**Title:** CARRY CASE ASSEMBLY FOR A PORTABLE ELECTRICAL DEVICE

A carry case assembly (100) capable of supplying electrical energy to a portable electrical device (110) is disclosed. The carry case assembly (100) includes a first set of contacts (102) which are electrically connected to battery (202) which is also part of the carry case assembly (100). When a portable electrical device (110) such as a radio is placed in the carry case (100), contacts on the radio mate with the contacts (102) on the carry case. Once the contacts have mated, an electrical connection is formed, and electrical energy flows from the battery (202) to the radio.
FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AT</td>
<td>Austria</td>
<td>ES</td>
<td>Spain</td>
<td>MG</td>
<td>Madagascar</td>
</tr>
<tr>
<td>AU</td>
<td>Australia</td>
<td>FI</td>
<td>Finland</td>
<td>ML</td>
<td>Mali</td>
</tr>
<tr>
<td>BB</td>
<td>Barbados</td>
<td>FR</td>
<td>France</td>
<td>MN</td>
<td>Mongolia</td>
</tr>
<tr>
<td>BE</td>
<td>Belgium</td>
<td>GA</td>
<td>Gabon</td>
<td>MR</td>
<td>Mauritania</td>
</tr>
<tr>
<td>BF</td>
<td>Burkina Faso</td>
<td>GB</td>
<td>United Kingdom</td>
<td>MW</td>
<td>Malawi</td>
</tr>
<tr>
<td>BG</td>
<td>Bulgaria</td>
<td>GN</td>
<td>Guinea</td>
<td>NL</td>
<td>Netherlands</td>
</tr>
<tr>
<td>BJ</td>
<td>Benin</td>
<td>GR</td>
<td>Greece</td>
<td>NO</td>
<td>Norway</td>
</tr>
<tr>
<td>BR</td>
<td>Brazil</td>
<td>HU</td>
<td>Hungary</td>
<td>PL</td>
<td>Poland</td>
</tr>
<tr>
<td>CA</td>
<td>Canada</td>
<td>IT</td>
<td>Italy</td>
<td>RO</td>
<td>Romania</td>
</tr>
<tr>
<td>CF</td>
<td>Central African Republic</td>
<td>JP</td>
<td>Japan</td>
<td>SD</td>
<td>Sudan</td>
</tr>
<tr>
<td>CG</td>
<td>Congo</td>
<td>KP</td>
<td>Democratic People’s Republic</td>
<td>SE</td>
<td>Sweden</td>
</tr>
<tr>
<td>CH</td>
<td>Switzerland</td>
<td>KR</td>
<td>Republic of Korea</td>
<td>SN</td>
<td>Senegal</td>
</tr>
<tr>
<td>CI</td>
<td>Côte d’Ivoire</td>
<td>LI</td>
<td>Liechtenstein</td>
<td>SO</td>
<td>Soviet Union</td>
</tr>
<tr>
<td>CM</td>
<td>Cameroon</td>
<td>LK</td>
<td>Sri Lanka</td>
<td>TD</td>
<td>Chad</td>
</tr>
<tr>
<td>CS</td>
<td>Czechoslovakia</td>
<td>LU</td>
<td>Luxembourg</td>
<td>TG</td>
<td>Togo</td>
</tr>
<tr>
<td>DE+</td>
<td>Germany</td>
<td>MC</td>
<td>Monaco</td>
<td>US</td>
<td>United States of America</td>
</tr>
</tbody>
</table>

+ Any designation of “SU” has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.
10 Carry Case Assembly For A Portable Electrical Device

Technical Field

This invention relates generally to the field of carry case assemblies for portable electrical devices, and more specifically, to a carry case assembly which includes a battery for supplying electrical energy to a portable communication device.

Background

In portable battery powered electrical device applications, there is a great need for batteries which have high capacities and small size. Portable electrical devices such as portable battery powered hand tools, portable radios, pagers, transportable cellular telephones, and other similar portable electrical devices would all benefit from batteries having higher capacities and smaller sizes. The greater the energy storage (capacity) a battery possesses, the greater is the amount of time the device user can use the device without having to recharge or replace the battery.

In some portable radio applications the need for high capacity batteries is critical (i.e. police officers, firemen). A major problem with high capacity batteries is that they are normally larger in size and weigh more than a comparable standard capacity battery. The larger the battery used in a communication device, the more obtrusive the device becomes to the user, due to the added weight and size of the larger battery.
The demand for higher capacity batteries for use in portable communication devices has been increasing in recent years, due mainly in part to the increased technological sophistication of modern day communication devices (i.e. addition of synthesizers, increased use of microprocessors, etc.). The added features of modern day communication devices have increased substantially the current drain of these devices, thereby requiring higher capacity batteries for the same amount of radio usage.

A large percentage of portable communication devices such as portable radios are carried in carry case assemblies, which are normally attached to the radio user's clothing. The carry cases allow the radio users to store away the radios while the radio users go about doing other activities. The radios tend to be carried in the carry case assemblies for the majority of the time the radios are being used. The radio communication device user normally removes the radio from the carry case only when he needs to speak into the radio in order to transmit a message. A carry case assembly which could increase the battery capacity of a radio when the radio is placed in the carry case would be very beneficial. This would give a portable communication device a longer battery life, while maintaining or decreasing the size of the communication device battery. Having an extra battery source which could supply electrical energy to the radio while in the carry case would be very beneficial.

**Summary of the Invention**

Briefly, according to the invention, a carry case assembly which can supply electrical energy (current) to a portable electrical device is disclosed.

In one aspect of the present invention the carry case assembly includes a battery which is retained inside the carry case assembly. The battery is connected to a set of contacts which make contact to a portable electrical device, once the communication device is placed in the carry case. This allows the battery to supply electrical energy to the electrical device.
In another aspect of the invention, the carry case assembly contains two sets of contacts which are connected to a rechargeable battery. One set of contacts mate with a portable communication device, allowing the battery to power the device. The second set of contacts, allows the carry case battery (this assumes the battery is a rechargeable type) to be charged by a battery charger while still inside the carry case assembly.

**Brief Description of the Drawings**

Fig. 1a is a drawing of a carry case assembly in accordance with the present invention.

Fig. 1b is a rear view of Fig. 1.

Fig. 2a is a side view of Fig. 1.

Fig. 2b is a schematic representation of a carry case assembly in accordance with the present invention.

Fig. 3a is a drawing of an alternate carry case assembly in accordance with the present invention.

Fig. 3b is a rear view of Fig. 3a.

Fig. 4a is a second alternate carry case assembly in accordance with the present invention.

Fig. 4b shows a cut away view of the adjustable battery receptacle of Fig. 4a.

Fig. 5 is a block diagram of a portable communication device coupled to the present invention.

**Detailed Description of the Preferred Embodiment**

Referring to Fig. 1a, a carry case assembly 100 in accordance with the present invention is shown. Carry case assembly 100 is suitable for use with a portable electrical device such as a portable radio 110. Other portable electrical devices such as cellular telephones, pagers, electric hand tools, etc. can also use the present invention. Preferably, the portable electric devices are powered by rechargeable batteries.

The carry case assembly 100 comprises a means for supporting a portable electric device, such as portable radio retainer 106. Radio retainer 106 allows a radio 110 to slide
through it and be retained in place. The carry case assembly 100 includes a main housing 108, preferably made out of a material having a substantial structural integrity, such as polycarbonate. The housing 108, and radio retainer 106 could preferably be designed using one molded piece of polycarbonate. The housing 108, could be designed out of almost any other type of material which displays some structural rigidity.

The housing 108, includes a first set of contacts 102 on the external surface of housing 108. Illustrated in Fig. 1a are four contacts 102, preferably only two are required. Contacts 102 mate to contacts on the portable radio 110 when the portable radio 110 is placed into the carry case assembly 100. The carry case assembly 100, also includes a means for attaching the carry case to the body of the radio user such as a belt loop 104 which can be looped around the users belt. Other commonly used methods of attachment include belt clips, hook and loop attachments, and other well known attachment methods.

Referring now to Fig. 1b, a rear view of the carry case assembly 100 is shown, and is depicted as 200. A second set of contacts 112 are shown in the rear of housing 108. The optional set of contacts 112, are used for charging the battery (not shown) that is part of carry case assembly 100.

A side view of a carry case assembly 200 is shown in Fig. 2a. Shown is battery storage area 206 which is part of housing 108. The battery storage area 206 is used to retain battery 202 inside of housing 108. Preferably, a conventional snap fit lid 204 can be used to seal battery pack 202 inside the housing 108, thereby retaining the battery 202. Housing 108 can be molded over battery 202 thereby sealing battery 202 into the housing 108.

Fig. 2b shows an electrical schematic depicting the connection of the battery pack 202 with the first and second set of contacts 102 (shown as 216,218) and 112 (shown as 220, 222, 224, and 226), respectively. The first set of contacts 102 act as a connecting means electrically connecting battery 202 to radio 110, allowing battery 102 to supply electrical energy (current) to radio 110. Battery 202 is preferably comprised of a plurality of
battery cells connected in series. Preferably, each of the battery cells is a rechargeable NiCd cell with a voltage of 1.25 volts. Preferably, the total voltage of the battery pack 202 should be at least 1.25 volts greater than the voltage of the battery which is found on radio 110. For example, if the battery of radio 110 is a 7.5 volt NiCd rechargeable battery then the battery pack 202 should have a voltage of at least 8.75 volts. This would allow for current (electrical energy) to flow from battery pack 202 to radio 110, while the radio 110 is resting in the carry case assembly 100. The voltage differential between the battery pack 202 and the radio battery allows the radio to use the electrical energy found in the battery pack 202. This effectively increases the battery capacity that the radio 110 can rely on while in the carry case 100. Since the extra battery pack 202 is part of the carry case 100, the weight of the battery pack 202 is not as noticeable to the radio user since it is normally carried on the users waist area. Also, the fact that the battery is preferably built into the carry case 100, it will not increase the size of a standard carry case by much.

In schematic of Fig.2b other electrical circuit elements are shown, which preferably are part of battery pack 202. The positive terminal of battery pack 202 is shown connected to diode 208 which is in turn connected to terminal point 216. Terminal point 216 is connected to one of the contacts 102 and couples the positive terminal of battery 202 to radio 110. Diode 208 prevents any discharging of current from the battery on radio 110 into battery 202. This could occur in the situation where battery 202 would be at a lower voltage potential than the communication device battery. Diode 208 also protects battery 202 against the connection of the positive and negative terminals of battery 202 to a device in reverse polarity order. The negative terminal (ground) of battery 202 is connected to terminal point 218 which in turn mates to radio 110 since it is connected to one of the contacts 102. Terminal points 216, and 218, are electrically connected to the set of contacts 102 that are shown in Fig. 1a. The configuration of the contacts of the portable communication
device 110 which mate to contacts 102, will determine on which of the contacts 102 each terminal point (216, 218) is connected to. Contacts 102 in turn are electrically coupled to radio 110 once the radio 110 is in the carry case 100. The radio 110 will preferably be friction fit by retainer 106 allowing the radio contacts to mate to contacts 102. The contacts 102 can preferably be made out of any conductive material known in the art. The contacts 102 could also be spring loaded, thereby guaranteeing a better electrical connection between the contacts.

Once contacts 102 mate to the contacts on radio 110 this allows for battery 202 to supply electrical energy to the radio 110, since both the positive and negative terminals of battery 202 are connected (216, 218). Preferably, radio 110 would include a battery which would normally supply power to the radio under normal operation. In this case, when the radio is placed in the carry case 100, the radio battery 110 would be in parallel to battery 202, and since battery 202 would be at a slightly higher voltage potential current would flow to the battery in the radio 110. The difference of voltage between the two batteries will be controlled by the communication device 110 by the use of a conventional input voltage regulator circuit.

Also shown in Fig. 2b are terminal points 220, 222, 224, and 226, which correspond to the second set of contacts 112 in Fig. 1b. The second series of contacts 112 are employed to interface battery 202 to a a battery charger (not shown) whenever battery 202 is of the rechargeable type such as a NiCd (Nickel Cadmium) battery. Other types of rechargeable types of batteries could also be used with the present invention. Nonrechargeable types of batteries can also be utilized with the present invention, such as alkaline and other similar types. Nonrechargeable types are not preferred with the present invention due to the fact that they can not be recharged. Diode 212 which is connected between the positive terminal of battery 202 and terminal point 220 has a selected polarity which prevents the energy in battery 202 to be discharged into the battery charger (not shown). Terminal point 224 is electrically connected to the negative
(ground) terminal of battery 202 allowing for connection of found to the battery charger. Optional coding resistor 214 which is connected between the negative terminal of battery 202 and terminal point 222, can be used to inform the battery charger of the capacity of battery 202. The value of resistor 214 is arbitrarily selected to indicate the capacity of battery 202 to the charger so that the charger can send the appropriate magnitude of charging current to the battery. For example, assigning a value of 1000 ohms to resistor 214 would indicate to the charger that the battery 202 exhibits a capacity of 1000 mA·h (milli-amp-hours). The charger which can be coupled to terminal point 222, senses the value of resistor 214, determines the capacity of battery 202, and then sends the appropriate amount of charging current via terminal points 220, and 224. When a battery charger is coupled to battery 202 it must make a determination of when it is appropriate to discontinue charging. To facilitate this determination, battery 202 is provided with a thermistor 210 coupled between the negative battery terminal (ground) 224 and terminal point 226. As battery charging progresses, the temperature of battery 202 rises until it reaches a temperature at which charging is complete. To proceed higher than this temperature would indicate that the battery is overcharged perhaps resulting in substantial battery damage. To prevent such overcharging, the charger (not shown) is coupled to terminal point 226 to permit the charger to sense the resistance of thermistor 210, and thus determine the temperature of the battery. When the charger determines that a battery temperature is reached which indicates that the battery is fully charged, then charging is discontinued. The second series of contacts 112 (220, 222, 224, and 226) are preferably located in the rear of the housing 108 in order to facilitate placement of the carry case into the charger. Contacts 112 mate with a similar set of contacts which are found in the battery charger. One could preferably be able to charge battery 202 which is inside of the carry case 200, and also the battery in the communication device at the same time. This could
be done by leaving the communication device 110 in the carry case 200 while inserting the carry case 200 into a battery charger.

Fig. 3a shows an alternate embodiment of the present invention. Carry case assembly 300 includes a communication device support 306 which gives a communication device added support while in the carry case 300. Similar to carry case 100, carry case 300 includes a first set of contacts 304, portable radio retainer 302, and belt loop 308.

Fig. 3b is a rear view of carry case 300, showing a second set of contacts 310 (similar to contacts 112 in Fig. 1b) which allow for the carry case assembly 300 to be placed in a battery charger (not shown), thereby allowing the battery pack inside the carry case 300 to be charged.

Fig. 4a shows a second alternate embodiment of the present invention. Carry case assembly 400 includes a moveable radio support 402 which allows the carry case 400 to be enlarged or retracted in order to accommodate radios having different sizes. The adjustable support 402, allows radios having different heights to make contact with the set of contacts 406 found in the carry case 400. Once the correct height has been established for the adjustable support 402, it can be held in place by the use of fasteners, built in mechanical stops, or other mechanical methods known in the art.

Fig. 4b is a cut away view of Fig. 4a showing the moveable radio support 402 which includes a reel mechanism 410, similar to the one disclosed in U.S patent 4,091,318 entitled "Charger/Converter Console With Reel Arrangement" by Eichler et al. the disclosure of which is hereby incorporated by reference. Reel 410, allows a flexible printed circuit board 408 to adjust in length thereby allowing the adjustable radio support 402 to be adjusted.

Fig. 5 is a block diagram of a portable communication device 502 coupled to a carry case assembly 506. The communication device 502 is shown having a battery 504 which is electrically coupled to the communication device 502 via power bus 510 which includes connections for the positive and negative
terminals of battery 504. An example of a communication device having a battery would be a conventional battery powered FM two-way radio. The carry case assembly 506 is shown coupled to the communication device battery 504 via power bus 508, which includes connections from the positive and negative terminals of the device battery 504, and the battery in carry case assembly 506. The coupling of the carry case 506 and the communication device battery 504 occurs when the communication device is placed into the carry case 506 and the radio battery contacts mate with the contacts in the carry case 506. Finally, if the battery (not shown) which is part of the carry case assembly 506 is of the rechargeable type (such as a NiCd battery) then the carry case 506 can be placed into a conventional battery charger 512 and recharged via power bus 514. This would occur by placing the carry case assembly 506 into the battery charger 512. The set of contacts in the carry case 506 would then mate with contacts in the battery charger 512, thereby charging the battery inside of the carry case 506.

While the present invention has been described with specific embodiments, it is evident that many alternatives, and modifications will be apparent to those skilled in the art. Accordingly, it is intended that the present invention embrace all such alternatives, modifications, and variations as fall within the broad scope of the appended claims.

What is claimed is:
Claims

1. A carry case assembly for a portable electrical device, which can supply electrical energy to a portable electrical device, comprising:
   a battery;
   a housing capable of retaining the battery;
   a means for supporting the portable electrical device; and
   a connecting means for electrical coupling the battery to the portable electrical device allowing the battery to supply electrical energy to the portable electrical device.

2. A carry case assembly in accordance with claim 1, wherein the connecting means further comprises a first set of contacts which couple the battery to the portable electrical device.

3. A carry case assembly in accordance with claim 2, wherein the battery is of the rechargeable type.

4. A carry case assembly in accordance with claim 2, wherein the portable electrical device is a portable radio.

5. A carry case assembly in accordance with claim 2, wherein the housing further comprises a second set of contacts which are electrically connected to the at least one battery cell and are used for coupling a charging means to the at least one battery cell.

6. A carry case assembly in accordance with claim 2, wherein the housing assembly includes an adjustable electrical device receptacle area.

7. A carry case assembly in accordance with claim 3, further comprising a second set of contacts which allow the battery to be coupled to an external battery charger.
8. A carry case assembly for a portable communication device, which can supply electrical energy to a portable communication device having a battery, comprising:
   a rechargeable battery;
   a housing capable of retaining the rechargeable battery;
   a means for supporting the portable communication device; and
   a connecting means for electrical coupling the rechargeable battery to the portable communication device battery, the connecting means having a first set of contacts which couple the rechargeable battery to the portable communication device battery.

9. A carry case assembly in accordance with claim 8, wherein the housing further comprises a second set of contacts which are electrical connected to the rechargeable battery and which can be used to couple the rechargeable battery to an external battery charger.

10. A carry case assembly for a portable communication device which can supply electrical energy to a portable communication device having a battery, comprising:
    a rechargeable battery, with the battery having a greater voltage potential than the portable communication device battery;
    a housing capable of retaining the battery, and also allowing for the removal of the battery;
    a means for supporting the portable communication device; and
    a connecting means for electrical coupling the rechargeable battery to the portable communication device battery, the connecting means having a first set of contacts which couple the rechargeable battery to the portable communication device battery, and a second set of contacts which electrically couple the rechargeable battery to an external battery charger.
INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/07087

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): HD4B 1/08, 1/38
U.S. CL.: 455/90, 351

II. FIELDS SEARCHED

Minimum Documentation Searched 7

<table>
<thead>
<tr>
<th>Classification System</th>
<th>Classification Symbols</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>455/89, 90, 344, 347, 348, 349, 351</td>
</tr>
</tbody>
</table>

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 9

III. DOCUMENTS CONSIDERED TO BE RELEVANT 8

<table>
<thead>
<tr>
<th>Category 9</th>
<th>Citation of Document, 11 with indication, where appropriate, of the relevant passages 12</th>
<th>Relevant to Claim No. 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US, S, D292,975 (KOBAYASHI) 01 December 1987, See entire document.</td>
<td>1</td>
</tr>
<tr>
<td>Y</td>
<td>US, A, 4,879,759 (MATSUMOTO ET AL) 07 November 1989, See figures 2A-12D.</td>
<td>2</td>
</tr>
<tr>
<td>X</td>
<td>US, A, 4,876,552 (ZAKMAN) 24 October 1989, See entire document.</td>
<td>2-10</td>
</tr>
<tr>
<td>Y</td>
<td>US, A, 4,829,224 ((GANDELMAN ET AL.) 09 May 1989, See entire document.</td>
<td>2-10</td>
</tr>
</tbody>
</table>

* Special categories of cited documents: 10

"A" document defining the general state of the art which is not considered to be of particular relevance.

"E" earlier document but published on or after the international filing date.

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified).

"O" document referring to an oral disclosure, use, exhibition or other means.

"P" document published prior to the international filing date but later than the priority date claimed.

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention.

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step.

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"Z" document member of the same patent family.

IV. CERTIFICATION

Date of the Actual Completion of the International Search 06 JANUARY 1991

Date of Mailing of this International Search Report 22 JAN 1992

International Searching Authority

Signature of Authorized Officer

ISA/US

LISA CHAROUCEL

Form PCT/ISA/210 (second sheet) (Rev.11-87)