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Research Article

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Innovative Product Design of Inflator with Deflate Function for Easy Storage

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Abstract Inflatables are often necessary for water activities during summer. These products need to be inflated before use. However, industrial inflators pose concerns about current leakage. In addition, deflating these items after usage is time consuming. Therefore, an inflator with deflate function for easy storage is needed to resolve these current issues. Such an inflator can be used to deflate inflatables rapidly for storage. It is also equipped with a fool-proof pressure-sensitive device that automatically turns off when the object being inflated is full to avoid rupture caused by over-inflating. It possesses low and high pressure selections and is easy to operate with just one button.

Keywords Deflate, Storage, Inflator, Creative Design, Product Design.

Introduction

Modern people often use products that need to be inflated, such as beds, rubber boats, swimming pools, swim rings, etc. in their daily life. After use, these items need to be deflated. However, huge items such as swimming pools have very small air valve, making deflation of such items time and energy consuming. Currently, there are many commercially available inflators but few deflators. Therefore, the development of a more practical and innovative structure is ardently awaited by consumers.

During summer, parents often go swimming and play in water with their children. If deflate function is available, storage of inflatable's would be effortless, making water activities easier and more fun-filled. When using inflatable mattresses, sofas and other furniture, a deflating devise would ensure fast and effortless storage and help in organizing things.

Literature Review

Environmentally friendly materials were used to form the housing of this creation. Oxo-biodegradable plastic technology was used to enable the plastic to automatically decompose in aerobic environment. This material does not require a special processing environment to decompose; therefore, it will not consume energy, eliminating green energy concerns [1-2]. Globally, an alliance already exists for the research and development of this material [3].

Green plastic is also known as biodegradable plastic. It takes advantage of the microbial decomposition in nature and finally becomes water and CO_2. Due to its biodegradability, this product can be disposed with general animal and plant wastes and livestock excrement, then recycled as composts and used as soil improvement material, green soil, fertilizers, etc. [4]. Yijun & Gengxin believe that achieving energy-saving, lower power consumption, as well as clean and green production in plastic molding factories is a very important technological research subject [5]. Therefore, increased attention was given to Green Supply Chain Management (GSCM), making it a very useful initiative for industries to improve their environmental capabilities in terms of reducing resources consumption and ensuring sustainable production in business [6]. Furthermore, lightweight design with thermoplastics is a robust approach that reduces CO_2 emission and fuel consumption [7]. Solar energy is a clean and renewable option for energy production that is used for several purposes [8]. This creation has an internal solar energy panel that can store energy, which is feasible for use in this sunny country [9].

Creation Design

The inflator with deflate function was designed in such a way by the creator with a motor installed inside, air inlet and outlet ports, and a passageway. The blades are placed in the passageway that has inlet and outlet ends connected to the air inlet and outlet valves. The product is connected to an air tube, and the air tube is connected to the inflator nozzle. The motor is connected to the blades and drives them to rotate and produce high-speed air flow within the passageway. Control valves are set in the inlet and the outlet ends and connect both inlet and outlet valves. A guide runner that helps control airflow is located within the control valves and is connected to the inlet or the outlet ends of the passageway. The guide runner is connected to the air tube. The product is connected to a power storage device that supplies power to the motor.

With this structure, upon contact of the inflator nozzle to the air valve of inflatables, the motor starts and drives the blades to rotate, thus producing high-speed air flow within the passageway. When the guide runner within the control valve connects with air within the passageway, it directs air into the air tube, resulting in a blowing effect. When the guide runner and the air inlet within the control valve are connected, the guide runner directs the air within the inflatable to be discharged, producing a suction effect.

Design Results

When this creation, an air pump with inflate and deflate function, is connected to the air valve, inflate and deflate functions start; model is shown in figure 1. The new patent application for this creation was reviewed and approved by the Intellectual Property Office of the Republic of China's Ministry of Economic Affairs (M476183, 2014/4/11-2023/9/30) (figure 2). Then a poster was designed according to its creative features (figure 3) and submitted to the 2013 International Innovation and Invention Competition (IIIC) Poster Contest (12/16), winning the bronze medal (figure 4); the 2013 Korea Cyber International Genius Inventor Fair (11/23), winning the silver medal (figure 5); and the 2014 Far East University's Commercialization of Innovative Technology Competition (6/5), winning the award for excellence (figure 6).

figure 1

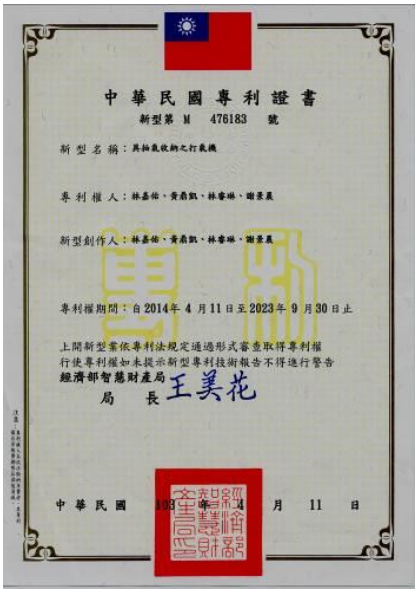

figure 2

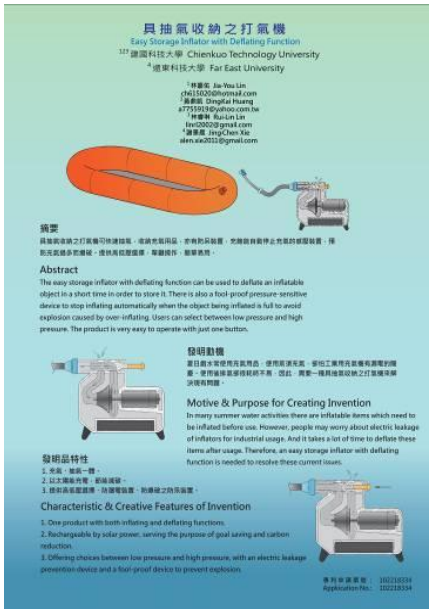

figure 3

figure 4

figure 5

figure 6

Conclusions

This creation has the following features:

(1) The product housing was designed with eco-friendly materials, reshaping the new concept of eco-friendly materials and attaining an innovative product design that possesses both innovative features and environmental performance.

(2) The product has high and low pressure selections and built-in solar charger that stores energy through sun exposure. Its new lithium battery can also be charged via a USB connector. This product is compact and portable, as well as eco-friendly and energy saving.

(3) The product has a fool-proof pressure-sensitive device that automatically shuts off when the object is filled with air, stopping inflation, preventing rupture, and ensuring safe operation.

(4) The deflate function of the product is stressed, which can be simply operated with one button. This helps storage, saves time and effort, and is different from commercially available inflators with only inflate function. It also has great market potential.

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