

DYNAMIC MECHANICAL COMPRESSION OF A BMDC BATTERY

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a compression system for a battery pack, in particular for a battery pack comprising prismatic battery cells arranged side by side.

STATE OF THE ART

Battery packs intended for automotive, industrial, and energy storage applications in general, such as lithium-ion battery packs, typically comprise a plurality of electrochemical battery cells arranged side by side. Specifically, each cell is typically made from a stack of electrically conductive sheets (e.g., the anode and cathode) stacked on top of each other, with the anode and cathode interleaved, typically separated by a separator sheet that acts as an insulator between two adjacent sheets.

The stack of sheets is then inserted into a container (or "case") filled with a liquid electrolyte, e.g., containing lithium salts, which wet the sheets to transfer electrical charges between adjacent sheets, forming the battery cell.

In recent years, manufacturers of prismatic battery cells have begun to include information in their technical data sheets regarding the need for compression on the outside of the larger walls, typically with values of 300 kgf (3000 N), but also with different loads. The compression must therefore be dynamic and adaptive to avoid excessive thrust due to (atomic swelling).

When cells begin to swell during charging and discharging, they tend to swell due to the internal production of gas (gas swelling). Prismatic cells tend to swell by a few millimeters on the largest walls during charge/discharge cycles. This causes the internal sheets that form the cathode and anode to move apart from each other, decreasing the cell's capacity, even permanently. With compression, maintaining the original prismatic shape prevents movement of the cell's aluminum container walls, which can also lead to cracks and breakages.

However, there is also the phenomenon of (atomic swelling). In this case, the internal thrust is at the atomic level, the swelling is a few hundredths of a millimeter with a thrust of up to 40-50,000 N, which must not be counteracted; therefore, the cells cannot be completely blocked with rigid systems.

One of the currently popular systems (Fig. 1) uses simple elastic pads placed between the cells.

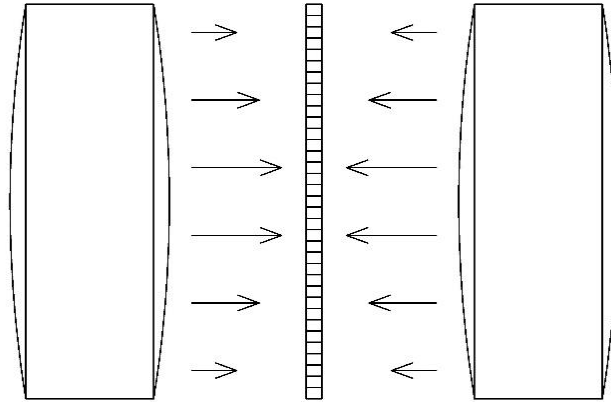


Fig. 1

This material does not have variable density or compressibility, so it cannot keep the main faces of the cells flat, as the internal thrust, or "gas swelling," causes the wall to curve (Fig. 2) shows how variable compression pads, with lower compressibility at the center, could overcome this problem (Fig. 3), but they are difficult to size and construct. It is therefore preferable to use a thin rigid separator, only as insulation, and create the necessary pressure by pushing on the end walls of the cells.

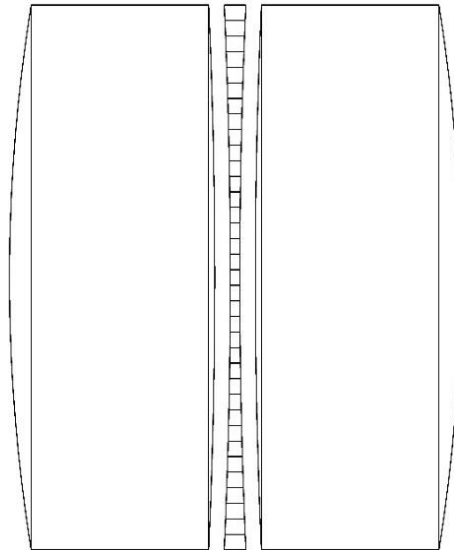


Fig. 2

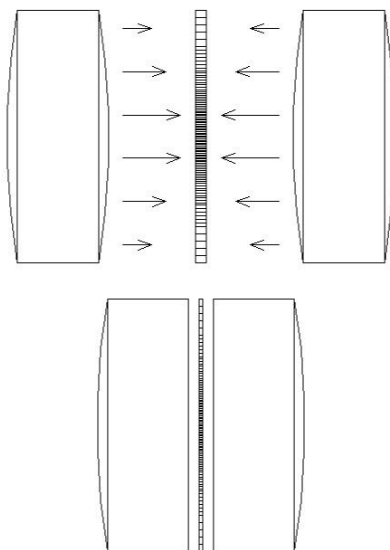


Fig. 3

The use of a leaf spring-type "spring" system allows for the compression needed to prevent swelling, as when tensioned, they evenly distribute the force across the largest main faces. The tension exerted by the straps (plastic straps) allows for compensation, through their elongation, for atomic swelling, without producing excessive thrust (Fig. 4) (Fig. 5) (Fig. 6).



Fig. 4

BMDC™ SYSTEM

PATENT PENDING | Appl. No. 102026000023320 (Filed: 05 Aug 2026)

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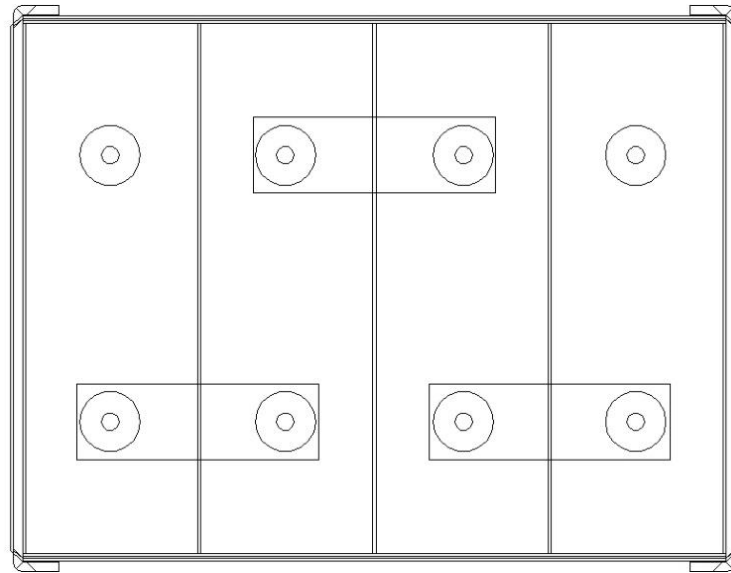


Fig. 5

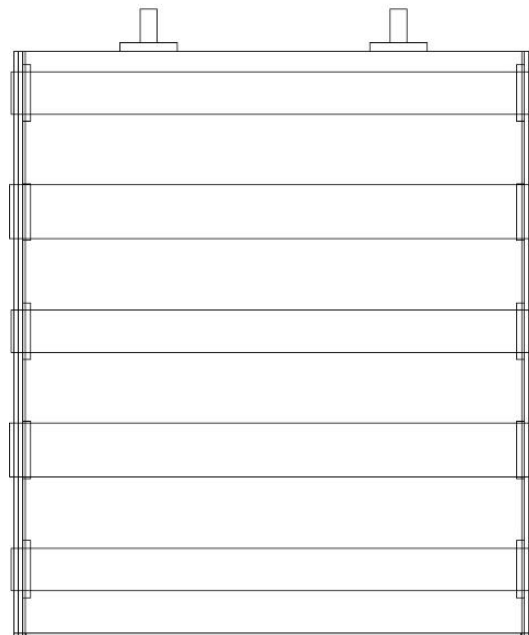


Fig. 6

BMDC™ SYSTEM

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This system has extremely small dimensions, just a few millimeters, and even allows for a concession in the volume and weight of the container (battery) where the cells are installed, if containment plates and their corresponding blocks are used (Fig. 7).

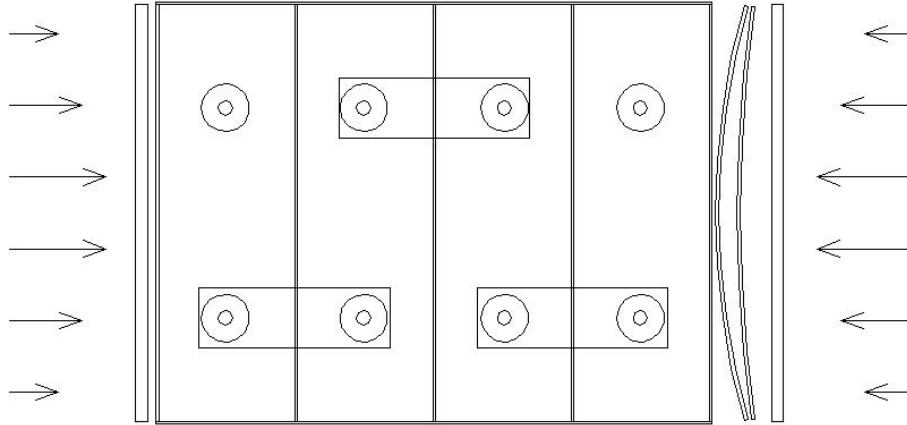


Fig.7

Working samples have been built in both hardened and tempered sheet steel and aluminum; both meet the required thrust requirements, but other flexible materials such as fiberglass, carbon fiber, etc. could also be used.

Specific extruded aluminum profiles can also be made, always with a cylindrical profile of adequate thickness to make it flexible, with fins for air cooling or channels for liquid flow (Fig. 8).