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(54) **Supply for discharge lamps**

Versorgung für Entladungslampe

Alimentation pour lampe à décharge

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(56) References cited:
GB-A- 2 337 644 **US-A- 4 434 388**

- **PATENT ABSTRACTS OF JAPAN vol. 017, no. 424 (E-1410), 6 August 1993 (1993-08-06) & JP 05 089978 A (TOSHIBA LIGHTING & TECHNOL CORP), 9 April 1993 (1993-04-09)**
- **PATENT ABSTRACTS OF JAPAN vol. 005, no. 186 (E-084), 25 November 1981 (1981-11-25) & JP 56 112046 A (TOSHIBA CORP), 4 September 1981 (1981-09-04)**

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Description

[0001] The present invention relates to a supply for discharge lamps as defined in the preamble of Claim 1 and disclosed in document US-A-4 434 388.

[0002] Known supplies for fluorescent lamps, .or for discharge lamps in general, provide for a first, starting voltage to be applied to the lamp or lamps to be supplied and, after a predetermined period of time during which the load settles, for a second, working voltage, lower than the first to be applied. Use is thus made of a characteristic of fluorescent lamps according to which, once the discharge which causes light to be emitted by the fluorescent material coating the inside of the tube of the lamp has been started, a reduction in voltage of up to about 30% leads to a negligible reduction in luminous flux. The saving in terms of electrical energy, on the other hand, is considerable.

[0003] A group of fluorescent lamps supplied by a supply of this type is prone to operating problems. In fact, since the lamps are supplied at less than the starting voltage, if conditions arise which are unfavourable to the maintenance of the operative state, for example, a reduction in ambient temperature, a reduction in the mains voltage, ageing of the lamps, or a fault in a lamp, the working voltage supplied by the supply may be insufficient for one or more of the lamps which therefore remain inoperative.

[0004] Supplies of the type described above require careful calibration on the basis of the number and type of lamps to be supplied since the working voltage is greatly affected by the overall current absorbed by the load.

[0005] An object of the present invention is to propose a supply which ensures not only a reduction in consumption of electrical energy but also effective supply of a group of lamps even if the unfavourable conditions indicated above arise and the capability of being calibrated automatically or semiautomatically by a very simple method.

[0006] This object is achieved by the provision of a supply as defined in general in Claim 1.

[0007] The invention will be understood better from the detailed description of some embodiments thereof, given by way of non-limiting example with reference to the appended drawings, in which:

> Figures 1, 2 and 3 show three embodiments of the invention in the form of block circuit diagrams.

[0008] With reference to Figure 1, the supply comprises an autotransformer 10 connected to the mains electrical power supply by means of a switch 11 and having a first output 10a for supplying a starting voltage and a second output 10b for supplying a working voltage lower than the starting voltage. It also comprises a controllable switch 12 and a control circuit module 13.

[0009] A set of lamps, represented by a generic load 14, is connected to the autotransformer by means of the switch 12 in order to receive the starting voltage or the working voltage therefrom.

[0010] A transformer or, in general, a voltage transducer having a first output for the starting voltage and a second output for the working voltage, could also be used, instead of the autotransformer.

[0011] In the embodiment shown, the switch 12 is part of a relay but, in practice, it could be formed by one or more solid-state components such as transistors or TRIACs.

[0012] The control circuit module 13 has the function of generating a switching signal for the switch 12 in various operating conditions. In particular, the module 13 comprises a current detector 15, for example, a toroidal magnetic circuit which detects the current absorbed by the load 14, a circuit 16, for example, a peak detector, for processing the signal of the detector 15, a calibration device 17, a first voltage comparator 18, a voltage detector 19, for example, a voltage divider with rectifiers, a second voltage comparator 20, and a relay driver stage 21 with a timer T and a relay coil 24 which operates the switch 12. The outputs of the comparators 18 and 20 are connected to the resetting and starting input of the timer 21 by means of respective decoupling diodes 22 and 23 which together form an OR logic function, as well as to respective indicator devices, for example two LEDs 25 and 26. One of the inputs of each of the comparators is connected to a respective trimmer 27 or 28 which sets its voltage to an adjustable reference value.

[0013] In this embodiment, the calibration device 17 is constituted by a voltage divider R1, R2 and by a push-button 17a, that is, a normally-open switch connected in parallel with one of the resistors of the divider. The phase and neutral terminals of an alternating-current mains electrical power supply (for example, 230 V, 50 Hz) are indicated L and N and the terminals of a direct-current voltage supply (for example, 12V) are indicated Vcc and by the earth symbol.

[0014] Further structural details will be given in the following explanation of the operation of the circuit.

[0015] The switch 12 has a rest position which is its position when the coil 24 is not energized. In this position, the higher voltage of the supply, that is, in this embodiment 230V, can be applied to the load 14. When the supply is connected to the mains by the closure of the switch 11, the timer T of the driver stage 21 is reset and started. The functional resetting relationship is represented by a broken line which joins the resetting input of the timer T of the stage 21 to the switch 11. In practice, it may be formed by an RC circuit which reacts to the starting transient of the circuit so as to bring the input terminal of the timer to the voltage necessary for resetting. When the predetermined count is reached, for example, after a few minutes, the driver stage 21 energizes the coil 24 of the relay, causing the switch 12 to switch so that the load is supplied with the working voltage.

[0016] If the working voltage falls below a predetermined threshold value, for example, because of a reduction in the mains voltage, so that the operative state of the lamp is no longer ensured, the comparator 20 generates an output signal which brings about resetting and restarting of the timer of the stage 21 and thus de-energization of the coil 24 and switching of the switch 12 to the position in which the load is supplied with the higher voltage. This takes place if the drop in the mains voltage is of a duration greater than a predetermined period of time, for example, of a few seconds, determined by a suitable device (not shown), for example, an RC circuit.

[0017] The detector 15 detects the current absorbed by the load. The signal generated thereby can be used to activate an indicator device (not shown) which supplies an indication of the state of the lamps to personnel managing the system. If the current detected is reduced by a predetermined value relative to the nominal current (for example, as a result of a group of lamps becoming inoperative) the comparator 18 generates an output signal which brings about resetting and restarting of the timer 21 and switching of the switch 12 again to supply the load with a higher voltage. If the current drop was due to a group of lamps becoming inoperative, the increase in voltage starts the lamps again so that, except in the event of an irreversible breakdown, the lamps remain operative, even when the working voltage is reestablished. The intervention threshold of the comparator 18 is set by the user by means of the trimmer 27. Since the current absorbed depends on the load, the trimmer 27 should be adjusted each time the load is changed, with the use of suitable instruments to measure the nominal current and the threshold current (which is usually selected to as to be approximately 30% lower than the nominal current).

[0018] According to the embodiment of the invention shown in Figure 1, this adjustment is greatly simplified by the calibration device 17. The adjustment is performed when the load is supplied with the working voltage.

[0019] The resistors are selected in a manner such that the ratio between the resistance of the resistor R2, that is, the resistor which is connected in parallel with the switch 17a, and the sum of the resistances of R1 and R2, is equal to the ratio between the threshold current at which intervention is required and the nominal current. The adjustment is performed by closing the push-button switch 17a and at the same time adjusting the trimmer 27 until the indicator 25 is lit. The closure of the switch 17a causes a reduction in the load of the peak detector 16, which causes a reduction in the voltage at the terminal of the comparator 18 to the value which it would have if the current absorbed by the lamps 14 were reduced by the desired percentage. This operation enables the circuit to be adjusted to the load 14 without the use of additional instruments. In other words, the circuit module 13 can be used without modifications, with any load, with a simple calibration operation.

[0020] To prevent the output of the comparator 18 from resetting the timer during this operation thus causing the switch 12 to switch to the higher voltage, a connection is provided between the device 17 and the resetting terminal of the timer by means of a diode 29. During the closure of the switch 17a, this connection has the effect of connecting the output of the comparator to earth through the two diodes 22 and 29, thus preventing the voltage at the input of the timer T from reaching the resetting value.

[0021] If necessary, a device similar to the device 17 may also be provided at the input of the comparator 20 to facilitate the adjustment of the intervention threshold when the voltage in the load is reduced.

[0022] In the embodiment shown in Figure 2, the procedure for adjusting the module to the load is performed entirely automatically. In Figure 2, in which elements identical to those of Figure 1 are indicated by the same reference symbols, the calibration device, which is indicated 17' in this case, comprises a micro-controller MC with a program resident in an internal ROM memory or in an external non-volatile memory (an EPROM), and with an incorporated or external analog/digital converter (A/D), a digital trimmer, that is, a digitally-controlled voltage divider, indicated G, a starting push-button S, an electrically-programmable and erasable non-volatile memory (EEPROM) E for holding data in the event of a failure of the supply of the micro-controller, a keyboard K for the input of data defining the relationship between the intervention threshold current and the nominal current absorbed by the load, and an indicator D for displaying data and messages. Instead of the trimmer 27 of Figure 1, there is a second digital trimmer F controlled by an output of the micro-controller MC.

[0023] Operation of the push-button S starts the program resident in the micro-controller MC, that is, the selection of the relationship between the desired threshold current and the nominal current absorbed. In practice, this is achieved by a corresponding adjustment of the electronic trimmer G and of the electronic trimmer F such as to equalize the voltages at the inputs of the comparator 18.

[0024] The embodiment shown in Figure 3 uses a switch 12' as switching means operated by the relay and an inductor 10' connected in parallel with the switch as a voltage transducer. When the switch 11 is closed, the switch 12' is closed, so that the load 14 is supplied at the mains voltage. When the timer T has reached the predetermined count, the driver stage 21 energizes the coil 24 of the relay, causing the switch 12' to open and the load 14 thus to be supplied by means of the inductor 10' in series. The inductance of the inductor 10' is selected in a manner such that the voltage drop caused thereby is such that the load has the desired working voltage.

[0025] As can easily be seen, the supply according to the invention achieves a saving in electrical energy together with complete reliability of the correct supply to

the lamps. Moreover, the semi-automatic or automatic adjustment to the load enables the supply to be installed without problems even by unskilled personnel.

Claims

1. A supply for discharge lamps, comprising:

- a voltage transducer (10) which can be connected to an electrical energy supply and has a first output (10a) for supplying a starting voltage and a second output (10b) for supplying a working voltage lower than the starting voltage,
- controllable switching means (12) for connecting an electrical load (14) comprising at least one discharge lamp selectively to the first output (10a) or to the second output (10b) of the transducer,
- timing means (T) which are reset and started when they receive a resetting input signal and which generate an output signal after a predetermined period of time,
- control means (21) connected to the timing means (T) and to the switching means (12) in order to generate a signal for switching from the first output (10a) to the second output (10b) in response to an output signal of the timing means (T),
- detector means (15, 19) for detecting at least one electrical quantity of the load and generating a corresponding signal, and
- comparator means (18, 20) having a first input for receiving said signal from the detector means (15, 19), a second input connected to a reference source and an output which is operatively connected to the input of the timing means (T) in order to supply a resetting signal when the electrical quantity detected falls below a predetermined reference level,

characterized in that it comprises a calibration device (17) connected to the first input of the comparator means (18) and having control means (71a) for reducing the level of the signal from the detector means (15) applied to the first input of the comparator (18) by a predetermined percentage.

2. A supply according to Claim 1, in which the detector means comprise a detector (15, 16) for detecting the current absorbed by the load (14) .

3. A supply according to Claim 1 or Claim 2, in which the detector means comprise a detector (19) for detecting the voltage in the load.

4. A supply according to Claim 2, in which the detector (15, 16) for detecting the current absorbed by the load (14) has a voltage output, and in which the comparator means comprise a voltage comparator (18) having a first input connected to the output of the current detector (15, 16) and a second input connected to a supply (27) of an adjustable reference voltage.

5. A supply according to Claim 4, in which the calibration device (17) comprises two resistors (R1, R2) in series, and in which the control means comprise a switch (17a) in parallel with one (R2) of the two resistors.

6. A supply according to Claim 4, in which the calibration device (17') comprises a programmed micro-controller (MC), a digitally-controlled divider (G) controlled by an output of the micro-controller (MC), and means (K) for the input of data into the micro-controller (MC), and in which the adjustable reference-voltage supply comprises a further digitally-controlled divider (F) controlled by an output of the micro-controller (MC).

7. A supply according to any one of the preceding claims, in which the voltage transducer (10) comprises an autotransformer.

8. A supply according to any one of Claims 1 to 6, in which the switching means comprise a switch (12') and the voltage transducer comprises an inductor (10') connected in parallel with the switch (12').

Patentansprüche

1. Eine Versorgung für Entladungslampen, die folgende Merkmale aufweist:

einen Spannungswandler (10), der mit einer elektrischen Energieversorgung verbunden werden kann und einen ersten Ausgang (10a) zum Liefern einer Zündspannung und einen zweiten Ausgang (10b) zum Liefern einer Arbeitsspannung, die geringer ist als die Zündspannung, aufweist,

eine steuerbare Umschalteinrichtung (12) zum selektiven Verbinden einer elektrischen Last (14), die zumindest eine Entladungslampe aufweist, mit dem ersten Ausgang (10a) oder mit dem zweiten Ausgang (10b) des Wandlers,

eine Zeitgebungseinrichtung (T), die zurückgesetzt und gestartet wird, wenn sie ein Rücksetzungs-Eingangssignal empfängt, und die nach einem vorbestimmten Zeitraum ein Ausgangssignal erzeugt,

eine Steuereinrichtung (21), die mit der Zeitgebungseinrichtung (T) und mit der Umschalteinrichtung (12) verbunden ist, um ansprechend auf ein Ausgangssignal der Zeitgebungseinrichtung (T) ein Signal zum Umschalten von dem ersten Ausgang (10a) zu dem zweiten Ausgang (10b) zu erzeugen,

eine Erfassungseinrichtung (15, 19) zum Erfassen zumindest einer elektrischen Quantität der Last und zum Erzeugen eines entsprechenden Signals, und

eine Vergleichseinrichtung (18, 20), die einen ersten Eingang zum Empfangen des Signals von der Erfassungseinrichtung (15, 19), einen zweiten Eingang, der mit einer Referenzquelle verbunden ist, und einen Ausgang aufweist, der wirksam mit dem Eingang der Zeitgebungseinrichtung (T) verbunden ist, um ein Rücksetzungssignal zu liefern, wenn die erfaßte elektrische Quantität einen vorbestimmten Referenzpegel unterschreitet,

dadurch gekennzeichnet, daß sie eine Kalibrierungsvorrichtung (17) aufweist, die mit dem ersten Eingang der Vergleichseinrichtung (18) verbunden ist und eine Steuereinrichtung (71a) zum Verringern des Pegels des Signals von der Erfassungseinrichtung (15), das an den ersten Eingang des Komparators (18) angelegt ist, um einen vorbestimmten Prozentsatz aufweist.

2. Eine Versorgung gemäß Anspruch 1, bei der die Erfassungseinrichtung einen Detektor (15, 16) zum Erfassen des durch die Last (14) absorbierten Stromes aufweist.

3. Eine Versorgung gemäß Anspruch 1 oder 2, bei der die Erfassungseinrichtung einen Detektor (19) zum Erfassen der Spannung in der Last aufweist.

4. Eine Versorgung gemäß Anspruch 2, bei der der Detektor (15, 16) zum Erfassen des durch die Last (14) absorbierten Stromes einen Spannungsausgang aufweist und bei der die Vergleichseinrichtung einen Spannungskomparator (18) aufweist, der einen ersten mit dem Ausgang des Stromdetektors (15, 16) verbundenen Eingang und einen zweiten mit einer Versorgung (27) einer einstellbaren Referenzspannung verbundenen Eingang aufweist.

5. Eine Versorgung gemäß Anspruch 4, bei der die Kalibrierungsvorrichtung (17) zwei in Serie befindliche Widerstände (R1, R2) aufweist und bei der die Steuereinrichtung einen zu einem (R2) der beiden Widerstände parallelen Schalter (17a) aufweist.

6. Eine Versorgung gemäß Anspruch 4, bei der die Kalibrierungsvorrichtung (17') eine programmierte Mikrosteuerung (MC), einen digital gesteuerten Dividierer (G), der durch eine Ausgabe der Mikrosteuerung (MC) gesteuert wird, und eine Einrichtung (K) für die Eingabe von Daten in die Mikrosteuerung (MC) aufweist und bei der die einstellbare Referenzspannungsversorgung einen weiteren digital gesteuerten Dividierer (F) aufweist, der durch eine Ausgabe der Mikrosteuerung (MC) gesteuert wird.

7. Eine Versorgung gemäß einem der vorhergehenden Ansprüche, bei der der Spannungswandler (10) einen Autotransformator aufweist.

8. Eine Versorgung gemäß einem der Ansprüche 1 bis 6, bei der die Schalteinrichtung einen Schalter (12') aufweist und der Spannungswandler einen parallel zu dem Schalter (12') geschalteten Induktor (10') aufweist.

Revendications

1. Alimentation pour lampes à décharge, comprenant :

- un transducteur de tension (10) qui peut être connecté à une alimentation en énergie électrique et qui comporte une première sortie (10a) destinée à délivrer une tension de démarrage et une seconde sortie (10b) destinée à délivrer une tension de service inférieure à la tension de démarrage,
- des moyens de commutation pouvant être commandés (12) destinés à connecter sélectivement une charge électrique (14), comprenant au moins une lampe à décharge, à la première sortie (10a) ou à la seconde sortie (10b) du transducteur,
- des moyens à minuterie (T) qui sont réinitialisés et démarrés lorsqu'ils reçoivent un signal d'entrée de réinitialisation, et qui génèrent un signal de sortie au bout d'une période de temps prédéterminée,
- des moyens de commande (21) connectés aux moyens à minuterie (T) et aux moyens de commutation (12) de manière à générer un signal permettant d'opérer une commutation de la première sortie (10a) à la seconde sortie (10b) en réponse à un signal de sortie des moyens à minuterie (T),
- des moyens détecteurs (15, 19) destinés à détecter au moins une quantité électrique de la charge et à générer un signal correspondant, et
- des moyens comparateurs (18, 20) comportant une première entrée destinée à recevoir le dit signal provenant des moyens détecteurs (15,

19), une seconde entrée connectée à une source de référence et une sortie qui est connectée, en fonctionnement, à l'entrée des moyens à minuterie (T) de manière à délivrer un signal de réinitialisation lorsque la quantité électrique détectée chute en-deçà d'un niveau de référence prédéterminé,

caractérisée en ce qu'elle comprend un dispositif de calibrage (17) connecté à la première entrée des moyens comparateurs (18) et comportant des moyens de commande (71a) destinés à réduire, d'un pourcentage prédéterminé, le niveau du signal provenant des moyens détecteurs (15) qui est appliqué à la première entrée du comparateur (18).

2. Alimentation selon la revendication 1, dans laquelle les moyens détecteurs comprennent un détecteur (15, 16) destiné à détecter le courant absorbé par la charge (14).

3. Alimentation selon la revendication 1 ou 2, dans laquelle les moyens détecteurs comprennent un détecteur (19) destiné à détecter la tension dans la charge.

4. Alimentation selon la revendication 2, dans laquelle le détecteur (15, 16) destiné à détecter le courant absorbé par la charge (14) comporte une sortie en tension, et dans laquelle les moyens comparateurs comprennent un comparateur de tensions (18) comportant une première entrée connectée à la sortie du détecteur de courant (15, 16) et une seconde entrée connectée à une alimentation (27) en tension de référence ajustable.

5. Alimentation selon la revendication 4, dans laquelle le dispositif de calibrage (17) comprend deux résistances (R1, R2) en série, et dans laquelle les moyens de commande comprennent un commutateur (17a) en parallèle à l'une (R2) des deux résistances.

6. Alimentation selon la revendication 4, dans laquelle le dispositif de calibrage (17') comprend un microcontrôleur programmé (MC), un diviseur à commande numérique (G) commandé par un signal de sortie du microcontrôleur (MC), et des moyens (K) destinés à l'entrée de données dans le microcontrôleur (MC), et dans laquelle l'alimentation en tension de référence ajustable comprend un diviseur à commande numérique supplémentaire (F) commandé par un signal de sortie du microcontrôleur (MC).

7. Alimentation selon l'une quelconque des revendications précédentes, dans laquelle le transducteur de tension (10) comprend un autotransformateur.

8. Alimentation selon l'une quelconque des revendications 1 à 6, dans laquelle les moyens de commutation comprennent un commutateur (12') et le transducteur de tension comprend un inducteur (10') connecté en parallèle avec le commutateur (12').

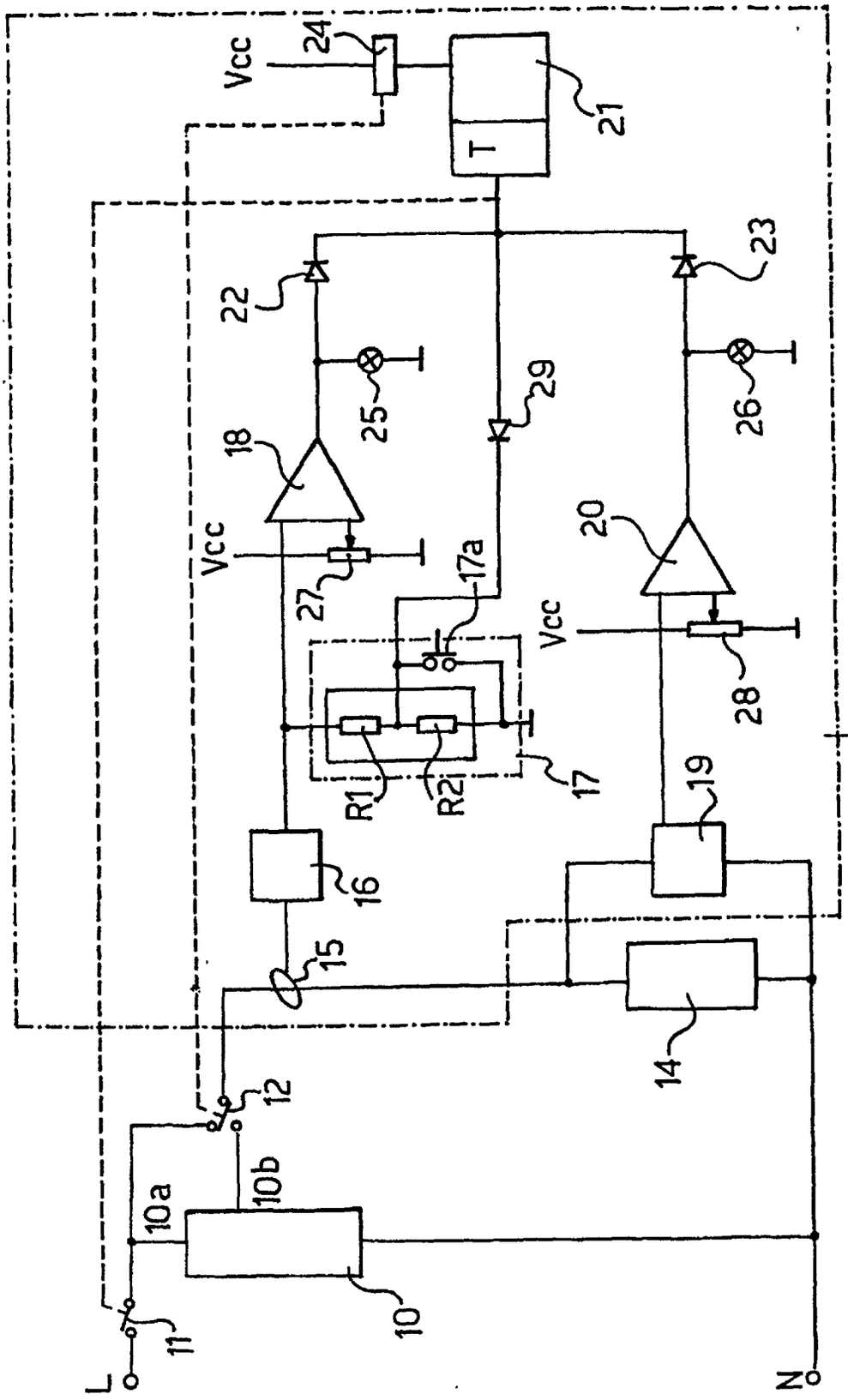
Vcc
24
21
T
22
23
25
26
29
18
20
Vcc
17a
27
Vcc
28
R1
R2i
17
13
19
16
15
14
12
10a
10b
10
11
L
N

FIG.1

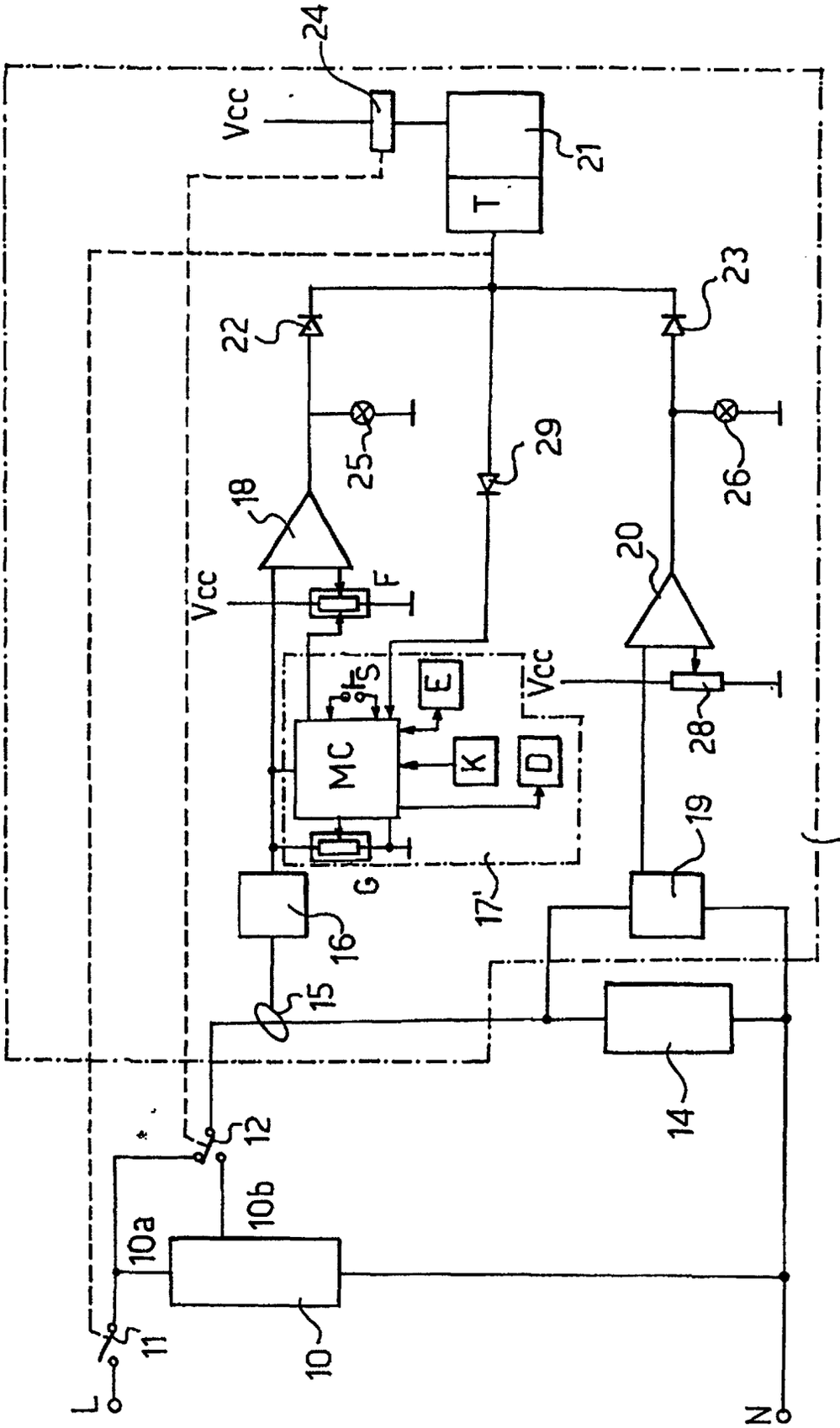
24
Vcc
21
T
23
22
25
29
26
18
20
Vcc
F
Vcc
E
MC
K
D
28
19
13
17'
G
16
15
14
12
10b
10a
11
10
L
N

FIG.2

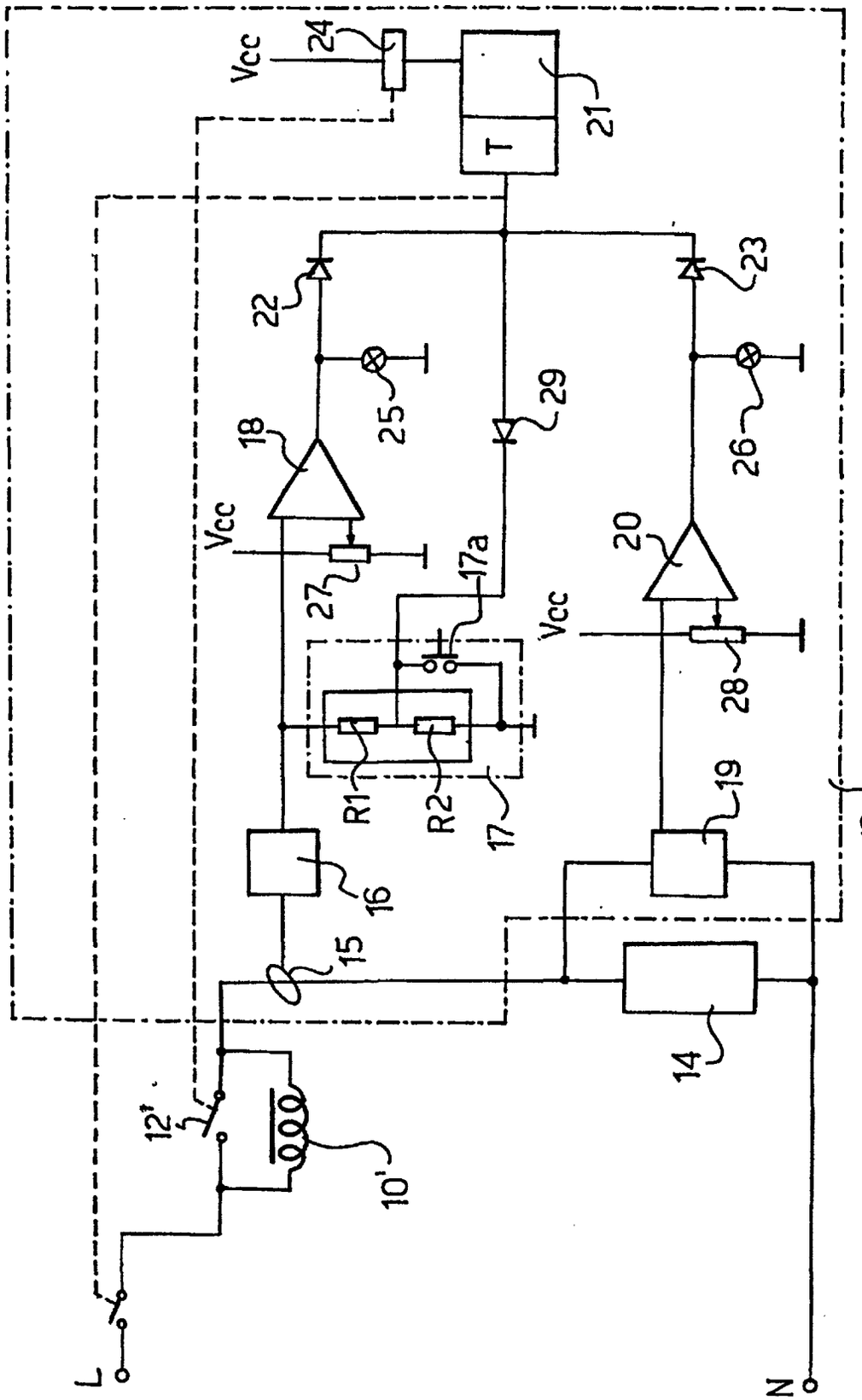
Vcc
24
T
21
22
23
25
29
26
18
Vcc
17a
20
27
Vcc
28
R1
R2
17
19
13
16
15
14
12'
10'
L
N

FIG.3