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(54) **BIMETALLIC SPARK GAP ARRANGEMENT**

(57) A bimetallic spark gap arrangement is hereby provided. The bimetallic spark gap arrangement of the invention comprises at least one elastic element made of a Shape Memory Alloy providing the advantage of spark gaps arrangements, with their associated simplicity and cost, adding a distinguishing feature allowing the object of the invention to get that the arc generated between electric poles can be extinguished even though

voltage is still applied between the component terminals. The bimetallic spark gap arrangement of the invention comprises at least one of the poles being associated to a bimetallic elastic element made of at least two different metallic materials so that when heated, due to the flow of electric current, the elastic element compress increasing the spark gap.

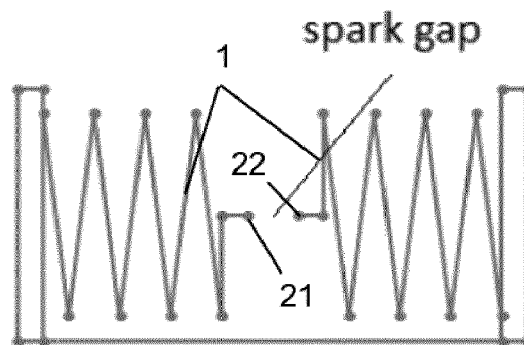


FIGURE 2A

Description

OBJECT OF THE INVENTION

[0001] The invention hereby provided belongs to the field of electricity.

[0002] More precisely, the object of the invention is directed to avoid electric arcs.

BACKGROUND

[0003] A voltage spike is a transient event, typically lasting 1 to 30 microseconds, that may reach over 1,000 volts. Lightning that hits a power line can give many thousands, sometimes 100,000 or more volts. A motor when switched off can generate a spike of 1,000 or more volts. Spikes can degrade wiring insulation and destroy electronic devices like battery chargers, modems and TVs.

[0004] Spikes can also occur on telephone and data lines when alternating current (AC) main lines accidentally connect to them or lightning hits them or the telephone and data lines travel near lines with a spike and the voltage is induced.

[0005] A long-term surge, lasting seconds, minutes, or hours, caused by power transformer failures such as a lost neutral or other power company error, are not protected by transient protectors. Long term surges can destroy the protectors in an entire building or area. Even tens of milliseconds can be longer than a protector can handle. Long term surges may or may not be handled by fuses and overvoltage relays.

[0006] A transient surge protector attempts to limit the voltage supplied to an electric device by either blocking or shorting current to reduce the voltage below a safe threshold. Blocking is done by using inductors which inhibit a sudden change in current. Shorting is done by spark gaps, discharge tubes, zener-type semiconductors, and metal-oxide varistors (MOVs), all of which begin to conduct current once a certain voltage threshold is reached, or by capacitors which inhibit a sudden change in voltage. Some surge protectors use multiple elements.

[0007] The most common and effective way is the shorting method in which the electrical lines are temporarily shorted together (as by a spark gap) or clamped to a target voltage (as by a MOV) resulting in a large current flow. The voltage is reduced as the shorting current flows through the resistance in the power lines. The spike's energy is dissipated in the power lines (and/or the ground), or in the body of the MOV, converted to heat. Since a spike lasts only 10s of microseconds, the temperature rise is minimal. However, if the spike is large enough or long enough, like a nearby hit by lightning, there might not be enough power line or ground resistance and the MOV (or other protection element) can be destroyed and power lines melted.

[0008] Surge protectors for homes can be in power strips used inside, or a device outside at the power panel. Sockets in a modern house uses three wires: line, neutral

and ground. Many protectors will connect to all three in pairs (line-neutral, line-ground and neutral-ground), because there are conditions, such as lightning, where both line and neutral have high voltage spikes that need to be shorted to ground.

[0009] A spark gap consists of an arrangement of two conducting electrodes separated by a gap usually filled with a gas such as air, designed to allow an electric spark to pass between the conductors. When the potential difference between the conductors exceeds the breakdown voltage of the gas within the gap, a spark forms, ionizing the gas and drastically reducing its electrical resistance. An electric current then flows until the path of ionized gas is broken, or the current reduces below a minimum value called the "holding current". This usually happens when the voltage drops, but in some cases occurs when the heated gas rises, stretching out and then breaking the filament of ionized gas. Usually, the action of ionizing the gas is violent and disruptive, often leading to sound (ranging from a snap for a spark plug to thunder for a lightning discharge), light and heat.

[0010] Spark gaps were used historically in early electrical equipment, such as spark gap radio transmitters, electrostatic machines, and X-ray machines. Their most widespread use today is in spark plugs to ignite the fuel in internal combustion engines, but they are also used in lightning arresters and other devices to protect electrical equipment from high-voltage transients.

[0011] Any electronic component susceptible to being damaged by overvoltage (lightning, inductive loads, etc.). It is especially useful for electronic equipment that must be protected against overvoltage but that under normal conditions must work at a high potential (1000v-1500v) with respect to ground (such as electronics to control solar trackers).

[0012] Known solutions cannot get the arc extinguished even though voltage is still applied between the component terminals.

DESCRIPTION

[0013] The object of the invention provides a bimetallic spark gap arrangement with the advantage of spark gaps (simplicity and cost) adding a distinguishing feature allowing the object of the invention to get that the arc can be extinguished even though voltage is still applied between the component terminals.

[0014] In addition, the bimetallic spark gap arrangement object of the invention hereby disclosed is self-resetting, meaning that once the arc is extinguished, the device is ready to provide protection again.

DRAWINGS

[0015] To complement the description being made and in order to aid towards a better understanding of the characteristics of the invention, in accordance with a preferred example of practical embodiment thereof, a set of draw-

ings is attached as an integral part of said description wherein, with illustrative and non-limiting character, the following has been represented:

Figures 1a and 1b: Depict a preferred embodiment of the invention where the arrangement comprises a bimetallic elastic element and a bimetallic plate respectively associated to the electric poles. Figure 1a shows the bimetallic element being in an original position defining the spark gap between the electric poles, whereas figure 1b shows the bimetallic element being compressed separating the electric poles, thus enlarging the spark gap so no spark can be generated between the electric poles.

Figures 2a and 2b: Depict a preferred embodiment of the invention where the arrangement comprises two bimetallic elastic elements respectively associated to the electric poles. Figure 2a shows the bimetallic elements being in an original position defining the spark gap between the electric poles, whereas figure 2b shows the bimetallic elements being compressed separating the electric poles, thus enlarging the spark gap so no spark can be generated between the electric poles.

DETAILED DESCRIPTION

[0016] In a preferred embodiment of the object of the invention, it is provided a spark arrangement in which the distance between poles increases after a start of a spark, thus forcing its extinction.

[0017] Provided a first electric pole (21) and a second electric pole (22), arrange at a distance defined by a spark gap, for generating a spark when electric current flows between said electric poles (21,22), the object of the invention encompasses at least one of said electric poles (21,22) being associated to an elastic element (1) made of at least two different materials so that when heated, due to the flow of electric current thru the elastic element (1), the elastic element (1) compresses thus increasing the spark gap. The elastic element is preferably made of a SMA "Shape Memory Alloy" being temperature a sensitive material such as a Ni-Ti alloy (Nitinol); so that a change in temperature renders a mechanical displacement. In a preferred embodiment of the invention nitinol is used, so that when heated, due to the flow of electric current, the bimetallic material of the elastic element (1) compresses therefore compressing the structure of the elastic element (1) thus increasing a spark gap defined between electric poles (21,22).

[0018] In order to achieve this, at least one elastic element (1) is used, in a preferred embodiment of the invention at least one bimetallic spring (1) as per figures 1a and 1b is used. Therefore, in a preferred embodiment of the invention represented in figures 1a and 1b, the first electric pole (21) may be associated to the elastic element (1) and a second electric pole (22) may be associ-

ated to a bimetallic plate (3), or vice-versa.

[0019] In alternative embodiments of the invention, as the one represented in figures 2a and 2b two bimetallic springs (1) may be used to control the distance between the two electric poles (21,22).

[0020] It would be clear to the skilled person that that due to the construction of two different metals that may define an alloy, the elastic element (1) may contract when heated due to the flow of current, returning to an original shape once it cools down when the current stops passing through.

Claims

1. A spark gap arrangement comprising a first electric pole (21) and a second electric pole (22) for generating a spark when electric current flows between said electric poles (21,22), the spark gap arrangement being **characterised by** at least one of the electric poles (21,22), being associated to an elastic element (1) made of at least two different materials so that when heated, due to the flow of electric current thru the elastic element (1), the elastic element compresses increasing the spark gap.
2. The spark gap arrangement of claim 1, wherein the first electric pole (21) is associated to the elastic element (1) and the second electric pole (22) is associated to a bimetallic plate (3).
3. The spark gap arrangement of claim 1, wherein the first electric pole (21) is associated to the elastic element (1) and the second electric pole (22) is associated to a bimetallic plate (3).
4. The spark gap arrangement of any one of the preceding claims, wherein the two different metallic materials elastic element are configured so that the elastic element (1) returns to its original shape once cooled down when the electric current stops passing through.
5. The spark gap arrangement of any one of the preceding claims, wherein the elastic element (1) is made of a Shape Memory Alloy.
6. The spark gap arrangement of claim 5, wherein the elastic element (1) is made of nitinol.

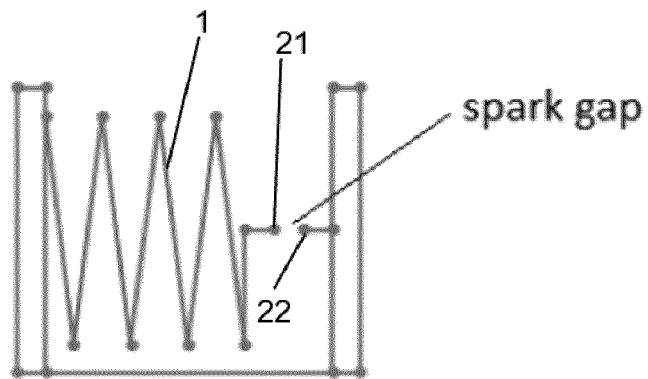


FIGURE 1A

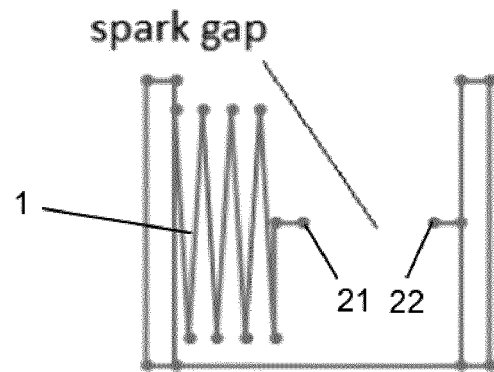


FIGURE 1B

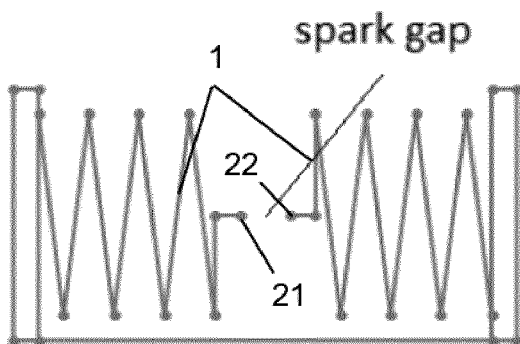


FIGURE 2A

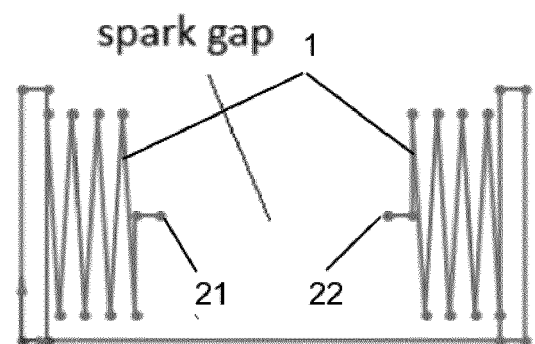


FIGURE 2B



EUROPEAN SEARCH REPORT

Application Number
EP 21 38 2190

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 917 265 A1 (SOULE MATERIEL ELECTR [FR]) 19 May 1999 (1999-05-19) * paragraph [0044] - paragraph [0055] * * paragraph [0075] - paragraph [0086] * * figures 1, 2, 5-7 *	1-6	INV. H01T4/10 H01T4/02 H01T1/02
X	DE 19 24 063 A1 (INST RUNDFUNKTECHNIK GMBH) 26 November 1970 (1970-11-26) * page 3, last line - page 4, paragraph 1 * * page 5, paragraph 3 - page 6, paragraph 1 * * figure 1 *	1-4	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01T
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 August 2021	Examiner Fribert, Jan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

EP 21 38 2190

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