A protective circuit (10) for a telecommunications system to protect equipment such as facsimile machines. The circuit includes a pair of signal lines (12, 13) to be attached to the telecommunications system. The signal lines (12, 13) are connected to an earth line (15) by means of a gas filled protector (14). A pair of varistors (17) are arranged so that each signal line (12, 13) is connected to the earth line (18) via one of the varistors (17), while located in each signal line (12, 13), between the gas filled protector (14) and the varistor (17), is a resistor (19). The gas filled protectors (14) act to limit the voltage applied to the equipment should the signal lines (12, 13) be subjected to a lightning strike.
### FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

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A CIRCUIT PROTECTION DEVICE

FIELD OF THE INVENTION

The present invention relates to two devices to protect electrical equipment from lightning strikes and more particularly but not exclusively to protect telephone equipment such as facsimile machines.

BACKGROUND ART

Gas arrestors in the past have been commonly used to protect telephone circuits by discharging the lightning to ground. However these arrestors are relatively slow and are therefore not totally successful.

One attempt to overcome the above problem is described in Australian Patent 590 491. This particular patent teaches the use of Zener diodes, in series with a parallel arrangement of capacitor and resistor. However this particular arrangement has the disadvantage that it is frequency-dependent. More particularly, it is only effective during rapid changes in voltage. In this regard it should be appreciated that the problem is high voltages, not high rates of change in voltage.

OBJECT OF THE INVENTION

It is the object of the present invention to overcome or substantially ameliorate the above disadvantages.

SUMMARY OF THE INVENTION

There is disclosed herein a protective circuit for a telecommunications system, the circuit comprising;

- a pair of signal lines to be attached to the telecommunications system;

- a gas filled protector operatively connected to each line and to an earth line means;

- a first and second varistor, each varistor being connected to a respective signal line and to a further earth line means;

- a first resistor in each signal line between said protector and the associated varistor; and

- a second resistor in each signal line to connect each first resistor and its associated protector to the telecommunications system.

Preferably, there would be a plurality of said protective circuits, arranged in parallel. It is still further preferred that the earth line means are earth lines having a total cross-sectional area greater than the cross-sectional area of the signal lines, so that the signal lines will fail prior to the earth lines.
It is still further preferred that the protective circuit is of a three or more layered construction, with the first layer consisting of the first resistors and the protectors, a further layer consisting of the earth line means, and the third layer consisting of the second resistors, with the third layer being adapted to be attached to the telecommunications system.

BRIEF DESCRIPTION OF THE DRAWING

A preferred form of the present invention will now describe by way of example with reference to the accompanying drawing, which schematically depicts a protective circuit for a telecommunications system.

BEST MODE AND OTHER EMBODIMENTS OF THE INVENTION

In the accompanying drawing, there is schematically depicted a protective circuit 10 for a telecommunications system. The circuit 10 includes a plurality of subcircuits 11, with the subcircuits 11 being arranged in parallel.

The circuit 10 includes signal lines 12 and 13 between which extends a gas filled protector 14. The gas filled protector has the object of clamping the voltage at 230 volts. Once the voltage rises to a certain level, the protector 14 starts to ionize and operatively connects the signal lines 12 and 13 to an earth line 15.

There is further provided in each line 12 and 13, resistors 15 and 16, with each resistor 15 being approximately 4.7 ohms, and each resistor 16 being 2.2 ohms.

Also extending between the lines 12 and 13 is a pair of varistors 17, which are preferably metal oxide varistors. The varistors attached to an earth line 18.

Preferably, the total sum of the cross-sectional areas of the earth lines 15 and 18 is greater than the cross-sectional area of each of the lines 12 and 13 so that the lines 12 and 13 will destruct prior to the earth lines 15 and 18.

In the abovedescribed circuit 10, the first stage of protection is provided by the varistors 17. They are effective for voltage surges above 140 volts. If the varistors 17 fail to clamp the voltage at 140 volts, the second stage of protection comes into operation. The second stage of protection is provided by the gas filled protectors 14 which act to clamp the voltage to 230 volts. If this second stage of protection fails, the "sacrificial" design in respect of the relative cross-sectional areas of the earth lines 15 and 18 relative to the lines 12 and 13 comes into
operation. That is the lines 12 and 13 will fuse. Accordingly, any
overwhelming strike on any one of the ten subcircuits 11, will "take out"
the lines 12 and 13, leaving the untouched lines 12 and 13 still guarded.
If all the lines 12 and 13 were struck at the same time, again the lines 12
and 13 would fail before the earth link.

A desirable construction for the circuit 10, is a multi-layered
construction, including three or more layers. For example the first layer
could include the protector 14, and resistors 17 and 19. The second layer
would include the earth lines 15 and 18. The third layer would include the
resistor 16.
1. A protective circuit for a telecommunications system, the circuit comprising:
   a pair of signal lines to be attached to the telecommunications system;
   a gas filled protector operatively connected to each line and to an earth line means;
   a first and second varistor, each varistor being connected to a respective signal line and to a further earth line means;
   a first resistor in each signal line between said protector and the associated varistor; and
   a second resistor in each signal line to connect each first resistor and its associated protector to the telecommunications system.

2. The circuit of claim 1, wherein said circuit consists of a three more layered construction, with a first layer consisting of the first resistors and the protectors, and a further layer consisting of the earth lines, and a third layer consisting of the second resistors, with the third layer being adapted to be attached to the telecommunications system.

3. The circuit of claim 1 or 2, wherein the first and second varistors are metal oxide varistors.

4. A circuit protection device including a plurality of protective circuits according to claim 1, 2 or 3, wherein said circuits are arranged in parallel, and wherein the earth line means are earth lines, with the total cross sectional area of the earth lines being greater than the cross sectional area of the signal lines, so that the signal lines will fail prior to the earth lines.

5. A protective circuit for a telecommunications system, substantially as hereinbefore described with reference to the accompanying drawing.
I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6
According to International Patent Classification (IPC) or to both National Classification and IPC
Int. Cl. 5 H02H 9/04, 9/06, HO4M 1/74

II. FIELDS SEARCHED

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Documentation Searched other than Minimum Documentation

to the extent that such Documents are Included in the Fields searched 8

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

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(continued)

* Special categories of cited documents: 10

*A* document defining the general state of the art which is not considered to be of particular relevance

*E* earlier document but published on or after the international filing date

*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

*O* document referring to an oral disclosure, use, exhibition or other means

*P* document published prior to the international filing date but later than the priority date claimed

*V* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

*G* document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search 25 July 1991 (25.07.91) 2 August 91

International Searching Authority

Australian Patent Office

A.W. DURE

Form PCT/ISA/210 (second sheet) (January 1985)
FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

| Y | Derwent Abstract Accession No. 89-028534/04, Class U24, JP,A, 63-302725 (MORINAGA BASHI) 9 December 1986 (09.12.86) | 1-4 |
| Y | Derwent Abstract Accession No. 86-046353/07, Class X13, JP,A, 61-001221 (NISSAN TELECOM & TELEPH) 7 January 1986 (07.01.86) | 1-4 |
| A | US,A, 4677518 (HERSFIELD) 30 June 1987 (30.06.87) | |
| A | AU,A, 56512/86 (ZELLMEIER USTER AG) 6 November 1986 (06.11.86) | |

V. [ ] OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE

This international search report has not been established in respect of certain claims under Article 17(2)(e) for the following reasons:

1.[ ] Claim numbers .... because they relate to subject matter not required to be searched by this Authority, namely:

2.[ ] Claim numbers .... because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3.[ ] Claim numbers .... because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4 (a);

VI. [ ] OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This International Searching Authority found multiple inventions in this international application as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. [ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. [ ] As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

[ ] The additional search fees were accompanied by applicant's protest.
[ ] No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (supplemental sheet (2)) (January 1985)
This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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