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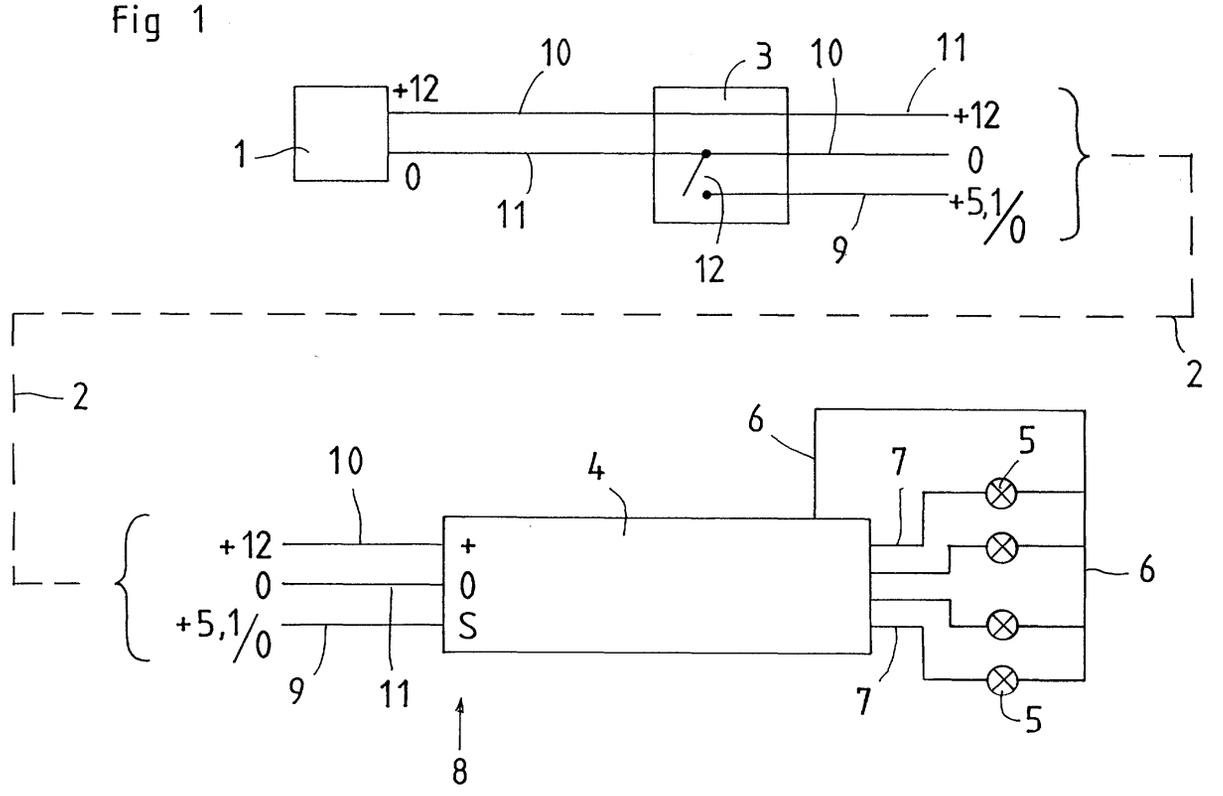
(54) Illumination apparatus

(57) An illumination apparatus, for example an Advent candelabra with a plurality of different lamps (5) which may be lit and extinguished independently of one another, has a current source (1) which is connected to a signal emitter (3) with a switch (12). The signal emitter (3) and a regulator device (4) are interconnected via a conductor (2). Depending on whether the switch (12) is closed or open, it emits signals to the regulator device (4) which control the lighting and extinguishing of the lamps (5). The control signals which the signal emitter (3) emits to the regulator device (4) determine how many lamps (5) are to be lit.

Fig 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to an illumination apparatus which comprises at least two light sources, a current source for powering the light sources, a conductor which has two power leads for current supply to the light sources and which is connectable to the illumination apparatus and the current source, and a connection device for connecting the light sources to the current source.

BACKGROUND ART

[0002] A large number of types of lighting fittings are previously known in the art. One such type of lighting fitting may be an electric candelabra with a number of electric lights or lamps, often between four and seven in number.

[0003] As regards electric candelabra with four lights or lamps, these have been used in certain cases as Advent candelabra in that one or more of the lamps is unscrewed from its socket so that there is no longer electric contact. Unfortunately, the sockets are not designed for such unscrewing, for which reason they are rapidly worn out or destroyed by other means.

[0004] Advent candelabra using wax candles are also known in the art. These are naturally aesthetically very appealing, but, at the same time, constitute a manifest fire hazard.

[0005] There are also other types of illumination fittings known in the art, for example such as are called spotlight ramps and include a metal rail in which a number of spotlights are secured. Such fittings all display lamps connected in parallel, for which reason the lamps are lit and extinguished simultaneously.

PROBLEM STRUCTURE

[0006] The present invention has for its object to design the illumination apparatus intimated by way of introduction so that individual lighting of the different light sources becomes possible, that the light sources may be lit in a special sequence or that the light sources may be lit in optional arrays or groups. The present invention further has for its object to design the lighting fitting in such a manner that it need not be cluttered with a number of switches, have more than one power chord, nor a power chord that contains a large number of leads. Finally, the present invention has for its object to design the illumination apparatus such that it can be manufactured at low cost.

SOLUTION

[0007] The objects forming the basis of the present invention will be attained if the illumination apparatus intimated by way of introduction is characterised in that the connection device includes a signal emitter which is disposed on the conductor or current source, and a regulator device which is disposed in, on or in association with the illumination apparatus and which is operative, in response to the signal from the signal emitter, to control the function of the light sources, the signal emitter and the regulator device being connected via the conductor.

[0008] In one embodiment, the apparatus according to the present invention is designed as an electric Advent candelabra where the individual lights or lamps may be lit in sequence after one another. This embodiment is characterised in that the signal emitter includes a spring-back switch which is open in a rest position and which is connected to a signal lead in the conductor in order, on activation, to transmit a control signal via the signal lead to the regulator device.

[0009] This embodiment enjoys major advantages in that there are no electronics in the signal emitter, but merely a simple switch.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0010] The present invention will now be described in greater detail hereinbelow, with reference to the accompanying Drawings. In the accompanying Drawings:

Fig. 1 is a block diagram of one embodiment of the present invention designed as an electric Advent candelabra;

Fig. 2 is a coupling diagram of a regulator device included in the Advent candelabra according to Fig. 1; and

Fig. 3 is an alternative coupling diagram for the regulator device.

DESCRIPTION OF PREFERRED EMBODIMENT

[0011] In Fig. 1, reference numeral 1 relates to a current source which, in one practical embodiment, may consist of a transformer and a rectifier connected thereto. In this embodiment, the current source is designed to emit 12V direct current. Naturally, other voltages may also be selected if desired. In addition, the current source may naturally also deliver a.c. voltage.

[0012] The current source 1 is connected via a conductor 2 to a signal emitter 3 which is operative for emitting control signals for controlling light sources included in the illumination apparatus according to the invention.

[0013] Via the conductor 2, the signal emitter 3 is connected to a regulator device 4 which, in response to received control signals from the signal emitter, is operative to control the operation of the light sources 5 with which the regulator device is interconnected. The regu-

lator device 4 is disposed in, on or adjacent the illumination fitting that per se includes the light sources 5.

[0014] Fig. 1 shows four light sources in the form of lamps. It should be emphasised that such a light source may also consist of a group or array of lamps.

[0015] A lead 6 runs from the regulator device 4 to the light sources 5, the lead supplying the light sources 5 with current for their operation. Further, there are four parallel conductors 7 running from the light sources 5 and connected to earth or zero via the regulator device 4 when the light sources are in operation.

[0016] It will be apparent from Fig. 1 that the regulator device 4 has terminals 8 which are connected to the positive pole (12V) of the current source and to its earth or zero. In addition, there is a connection for a control conductor 9 by the intermediary of which control signals are fed to the regulator device 4 from the signal emitter 3.

[0017] It will further be apparent from Fig. 1 that the current source 1 is connected to the regulator device via two power conductors 10 and 11 which thus supply the regulator device with operating current from the current source 1. In electric terms, both of the power conductors 10 and 11 pass unbroken straight through the signal emitter 3.

[0018] In this embodiment, the signal emitter 3 has a switch 12 which is open in its rest position and which springs back towards the rest position. On closure of the switch 12, it connects the power conductor 11 with zero potential to the control conductor 9. The opposite end of the control conductor 9 is connected to the regulator device 4 and is supplied therefrom with a d.c. voltage which, in the present embodiment, amounts to 5.1V. This implies that when the switch 12 is closed, the potential +5.1V in the regulator device 4 will disappear and instead become zero. This change of the potential of the control conductor 9 entails a control signal from the signal emitter 3 to the regulator device 4.

[0019] In Fig. 2, the terminals 8 have been marked out and the conductors connected thereto have been given the same reference numerals as in Fig. 1. This implies that the abbreviation Vin given in Fig. 2 means + 12V regardless of where this abbreviation is to be found in the Figure. Correspondingly, VCC corresponds to a connection to the control conductor 9 and it is assumed that all terminals with the designation VCC are connected to one another.

[0020] The conductors 6 and 7 illustrated in Fig. 1 to and from the light sources or lamps 5, respectively, have been given the same reference numerals in Fig. 2. This entails that the lead 6 which also carries the abbreviation Vin is connected to the current source 1 and the terminal 12V thereon.

[0021] Between the light sources 5 in Fig. 2 and earth or zero, i.e. the power conductor 11, there is disposed a switching device 13 which comprises the four transistors Q1, Q2, Q3 and Q4. These transistors are connected in such a manner that when they receive lighting voltage, the transistors connect the lamps 5 one-by-one to zero via the conductor 11.

[0022] The regulator device further includes a current supply circuit 14 which is connected to the two power conductors 10 and 11 and which, between them, includes a resistor R1 and a Zenor diode D 1. The Zenor diode is designed in such a manner that, between the zero conductor 11 and the terminals VCC, it gives a voltage of 5.1V. This voltage of 5.1V is also to be found, as was mentioned above, in the control conductor 9 at the terminal VCC and is also employed as operating voltage to an integrated circuit U2 via its two inputs A and B.

[0023] The integrated circuit U2 has a number of outputs QA, QB, QC and QD which, via corresponding resistors R2, R4, R5 and R6, are connected to each respective base in the transistors Q1, Q2, Q3 and Q4. This implies that, when a sufficient output signal exists on, for example, the output QA, the transistor Q1 will be conductive and the corresponding light source 5 will be lit. When the output signal on the output QB subsequently becomes sufficient, the transistor Q2 becomes conductive so that the next lamp 5, and so on.

[0024] The integrated circuit U2 has an input CLK which is counter function. On each occasion the input CLK receives a signal, an output signal also occurs in one of the outputs QA-QD. The layout and design are such that the output QA is activated first, followed by the output QB, while the output QA is still activated. Thereafter, the output QC is activated while the outputs QA and QB are still kept activated. Finally, the output QD is activated while the outputs QA-QC are still kept activated. This means that the lamps 5 are lit one-by-one in sequence after one another and are thereafter kept lit continuously.

[0025] The output QE on the integrated circuit U2 fulfils another function and is operative to extinguish all lamps as soon as this output is activated. Such an activation takes place when the input CLK receives a fifth signal.

[0026] The output QE is connected to a NAND gate U1D which, via an additional two NAND gates U1C and U1A, is connected to the input CLR of the IC circuit U2. This input triggers on zero signal and then resets the counter function in the IC circuit U2, at the same time as all lamps 5 are extinguished.

[0027] If the switch 12 is kept depressed a lengthier period of time, this entails that the control conductor 9 receives a zero signal, for which reason the NAND gate U1C receives an input signal 00 and output signal 1, for which reason also in this case the input CLR in the IC circuit is activated so that the counter function is reset and all lit lamps are extinguished.

[0028] In a brief depression of the switch 12, the control signal passes to the NAND gate U1B which then, on each depression of the switch 12, emits an activation signal to the input CLK of the IC circuit U2 so that, on each depression, one lamp is lit and thereafter kept lit.

[0029] Fig. 3 shows an alternative coupling diagram for the signal emitter 3 and the regulator device 4. In this

embodiment, the signal emitter has a number of potentiometers or voltage dividers 19 and a switch 15 by means of which the mutually different control voltages received by the voltage dividers (four are shown in Fig. 3) between 0 and 12V can be connected to the control conductor 9. This signal voltage or control signal is connected to the inputs 3 and 5 on two IC circuits 16 and 17. There are further connected to these IC circuits 16 and 17 reference voltages to the inputs 2 and 6, in which even four different reference voltages are in place. These reference voltages are realised via voltage dividers 20.

[0030] Each IC circuit 16 and 17 includes operational amplifiers with the outputs 1 and 7. These outputs are connected to the base of a number of transistors 18 which are operative to light or extinguish those lamps 5 to which they are connected. This lighting and extinguishing function via the transistors 18 is completely analogous with that described above with reference to Fig. 2.

[0031] By means of a suitable selection of the four control voltages that may be realised in the signal emitter 3, a suitable selection of the reference voltages on the inputs 2 and 6 of the IC circuits 16 and 17 and by a suitable selection of the amplification factor in those operational amplifiers that are included in the IC circuits, it is possible to sequentially light those lamps 5 that are connected to the transistors 18.

[0032] In a modified embodiment of the regulator device 4, it is possible to light and extinguish optional lamps 5 one-by-one or in different predetermined arrays or groups. Such a solution is particularly suitable for the embodiment involving a "spot ramp".

[0033] According to the present invention, it is possible to dispense with the signal conductor 9 in the conductor 2 for example by providing, in the signal emitter 3, a source of a.c. voltage, which is stored on both of the conductors 10 and 11. This a.c. voltage can then, in the regulator device, be taken out and per se include coded signals that are employed for controlling the different light sources 5.

Claims

1. An illumination apparatus which comprises: at least two light sources (5), a current source (1) for powering the light sources, a conductor (2) which has two power conductors (10, 11) for current supply to the light sources and which is connectable to the illumination apparatus and the current source, and a connection device for connecting the light sources to the current source, **characterised in that** the connection device includes a signal emitter (3) which is disposed on the conductor (2) or current source (1), and a regulator device (4) which is disposed in, on or in association with the illumination apparatus and which is operative, in response to signals from the signal emitter (3), to control the function of the light sources (5), the signal emitter (3) and the regulator device (4) being connected via the conductor (2).

2. The illumination apparatus as claimed in Claim 1, **characterised in that** both of the power conductors (10, 11) extend in electric respects unbroken through the signal emitter (3).

3. The illumination apparatus as claimed in Claim 1 or 2, **characterised in that** the signal emitter (3) includes a number of voltage dividers (19) for realising a number of control voltages separate from one another and from the voltage of the current source (3) which, via a switch (15), are connectable one-by-one to a signal conductor (9) in the conductor (2), the signal conductor being connected to said regulator device (4).

4. The illumination apparatus as claimed in Claim 1 or 2, **characterised in that** the signal emitter (3) includes a switch (12) which is open in a rest position and which is connected to a signal conductor (9) in the conductor (2) in order, on activation, to transmit a control signal via the signal conductor to the regulator device (4).

5. The illumination apparatus as claimed in Claim 1 or 2, **characterised in that** the signal emitter (3) includes a source of a.c. voltage which contains control signals, the a.c. voltage being transferable to the regulator device (4) via the conductor (2), and the regulator device including means for reading the control signals carried by the a.c. voltage.

6. The illumination apparatus as claimed in Claim 4, **characterised in that** the regulator device (4) includes a counter (CLK) with a number of outputs (QA-QE), said counter, on receipt of a control signal, being operative to provide an output signal on an output, each output signal being operative to light a light source (5) via a corresponding switch device (13, Q1-Q4).

7. The illumination apparatus as claimed in Claim 6, **characterised in that** the counter (CLK), on a signal number 1, is operative to light a first of a number n of light sources (5), on a control signal number 2 to a light a second light source (5) at the same time as the first light source is kept lit, and so on, and at n+1 control signals, to reset the counter (CLK) and extinguish all light sources (5).

8. The illumination apparatus as claimed in Claim 1 or 2, **characterised in that** the signal emitter (3) is operative to emit a first control signal defining or selecting one light source (5) among the light sources,

and a second control signal for controlling the function of the selected light source (5).

9. The illumination apparatus as claimed in any of Claims 1 to 8, **characterised in that** the control of the light sources (5) comprises lighting, extinguishing and control their light strength.

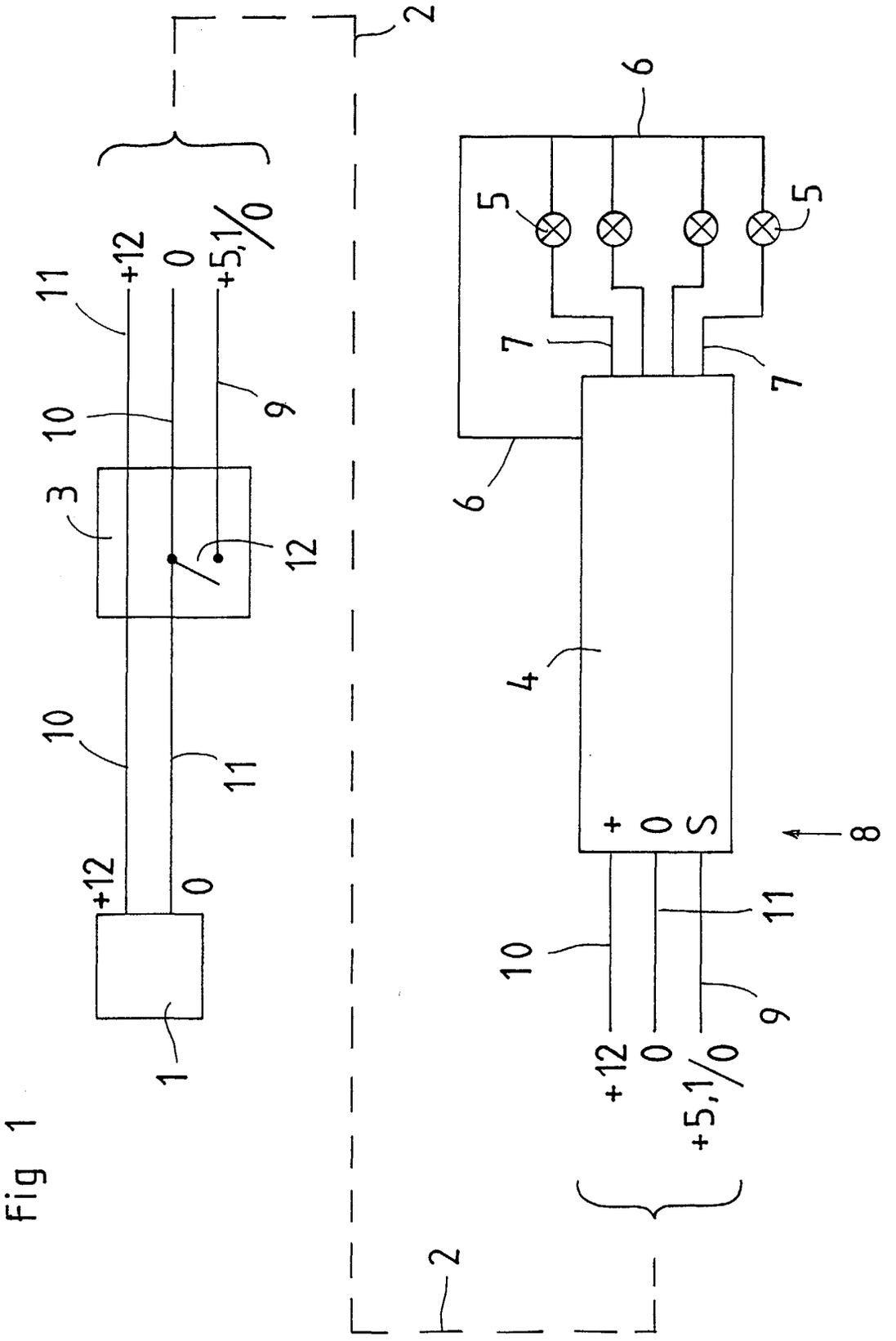
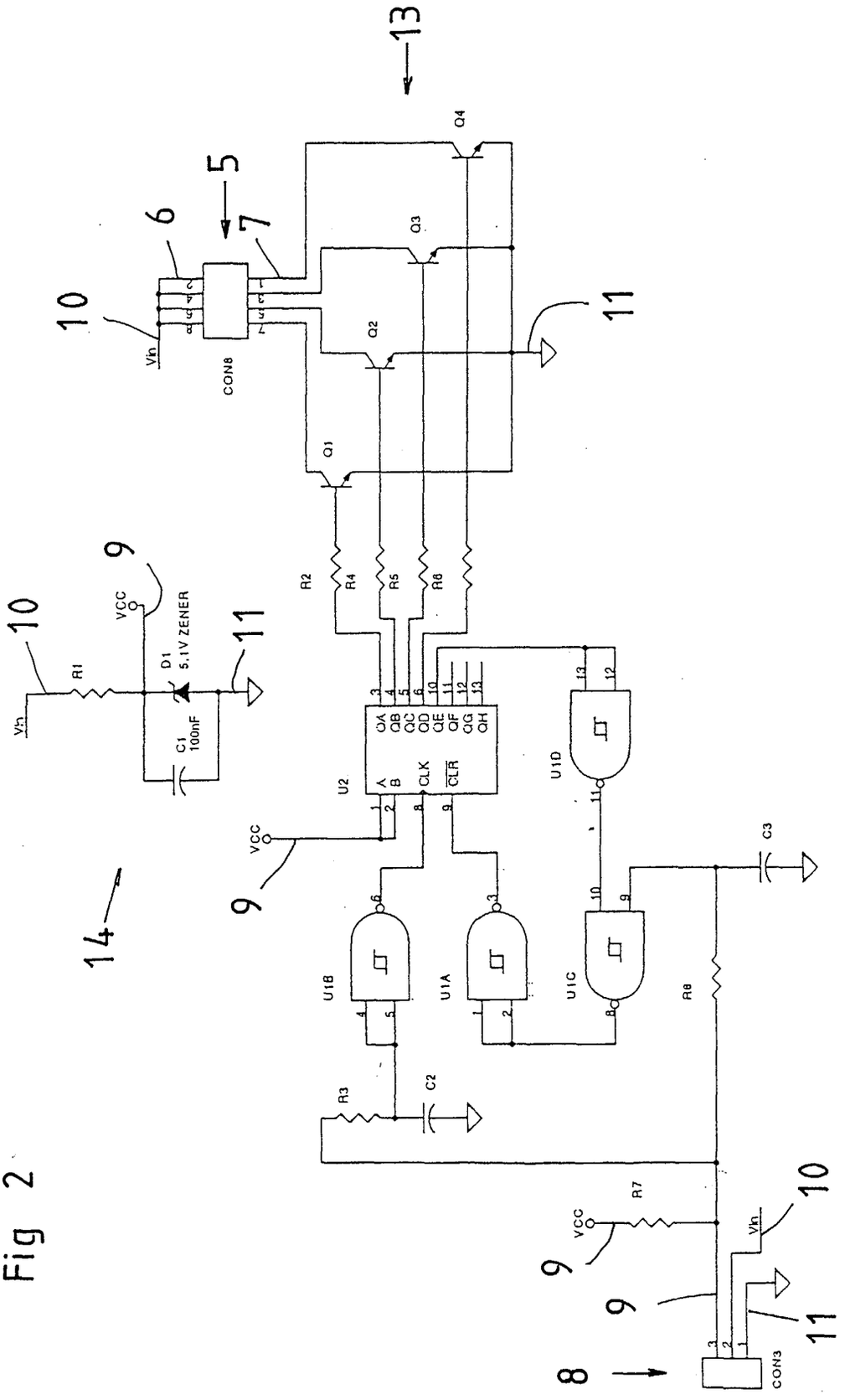


Fig 1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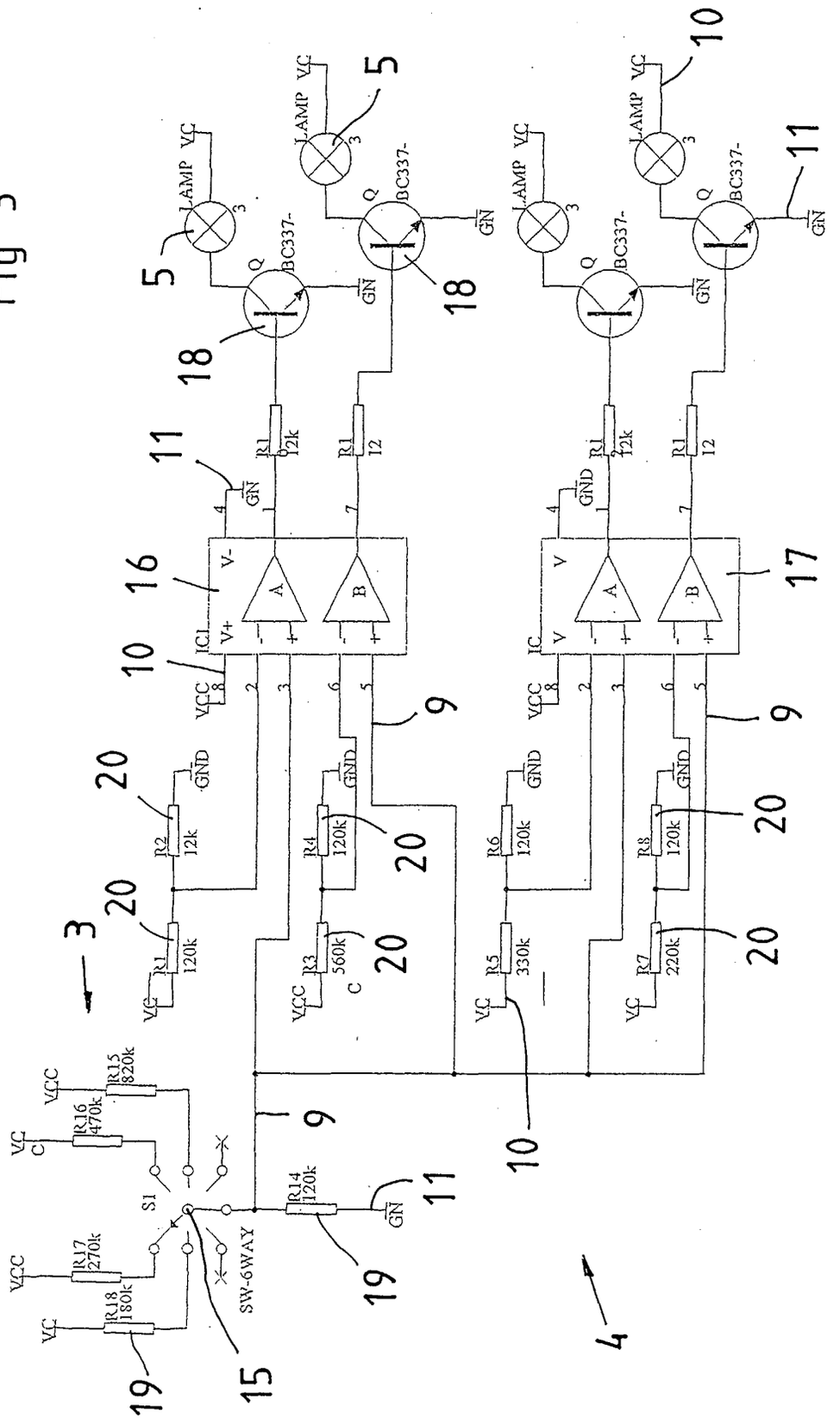
6
7
10
Vin
CON8
Q4
Q3
Q2
Q1
11
R2
R4
R5
R6
9
VCC
D1
5.1V ZENER
R1
C1
100nF
U2
CLK
CLR
U1D
U1B
U1A
U1C
C3
C2
R3
R8
R7
14
8
CON3

Fig 2

Fig 3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R6
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R5
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R7
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EUROPEAN SEARCH REPORT

Application Number
EP 05 07 5180

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Y	* page 1, lines 5-7; figures 1-4,8-13 * * page 6, lines 6-25 * * page 8, line 11 - page 28, line 7 * * page 31, line 15 - page 37, line 19; claims 1-109,120-167 *	7	
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Y	* abstract; figures 1-4 *	7	
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X	US 4 253 045 A (WEBER ET AL) 24 February 1981 (1981-02-24) * column 1, lines 6-16; figures 1,2,8 * * column 4, line 30 - column 6, line 30 * * column 7, lines 41-51 *	1,2,4,6, 8,9	TECHNICAL FIELDS SEARCHED (Int.Cl.7) H05B G02B A43B
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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
Munich	17 March 2005	Brosa Gonzalez, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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