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(54) **GAS TUBE FAIL SAFE DEVICE FOR TELEPHONE PROTECTOR MODULES.**

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**WO-A-88/08634**
**FR-A- 2 622 047**
**US-A- 4 649 456**

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## Description

The invention relates generally to the field of telephony, and more particularly to a thermally sensitive second protection device for individual subscriber pair protector modules normally installed upon a mainframe in a telephone office.

Such protection devices traditionally employed a pair of carbon electrodes which arced upon the occurrence of momentary current overload to ground the individual circuit. Later developments included heat-sensitive devices employing a fusible solder member which, upon fusing, allowed a resilient member permanently to short the module to ground.

A still later development, now in widespread use is the so-called three element gas tube in which momentary overloads cause the tube to become conductive to short the overload to ground, and in which, upon the occurrence of a sustained overload, the tube develops sufficient heat to activate a separate heat-sensitive device to cause permanent shorting to ground.

With the development of requirements for protective modules of ever smaller dimensions consistent with connector blocks having ever higher circuit densities, the use of conventional heat sensitive devices including heat coils becomes more difficult because of space limitations, and it has become necessary to provide a heat-sensitive element of sufficiently simple construction to supplement the action of the three-element gas tube without requiring significant additional volume within the protector module housing. Further, in some cases, there is a requirement for secondary air gap protection which will provide protection against momentary overloads in the event of a defective gas tube in which the conductivity voltage levels are other than standard, apart from the function of the heat-sensitive element.

Our Patent Specifications US-A-4 649 456 which is considered as being the closest prior art discloses a three element gas tube mounted in a housing which also contains test point contacts, a ground pin assembly with a spring loaded contact pin and solder pellets which are held between insulated ends of a ground clip and the test point contacts, which test point contacts are pressed against ends of the gas tube. Melting of the solder pellets due to prolonged excess current allows direct shorting and openings in the insulation on the ends of the ground clip allows momentary surges to cause arcing therethrough between the ground clip and the test point contacts.

Patent Specification FR-A-2 622 047 discloses a lightning arrester device comprising a cylindrical casing with pins insulated in the ends thereof. A fusible element is disposed in a groove around each end of the cylinder and is covered by a perforated insulating layer which is covered by an electrode strip connected to the pins. Upon rise in temperature due to over voltage the fusible strip melts, flows through the holes in the insulating layer and creates a short circuit between the cylindrical casing and the electrode strip.

Patent Specification WO 88/08634 discloses a gas filled surge arrestor with a centre and two end electrodes with the electrodes held at desired spacings by annular ceramic discs which form a housing. A contact pin of the centre electrode is connected to a spring metal strip which has end portions urged towards the end electrodes but separated therefrom by an insulating coating. Upon excess voltage occurring air gap breakdown occurs at repeatable values and upon overheating the insulating coating breaks down.

According to the invention there is provided a thermally sensitive secondary protection device for use with a 3-element gas tube employed for protecting an individual telephone subscriber circuit, the gas tube including first and second end electrodes and a centrally disposed electrode with the centrally disposed electrode having a laterally extending contact pin thereon; the protection device comprising a member of resilient conductive sheet material having a principal axis parallel to that of the tube and having first and second end portions and a medially disposed portion therebetween, the first and second end portions being resiliently engageable with the first and second end electrodes on the gas tube but having fusible insulative members therebetween which, under normal conditions, prevent electrical current conduction therebetween, the medially disposed portion including means engaging the contact pin on the central electrode on the gas tube in electrically conductive relation whereby the development of a predetermined degree of heat by the gas tube upon the occurrence of a sustained current overload will cause fusing of the insulative members causing shorting of the end electrodes to the centre electrode; the member of resilient conductive sheet material being in the form of a stamping and having the end portions formed as arcuately shaped terminals to engage outer end surfaces of the first and second end electrodes of the gas tube to fix the relative position therebetween; the medially disposed portion including a centrally disposed opening bordered by first and second laterally bent tabs, the tabs resiliently engaging the laterally extending contact pin; secondary air gap protection means positioned between the stamping and the end electrodes to provide backup protection against momentary voltage surges not developing sufficient heat to melt the fusible components where the associated gas tube has failed to function at standard levels of conductivity and including a substantially rectangular thin member of insulative sheet material having air holes in portions thereof which overlie the end electrodes of the gas tube; and a shorting plate overlying the thin member and positioned between the thin member and the stamping, the thin member and

the shorting plate each including an aperture to receive the contact pin of the central electrode of the gas tube so as to maintain them in congruent relation, the resilient grip of the tabs on the contact pin and the resilient action of the medially disposed portion of the stamping keeping the thin member and the shorting plate in close contact with the electrodes of the gas tube and with each other to form an effective air gap.

Thus the invention can provide a fail-safe heat-sensitive device. The thin perforated insulative sheet material member can provide secondary air gap means permitting arcing to ground in the event of a momentary excess voltage surge not developing sufficient heat to melt the fusible components, where the associated gas tube has failed to function at standard levels of conductivity.

The invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a side elevational view showing a clip, formed as a length of resilient conductive sheet material, of a protection device according to the invention;

Figure 2 is a top plan of the clip of Figure 1;

Figure 3 is an elevation showing a shorting plate of a protection device according to the invention;

Figure 4 is a view in elevation of an arc gap insulator member of a protection device according to the invention; and

Figure 5 is a perspective view of a protection device according to the invention.

As shown in Figure 5, a 3-element gas tube 10, of a kind commonly used as the principal protection means in individual subscriber circuit protector modules (not shown), has a ceramic main body forming first and second sections 11 and 12 each of which is filled with a gas, such as neon gas, which becomes electrically active above a pre-determined potential. Communicating with the sections 11 and 12 are end electrodes 14 and 15, and a central electrode 16 which, in installed condition within the module, communicates with a ground pin 19 which, in turn, communicates with a source of ground potential on the protector block upon which the module is mounted.

Cooperating with the gas tube 10 is a clip 49, shown in Figures 1 and 2 and comprising a body 121 formed of sheet beryllium copper, or similar material as a stamping. The body 121 has end portions 126 and 127 and to assist in maintaining the body 121 in electrical contact with the end electrodes 14 and 15 of the gas tube 10, the end portions 126 and 127 are bent to form generally arcuately shaped terminals 128 and 129 which partially wrap around the electrodes. Insulative members 130 are most conveniently formed by cutting lengths of fusible insulative material sold under the Registered Trade Mark Mylar or the like.

The body 121 includes a centrally disposed rectangular opening bordered by first and second upwardly bent tabs 133 and 134 which engage the pin 19 which is thus positioned within an open area 135 disposed therebetween. Since the open area 135 is of a width less than the diameter of the pin 19, when the tabs 133 and 134 are in relatively unstressed condition, a resilient purchase on the pin 19 is obtained after engagement therewith.

In use, excess sustained current overloads are transformed into heat sufficient to fuse the insulative lengths 130 and 131 resulting in grounding the end electrodes 14, 15 of the gas tube to the centre electrode 16.

The device requires only limited space within the protector module, and completely eliminates the need for devices having a similar function but requiring much greater volume, such as wire wound heat coils which serve to melt a solder pellet and thus release a separate coil spring which effects a grounding function.

The protection device provides not only protection against relatively sustained current overloads but also protection through secondary air gap means against momentary voltages which is useful, for example, in the case of a defective gas tube which while not totally inoperative has leaked to a degree sufficient substantially to alter the range of voltage over which it is conductive, thus destroying the protection for which it was provided.

As shown in Figures 3 and 5. a pair of integral shorting plates 50 and 51 are bounded by side edges 52 and 53 and end edges 54 and 55. The plates 50 and 51 are positioned beneath the body 121 and overlie an air gap insulative member 60 formed of thin insulative material and shown in Figures 4 and 5. A centrally disposed opening 65 in each of the member 60 and the shorting plates 50 and 51, permits access to the pin 19. The member 60 is bounded by longitudinal edges 61 and 62, and end edges 63 and 64. Extending along the end edges 63 and 64 are lines of small orifices 66 which provide air gaps through which excess voltage surges may arc to provide a backup function equivalent to that of the gas tubes. Thus, the occurrence of momentary excess voltage surges as well as sustained excess current surges is fully accommodated, even if the gas tube 10 with which it is associated ceases to function.

## Claims

1. A thermally sensitive secondary protection device for use with a 3-element gas tube (10) employed for protecting an individual telephone subscriber circuit, the gas tube (10) including first and second end electrodes (14, 15) and a centrally disposed electrode (16) with the centrally disposed electrode (16) having a laterally extend-

ing contact pin (19) thereon; the protection device comprising a member (49) of resilient conductive sheet material having a principal axis parallel to that of the tube (10) and having first and second end portions (126, 127) and a medially disposed portion (121) therebetween, the first and second end portions (126, 127) being resiliently engageable with the first and second end electrodes (14, 15) on the gas tube (10) but having fusible insulative members (130) therebetween which, under normal conditions, prevent electrical current conduction therebetween, the medially disposed portion (121) including means (133, 134) engaging the contact pin (19) on the central electrode (16) on the gas tube (10) in electrically conductive relation whereby the development of a predetermined degree of heat by the gas tube (10) upon the occurrence of a sustained current overload will cause fusing of the insulative members (130) causing shorting of the end electrodes (14, 15) to the centre electrode (16); the member (49) of resilient conductive sheet material being in the form of a stamping and having the end portions (126, 127) formed as arcuately shaped terminals (128, 129) to engage outer end surfaces of the first and second end electrodes (14, 15) of the gas tube (10) to fix the relative position therebetween; the medially disposed portion (121) including a centrally disposed opening (135) bordered by first and second laterally bent tabs (133, 134), the tabs (133, 134) resiliently engaging the laterally extending contact pin (19); secondary air gap protection means positioned between the stamping (49) and the end electrodes (14, 15) to provide backup protection against momentary voltage surges not developing sufficient heat to melt the fusible components where the associated gas tube has failed to function at standard levels of conductivity and including a substantially rectangular thin member (60) of insulative sheet material having air holes (66) in portions thereof which overlie the end electrodes (14, 15) of the gas tube (10); and a shorting plate (50, 51) overlying the thin member (60) and positioned between the thin member (60) and the stamping (49), the thin member (60) and the shorting plate (50, 51) each including an aperture (65) to receive the contact pin (19) of the central electrode (16) of the gas tube (10) so as to maintain them in congruent relation, the resilient grip of the tabs (133, 134) on the contact pin (19) and the resilient action of the medially disposed portion (121) of the stamping (49) keeping the thin member (60) and the shorting plate (50, 51) in close contact with the electrodes (14, 15, 16) of the gas tube (10) and with each other to form an effective air gap.

**Patentansprüche**

1. Thermisch empfindliche, sekundäre Schutzeinrichtung für die Verwendung bei einem 3-Element-Gasrohr (10), wie es für den Schutz eines individuellen Telefonteilnehmerschaltkreises verwendet wird, wobei das Gasrohr (10) erste und zweite Endelektroden (14, 15) und eine zentral angeordnete Elektrode (16) aufweist, wobei die zentral angeordnete Elektrode (16) einen sich seitlich erstreckenden Kontaktstift (19) darauf hat, wobei die Schutzeinrichtung ein Teil (49) aus einem federnd nachgiebigen, leitfähigen Bahnmaterial hat, welches eine Hauptachse aufweist, die parallel zu derjenigen des Rohres (10) verläuft und erste und zweite Endabschnitte (126, 127) sowie einen mittig angeordneten Abschnitt (121) dazwischen hat, wobei die ersten und zweiten Endabschnitte (126, 127) federnd nachgiebig mit den ersten und zweiten Endelektroden (14,15) an dem Gasrohr (10) in Eingriff bringbar sind, jedoch durchschmelzbare isolierende Teile (130) dazwischen haben, weiche unter normalen Umständen eine elektrische Stromleitung dazwischen verhindern, wobei der mittig angeordnete Abschnitt (121) Einrichtungen (133, 134) aufweist, welche mit dem Kontaktstift (19) an der zentralen Elektrode (16) des Gasrohres (10) in elektrisch leitfähiger Beziehung in Eingriff treten, wodurch die Entwicklung einer vorbestimmten Menge an Wärme durch das Gasrohr (10) beim Auftreten einer andauernden Stromüberlast bewirkt, daß die isolierenden Teile (130) schmelzen und damit einen Kurzschluß der Endelektroden (14,15) mit der zentralen Elektrode (16) bewirken, wobei das Teil (49) aus federnd nachgiebigem, leitfähigen Bahnmaterial bzw. Blech die Form eines Preß- bzw. Stanzteiles hat und die Endabschnitte (126, 127) als bogenförmig verlaufende Anschlüsse (128, 129) aufweist, so daß sie mit äußeren Endflächen der ersten und zweiten Elektroden (14, 15) des Gasrohres (10) in Eingriff treten, um die relative Position zwischen diesen Teilen zu fixieren, der mittig angeordnete Abschnitt (121) eine zentral angeordnete Öffnung (135) einschließt, die durch erste und zweite seitlich gebogene Streifen (133, 134) begrenzt wird, wobei die Streifen bzw. Lappen (133, 134) federnd nachgiebig mit dem sich seitwärts erstreckenden Kontaktstift (19) in Eingriff treten, sekundäre Luftspaltschutzeinrichtungen zwischen dem Stanzteil (49) und den Endelektroden (14, 15) angeordnet sind, um einen Sicherheitsschutz gegenüber momentanen Spannungsstößen bereitzustellen, die keine ausreichende Hitze entwickeln, um die aufschmelzbaren Komponenten aufzuschmelzen, wenn das zugehörige Gasrohr nicht bei Standardniveaus der Leitfähigkeit funk-

tioniert hat, und mit einem im wesentlichen rechtwinkligen dünnen Teil (60) aus einem isolierenden Bahnmaterial, welches Luftlöcher (66) in einigen Bereichen hat, welche über den Endelektroden (14, 15) des Gasrohres (10) liegen, und mit einer Kurzschlußplatte (50, 51), weiche über dem dünnen Teil (60) liegt und zwischen dem dünnen Teil (60) und dem Stanzteil (49) angeordnet ist, wobei das dünne Teil (60) und die Kurzschlußplatte (50, 51) jeweils eine Öffnung (65) aufweisen, um den Kontaktstift (19) der zentralen Elektrode (16) des Gasrohres (10) aufzunehmen, um sie so in einer kongruenten Beziehung zueinander zu halten, wobei der federnd nachgiebige Griff der Streifen (133, 134) an dem Kontaktstift (19) und die Federwirkung auf den mittig angeordneten Abschnitt (121) des Stanzteiles (49) das dünne Teil (60) und die Kurzschlußplatte (50, 51) in engem Kontakt mit den Elektroden (14, 15, 16) des Gasrohres (10) und miteinander halten, so daß sie einen wirksamen Luftspalt bilden.

## Revendications

1. Dispositif de protection secondaire sensible à la chaleur pour utilisation avec un tube à gaz à trois éléments (10) servant à protéger un circuit individuel d'abonné au téléphone, le tube à gaz (10) comprenant des première et seconde électrodes d'extrémité (14, 15) et une électrode disposée de façon centrale (16), l'électrode disposée de façon centrale (16) portant une broche de contact (19) s'étendant latéralement ; le dispositif de protection comprenant un élément (49) fait d'une matière en feuille conductrice élastique ayant un axe principal parallèle à celui du tube (10) et comportant des première et seconde parties d'extrémité (126, 127) et une partie disposée, entre elles, de façon médiane (121), les première et seconde parties d'extrémité (126, 127) pouvant contacter de manière élastique les première et seconde électrodes d'extrémité (14, 15) du tube à gaz (10) mais avec, entre elles, des éléments isolants fusibles (130) qui, dans les conditions normales, empêchent le passage du courant électrique entre elles, la partie disposée de manière médiane (121) incluant un moyen (133, 134) contactant la broche de contact (19) de l'électrode centrale (16) du tube à gaz (10) dans une relation de conduction de l'électricité, ce par quoi le développement d'un certain degré prédéterminé de chaleur par le tube à gaz (10), lors de l'apparition d'une surcharge de courant soutenue, provoquera la fusion des éléments isolants (130) en provoquant la mise en court-circuit des électrodes d'extrémité (14, 15) avec l'électrode centrale (16) ; l'élément (49) de matière en feuille conductrice élastique étant sous la forme d'une pièce fabriquée à la presse et dont les parties d'extrémité (126, 127) sont formées comme des bornes de forme arquée (128, 129) pour contacter les surfaces d'extrémité extérieures des première et seconde électrodes d'extrémité (14, 15) du tube à gaz (10) pour fixer la position relative entre elles ; la partie disposée de façon médiane (121) incluant une ouverture disposée de manière centrale (135) bordée par des première et seconde pattes (133, 134) recourbées latéralement, les pattes (133, 134) contactant de manière élastique la broche de contact s'étendant latéralement (19) ; un moyen de protection secondaire par espace d'air situé entre la pièce fabriquée à la presse (49) et les électrodes d'extrémité (14, 15) pour fournir une protection de secours contre des pointes de tension momentanées ne développant pas une chaleur suffisante pour fondre les composants fusibles si le tube à gaz associé ne fonctionne plus aux niveaux normaux de conductivité, et incluant : un élément mince sensiblement rectangulaire (60) fait d'une matière en feuille isolante comportant des trous d'air (66) dans ses parties qui recouvrent les électrodes d'extrémité (14, 15) du tube à gaz (10) ; et une plaque de court-circuit (50, 51) recouvrant l'élément mince (60) et placée entre l'élément mince (60) et la pièce fabriquée à la presse (49), l'élément mince (60) et la plaque de court-circuit (50, 51) comportant chacun une ouverture (65) pour recevoir la broche de contact (19) de l'électrode centrale (16) du tube à gaz (10) de manière à les maintenir dans une disposition en coïncidence, le serrage élastique des pattes (133, 134) sur la broche de contact (19) et l'action élastique de la partie disposée de façon médiane (121) de la pièce fabriquée à la pièce (49) maintenant l'élément mince (60) et la plaque de court-circuit (50, 51) en contact étroit avec les électrodes (14, 15, 16) du tube à gaz (10) et les unes avec les autres pour former un espace d'air efficace.

FIG. 1

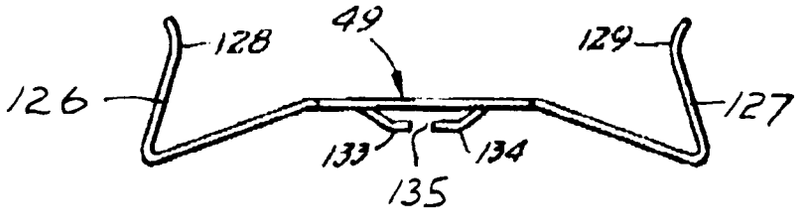



FIG. 2

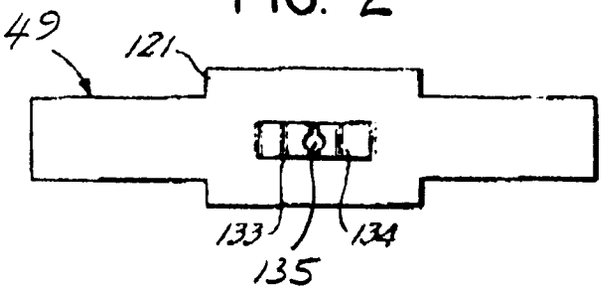



FIG. 3

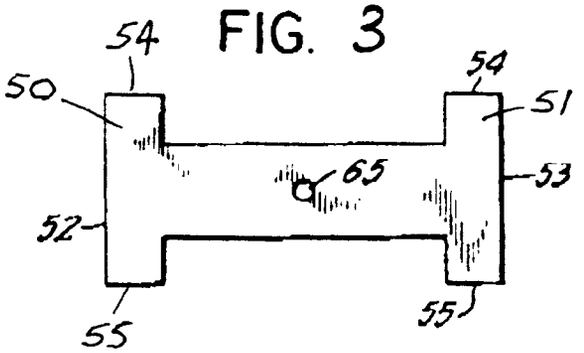



FIG. 4

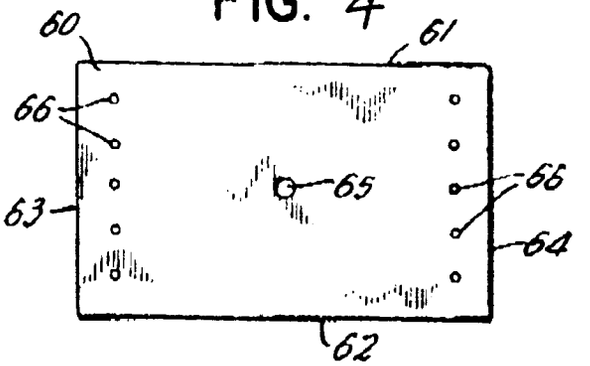



FIG. 5

