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Remarks:
Amended claims in accordance with Rule 86 (2) EPC.

(54) **Safety valve power supply circuit for the ignition of a gas burner**

(57) Safety valve power supply circuit for the ignition of a gas burner, said safety valve (2) being powered by a flame detecting thermocouple (3). The power supply circuit (1) comprises conditioning means (4) for converting an input signal (E) into an output signal (S) able to maintain the safety valve (2) open, and said input signal (E) is generated by the energy accumulated in a capacitor (5), said capacitor (5) being charged when the gas burner is activated.

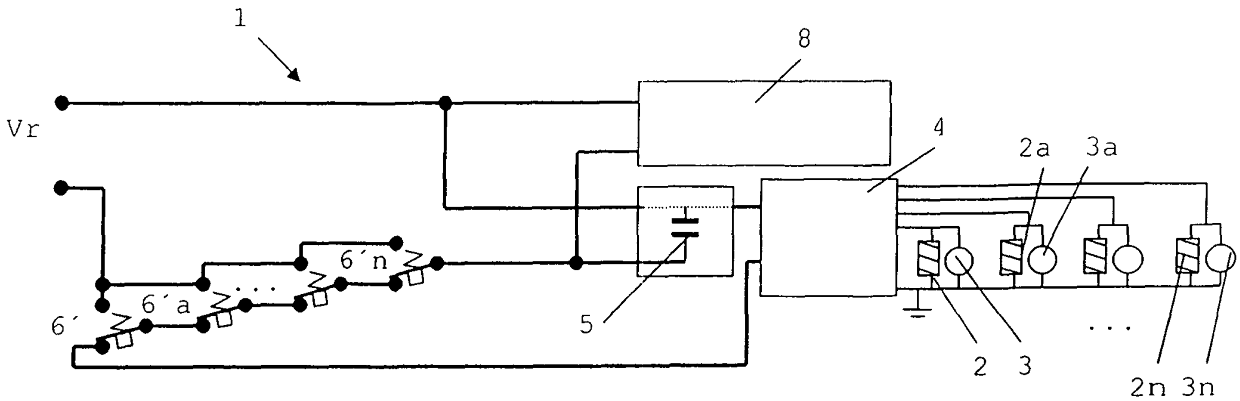

Fig. 3

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Description

TECHNICAL FIELD

[0001] The present invention refers to auxiliary power supply circuits used in safety valves that are powered by a thermocouple.

PRIOR ART

[0002] Safety valves powered by thermocouples for their use in gas burners are known. The thermocouple actuates the safety valve keeping it open while the flame is lit. If the flame goes out, the safety valve closes, cutting off the flow of gas. The safety feature combination formed by the safety valve and the thermocouple gives way to an intrinsically safe device, because any type of failure in said safety group causes the safety valve to close and therefore gas flow is cut off.

[0003] One problem with these safety valves is that when the gas burner is lit a certain amount of time must pass before the thermocouple alone is capable of keeping the safety valve open. The first possible solution to this problem is to require the user to keep the pushbutton switch depressed when lighting the gas burner. Thus, the safety valve will remain open until the thermocouple acquires the minimum temperature necessary to keep the safety valve open while the flame is lit.

[0004] A second solution is to add an auxiliary power supply circuit that provides the safety valve with the necessary power to keep it open when the gas burner is activated.

[0005] EP1113227A2 describes a device used in the ignition of a gas burner that comprises a safety valve. Said device comprises a power supply circuit, connected to the safety valve, which actuates the valve keeping it open once the gas burner has been ignited. Said power supply circuit is connected to source voltage by a switch that is operated by a timer. Accordingly, the power supply circuit is connected to source voltage for the time necessary for the thermocouple to actuate the safety valve alone.

[0006] In the described device, a switch failure or a failure in any of the timer's components could cause the power supply circuit to be permanently connected to the source voltage. The resulting problem is that this failure compromises the user's safety.

[0007] EP1113227A2 solves this safety problem by adding a fuse that burns if the time that the power supply circuit is connected to source voltage exceeds a predetermined maximum time. One problem with this solution is that it is hard to establish said predetermined maximum time. Another problem is that when the fuse burns, it has to be replaced.

DISCLOSURE OF THE INVENTION

[0008] The object of the invention is to provide a safety valve power supply circuit for the ignition of a gas burner that safeguards its own failures.

[0009] The power supply circuit, which is used with safety valves that are powered by a thermocouple flame detector, comprises conditioning means for processing an input signal to convert it into an output signal capable of actuating the safety valve to keep it open. Said input signal is generated by the energy stored in a capacitor, which charges in the same instant that the gas burner is lit.

[0010] Therefore, energy supplied to the safety valve after the gas burner has been lit will be the energy stored in the capacitor rather than the energy supplied by source voltage. Thus, failures in the power supply circuit do not imply that the safety valve will stay open for an indefinite time, as once the capacitor's stored energy is depleted, the power supply circuit will not be able to keep the safety valve open.

[0011] On the other hand, the power supply circuit of the invention is a simple and low cost circuit.

[0012] These and other characteristics and advantages of the invention will be best understood from the figures and the detailed description of the invention.

DESCRIPTION OF THE DRAWINGS

[0013]

FIG. 1 is a schematic view of a first embodiment of the present invention.

FIG. 2 is a schematic view of a second embodiment of the present invention.

FIG. 3 is a schematic view of an embodiment of FIG. 2 for a plurality of safety valves.

FIG. 4 is a block circuit of the conditioning means of the circuit of the invention.

FIG. 5 is a first embodiment of the conditioning means of the circuit of the invention.

FIG. 6 is a second embodiment of the conditioning means of the circuit of the invention.

FIG. 7 is a third embodiment of the conditioning means of the circuit of the invention.

DETAILED DISCLOSURE OF THE INVENTION

[0014] Referring to figure 1, the power supply circuit 1, which actuates safety valve 2 and is powered by a thermocouple 3 that detects flame, comprises conditioning means 4 for converting an input signal E into an output signal S that is capable of maintaining the safety valve 2 open. Said input signal E is generated by the energy stored in a capacitor 5.

[0015] Said capacitor 5 charges at the moment the gas burner is lit. In this first embodiment, circuit 1 comprises a switch 6 that connects the capacitor 5 with source voltage Vr at the moment the user lights the burner and disconnects it immediately after. More specifically, to activate the burner, the user presses a pushbutton switch 7, using the switch 6 to connect the capacitor 5 to source voltage Vr for the instant that the pushbutton switch 7 remains pressed. In addition, circuit 1 comprises a spark generator 8 that is also activated by the switch 6.

[0016] In a second embodiment of the invention, shown in figure 2, circuit 1 comprises a switch 6' that alternately connects the capacitor 5 to the source voltage Vr and to the conditioning means 4. The switch 6' is used to connect the capacitor 5 to source voltage Vr at the moment the user ignites the burner, and immediately following, it connects it to the conditioning means 4.

[0017] Just as in the first embodiment, to activate the burner, the user presses a pushbutton 7 and through switch 6' connects capacitor 5 to source voltage Vr when pushbutton 7 is pressed.

[0018] Now, referring to figure 3, when circuit 1 supplies a plurality of safety valves 2, 2a, 2b,... and 2n, said circuit 1 comprises a switch 6', 6'a, 6'b,... and 6'n for each safety valve 2, 2a, 2b,... and 2n. Said switches 6', 6'a, 6'b,... and 6'n are connected, as shown in figure 3, in such a way that capacitor 5 charges when any of the burners is ignited. Additionally, said capacitor 5 connects to the conditioning means 4 only when none of the switches 6', 6'a, 6'b,... and 6'n is connecting the capacitor 5 to source voltage Vr.

[0019] Referring to figure 4, the conditioning means comprise a regulator block 10 that receives the input signal E, an oscillator block 11, a transformer 12 and a rectifier 13 that generates the output signal S.

[0020] The conditioning means 4 also comprise a rectifier and limiter block 9 that is used to charge the capacitor 5. As shown in the embodiments of figures 5, 6, and 7, the rectifier and limiter block 9 comprises a Zener diode D1 with a transistor Q1 connected as an emitter follower so that said transistor Q1 conducts only until the capacitor 5 reaches a determined voltage Vc.

[0021] The three embodiments of the conditioning means 4 shown in figures 5, 6, and 7 comprise an oscillator block 11 that receives an input signal generated by the capacitor 5, a transformer 12 that receives the signal from said oscillator 11, and a rectifier 13 that receives the output signal from the transformer 12 and generates the output signal S that the corresponding safety valve 2 receives.

[0022] The embodiments of figures 5 and 6 also comprise a regulator block 10 through which a decreasing voltage is generated from the input signal E. The oscillator block 11 receives said decreasing voltage. Accordingly, the energy supplied by circuit 1 to the corresponding safety valve 2 is greater in the beginning and declines progressively.

[0023] In the embodiment of figure 5, the rectifier 13 comprises a diode D for each safety valve 2. Instead of diodes D, in the embodiment of figure 6 the rectifier 13 comprises a bi-polar transistor Q for each safety valve 2. In this embodiment the transformer 12 comprises two coils: a first coil 12a supplies the safety valve and a second coil 12b is used to excite the base of every transistor Q.

[0024] Using bipolar transistors Q instead of diodes D, the voltage drop is reduced from 0.6 V in the diodes to 0.15 V in the transistors. Losses are reduced in the same proportion, and therefore, a capacitor 5 with between two and three times less capacitance can be used.

[0025] In the embodiment of figure 7, the rectifier 13 comprises a MOSFET transistor Q' with low resistance between source and drain for each safety valve 2. The MOSFET transistors Q' need a gate signal generating circuit 14. In this embodiment, transformer 12 also comprises a second coil 12b, which in this case is used to power the gate signal generating circuit 14. With MOSFET transistors, the voltage drop is reduced to 10 mV. Losses are reduced in respect to the two preceding embodiments, and therefore, a capacitor 5 of lower capacitance can be used.

[0026] In this last embodiment, the transformer 12 could be used in an inductance mode. In this way, when the primary of said transformer 12 receives energy, the MOSFET transistors Q' are cut off. When the supply to the primary is shut off, the MOSFET transistors Q' enter into conduction as a consequence of the reaction of the transformer 12 for releasing its magnetic energy.

[0027] As is shown in figure 7, the functioning in inductance mode allows the regulator block 10 to be done away with and enables the oscillator block 11 to receive the input signal E directly. Thus, losses produced in block 10 are eliminated.

Claims

1. Safety valve power supply circuit for the ignition of a gas burner, said safety valve (2) being supplied by a flame detecting thermocouple (3) and the power supply circuit (1) comprising conditioning means (4) for converting an input signal (E) into an output signal (S) able to maintain the safety valve (2) open, **characterised in that** said input signal (E) is generated by the energy accumulated in a capacitor (5), said capacitor (5) being charged upon activation of the gas burner.

2. Power supply circuit according to claim 1, **characterised in that** it comprises a switch (6) that connects the capacitor (5) to the source voltage (Vr) when the user activates the burner, disconnecting it immediately after.

3. Power supply circuit according to claim 2, **characterised in that** the user presses a pushbut-

ton (7) to ignite the burner, the capacitor (5) being connected to source voltage (Vr) by way of the switch (6) when the pushbutton (7) is pressed.

4. Power supply circuit according to claim 1, **characterised in that** it comprises a switch (6') that connects the capacitor (5) alternately either to the source voltage (Vr) or the conditioning means(4), the capacitor (5) being connected to source voltage (Vr) by way of the switch (6') when the user activates the burner, and being connected to the conditioning means(4) immediately after.

5. Power supply circuit according to claim 4, **characterised in that** the user presses a pushbutton (7) for activating the burner, the capacitor (5) being connected to source voltage (Vr) by way of the switch (6') when the pushbutton (7) is pressed.

6. Power supply circuit, according to claims 4 or 5, **characterised in that** said circuit supplies a plurality of safety valves (2, 2a, 2b,..., 2n) and comprises a switch (6', 6'a, 6'b,..., 6'n) for each safety valve (2, 2a, 2b,..., 2n), said switches (6', 6'a, 6'b,..., 6'n) being connected in such a way that the capacitor (5) charges when any of the burners is ignited, and said capacitor (5) connects to the conditioning means (4) only when none of the switches (6', 6'a, 6'b,..., 6'n) is connecting the capacitor (5) to source voltage (Vr).

7. Power supply circuit according to any of the preceding claims, **characterised in that** it comprises a rectifier and limiter block (9) for charging the capacitor (5).

8. Power supply circuit according to claim 7, **characterised in that** the rectifier and limiter block (9) comprises a Zener diode (D1) with a transistor (Q1) connected as an emitter follower, so that said transistor Q1 conducts only until the capacitor 5 reaches a determined voltage Vc.

9. Power supply circuit according to any of the preceding claims, **characterised in that** the conditioning means (4) comprise an oscillator block (11) that receives an input signal from the capacitor (5), a transformer (12) that receives the output signal from the oscillator (11), and a rectifier (13) that receives the output signal from the transformer (12) and generates the output signal (S) that the corresponding safety valve (2) receives.

10. Power supply circuit according to claim 9, **characterised in that** the conditioning means (4) also comprise a regulator block (10) through which a decreasing voltage is generated from the input signal (E), said decreasing voltage being received by the oscillator block (11).

11. Power supply circuit according to claim 10, **characterised in that** the rectifier (13) comprises a diode (D) for each safety valve (2).

12. Power supply circuit according to claim 10, **characterised in that** the rectifier (13) comprises a bipolar transistor (Q) for each safety valve (2), the transformer (12) comprising a second coil (12b) by which the base of every transistor (Q) is excited.

13. Power supply circuit according to claims 9 or 10, **characterised in that** the rectifier (13) comprises a MOSFET transistor (Q') with low resistance between source, and drain for each safety valve (2) and a gate signal generating circuit (14), the transformer (12) comprising a second coil (12b) which is used to power the gate signal generating circuit (14).

Amended claims in accordance with Rule 86(2) EPC.

1. Safety valve power supply circuit for the ignition of a gas burner, said safety valve (2) being directly supplied by a flame detecting thermocouple (3), said power supply circuit (1) comprising a capacitor (5) that is charged from a power source (Vr), obtaining from the energy accumulated in said capacitor (5), due to said charging, an electrical signal (E) that is used to temporarily supply said safety valve (2) in order to maintain it open, **characterised in that**:

- said power source (Vr) is an alternating mains voltage (Vr);
- said charging of the capacitor (5) is carried out by momentarily activating a switch (6, 6') to temporarily connect the capacitor (5) to said alternating mains voltage (Vr), said switch (6, 6') activation occurring concurrently with the activation of the gas burner; and
- it comprises conditioning means (4) for converting said electrical signal (E), into an output electrical signal (S) that is directly applied to said safety valve (2) to supply it, and so maintain it open.

2. Power supply circuit according to claim 1, wherein said capacitor (5) is always connected to the conditioning means (4).

3. Power supply circuit according to claim 1, wherein said switch (6') is a changeover switch (6') arranged to connect the capacitor (5) alternately either to the alternating mains voltage (Vr) or to the conditioning means (4), the capacitor (5) being connected to the alternating mains voltage (Vr), in order to charge it, when the switch (6') is momentarily activated, and the capacitor (5) being connected to the conditioning means (4) when the switch (6') is not activated, or in a rest position, to permit its discharging when the capacitor (5) is charged.

4. Power supply circuit according to any of the preceding claims, that comprises a pushbutton (7) to activate the gas burner, said pushbutton (7) acting on said switch (6, 6') to momentarily activate it when said pushbutton (7) is kept momentarily pressed.

5. Power supply according to any of the preceding claims, that comprises a spark generator (8) that is connected to the alternating mains voltage (Vr) when said switch (6, 6') is activated, in order to generate a spark to ignite the burner.

6. Power supply circuit, according to claim 3 or 4 when depending on claim 3, wherein said circuit supplies a plurality of safety valves (2, 2a, 2b,..., 2n) and comprises a changeover switch (6', 6'a, 6'b,..., 6'n) for each safety valve (2, 2a, 2b,..., 2n), said switches (6', 6'a, 6'b,..., 6'n) being connected in such a way that the capacitor (5) charges when any of the switches (6', 6'a, 6'b,..., 6'n) is activated, and said capacitor (5) connects to the conditioning means (4) only when none of the switches (6', 6'a, 6'b,..., 6'n) is connecting the capacitor (5) to the alternating mains voltage (Vr).

7. Power supply circuit according to any of the preceding claims, that comprises a rectifier and limiter block (9) for charging the capacitor (5).

8. Power supply circuit according to claim 7, wherein the rectifier and limiter block (9) comprises a Zener diode (D1) with a transistor (Q1) connected as an emitter follower, so that said transistor (Q1) conducts only until the capacitor (5) reaches a determined voltage (Vc).

9. Power supply circuit according to any of the preceding claims, wherein the conditioning means (4) comprise an oscillator block (11) that receives a signal from the capacitor (5), a transformer (12) that receives the output signal of said oscillator (11), and a rectifier (13) that receives the output signal of said transformer (12) and generates the output signal (S) that the corresponding safety valve (2) receives.

10. Power supply circuit according to claim 9, wherein the conditioning means (4) also comprise a regulator block (10) by which a decreasing voltage is generated from the input signal (E), said decreasing voltage being received by the oscillator block (11).

11. Power supply circuit according to claim 10, wherein the rectifier (13) comprises a diode (D) for each safety valve (2).

12. Power supply circuit according to claim 10, wherein the rectifier (13) comprises a bipolar transistor (Q) for each safety valve (2), the transformer (12) comprising a second coil (12b) by which the base of every transistor (Q) is excited.

13. Power supply circuit according to claims 9 or 10, wherein the rectifier (13) comprises a MOSFET transistor (Q') with low resistance between source and drain, for each safety valve (2) and a gate signal generating circuit (14), the transformer (12) comprising a second coil (12b) which is used to power the gate signal generating circuit (14).

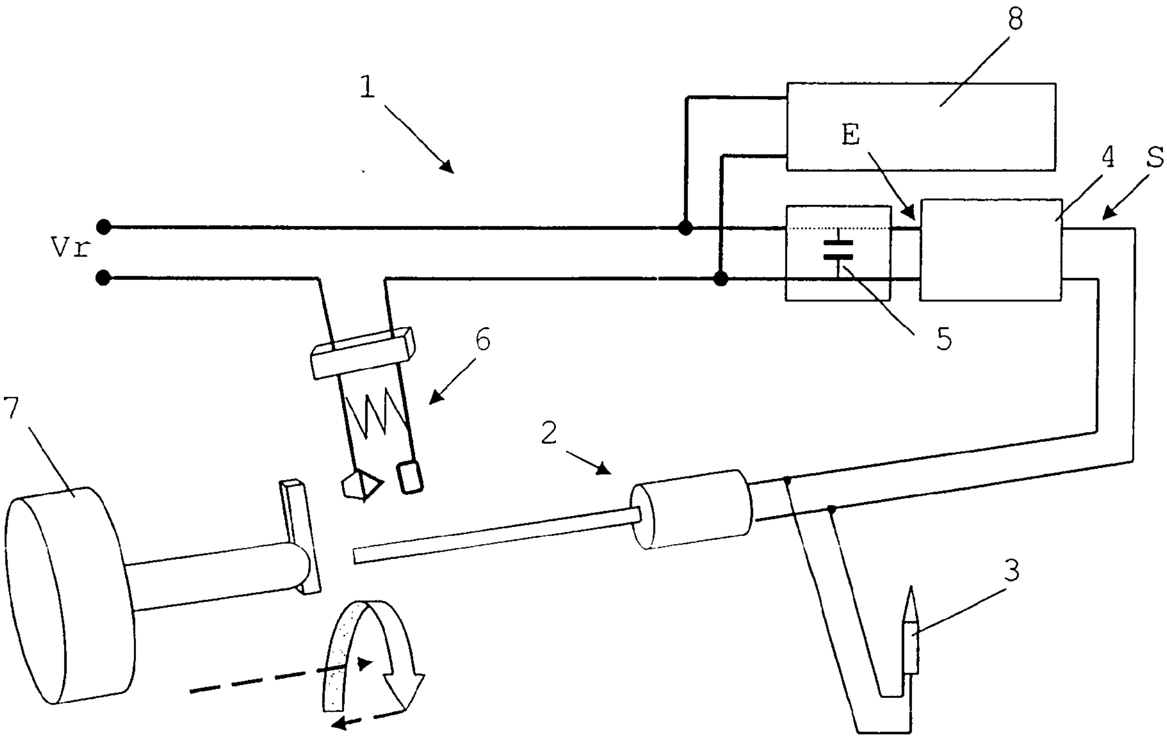

Fig. 1

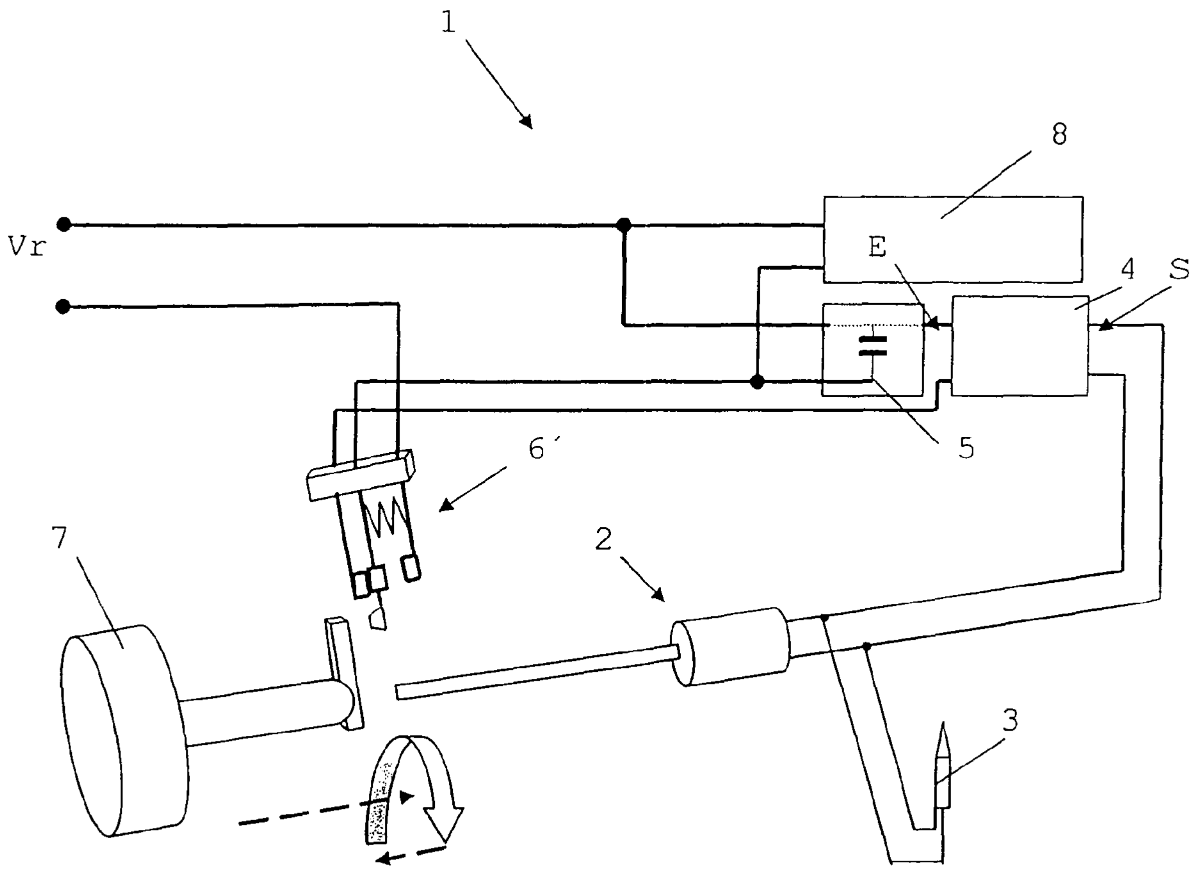

Fig. 2

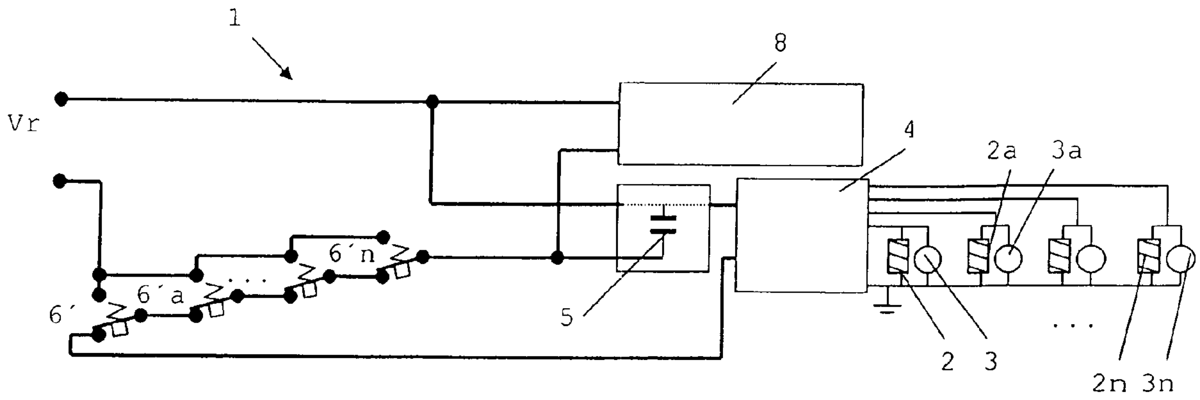

Fig. 3

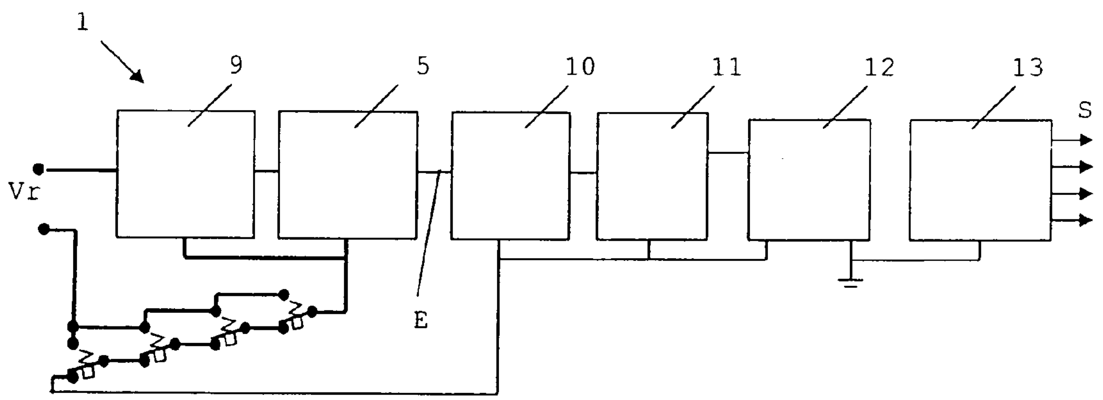

Fig. 4

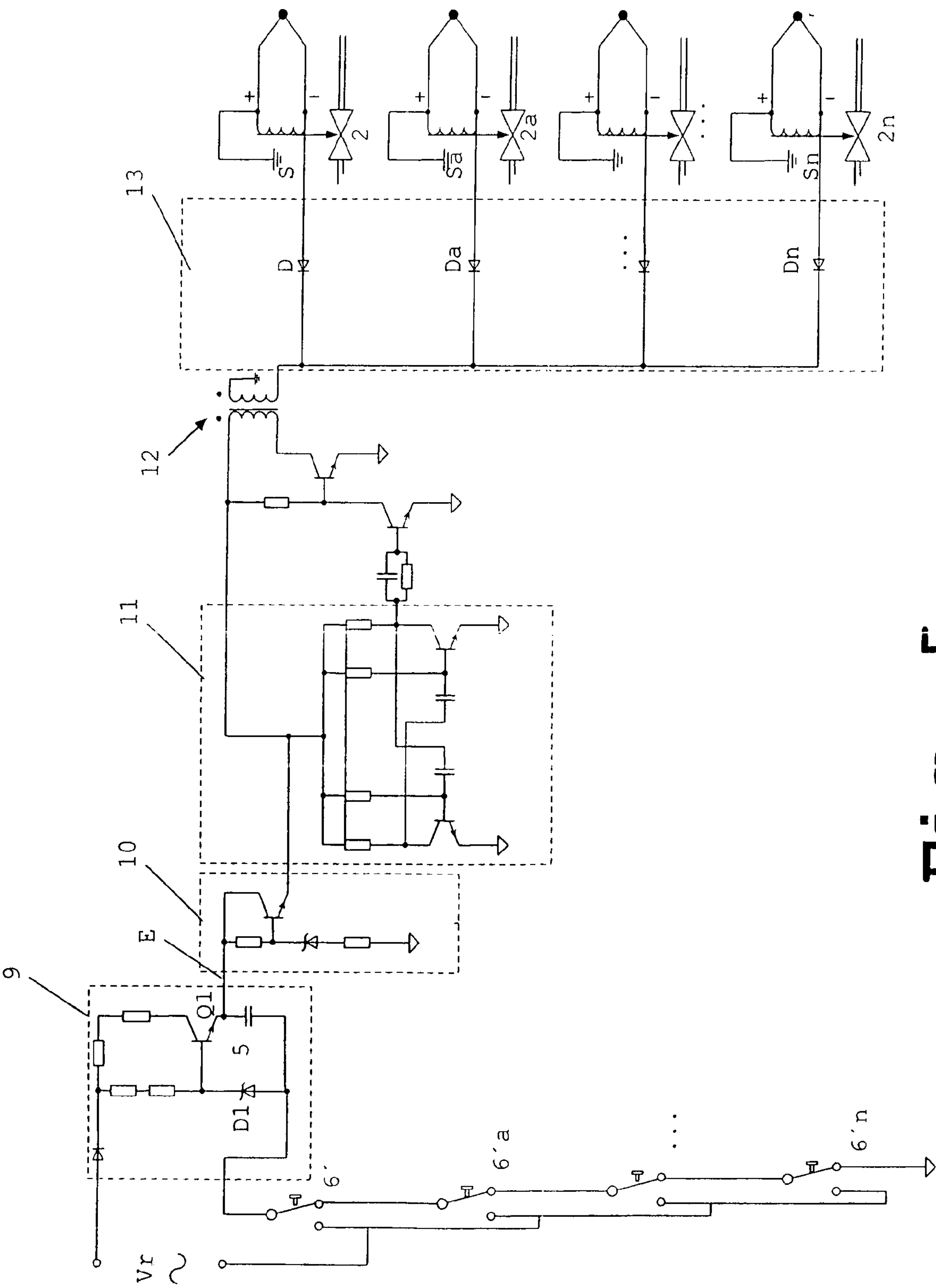

Fig. 5

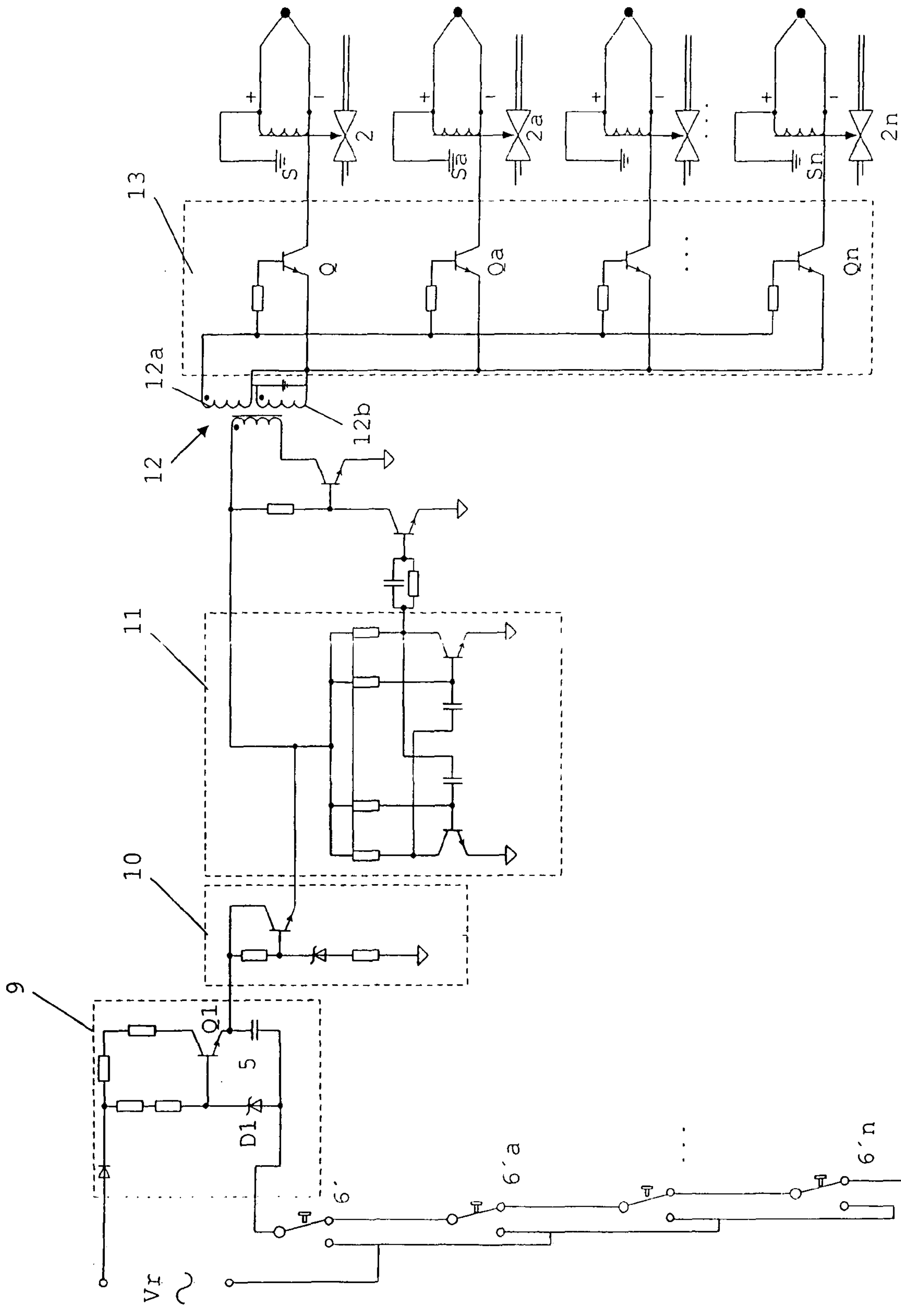

Fig. 6

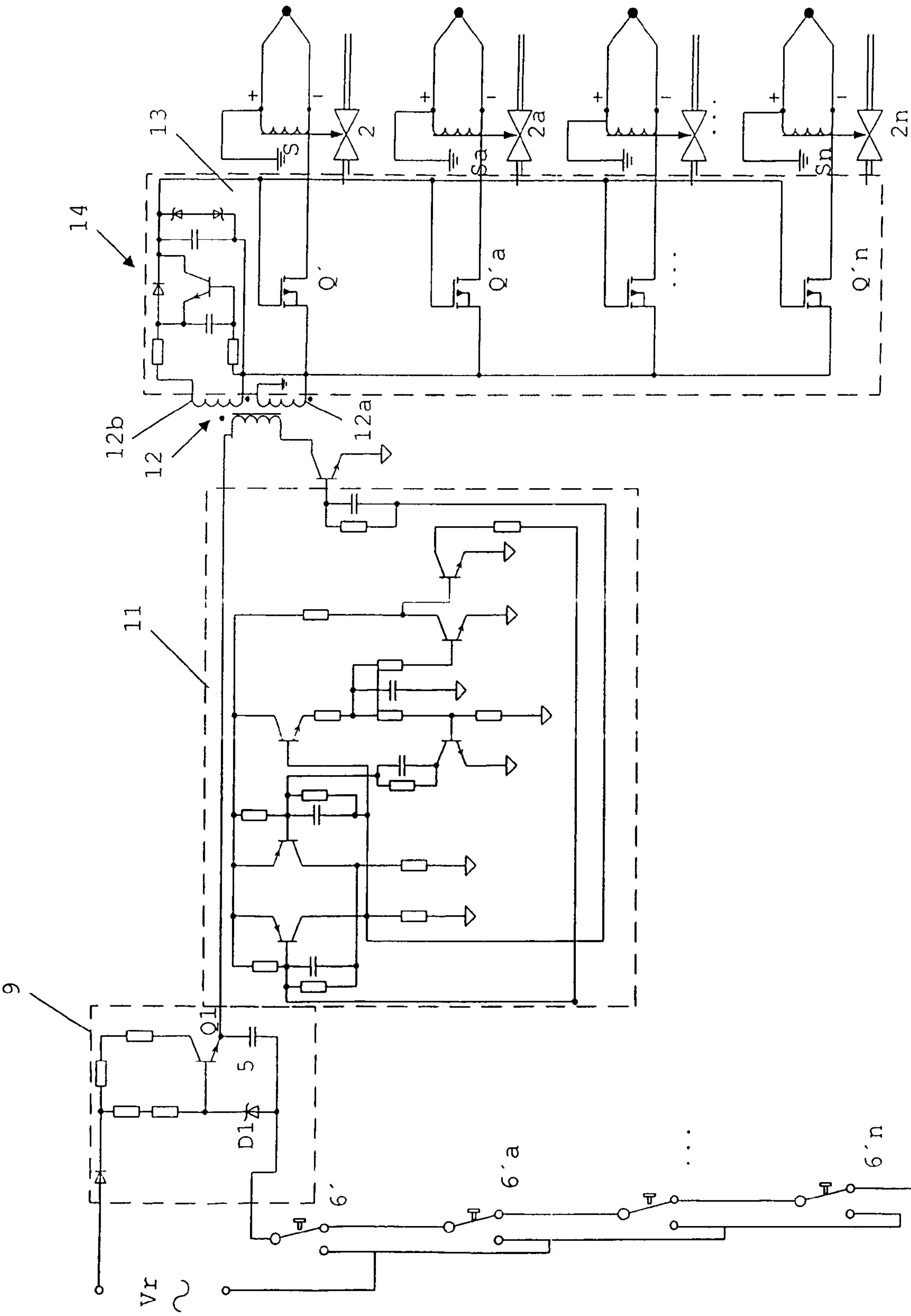

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 05 01 4136

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 December 2005	Verdoodt, L

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EUROPEAN SEARCH REPORT

Application Number
EP 05 01 4136

DOCUMENTS CONSIDERED TO BE RELEVANT

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 01 4136

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