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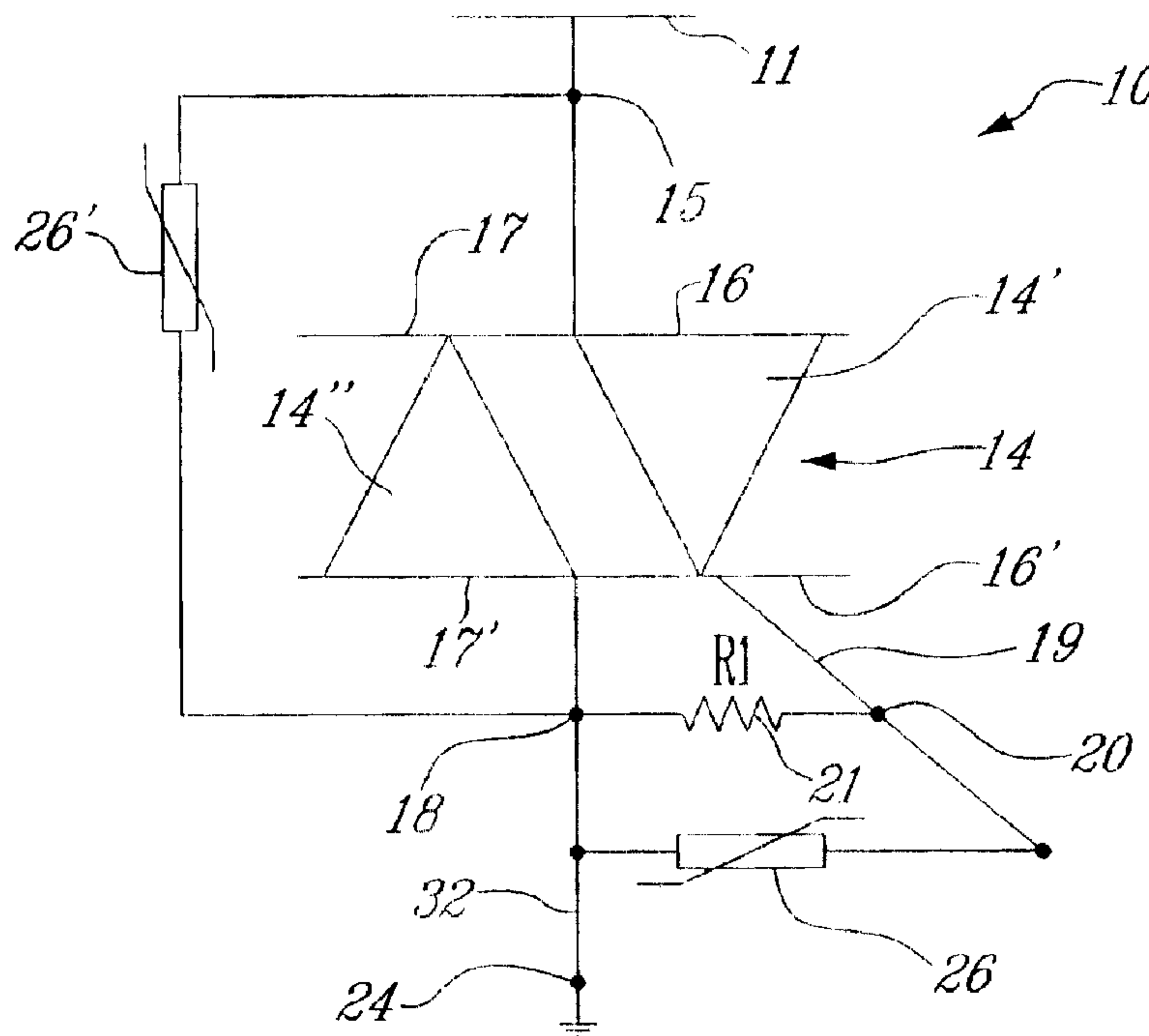
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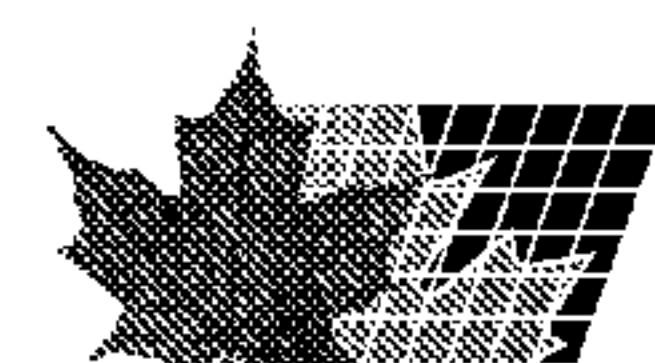
(54) Titre : CIRCUIT DE PROTECTION CONTRE LA TENSION VAGABONDE

(54) Title: STRAY VOLTAGE PROTECTION CIRCUIT



(57) Abrégé/Abstract:

A stray voltage protection circuit for grounding stray voltages above a predetermined threshold value and present on a neutral conductor of a power line input supply connection in a distribution box. The protection circuit comprises a bi-directional triode thyristor having a first terminal connected to the neutral conductor. A second terminal is connected to a ground connection associated with a ground conductor of the power line input connection and a local distribution network ground. The thyristor has a gate electrode. A threshold voltage setting resistor is connected between the second terminal and the gate electrode and has a value selected in accordance with the predetermined threshold value. The thyristor is secured on a heat sink element to dissipate heat generated thereby when made conductive by stray voltages present on the neutral conductor and above the said threshold value.



ABSTRACT

A stray voltage protection circuit for grounding stray voltages above a predetermined threshold value and present on a neutral conductor of a power line input supply connection in a distribution box. The protection circuit comprises a bi-directional triode thyristor having a first terminal connected to the neutral conductor. A second terminal is connected to a ground connection associated with a ground conductor of the power line input connection and a local distribution network ground. The thyristor has a gate electrode. A threshold voltage setting resistor is connected between the second terminal and the gate electrode and has a value selected in accordance with the predetermined threshold value. The thyristor is secured on a heat sink element to dissipate heat generated thereby when made conductive by stray voltages present on the neutral conductor and above the said threshold value.

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STRAY VOLTAGE PROTECTION CIRCUIT

BACKGROUND OF INVENTION

Field of the Invention

5 Various stray or parasitic voltage protecting devices are known whereby to ground voltages present on various electrical equipment or conductive objects which are connected to a ground reference.

Description of Prior Art

10 The various problems associated with stray voltages are discussed in a paper entitled "Diagnosis and Trouble Shooting of Stray Voltage Problems" by the Iowa Association of Electric Cooperatives. That article deals primarily with the annoying contact problems that can affect livestock
15 production. These electrical contact problems are parasitic voltages which appear from time to time on grounded equipment and metallic objects which are connected to the grounding system. The National Electric code specifies that all electric panels be grounded to both a grounding
20 electrode or ground rod and a grounding source that is metallic, which makes contact with concrete or earth.

Parasitic voltages on the neutral conductor of a supply line can occur due to many reasons such as induce voltages by the current carrying conductors or
25 caused by lightening, transformer malfunctions, etc. Often, people use the neutral wire for a ground connection and this causes further induced voltages in the neutral as it provides a low impedance to ground. Metallic surfaces that are connected to a neutral conductor
30 are therefore induced with parasitic voltages and currents and this provides irritants to animals, such as farm animals and the end result is that the production of that livestock is affected as well as the business of the

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farmer. It is also recognize that animals have a much lower tolerance to "neutral to ground" voltage than do humans. Animals will normally contact the neutral ground when eating or
5 drinking while some of their feet or the body becomes energized while other body parts, such as the rear part of the body normally remains at true ground. This causes a current flow because of the voltage difference between parts of the
10 animal. This energizing problem is prevalent with four-legged animals rather than two-legged animals as there are more terminal points in four legged animals where different potentials can be induced.

15 An example of "neutral to ground" problem in a home occurs when a person touches a water faucet that is electrically bonded, while a foot or hand touches a metallic drain pipe or sink that is making contact with true earth. The
20 National Electric Code was therefore revised to allow the isolation of neutrals and grounds in farm outbuildings or allows the use of a high impedance device for neutral and ground wire bonding. The high impedance device restricts the
25 flow of low current levels, but permits the flow of higher levels of current generated by a fault. A typical example of such a device is described in Canadian Patent N° 2,046,134. However, the disadvantage of such a device is that they are
30 connected directly to objects which are floating grounds and to a ground connection which should lead to an electrical junction box. Accordingly, in order to isolate many of these devices or elements or equipments which have a floating
35 ground, many protection devices are necessary. Further, many of these devices do not operate at

low voltages and there is always a potential of 5 to 8 volts floating on these conductive elements.

SUMMARY OF INVENTION

It is a feature of the present invention to
5 provide a stray voltage protection circuit for grounding stray voltages above a predetermined threshold value and present on a neutral connector of a power line input supply cable in an electrical distribution box.

10 According to the above feature, from a broad aspect of the present invention, there is provided a stray voltage protection circuit for grounding stray voltages above a predetermined threshold value and present on a neutral
15 conductor of a power line input supply cable in an electrical distribution box. The protection circuit comprises a bi-directional triode thyristor having a first terminal connected to the neutral conductor. A second terminal is
20 connected to a ground connection associated with a ground conductor of the power line input connection and a local distribution network ground. The thyristor has a gate electrode. A threshold voltage setting resistor is connected
25 between the second terminal and the gate electrode and has a value selected in accordance with the predetermined threshold value.

BRIEF DESCRIPTION OF DRAWINGS

Referring to the drawings and more
30 particularly to FIGURE 1, there is shown the construction of the stray voltage protection circuit of the present invention;

FIGURE 2 is a perspective view showing the stray voltage protecting circuit housing and the
35 manner in which the protection circuit is connected to an electrical distribution, and

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FIGURE 3 is a view similar to Figure 2 but showing an electrical distribution box with a high voltage supply and wherein two protection circuits are connected in parallel thereto.

5 DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawings and more particularly to Figures 1 and 2, there is shown generally at 10 the protection circuit of the present invention for grounding stray voltages,
10 above a predetermined threshold value and present on a neutral conductor 11 of a power line input supply cable 12 in a distribution box 13.

The protection circuit 10 comprises a bi-directional triode thyristor 14 which consists of
15 two thyristor connected in reverse. The thyristor have a first terminal 15 connected to the anode 16 and cathode 17 of the bi-directional thyristors 14' and 14" respectively and a second terminal 18 connected respectively to the cathode
20 16' and anode 17' of the thyristor 14' and 14" respectively. A gate electrode 19 is also common to both thyristors 14' and 14" and as herein shown connected to terminal 20.

A threshold setting resistor 21 is connected
25 across terminals 20 and 18. The terminal 18 is connected to a ground conductor 32 via a bus bar 23 secured inside the electrical distribution box 13. Accordingly, it is not necessary to connect the grounding log 24 usually supplied with the
30 distribution box 13 to the bus bar 23 and this is shown herein by the additional wiring 25 which is added by an electrician. The terminal 20 is connected to the gate electrode 19 and therefore, the setting resistor will provide the proper the
35 threshold value to trigger the triac 14. The value of the resistance 21 is herein selected to

trigger the triac when a parasitic voltage on the neutral conductor 11 reaches a value of ± 1 volt.

In order to provide additional protection for the protection circuit, a varistor 26 is
5 connected in parallel across the threshold voltage setting resistor 21 so as to vary the setting on the gate 19 to cause the triac to trigger at a different voltage level. Accordingly, if desired, the triac can be set to
10 fire at higher voltages, generally from 1 to 10 volts and provides a short-circuit at a higher selected voltage value depending on the rating of the thyristor. Similarly, a further varistor 26' may be connected between the first and second
15 terminals 15 and 18 to short-out the triac should there be a high-voltage surge on the neutral conductor. This would connect the neutral directly to the ground.

Referring now more specifically to Figures 2
20 and 3 illustrate applications of the present invention, but it is to be understood that other applications are also foreseen. It is only necessary to change the value of the components depending on the specific application. As shown
25 in Figure 2 a distribution box for the normal 200 amp supply while in Figure 3 a junction box for a 400 or 600 amps supply is shown. As herein shown, the supply comes through a metering device 28 which is controlled by a utility. The
30 protection circuit 10 of the present invention is secured to a heat sink element or heat conductive board, usually a metal finned element whereby to dissipate heat generated by the triac when in operation. The heat sink 27 is secured to a
35 metal housing 29 or box usually secured adjacent the electrical distribution box 13. The box 13 could also serve as a heat sink. The first

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terminal 15 of the protection circuit has a conductor 30 connected thereto and to the neutral wire connection or bus 31 located within the distribution box 13, as herein shown. The second
5 terminal 18 is connected to the bus-bar 23 via a wire 32.

In the case of a 400 or 600 amps supply, as shown in Figure 3, there would be provided two protection circuits 10, each mounted in a
10 respective housing 29 and 29' and connected side by side and in parallel with one another and respectively to the bus-bar 23 and 31 whereby the circuit is connected between the neutral conductor 11 and the ground connection 24. It is
15 of course obvious that both voltage protection circuits could be mounted in a single housing 29.

It is within the ambit of the present invention to cover any obvious modifications of the preferred embodiment described herein,
20 provided such modifications fall within the scope of the appended claims.

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

- 5
1. A stray voltage protection circuit for grounding stray voltages above a predetermined threshold value and present on a neutral conductor of a power line input supply cable in a
10 distribution box, said protection circuit comprising a bi-directional triode thyristor having a first terminal connected to said neutral conductor, a second terminal connected to a ground connection associated with a ground
15 conductor of said power line input connection and a local distribution network ground, said thyristor having a gate electrode, a threshold voltage setting resistor is connected between said second terminal and said gate electrode and
20 having a value selected in accordance with said predetermined threshold value.
 2. A stray voltage protection circuit as claimed in claim 1, wherein said thyristor being
25 secured on a heat sink element to dissipate heat generated whereby when made conductive by stray voltages present on said neutral conductor above said threshold value.
 - 30 3. A stray voltage protection circuit as claimed in claim 2, wherein a varistor is connected in parallel with said threshold voltage setting resistor to provide additional protection by providing a short-circuit at a higher selected
35 voltage value.

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4. A stray voltage protection circuit as
claimed in claim 3, wherein a further varistor is
connected between said first and second terminal
to protect said triac against high voltage
5 surges.

5. A stray voltage protection circuit as
claimed in claim 2, wherein said resistor has a
resistance value to bias said gate to trigger
10 said triode thyristor upon the presence of a
fault voltage on said neutral conductor exceeding
 ± 1 volt.

6. A stray voltage protection circuit as
15 claimed in claim 1, wherein said protection
circuit is secured in a circuit housing secured
adjacent said distribution box, said input supply
connection having a voltage supply with a
predetermined amperage capacity.

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7. A stray voltage protection circuit as
claimed in claim 6, wherein an additional
protection circuit housing is provided and
connected in parallel with said protection
25 circuit when said voltage supply requires same.

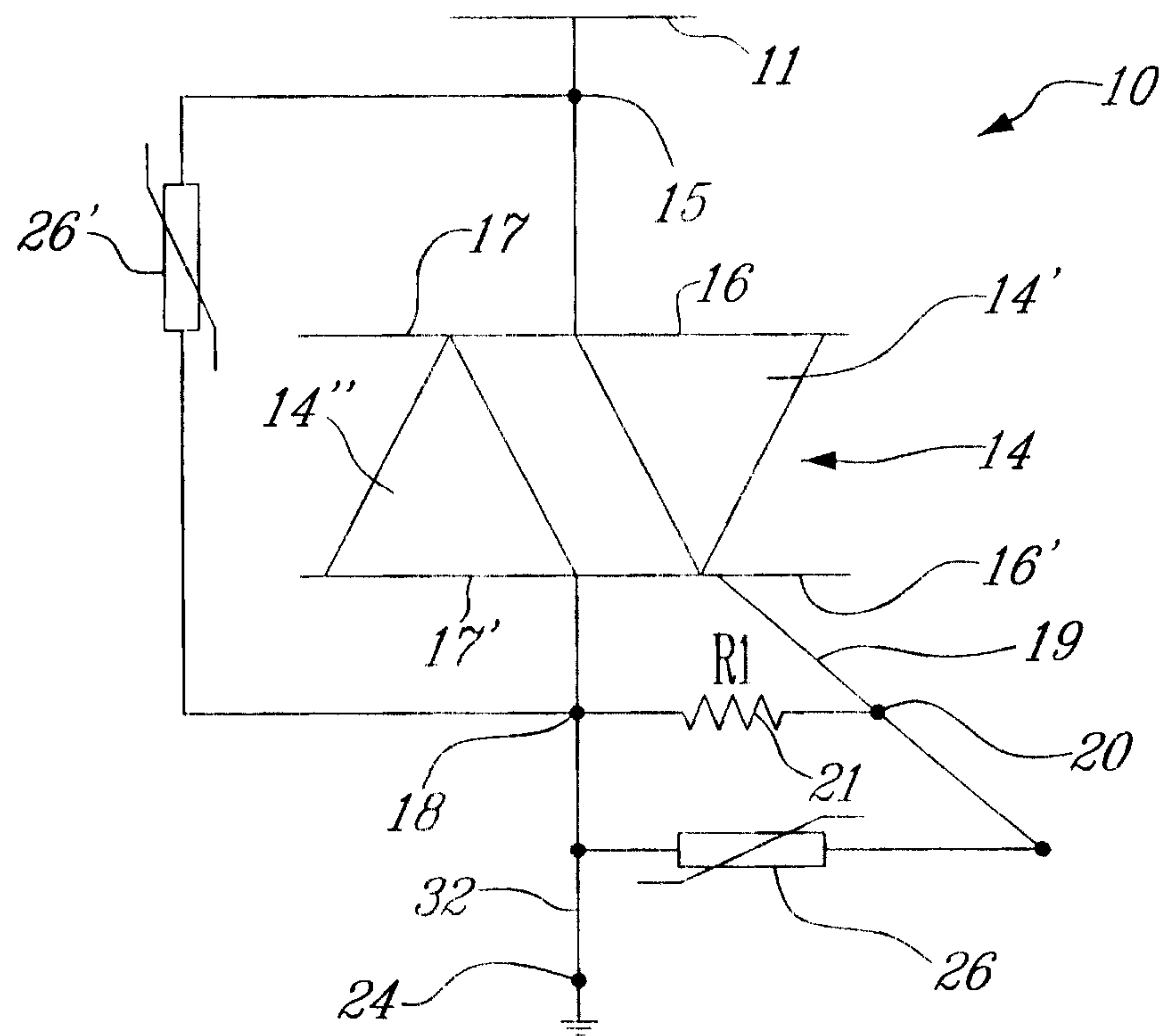


FIG. 1

