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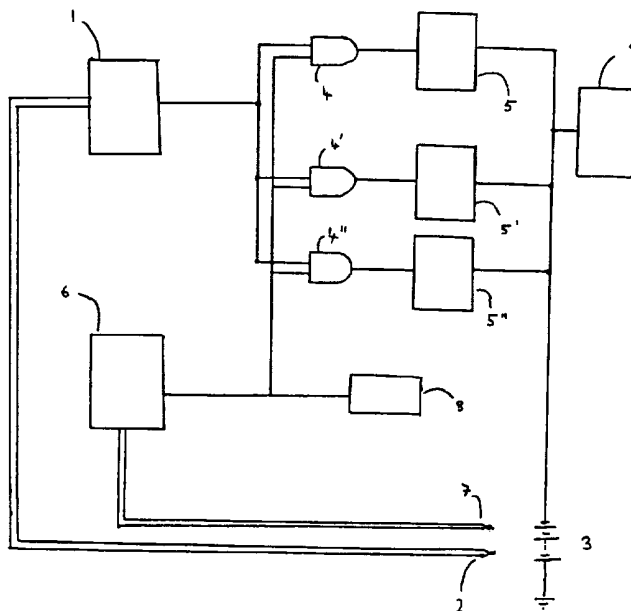
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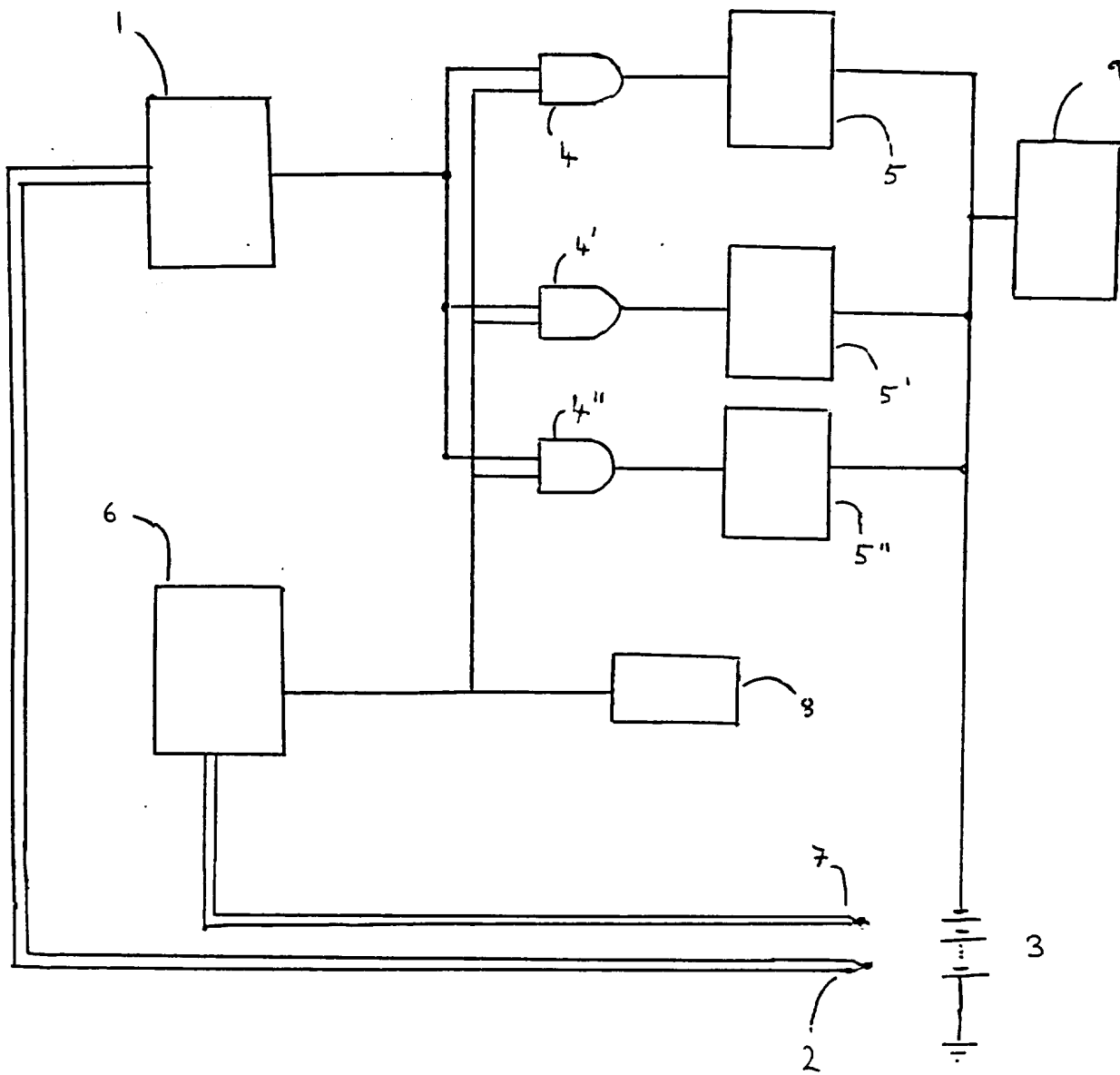
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(54) **Fail-safe float temperature compensating battery charger**

(57) During float charging of a standby battery 3 at constant charging voltage via rectifiers 5,5',5", a float temperature compensation block 1 responds to the output of battery temperature and voltage sensing means 2 to control the rectifiers 5,5',5" so that the charging voltage decreases as battery temperature increases. The block 1 controls the rectifiers via respective logic gates 4,4',4" which each have a second input from a watchdog block 6 connected to battery temperature and voltage sensing means 7. If the watchdog block 6 senses that the battery voltage does not lie within a predetermined margin of error of the voltage which should be instructed by the block 1 for the present battery temperature, the block 6 assumes that there is a failure in block 1 and turns off the gates 4,4',4" and activates an indicator 8. The rectifiers 5,5',5" then revert to an internally reset output voltage. The gates 4,4',4" also turn off in the event of a failure in block 6, or in both blocks 1 and 6.



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Float Temperature Compensation System

The present invention relates to a float temperature compensation system for maintaining standby batteries in a condition of optimum charge whilst in the standby mode. Electrical installations are known in which the electrical load of the installation is normally powered by an external source, such as the main electricity supply, but which includes a standby battery system which provides the necessary power for the installation in the event of failure of the external source. It is desirable for the battery to be maintained in a condition of optimum charge.

The condition of optimum charge may be maintained by float charging whereby the battery terminals are held at a constant voltage with respect to time and the current flowing into the terminals is sufficient to replenish lost charge. This constant voltage is provided by the battery charger which also typically powers the load circuitry.

To increase the life of the battery it has been found to be advantageous to make the float charging voltage temperature dependent such that the float charging voltage decreases approximately linearly with battery temperature increase but such that the float charging voltage changes by only a relatively small amount, typically a few volts, over the expected temperature range. The temperature compensation is generally provided by a battery charging rectifier in conjunction with temperature sensing means together with associated signal processing means.

A known float temperature compensation system consists of a temperature sensor, an amplifier and a plurality of rectifiers, wherein the amplifier converts the temperature sensor signal, which may be small non-linear and subject to wide tolerances, into a signal of sufficient magnitude and accuracy so as to be able to influence the rectifier output.

The amplifier may be a single item driving all the rectifiers or each individual rectifier may include its own amplifier.

The reliability of the known system is often enhanced by means of an N+1 redundancy system, wherein for a system requirement of N rectifiers, there is provided N+1 rectifiers, so that in the event of a rectifier failure the system will still be operationally intact.

There are however several problems with the known systems. In a system incorporating only a single amplifier there is a common connection into each of the rectifiers and therefore each rectifier is not completely isolated from the other rectifiers and redundancy is lost to some extent. In the multiple amplifier system there is consequent duplication and increased costs. A further disadvantage of the multiple system is that in the event of damage to the temperature sensing means, any of the amplifiers or associated circuitry, the whole system may crash because of the lack of redundancy.

These problems may be overcome by means of a float temperature compensation system biased in a fail-safe manner such that in the event of a component failure the individual rectifiers revert to a normal float mode.

According to the present invention there is provided a float temperature compensation charging system for a standby battery comprising a rechargeable power source, the system comprising a plurality of rectifiers for controlling charging being controllable by first float temperature compensation means comprising amplifier means and sensing means adapted to measure the temperature and/or voltage of the rechargeable power source, wherein connected between the output of the first float temperature compensation means and each rectifier is a gate, and wherein a further input of each gate is provided by further float temperature compensation means comprising further amplifier means and further sensing means adapted to measure the temperature and/or voltage of the rechargeable power source, said further float temperature compensation means being adapted to monitor the output of the rechargeable power source.

Preferably, if the output of the rechargeable

power source deviates outside a predetermined range, the gates are switched off. If the output of the rechargeable power source deviates outside a predetermined range, the output of the rectifiers may revert to an internally reset output voltage. Indicator means may be provided to indicate when the output of the rechargeable power source deviates outside a predetermined range. In a preferred embodiment of the invention the rechargeable power source is a lead acid battery.

The float temperature compensation system provides the function of battery charging voltage compensation and has the additional benefit by reason of its greater signal gain of exerting an overriding authority over each individual rectifier, thereby maintaining the desired voltage at the battery terminals. Therefore the float temperature compensation block provides the additional ability to sense the voltage remotely irrespective of whether the individual rectifiers are adapted for local or remote sensing.

A further additional and unexpected benefit of the system according to the invention is that whereas in a standard uncompensated $N+1$ rectifier system there is a degree of current sharing between the rectifiers, by providing a combination of accurate output voltage setting of the individual rectifiers and a deliberate degradation of the gain of the internal rectifier feedback loops a finite zero-to-rated load regulation is produced.

In the present system the high gain of the float temperature compensation system restores the system load regulation at the battery terminals to an accurate independent level, with no loss of current sharing accuracy, even if the rectifiers have a degraded load regulation thereby obviating the performance compromise inherent in the known system.

The present invention will now be described in greater detail by way of example with reference to the drawing in which the single Figure shows a block diagram of a float temperature compensation system having three

rectifiers.

The drawing shows a float temperature compensation block 1 having sensing means 2 adapted to measure the temperature and voltage of the battery 3. The output of the float temperature compensation block 1 is fed to gates 4, 4', 4", the output of the gates being fed to the rectifiers 5, 5', 5". A second input of the gates is provided by the float temperature compensation watchdog block 6, which has sensing means 7 adapted to measure the temperature and voltage of the battery 3. The float temperature watchdog block 6 is provided with an indicator 8, adapted to indicate whether the circuit is functioning normally or not.

In a system according to the invention the rectifiers 5, 5', 5" are controlled by an input signal from the float temperature compensation block 1, said signal being fed via gates 4, 4', 4" corresponding to the rectifiers 5, 5', 5", by means of which the rectifier signal inputs are isolated from one another. The block 1 monitors the battery 3, converting the signal from the sensing means 2 into a form suitable for influencing the rectifiers 5, 5', 5" in the desired manner. The battery 3 is also monitored by means of the float temperature compensation watchdog block 6 by means of further sensing means 7, said block 6 checking that the battery terminal voltage lies within a predetermined margin of error for the voltage instructed by the block 1. In the case where the voltage deviates outside the predetermined margin of error the block 6 makes an assumption of a failure in the block 1 and after a delay for eliminating any transient effects turns off the gates 4, 4', 4". The rectifiers 5, 5', 5" then revert to an internally reset output voltage. The block 6 is designed in a fail-safe manner such that in the event of a failure occurring in the block 6, then the gates 4, 4', 4" are turned off. In the event of failure of both block 1 and block 6 the gates 4, 4', 4" are turned off. The integrity of the system may be monitored by monitoring means 8 by taking a signal from a turn-off input bus to gates of the block 6. The output of the rectifiers 5, 5', 5" goes to the load 9.

Claims

1. A float temperature compensation charging system for a standby battery comprising a rechargeable power source, the system comprising a plurality of rectifiers for controlling charging being controllable by first float temperature compensation means comprising amplifier means and sensing means adapted to measure the temperature and/or voltage of the rechargeable power source, wherein connected between the output of the first float temperature compensation means and each rectifier is a gate, and wherein a further input of each gate is provided by further float temperature compensation means comprising further amplifier means and further sensing means adapted to measure the temperature and/or voltage of the rechargeable power source, said further float temperature compensation means being adapted to monitor the output of the rechargeable power source.

2. A float temperature compensation system according to Claim 1, wherein, if the output of the rechargeable power source deviates outside a predetermined range, the gates are switched off.

3. A float temperature compensation according to Claim 1 or Claim 2, wherein, if the output of the rechargeable power source deviates outside a predetermined range, the output of the rectifiers reverts to an internally reset output voltage.

4. A float temperature compensation system according to any one of Claims 1 to 3, wherein indicator means are provided to indicate when the output of the rechargeable power source deviates outside a predetermined range.

5. A float temperature compensation system according to any one of Claims 1 to 4, wherein the rechargeable power source is a lead acid battery.

6. A float temperature compensation system substantially as described herein, with reference to, and as illustrated in the accompanying drawing.



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Claims searched: 1 to 6

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Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
 UK CI (Ed.O): H2H HBCD, HBCE, HBCF, HBCG; H2K KCX, KJS, KSX.
 Int CI (Ed.6): H02H 7/18; H02J 7/00, 7/02, 7/04, 7/10.
 Other: ONLINE : WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X,P	GB2290177A (MOTOROLA) - Fig.6; published 13 December 1995	1,2 at least
X	EP0480648A2 (COMPAQ) - Fig.3	1,2 at least
X	EP0258850A2 (INELCO) - Fig.2	1,2 at least
X	EP0161109A2 (NEWTON DERBY) - Fig.1	1,2 at least
X	US5214369 (CHARLES MACHINE WORKS) - Fig.1	1,2 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.