and vent opening when the cell or battery is inverted and rocked from side to side.

2. A cover as claimed in claim 1, wherein each fill and vent opening has a collar for projection into the cell or battery and the rib directs the flow of liquid towards and over said collar.

3. A cover as claimed in claim 1 or claim 2, having a plurality of fill and vent openings disposed in a recessed, channel-like portion of the cover which presents a raised step on the inner surface of the cover when the case is inverted, and the rib extends from adjacent one edge of the cover and over the raised step.

4. A cover as claimed in any of the preceding claims, having an integral portion for projection into the cell and extending from part of the circumferential edge of each of



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said openings and the rib extends from adjacent one edge of the cover to said opening opposite the said integral portion.

5 5. A cover as claimed in any of the preceding claims, having a pair of upstanding ribs integrally molded with the inner surface of the cover and a portion of the upstanding ribs converges into a channel converging towards the fill and vent opening.

10 6. A cover as claimed in any of the preceding claims, having a plurality of upstanding ribs integrally molded with the inner surface of the cover and defining a series of progressively smaller channels leading to the fill and vent opening.

15 7. A cover as claimed in any of the preceding claims, wherein the rib on the inner surface of the cover is integrally molded therewith, and is shaped for co-operation with one of the walls of the case to form a channel leading to the fill and vent opening.

20 8. A cover as claimed in claim 7, having a

barrier for connecting said one wall with an extension piece at the fill and vent opening so that the flow of liquid past said opening along said one wall is obstructed. 25

9. A cover as claimed in claim 3, having one rib on its inner surface for directing liquid from one edge of the cover to the fill and vent opening and another rib on its inner surface for concentrating and directing the flow of liquid from the other edge of the cover over the raised step and then around the fill and vent opening. 30

10. A cover for a case of an electric storage battery, the cover being substantially as herein described with reference to the accompanying drawings. 35

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