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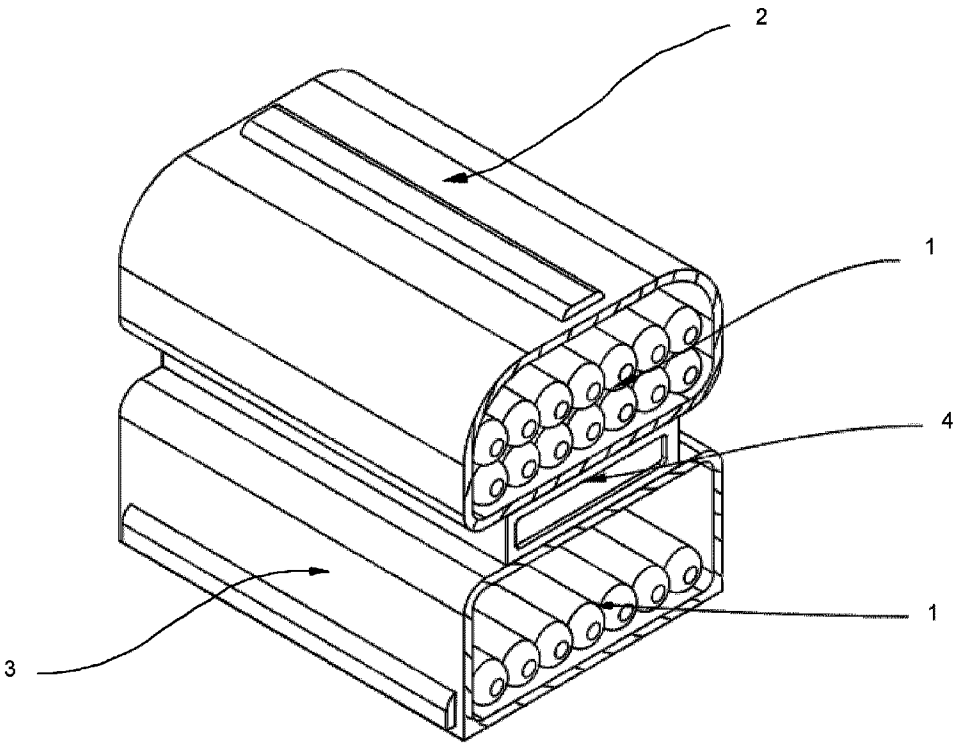
(54) Title: A BATTERY SWAPPING SYSTEM WITH BATTERY MAGAZINE FOR GENERAL APPLICATIONS



(57) Abrégé/Abstract:
A battery swapping system is disclosed. The system works such that basically several convenient swappable batteries are stored in a reservoir (magazine) and only one or few batteries are taken and engaged electrically in one time to deliver power.

Abstract

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A BATTERY SWAPPING SYSTEM WITH BATTERY MAGAZINE FOR GENERAL APPLICATIONS

Related Application:

This application is a divisional application related to the application No 3,224,777 titled “a Swappable Battery and a Battery Swapping System for EV's and Other Application” filed in Canada on December 26, 2023, the contents of which are incorporated herein by reference.

Field of the Invention:

This proposed invention relates to energy storage batteries used to power electrical vehicles and a wide range of other applications. More particularly, it relates to swappable batteries.

Background of the Invention:

The classical design of EV's with fixed battery packs comes with many disadvantages. One of them is the non-standardised battery pack across all EV's leading to higher production cost and higher maintenance costs in repairing or replacing the battery pack. Also, for recharging those vehicles, a big number of charging stations is needed, and building these infrastructure needs a lot of resources and comes at a high cost. And no mater how big the charging station is (the number of charging points), its charging capacity is limited by the maximum electrical power it can withdraw from the local electrical grid.

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Even with increasing charging capacity by adding energy storage to the charging station, it is still limited by the available electrical power from the grid at that location, and yet by increasing its cost (the energy storage units are expansive).

And given the relatively long time it takes to fully charge an EV even with a super charger, recharging an EV is somehow inconvenient especially when in high demand (too many vehicles at the same station), for long distance drivers, long distance shipment trucks and for taxi and delivery fleet, etc.

Another drawback of the superchargers especially when using them often is the reducing of lifespan of the Li-ion batteries of the EV's.

It is also known that the classical EV's equipped with fixed battery packs are much more expensive compared to conventional internal combustion engines vehicles due primarily to the cost of the fixed battery pack. Even if EV's routine maintenance cost is less expensive, the battery capacity is degrading overtime and the cost of replacing the battery pack after warranty is very high for the owner.

A proposed technology for mitigating the drawbacks of the fixed battery packs consist of the swappable battery systems. There were some solutions for swappable battery systems that are developed in the recent years but none of them was adopted broadly by the EV's manufacturing companies like Tesla or widely used in mobile or stationary applications. Among the reasons are the degree of complexity of such proposed systems, the economical feasibility, the convenience, the safety, and the non standardisation of both the swappable batteries and the swapping systems. Some examples of those systems are the ones developed by companies like Ample, Aulton and CATL.

This emphasis the need to find a better solution for a battery swapping system and a swappable battery that mitigate those issues.

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Summary of the Invention:

The proposed battery swapping system used with a portable and convenient battery is one solution regarding battery swapping. It will redesign the charging of heavy EV's and stationary applications by bringing more charging capacity and by speeding up the recharging process, giving more convenience and flexibility for the end user.

The invention specifically relates to the serial engaging battery swapping system with the use of two battery reservoirs and mechanisms for loading/unloading the batteries and for making electrical contact.
One reservoir where several charged batteries are stored (magazine) and only a given number of charged batteries is taken from that reservoir (magazine) to be engaged electrically at one time. Another reservoir is where the discharged batteries are disposed off.

The proposed swapping system uses a battery that is designed such a way to facilitate its loading, unloading, transportation and handling during the replacement, transportation, and recharging procedures.

For the end user, the proposed battery swapping system with the swappable batteries will remove the burden of replacing a degraded battery pack or repairing a malfunctioning one, in fact with swappable batteries, there is no battery degradation or functionality issues, thus less maintenance is needed.

Also, the proposed battery and battery swapping system will bring recharging flexibility in a way that the batteries could be recharged locally, otherwise if there is not enough power from the local grid they will be brought to be recharged in another location and the recharged batteries will be brought back to be reloaded, and this could be done by special trucks like conventional fuel.

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Furthermore, it is not even necessarily for the batteries to be recharged at all locally thus removing the load demand on the local electrical grid and reducing the charging cost since there is less needed distributed electrical infrastructure.

Also, with the proposed battery swapping system, the electrical vehicles will be featured with modulable autonomy, given that the battery system can work with only a few loaded batteries. This will bring flexibility of using only a needed number of batteries and a possibility of adding more batteries in the future as needed, this will reduce even further the front cost of battery-powered-applications ownership for some users. Also, there is even more flexibility with many options of using the batteries as needed, for the end user, with the possibility of buying, renting, or paying per use…etc.

Regarding the applications, the proposed battery swapping system will bring considerable benefits over the classical fueling or recharging methods especially for energy demanding applications as machinery in remote sites, trucks, ships, trains…etc. where several batteries are used in relatively a short period of time, but only the minimum needed battery to produce the desired power are engaged electrically at the same time.

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Brief Description of the Drawings:

- Fig 1 is showing an example of a swappable and portable battery that is suitable for use with the proposed swapping system. The shown battery is the preferred embodiment of the UNiBat battery (Ref: application No 3,224,777) that is made of two heads and a body with a slotted heat sink envelope.

- Fig 2 is showing a view of the battery head (shown in Fig 1) and a partial view of the slotted battery body heat exchange envelope.

- Fig 3 is showing a sectional view of the battery (shown in Fig 1) with an embodiment of the electrical contact and holding mechanism using plug members with linear actuators.

- Fig 4 is an illustration of one embodiment of the serial engaging system, with contactor engaging mechanism, charged batteries reservoir and discharged batteries reservoir.

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Description of the Preferred Embodiment:

-The Serial Electrically Engaging Battery Swapping System:

As shown in Fig 4, the serial electrical engaging system works such that several batteries (1) are stored in a reservoir (2) (battery magazine) and one or more batteries (1) are taken in one time through an appropriate mechanism (4) to be engaged to make an electrical contact and deliver power.
The swapping system engage the charged batteries in a serial procedure and depending on the amount of power needed for the usage, only a given number of batteries are electrically engaged at the same time by the system.
Once the engaged batteries are used and drained from their stored energy, they will be disengaged by the system and recovered in a reservoir (3) made for this purpose. Then, the same number of charged batteries is pulled again from the first reservoir (2) (battery magazine), and in their turn they will be electrically engaged with the battery system, and so on.

It is however worth noting that a device for storing and releasing the energy needed during the transitional step is necessary, preferably super capacitors given their high-power output, so there will be no power shortage from the battery system during that transitional step.

Note:

Although the invention has been described in connection with a preferred embodiment, it should be understood that various modifications, additions and alterations may be made to the invention by one skilled in the art without departing from the spirit and scope of the invention as defined in the appended claims.

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Claims

The Embodiments of The Invention in Which an Exclusive Property or Privilege is Claimed Are Defined as Follows:

1 - A battery swapping system, comprising:

- a first reservoir where several charged batteries are stored;

- a second reservoir where discharged batteries are disposed of; and

- a mechanism that pulls one or more of the charged batteries from the said first reservoir; and electrically engage them in order to make electrical contact with the said battery swapping system and deliver power; and after the batteries are drained from their stored energy; the said mechanism transfers the discharged batteries to the said second reservoir, and the process repeats itself until all the batteries of the first reservoir are used.

2 – The battery swapping system recited in claim 1 further comprising a mean for storing energy to be released temporarily during the swapping process, in order for the system to deliver a continuous power.

3 – The battery swapping system recited in claim 2 wherein the said mean for storing energy is a supercapacitor.

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Drawings

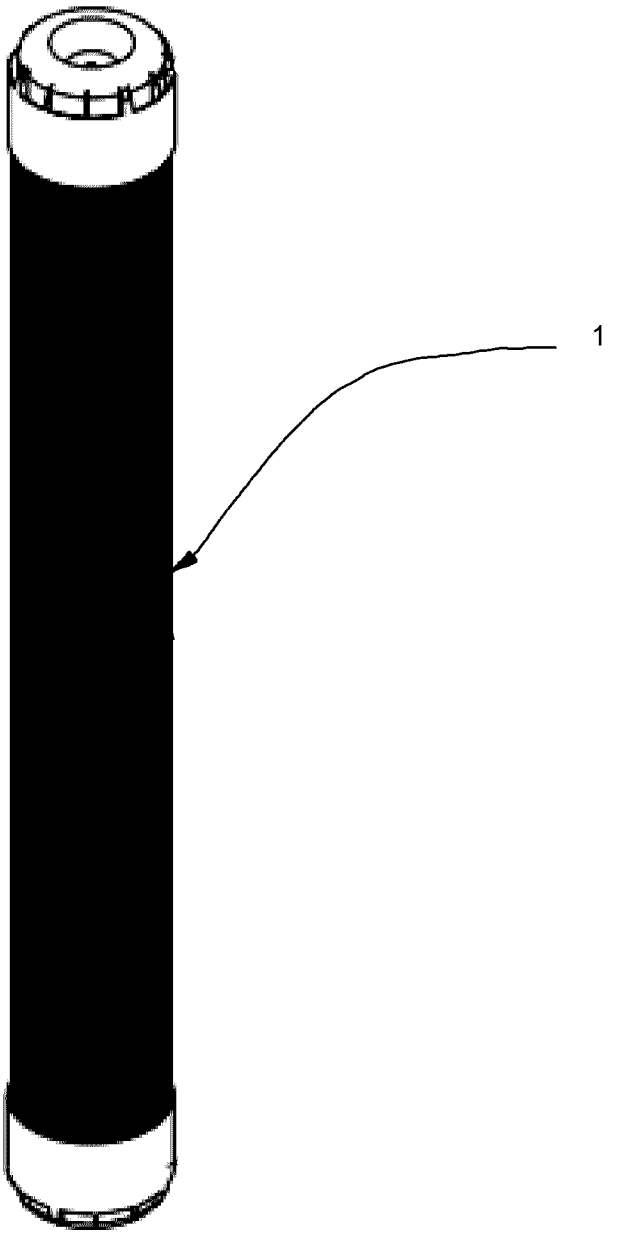

Fig 1

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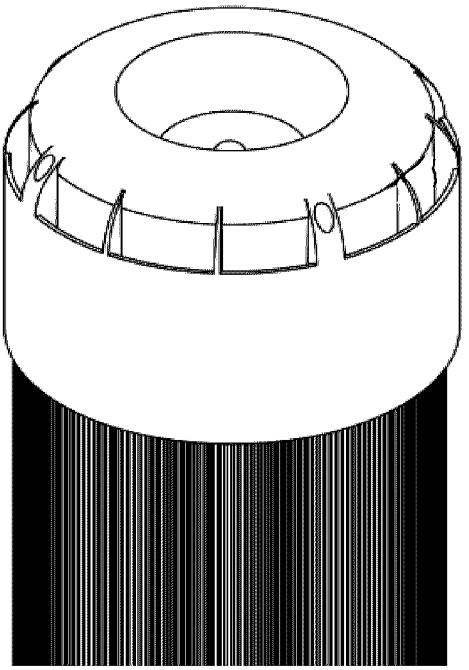

Fig 2

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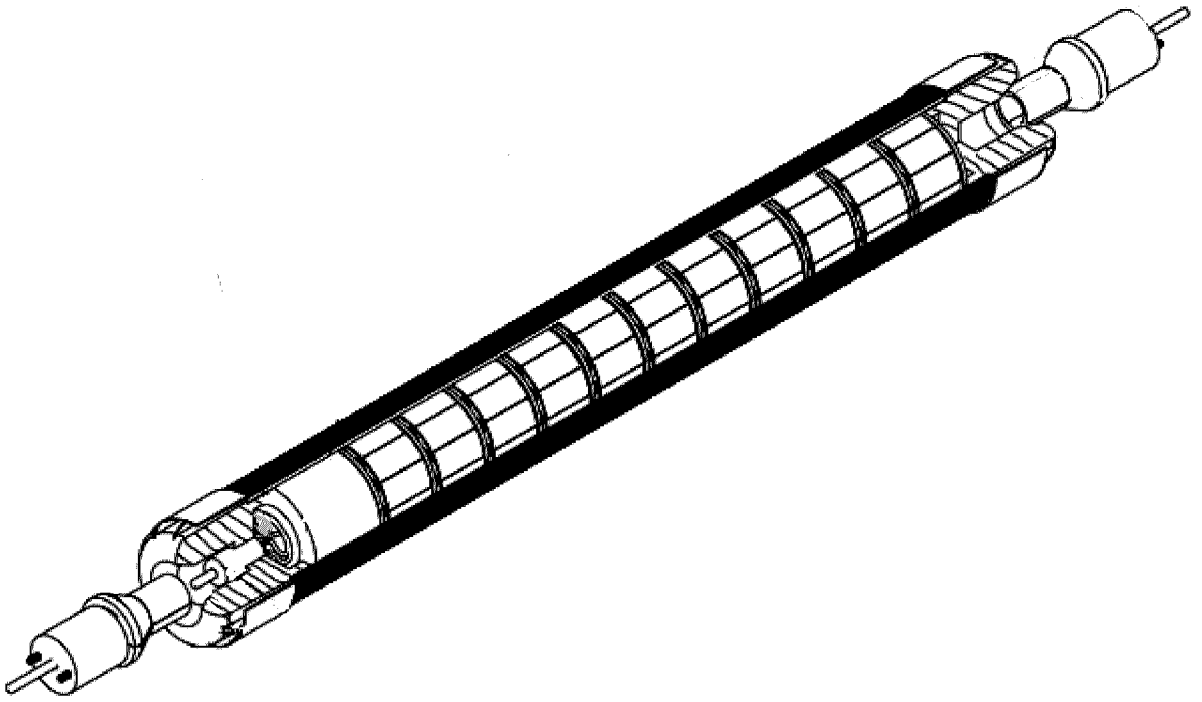

Fig 3

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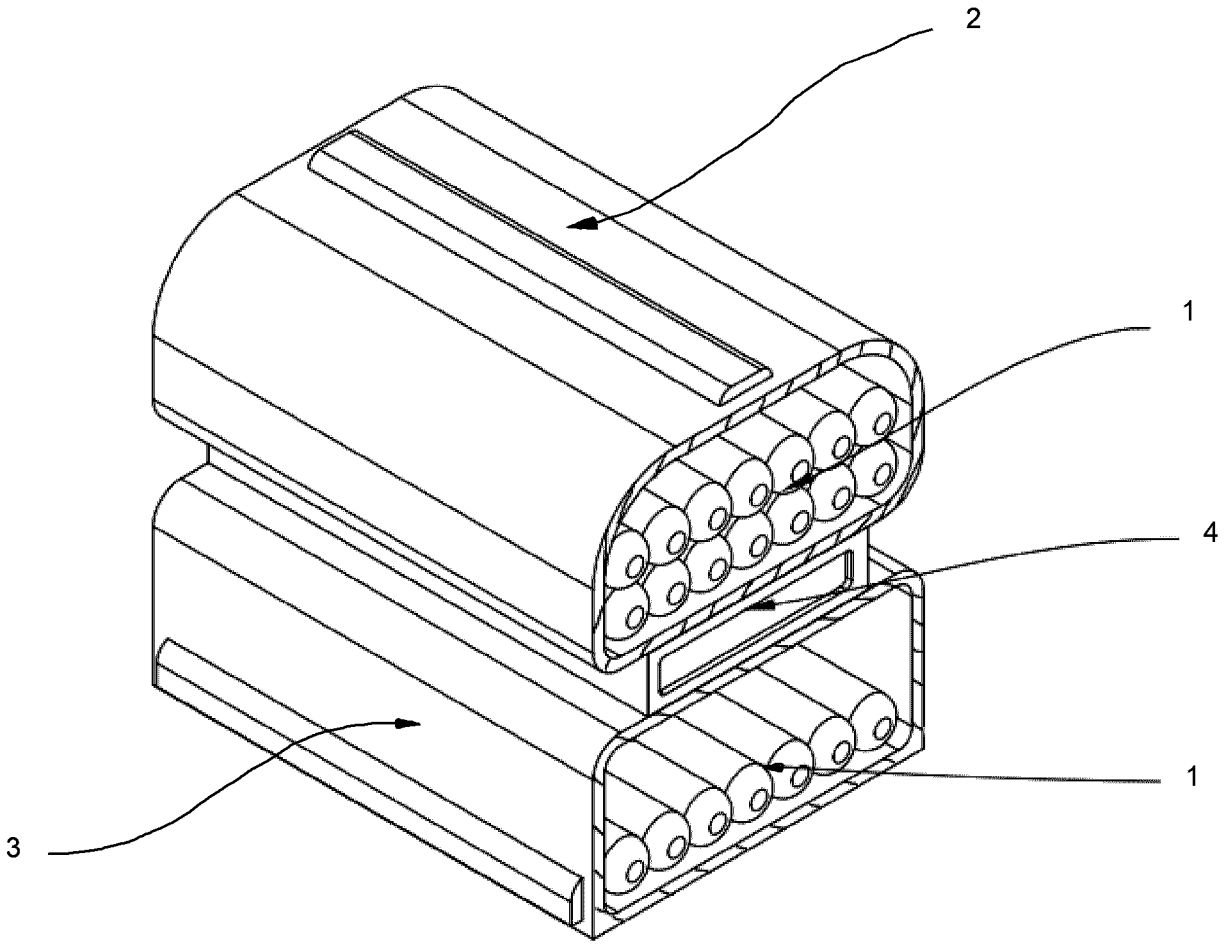

Fig 4

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