

Candidate's Answer Paper

Rechargeable battery and charger for the Use there with

The present invention relates to rechargeable battery packs and to chargers for use with such battery packs.

Battery packs are used as power sources for portable electrical appliances and are normally of the rechargeable type for reasons of economy.

Formerly it was usual to provide a specific battery pack for each particular appliance, so that an appliance could only be powered by a single, specifically designed battery pack. The reason for this was that, frequently, the manufacturer of the appliance wanted to hinder use of battery packs from other manufacturers that could compromise proper operation of the appliance.

Now the tendency is to have a set of interchangeable battery packs for each appliance. Each battery pack of the set is suitable for powering the appliance but differs from the other battery packs of the set as regards the rechargeable cells included therein, which have different weights and capacities and thus also different prices. However the different battery packs of a set all have the same housing so as to be interchangeable. For example, a mobile telephone could be powered by three different interchangeable battery packs: a first "standard" pack with cells of low capacity, high weight and low price, a second "light" pack with cells of low capacity, low weight and higher price, and a third "premium" pack with cells of high capacity, low weight and still higher price. Since the different battery packs of a set include different rechargeable cells, they require different charging programmes, each of which is specifically adapted to the particular rechargeable cells included in the battery pack.

Thus it is necessary to be able to identify the different battery packs of a set, all of which have the same housing, in order to select the particular charging programme which is particularly adapted to the rechargeable cells of a particular battery pack. However, it is not easy to detect the type of the rechargeable cells ~~14~~ included in a battery pack by performing measurements at terminals ~~16~~ and ~~18~~ which constitute the only available access to the cells ~~14~~.

Document D2 discloses a battery charger and battery pack combination which seeks to overcome this problem by providing each battery pack with a visible identification sign that is printed on the housing of the battery pack so that it can be clearly seen, even when the battery is in the charger. The associated charger has a manually rotatable selection knob which must be adjusted by the operator to the position corresponding to the battery pack inserted therein prior to charging.

A problem associated with the charger and battery pack combination disclosed in D2 is that it relies on the user making the correct selection on the dial of the charger appropriate for the pack to be charged, an assumption which is not always a safe one to make. It may, for example, be the case that an old pack has become worn resulting in the identification on its casing having been worn off, or the identification may be concealed by dirt or the like. Similarly, the identification on the dial of the charger may be obscured or worn off over time.

The object of the present invention is to provide a rechargeable battery pack and a charger for use therewith which further reduces the possibility of charging a battery pack wrongly.

Accordingly, the present invention provides a rechargeable battery pack as claimed in claim 1.

The present invention further provides a battery charger as claimed in claim 6.

The rechargeable battery pack and battery charger in accordance with the invention has the advantage that selection of the charging programme is carried out automatically by the electronics of the battery charger and not by the user, so any chance of selection of the wrong programme is eliminated.

One particularly advantageous development of the invention is the arrangement of the charging circuitry in claim 9, in which the voltage across a charging battery pack is continuously monitored and the charging programme adjusted so as to achieve optimum charging.

Claims

1. A rechargeable battery pack (1) comprising a housing (12) containing at least one rechargeable cell (14) connected between first and second charging terminals (16,18) which are accessible from outside of the housing (12), characterised in that the battery pack (1) includes a third terminal (22) accessible from outside the housing (12) which is connected to an electronic identification means (20) contained within the housing (12) for providing an electronic battery identification signal indicative of the type of charging required for the pack (1), which signal may be used by a battery charger automatically to determine and select the charging programme appropriate for the pack (1).
2. A rechargeable battery pack (1) as claimed in claim 1, wherein the electronic identification means (20) is connected between the third terminal (22) and one of said first and second terminals(16,18).
3. A rechargeable battery pack (1) as claimed in claim 1, wherein the battery pack (1) includes a fourth terminal which is accessible from outside the housing (12), the electronic identification means being connected between the third (22) and fourth terminals.
4. A rechargeable battery pack as claimed in any of the preceding claims, wherein the electronic identification means (20) is a resistor, capacitor or the like whose value is indicative of the type of battery pack (1).
5. A rechargeable battery pack as claimed in any of claims 1 to 3, wherein the electronic identification means is an integrated circuit.
6. A battery charger (4) for use with a rechargeable battery pack (1) as claimed in any of the preceding claims, comprising means (48) for connecting to a power supply, charging circuitry and first and second charging output terminals (42,44), respectively, which output terminals (42,44), in use, connect to corresponding first and second charging terminals (16,18) of the rechargeable battery pack (1) for providing a charging current thereto; characterised in that the charger includes a third terminal (46) which, in use, connects to the third terminal (22) of the battery pack (1), and connected to said third terminal (46) of the charger (4), electronic detecting means (50,58) for detecting the electronic identification signal of the pack (1), whereby the charger (4) automatically distinguishes between different battery packs (1) and automatically selects the appropriate charging programme.
7. A battery charger as claimed in claim 6, wherein the electronic detecting means (50,58), when connected to a battery pack (1), has a voltage across the indicative of the type of battery pack (1) which is used by the charging circuitry to identify the battery pack (1) and select the charging programme accordingly.

8. A battery charger as claimed in claim 7, wherein the detecting means (50,58) is connected to a source of constant voltage within the charger and forms, with the electronic identification means of the pack (1), a voltage divider, by which means the voltage indicative of the pack (1) type is developed across the detecting means (50,58).
9. A battery charger as claimed in any of claims 6 to 8, further including measuring means for measuring the voltage across the battery pack (1) during charging, the course of the charging programme being varied by the charging circuitry during charging in response to the voltage measured across the battery pack (1) so as to provide optimum charging of the battery pack (1).
10. A battery charger as claimed in any of claims 7 to 9, wherein the charger further includes an analogue to digital convertor (58) which receives at its input a measured voltage and converts this to a digital value which is provided to a microcomputer (56), the microcomputer (56) selecting and/or varying the course of different charging programmes stored therein in response to the digital value received.

Note to the Examiner:

I believe that the provision within the charger of circuitry to monitor the voltage across the battery pack during charging and vary the charging programme in response to the measured voltage in order to achieve optimum charging warrants independent protection.

Accordingly, the client is advised that a second application should be filed with a claim generally directed to a battery charger having means for monitoring the voltage across the battery pack and means for automatically adjusting the charging programme in response to the measured voltage, so as to achieve optimum charging.