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(54) **STRUCTURE FOR FIXING GRAPHITE SHEETS AND INSULATION GAPS**

(57) The present invention discloses a structure for fixing graphite sheets and insulation gaps. The structure comprises housing, electrodes, springs and fixing caps, wherein the housing is configured to receive a stack of graphite sheets and insulation gaps stacked in combination, both ends of the housing are provided with threads;

the fixing caps match with the housing and are to be screwed tight onto the housing; the electrodes are to be located at both ends of the stack of graphite sheets and insulation gaps; and the springs are to be located between the electrodes and the fixing caps.

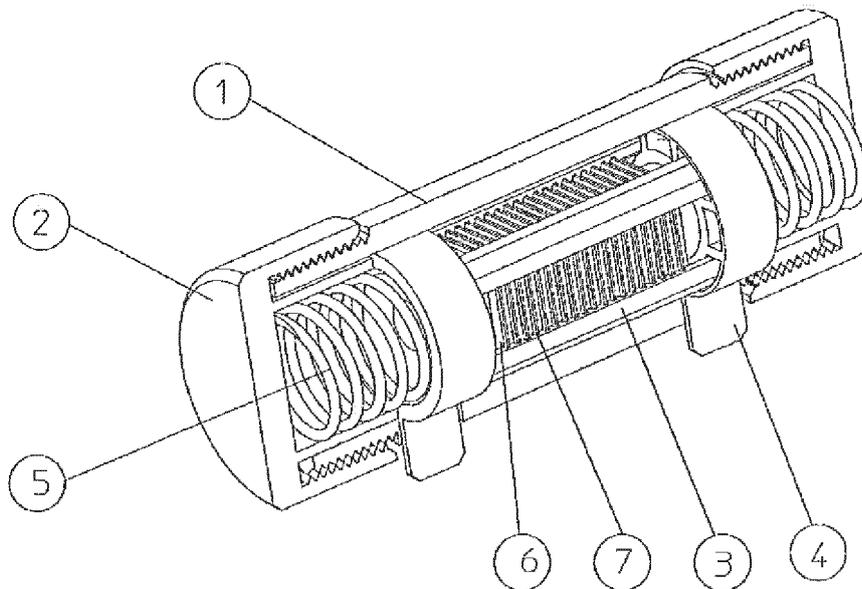


FIG. 1

**Description****TECHNICAL FIELD**

**[0001]** The present invention relates to a structure for fixing graphite sheets and insulation gaps thereof, and belongs to the field of industrial surge protection devices.

**BACKGROUND**

**[0002]** Due to the rapid development of communication industry, the rapid development of mobile terminals and mobile internet business are proposing new challenge to stability of mobile networks. In particular, as the application of the 4G networks and research and development of 5G networks, existing mobile base station technologies and deployment methods are no longer able to satisfy the growing demands for data business. The mobile base stations are showing a trend toward miniaturization. And, more and more small-scale base station products with deep coverage, easy deployment and low energy consumption are emerging.

**[0003]** Due to small volume of small and micro base station, internal surge protection requirements are higher, and volumes of surge protectors are required to be smaller. The original track-mounted surge protector already cannot meet the existing technology and size requirements. A circuit board with high-density component arranged thereon has limited space. And once the surge protector directly soldered to the circuit board is damaged, the entire circuit board needs to be replaced, causing the maintenance cost to be very high. Under the above requirements, in order to meet the demands of overall power supply integration, volume miniaturization, and power maximization, the design of the power supply circuit board tends to be highly integrated. We have developed a small surge protector base, which is easy to be soldered and installed, and is configured with remote communication output function. Compared to the surge protector directly soldered to the circuit board, this surge protector with solderable surge protector base is of easy maintenance.

**[0004]** In order to solve the above technical problems, a structure for fixing graphite sheets and insulation gaps thereof is provided. This structure is compact and is able to fix graphite sheets very well. The forces of springs, which are provided on two sides of a stack of graphite sheets and insulation gaps thereof, act on the graphite sheets and insulation gaps thereof, so as to ensure the structure would not loosen after a surge shock.

**SUMMARY**

**[0005]** The present technical solution is used to solve the above problems and provides a structure for fixing graphite sheets and insulation gaps thereof. In the present solution, several sets of graphite sheets and insulation gaps thereof are stacked in combination and

placed within round insulating housing, and further fixed around by insulating fixing clips. The fixing clips are provided with trapezoid structure slots. Corresponding mounting electrodes are provided on two ends of the stack consisting of graphite sheets and insulation gaps thereof, and corresponding springs are provided to connect. Two ends of the housing are provided with threads for matching with the fixing cap and being screwed tight, thus avoiding space limitations of traditional methods for fixing graphite sheets. The stacked graphite sheets and insulation gaps thereof would not loosen after a surge, and would not result in decreased product performance or even failure. Further, this solution meets the demands of overall power supply integration, volume miniaturization, and power maximization, facilitates circuit board to be arranged with a high-density elements, saves cost and improves efficiency.

**[0006]** The technical solution adopted by the present invention is as follows.

**[0007]** A structure for fixing graphite sheets and insulation gaps thereof is provided, comprises housing, fixing caps, fixing clips, electrodes, springs, graphite sheets and insulation gaps, wherein the several sets of graphite sheets and insulation gaps are stacked in combination and placed within the round insulating housing. The fixing clips are evenly distributed and fixed around the graphite sheets and insulation gaps. The fixing clips are provided with trapezoid structure slots. There are also corresponding mounting electrodes located at two ends of the graphite sheets and the insulation gaps. The springs are mounted between the electrodes and the fixing caps. The two ends of the housing are provided with threads, and the fixing caps match with and are to be screwed tight onto the housing.

**[0008]** The housing has a cylindrical cavity structure with fastening threads at its two ends, and electrode extraction holes are provided at the threads. The fixing caps match with and are to be screwed tight onto the housing. The graphite sheets are circular or polygonal in shape. The electrodes are located between the graphite sheets and the springs with its one end connecting to the graphite sheets and a pin provided at its lower end for being directly soldered on a circuit board. The springs are disposed between the electrodes and fixing caps.

**[0009]** The fixing clips are semi-circular plastic pieces with the trapezoidal structure slots in the middle, for fixing the graphite sheets and the insulation gaps material. Several pieces of fixing clips are evenly wrapped around the graphite sheets to fix them.

**[0010]** The present invention has the following beneficial effects.

**[0011]** The present technical solution is used to a structure for fixing graphite gaps, and to change the phenomenon that the graphite sheets and insulation gap thereof would loosen after being subjected to a surge shock. This problem is well solved by mounting springs between the electrodes and the fixing caps. The springs apply pressure, at the two ends, to the graphite sheets and insula-

tion gaps thereof, ensuring them firmly attached to each other. Meanwhile, the pins are to be directly soldered onto the circuit board, which solves the problem that the graphite sheets and insulation gaps thereof are easy to loosen after a surge shock, which results in decreased product performance or even failure.

## BRIEF DESCRIPTION OF THE DRAWINGS

### [0012]

**Figure 1** is an overall structure diagram of a structure for fixing graphite sheets and insulation gap thereof, in accordance with the present invention.

**Figure 2** is an assembly structure diagram of a structure for fixing graphite sheets and insulation gap thereof, in accordance with the present invention.

**Figure 3** is a fixing clip structure diagram of a structure for fixing graphite sheets and insulation gap thereof, in accordance with the present invention.

Reference numerals:

**[0013]** 1-housing, 2-fixing cap, 3-fixing clip, 4-electrode, 5-spring, 6-graphite sheet, 7-insulation gap, 31-trapezoid structure slot

## DETAILED DESCRIPTION

**[0014]** The present invention is described in detail below in conjunction with the drawings and detailed embodiments.

**[0015]** FIG. 1 and 2 schematically show a structure for fixing graphite sheets and an insulation gap thereof according to an embodiment of the present invention.

**[0016]** In a specific embodiment, a structure for fixing graphite sheets and insulation gaps thereof comprises a housing 1, fixing caps 2, fixing clips 3, electrodes 4, springs 5, graphite sheets 6, and insulation gaps 7. The several sets of graphite sheets 6 and insulation gaps 7 are stacked in combination and placed within the round insulating housing 1. The fixing clips 3 are evenly distributed and fixed around the graphite sheets 6 and insulation gaps 7. The fixing clips 3 are provided with trapezoid structure slots 31 thereon. There are also corresponding mounting electrodes 4 located at two ends of the graphite sheets 6 and the insulation gaps 7. The springs 5 are mounted between the electrodes 4 and the fixing caps 2. The two ends of the housing 1 are provided with threads, and the fixing caps 2 match with and are to be screwed tight onto the housing 1.

**[0017]** Further, the housing 1 and the fixing caps 2 are made of industrial flame retardant insulating materials. This type of materials, due to the variety of shapes and impact resistance and electrical characteristic of ensuring safe electrical insulation with the circuit board and adjacent electronics during the use of the products, are of good process ability, and safe and reliable.

**[0018]** The housing 1 has a cylindrical cavity structure with fastening threads at its two end, and electrode 4 extraction holes are provided at the threads. The fixing caps 2 match with and are to be screwed tight onto the housing 1.

**[0019]** The graphite sheets 6 are circular or polygonal in shape.

**[0020]** Several sets of graphite sheets 6 are stacked to form a stack, and the insulation gaps 7 are formed between adjacent graphite sheets 6, respectively.

**[0021]** The electrodes 4 are located between the graphite sheets 6 and the springs 5. One end of the electrode 4 is connected to the graphite sheets 6, and the lower end is provided with a pin for being directly soldered onto a circuit board. The springs 5 are disposed between the electrodes 4 and fixing caps 2.

**[0022]** The springs 5 are disposed between the electrodes 4 and fixing caps 2. The springs 5 apply pressure, at two ends, to the graphite sheets 6 and insulation gaps 7 thereof by using forces, ensuring them to be firmly attached to each other and preventing the phenomenon that the graphite sheets 6 and insulation gap 7 thereof loosen after being subjected to a surge shock.

**[0023]** As shown in FIG. 3, the fixing clips 3 are semi-circular plastic pieces with the trapezoidal structure slots in the middle, for fixing the graphite sheets 6 and the insulation gaps 7 material. Several pieces of fixing clips 3 are evenly fixed around the graphite sheets 6 and the insulation gaps 7. The trapezoidal structure slots are to be interleaved with and clamp with the insulation gaps 7.

**[0024]** The above description is only preferred implementation of the present invention. It should be noted that those skilled in the art can make several improvements without departing from the principles of the present invention. These improvements are also considered to be within the protection scope of the present invention.

## Claims

1. A structure for fixing graphite sheets and insulation gaps, said structure comprising housing, electrodes, springs and fixing caps, **characterized in that:**

the housing is configured to receive a stack of graphite sheets and insulation gaps stacked in combination, both ends of the housing are provided with threads;

the fixing caps match with the housing and are to be screwed tight onto the housing;

the electrodes are to be located at both ends of the stack of graphite sheets and insulation gaps; and

the springs are to be located between the electrodes and the fixing caps.

2. The structure for fixing graphite sheets and insulation gaps of claim 1, further comprising fixing clips, the

fixing clips are evenly distributed and fixed around the stack of graphite sheets and insulation gaps, and the fixing clips are provided with trapezoid structure slots thereon.

3. The structure for fixing graphite sheets and insulation gaps of claim 2, wherein the fixing clips are semi-circular plastic pieces with trapezoidal structure slots in the middle, for fixing the graphite sheets and the insulation gaps, wherein several pieces of fixing clips are to be evenly fixed around the graphite sheets and the insulation gaps, and the trapezoidal structure slots of the fixing clips are to be interleaved with and clamp with the insulation gaps. 5  
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4. The structure for fixing graphite sheets and insulation gaps of any of claims 1-3, wherein the housing has a cylindrical cavity structure with fastening threads at its both ends, and electrode extraction holes are provided at the place of the threads. 20
5. The structure for fixing graphite sheets and insulation gaps of any of claims 1-3, wherein each of the electrodes has one end to connect the graphite sheet, and has a pin provided at its lower end for being directly soldered onto a circuit board. 25
6. The structure for fixing graphite sheets and insulation gaps of any of claims 1-3, wherein the springs are to apply pressure, at both ends of the stack of the graphite sheets and insulation gaps. 30
7. A surge protector device, comprising a base, **characterized in that**, the base adopting the structure as defined in any of claims 1-6. 35
8. A surge protector device, comprising insulating housing, fixing caps, fixing clips, electrodes, springs, a plurality of graphite sheets and insulation gaps, **characterized in that:** 40
 

the plurality of graphite sheets and insulation gaps are stacked in combination to form a stack, said stack is placed within the insulating housing, 45

the electrodes are located at both ends of the stack of graphite sheets and insulation gaps, the springs are mounted between the electrodes and the fixing caps, both ends of the housing is provided with threads, and the fixing caps are to match with the housing to be screwed tight onto the housing. 50
9. The surge protector device of claim 8, wherein the fixing clips are evenly distributed and fixed around the stack of graphite sheets and insulation gaps, and the fixing clips are provided with trapezoid structure slots thereon. 55

10. The surge protector device of claim 8 or 9, wherein in the stack of graphite sheets and insulation gaps, each of the insulation gaps are formed between adjacent graphite sheets, the graphite sheets are circular or polygonal in shape. 5

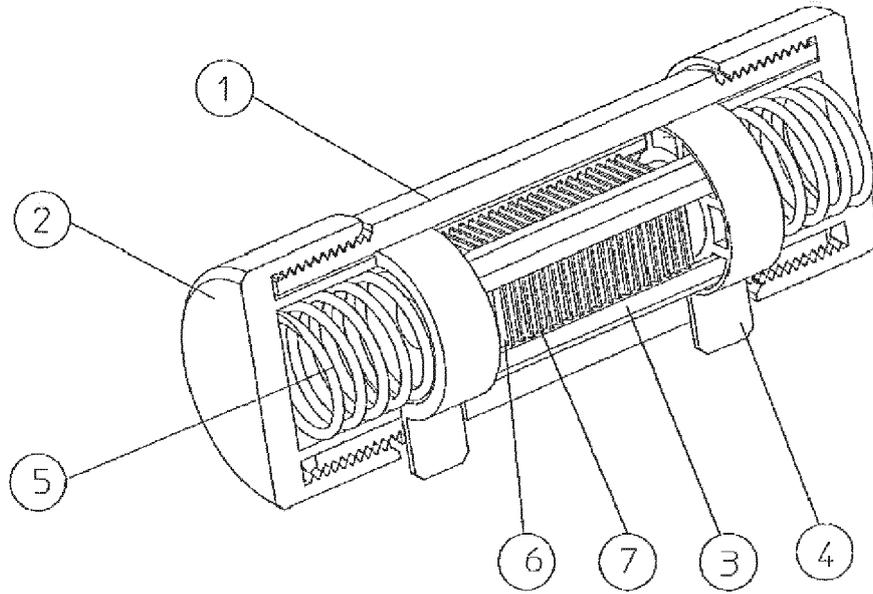


FIG. 1

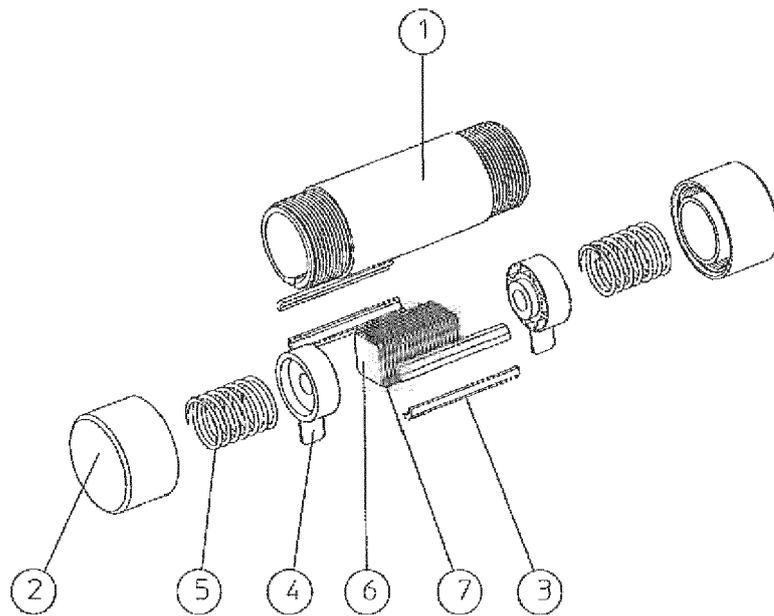


FIG. 2

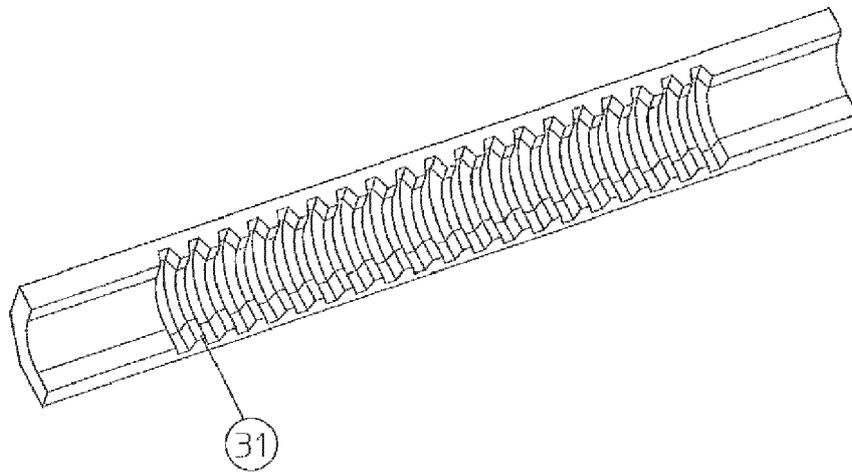


FIG.3



EUROPEAN SEARCH REPORT

Application Number  
EP 19 17 0027

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 665 052 A (E M P ELECTRIC LTD; WILLIAM WALTER JAMES MILES) 16 January 1952 (1952-01-16)	1,4,6	INV. H01T4/16 H01T4/04
Y	* page 2, line 15 - line 57 *	5,7,8,10	
A	* figure 1 *	2,3,9	
X	----- EP 2 565 899 A1 (SIEMENS AG [DE]) 6 March 2013 (2013-03-06)	1	
Y	* paragraph [0018] *	7,8	
	* figure 1 *		
Y	----- CN 106 602 536 A (XIAMEN HONGFA ELECTRICAL SAFETY & CONTROLS CO LTD) 26 April 2017 (2017-04-26)	5,7,8,10	
A	* paragraph [0017] *	9	
	* figure 3 *		
Y	----- EP 0 905 840 A1 (BETTERMANN OBO GMBH & CO KG [DE]) 31 March 1999 (1999-03-31)	7,8	
	* paragraph [0021] *		
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search		Date of completion of the search	Examiner
Munich		28 August 2019	Fribert, Jan
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone		T : theory or principle underlying the invention	
Y : particularly relevant if combined with another document of the same category		E : earlier patent document, but published on, or after the filing date	
A : technological background		D : document cited in the application	
O : non-written disclosure		L : document cited for other reasons	
P : intermediate document		& : member of the same patent family, corresponding document	

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ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 19 17 0027

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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28-08-2019

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