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81: 206/2, 46 FR. 62, 65

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ABSTRACT: Springlike packing ribs integrally molded with the walls of a battery container permit a single container to accommodate elements of varying thicknesses, thus reducing the number of different sizes of containers and container molds required for battery manufacturing.

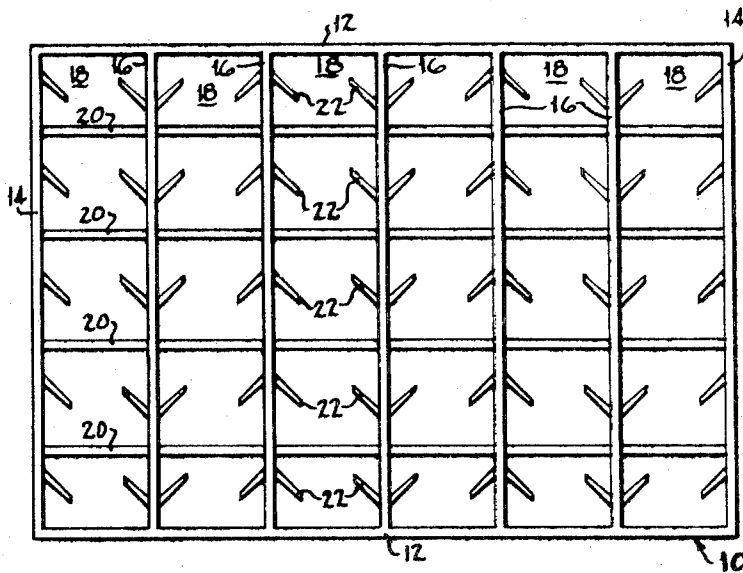


Fig. 1

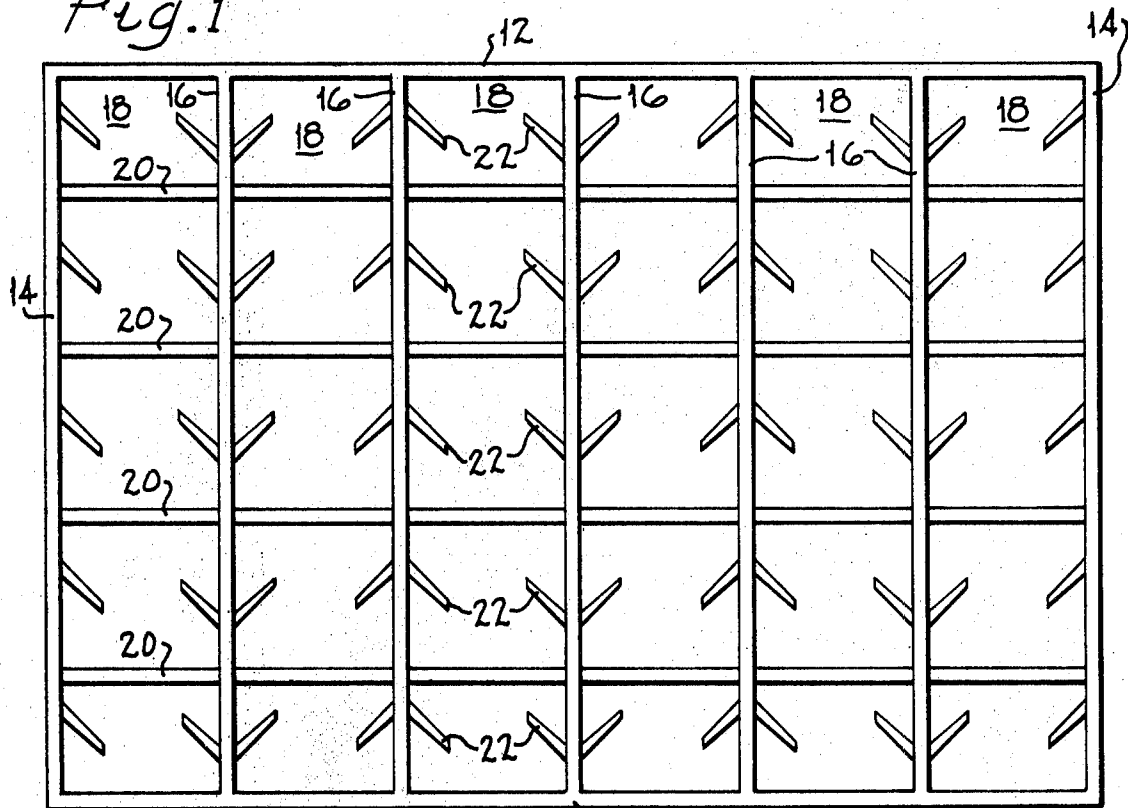


Fig. 2

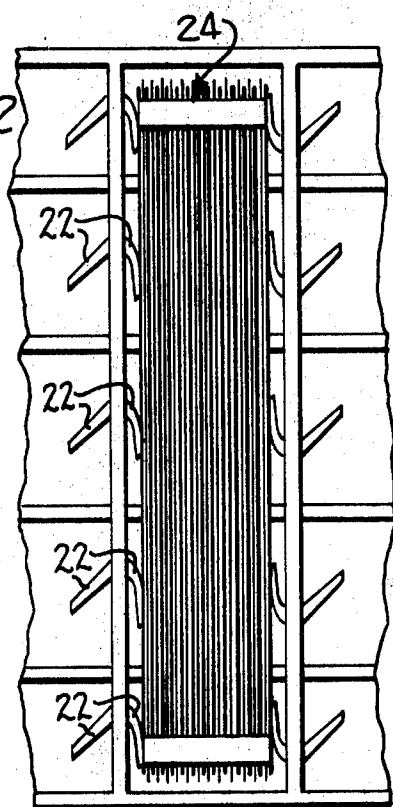
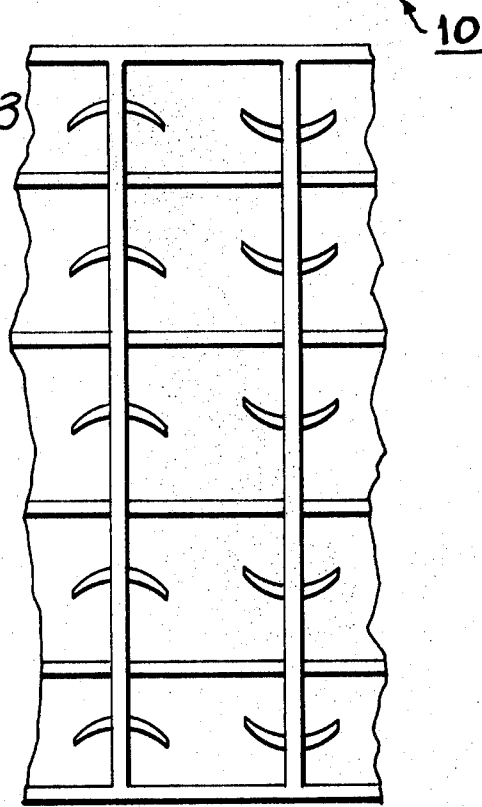
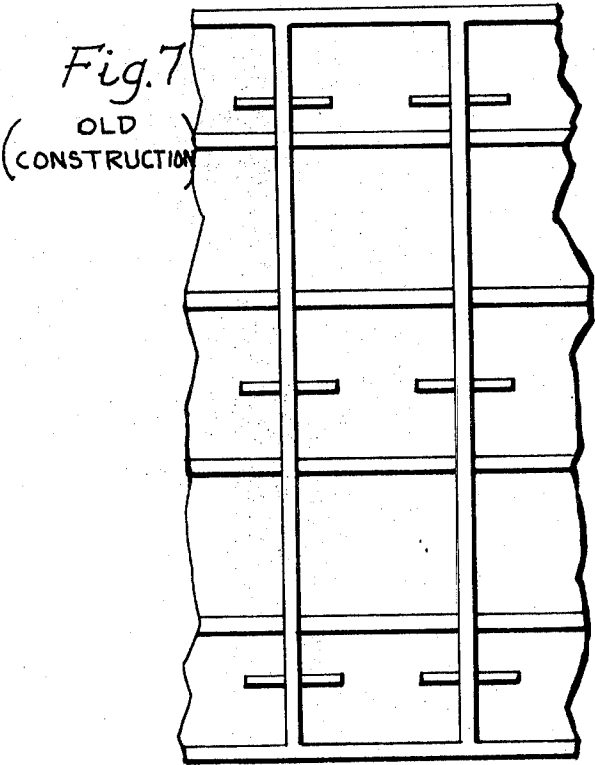
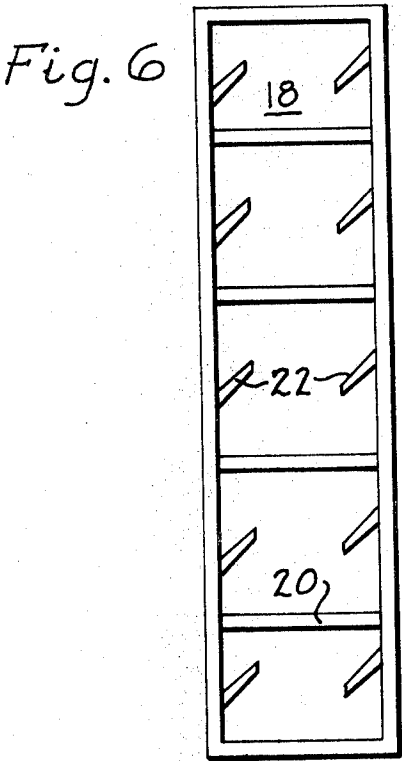
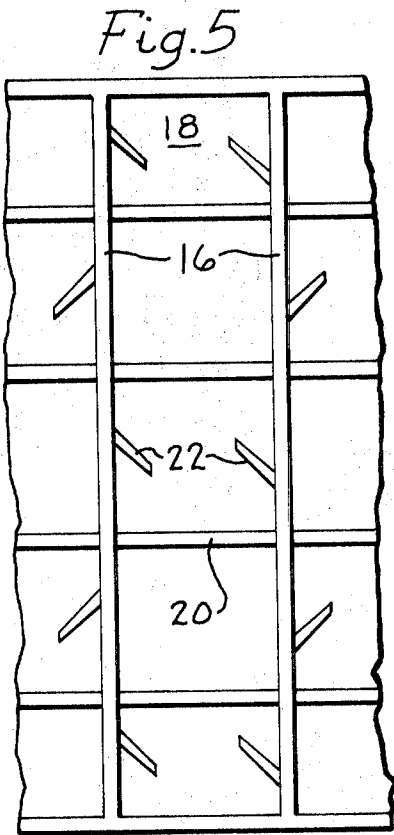
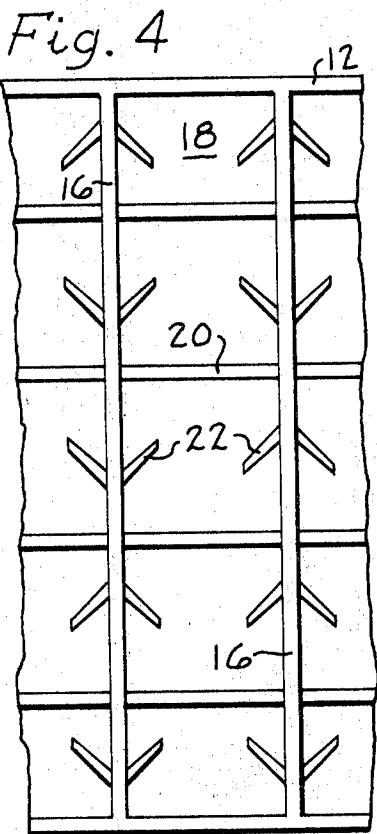


Fig. 3





BATTERY CONTAINER HAVING SPRINGLIKE PACKING RIBS TO ACCOMMODATE ELEMENTS OF VARYING THICKNESSES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to batteries, particularly multicell batteries such as are used in automobiles, in which the containers have springlike ribs extending from their walls to accommodate elements of varying thicknesses. (Class 136, Subclass 166.)

2. Description of the Prior Art

Previous containers have had rigid ribs projecting outwardly at 90° from the surfaces of walls inside the battery container for the purpose of preventing or restricting vibrations in the elements. Separate containers differing from one another sometimes only by the distance which the ribs extend away from the walls were needed to accommodate elements of varying thicknesses, and the consequence was that an expensive proliferation of different containers and container molds was needed by a battery manufacturer wishing to produce a broad line of his products.

SUMMARY OF THE INVENTION

Springlike packing ribs are molded integrally with and project outwardly from the walls of the container, permitting a single container to accommodate elements of varying thicknesses and thus permitting a battery manufacturer to reduce the number of different sizes of containers and container molds needed to produce a broad line of products. The ribs are bent inwardly toward the container walls by the elements; the magnitude of the deflection increases as the thicknesses of the elements increases, resulting in greater vibration resistance for premium batteries having relatively large element thicknesses than for batteries having elements of lesser thicknesses. The ribs, which project outwardly from the container walls at angles other than 90°, may be tapered, having thicknesses which decrease from the points where they join the walls to their ends. Preferably ribs projecting outwardly from the opposite sides of a partition wall are joined to the wall at the same point and project in the same direction, like a wishbone. The direction of the ribs projecting from one wall may be opposite that of the ribs projecting from the next adjacent wall.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of an empty 6-cell automotive battery container having tapered, plane surfaced, springlike ribs integrally molded with the walls of the container. The ribs projecting outwardly from opposite sides of the partition walls project from the same points along the walls and project in the same direction, thus projecting from the walls like wishbones.

FIG. 2 is a plan view of a segment of the battery container of FIG. 1, with an element placed in one cell compartment to illustrate the deflection produced in the ribs.

FIG. 3 is a plan view of a segment of an empty multicell battery container having tapered, curved, springlike ribs integrally molded with the walls of the container. The ribs in FIG. 2 also resemble a wishbone in configuration.

FIG. 4 is a plan view of a segment of an empty multicell battery container having tapered, plane-surfaced, springlike ribs integrally molded with the walls of the container. The ribs in FIG. 3 also resemble a wishbone in configuration, but the ribs are not all pointed toward the same exterior wall of the container.

FIG. 5 is a plan view of a segment of an empty multicell battery container having tapered, plane-surfaced, springlike ribs integrally molded with the walls of the container. The ribs are spaced alternately along the opposing sides of partition walls.

FIG. 6 is a plan view of a single cell battery container having tapered, plane-surfaced, springlike ribs integrally molded with the walls of the container.

FIG. 7 is a plan view of a segment of a conventionally constructed battery container in which rigid ribs project perpendicularly outward from the walls of the container.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows a 6-cell automotive battery container 10 having exterior side and end walls 12 and 14, respectively. Integrally constructed with the container are a series of interior partition walls 16 which divide the interior of the container into a series of cell compartments 18. At the bottom of each cell compartment is a series of four electrode rests, or bridges 20 which are conventionally provided to elevate the electrodes above the container bottom.

FIG. 1 shows a series of springlike packing ribs 22 integrally constructed with the end and partition walls and projecting outwardly into the cell compartments at angles other than 90°. The particular ribs shown in FIG. 1 have plane surfaces and are tapered, having thicknesses which decrease from the points where they join the walls to the ends of the ribs. The ribs shown in FIG. 1 also project outwardly from opposite sides of the partition walls from the same points along the walls, and thus have the configuration of a wishbone. Finally, the ribs extending from one end wall 14 or one side of a partition wall 16 all point toward the same sidewall 12.

FIG. 2 shows an element 24 placed in one of the cell compartments of the container shown in FIG. 1. The element 24 is typical of those used in automotive batteries, having series of alternately spaced positive and negative electrodes which are customarily separated from each other by separators, with the electrodes of like polarity being electrically connected together in series. (The minimum requirements of the element are a single electrode of each polarity. Separators are not needed if self-discharge by plates of opposite polarity can be prevented in their absence.) FIG. 2 shows the deflection produced in the springlike ribs 22 by the presence of the element. As will be apparent from FIG. 2, the deflection of the ribs is a variable which permits use of elements having different thicknesses to be placed in the same battery container. Since it is industry practice to vary the capacity (i.e., the amount of internally stored energy) of the battery by varying the number of electrodes included in the element, the inclusion of the flexible, springlike ribs permits the battery manufacturer to manufacture batteries of different capacities from an inventory of identical containers. Since the pressure exerted on the element will increase as the deflection of the ribs increases, the battery having a thick element and consequently a high capacity (i.e., a premium-grade battery) will have greater vibration resistance than a battery with a thinner element.

The ribs 22 are preferably tapered, having thicknesses which are greater near the point where the ribs are connected to the container walls than at the ends of the ribs. This is because the bending moments and consequently the stresses increase as one moves along the cantilevered ribs toward their fixed ends.

The bending moments and stresses transferred from a single rib tends to result in a bending or deflection in the wall from which the rib extends. If the bending in the wall becomes too great, difficulty in matching the container walls with its mating but undistorted counterpart in the cover may result. To avoid this problem irrespective of the magnitude of the deflection produced in the ribs, it is preferable to have a pair of ribs project outwardly from opposite sides of a partition wall, at the same point along the partition wall, and project so that the two ribs both point to the same sidewall 12 of the container; in this way the bending moments which they transfer to the wall will be equal in magnitude and opposite in direction and thus cancel each other out. This explains the desirability of the "wishbone" configuration shown in FIG. 1 and other figures.

It will be noted from a careful inspection of FIG. 1 that of the total of 10 ribs projecting into a single cell compartment, five are pointed to one sidewall 12 and the other five are

pointed toward the other sidewall 12. To some extent a bent, deflected, springlike rib may act as a wedge, permitting movement of the element in the direction in which the rib is bent but resisting movement of the element in the opposite direction. By having a plurality of such ribs the wedging action may be increased (and a tendency for the element to rotate within the cell compartment may be reduced), while the wedging action preventing movement of the element toward one sidewall may be made equal to opposing wedging action in the other direction by having an equal number or ribs aimed or pointed at each of the two opposite sidewalls.

The ribs project outwardly from the side and partition walls at an angle other than 90° to permit the easy insertion of elements into cell compartments.

FIG. 3 illustrates that the ribs need not be plane surfaced. The curved ribs shown in FIG. 3 may also be used, although they may be less desirable than plane-surfaced ribs from the point of view of the difficulty in cutting the molds in which the containers are made.

FIG. 4 illustrates that a container may have ribs of wishbone configuration and may have an equal number of ribs in a single-cell compartment pointing toward each of the two sidewalls, but it is not necessary that all of the ribs projecting from one side of a partition wall be pointed toward the same sidewall.

FIG. 5 illustrates another alternative construction, one in which the wishbone configuration is missing. If the consequent bending which occurs in the partition walls of the container of FIG. 5 is not excessive, this construction may be satisfactorily used. Note that in FIG. 3 the total number of ribs projecting into a single cell compartment is divided equally, with one half pointing to one sidewall and one half pointing to the opposite sidewall. Note also that it is not essential that each cell compartment have the same number of ribs; FIG. 5 shows a container in which three ribs project outward from one side of a partition wall while only two project from the opposite side of that wall, a construction in which it might be desirable to use different thicknesses and angles in the ribs on one side of the partition wall than are used in the ribs projecting from the opposite side of that same wall.

FIG. 6 is included to illustrate that the concepts of this invention may be applied to single-cell as well as to multicell batteries.

FIG. 7 is included to illustrate the battery containers of prior conventional construction. Those containers employed ribs projecting perpendicularly from the walls, and the ribs were rigid rather than bending. To construct batteries having elements of several different thicknesses, even when the size and thickness of each electrode and separator and the distances between them remained unchanged and only the total number of electrodes and separators varied, it was necessary either to have an inventory of containers differing from each other only by the distance by which the rigid ribs extended away from the walls, or to use shims.

A number of observations should be made about battery containers having ribs according to this invention. First, the ribs preferably begin at or near the tops of the container walls and extend downward to or near the bottom of the container. If the rib extends down to and is joined with the bottom, it may be desirable to sever the connection with the bottom to avoid a twisting of the rib near the bottom; this can be done by such techniques as cutting or melting by the appropriate amounts.

It may be desirable also to deflect the ribs toward the walls to which they are connected prior to inserting the elements into the cell compartments, a result which can be achieved by pressing against the ribs on one or both walls of a cell compartment with one or a pair of appropriate plates which are removed after an element has been inserted. It might also be desirable as a means of facilitating entry of the element into the cell compartment to soften the ribs temporarily just before inserting the elements, and this might be done for instance by heat.

A number of interrelated factors remain as variables which permit a designer some freedom of choice in fashioning a container having certain desired characteristics. Among these are: the thickness of a rib in comparison with the thickness of the wall from which it projects; the angle at which a rib departs from the wall to which it is attached; the rate of taper of a rib; or the rate at which the thickness of a tapered rib changes along its length; the number of ribs per wall or per cell compartment, with perhaps only one of the springlike ribs of the present ribs being used per cell compartment and perhaps using in a cell compartment a combination of conventional rigid perpendicular ribs on one wall and only one springlike rib of this invention on the opposing wall; and the material from which the container is molded. On the last-mentioned factor, the strength and elasticity of the material, the ease of molding the material into thin cross sections, the costs of the material, and other factors will influence the selection of the material to be used. While polypropylene appears to be a desirable material, others yielding the desired results may also be used.

We claim:

1. A battery container having walls which define a cell compartment, wherein the improvement comprises at least one springlike packing rib projecting outwardly into the cell compartment from one of the container walls, the rib being integrally constructed with the wall and projecting outwardly from the wall at an angle other than 90°.

2. A battery container having walls which define a cell compartment, wherein the improvement comprises at least one springlike packing rib projecting outwardly into the cell compartment from each of two opposite container walls, the ribs being integrally constructed with the walls and projecting outwardly from the walls at angles other than 90°.

3. A multicell battery container having exterior walls and at least one interior partition wall integrally constructed with some of the exterior walls, the walls defining at least two cell compartments within the container, wherein the improvement comprises at least one springlike packing rib projecting outwardly into adjacent cell compartments from each side of a partition wall, the ribs being integrally constructed with the partition wall and projecting outwardly from the wall at angles other than 90°.

4. The battery container of claim 1 in which the rib is tapered, having a thickness which decreases from the point where the rib joins the wall to the end of the rib.

5. The battery container of claim 2 in which the ribs are tapered, having thicknesses which decrease from the points where the ribs join the walls to the ends of the ribs.

6. The battery container of claim 3 in which the ribs are tapered, having thicknesses which decrease from the points where the ribs join the partition wall to the ends of the ribs.

7. The battery container of claim 3 in which the ribs project outwardly from the same point along the partition wall and project in the same direction, thus projecting from the partition wall like a wishbone.

8. The battery container of claim 6 in which the ribs project outwardly from the same point along the partition wall and project in the same direction, thus projecting from the partition wall like a wishbone.

9. A multicell battery container having exterior walls and a plurality of interior walls integrally constructed with some of the exterior walls, the walls defining cell compartments within the container, wherein the improvement comprises at least one springlike packing rib projecting outwardly into adjacent cell compartments from each side of each partition wall, the ribs being integrally constructed with the partition walls and projecting outwardly from the walls at angles other than 90°, the ribs on opposite sides of a single partition wall projecting outwardly from the same point along the partition wall and projecting in the same direction.

10. The battery container of claim 9 in which the ribs are tapered, having thicknesses which decrease from the points where the ribs join the partition wall to the ends of the ribs.