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(56) Documents cited
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US 4847545 A US 4831321 A US 4638236 A
US 4233552 A

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(54) Apparatus for in-situ charging of a vehicle battery from an external power source

(57) The apparatus contains a rechargeable battery 1 which can be connected via switches 3, a charging current/voltage regulator 4, a polarity reversing switch 6, and connecting means 7 to charge the vehicle battery. A switch 11 allows selection of a triple charge current (25 to 1 150 mA) or a boost charge current (150 to 500 mA). The regulator 4 also adjust charging current in response to ambient temperature sensed by a detector 9. Switches 3 may be changed over to allow battery 1 to be charged from the vehicle electrical system. A connector 8 and circuit 21 allows battery 1 to be recharged from an external A.C. or D.C. supply. The voltage of battery 1 may be lower than the vehicle battery voltage, regulator 4 then also stepping up the voltage for charging the vehicle battery.

A microprocessor (12), (Fig 2), with a keypad (13) and display (14), may be used to control switches 3, 6, 11, switch 6 being charged automatically on detection of incorrect polarity.

FIG. 1.

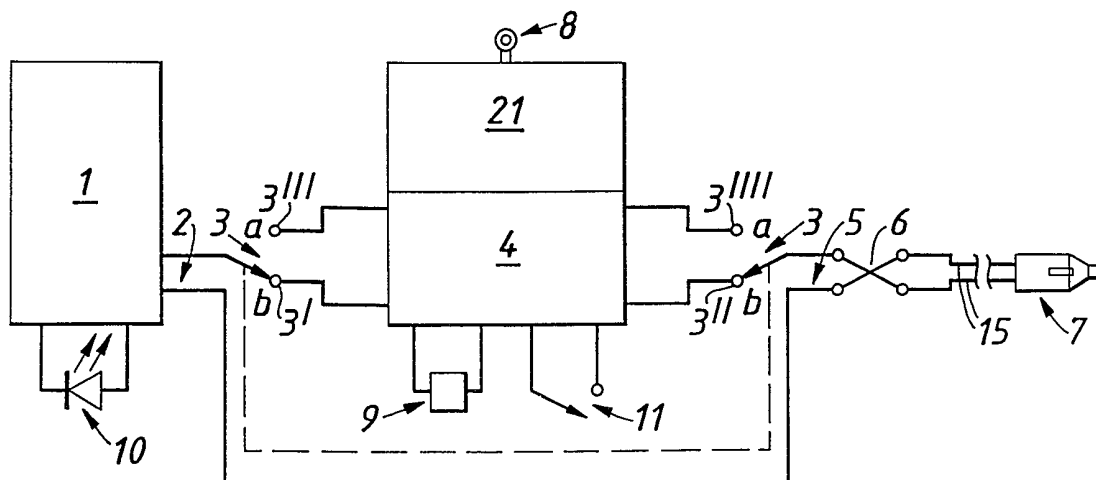
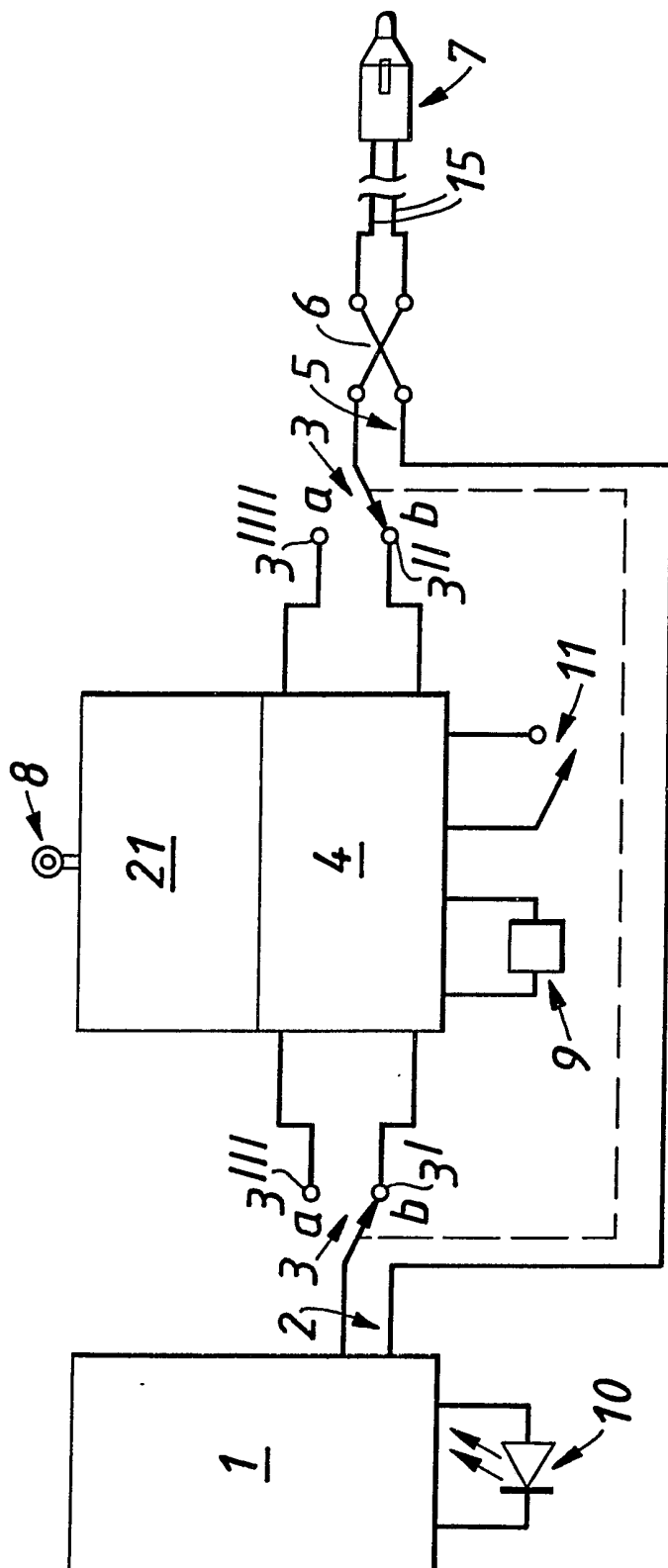
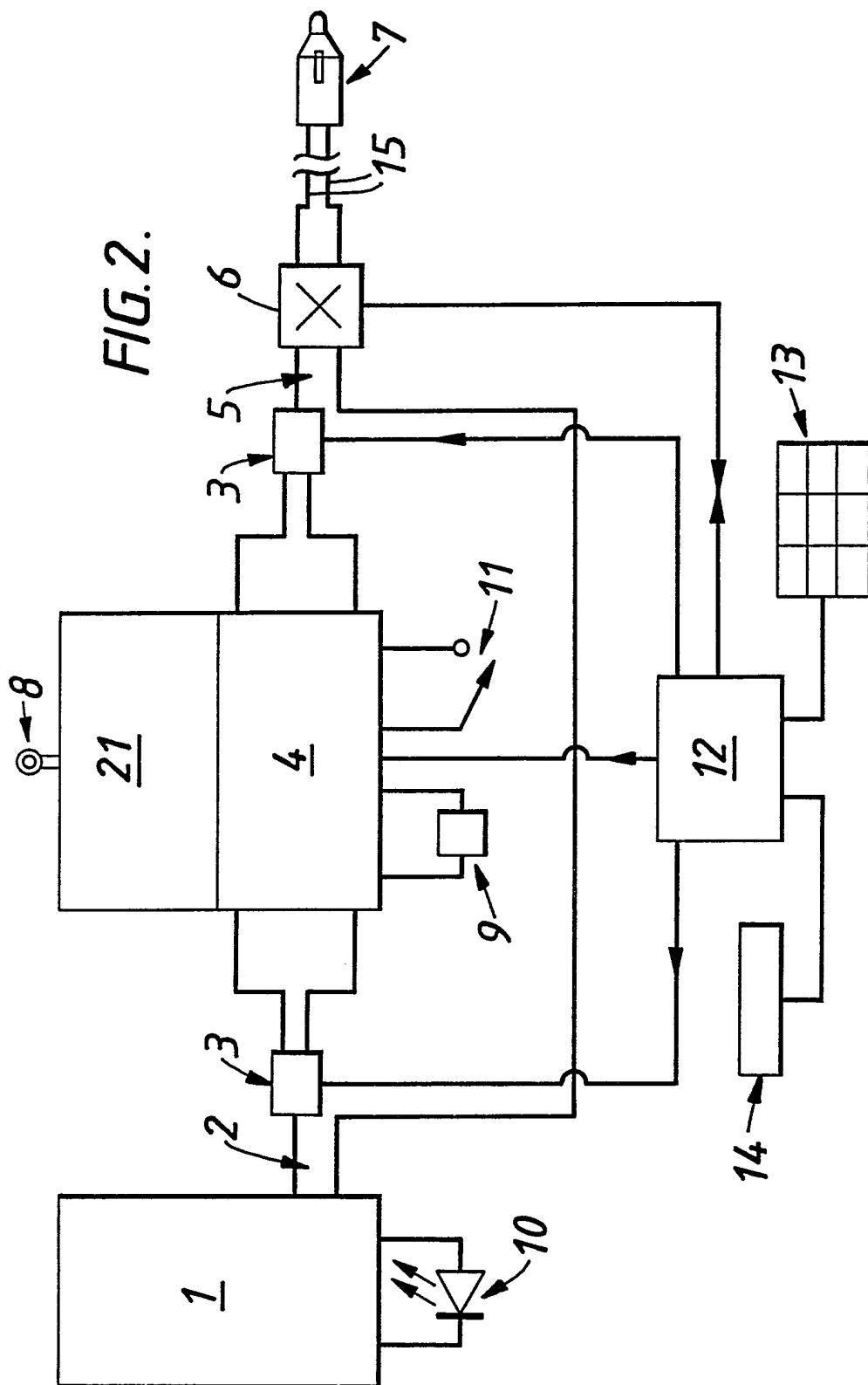
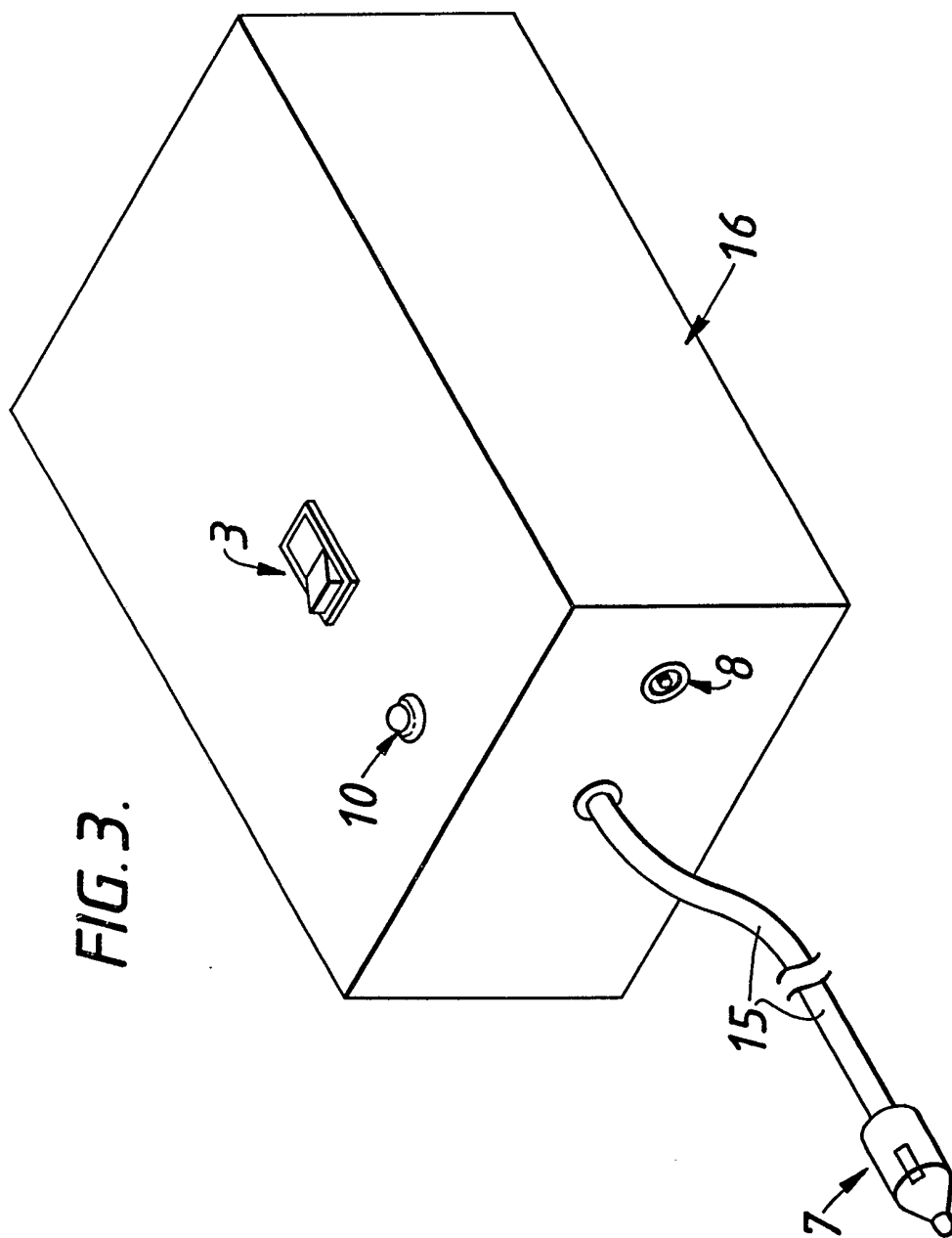


FIG. 1.







IMPROVEMENTS IN BATTERY CHARGERS

The present invention relates to apparatus for use in charging batteries, particularly vehicle batteries.

It is well known that on a morning following a very cold night a vehicle will not start or may start only with some difficulty. One of the reasons for this is that the cold weather performance of lead-acid batteries is poor. A vehicle battery often cannot deliver enough power to start the vehicle, especially if the battery is cold and not in a good condition and/or not fully charged. If a vehicle has been used primarily for short journeys then such journeys do not allow the vehicle battery sufficient time to recharge, and consequently starting from cold, particularly in cold weather, can prove problematic.

If the vehicle is located convenient to a domestic mains supply then a conventional charger can be used to charge the battery in situ. In many cases, however, this is not the case and the only solution then is to remove and transport the battery to a location convenient to a mains supply. Clearly this is an inconvenience and since a vehicle battery is usually heavy the task can be arduous.

There are several battery powered devices available that use various techniques to boost or recharge a flat vehicle battery, the most common of these being the parallel - series connection of batteries. These generally consist of two high power batteries of a lower voltage than the vehicle battery, typically six volts, connected in parallel for charging from a twelve volt vehicle system via current limiting devices. These batteries are then switched to be in series to provide the twelve volts which is then available for either boost charging a flat battery or for jump-starting the vehicle. This technique involves the use of a high current in operation, in the order of amps or even tens of amps. Provided a vehicle battery is not defective, it has been found that to a large degree the above problems can be mitigated by subjecting the vehicle battery to a trickle charge overnight or for one or two hours at a higher charge prior to use. It has been found that the trickle charging of a battery in such a fashion maintains the battery in a suitable condition for cold weather starting. It is believed that a small trickle current does not charge the battery to any appreciable degree, but is sufficient to keep the electrolyte active and thus

maintain the efficiency of the battery.

A general object of the present invention is to provide an improved apparatus for charging batteries, and which is capable of maintaining the efficiency of batteries. The invention is of particular relevance to a battery for a vehicle especially for a vehicle subject to adverse weather conditions.

According to the invention there is provided an apparatus for charging a vehicle battery in-situ, comprising a power source unit comprising one or more re-chargeable electrical cells, and preferably providing a voltage no greater than the voltage of the vehicle battery; a controller for regulating the current and/or voltage delivered to the vehicle battery; and switch means operable to change the output from the controller between a lower trickle charge mode and a higher boost current mode. In the case where the power source unit is composed of a number of cells these may be arranged in series or in parallel.

The invention provides an apparatus which is preferably self-contained and independent of the mains supply yet serves to charge a vehicle battery in situ. Although the apparatus employs a power source unit, itself in the form of one or more re-chargeable batteries

or cells, it is capable of delivering a voltage at two current levels sufficient to be able to either trickle or boost charge a vehicle battery with both currents below one ampere. The apparatus can thus trickle charge a battery over a longer period of time or can charge a battery at a higher level for a shorter period of time. The controller regulates, inter alia, the current and/or voltage applied between the power source unit and the vehicle battery. The apparatus can be provided with another switch means to selectively connect the power source unit to a vehicle battery through the controller in order that the vehicle battery may be charged or to connect the vehicle electrical system to the power source unit via the controller so that the power source can itself be charged as well as the vehicle battery or to connect the power source unit to another charging power source. If the voltage of the power source is lower than that of the battery the controller must also step-up the voltage of the apparatus to a level suitable for trickle charging the battery.

The apparatus is preferably compact and light in weight so that in the event of the power source of the apparatus requiring charge further to that as provided by the vehicle, the apparatus may easily be removed from

the vehicle for external charging, by for example a charger connected to a domestic electrical supply. The apparatus may also include a mains powered charger or transformer-rectifier circuit for this purpose.

Conveniently a cigarette lighter socket or other auxiliary electrical socket of the vehicle is employed for electrically connecting the apparatus with the electrical system of the vehicle. Preferably a polarity detecting means is provided together with means for automatically reversing the polarity of the interface between the apparatus and the electrical system of the vehicle.

The apparatus may employ an indicator, such as a (LED) light emitting diode, to give a visual indication that the power source unit is in a state of readiness and fully charged.

The invention may be understood more readily and various other features of the invention may become apparent from consideration of the following description.

Embodiments of the invention will now be described by way of examples only, with reference to the accompanying drawings wherein:

Figure 1 is a block schematic diagram representing one embodiment of the invention; and

Figure 2 is a block schematic diagram representing another embodiment of the invention.

Figure 3 is a perspective view of the first embodiment of the present invention.

As shown in Figure 1, an apparatus constructed in accordance with the invention is composed of a self-contained power source unit 1 containing one or a number of proprietary re-chargeable cells or batteries with an input/output 2 enabled with a two position function select switch 3 with terminals 3' 3" connected to a controller 4. The controller 4 is connected through terminals 3"' 3"" of the switch 3 via a polarity-charging switch 6 and leads 15 to some form of connector 7 providing an input/output interface with the apparatus. A connector 8 leads to means 21 for recharging the unit 1 from an external supply other than that of the vehicle. The connector 8 can be a mains connector and the means 21 can comprise a conventional mains transformer and rectifier circuit. Alternatively the connector 8 may be a socket receiving a plug with a d.c. charging voltage from a separate charger.

A sensor 9 is used to detect the local ambient temperature, and, in conjunction with the controller 4,

adjusts the rate of current flow. An indicator 10, typically in the form of a light emitting diode (LED), displays the charging state of the internal power source unit 1.

The controller 4 serves to regulate the charging current and/or voltage supplied to the connector 7 as well as the charging current supplied back to the power source unit 1 in dependence on the position of switch 3. With the switch 3 in the first position a with the terminals 3" and 3"' connected through the switch 3 and when no electrical external connections have been made, the apparatus is in an off state. However, the internal power source unit 1 may be recharged whilst the switch 3 is in this first position a). More particularly, when an external charging source is connected via the connector 8, or the connector 7 is connected to a vehicle battery circuit, say via an auxiliary electrical socket of the vehicle then the battery or batteries of the internal power source unit 1 can be recharged. Typically the auxiliary electrical socket is a cigarette lighter socket. The connector 7 can however be replaced by clip connectors (not shown) which can be directly connected to a vehicle battery. The polarity change switch 6 may be used if the polarity of connector 7 needs reversing to

match the polarity of vehicle's earth.

With the switch 3 in the second position b and the terminals 3' and 3" connected through the switch 3 connection is made with the vehicle battery and charging of the vehicle battery can take place. In this mode the apparatus can deliver a trickle charge current which is preferably used overnight or for a few hours prior to the vehicle being used.

The controller 4 has another switch 11 which can be used to boost the current delivered by the controller 4 for a limited time. This is useful when there is insufficient time to provide a few hours trickle charge. Typically, on trickle charge, the charge current delivered by the apparatus of the present invention is of the order of 25 to 150 milliamps (mA) whilst in the boost mode the charge current is between 150 and 500 milliamps (mA). Provision can be made so that in the event of the internal power source 1 being discharged to a preset level, the apparatus will switch off automatically thus preventing the internal power source unit 1 from being discharged to too great an extent.

In the version of the apparatus shown in Figure 2, the same reference numerals have been used as in Figure 1. The various switching modes are here selected by

electromechanical or electronic switches 3, 6, 11 instead of manual switches 3, 6, 11. The switches are controlled by a microprocessor 12 which is programmed to set up predetermined operational cycles. A key pad 13 co-operating with a display 14 can be used to vary the operation of the apparatus. A polarity detecting means 6 determine the polarity of the vehicle's auxiliary socket in relation to the leads 15 of the apparatus and alters the polarity of the leads 15 automatically if the detected polarity is incorrect. Since not all vehicles are equipped with a negative earth, this feature may avoid expensive disablement of a vehicle's electrical system.

The key pad 13 can also be used to set up the boost function with the switch 11. Although the LED 10 is shown in Figure 2 this function can also be taken over by the display 14.

Figure 3 shows a perspective view of a housing 16 of the first embodiment but many modifications may be made. Preferably, the dimensions are such that the apparatus may conveniently be placed in a glove-box or under a seat. Typically the base dimensions of the housing 16 are 8 cm x 16 cm and the height 5 cm.

CLAIMS

1. An apparatus for charging a vehicle battery in-situ, comprising a power source unit comprising one or more re-chargeable electrical cells, a controller for regulating the current and/or voltage delivered to the vehicle battery; and switch means operable to change the output from the controller between a lower trickle charge mode and a higher boost current mode.
2. An apparatus according to Claim 1, wherein the current delivered by the apparatus in either mode is below one ampere.
3. An apparatus according to Claim 1 or 2, wherein the current delivered to the battery when the output of the controller is at the lower trickle charge mode is of the order of 25 to 150 milliamps.
4. An apparatus according to Claim 1, 2 or 3, wherein the current delivered to the battery when the output of the controller is at the higher boost charge mode is of the order of 150 to 500 milliamps.
5. An apparatus according to any one of Claims 1 to 4, and further comprising a second switch means for connecting the power source unit to the vehicle battery to enable energy to be transferred from the unit to the

vehicle battery or to enable energy to be transferred to the unit from either the vehicle charging system or another charging system.

6. An apparatus according to any one of the preceding claims wherein the electrical cells of the power source unit are low power proprietary rechargeable batteries.

7. An apparatus according to Claim 6, wherein the proprietary batteries comprise dry rechargeable cells.

8. An apparatus according to any one of the preceding claims and further comprising another or a third switch means for changing the polarity of the interface between the apparatus and the electrical system of the vehicle.

9. An apparatus according to Claim 8 and further comprising a polarity detecting means which actuates the other or third switch means automatically.

10. An apparatus according to any one of the preceding claims and further comprising a microprocessor for controlling the operation of the apparatus over various time cycles and a key pad and display for setting up the functions of the microprocessor.

11. An apparatus according to any one of the preceding claims wherein there is provided indicating means to indicate the condition of charge of the power source unit.

12. An apparatus according to any one of the preceding claims and further comprising transforming and rectifying means to enable the power source to be recharged from a domestic electrical supply.

13. An apparatus according to any one of the preceding claims further comprising temperature sensing means which can vary the rate of charging depending on the ambient temperature.

14. An apparatus according to any one of the preceding claims, wherein the power source unit provides a voltage no greater than the voltage of the vehicle battery.

15. An apparatus substantially as described with reference to and as illustrated in Figure 1, 2 or 3 of the accompanying drawings.

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Examiner's report to the Comptroller under
Section 17 (The Search Report)

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Relevant Technical fields

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(ii) Int CI (Edition 5) F02N 11/08, 11/12, 11/14;
H02J 7/00, 7/14, 7/34

Search Examiner

M J BILLING

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

6 MAY 1993

Documents considered relevant following a search in respect of claims 1 TO 14

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X, P	GB 2254205 A (COLE) whole document; published 30 September 1992	1 at least
Y	EP 0229722 A2 (YANG) eg see figures 1, 2, 15, 16, 20	1,5 to 14 at least
Y	EP 0152118 A2 (ENERGY EXCHANGE) eg see figures 1, 2, 3; page 10 lines 10-11	1,5 to 14 at least
X, Y	US 4847545 (REID) eg see Abstract, column 9 lines 9-17; figure 1	X: 1 Y: 5 to 14 at least
Y	US 4831321 (COOPER) eg see figure 6	1,5 to 14 at least
Y	US 4638236 (BUSCH) eg see Abstract, column 1 lines 12-14; figure 1	1, 5 to 14 at least
X, Y	US 4233552 (BAUMBACH) eg see column 3 line 30 - column 4 line 49	X: 1 Y: 5 to 14 at least

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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