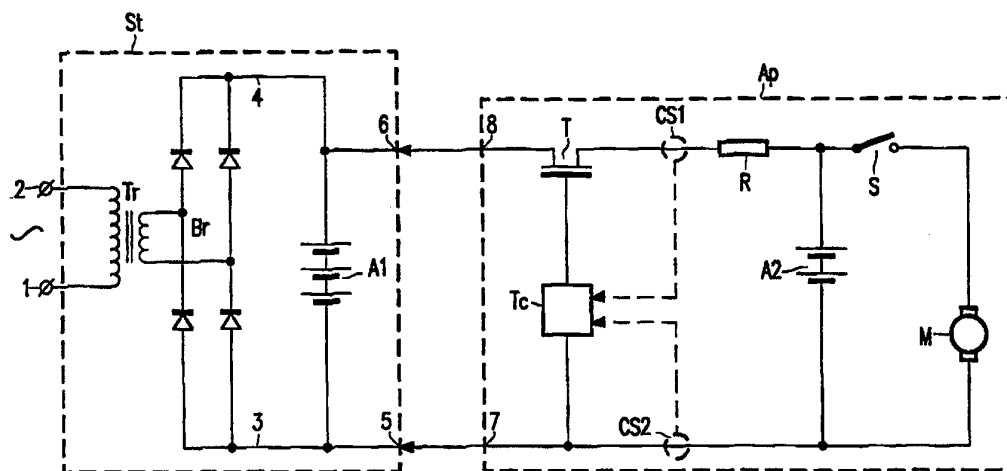




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(54) Title: COMBINATION OF AN ELECTRICAL APPLIANCE AND AN ASSOCIATED STAND



(57) Abstract

A combination of an electrical appliance (Ap) with a rechargeable battery (A2) and an associated stand (St). The stand includes a buffer battery (A1) which is charged comparatively slowly from the mains supply and which charges the appliance battery comparatively rapidly when the appliance has been placed into the stand.

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Combination of an electrical appliance and an associated stand.

The invention relates to a combination of a hand-held appliance including a rechargeable battery and an associated stand adapted to charge said rechargeable battery and comprising for this purpose first electrical connection means for connecting the stand to a mains supply and second connection means for connecting the appliance to the stand.

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Such a combination of an appliance and an associated stand is known, for example from the rechargeable beard trimmer type HS075 put on the market by the Applicant. Hand-held electrical appliances, such as for example shavers, epilators, toothbrushes, drills, torches and the like are often constructed as cordless appliances, thus
10 allowing the appliance to be handled without hindrance by the mains cord and thereby improving its convenience for the user. The electric power required for such appliances is obtained from the rechargeable battery present in the appliance. Subsequently, after use of the appliance, the battery is recharged by placing the appliance into the stand, the electric power being taken from the mains supply connected to the first electrical connection means
15 and being supplied to the rechargeable battery in the appliance via the second electrical connection means. The stand or the appliance will generally include an ac/dc converter (rectifying circuit) to reduce the a.c. mains voltage and convert this alternating voltage into a direct voltage suitable for charging the battery.

Charging the battery from the mains supply requires some time, during
20 which the appliance should remain in the stand and, as a consequence, cannot be used. This is experienced as a serious drawback of said appliances if this charging time is (too) long. Generally, the capacity of the rechargeable battery will be adequate to power the appliance for at least one normal period of use. However, quick charging of the battery may be desirable in the case of an extremely long period of use or in the case of several rapidly
25 succeeding periods of use, or in the case that the appliance has not been in use for a longer time and has not been replaced in the stand, causing the battery to be drained by self-discharging.

This means that charging from the mains supply should be effected with a high power. A first problem of this is that mains supplies in washrooms often have only a

limited power rating (for example 15 VA) for safety reasons. A second problem is that the required ac/dc converter should then have a substantially higher power rating and consequently becomes too expensive and bulky.

5 It is an object of the invention to provide a combination of the type defined in the opening paragraph, which substantially reduces the charging time of the rechargeable battery of the appliance while the power drained from the mains supply is limited to a considerable degree and to this end, in accordance with the invention, the combination of a hand-held electrical appliance provided with a rechargeable battery is
10 characterized in that the stand includes a rechargeable buffer battery having a higher rated voltage than the rechargeable battery of the appliance, which buffer battery is connected to the first electrical connection means so as to be charged comparatively slowly from the mains supply, and is connected to the second electrical connection means so as to charge the rechargeable battery of the appliance comparatively rapidly from the buffer battery when the
15 appliance has been placed into the stand. By placing the appliance in the stand both batteries can then be connected in a low-impedance parallel arrangement via the second connection means of the stand, as a result of which a rapid charge transfer from the buffer battery to the appliance battery is obtained in a simple manner.

 Preferably, the combination of an electrical appliance and an associated
20 stand in accordance with the invention is further characterized in that the capacity (in mAh) of the rechargeable battery of the appliance is smaller than the capacity (in mAh) of the buffer battery in the stand. The use of a buffer battery in the stand enables the appliance battery to be charged more rapidly. As a result, it is less important that the storage capacity of the appliance battery is adequate for a large number of periods of use. By choosing a
25 comparatively low capacity for this battery, for example adequate for three periods of use, the desired short charging time of this battery can be achieved by means of a comparatively small charging current.

 Preferably, the combination of an electrical appliance and an associated
stand in accordance with the invention is further characterized in that the rechargeable
30 battery of the appliance comprises a first number of series-connected storage cells and in that the buffer battery of the stand comprises a second number of series-connected storage cells, which second number is larger than the first number. It is then possible to use storage cells of the same voltage rating (for example 1.2 V), the required higher voltage rating of the buffer battery being simply obtained by the larger number of cells of the buffer battery.

In order to prevent the appliance battery from being overcharged, the combination in accordance with the invention is preferably characterized in that the appliance comprises a timing circuit which controls the charging process of the rechargeable battery, which timing circuit is controlled in dependence upon the charging current and the
5 discharging current of this battery.

A numerical example is given to elucidate the invention. It is assumed that a shaver comprises two series-connected 1.2 V rechargeable storage cells of 1200 mAh each. To charge each of these cells in 10 minutes a power is needed of $2 * 1.2 * 1.2 * 60/10 = 17.3$ W. This power already exceeds the power rating of the mains supply in washrooms,
10 which is limited for safety reasons. Moreover, this power requires a bulky and expensive converter and a charging time of 10 minutes is, in fact, too long for a user waiting for his shaver to be charged.

When the invention is utilized the stand for a shaver may comprise a buffer battery of three series-connected 1.2 V rechargeable batteries of 1200 mAh each.
15 Normally, the stand is continuously connected to the mains supply. If it is desired for the buffer battery to be charged in, for example, 12 hours, the required charging power for the buffer battery is $3 * 1.2 * 1.2 * 1/12 = 0.36$ W. This power can readily be supplied by any safety mains supply and requires a very simple and cheap converter. The shaver comprises a rechargeable battery of two series-connected 1.2 V rechargeable storage cells of 100 mAh
20 each. This capacity is adequate for about three shaves. As soon as this shaver with an empty battery is put into the stand the 2.4 V shaver battery is charged from the 3.6 V buffer battery. The shaver battery is then charged in, for example 1 minute with a current of $0.1 * 60 = 6$ A from the buffer battery, the power thus drained from the buffer battery being replenished from the mains supply in one hour.

25 Battery chargers by means of which a battery is charged from the accumulator battery of a vehicle are known from various publications, for example United States Patent 4,638,236. However, no reference is made to an appliance with an associated stand adapted specifically to charge the appliance. Moreover, these publications do not contain any indication that the battery is charged more rapidly than the vehicle battery.
30 United States Patent 3,646,422 discloses a threshold circuit formed by a zener diode arranged between the appliance battery and the vehicle battery. This threshold circuit prevents the appliance battery from being charged by the vehicle battery when the electrical system of the vehicle does not supply any power. Therefore, owing to the threshold circuit, the vehicle battery cannot function as a buffer for charging the appliance battery.

The invention will now be described in more detail with reference to the Figure, which shows a combination of an electrical appliance provided with a rechargeable battery and an associated stand in accordance with the invention.

5 The Figure shows diagrammatically the stand St. This stand comprises a mains transformer Tr having a primary winding connected to first connection means 1 and 2 for connection to an a.c. mains supply. A secondary winding of the transformer Tr is connected to a bridge rectifier Br which comprises four rectifier diodes and which supplies the transformed and rectified mains voltage across two rectifier output terminals 3 and 4. The stand further includes a buffer battery A1 comprising three series-connected storage cells and
10 having its positive terminal connected to the rectifier output terminal 4 and its negative terminal to the rectifier output terminal 3. The negative and the positive terminal of the buffer battery are also connected to the connection terminals 5 and 6, respectively, which form the electrical connection means of the stand St to an appliance Ap.

15 The appliance Ap comprises connection terminals 7 and 8, which establish a connection with the respective connection terminals 5 and 6 of the stand when the appliance is placed into the stand. The positive connection terminal 8 is connected to the drain electrode of a FET switching transistor T, which has its source electrode connected, via a resistor R, to the positive terminal of a rechargeable battery A2 comprising two series-
20 connected storage cells and, via an actuating switch S, to one terminal of a motor M. The other terminal of the motor M and the negative terminal of the rechargeable battery A2 are connected to the negative connection terminal 7. A timing circuit Tc is arranged between the gate electrode of the FET switching transistor T and the negative connection terminal 7. Current sensors CS1 and CS2, shown in broken lines, supply information about the charging
25 current of the rechargeable battery A2 measured by CS1 and the discharging current measured by CS2 to the timing circuit Tc. S is the actuating switch and M is the drive motor of the appliance Ap. If the appliance is for example a torch the lamp should take the place of the motor M. The function of the FET switching transistor can alternatively be performed by any other type of electrically controlled switch, for example a relay.

30 The combination shown in the Figure operates as follows.

 With the mains supply connected to the connection terminals 1 and 2 the buffer battery A1 is charged via the transformer Tr and the bridge rectifier Br. This charging proceeds slowly, for example in a period of 12 hours, owing to the comparatively high internal resistance of the mains supply and/or the transformer Tr. Consequently, this can be

a small and cheap part.

When the appliance Ap with its empty battery A2 is placed in the stand the battery A2 is charged rapidly from the buffer battery A1 and via the conductive FET switching transistor T. The resistor R of, for example, 100 mΩ in series with the FET switch
5 T serves to keep the charging current defined to some degree, i.e.: less dependent on the contact resistance of the connection means between the stand and the appliance.

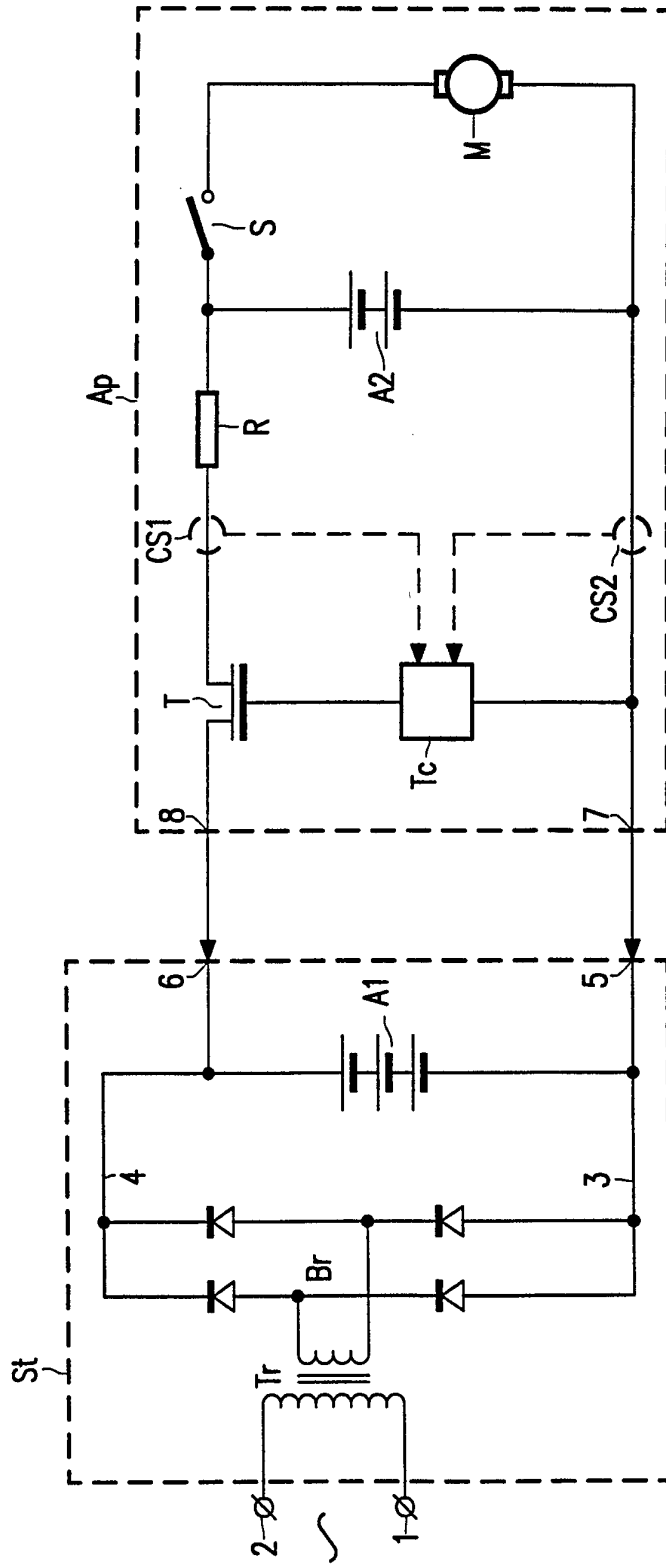
The charging process of the battery A2 is controlled by the timing circuit Tc, which stops or temporarily interrupts the charging process of A2 by turning off the FET switching transistor T. For this purpose, the timing circuit Tc comprises an "energy-
10 management" circuit, which monitors the charge condition of the battery A2 by means of the charging current measured by the current sensor CS1 and the discharging current measured by the current sensor CS2. The current sensors can be formed by small sensing resistors of, for example, 70 mΩ, across which a measurement voltage is produced depending on the current flowing through them, which voltage is transferred to the timing circuit Tc. The
15 "energy-management" circuit used in the embodiment shown by way of example in the Figure, is known per se, for which reference is made to the IC SAA1501T described in the Data Sheet published by Philips Semiconductors in december 1994.

Preferably, the timing circuit is designed in such a manner that once the battery A2 has been charged, for example, for 80%, rapid charging of this battery changes to
20 slower charging. This can be achieved in that the FET switch T is alternately turned on and turned off by means of pulses supplied by the timing circuit Tc. When the battery A2 is in the fully charged condition the duty cycle of these pulses can be further reduced so as to obtain a small trickle-charging current, which compensates for the self-discharge of the battery A2. As an alternative, it is also possible to arrange a suitable resistance across the
25 switch T in order to provide the trickle-charging current to the battery A2.

The rated voltage of the buffer battery A1 is higher than that of the rechargeable battery A2, so that A2 is charged directly from A1 via the FET switch. Otherwise, a dc-dc converter would be required between the two batteries. As described in the introduction, the capacity (the number of mAh) of the storage cells of A2 is preferably
30 selected smaller than that of the storage cells of A1 in order to ensure that the cells of A2 are charged at an adequate rate with a current which is not too large. The buffer battery A1 uses for example cells of 1200 mAh and the battery A2 uses cells of 100 mAh. An average shave requires approximately 30 mAh, so that the capacity of A2 is adequate for about three shaves and the battery A2 can be charged about 12 times from the buffer battery A1 if by any
35 chance no mains power is available.

Claims:

1. A combination of a hand-held appliance including a rechargeable battery and an associated stand adapted to charge said rechargeable battery and comprising for this purpose first electrical connection means for connecting the stand to a mains supply and second connection means for connecting the appliance to the stand, characterized in that the stand (St) includes a rechargeable buffer battery (A1) having a higher rated voltage than the rechargeable battery (A2) of the appliance (Ap), which buffer battery is connected to the first electrical connection means (1, 2) so as to be charged comparatively slowly from the mains supply, and is connected to the second electrical connection means (5, 6) so as to charge the rechargeable battery of the appliance comparatively rapidly from the buffer battery when the appliance has been placed into the stand.
2. A combination as claimed in Claim 1, characterized in that the capacity (in mAh) of the rechargeable battery (A2) of the appliance is smaller than the capacity (in mAh) of the buffer battery (A1) in the stand.
3. A combination as claimed in Claim 1 or 2, characterized in that the rechargeable battery (A2) of the appliance comprises a first number of series-connected storage cells and in that the buffer battery (A1) of the stand comprises a second number of series-connected storage cells, which second number is larger than the first number.
4. A combination as claimed in Claim 1, characterized in that the appliance comprises a timing circuit (Tc) which controls the charging process of the rechargeable battery (A2), which timing circuit is controlled in dependence upon the charging current and the discharging current of this battery.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB 96/00816

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6: H02J 7/02, H01M 10/44 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC6: H02J, H01M		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
WPIL		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 2458053 A (GES GESELLSCHAFT FÜR ELEKTRISCHEN STRASSENWERKEHRMBH), 10 June 1976 (10.06.76), page 3, line 1 - page 5, line 6 --	1-4
A	EP 0468241 A2 (BRAUN AKTIENGESELLSCHAFT), 29 January 1992 (29.01.92), abstract, see abstract, figure -- -----	1-4
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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A- 2458053	10/06/76	NONE	
EP-A2- 0468241	29/01/92	DE-A- 4022642	23/01/92