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SURGE LIMITING SYSTEM

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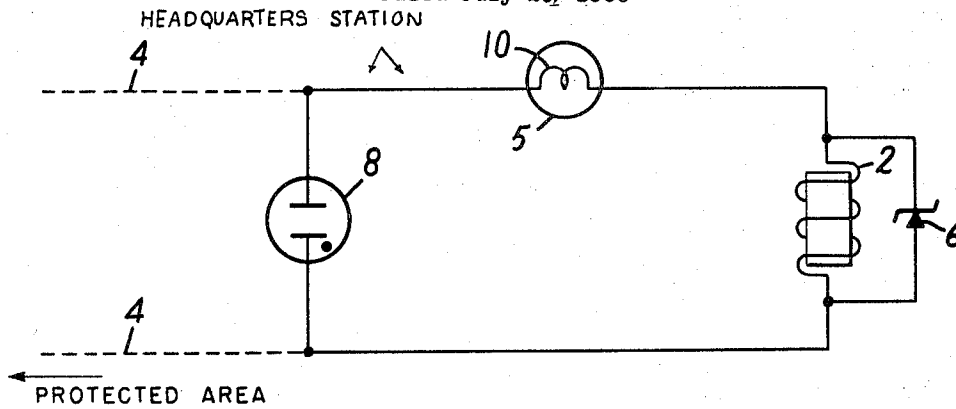


FIG. 1

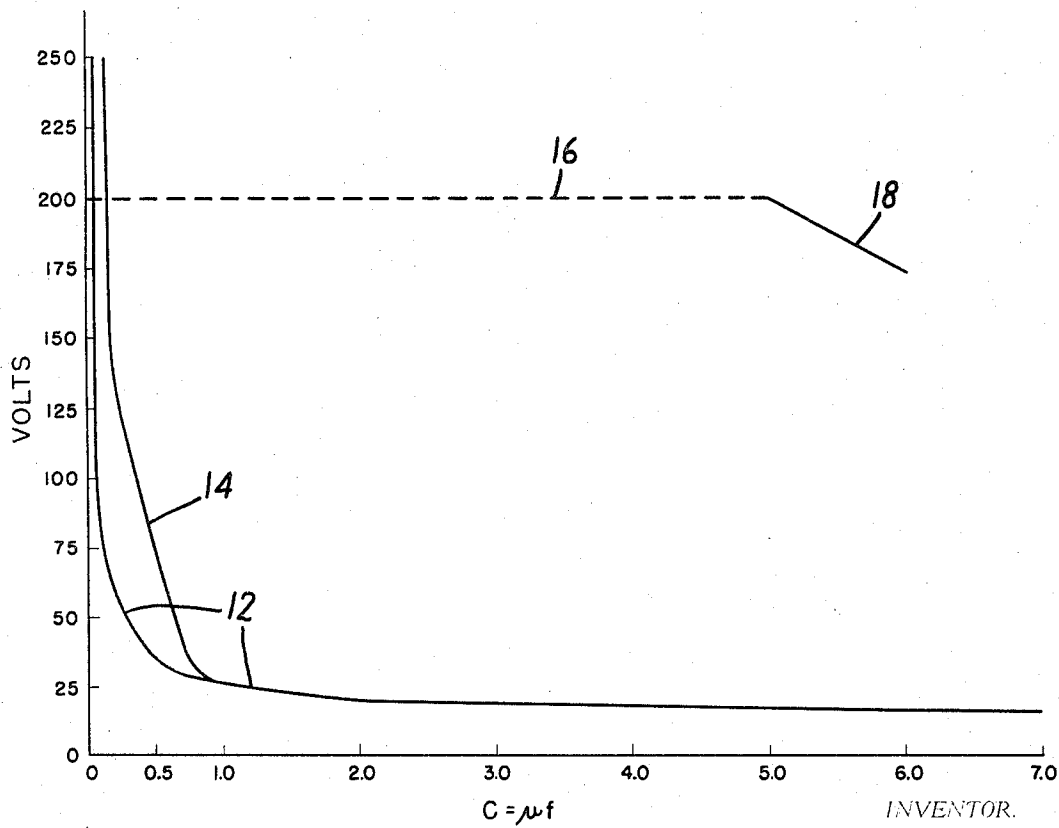


FIG. 2

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SURGE LIMITING SYSTEM

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5 Claims 5

ABSTRACT OF THE DISCLOSURE

A surge limiting system is provided to protect a sensitive relay connected to transmission wires wherein a diode is connected in multiple with the relay to protect the relay, a barretter is connected in series with the transmission line to protect the diode, and a gas tube is connected across the transmission wires to protect against high voltage surges.

The present invention relates to a surge limiting system for protecting a sensitive relay connected to a transmission line and it more particularly to a surge limiting system having a solid state gate, a barretter and a gas tube the conjoint action of which prevents false signaling of the protected relays during voltage surges on the system transmission lines.

Present day alarm signaling systems of the burglar alarm and fire alarm type generally include a monitoring headquarters station which is separated from a protected area by a distance of several miles. These systems are frequently designed to operate over telephone lines which extend between the protected area and the headquarters station, and can utilize various types of signaling methods. One of these methods is differential current signaling which can be employed to indicate the presence of alarm conditions at the protected area. An example of this type of alarm system may be found in the recent application of Walter E. Rowley, Jr. and Basil D. Rissolo Ser. No. 508,703 filed on Nov. 19, 1965 and entitled "A Differential Sensing Circuit for Alarm Systems."

A problem encountered in the use of such alarm systems arises from the fact that voltage surges can occur in the telephone signaling lines due to lightning and other electrical transients and these surges can cause false alarms. Lightning surges are known to be of very short duration, usually in the microsecond range, and of high amplitude. Although the telephone company provides protection at both ends of the signal line pairs, the protection only consists of series fusing and a carbon-block gap arranged between the lines and ground. Carbon-block gaps are designed to break down at potentials of 300 to 600 volts. Consequently, voltage surges below such values pass the gap and such surges can impulse sensitive alarm relays of the type employed in fire and burglar alarm systems to cause false alarms. Furthermore, once a relay is energized in most alarm systems it is "locked in" and must be manually reset. This requires that additional personnel or equipment be available to monitor the alarm system and to distinguish between real and false alarms.

The present invention provides a surge limiting device which prevents energization of an alarm system relay when a voltage surge occurs on the transmission lines to which the relay is connected. More particularly, the present invention provides a surge protection device which comprises a semi-conductor, having a reverse conduction characteristic, and a barretter. The semi-conductor is connected across the relay which is to be protected and the barretter is connected in series with the parallel combination of the relay and the semi-conductor. The operational voltage of the semi-conductor for reverse conduction is selected to be slightly greater than that of the relay. Thus, a surge on the transmission lines of either

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polarity which exceeds the operational voltage of the semi-conductor is shunted around the relay to prevent energization thereof. The barretter limits the current induced in the transmission lines by the voltage surge and thereby protects the semi-conductor from damage.

In a preferred embodiment of the invention, the semi-conductor is a Zener diode and the barretter is an incandescent lamp having a filament with a positive temperature coefficient of resistivity. In an alternate embodiment supplementary voltage surge protection for the relay is provided by connecting a gas tube across the system lines. The gas tube is positioned in advance of the semi-conductor and barretter elements to prevent voltage surges above the sustaining potential of the tube from reaching the relay. When the semi-conductor, the barretter and the gas tube are connected in a circuit, voltage surges over a wide range are readily arrested.

The novel surge protection device of the present invention can be employed to great advantage in an alarm signaling system. The components of the device can be designed to provide overlapping protection for an alarm relay and to divert all voltage surges in the range of 10 to 300 volts, whereby the alarm system will be virtually free from false alarms. Besides overcoming the problem of false alarms and the obvious hazards associated therewith, the device also eliminates the necessity of costly time delay means that are used in conventional alarm systems to electrically sense the difference between a false alarm and a true alarm condition. In addition, permanent damage to the sensitive alarm relay is prevented.

These and other advantages will become apparent from the following description and drawings which illustrate preferred and alternate embodiments of the present invention and of which:

FIG. 1 is a circuit diagram showing both embodiments of the surge protection device of the present invention;

FIG. 2 is a graphic representation of the operation of an alarm relay when the present invention is employed, as compared with the operation of an unprotected relay.

In FIG. 1, an alarm relay coil 2 is shown at the headquarters station of an alarm signaling system. The coil 2 operates a pair of relay contacts in conventional manner. During non-alarm conditions relay coil 2 receives a minimal current through the transmission lines 4, but the flow is insufficient to operate the relay. A power supply is located at the protected area (not shown) and can be either AC or DC depending on the design of the particular alarm system. A barretter 5, preferably in the form of a No. 1829, 28 volt, incandescent lamp, is connected in series with the parallel combination of the relay coil 2 and a Zener diode 6.

Since the incandescent barretter 5 has a positive temperature coefficient of resistivity, its resistance will increase from 50 ohms up to 400 ohms or more when heated by surges on the transmission lines. In contrast, the resistance of the barretter is very low during nonsurge conditions and will not in any way degrade the operation of the remainder of the system. The barretter 5 also functions to protect the Zener diode 6 which is connected across the alarm relay coil 2.

The diode 6 is preferably a 6.2 volt Zener diode but can be any semi-conductor device with a reverse conduction characteristic. The reverse conduction voltage of the Zener diode 6 is selected to be slightly greater than the normal operation voltage of the relay. Consequently, when the 6.2 volt Zener diode is connected across the relay coil, a true alarm condition corresponding to a potential of 4 volts is not diverted by the diode and the alarm is activated. During surges which exceed the true alarm potential, the Zener diode 6 either breaks down in the reverse direction or conducts freely in the forward direction to

shunt the surge current around the alarm relay coil 2 and thus prevents energization of the relay. A corresponding increase in the resistance of the barretter 5 during the surge prevents increased current flow through the Zener diode and prevents excessive heating of the diode junction. If the surge energy is overwhelming, the barretter filament 10 ruptures and thus functions as a fuse to protect both the relay and the Zener diode from physical damage.

A supplementary form of protection is obtained by connecting a gas tube 8 across the transmission lines 4. The tube 8 functions to arrest surges which are of excessive pulse height. In this embodiment of the invention, the tube 8 is a neon gas-discharge tube having an arc-sustaining potential of between 55 and 100 volts and a reaction time in the micro-second range. Only the energy pulses which exceed these values are shorted by the tube 8. Other forms of gas-filled tubes which operate over different voltage ranges can also be utilized in combination with the Zener diode 6 and the barretter 5. The gas tube 8 is of the greatest value when the pulse amplitude of the surge is several times larger than the normal arcing potential of the tube.

In operation, a voltage surge induced on the transmission lines 4, encounters the tube 8 prior to reaching the alarm relay coil 2. If the pulse amplitude of the surge exceeds the arc-sustaining potential of the tube 8, a full-arc discharge occurs and the current generated by the pulse flows immediately through the tube. In the case of either a voltage surge not exceeding the potential of the tube 8 or one that reaches maximum amplitude prior to ignition time of the tube, the Zener diode alone will initially afford sufficient protection to prevent energization of the relay coil 2. The barretter 5, limits the current during the surge and the Zener diode junction is not damaged. The barretter filament 10 will rupture should a pulse of high amplitude occur on the lines 4.

FIG. 2 graphically compares the false alarm characteristics of alarm relays protected by the novel surge limiting device of the invention and relays which are not so protected. The graduated markings on the X axis of the graph represent discharge of capacitors to create simulated voltage surges. These surges were created by charging capacitors of the values indicated below the X axis to various voltages and then discharging the capacitors through the circuit of FIG. 1 and through unprotected relays. The capacitive values range from .1 microfarad to 7.0 microfarads. Values on the Y axis represent the range of voltages between 0 and 250 volts which correspond to the simulated voltage surges. Solid line 12 in FIG. 2 represents voltage and capacitive values which energize an unprotected alarm relay. Solid line 14 represents values which energize the relay when only the neon gas-discharge tube 8 is connected across the transmission lines 4. The simulated voltage surges below dashed line 16 fail to energize the alarm relay coil 2 of FIG. 1, when the neon tube 8, Zener diode 6 and incandescent lamp 5 are employed to protect the relay. These values clearly show the superior surge limiting protection provided by the device of the present invention. A short line segment 18 indicates that the alarm relay coil is only energized when a simulated voltage surge of 200 volts discharged from a 5.0 microfarad capacitor is induced on the transmission lines 4.

Although the surge limiting system of the present invention as described herein is applicable to alarm relays, it can be adapted to protect any electrical device as will be evident to those skilled in the art. Nor is it limited to the differential sensing type alarm systems but can be utilized in AC or DC polarity reversal systems.

It will be understood that it is intended to cover all

changes and modifications of the preferred embodiments of the invention, herein chosen for the purpose of illustration, which do not constitute departures from the spirit and scope of the invention.

What is claimed is:

1. A surge protection system for preventing false signaling of a relay due to voltage surges of either polarity occurring on the transmission lines connected to said relay comprising, a semi-conductor having a reverse conduction characteristic, said semi-conductor being connected across the relay and having an operational voltage for reverse conduction at least slightly greater than the operational voltage requirement of the relay, a barretter having a positive temperature coefficient of resistivity and connected in series with the parallel combination of said relay and said semi-conductor, said barretter preventing increase of current in the transmission lines during voltage surges to thereby prevent damage to the semi-conductor, and a gas-filled tube connected across the transmission lines and having an arc-sustaining potential which is greater than the operational voltage requirement of said relay, said tube being positioned in advance of said semi-conductor device and said barretter to provide supplementary voltage surge protection for said relay.

2. The invention according to claim 1 wherein said gas-filled tube is a neon gas-discharge tube having a discharge characteristic of between about 55 and 100 volts.

3. The invention according to claim 1 wherein the semi-conductor device is a Zener diode.

4. In an alarm signaling system having a power source, a protected area, a headquarters station located at a substantial distance from said protected area, transmission lines for carrying an alarm signal between the protected area and the headquarters station, and an alarm relay to be energized by said alarm signal to give an alarm, the improvement comprising, a surge protection system including a semi-conductor having a reverse conduction characteristic, said semi-conductor being connected across the relay and having an operational voltage for reverse conduction at least slightly greater than the operational voltage requirement of the relay, a barretter having a positive temperature coefficient of resistivity and connected in series with the parallel combination of said relay and said semi-conductor, said barretter preventing the increase of current in the transmission line during voltage surges to thereby prevent damage to the semi-conductor device, and a gas-filled tube connected across the transmission lines and having an arc-sustaining potential which is greater than the operational voltage requirement of said relay, said tube being positioned in advance of said semi-conductor and said barretter to provide supplementary voltage surge protection for said relay.

5. The alarm signaling system according to claim 4 wherein the semi-conductor device is a Zener diode.

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