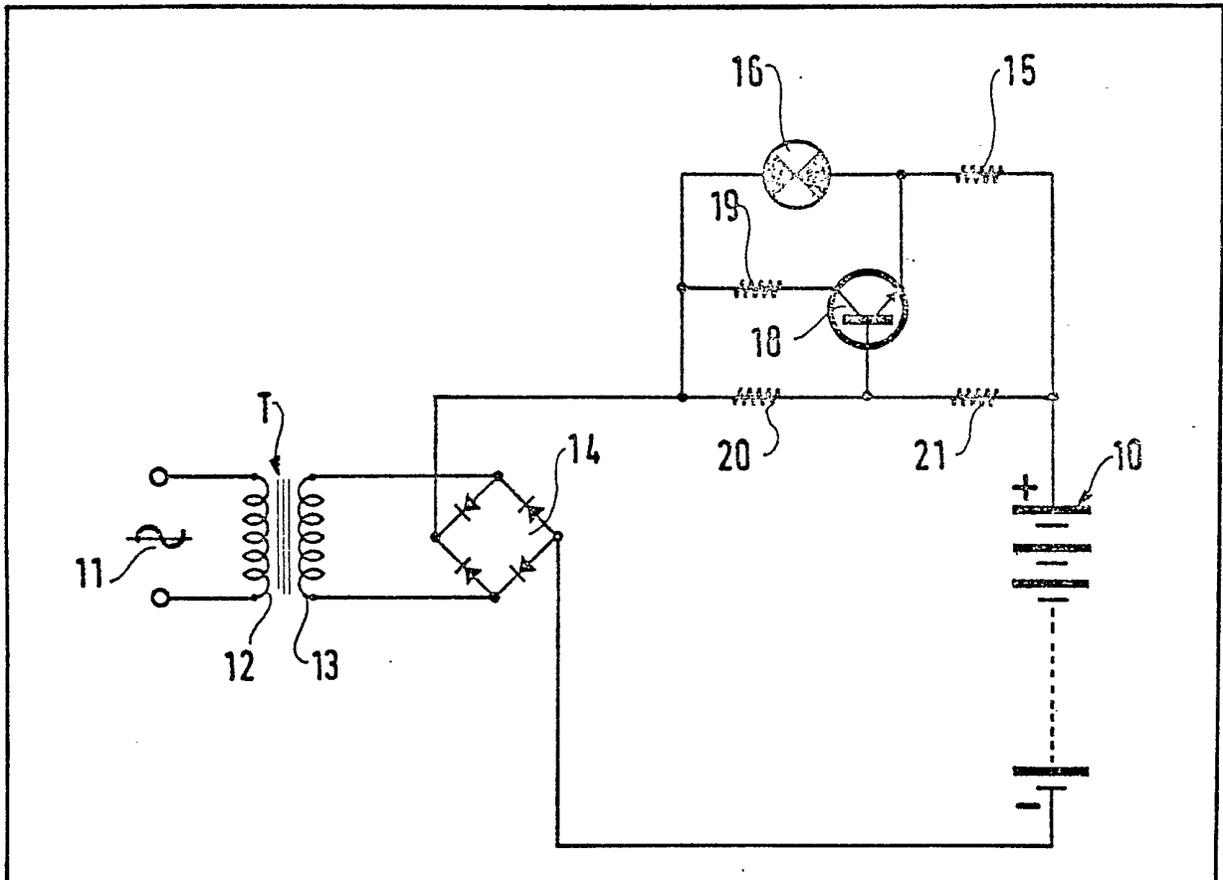


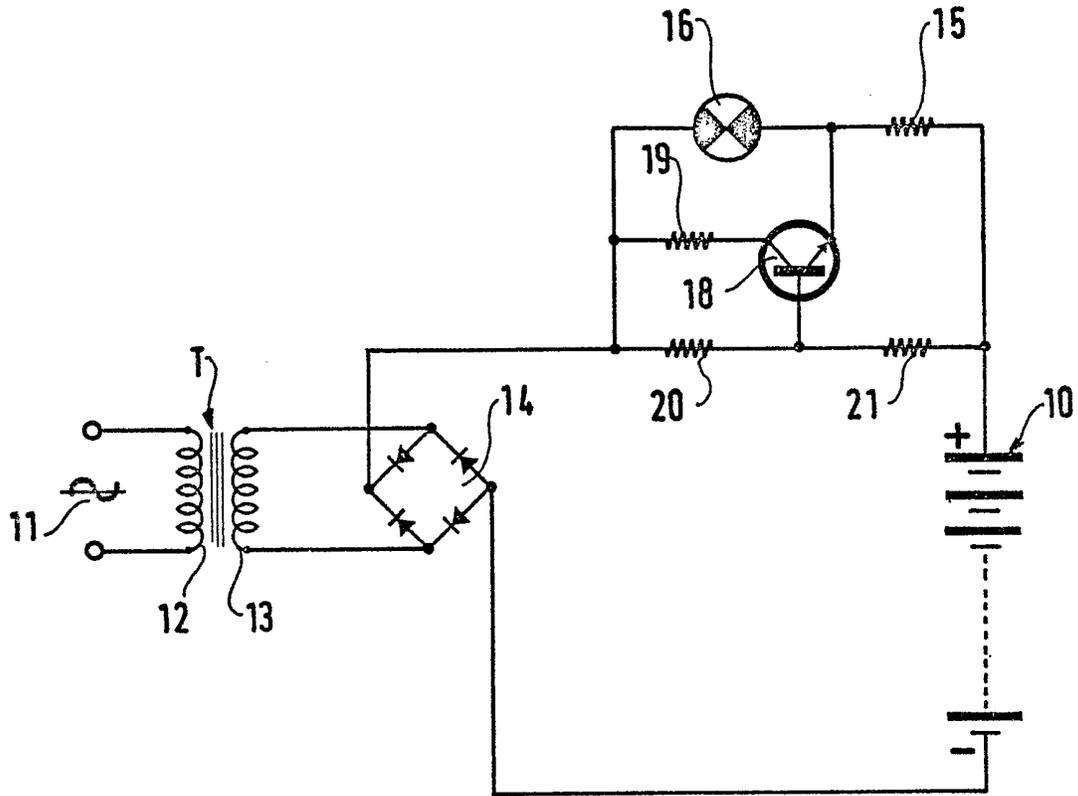
- (21) Application No 7940135
- (22) Date of filing 20 Nov 1979
- (30) Priority data
- (31) 7832610
- (32) 20 Nov 1978
- (33) France (FR)
- (43) Application published 25 Jun 1980
- (51) INT CL³
H02J 7/00//7/04
- (52) Domestic classification
H2H 25G BCH BCJ
- (56) Documents cited
None
- (58) Field of search
G3U
H2H
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(54) A Current Regulator Circuit, in Particular for Charging an Emergency Power Supply Unit at Constant Current

(57) A circuit for charging a storage battery (10) at constant current by means of a transformer (T) whose primary winding (12) is connected to an AC mains (11) and whose secondary winding (13) feeds a rectifier bridge (14). The storage battery is connected, at the output of the rectifier bridge, in series with a resistor (15) and a light bulb (16). A transistor (18) has its emitter-collector

circuit connected in series with a resistor (19) and this series connection is connected in parallel with the light bulb (11). The transistor base is biased by a voltage divider chain (20, 21) connected between one pole of the battery and the output of the rectifier bridge. While the bulb is in order it acts both as a pilot lamp and as a regulator device to ensure substantially constant current charging of the battery. The transistor is then off. If the bulb filament breaks, the transistor is biased to become conductor to maintain adequate charging current through the battery.





SPECIFICATION

A Current Regulator Circuit, in Particular for Charging an Emergency Power Supply Unit at Constant Current

- 5 The present invention relates to a circuit for charging a storage battery at constant current, and in particular a storage battery for an emergency power supply unit.
- 10 Known constant current charging circuits include a transformer whose primary winding is connected to an AC electric mains supply and whose secondary winding is connected, via a rectifier bridge, to the storage battery to be charged. A resistor and a light bulb are disposed
- 15 in series with the battery. The light bulb is used simultaneously as a pilot light to indicate that the charging circuit is operating, and as a device for regulating the charging current as a function of the mains voltage.
- 20 When the filament of the pilot light breaks, the charging process is interrupted. However, specifications relating to emergency power supply units stipulate that charging shall not be interrupted. An attempt has been made to remedy
- 25 the drawback caused by the breakage of a filament by disposing a resistor in parallel with the light bulb so as to provide circuit continuity in the event of light bulb failure.
- 30 This solution to the problem is not entirely satisfactory. Thus if the resistance of the resistor has low resistance, the light bulb no longer performs its regulator function, while if its resistance is high, the storage battery is insufficiently charged when the light bulb has
- 35 failed.
- Preferred embodiments of the present invention remedy the problem of light bulb failure by providing a circuit which can be used to regulate charging when the light bulb is in order,
- 40 and to maintain adequate charging when the light bulb is out of order.
- The present invention provides a current regulator circuit for connection in series between a battery to be charged and a source of charging
- 45 current, the current regulator circuit comprising:
- a main, current-regulating path comprising an incandescent light bulb connected in series with a charging current limiting resistor;
 - a voltage divider chain connected in parallel
 - 50 with the main path; and
 - an auxiliary charging current path connected in parallel with the light bulb, the auxiliary charging current path comprising the emitter-collector circuit of a transistor with the emitter of
 - 55 the transistor being connected to the charging current limiting resistor of the main path and the base of the transistor being connected to a point on the voltage divider chain to bias the transistor in such a manner that when the light bulb is conductive
 - 60 the transistor is non-conductive and when the light bulb is open circuit the transistor is conductive to charge the battery with unregulated current.
- The auxiliary charging current path preferable

- 65 includes an auxiliary resistor connected in series with the collector of the transistor, the resistance value of the auxiliary resistor being chosen so that, when the transistor is conductive, the current flowing through the transistor is limited by
- 70 the auxiliary resistor rather than by the base-emitter potential of the transistor.
- The invention also provides a battery charger circuit incorporating the above-defined current regulator circuit.
- 75 An embodiment of the invention is described with reference to the accompanying drawing in which the single figure illustrates the circuit diagram of an emergency power supply unit implementing the invention.
- 80 In the figure, reference 10 designates a storage battery charged at constant current from AC mains 11 via a transformer T whose primary winding 12 is connected to the mains and whose secondary winding 13 feeds a rectifier bridge. A
- 85 negative output of the bridge is connected directly to the negative terminal of the storage battery; a positive output of the bridge is connected to the positive terminal of the storage battery via a current regulator circuit having a main path which
- 90 comprises a charging current limiting resistor 15 and an incandescent light bulb 16 which regulates the charging current of the battery against voltage variations in the mains 11 and in the battery voltage.
- 95 The emitter of an NPN transistor 18 is connected to the point common to the resistor 15 and to the light bulb 16 and the collector of the transistor is connected via a resistor 19 to the positive output of the bridge. This connection
- 100 constitutes an auxiliary charging current path. The base of the transistor is biased by a voltage tapped from a voltage divider chain comprising two resistors 20 and 21 connected in parallel with the main path formed by the light bulb 16
- 105 and the resistor 15.
- The charging circuit operates as follows:
- When mains 11 voltage is present and when the light bulb 16 is in good condition, the charging current of the battery passes through the
- 110 light bulb 16 and the resistor 15. The transistor 18 is then non-conductive, since the voltage applied to its emitter (resistor 15) is higher than the voltage applied to its base (resistor 21), due to a suitable choice of resistance values for the
- 115 various resistors.
- The charging current is regulated by the light bulb, whose resistance varies with variations in mains voltage.
- 120 If the filament of the light bulb breaks, charging is maintained by means of the transistor 18 which becomes conductive, since the potential of the emitter decreases suddenly to a value lower than that of the base; the charging current then passes through the resistor 19, the transistor 18 and the
- 125 resistor 15. Clearly the charging current provided by the auxiliary charging current path must be less than that provided by the main path in order to ensure that the emitter voltage stays far

enough below the base voltage for the transistor to remain switched on.

5 The resistance of the resistor 19 is chosen so as to ensure that substantially all of the voltage drop due to the slightly lower charging current appears across the resistor rather than across the transistor, thereby reducing the power dissipating requirements for the transistor. Furthermore, since the circuit no longer includes a regulator device, protection must be provided against possible increases in the mains voltage. Thus it is essential for the unregulated charging current to be kept below the normal regulated charging current. However, a charging current which is sufficient to comply with the specifications can still be maintained.

10 The invention is in no way limited to the embodiment described by way of example. In particular, the NPN transistor can be replaced by a PNP transistor by making the necessary transpositions in the connections.

Claims

25 1. A current regulator circuit for connection in series between a battery to be charged and a source of charging current, the current regulator circuit comprising:

30 a main current-regulating path comprising an incandescent light bulb connected in series with a charging current limiting resistor;
a voltage divider chain connected in parallel with the main path; and
an auxiliary charging current path connected in

35 parallel with the light bulb, the auxiliary charging current path comprising the emitter-collector circuit of a transistor with the emitter of the transistor being connected to the charging current limiting resistor of the main path and the base of the transistor being connected to a point on the voltage divider chain to bias the transistor in such a manner that when the light bulb is conductive the transistor is non-conductive and when the light bulb is open circuit the transistor is conductive to charge the battery with unregulated current.

45 2. A current regulator circuit according to Claim 1, wherein the auxiliary charging current path includes an auxiliary resistor connected in series with the collector of the transistor, the resistance of the auxiliary resistor being chosen so that, when the transistor is conductive, the current flowing through the transistor is limited by the auxiliary resistor rather than by the base-emitter potential of the transistor.

55 3. A current regulator circuit substantially as herein described with reference to the accompanying drawing.

60 4. A battery charger circuit comprising a transformer having a primary winding for connection to AC mains and a secondary winding connected to a rectifier bridge, the current regulator circuit of any preceding claim being connected in series with the DC output from the rectifier bridge and terminals for connection to a storage battery.