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(54) Power unit.

(57) The power unit supplies two output voltages $+U_A$, $-U_A$ having opposite polarities and a common zero potential (0). To ensure symmetrical loading on the common neutral conductor, a current balancing circuit is provided in the power unit between the rectifiers (D1, D2) and the longitudinal regulators (IC1, IC2).

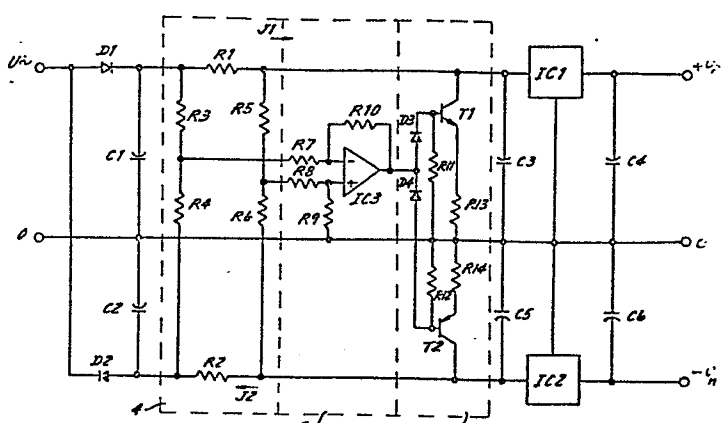

FIG. 2

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Power Unit

The invention relates to power units having two output voltages of opposite polarity and common zero potential which, for connection to an input a.c. voltage, has a rectifier and a linear longitudinal regulator for each output voltage.

Such a power unit is known from the article "Integrated Voltage Regulator" in Elektronik Entwicklung 6/1979,pp.24 to 46.

Installations are known which have a central mains supply connected via a transformer to a transmitter with an incorporated power unit and a plurality of remote electronic regulators each having an incorporated power unit. To reduce the number of lines which have to be installed, one connection of the secondary winding of the transformer is chosen as the zero potential. The secondary winding supplies a voltage serving as an input a.c. voltage $U_{\sim}$ to the transmitter and the regulators. The transmitter voltage at an output A of the transmitter is also related to this zero potential. The transmitter voltage is applied to inputs E_1 to E_4 of the regulators 3a-d, respectively, and is used for the control thereof.

It is a problem to provide a power unit of the aforementioned type having a balanced load of the common zero potential line.

According to the invention there is provided a power unit with two output voltages of opposite polarity and common zero potential which, for connection to an input a.c. voltage, has a rectifier and a linear longitudinal regulator for each output voltage, characterized in that a current balancing circuit (4, 5, 6) is arranged between the rectifiers (D1, D2) and the longitudinal regulators (IC1, IC2) and that the line carrying the zero potential (O) is connected to one of the two lines of the input a.c. voltage ($U_{\sim}$).

Power units according to the invention have a balanced current on the zero potential line. As a result, it is possible to use a common neutral conductor which reduces expenditure in connection with the line. It is even possible to connect regulators with a switching behaviour and can be controlled with a d.c. voltage from the remote transmitter, without feedbacks occurring.

The invention, will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig 1 a block circuit diagram of a known installation with a central transmitter and regulators remote therefrom;

Fig 2 a circuit diagram of a power unit according to the invention with a current balancing circuit; and

Fig 3 a circuit diagram of a further power unit according to the invention. Referring to Fig 1, a known installation has a central mains supply connected via a transformer 1. to a transmitter 2 with incorporated power unit and a plurality of remote electronic regulators 3a - 3d each having an incorporated power unit. To reduce the number of lines which have to be installed, one connection of the secondary winding of the transformer 1 is chosen as the zero potential. The secondary winding supplies a voltage serving as an input a.c. voltage $U_{\sim}$ to the transmitter 2 and the regulators 3a-d. The transmitter voltage at an output of A of the transmitter 2 is also related to this zero potential. The transmitter voltage is applied to inputs E_1 to E_4 of the regulators 3a-d, respectively, and is used for the control thereof.

Fig 2 shows a power unit, to whose input terminals are applied the input a.c. voltage $U_{\sim}$. The lower input terminal in Fig 2 has zero potential and is designated by 0. The input a.c. voltage $U_{\sim}$ is rectified by two rectifiers D1 and D2. As the rectifiers have opposite polarity, two voltages occur at the two following capacitors C1 and C2 with different polarities related to the common zero potential. These two voltages are applied by means of low-valued resistors R1 or R2 of a current measuring circuit 4 to in each case one linear longitudinal regulator IC1 or IC2. In the represented embodiment, the longitudinal regulators comprise known integrated voltage regulators. Longitudinal regulators IC1 and IC2 are wired to capacitors C3 to C6 in order to prevent undesired oscillations. The two output voltages $+U_A$ and $-U_A$, related to the zero potential O, are then available at the indicated terminals.

To current measuring circuit 4 is connected a comparator circuit 5 and to the latter a current control circuit 6. Together all the three circuits 4, 5 and 6 form a current balancing circuit.

The current measuring circuit 4 comprises a bridge circuit formed from resistors R3 to R6 and which measures the voltage drop corresponding to the current J_1 or J_2 through resistor R1 or R2. These voltage values reach the comparator circuit 5, which comprises the operational amplifier IC3 and the resistors R7 and R8 at the inverting or non-inverting input, resistor R7 from the non-inverting input to the zero potential 0 and resistor R10 from the output to the inverting input of the operational amplifier IC3. The comparison result at the output of the operational amplifier IC3 is a positive or negative voltage value, depending on whether current J_1 or current J_2 preponderates. This voltage value reaches the base of transistor T1 or T2 across a diode D3 or D4. The collector of transistor T1 is connected to the input of longitudinal regulator IC1 and its emitter is connected across a resistor R13 to the zero potential. A resistor R11 is connected from the base of transistor T1 to zero potential. Transistor T2 is connected in the same way with resistors R12 and R14 between the input of longitudinal regulator IC 2 and zero potential.

The voltages corresponding to currents J_1 and J_2 are determined by the current measuring circuit 4 compared with one another in comparator circuit 5 acting as a proportional controller and a resulting voltage value is supplied to transistor T1 or T2 acting as the control element. Transistor T1 or T2 then carries such a current that, apart from the very small control deviation, currents J_1 and J_2 are the same.

Fig 3 shows a power unit in which one output voltage $+U_A$ is much more highly loaded than the other output voltage $-U_A$. Due to the lighter loading, a circuit comprising a resistor R12 and a Zener diode D6 is used as the longitudinal regulator for this output voltage $-U_A$. The input and output connection is the same as the circuit according to Fig 2 and consequently the same references are used for the same parts.

Downstream of capacitor C1 a series connection of a resistor R13 and a Zener diode D5 is connected to zero potential. Zener diode D5 has the same Zener voltage as Zener diode D6 and resistors R12 and R13 are identical. This power unit also has a current measuring circuit 4', to which is connected a comparator circuit 5'. The following current control circuit 6' has only one transistor T3 in series with a resistor R11 connected from the input of longitudinal regulator 7 to zero potential A. The addition of the apostrophe means that in principle the circuit with the same reference numeral is used. Transistor 13 is adequate, provided that the output voltage $-U_A$ is more lightly loaded than output voltage $+U_A$, because then a balancing current only has to flow in the lightly loaded branch.

Current J_6 is the same as current J_7, it being assumed that current J_2 is lower than current J_6. Current

J_1 is subject to greater fluctuations and greater loading and consequently so is current J_8. Current J_8 is determined by the current measuring circuit 4' and from this a control signal for transistor T3 is obtained in such a way that current J_5 is the same as current J_8.

As $J_6 = J_7$ and now $J_5 = J_8$ and $J_3 = J_5 + J_6$ and $J_4 = J_7 + J_8$, it follows that $J_3 = J_4$, so that balanced loading of the neutral conductor is obtained.

CLAIMS

1. Power unit with two output voltages of opposite polarity and common zero potential which, for connection to an input a.c. voltage, has a rectifier and a linear longitudinal regulator for each output voltage, characterized in that a current balancing circuit (4, 5, 6) is arranged between the rectifiers (D1, D2) and the longitudinal regulators (IC1, IC2) and that the line carrying the zero potential (0) is connected to one of the two lines of the input a.c. voltage ($U_\sim$).

2. Power unit according to claim 1, characterized in that the current balancing circuit comprises a current measuring circuit (4) determining the currents (J_1, J_2) of the output voltages ($+U_A$, $-U_A$), a following comparator circuit (5) and a current control circuit (5) connected thereto between the inputs of the longitudinal regulators (IC1, IC2) and the zero potential (0).

3. Power unit according to claim 2, characterized in that the current measuring circuit (4) comprises in each case one low-valued resistor (R1, R2) downstream of the rectifiers (D1, D2) with a bridge circuit (R3 to R6) connected thereto.

4. Power unit according to claim 2, characterized in that the comparator circuit (5) comprises an operational amplifier (IC3) connected as a proportional controller.

5. Power unit according to claim 2, characterized in that the current control circuit (6) comprises in each case one transistor (T1, T2) connected between the input of the longitudinal regulators (IC1, IC2) and the zero potential (0).

6. Power unit according to claim 5, characterized in that in the case of light loading of an output voltage ($-U_A$) a transistor (T3) is only connected from the input of the associated longitudinal regulator (7) to the zero potential (0).

7. Power unit according to claim 6, characterized in that from the low-valued resistor (R1) in the branch of the more highly loaded output voltage ($+U_A$) a series connection of a resistor (R30) and a Zener diode (D5) is connected to the zero potential.

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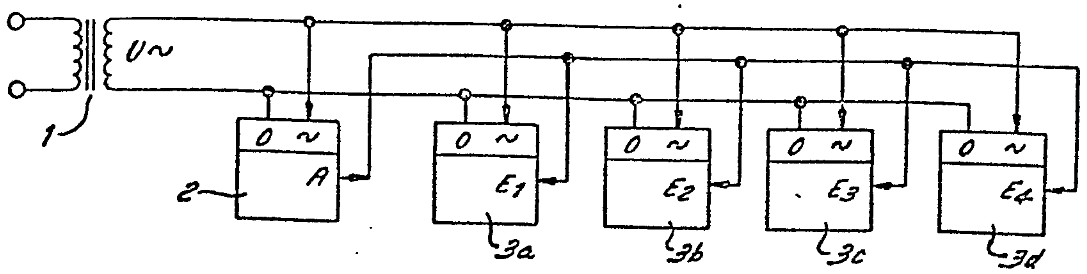

FIG. 1

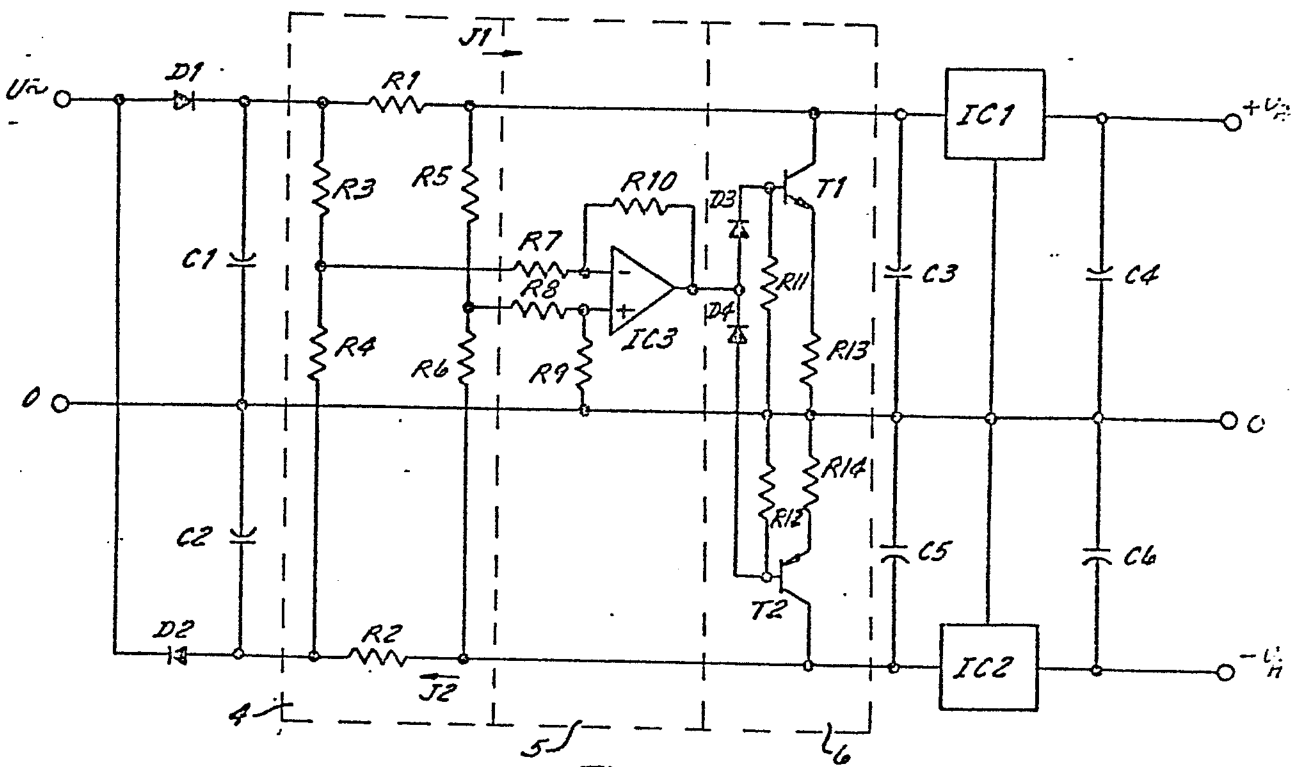

FIG. 2

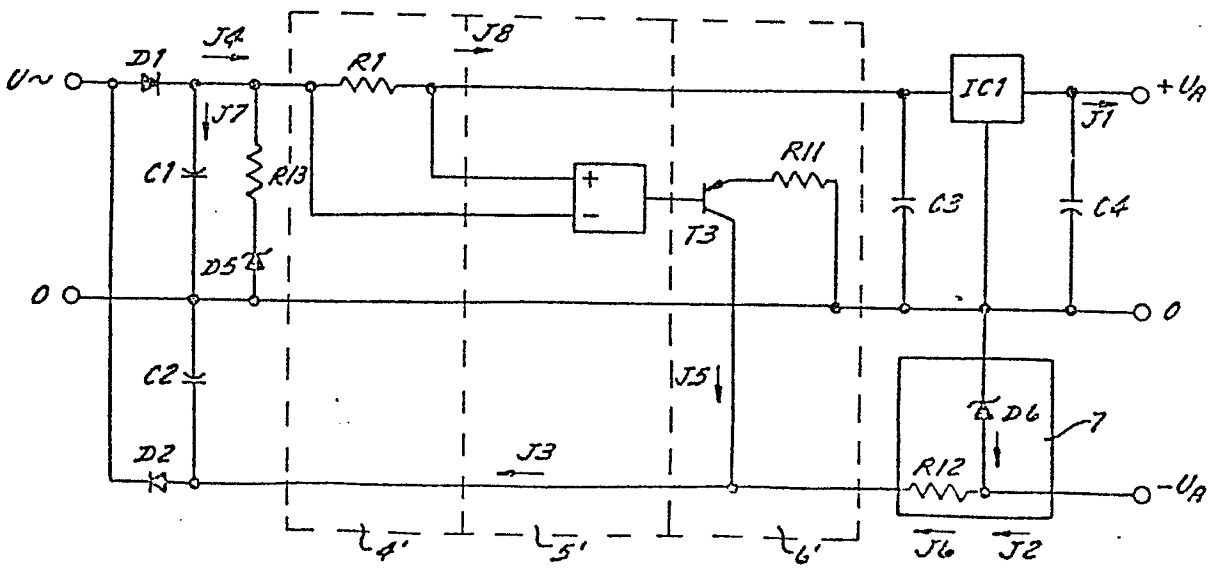

FIG. 3