(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 402 834 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.01.2012 Bulletin 2012/01

(51) Int Cl.:
G05F 1/445 *(2006.01)*

(21) Application number: **10167422.4**

(22) Date of filing: **25.06.2010**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
BA ME RS

(71) Applicant: **Yuieh Hsene Electronics Co., Ltd.**
Kaohsiung City (TW)

(72) Inventor: **Wu, Chao Lin**
Kaohsiung City (TW)

(74) Representative: **Lang, Christian et al**
LangRaible GbR
Patent- und Rechtsanwälte
Rosenheimerstrasse 139
81671 München (DE)

(54) Alternating current regulating means

(57) The present invention provides an alternating current regulating means including a positive half-cycle current-limiting circuit and a negative half-cycle current-limiting circuit. The positive half-cycle current-limiting circuit includes a first diode and a first current-limiting circuit. The negative half-cycle current-limiting circuit includes a second diode and a second current-limiting circuit. The first diode allows the positive half-cycle current of the alternating current to pass through, and the second diode allows the negative half-cycle current of the alternating current to pass through. Thus, when the input power supply generates an alternating current, the first diode and the second diode respectively allow the positive half-cycle current and the negative half-cycle current of the alternating current to pass through. Then, the first current-limiting circuit and the second current-limiting current respectively process the positive half-cycle current and the negative half-cycle current, so that the average current value of the outputted alternating current can be restricted to a stable value for a load.

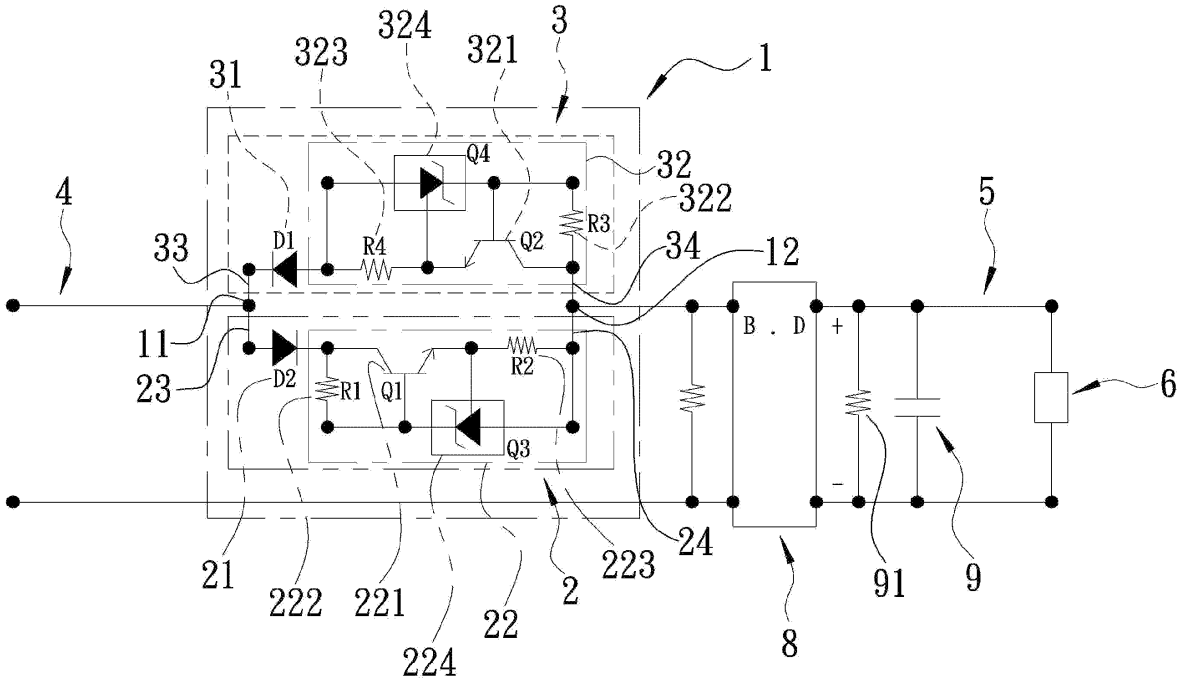

FIG. 1

EP 2 402 834 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an alternating current regulating means, and in particular to a means for outputting a stable electric current.

2. Description of Prior Art

[0002] A load means an object which consumes electricity for its operation, such as a television, air conditioner, electric fan or the like. Since the electricity generated by a power plant is delivered for a long distance so as to a end user and electric cables used for delivering the electricity inevitably have a large internal resistance, the electric current reaching the user end is unstable, which may adversely affect the lifetime of the load. Even, some delicate or precise loads may suffer damage due to the unstable input electric current.

[0003] Therefore, people try to propose a current-regulating means. One end of the current-regulating means is electrically connected to a power supply, and the other end thereof is electrically connected to a load. After an electric current passes through the current-regulating means, the electric current can be regulated to become a stable current for the load.

[0004] However, the conventional current-regulating means has a drawback. That is, the input electric current has to be a direct current, and otherwise the conventional current-regulating means cannot generate a stable current. Since the power supply in a house or a factory generates an alternating current, the conventional current-regulating means cannot be directly used in a house or factory.

[0005] Since the conventional current-regulating means has the above-mentioned problems, the present Inventor tries to solve the problems in prior art.

SUMMARY OF THE INVENTION

[0006] In order to solve the problems of the conventional current-regulating means, the present Inventor proposes a novel and reasonable structure based on his research and experiments.

[0007] The present invention relates to an alternating current regulating means, which includes:

a positive half-cycle current-limiting circuit comprising a first diode, a first current-limiting circuit, a first input end and a first output end, a cathode of the first diode being electrically connected to an input end of the first current-limiting circuit, an anode of the first diode being electrically connected to the first input end, an output end of the first current-limiting circuit being electrically connected to the first output end;

a negative half-cycle current-limiting circuit comprising a second diode, a second current-limiting circuit, a second input end and a second output end, an anode of the second diode being electrically connected to an input end of the second current-limiting circuit, a cathode of the second diode being electrically connected to the second input end, an output end of the second current-limiting circuit being electrically connected to the second output end;

a current input section, one end of the current input section being electrically connected to the first input end and the second input end and coupled to a first connecting point, the other end of the current input section being electrically connected to an input power supply; and

a current output section, one end of the current output section being electrically connected to the first output end and the second output end and coupled to a second connecting point, the other end of the current output section being electrically connected to a load.

[0008] According to the present invention, one end of the alternating current regulating means is electrically connected to the input power supply, and the other end thereof is electrically connected to the load. When the input power supply generates an alternating current flowing to the first connecting point, the first diode allows the positive half-cycle current of the alternating current to pass through, and the second diode allows the negative half-cycle current of the alternating current to pass through. As a result, the alternating current is divided into the positive half-cycle current flowing into the first current-limiting circuit and the negative half-cycle current flowing into the second current-limiting circuit. The difference of phase angle between the positive half-cycle current and the negative half-cycle current is 180 degree. Thus, the positive half-cycle current flowing to the first current-limiting circuit is outputted to the second connecting point with a stable and constant value, and the negative half-cycle current flowing into the second current-limiting circuit is outputted to the second connecting point with a stable and constant value. Since the difference of phase angle between the positive half-cycle current and the negative half-cycle current is 180 degree, the positive half-cycle current and the negative half-cycle current flow to the second connecting point to form an electric current having a continuous periodic wave for the load. In this way, the problem that the conventional current-regulating means only regulates a direct current to become a stable output current can be solved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a schematic view of the present invention;
FIG. 2 is a schematic view showing a positive half-

cycle current-limiting circuit of the present invention;

FIG. 3 is a schematic view showing a negative half-cycle current-limiting circuit of the present invention; and

FIG. 4 is a schematic view showing an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0010] Please refer to FIG. 1. The present invention is directed to an alternating current regulating means 1, which includes a positive half-cycle current-limiting circuit 2, a negative half-cycle current-limiting circuit 3, a current input section 4, and a current output section 5.

[0011] The positive half-cycle current-limiting circuit 2 comprises a first diode 21, a first current-limiting circuit 22, a first input end 23 and a first output end 24. A cathode of the first diode 21 is electrically connected to an input end of the first current-limiting circuit 22. An anode of the first diode 21 is electrically connected to the first input end 23. An output end of the first current-limiting circuit 22 is electrically connected to the first output end 24. With this arrangement, when the first input end 23 is electrically connected to an input power supply generating an alternating current, the first diode 21 allows the positive half-cycle current of the alternating current to pass through but obstructs the passage of the negative half-cycle current of the alternating current. As a result, only the positive half-cycle current of the input power supply can flow into the first current-limiting circuit 22, and then the first current-limiting circuit 22 makes the positive half-cycle current to become a stable valve.

[0012] Please refer to FIGS. 1 and 2, which show a preferred embodiment of the positive half-cycle current-limiting circuit 2. The first current-limiting circuit 22 includes a first bipolar junction transistor 221, a first bias resistor 222, a first current-limiting resistor 223, and a first voltage-regulating unit 224. The first bipolar junction transistor 221 is electrically connected to the input end of the first current-limiting circuit 22. One end of the first bias resistor 222 is electrically connected to a base of the first bipolar junction transistor 221, and the other end of the first bias resistor 222 is electrically connected to the input end of the first current-limiting circuit 22. The first voltage-regulating unit 224 is electrically connected to the base of the first bipolar junction transistor 221, the output end of the first current-limiting circuit 22, and an emitter of the first bipolar junction transistor 221. The first voltage-regulating unit 224 is configured to control the current value outputted by the emitter of the first bipolar junction transistor (221. One end of the first current-limiting resistor (223 is electrically connected to the first voltage-regulating unit (224, and the other end of the first current-limiting resistor (223 is electrically connected to the output end of the first current-limiting circuit (22. A preferred embodiment of the first voltage-regulating unit (224 is a controllable Zener diode (also referred as "TL431"). An anode of the controllable Zener diode is electrically connected to the output end of the first current-limiting circuit 22, and a cathode of the controllable Zener diode is electrically connected to the base of the first bipolar junction transistor 221. A reference end of the controllable Zener diode is electrically connected to the input end of the first current-limiting resistor 223. Hereinafter, the first voltage-regulating unit 224 is described by using the controllable Zener diode as an example.

[0013] When the positive half-cycle current of the alternating current flows through the first diode 21 and into the first current-limiting circuit 22, the positive half-cycle current flows through a collector of the first bipolar junction transistor 221 and reaches the emitter of the first bipolar junction transistor 221. The value of the current reaching the emitter depends on the first bias resistor 222. When the positive half-cycle current flows through the current-limiting resistor 223, both ends of the current-limiting resistor 223 will generate a voltage Ve-r. The breakdown voltage of the first voltage-regulating unit 224 is defined as V_z. If Ve-r $>V_z$, the first voltage-regulating unit reduces the bias voltage outputted by the first bipolar junction transistor 221, so that the output current of the first bipolar junction transistor 221 can be limited to an average current value. Therefore, when the resistance of the bias resistor 222 and the current-limiting resistor 223 is changed, the average current value of the positive half-cycle current can be controlled. Since the first current-limiting circuit 22 of the present embodiment is constituted of fewer elements, the total manufacturing cost is reduced to make the present invention more competitive. Furthermore, the manufacturing procedure is also simplified.

[0014] The negative half-cycle current-limiting circuit 3 comprises a second diode 31, a second current-limiting circuit 32, a second input end 33 and a second output end 34. An anode of the second diode 31 is electrically connected to an input end of the second current-limiting circuit 32. A cathode of the second diode 31 is electrically connected to the second input end 33. With this arrangement, when the second input end 33 is electrically connected to an input power supply generating an alternating current, the second diode 31 allows the negative half-cycle current of the alternating current to pass through but obstructs the passage of the positive half-cycle current of the alternating current. The output end of the second current-limiting circuit 32 is electrically connected to the second output end 34. The second current-limiting circuit 32 allows the negative half-cycle current to pass through to become a stable valve.

[0015] Please refer to FIGS. 1 and 3, which show a preferred embodiment of the negative half-cycle current-limiting circuit 3. The second current-limiting circuit 32 includes a second bipolar junction transistor 321, a second bias resistor 322, a second current-limiting resistor 323, and a second voltage-regulating unit 324. A collector of the second bipolar junction transistor 321 is electrically connected to an output end of the second current-limiting

circuit 32. One end of the second bias resistor 322 is electrically connected to a base of the second bipolar junction transistor 321, and the other end of the second bias resistor 322 is electrically connected to the output end of the second current-limiting circuit 32. The second voltage-regulating unit 324 is electrically connected to the base of the second bipolar junction transistor 321, the output end of the second current-limiting circuit 32, and an emitter of the second bipolar junction transistor 321. The second voltage-regulating unit 324 is configured to control the current value outputted by the emitter of the second bipolar junction transistor 321. One end of the second current-limiting circuit 323 is electrically connected to the second voltage-regulating unit 324, and the other end of the second current-limiting circuit 323 is electrically connected to the input end of the second current-limiting circuit 32. A preferred embodiment of the second voltage-regulating unit 324 is a controllable Zener diode. An anode of the controllable Zener diode is electrically connected to the input end of the second current-limiting circuit 32, and the cathode of the controllable Zener diode is electrically connected to the base of the second bipolar junction transistor 321. A reference end of the controllable Zener diode is electrically connected to an output end of the second current-limiting resistor 323. Hereinafter, the second voltage-regulating unit 324 is described by using the controllable Zener diode as an example.

[0016] When the negative half-cycle current of the alternating current flows through the second diode 31 and into the second current-limiting circuit 32, the second current-limiting circuit 32 is operated in the same manner as that of the first current-limiting circuit 22. Thus, the redundant description is omitted for simplicity. Therefore, the second current-limiting circuit 32 restricts the negative half-cycle current to an average current value. Since the second current-limiting circuit 32 of the present embodiment is constituted of fewer elements, the total manufacturing cost is reduced to make the present invention more competitive. Furthermore, the manufacturing procedure is also simplified.

[0017] One end of the current input section 4 is electrically connected to the input power supply, and the other end of the current input section 4 is electrically connected to the first input end 23 and the second input end 33 and coupled to a first connecting point 11. One end of the current output section 5 is electrically connected to a load 6, and the other end of the current output section 5 is electrically connected to the first output end 24 and the second output end 34 and coupled to a second connecting point 12. In the present embodiment, the load 6 means an object which consumes electricity for its operation, such as a television, electric fan, electric lamp or the like.

[0018] The current input section 4 is electrically connected to the first input end 23 and the second input end 33 and coupled to the first junction 11. The current output section 5 is electrically connected to the first output end 24 and the second output end 34 and coupled to the second connecting point 12. With this arrangement, when the alternating current flows through the first diode 21 and the second diode 31, the alternating current is divided into a positive half-cycle current and a negative half-cycle current. Since the difference of phase angle between the positive half-cycle current and the negative half-cycle current is 180 degree, the positive half-cycle current and the negative half-cycle current flow to the second connecting point 12 to form an electric current of a continuous periodic wave for a load. Thus, the phase angle error will not be generated in the alternating current to adversely affect the load 6.

[0019] Please refer to FIG. 4, which shows another embodiment of the present invention. In the present embodiment, a voltage-controlling unit 7 is provided. One end of the voltage-controlling unit 7 is electrically connected to the current input section 4, and the other end of the voltage-controlling unit 7 is electrically connected to the input power supply. The voltage-controlling unit 7 is configured to control the voltage V of the input power supply and to change the value Ve-r. As a result, after the alternating current flows through the first current-limiting circuit 22 and the second current-limiting circuit 32, the average current value is changed, thereby controlling the current value flowing into the load 6. When the load 6 is an electric bulb, the voltage-controlling unit 7 is configured to control the brightness of the electric bulb, thereby saving the electricity. The voltage-controlling unit 7 may be a variable resistor. By changing the resistance of the variable resistor, the voltage of the input power supply can be changed. A preferred embodiment of the voltage-controlling unit 7 may be a bidirectional silicon controlled rectifier for adjusting the voltage of the input power supply.

[0020] Please refer to FIG. 1, which shows another embodiment of the present invention. In the present embodiment, a rectifier 8 is provided. One end of the rectifier 8 is electrically connected to the load 6, and the other end of the rectifier 8 is electrically connected to the current output section 5. When the input power supply generates an alternating current, the rectifier 8 converts the alternating current into a direct current for the load 6. In a further embodiment of the present invention, a capacitor 9 is provided. One end of the capacitor 9 is electrically connected to the load 6, and the other end of the capacitor 9 is electrically connected to the rectifier 8. By using the capacitor 9, the current flowing into the load 6 becomes more stable. Furthermore, a bleeder resistor 91 is provided to be electrically connected to the capacitor 9. The bleeder resistor 91 is configured to bleed excess charges in the capacitor 9 when the alternating current regulating means 1 is inactive. In this way, it is safer to use the alternating current regulating means 1 in the next time.

[0021] According to the above, the present invention really has industrial applicability and it has not seen or used in public. Further, the present invention has non-obviousness, so that it conforms to the requirements for an invention patent.

[0022] The above disclosed embodiment is merely a preferred embodiment of the present invention. Various equivalent variations and modifications may be designed as known to those skilled in the art in view of the teachings of the present invention. Thus, all such variations and equivalent modifications are also embraced within the scope of the invention as defined in the appended claims.

Claims

1. An alternating current regulating means, including:

a positive half-cycle current-limiting circuit (2) comprising a first diode(21), a first current-limiting circuit (22), a first input end (23) and a first output end (24), a cathode of the first diode (21) being electrically connected to an input end of the first current-limiting circuit (22), an anode of the first diode (21) being electrically connected to the first input end (23), an output end of the first current-limiting circuit (22) being electrically connected to the first output end (24);
a negative half-cycle current-limiting circuit (3) comprising a second diode (31), a second current-limiting circuit (32), a second input end (33) and a second output end (34), an anode of the second diode (31) being electrically connected to an input end of the second current-limiting circuit (32), a cathode of the second diode (31) being electrically connected to the second input end (33), an output end of the second current-limiting circuit (32) being electrically connected to the second output end;
a current input section (4), one end of the current input section (4) being electrically connected to the first input end (23) and the second input end (33) and coupled to a first connecting point (11), the other end of the current input section (4) being electrically connected to an input power supply; and
a current output section (5), one end of the current output section (5) being electrically connected to the first output end (24) and the second output end (34) and coupled to a second connecting point (12), the other end of the current output section (5) being electrically connected to a load (6).

2. The alternating current regulating means according to claim 1, wherein the first current-limiting circuit (22) includes a first bipolar junction transistor (221), a first bias resistor (222), a first current-limiting resistor (223), and a first voltage-regulating unit (224), a base of the first bipolar junction transistor (221) is electrically connected to an input end of the first current-limiting circuit (22), one end of the first bias resistor (222) is electrically connected to a base of the first bipolar junction transistor (221), the other end of the first bias resistor (222) is electrically connected to the input end of the first current-limiting circuit (22), one end of the first current-limiting resistor (223) is electrically connected to an emitter of the first bipolar junction transistor (221), the other end of the first current-limiting resistor is electrically connected to the output end of the first current-limiting circuit (22), the first voltage-regulating unit (224) is electrically connected to the base of the first bipolar junction transistor (221), the output end of the first current-limiting circuit (22) and the emitter of the first bipolar junction transistor (221), the first voltage-regulating unit (22) is configured to control the current value outputted by the emitter of the first bipolar junction transistor (221).

3. The alternating current regulating means according to claim 1, wherein the second current-limiting circuit (32) includes a second bipolar junction transistor (321), a second bias resistor (322), a second current-limiting resistor (323), and a second voltage-regulating unit (324), a base of the second bipolar junction transistor (321) is electrically connected to an output end of the second current-limiting circuit (32), one end of the second bias resistor (322) is electrically connected to a base of the second bipolar junction transistor (321), the other end of the second bias resistor (322) is electrically connected to the output end of the second current-limiting circuit (32), one end of the second current-limiting resistor (323) is electrically connected to an emitter of the second bipolar junction transistor (321), the other end of the second current-limiting resistor (323) is electrically connected to the input end of the second current-limiting circuit (32), the second voltage-regulating unit (324) is electrically connected to the base of the second bipolar junction transistor (321), the input end of the second current-limiting circuit (32) and the emitter of the second bipolar junction transistor (321), the second voltage-regulating unit (324) is configured to control the current value outputted by the emitter of the second bipolar junction transistor (321).

4. The alternating current regulating means according to claim 2, wherein the second current-limiting circuit (32) includes a second bipolar junction transistor (321), a second bias resistor (322), a second current-limiting resistor (323), and a second voltage-regulating unit (324), a base of the second bipolar junction transistor (321) is electrically connected to an output end of the second current-limiting circuit (32), one end of the second bias resistor (322) is electrically connected to a base of the second bipolar junction transistor (321), the other end of the second bias resistor (322) is electrically connected to the output end of the second current-limiting circuit (32), one

end of the second current-limiting resistor (323) is electrically connected to an emitter of the second bipolar junction transistor(321), the other end of the second current-limiting resistor (323) is electrically connected to the input end of the second current-limiting circuit (32), the second voltage-regulating unit (324) is electrically connected to the base of the second bipolar junction transistor (321), the input end of the second current-limiting circuit (32) and the emitter of the second bipolar junction transistor (321), the second voltage-regulating unit (324) is configured to control the current value outputted by the emitter of the second bipolar junction transistor (321).

5. The alternating current regulating means according to claim 2, wherein the first voltage-regulating unit (224) is a controllable Zener diode (also referred as "TL431"), an anode of the controllable Zener diode is electrically connected to an output end of the first current-limiting circuit (22), a cathode of the controllable Zener diode is electrically connected to the base of the first bipolar junction transistor (221), a reference end of the controllable Zener diode is electrically connected to the input end of the first current-limiting resistor (223), the second voltage-regulating unit (324) is a controllable Zener diode (also referred as "TL431"), an anode of the controllable Zener diode is electrically connected to an input end of the second current-limiting circuit (32), and a cathode of the controllable Zener diode is electrically connected to the base of the second bipolar junction transistor (321), a reference end of the controllable Zener diode is electrically connected to an output end of the second current-limiting resistor (323).

6. The alternating current regulating means according to claim 3, wherein the first voltage-regulating unit (224) is a controllable Zener diode (also referred to as "TL431"), an anode of the controllable Zener diode is electrically connected to the output end of the first current-limiting circuit (221), a cathode of the controllable Zener diode is electrically connected to the base of the first bipolar junction transistor (221), a reference end of the controllable Zener diode is electrically connected to the input end of the first current-limiting resistor (223), the second voltage-regulating unit (324) is a controllable Zener diode (also referred to as "TL431"), an anode of the controllable Zener diode is electrically connected to an input end of the second current-limiting circuit (324), and a cathode of the controllable Zener diode is electrically connected to the base of the second bipolar junction transistor (321), a reference end of the controllable Zener diode is electrically connected to an output end of the second current-limiting resistor (323).

7. The alternating current regulating means according to claim 1, further including a voltage-controlling unit (7), one end of the voltage-controlling unit (7) being electrically connected to the current input section (4), and the other end of the voltage-controlling unit (7) being electrically connected to the input power supply.

8. The alternating current regulating means according to claim 7, wherein the voltage-controlling unit (7) is a bidirectional silicon controlled rectifier.

9. The alternating current regulating means according to claim 1, further including a rectifier (8), one end of the rectifier (8) being electrically connected to the current output section (5), and the other end of the rectifier being electrically connected to a load 6.

10. The alternating current regulating means according to claim 9, further including a capacitor (9) and a bleeder resistor (91), one end of the capacitor (9) being electrically connected to the rectifier (8), the other end of the capacitor (9) being electrically connected to the load (6), the bleeder resistor (91) being electrically connected to the capacitor (9), the bleeder resistor (91) being configured to bleed charges stored in the capacitor (9) when the alternating current regulating means is inactive.

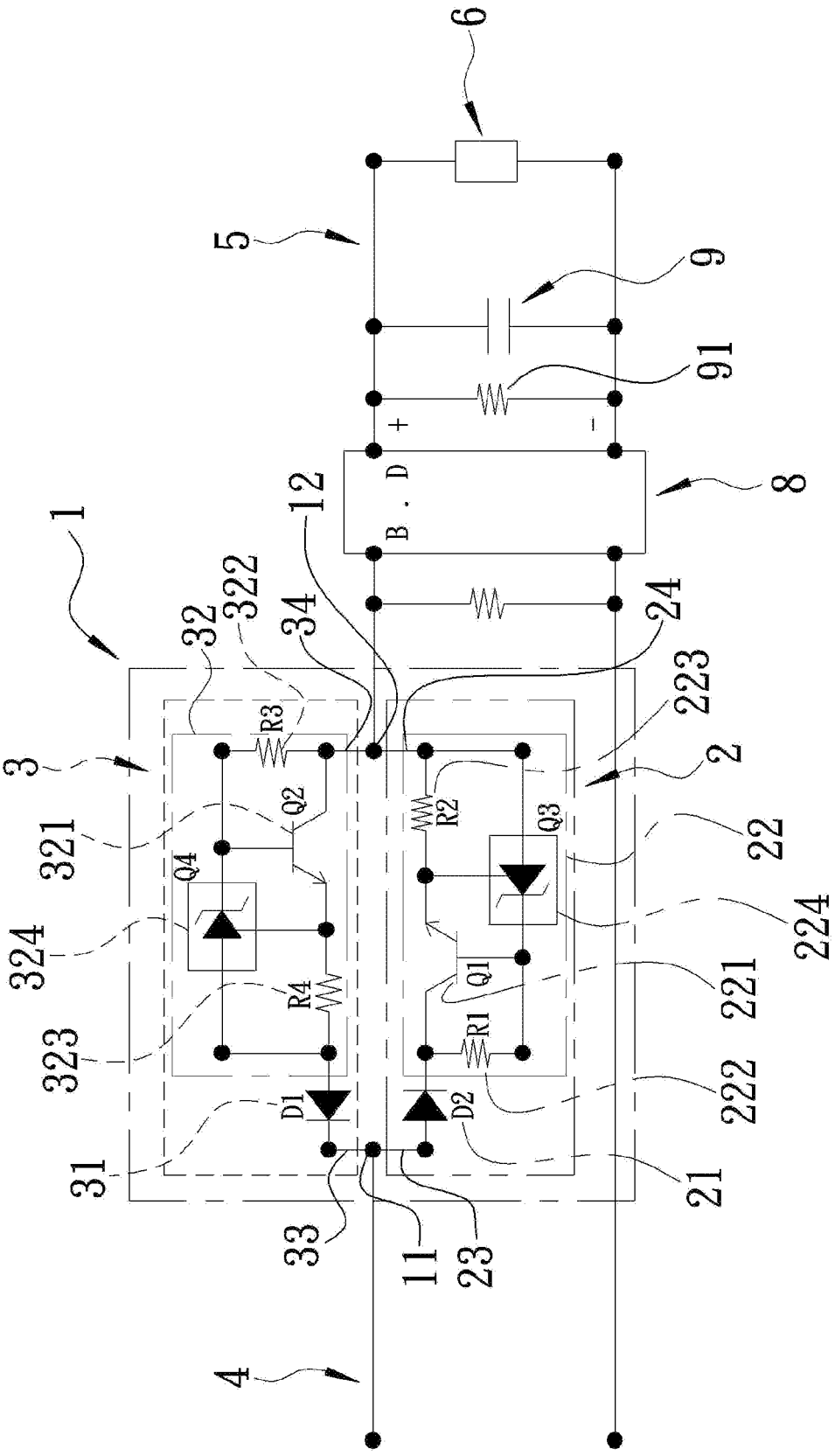
6
5
9
91
+
-
B . D
8
12
1
322
32
34
24
223
3
2
R3
Q2
R2
Q3
321
22
Q4
224
324
Q1
R4
221
323
R1
D1
D2
222
31
21
33
11
23
4

FIG. 1

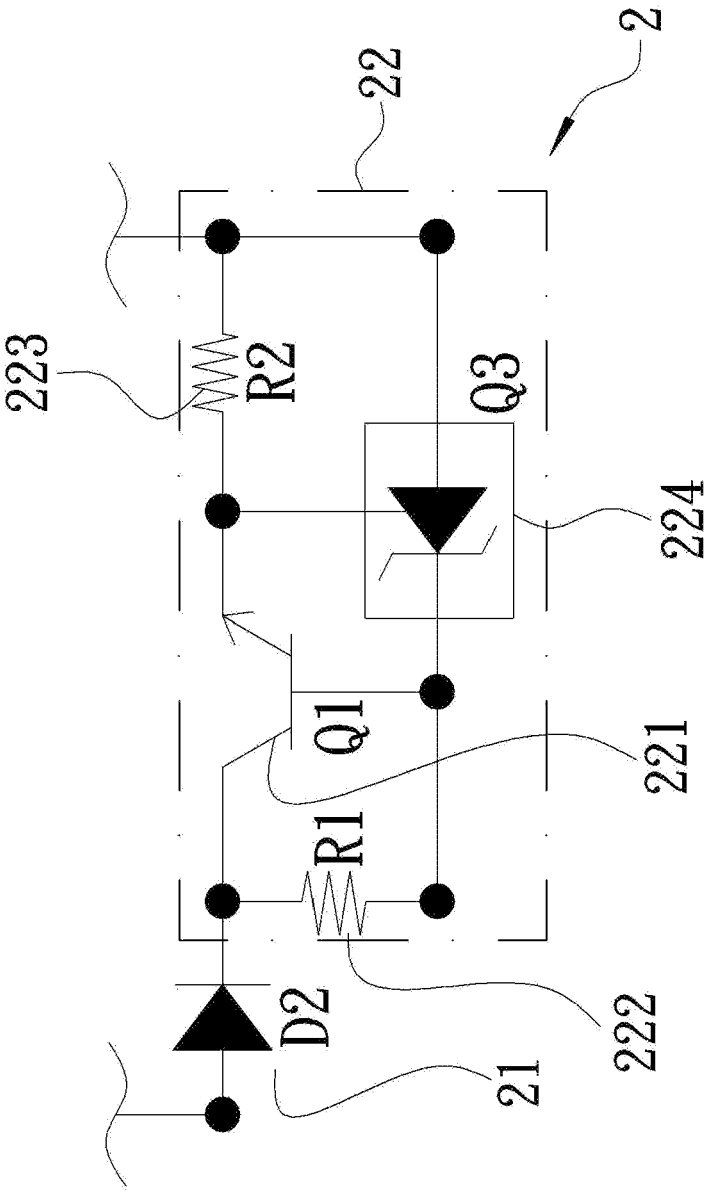

FIG. 2

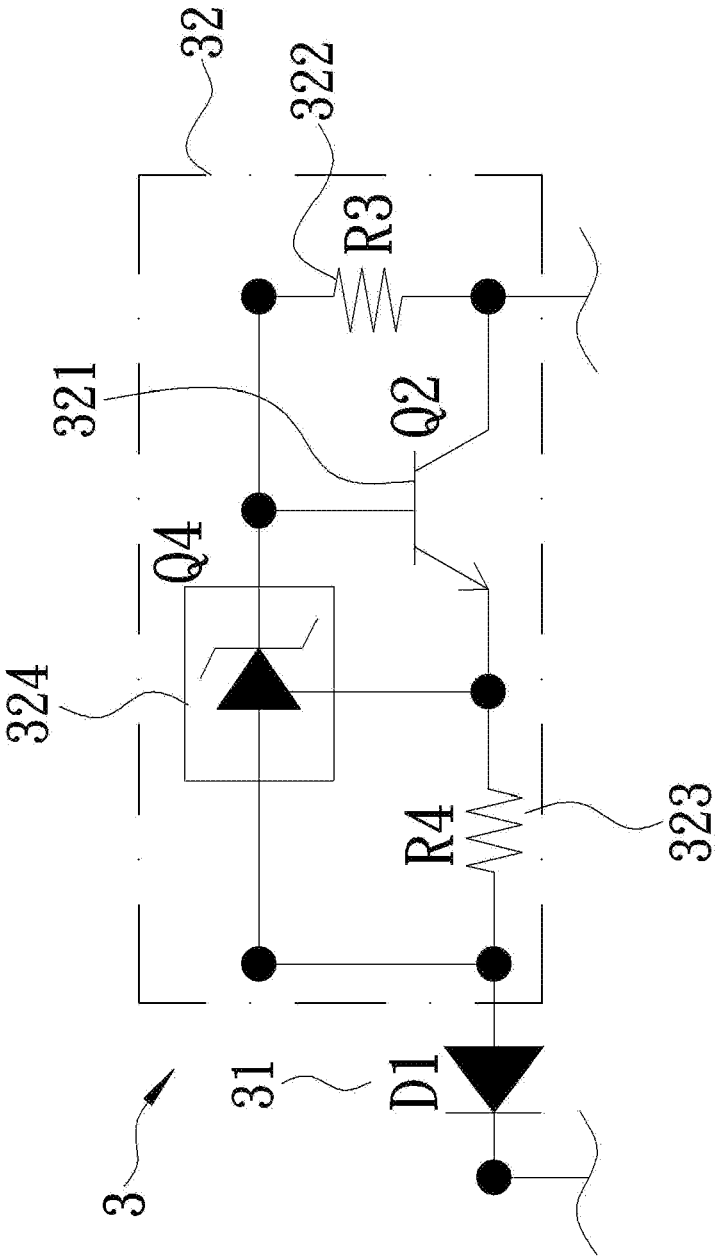

FIG. 3

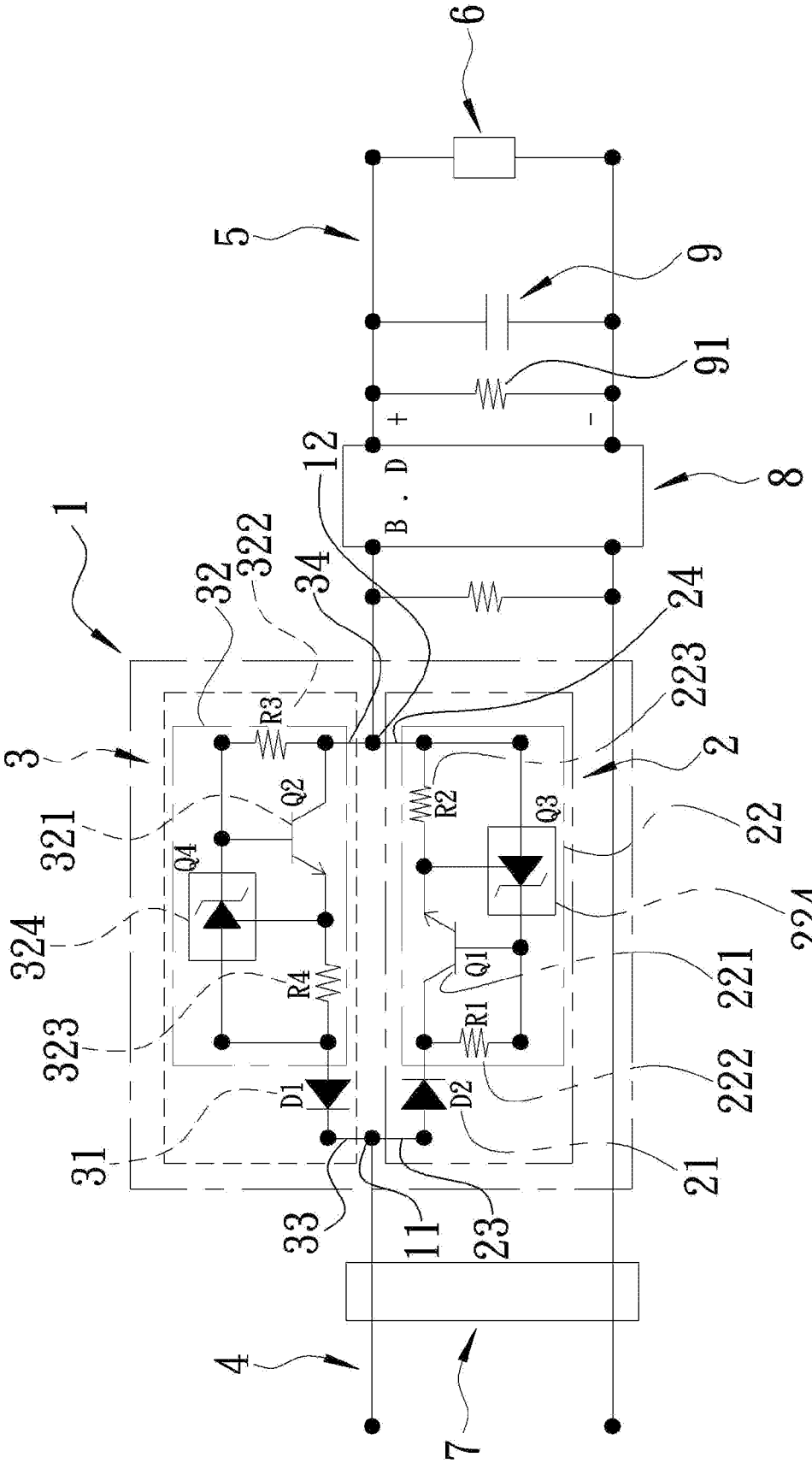
6
5
9
91
+
-
12
B . D
8
1
322
32
34
24
223
3
R3
2
Q2
R2
Q3
321
22
Q4
224
324
Q1
221
R4
323
R1
222
D1
D2
31
21
33
11
23
4
7

FIG. 4

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 10 16 7422

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 153 187 A (KLEES GEORGE N) 13 October 1964 (1964-10-13) * column 2, line 65 - column 4, line 35; figure 2 *	1-10	INV. G05F1/445
A	US 3 226 627 A (JACK FROMKIN) 28 December 1965 (1965-12-28) * figure 1 *	1-10	
A	US 4 238 723 A (JENKS WILLIAM C [US]) 9 December 1980 (1980-12-09) * figure 8 *	1-10	
A	US 5 239 255 A (SCHANIN DAVID J [US] ET AL) 24 August 1993 (1993-08-24) * figure 1 *	1-10	
A	GB 1 178 440 A (CENTURY LIGHTING INC [US]) 21 January 1970 (1970-01-21) * the whole document *	1-10	TECHNICAL FIELDS SEARCHED (IPC)
A	US 3 076 925 A (JACKSON STUART P) 5 February 1963 (1963-02-05) * the whole document *	1-10	G05F H05B H02M G03G H03K H01L G05D
A	US 3 159 766 A (HARPLEY THEODORE R) 1 December 1964 (1964-12-01) * figure 3 *	1-10	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 October 2011	Hernandez Serna, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 16 7422

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-10-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3153187 A	13-10-1964	NONE	
US 3226627 A	28-12-1965	NONE	
US 4238723 A	09-12-1980	NONE	
US 5239255 A	24-08-1993	CN 1068237 A EP 0572567 A1 WO 9215052 A1	20-01-1993 08-12-1993 03-09-1992
GB 1178440 A	21-01-1970	NONE	
US 3076925 A	05-02-1963	NONE	
US 3159766 A	01-12-1964	ES 273264 A1	16-05-1962

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82