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[54] **METHOD AND APPARATUS FOR CHARGING A BATTERY**

[75] Inventors: **William A. Gabehart**, Fort Worth; **Mario A. Riveron**, Keller, both of Tex.

[73] Assignee: **Motorola, Inc.**, Schaumburg, Ill.

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[51] **Int. Cl.**[7] **H02J 7/00**

[52] **U.S. Cl.** **320/103**; 320/114

[58] **Field of Search** 320/103, 114

[56] **References Cited**

U.S. PATENT DOCUMENTS

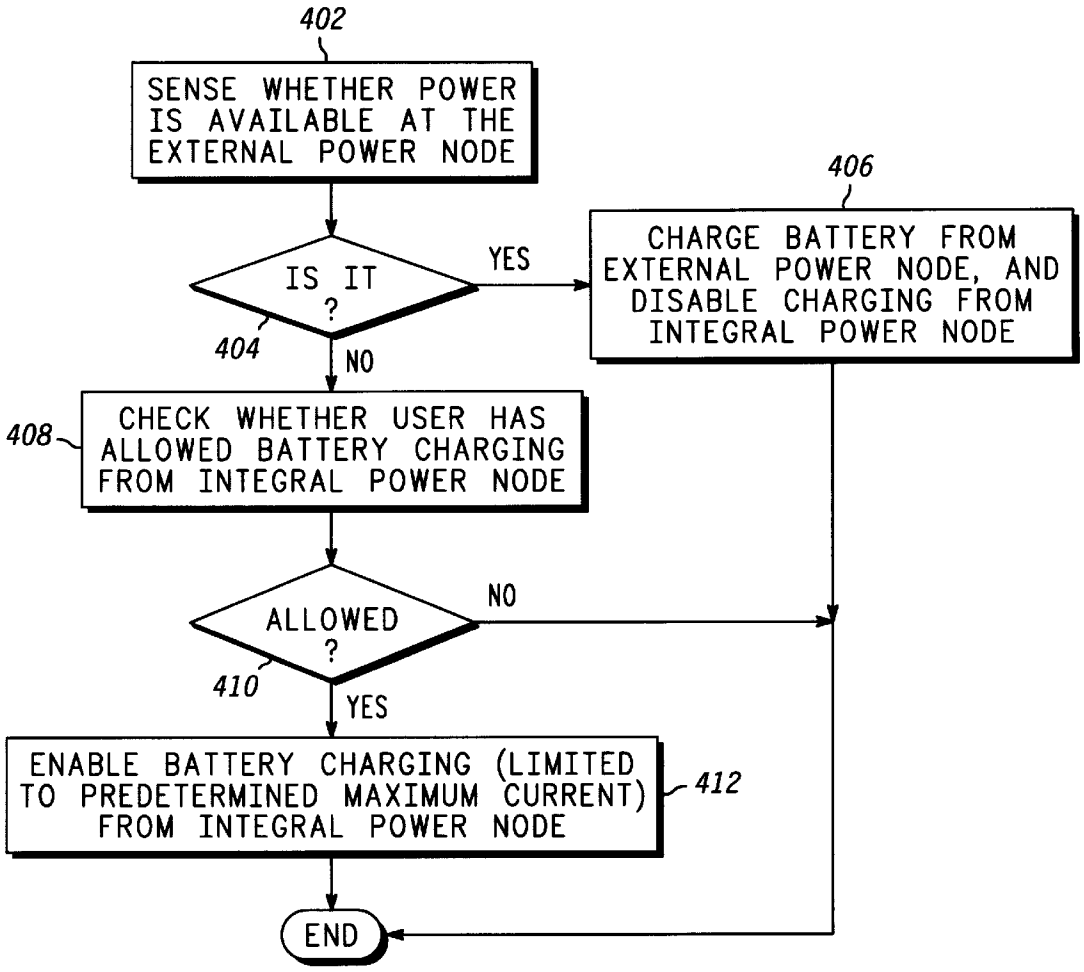
4,673,861	6/1987	Dubovsky et al.	455/575
5,675,813	10/1997	Holmdahl	713/310
5,926,006	9/1999	Burroughs et al.	320/114
6,044,280	3/2000	Muller	455/572

Primary Examiner—Peter S. Wong
Assistant Examiner—Pia Tibbits
Attorney, Agent, or Firm—R. Louis Breeden

[57] **ABSTRACT**

A portable communication device **(300)** powered by a battery **(210)** has an external connector **(202)** that includes an external power node **(220)** and a data bus **(204)** having an integral power node **(218)**. A processing system **(228)** of the device senses **(402)** whether power is available at the external power node, and controls a charging switcher **(216)** to charge **(406)** the battery from the external power node whenever power is available at the external power node. The processing system enables **(412)** battery charging from the integral power node when power is not available at the external power node.

15 Claims, 3 Drawing Sheets



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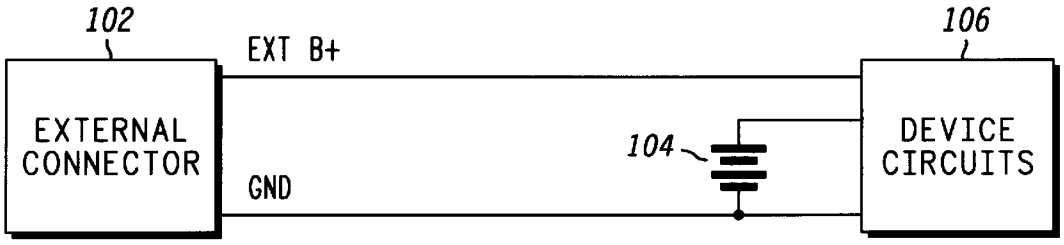

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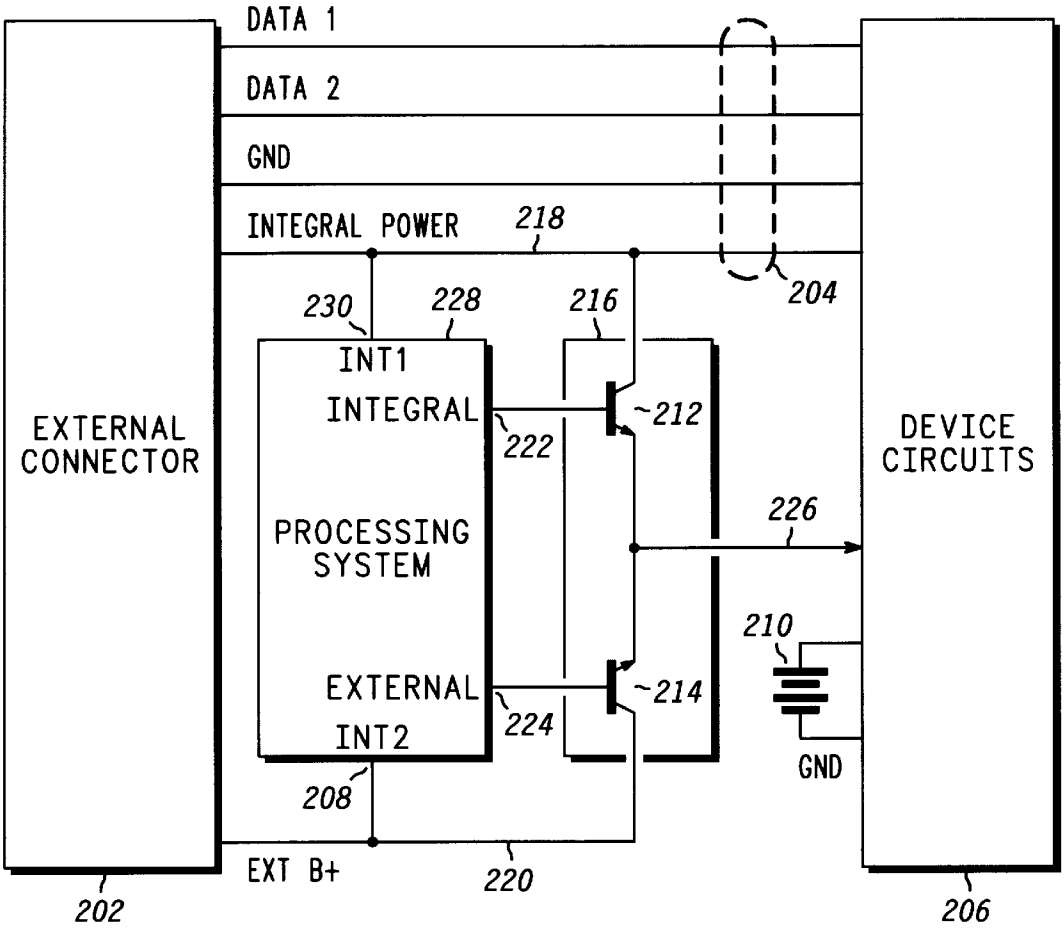
FIG. 1
-PRIOR ART-

FIG. 2



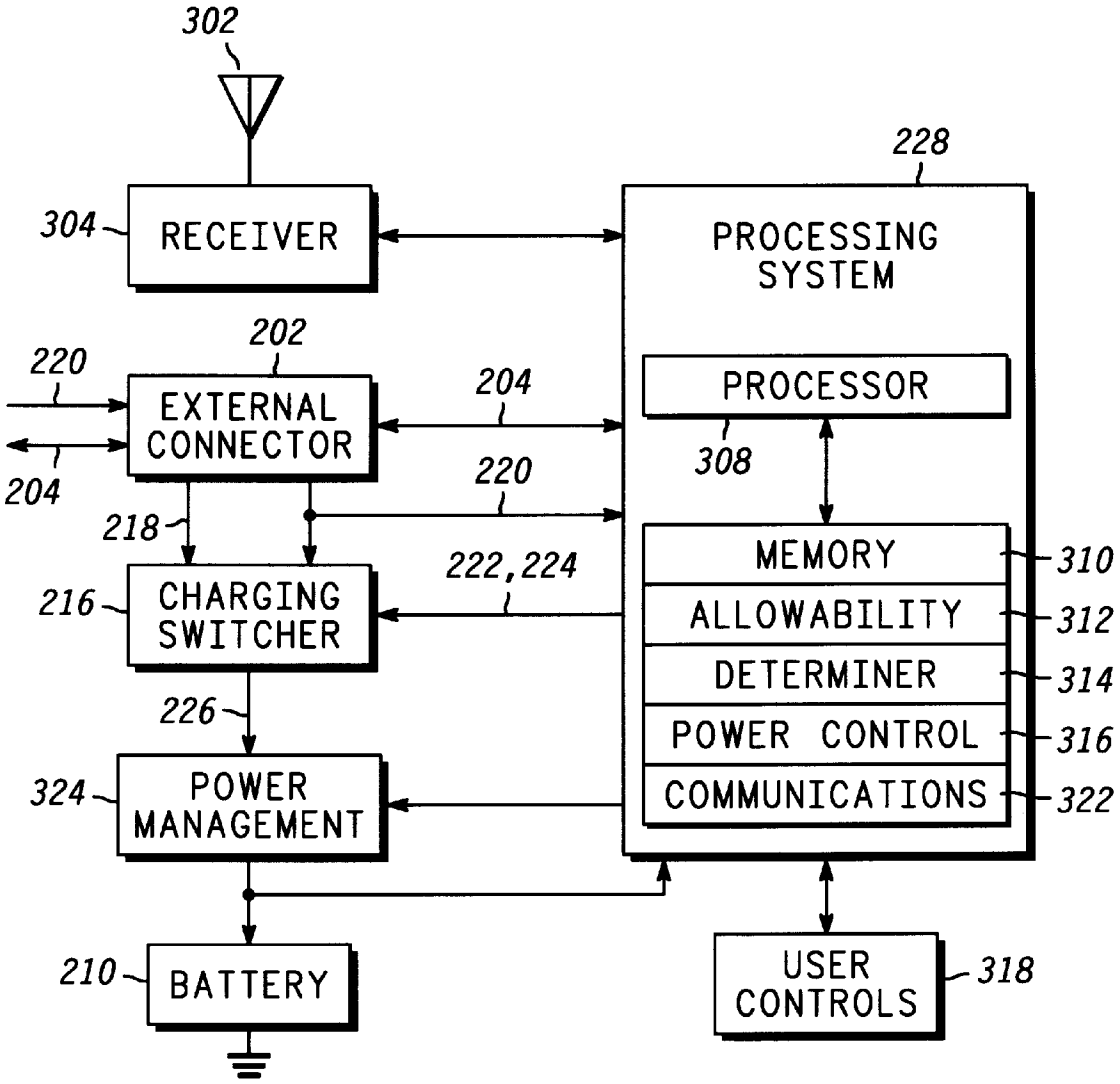


FIG. 3

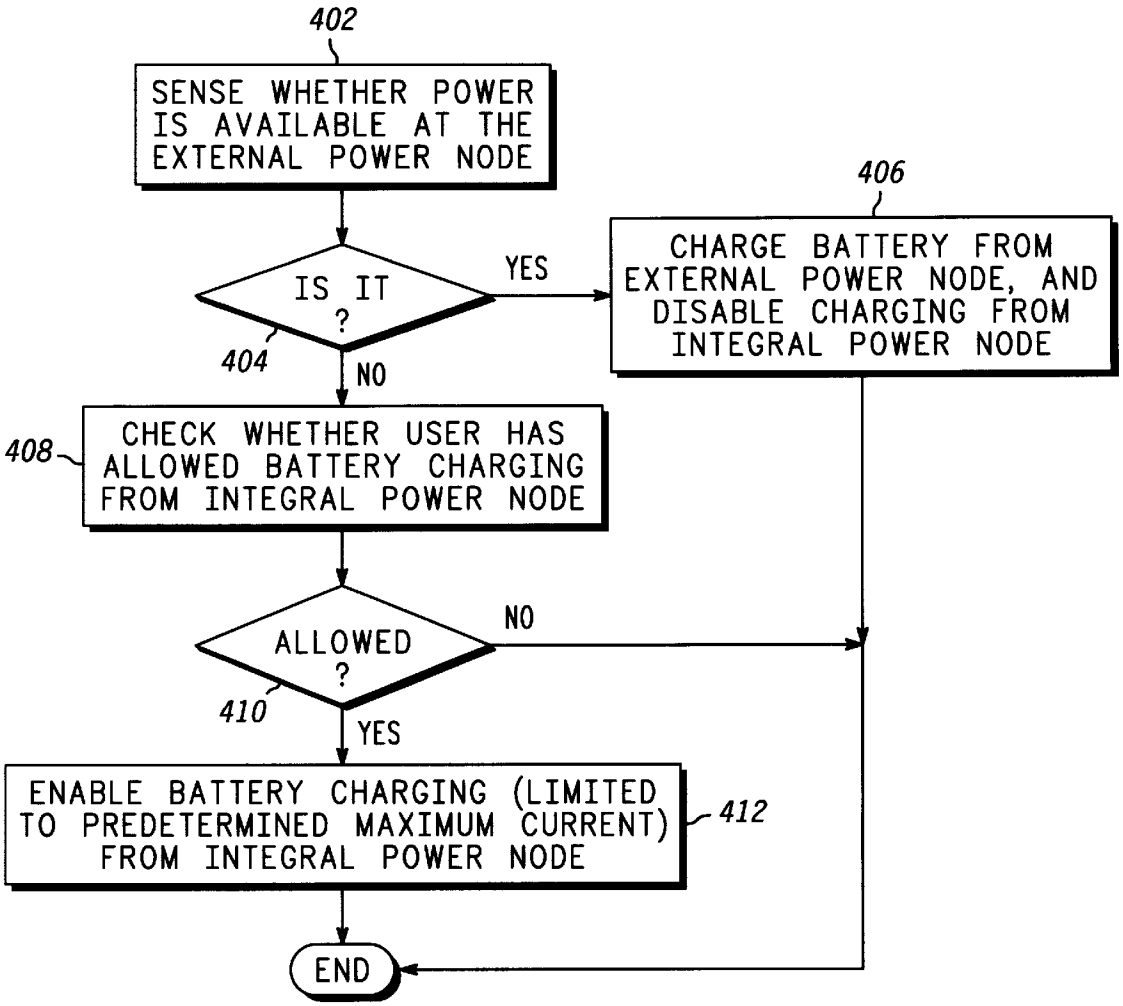


FIG. 4

METHOD AND APPARATUS FOR CHARGING A BATTERY

FIELD OF THE INVENTION

This invention relates in general to battery chargers, and more specifically to a method and apparatus for selectively charging a battery in a portable communication device from an integral power node of a data bus.

BACKGROUND OF THE INVENTION

Battery chargers are well known. Such devices generally receive power from a standard AC electrical outlet and convert the power into a proper DC voltage for recharging a battery. There can be times, however, when it is inconvenient or impossible to use a prior-art battery charger to recharge a battery in a portable communication device. For example, when one is travelling, there may be no suitable power outlet for powering the prior-art battery charger, or one may not have brought the battery charger along on the trip.

Thus, what is needed is an alternative method and apparatus for recharging a battery. Preferably, the alternative method and apparatus will not require an AC power outlet or a battery charger, but will utilize power from another device to which the portable communication device can be coupled.

SUMMARY OF THE INVENTION

An aspect of the present invention is a method for charging a battery in a portable communication device having an external connector that includes an external power node and a data bus having an integral power node. The method comprises the steps of sensing whether power is available at the external power node, and charging the battery from the external power node whenever power is available at the external power node. The method further comprises the step of enabling battery charging from the integral power node when power is not available at the external power node.

Another aspect of the present invention is an apparatus for charging a battery in a portable communication device having an external connector that includes an external power node and a data bus having an integral power node. The apparatus comprises a sensor for sensing whether power is available at the external power node, and charging circuitry coupled to the sensor for charging the battery from the external power node whenever power is available at the external power node. The apparatus further comprises enabling circuitry coupled to the sensor for enabling battery charging from the integral power node when power is not available at the external power node.

Another aspect of the present invention is a portable communication device. The portable communication device comprises a receiver for receiving a message, and a processing system coupled to the receiver for processing the message. The portable communication device further comprises an external connector including an external power node and a data bus having an integral power node. The portable communication device also includes an apparatus for charging a battery. The apparatus comprises a sensor for sensing whether power is available at the external power node, and charging circuitry coupled to the sensor for charging the battery from the external power node whenever power is available at the external power node. The apparatus further comprises enabling circuitry coupled to the sensor for enabling battery charging from the integral power node when power is not available at the external power node.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an electrical block diagram of a prior-art battery charging apparatus.

FIG. **2** is a simplified electrical block diagram of a first embodiment of a battery charging apparatus in accordance with the present invention.

FIG. **3** is an electrical block diagram of a portable communication device comprising a second embodiment of the battery charging apparatus in accordance with the present invention.

FIG. **4** is a flow chart depicting the operation of the battery charging apparatus in accordance with the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. **1** is an electrical block diagram of a prior-art battery charging apparatus, comprising an external connector **102** for providing an external B^+ charging power and ground supplied from a external charging element. In the prior-art battery charging apparatus, the external B^+ charging power and ground are coupled to a battery **104** through the device circuits **106** The device circuits **106** can include communication circuits powered from the battery **104** and circuits for regulating the charging voltage and/or current.

FIG. **2** is a simplified electrical block diagram of a first embodiment **200** of a battery charging apparatus in accordance with the present invention, comprising an external connector **202** that includes an external power node **220** and a data bus **204** having an integral power node **218**. The data bus **204** preferably meets the well-known Universal Serial Bus (USB) standards as defined in the Universal Serial Bus Specification Revision 1.1. The data bus **204** preferably includes differential data input/output (I/O) lines DATA **1** and DATA **2** and a ground reference GND, as well as the integral power node **218**, all of which are preferably coupled to the device circuits **206**. The Universal Serial Bus is commonly found on modern computers, including portable laptop computers, and other communication devices that have a need to exchange data with one another. It will be appreciated that, alternatively, other types of busses can be substituted for the USB.

Both the integral power node **218** and the external power node **220** preferably are coupled to a charging switcher **216**, which is coupled to a processing system **228**. The integral power node is coupled to a first interrupt port **230** of the processing system **228**, so that the processing system **228** can sense, through well-known techniques, whether power is available at the integral power node. The external power node **220** is coupled to a second interrupt port **208** of the processing system **228** so that the processing system **228** can sense, through well-known techniques, whether power is available at the external power node **220**. A first I/O port **224** of the processing system **228** is controlled by the processing system **228** to maintain a HIGH state, e.g., 5 volts, whenever power is available at the external power node **220**, and a LOW state, e.g., near zero volts, whenever power is not available at the external power node **220**. A second I/O port **222** of the processing system **228** is controlled by the processing system **228** to maintain a HIGH state whenever power is not available at the external power node **220**, and a LOW state whenever power is available at the external power node **220**. It will be appreciated that, alternatively, the processing system **228** can evaluate additional information, e.g., a user-programmed instruction, before changing the second I/O port **222** to a HIGH state.

A first transistor **214** is coupled between the external power node **220** and a charging node **226** preferably coupled

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