



- (51) **International Patent Classification:**  
*H02J 7/02* (2006.01) *H01F 38/14* (2006.01)  
*H02J 5/00* (2006.01)
- (21) **International Application Number:** PCT/IL2011/050066
- (22) **International Filing Date:** 15 December 2011 (15.12.2011)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:** 61/424,316 17 December 2010 (17.12.2010) US
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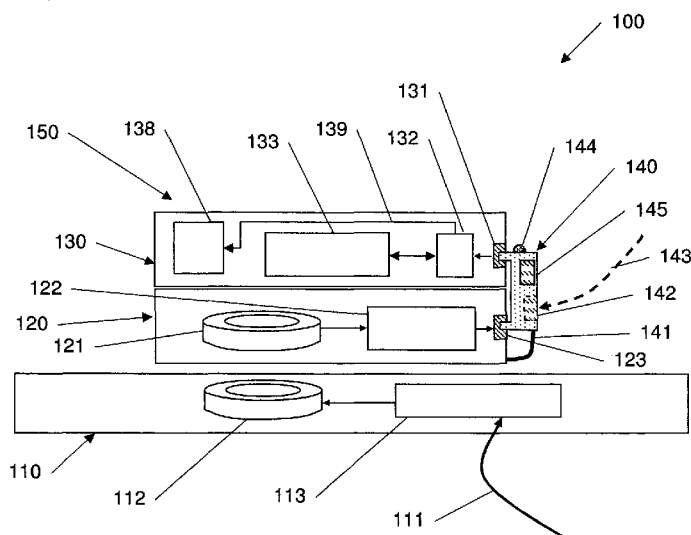
(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) **Title:** CHARGING ARRANGEMENT USING INDUCTIVE ENERGY TRANSFER



**Fig 1**

(57) **Abstract:** A bridge connector (140) for connecting inductively coupled power receiver (120) to a chargeable device (130) such as a mobile phone enables adopting an inductively coupled power receiver to a variety of chargeable device types with minimal or no modifications to the power receiver or to the chargeable devices. The inductively coupled power receiver receives power from a contactless induction coupled charger (110). The bridge connector has two electrical connectors for mating with the power receiver's output connector and the chargeable device's charging connector respectively. An indicator (144) on the bridge connector indicates battery charge level and charging progress. A fastener (141) prevents loosening the bridge connector by attaching it to the contactless chargeable device.

## CHARGING ARRANGEMENT USING INDUCTIVE ENERGY TRANSFER

### 5 FIELD OF THE INVENTION

Embodiments of the present disclosure relate to inductive power transmission systems. In particular the embodiments relate to a connector for connecting a receiver of an inductive power transfer system to a chargeable device.

### 10 BACKGROUND

Inductive power coupling allows energy to be transferred from a power supply to an electric load without a wired connection therebetween. An oscillating electric potential is applied across a primary inductor. This sets up an oscillating magnetic field in the vicinity of the primary inductor. The oscillating magnetic field may induce  
15 a secondary oscillating electrical potential in a secondary inductor placed close to the primary inductor. In this way, electrical energy may be transmitted from the primary inductor to the secondary inductor by electromagnetic induction without a conductive connection between the inductors.

When electrical energy is transferred from a primary inductor to a secondary  
20 inductor, the inductors are said to be inductively coupled. An electric load wired in series with such a secondary inductor may draw energy from the power receiver wired to the primary inductor when the secondary inductor is inductively coupled thereto.

Inductive power connectors for providing insulated electrical connection are known. For example United States Patent No. 7,210,940 to Baily et al. describes an  
25 inductive coupling for transferring electrical energy to or from a transducer and measuring circuit. Baily's system consists of a male connector having a single layer solenoid wound on a ferromagnetic rod and a female connector having a second single layer solenoid. By inserting the male connector into the female connector, the two solenoids are brought into alignment, enabling inductive energy transfer  
30 therebetween. This coupling provides a sealed signal connection without the disadvantages of having exposed contact surfaces.

United States Patent No. 7,164,255 to Hui. In Hui's system a planar inductive battery charging system is designed to enable electronic devices to be charged. The system includes a planar charging module having a charging surface on which a device to be charged is placed. Within the charging module, and parallel to the charging surface, is at least one, and optionally an array of primary windings that couple energy inductively to a secondary winding formed in the device to be charged. Hui's system also provides secondary modules that allow the system to be used with conventional electronic devices not supplied with secondary windings.

## 10 SUMMARY OF THE EMBODIMENTS

It is one aspect of the current disclosure to provide a bridge connector for connecting a chargeable device with a contactless inductively coupled power receiver, the bridge connector comprises: a body; a first connector for mating with charging connector of a chargeable device; and a second connector for mating with output connector of contactless inductively coupled power receiver, wherein said contactless inductively coupled power receiver receives power from a contactless charger and provides electrical power to said chargeable device through said bridge connector.

In some embodiments the bridge connector further comprising at least one indicator indicating charging parameters such as: battery charging in progress; battery charging complete; battery charging terminated before completion; low charging; rate; low level of battery charge; battery full; and battery malfunction.

In some embodiments the bridge connector further comprising a secondary connector for connecting external charger to said chargeable device (130) through said bridge connector.

In some embodiments the bridge connector further provides data exchange between said first connector and said secondary connector.

In some embodiments the body of said bridge connector further comprises at least one additional function.

In some embodiments at least one additional function is function such as: ID chip; and RFID chip.

In some embodiments the body of said bridge connector further comprises a local controller for interfacing said additional function with said chargeable device.

In some embodiments at least one additional function is functions such as: accelerometer; microphone; thermometer; magnetic compass; GPS; short range IR communication; short range RF communication; FM radio transmission; video interface; and additional memory.

In some embodiments the body of said bridge connector further comprises additional functions such as a camera; and a barcode reader.

In some embodiments the body of said bridge connector further comprises at least one slot for insertion of a removable card such as a memory card; and a secondary SIM card.

In some embodiments said bridge connector further comprises a power conditioning electronics such as DC to DC convertor; current limiter; and overvoltage protection.

It is another aspect of the current disclosure to provide a system for contactless charging a contactless chargeable device comprising: a contactless charger receiving power from household electrical outlet; and a contactless chargeable device comprising: a chargeable device; a contactless inductively coupled power receiver; and a bridge connector comprising: a body; a first connector for mating with charging connector of said chargeable device; and a second connector for mating with output connector of said contactless inductively coupled power receiver, wherein said contactless inductively coupled power receiver receives power from said contactless charger and provides electrical power to said chargeable device through said bridge connector.

In some embodiments the bridge connector further comprising at least one indicator indicating at least one charging parameter such as: battery charging in progress; battery charging complete; battery charging terminated before completion; low charging; rate; low level of battery charge; battery full; and battery malfunction.

In some embodiments the bridge connector further comprising a secondary connector for connecting external charger to said chargeable device through said bridge connector.

5 In some embodiments the bridge connector further provides data exchange between said first connector and said secondary connector.

In some embodiments the body of said bridge connector further comprises at least one additional function.

In some embodiments at least one additional function is a function such as: ID chip; and RFID chip.

10 In some embodiments the body of said bridge connector further comprises a local controller for interfacing said additional function with said chargeable device.

In some embodiments at least one additional function is a function such as: accelerometer; microphone; thermometer; magnetic compass; GPS; short range IR communication; short range RF communication; FM radio transmission; video  
15 interface; and additional memory.

In some embodiments the body of said bridge connector further comprises additional functions such as a camera; and a barcode reader.

In some embodiments the body of said bridge connector further comprises at least one slot for insertion of removable card such as a memory card; and a secondary  
20 SIM card.

In some embodiments said bridge connector further comprises a power conditioning electronics such as DC to DC convertor; current limiter; and overvoltage protection.

25 In some embodiments, said contactless inductively coupled power receiver further comprises additional battery.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present

disclosure, suitable methods and materials are described below. In case of conflict, the patent specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting.

## 5 BRIEF DESCRIPTION OF THE FIGURES

For a better understanding of the disclosure and to show how it may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings.

10 With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of selected embodiments of the present disclosure only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of embodiments of the disclosure. In this regard,  
15 no attempt is made to show structural details in more detail than is necessary for a fundamental understanding of the embodiments; the description taken with the drawings making apparent to those skilled in the art how the several forms of the disclosure may be embodied in practice. In the accompanying drawings:

Fig. 1 is a block diagram schematically showing the main elements of system for  
20 contactless charging a chargeable device according to an exemplary embodiment of the current disclosure.

Fig. 2A is a block diagram schematically showing the main elements of a contactless chargeable device according to another exemplary embodiment of the current disclosure.

25 Fig. 2B is a block diagram schematically showing the main elements of a contactless chargeable device according to another exemplary embodiment of the current disclosure.

Fig. 2C is a block diagram schematically showing the main elements of a contactless chargeable device according to another exemplary embodiment of the  
30 current disclosure.

Fig. 2D is a block diagram schematically showing the main elements of a contactless chargeable device having power standard matching connector according to yet another exemplary embodiment of the current disclosure.

5 Figure 3A schematically depicts a bridge connector for connecting two subunits of contactless chargeable device according to an exemplary embodiment of the current disclosure.

Figure 3B schematically depicts a bridge connector for connecting two subunits of contactless chargeable device according to another exemplary embodiment of the current disclosure.

10 Figure 4 schematically depicts a three-dimensional isometric view of contactless chargeable device according to an exemplary embodiment of the current disclosure.

Figure 5A schematically depicts a three-dimensional isometric partial view of contactless chargeable device according to another exemplary embodiment of the current disclosure.

Figure 5B schematically depicts a back view of contactless chargeable device seen in figure 5A.

Figure 5C schematically depicts a side view of contactless chargeable device seen in figure 5A and 5B.

20 Figure 6 schematically depicts some details of a bridge connector having additional functions according to an exemplary embodiment of the current disclosure.

#### DESCRIPTION OF SELECTED EMBODIMENTS

25 Before explaining at least one embodiment of the disclosure in detail, it is to be understood that the disclosure is not necessarily limited in its application to the details set forth in the following description or exemplified by the Examples. The disclosure is capable of other embodiments or of being practiced or carried out in various ways. The terms "comprises", "comprising", "includes", "including", and  
30 "having" together with their conjugates mean "including but not limited to". The term "consisting of" has the same meaning as "including and limited to". The term "consisting essentially of" means that the composition, method or structure may

include additional ingredients, steps and/or parts, but only if the additional ingredients, steps and/or parts do not materially alter the basic and novel characteristics of the claimed composition, method or structure. As used herein, the singular form "a", "an" and "the" include plural references unless the context clearly dictates otherwise. For example, the term "a compound" or "at least one compound" may include a plurality of compounds, including mixtures thereof. It is appreciated that certain features of the disclosure, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the disclosure, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable sub-combination or as suitable in any other described embodiment of the disclosure. Certain features described in the context of various embodiments are not to be considered essential features of those embodiments, unless the embodiment is inoperative without those elements.

In discussion of the various figures described herein below, like numbers refer to like parts. The drawings are generally not to scale. For clarity, non-essential elements were omitted from some of the drawing.

Fig. 1 is a block diagram schematically showing the main elements of system 100 for contactless charging a contactless chargeable device 150 according to an exemplary embodiment of the current disclosure.

A standard chargeable device 130 may be a communication device, telephone, a PDA, GPS, or other hand-held device such as personal entertainment unit such as a tablet computer, media player and the likes. Standard chargeable devices 130 are powered by a chargeable battery 133 that receives external power from an external power supply (not seen in this figure) via charging connector 131. charging connector 131 may be in the form of power plug used only for charging device 130, or may combine power and data as will discussed later. charging electronics 132 controls the charging and discharging operation of battery 133 and supplies power 139 to power the functional electronics 138 in chargeable device 130. For drawing clarity, no details of the functional electronics 138 or other functions or features of chargeable device 130 such as display, keyboard and the like are given herein. charging electronics 132 may perform one or more other functions such as conditioning the

voltage 139 supplied to the functional electronics 138 during the charge/discharge cycle of battery 133; protecting battery 133 against overcharging; protect battery 133 against over discharging; control charging rate; and provide indication as to the battery condition such as level of battery charge or battery faults.

5           In some modern mobile phones, Micro-USB interface is a new standard charging port. This miniature, 5 pins connector may, and often is used for other functions such as connecting the device 130 with external headset, interfacing to a host computer for data exchange and the like. It should be noted that most data exchange functions may be performed without using charging connector 131, by  
10       using short range RF link such as Wi-Fi or Bluetooth with which communication devices may be equipped. However, a variety of proprietary or standard connectors may be used by the independent manufacturers of chargeable devices 130 with a variety of proprietary or standard charging voltages and communication protocols.

          Connecting a wired charger to chargeable devices 130 may be inconvenient,  
15       time consuming and finicky due to the small size of charging connector 131, which may causes wear and tear to the connector. In order to convert a standard chargeable device 130 into a contactless chargeable device 150, a contactless inductively coupled power receiver 120 may be attached thereto. Although it is possible to integrate an inductively coupled power receiver within the chargeable devices, the inductively  
20       coupled power receiver may be retrofitted as an added option. Inductively coupled power receiver 120 ,may be manufactured by an external source, such as an original equipment manufacturer (OEM) other than the manufacturer of the chargeable device 130.

          Various inductively coupled power receivers are known in the art. For  
25       example:

          International patent application, publishing number WO2008093334,; titled "Pinless Power Coupling"; to Azancot, Yossi, et. al.; discloses a pinless power coupling arrangement for inductive power transmission across flat surfaces has pinless power jack and pinless power plug which are aligned by alignment unit and  
30       inductively coupled by flat insulating layer.

          International patent application, publishing number WO2009040807; titled "Inductive Power Transmission Platform"; to Azancot, Yossi, et. al.; discloses a

power module for providing power inductively to electrical load e.g. laptop computer, has secondary inductors that are wired to primary inductor whose location is adjustable.

United States patent application, publishing number US20100253282; titled  
5 "chargeable Inductive Power Outlet"; to Azancot, Yossi, et. al.; discloses a power supply system e.g. inductive charger for portable electrical device e.g. portable computer, has secondary inductor coil that is integrated into handle of accessory e.g. carrying case of electrical device.

The inductively coupled power receiver 120, comprises a secondary inductor  
10 such as a secondary coil 121. When the inductively coupled power receiver 120 is placed on or near contactless charger 110, a primary inductor such as a primary coil 112 which receives an oscillating voltage from an external power source 111, such as a mains line, electromagnetic cell or the like, via a driver 113, becomes inductively coupled to the secondary coil 121 in power receiver 120. Electric power generated by  
15 secondary coil 121 may be modified by power receiver electronics 122, such as a reception circuit or the like, to fit the needs of chargeable device 130. For example, power receiver electronics 122 may rectify AC power generated by secondary coil 121 and regulate its voltage.

Power source electronics 122 may perform other functions such as wirelessly  
20 communicating with contactless charger 110, for example to initiate, regulate and/or terminate power transmission from coil 112 to coil 121. Optionally, power receiver electronics 122 may monitor the status and charging progress of the battery 133 by monitoring the current and/or voltage at its power receiver output connector 123.

It should be realized that in order that contactless charging would become  
25 commercially economical and successful option, power receivers 120 may initially require adaptation to a large and rapidly increasing selection of different chargeable devices 130 with minimal design cost, manufacturing cost and delay. Thus there is a need to be able to retrofit an interfacing mechanism between the power receiver 120 and variety of chargeable devices 130 with minimal modifications, design efforts and  
30 manufacturing costs.

Generally, a power receiver 120 is attached to the back of chargeable device 130 so as to not interfere with display and other input or output means placed on the

front of device 130. Attachment may be as simple as using double sided adhesive tape, gluing, or using a fastener or fasteners. In some embodiments, power receiver 120 is mechanically formed so as to replace the back panel of the case of device 130. In other embodiments, power receiver 120 is mechanically formed as to replace the battery door of device 130.

According to some embodiments of the current disclosure, a bridge connector 140 connects the output connector 123 of power receiver 120 with the charging connector 131 of chargeable device 130.

In a basic form, a bridge connector 140 may be used for: transferring charging power from the output connector 123 of power receiver 120 to the charging connector 131 of chargeable device 130; bridging the physical distance between output connector 123 and charging connector 131; and optionally allowing for possible differences of the type (male/female) and standard of output connector 123 and charging connector 131.

It will be appreciated that the introduction of the bridge connector 140 may allow the power receiver 120 to be used with a variety of chargeable devices 130 with only minor modifications in the dimensions of bridge connector 140.

Optionally, the bridge connector 140 may comprise further elements and be operable to perform other functions.

For example, the bridge connector 140 may comprise a mechanical fastener 141 to keep it physically attached to contactless chargeable device 150 and prevent its loss while bridge connector 140 is removed from connector 131. Optionally, the bridge connector 140 may be removed from the connector 131 for example for connecting a conductive charger to the device 130 where a contactless charger 110 is unavailable. Alternatively or additionally, the bridge connector 140 may be removed from the connector 131 to connect auxiliary devices such as earphones; a headset; data cords, cables or the like. Optionally, additionally or alternatively, the bridge connector 140 may comprise a secondary connector 142, possibly akin to the standard connector 131 which may be pin-to-pin electrically connected to the connector 131 thereby providing conductive access to the connector and at least some or all the functionality of connector 131 without the necessity of removing the bridge connector 140. For example a data or power cable 143 may be connected to secondary connector

142 to allow charging device 130 by wired charger, or allow synchronization of data with a computer or the like.

Optionally, the bridge connector 140 may further comprise an indicator or indicators 144. An indicator 144 may be a light emitting diode (LED), a plurality of  
5 LEDs, a multi-color LED or the like and may be used for indicating to the user information such as the status of system 100. An indicator 144 may be situated on the bridge connector 140 such that it is visible while the contactless chargeable device 150 is placed on 110 contactless charger 110. Optionally or alternatively, the indicator 144 may comprise an audio indicator such as buzzer or a speaker, a haptic indicator,  
10 such as a vibrator or the like.

For example, the indicator 144 may be capable of indicating one or a more of the following system statuses such as: Battery charging in progress; battery charging complete; battery charging terminated before completion; improper alignment of coils 112 and 121 which may lead to inefficient charging; low level of battery charge;  
15 battery full; battery malfunction; other malfunction, etc.

In some embodiments the connector may be used for enhancing the performance or adding functions not available to chargeable device 130.

For example, bridge connector 140 may optionally comprise an additional function 145, such as an ID chip, an RFID chip or the like.

20 A chip 145, such as RFID chip, may be wirelessly interrogated by contactless charger 110. Data on chip 145 may be set to be indicative of the type of chargeable device 130, the type of power receiver 120 or both. Contactless charger 110 may use information provided by the chip 145 to set charging parameters suitable to chargeable device 130.

25 Alternatively or additionally, the chip 145 may be interrogated by power receiver electronics 122 via power receiver output connector 123. Power source electronics 122 may use information provided by Chip 145 to set charging parameters suitable to chargeable device 130, or may relay the information to contactless charger 110.

30 Thus, the chip 145 may allow programming system 100 without modifying the device 130 or the power receiver 120.

Optionally, the chip 145 may provide further functionality such by the addition of an accelerometer, microphone, thermometer, magnetic compass, GPS, biometric recordation device or the like.

Optionally, the chip 145 may provide short range communication such as  
5 Infra-Red (IR) communication or RF communication such as using Wi-Fi, Bluetooth, NFC or other protocols. For example, a short range radio transmitter in the bridge connector may provide FM radio transmission for broadcasting music or other audio signals. Such FM transmission may be used for transmitting audio signals to an FM car radio to such that the car's speakers may be used.

10 Similarly, the bridge connector may be used as video interface, allowing viewing video contents from chargeable device 130 on an external display such as a TV set or other display. Video output may be wired or in the form of low power RF broadcasting.

It should be noted that the chip 145 may comprise several chips and/or  
15 components, for example to enable more complex functions such as a camera, scanner, barcode reader or the like.

Optionally, the chip 145 may comprise a memory and be used for extending the memory available to the chargeable device 130. For example, the chip 145 may comprise a non-volatile memory and thus the bridge connector 140 may act as a USB-  
20 type external storage device inserted into the charging connector (331 of figure 2B) of the chargeable device 130.

Optionally, the bridge connector may comprise a slot, for example card reader such as a micro SD slot, for inserting a secondary memory thereby extending the memory of the chargeable device 130.

25 It should be noted that the bridge connector 140 may provide one, few or none of the abovementioned additional functions. It also should be noted that by exchanging the bridge connector, enhancements and additional functions may be easily and flexibly added or changed. Some details of the bridge connector with additional functions are presented hereinbelow in reference to figure 6.

30 Fig. 2A is a block diagram schematically showing the main elements of contactless chargeable device 250 wherein power receiver 220 further comprises an

additional battery 233 according to another exemplary embodiment of the current disclosure.

For drawing simplicity, some elements that already been identified by numbers were not marked in this and the following figures.

5           In order to extend the operation time between charges, power receiver 220 may further comprise an additional battery 233. In operation, chargeable battery 233 is used to provide charging power to device 130. Optionally, power receiver electronics 222 controls the power transfer to device 130.

10           When the contactless chargeable device 250 is placed on contactless charger 110, power receiver electronics 222 charges cells 233 and 133. Depending on the amount of power available and power required, batteries 233 and 133 may be charged in parallel or sequentially. Optionally, the battery 133 of the device 130 may be maintained at maximum charge whenever possible while using the additional battery 233 such that device 130 may be operated even if it has to be separated from power  
15   receivers 220.

Fig. 2B is a block diagram schematically showing the main elements of contactless chargeable device 350 having digital data transfer between chargeable device 130 and power receiver 320 according to another exemplary embodiment of the current disclosure.

20           In some mobile phones, a charging connector 331 may comprise data pins as well as power pins. For example, charging connector 331 may be a micro USB connector. In these cases, data 351 as well as power 352 may be exchanged through charging and data electronics 332 via connector 331.

25           It is a feature of some embodiments of the bridge connector 340 that a chip 345 within the bridge connector 340 may communicate with device 130. Chip 345 may be a microcontroller or other chip capable of interfacing with device 130, for example using USB protocol or the like. The chip 345 may receive information about the status of battery 133 and the charging process and activate indicator 144 accordingly.

30           In some applications data 355 as well as power 356 is exchanged between power receiver electronics 322 and device 130 via bridge connector 340 and connectors 331 and 323. For example output connector 323 may be a micro SD

connector having 8 Pins, breadth of 11 mm; width of 15 mm; and depth of 1 mm .  
Alternatively, output connector 323 may be a proprietary connector or some other connector.

In these cases, power receiver electronics 322 within power receiver 320 may  
5 be configured to be able to receive data from device 130. For example, power receiver  
electronics 322 may receive from device 130 information about battery status and/or  
charging progress and use this information for example to activate indicator 144 or to  
relay this information to contactless charger 110. In some applications, power receiver  
electronics 322 may initiate data exchange with device 130, for example when it is  
10 placed on contactless charger 110. Data received by contactless charger 110 may be  
used to regulate or terminate charging, or to activate status indicator (not seen in these  
figures) on contactless charger 110.

In some embodiments, the chip 345 in the bridge connector 340 may be used  
for data translating from protocol used by device 130 and protocol used by power  
15 receiver electronics 322.

Fig. 2C is a block diagram schematically showing the main elements of  
contactless chargeable device 380 according to another exemplary embodiment of the  
current disclosure.

In this exemplary embodiment, output of power receiver electronics 122 is  
20 connected to a source output connector 385 by a flexible cable 387. The flexible  
cable 387 may optionally comprise electric wires, flat cable or a flexible print as  
known in the art

The output connector 385 may be affixed to the body of the device 130 or to  
the body of the inductive power receiver 382 or both by mechanical connector holder  
25 386. Optionally, the mechanical connector holder 386 is further used to secure the  
device 130 to the inductive power receiver 382. Using a flexible cable 387 may  
provide flexibility in the design and installation of the inductive power receiver 382.

Fig. 2D is a block diagram schematically showing the main elements of a  
contactless chargeable device 390 having power standard matching bridge connector  
30 395 according to yet another exemplary embodiment of the current disclosure.

In some cases, voltage requirement of device 130 is different than the output  
voltage of power receiver 382. In this case, power conditioning electronics 396 such

as DC to DC convertor may be placed within bridge connector 395 to perform voltage conversion. Optionally, additionally or alternatively, power conditioner 396 may perform other functions such as current limit and overvoltage protection.

Figure 3A schematically depicts a bridge connector 400 for connecting two  
5 subunits of a contactless chargeable device according to an exemplary embodiment of the current disclosure.

In the depicted exemplary embodiment, bridge connector 400 is presented comprising two connectors 403 and 406 configured to mate with source output connector and the charging connector, thus providing electrical connection between  
10 the chargeable device and the power receiver.

Post 421 protruding from body 412 of bridge connector 400 may be used for guiding the connector during insertion of connectors 403 and 406. Further, teeth 422 or other latching mechanism on post 421 may be used for securing bridge connector 400 to the cordless chargeable device while connectors 403 and 406 are not engaged  
15 with the source output connector and the charging connector. Optionally, post 421 mate with a hole in, or near the power receiver output connector such as connector 123, 323 or 385 such that no modification is needed on the chargeable device 130.

Optional locking latch 405, which may be released by pressing the release lever 410, secures bridge connector 400 in place during normal operation. To access  
20 the charging connector such as connector 131, 331 or 394, lever 410 is pressed unlocking latch 405. Bridge connector 400 may be pulled away and swing aside exposing the charging connector, while still mechanically attached by post 421 to the cordless chargeable device.

Figure 3B schematically depicts a bridge connector 500 for connecting two  
25 subunits of contactless chargeable device according to another exemplary embodiment of the current disclosure.

In this embodiment post 502 protruding from body 501 of bridge connector 500 is seen having securing tooth 503 for holding it in place.

Figure 4 schematically depicts a three-dimensional isometric back view of  
30 contactless chargeable device 600 according to an exemplary embodiment of the current disclosure.

For illustrative purposes only, the chargeable device 602 shown in Figure 4 is a BlackBerry 8520 mobile phone, seen with power receiver 601 attached to its back and a bridge connector 610 providing electrical connection between the chargeable device 602 and power receiver 601. It will be appreciated that bridge connectors may be provided for other communication devices as required.

Figure 5A schematically depicts a partial three-dimensional back isometric view of contactless chargeable device 700 according to another exemplary embodiment of the current disclosure.

For illustrative purposes only, the chargeable device 602 shown in Figure 4 is a HTC Evo mobile phone seen with power receiver 701 attached to its back and a bridge connector 711 providing electrical connection between the chargeable device 702 and power receiver 701. It will be appreciated that bridge connectors may be provided for other communication devices as required.

Figure 5B schematically depicts a back view of contactless chargeable device 700 seen in figure 5A.

Figure 5C schematically depicts a side view of contactless chargeable device seen in figure 5A and 5B.

Figure 6 schematically depicts some details of a bridge connector 640 having additional functions according to an exemplary embodiment of the current disclosure.

As noted herein, the bridge connector may provide additional functions and enhancements to the chargeable device 130. It should be appreciated that the configuration depicted here is to be viewed as a non limiting embodiment, and that other configurations may be within the scope of the current disclosure.

In the depicted embodiment, the body 691 of the bridge connector 640 is provided with a first connector 403 for connecting with a chargeable device 130 and second connector 406 for connecting with an inductive power receiver 120, 220 or 382. In the depicted exemplary embodiment, second connector 406 is used for providing power to chargeable device 130 through charging power line 611 and first connector 403. An external charger may be connected to secondary charging connector 642 which is electrically connected to charging power line 611. For simplicity, connectors 406 and 642 are represented having no data pins, it is noted

however that such connectors may include micro USB connectors or the like having data pins for providing data transfer functionality to the device.

The first connector 403 may exchange data with chargeable device 130 via a data channel 351. The data channel 351 may be optionally exchanged with local  
5 controller 612 which interfaces the additional functions provided by bridge connector 640 with chargeable device 130. In some applications local controller 612 is a rudimentary USB controller capable of interfacing with a mini USB connector 331 or the like of chargeable device 130.

For example, slot 615, for example a micro SD slot, may be used for insertion  
10 of additional memory. Controller 612 may exchange data with the memory in slot 615 via data channel 625. In other embodiments, other types of cards, for example a secondary SIM card may be inserted to the appropriately configured slot 615.

The local controller 612 may control indicator or indicators 144 to provide indication of status and operation of chargeable device 130 or the additional function  
15 645. The local controller 612 may receive input used for operating the additional function 645 from input switches, keys, buttons or dial 635. Additionally or alternatively, input and/or outputs of chargeable device 130 may be used for providing operation commands and/or status indications for the additional function 645.

In some embodiments, operation of additional functions 645 is governed by a  
20 software application executed by the chargeable device 130. For example, a communication device such as a mobile phone, computing device, media player or the like may be loaded with and execute software applications.

Although the disclosure has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations  
25 will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims. All publications, patents and patent applications mentioned in this specification are herein incorporated in their entirety by reference into the specification, to the same extent as if each individual publication, patent or  
30 patent application was specifically and individually indicated to be incorporated herein by reference. In addition, citation or identification of any reference in this

application shall not be construed as an admission that such reference is available as prior art to the present disclosure.

## CLAIMS

1. A bridge connector for connecting a chargeable device with a contactless inductively coupled power receiver comprising:  
a body;  
5 a first connector for mating with charging connector of a chargeable device; and  
a second connector for mating with output connector of contactless inductively coupled power receiver,  
wherein said contactless inductively coupled power receiver receives power from a contactless charger and provides electrical power to said chargeable device  
10 through said bridge connector.
2. The bridge connector of claim 1 and further comprising at least one indicator, operable to indicate at least one charging parameter selected from a group consisting of: battery charging in progress; battery charging complete; battery charging terminated before completion; low charging; rate; low level of battery  
15 charge; battery full; and battery malfunction.
3. The bridge connector of claim 1 and further comprising a secondary connector for connecting external charger to said chargeable device through said bridge connector.
4. The bridge connector of claim 3 wherein said bridge connector is further operable  
20 to provide data transfer between said first connector and said secondary connector.
5. The bridge connector of claim 1 wherein said body of said bridge connector further comprises at least one additional functionality element.
6. The bridge connector of claim 5 wherein said at least one additional functionality element is selected from: ID chips; and RFID chips.
- 25 7. The bridge connector of claim 5 wherein said body of said bridge connector further comprises a local controller for interfacing said additional functionality element with said chargeable device.
8. The bridge connector of claim 7 wherein said at least one additional functionality element is selected from a group consisting of: accelerometer; microphone;

thermometer; magnetic compass; GPS; short range IR communication; short range RF communication; FM radio transmission; video interface; additional memory; and biometric monitors.

- 5 9. The bridge connector of claim 7 wherein said body of said bridge connector further comprises additional functionality elements selected from cameras; scanners; and barcode reader.
10. The bridge connector of claim 7 wherein said body of said bridge connector further comprises at least one slot for insertion of a removable card.
- 10 11. Then bridge connector of claim 10 wherein said removable card is selected from a memory card; and a secondary SIM card.
12. The bridge connector of claim 1 wherein said bridge connector further comprises power controlling electronics.
- 15 13. The bridge connector of claim 11 wherein said power controlling electronics is selected from: DC to DC convertors; current limiters; and overvoltage protection elements.
14. The bridge connector of claim 1 wherein said chargeable device is a hand-held device.
- 20 15. The bridge connector of claim 11 wherein said hand-held device is selected from: communication devices; telephones; media players, computing devices PDAs; GPS; personal entertainment unit; media renderers and tablet computers.
16. A system for contactless charging a contactless chargeable device comprising:  
a contactless charger receiving power from a mains outlet; and  
a contactless chargeable device comprising:  
a chargeable device;  
25 a contactless inductively coupled power receiver; and  
a bridge connector comprising:  
a body;

a first connector for mating with charging connector of said chargeable device; and

a second connector for mating with output connector of said contactless inductively coupled power receiver,

5 wherein said contactless inductively coupled power receiver receives power from said contactless charger and provides electrical power to said chargeable device through said bridge connector.

10 17. The system of claim 16 wherein said bridge connector further comprising at least one indicator indicating at least one charging parameter selected from: battery charging in progress; battery charging complete; battery charging terminated before completion; low charging; rate; low level of battery charge; battery full; and battery malfunction.

15 18. The system of claim 16 wherein said bridge connector further comprising a secondary connector for connecting external charger to said chargeable device through said bridge connector.

19. The system of claim 18 wherein said bridge connector further provides data exchange between said first connector and said secondary connector.

20 20. The system of claim 16 wherein said body of said bridge connector further comprises at least one additional functionality element.

21. The system of claim 20 wherein said at least one additional functionality element is selected from: ID chips; and RFID chips.

25 22. The system of claim 20 wherein said body of said bridge connector further comprises a local controller for interfacing said additional functionality element with said chargeable device.

30 23. The system of claim 22 wherein said at least one additional functionality element is selected from a group consisting of: accelerometer; microphone; thermometer; magnetic compass; GPS; short range IR communication; short range RF communication; FM radio transmission; video interface; additional memory; and biometric monitors.

24. The system of claim 22 wherein said body of said bridge connector further comprises additional functionality elements selected from cameras; scanners; and barcode reader.
25. The system of claim 22 wherein said body of said bridge connector further  
5 comprises at least one slot for insertion of a removable card.
26. Then system of claim 25 wherein said removable card is selected from a memory card; and a secondary SIM card.
27. The system of claim 16 wherein said bridge connector further comprises power controlling electronics.
- 10 28. The system of claim 27 wherein said power controlling electronics is selected from: DC to DC convertors; current limiters; and overvoltage protection elements.
29. The system of claim 1 wherein said chargeable device is a hand-held device.
30. The system of claim 29 wherein said hand-held device is selected from:  
communication devices; telephones; media players, computing devices PDAs;  
15 GPS; personal entertainment unit; media renderers and tablet computers.

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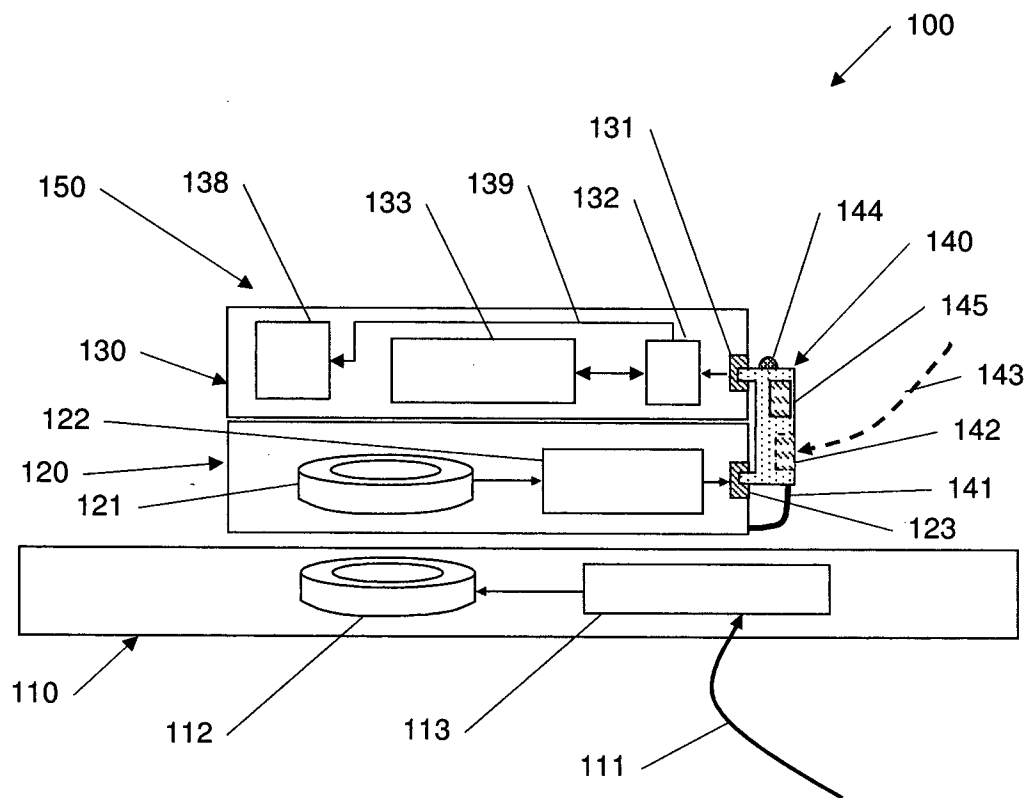


Fig 1

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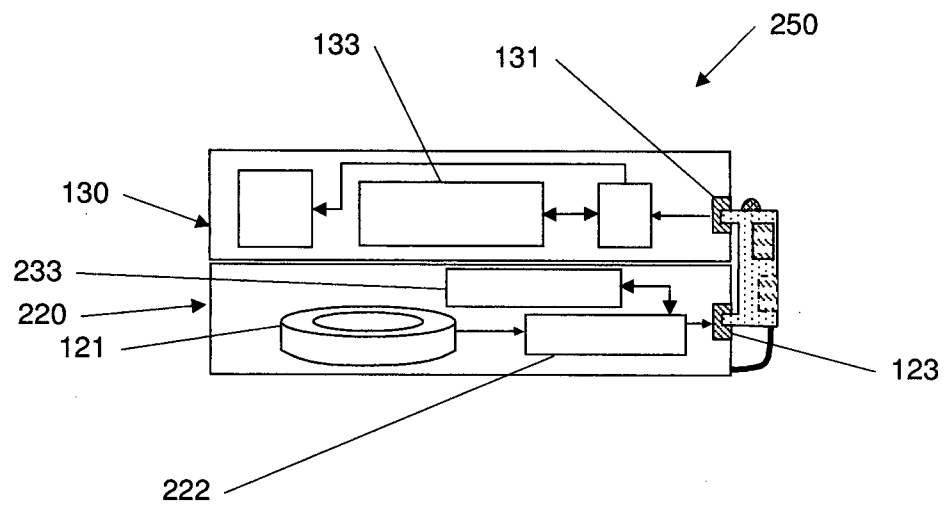


Fig 2A

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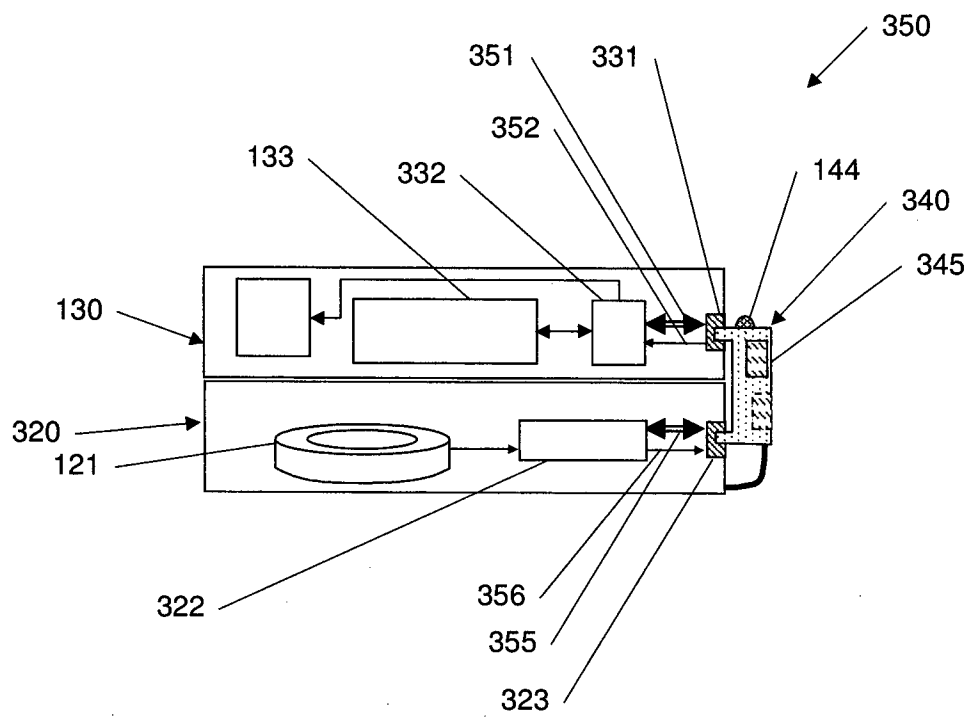


Fig 2B

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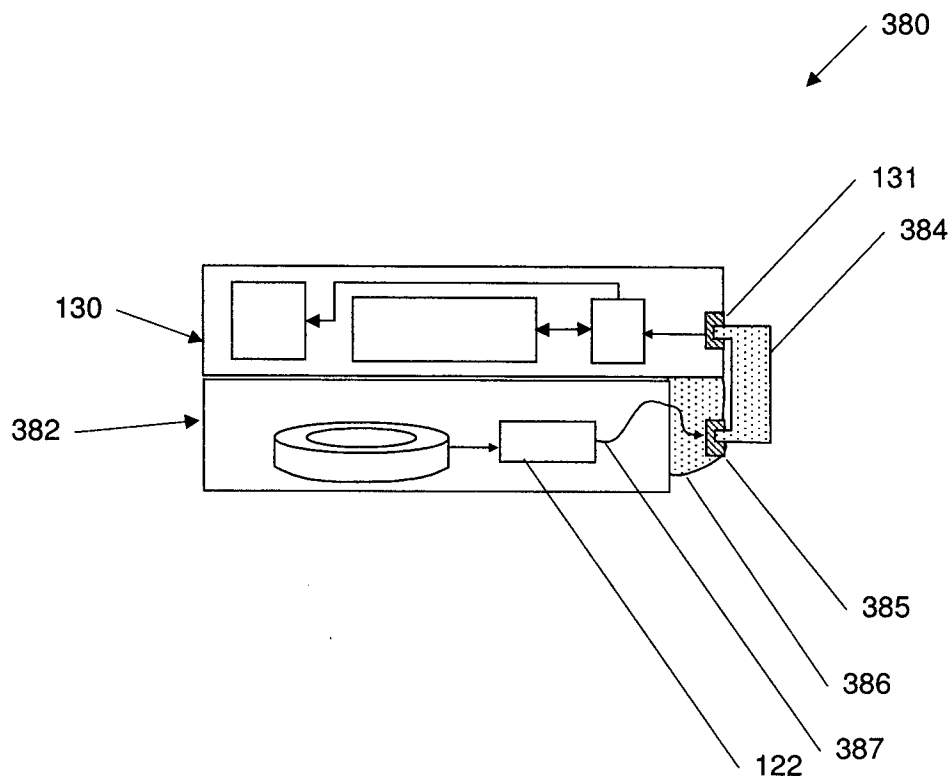


Fig 2C

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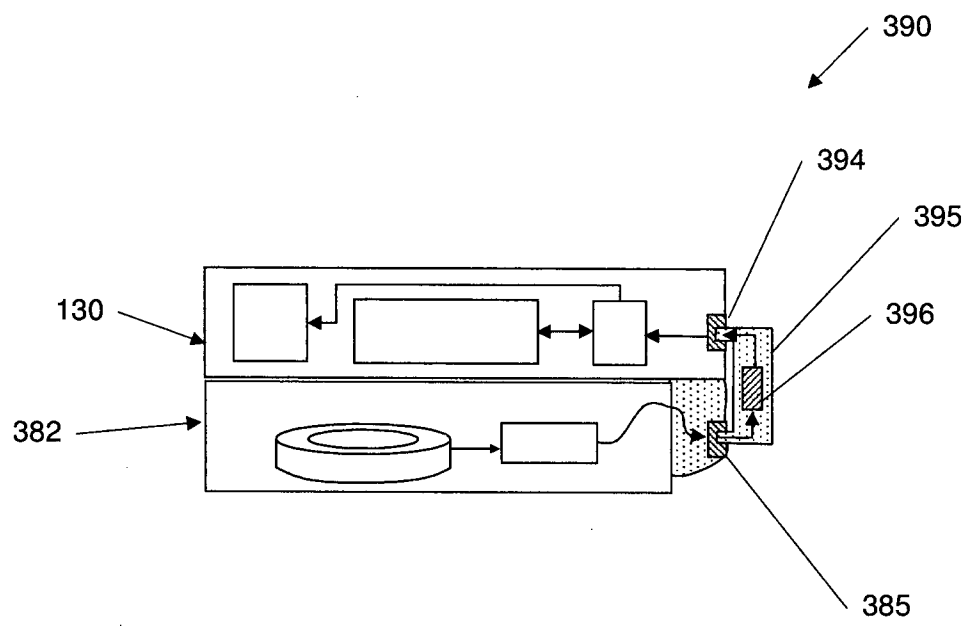


Fig 2D

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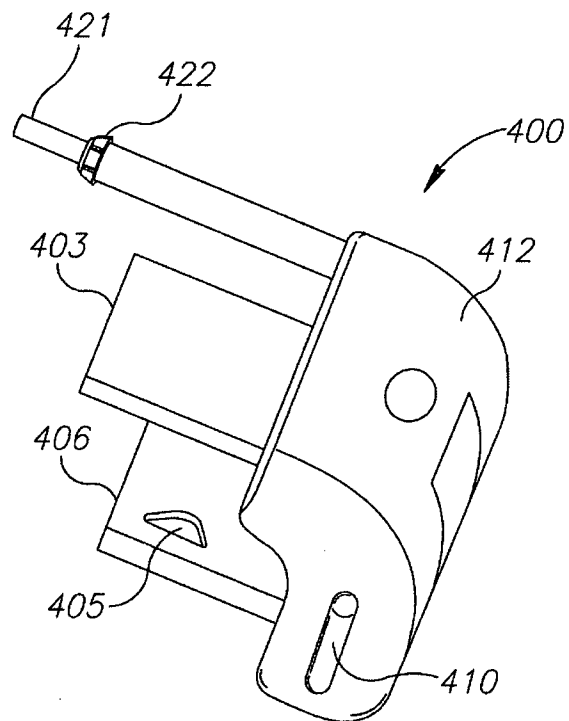


Fig 3A

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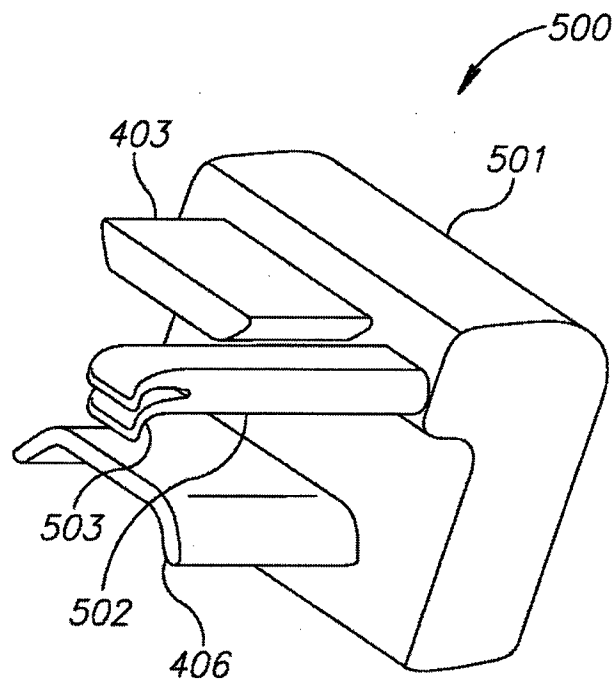


Fig 3B

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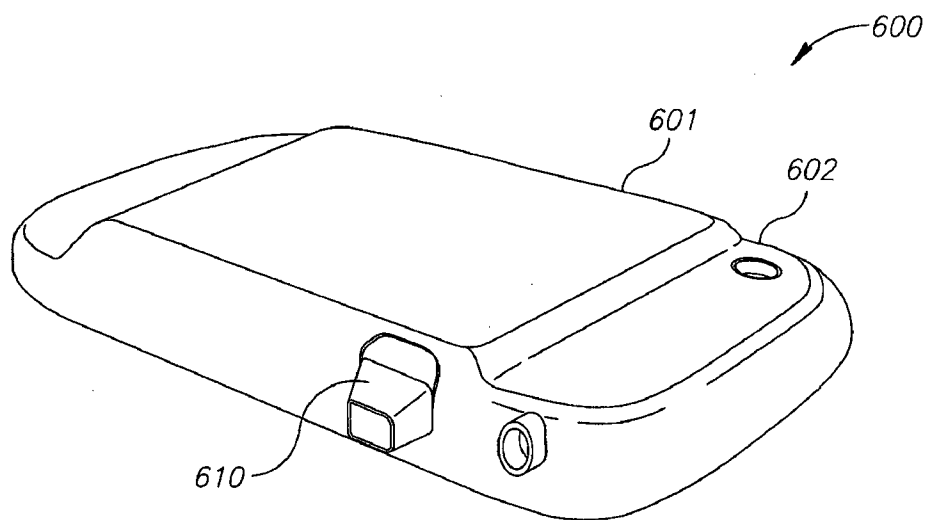


Fig 4

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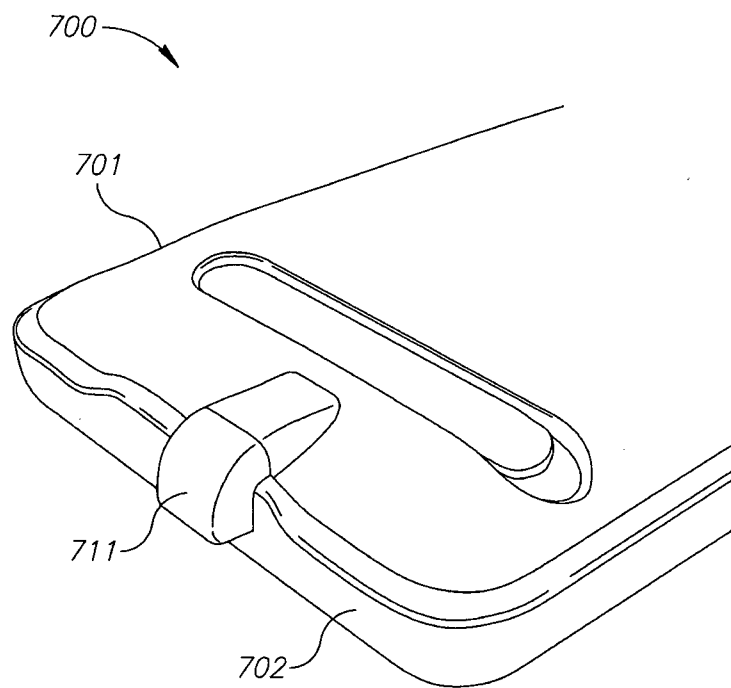
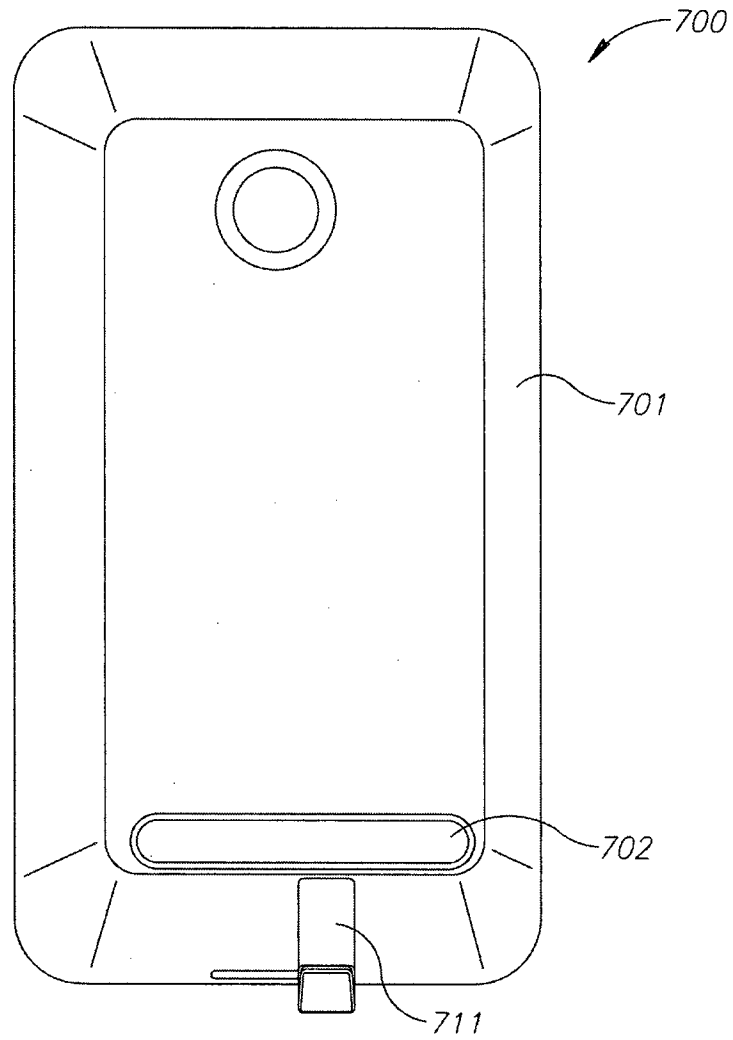
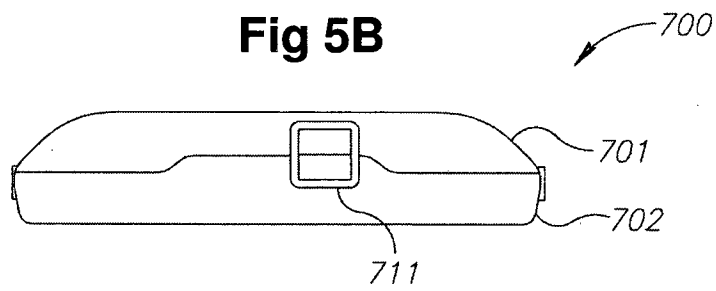


Fig 5A

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**Fig 5B**



**Fig 5C**

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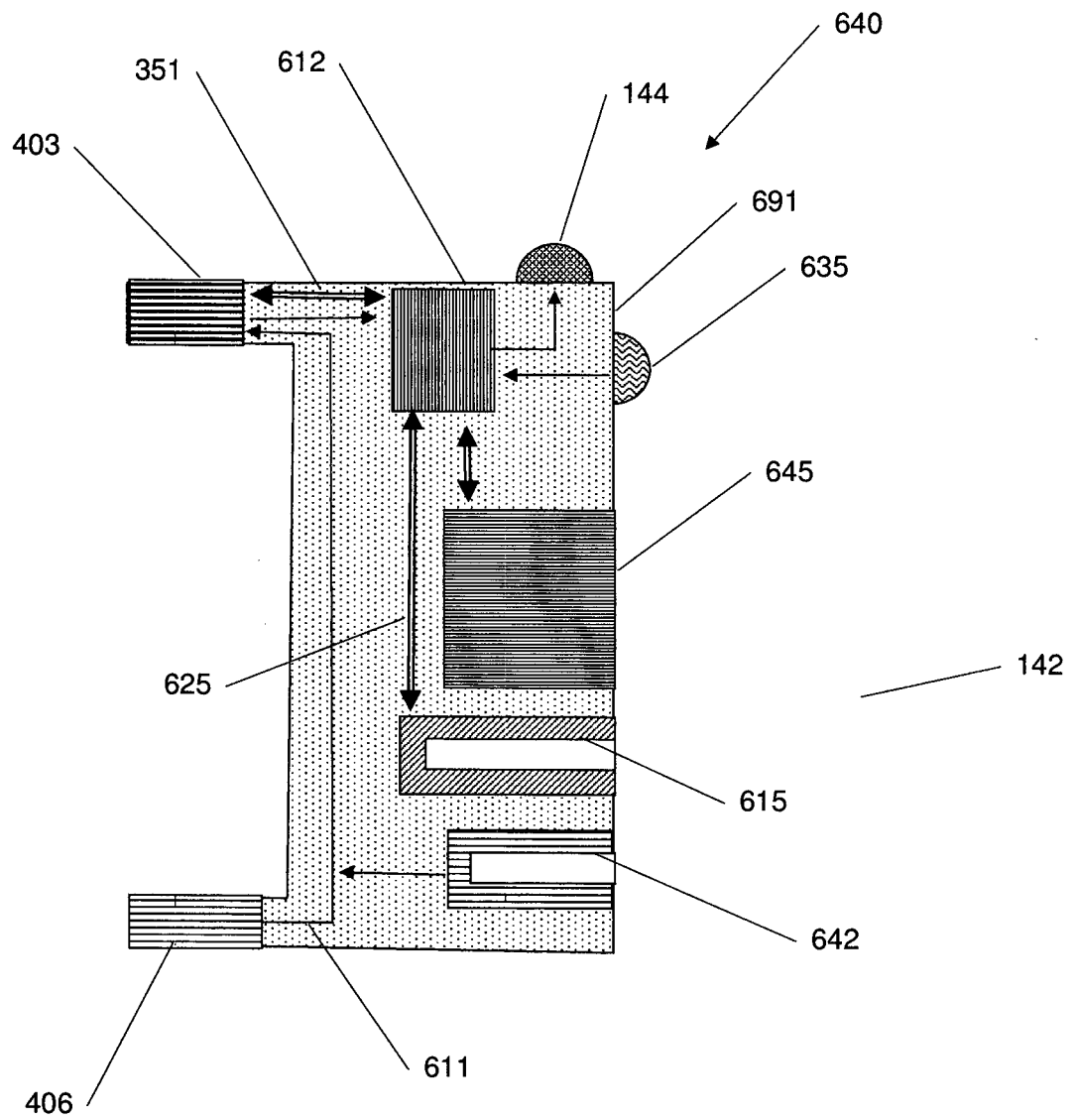


Fig 6

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/IL2011/050066

A. CLASSIFICATION OF SUBJECT MATTER  
INV. H02J7/02 H02J5/00 H01F38/14  
ADD.

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)  
H02J H01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                               | Relevant to claim No. |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
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| X         | US 2010/181841 A1 (POWERMAT LTD [IL];<br>AZANCOT YOSSI [IL]; BEN-SHALOM AMIR [IL];<br>GREENWALD) 22 July 2010 (2010-07-22)<br>paragraphs [0102], [0156]; figures 2d,12c<br>----- | 1-30                  |
| X         | US 2007/182367 A1 (PARTOVI AFSHIN [US]<br>PARTOVI AFSHIN [US] ET AL)<br>9 August 2007 (2007-08-09)<br>paragraphs [0081] - [0083], [0170];<br>figures 6-8<br>-----<br>-/--        | 1-4,<br>16-19         |

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"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.

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Date of the actual completion of the international search

12 April 2012

Date of mailing of the international search report

18/04/2012

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Heusler, Nikolaus

## INTERNATIONAL SEARCH REPORT

International application No

PCT/IL2011/050066

| C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |                                                                                                                                         |                               |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Category*                                            | Citation of document, with indication, where appropriate, of the relevant passages                                                      | Relevant to claim No.         |
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Information on patent family members

International application No

PCT/IL2011/050066

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