July 17, 1962 J. B. SHICKEL 3,045,143

SPARK GAP PROTECTOR

Filed July 3, 1959

FIG.1

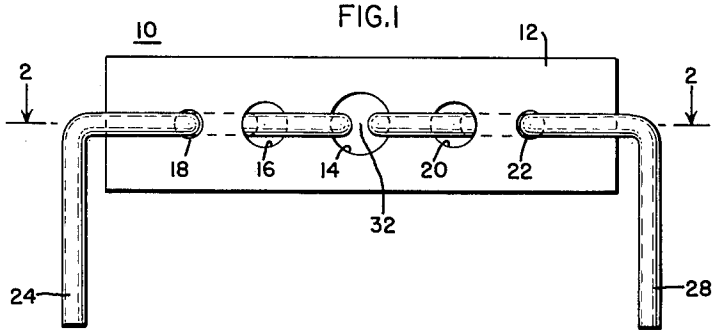


FIG.2

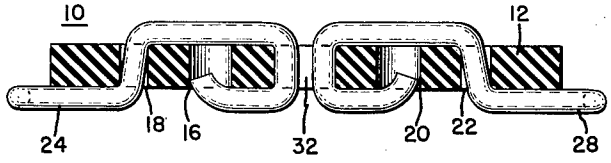
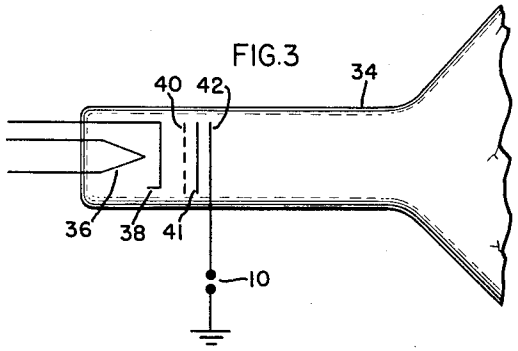


FIG.3



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SPARK GAP PROTECTOR

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This invention relates to a protective device, and more particularly to a spark gap protector for limiting the amount of potential applied to electrical or electronic components and circuits.

It is often desirable to protect electrical and electronic components from damage due to excessive voltage. Generally, such protection would be too expensive for the few times it is actually needed. On the other hand, a ruined component could involve a considerable expense. For example, a large voltage is applied to the second anode of a cathode ray tube. If this voltage becomes excessive, an arc-over may occur between the cathode and the second anode which could permanently injure the cathode and render the cathode ray tube inoperative. The need in such a situation is for inexpensive protection.

Accordingly, it is an object of this invention to provide an inexpensive spark gap protector for the protection of electrical and electronic components and circuits.

A further object of this invention is to provide a spark gap protector which uses its lead wires as gap electrodes.

Another object of this invention is to provide a spark gap protector with a constant gap even through the external leads are moved in mounting the device in a circuit.

Still another object of this invention is to provide a spark gap protector having round electrodes to provide a spherical type gap, rather than a needle type gap.

A further object of this invention is to provide a spark gap protector having an enclosed gap in which the arcing takes place through air as distinguished from arcing across a surface.

In carrying out this invention in one illustrative embodiment thereof, a spark gap protector is provided which consists of a base of fireproof material of high resistivity which has a plurality of openings including a centrally located opening in which the spark gap is formed. A pair of lead-in conductors are interlaced in said openings to form an air gap therebetween in the central opening.

These and other objects of this invention will be more clearly understood from the following description taken in connection with the accompanying drawings, and its scope will be apparent from the appended claims.

In the drawings,

FIGURE 1 is a top view of the spark gap protector embodied in this invention,

FIGURE 2 is a cross sectional view of the spark gap protector taken along lines 2—2 of FIGURE 1, and

FIGURE 3 shows a diagrammatic illustration of one application of the novel spark gap protector embodied in this invention.

Referring now to FIGURES 1 and 2, the spark gap protector of this invention is generally referred to with the reference character **10**. The spark gap protector **10** is provided with a body or base **12** of a fireproof material having high resistivity to electrical currents. Silicone impregnated fibre glass has been found suitable for this purpose, although other materials having similar characteristics may be utilized. The base **12** has a plurality of openings **14**, **16**, **18**, **20** and **22** therein. The opening **14** is centrally located in the base **12** and is larger than the other enumerated openings in order to accommodate the spark gap. A lead-in conductor **24** is interlaced in

the openings **18**, **14** and **16**, while a lead-in conductor **28** is interlaced to the base **12** through openings **22**, **20** and **14** to form a spark gap designated by the reference character **32** in the central opening **14**. The interlacing and crimping of the conductors in the base **12** is clearly shown in FIGURE 2. The particular method of interlacing and crimping the conductors **24** and **28** to the base **12** provides stability such that when the lead-in conductors **24** or **28** are mounted in an electrical circuit or to an electrical component, movement of these conductors does not vary the spark gap **32**.

The spark gap protector **10** can be mass produced within close tolerances. The gap width **32** is critical and can be set within close limits by a steel blade or other suitable means inserted between the lead-in conductors **24** and **28** while the gap is being formed to insure a uniform gap.

It will be noted that the gap **32** is enclosed to the extent that any firing or discharge occurs in the middle of the gap as distinguished from on a surface of the body or base **12**. Furthermore, the rounded configuration of the lead-in wires **24** and **28** provides a spherical discharge path which is capable of handling more power than, for example, a point discharge path which would tend to burn out more rapidly. Furthermore, any arcing across the gap **32** takes place through air instead of across a surface. A surface discharge path produces burning which would provide a carbonized path having a low resistance to electrical currents. This would make the spark gap protector ineffective and would probably render the component or circuit to which it is applied inoperative by providing a low resistance path to ground for the signals applied thereto.

The spark gap protector **10** functions as a protective device in that if a potential is applied thereto which exceeds a predetermined limit as is established by the width of the gap, the spark gap protector arcs over thereby conducting a surge of current which reduces the potential difference existing across the gap. The spark gap continues to arc until the potential drops below the predetermined limit. The value or magnitude of the voltage required for the spark gap to arc or fire is determined by the width of the gap. Generally, the bigger the gap the higher the voltage required for breakdown of the gap or arc-over.

In FIGURE 3, a diagrammatic illustration of one practical application of the spark gap protector **10** is shown as applied to a cathode ray picture tube. Although many other uses may occur, the particular application described in connection with FIGURE 3 is merely for illustrative purposes, and the invention is not considered limited thereto. In FIGURE 3, a cathode ray tube **34** is shown having a filament **36**, a cathode **38**, a grid **40**, a first anode **41** and a second anode **42**. The spark gap protector **10** is connected between the second or focusing anode **42** and ground. A large positive potential is normally applied to the second anode of the cathode ray tube. If this potential becomes too large, an arc-over may occur between the anode **42** and the cathode **38** which may permanently injure the cathode **38** and render the cathode ray tube **34** ineffective or inoperative for the purpose which it is to perform. By inserting the spark gap protector **10** between the second anode and ground, if the voltage exceeds a predetermined limit, the spark gap will arc-over so as to effectively ground the second anode and prevent any damage to the cathode ray tube. The spark gap protector **10** may be used in other applications such as power tubes, lightning arrestors or other applications where the same protective function is desired.

In the illustrative example, a very expensive component is protected by the spark gap protector **10** which represents only a small fraction of the cost of the component which

is protected. The spark gap protector **10** is small, inexpensive, and reliable. The spark gap protector is easy to install, and the gap is not subject to change due to the particular interlace construction of the lead-in conductors. Furthermore, no additional conductors or components are necessary for the gap as the lead-in wires themselves are utilized to form the spark gap.

Since other modifications, varied to fit particular operating requirements and environments, will be apparent to those skilled in the art, this invention is not considered limited to the examples chosen for purposes of disclosure and covers all changes and modifications which do not constitute departures from the true spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A spark gap protector for limiting an electric potential by arcing when an electric potential applied thereto exceeds a predetermined level comprising, a body of fireproof material having a high resistance to electrical currents, a plurality of openings in said body of fireproof material including a central opening in which a spark gap is formed, a pair of lead-in conductors interlaced in said body of fireproof material through said plurality of openings to form a predetermined air gap between said conductors in said central opening in accordance with the size of said central opening and the spacing between said conductors, the interlacing of said conductors through said openings preventing a change in said air gap even though the external portion of said conductors are moved.

2. A spark gap protector for limiting the amount of electric potential capable of being supplied to a circuit to prevent damage to the elements of the circuit comprising, a base of fireproof material having a high resistance characteristic, a plurality of openings in said base including a centrally located opening for accommodating a spark gap, first and second round conductors having end portions thereof interlaced in said openings to form a predetermined spherically shaped air gap between the end portions of said conductors in said centrally located opening.

3. A spark protector for limiting the amount of electric potential capable of being supplied to an electrical component to prevent damage to said electrical component comprising, a base of fireproof material having a high resistance characteristic, a central opening and a pair of openings on each side of said central opening in said base, a first conductor interlaced through one pair of said openings and said central opening, a second conductor interlaced through the other pair of said openings and said central opening to form a spark gap between said conductors in said central opening.

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