Express Mail
EV 195836125 US

ADAPTER

RELATED APPLICATIONS

This application claims priority to and benefit of U.S. Provisional Application No. 60/444,794, entitled Adaptively Inductively Coupled Ballast Circuit, by David W. Baarman, filed February 4, 2003. The full disclosure of the prior application is incorporated herein by reference. This application is a continuation-in-part of U.S. application Serial No. 10/357,932, entitled Inductively Powered Apparatus, which is hereby incorporated by reference.

This application incorporates by reference the following applications filed on the same date and assigned to the same assignee as this application: Adaptive Inductive Power Supply, Serial No. _____; Inductive Coil Assembly, Serial No. _____; Electrostatic Charge Storage Assembly, Serial No. _____ and Adaptive Inductive Power Supply with Communication , Serial No. _____.

BACKGROUND OF THE INVENTION

This relates generally to electronic devices, and more specifically to the contactless supply of power and communication to an electronic device.

A CPS (contactless power supply) provides power to a remote device without any physical connection. An adaptive CPS allows power to be simultaneously provided to a number of different remote devices. Thus, a CD player, an MP3 player, and a cellular telephone could all be supplied power from the same adaptive CPS at the same time. One of the primary advantages of an adaptive CPS is to free the user from maintaining an array of charging equipment, cables and batteries to power the system. With a CPS and appropriately equipped remote devices, there is no need for separate chargers, cables and batteries for each remote device.

However, these remote devices must be constructed with the ability to obtain power from the CPS. There are many remote devices that are in use which have not been specifically built to use a CPS.

Some remote devices, such as MP3 players, are required to communicate with workstations. When connecting such a remote device to a workstation, the user connects a cable between the remote device and the workstation. The use of the cable further clutters the work area around the workstation and causes increased problems.

An adapter to enable these remote devices with no CPS power interface to utilize a CPS would be highly desirable. An adapter which would also enable the remote devices to access a workstation is also highly desirable.

SUMMARY OF THE INVENTION

An adapter for coupling a remote device with a rechargeable power source has a contactless power interface and a power regulator for supplying power to the remote device. The adapter may have a rechargeable power source, such as a battery, for powering the adapter. The adapter may also have a first transceiver for communicating with the contactless power supply.

The adapter may have a second transceiver for communicating with the remote device. Alternatively, the adapter may have simply a transmitter.

The contactless power interface may include a variable impedance element, such as a variable inductor. A controller is coupled to the variable impedance element and can change the impedance of the variable impedance element. The controller changes the impedance of the variable impedance element in response to instructions from the contactless power supply.

Apple Inc. EX1010 Page 2

The operating of the adapter may include obtaining charging information from the remote device and then providing the charging information to the contactless power supply. Power is then supplied to the remote device. Alternatively, the adapter may have a memory which is pre-loaded with power information for the specific remote device.

If equipped with a first and second transceiver, the adapter establishes a first communication link between the adapter and the remote device. The adapter establishes a second communication link between the adapter and the remote device. The adapter then receives the power requirement information from the adapter and sends the power requirement information to the contactless power supply.

When the adaptive power interface has an adjustable element, then the contactless power supply will be set to an optimal setting for the adjustable element. If the adjustable element is a variable inductor, and the step of determining an optimal setting for the adjustable element comprises determining the optimal inductance setting for the variable inductor.

The adapter and the method for operating the adapter allow a remote device to use a contactless power supply even though the remote device was not specifically designed to operate with a contactless powers supply. Additionally, the adapter allows for the remote device to be connected to a workstation attached to the contactless power supply.

These and other objects, advantages and features of the invention will be more readily understood and appreciated by reference to the detailed description of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows an adapter, a remote device and a CPS.

FIG. 2 shows a CPS system interfaced with a computer workstation and a remote device equipped with a CPS interface.

Apple Inc. EX1010 Page 3

FIG. 3 is a block diagram of a CPS interface for a remote device.

FIG. 4 is a method of operation of a CPS interface.

FIG. 5 is an alternative embodiment for the adapter.

FIG. 6 is a circuit diagram of a CPS interface.

FIG. 7 is a circuit diagram of a CPS interface having a half-wave rectifier.

FIG. 8 is a circuit diagram of a CPS interface having a full-wave rectifier.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 shows CPS 10 connected to remote device 12 by way of adapter 14. Remote device 12 could be a notebook computer, a PDA (personal digital assistant), a cellular telephone, an MP3 (Moving Picture Experts Group Layer-3 Audio) player, or any one of a myriad of portable electronic devices. CPS 10 provides power to remote device 12 through adapter 14. Further, if remote device 12 has a communication bus, as many remote devices do, CPS 10 could communicate directly with remote device 12 by way of adapter 14.

FIG. 2 shows CPS 10 is connected to PC (personal computer) 16. PC 16 is coupled to network 18. Network 18 could be a LAN (local area network), a WAN (wide area network) or the Internet. Personal computer 16 can communicate with remote device 12 by way of CPS 10. According to this embodiment, remote device 12 can communicate with PC 16 and optionally network 18 by way of adapter 14 and CPS 10.

FIG. 3 shows block diagrams of CPS 10, adapter 14, and remote device 12. Remote device rechargeable power source 20 supplies power to remote device 12. Rechargeable device power source monitor 22 oversees the operation of rechargeable power source 20. Rechargeable device power source monitor 22 and remote device rechargeable power source 20 could be components of modern rechargeable batteries known commonly as "smart batteries" or

"intelligent batteries". In smart batteries, rechargeable device power source monitor 22 can provide information related the operation and power requirements of remote device rechargeable power source 20, such as the temperature, current draw, voltage, remaining charge, and estimated time to complete charge. Further enhancements to the information supplied by smart batteries have been proposed. For example, U.S. Patent 5,572,110 contains several enhancements for information that could be monitored relating to the operation of a smart battery.

Comm link 24 is a communication link provided within remote device 12. Comm link 24 could be a USB, RS-232, serial, single wire, two wire, on any other suitable communication link. Comm link 24 could be connected to the system management bus of remote device 12 or directly to the rechargeable device power source monitor 22.

Remote device 12 could also contain a number of other systems providing unique functionality of remote device 12.

PC 16 is connected to CPS 10 by way of PC interface 30. PC interface 30 could be any type of interface, such as USB (universal serial bus), Firewire, RS-232, parallel, Bluetooth, WIFI, or any other interface allowing two-way communication between two or more devices.

CPS controller 32 has a number of different functions. It controls the communication of PC 16 through PC interface 30. It also controls the operation of CPS power interface 34. One embodiment of CPS power interface 34 is more fully described in application "Adaptive Inductive Power Supply," assigned to the assignee of this application naming David Baarman as inventor, Serial Number _____, which is hereby incorporated by reference.

CPS controller 32 can adjust the frequency, duty cycle, and resonant frequency of CPS power interface 34.

CPS controller 32 also controls the operation of transceiver 36. CPS transceiver 36 could use many different types of communication protocols. CPS transceiver 36 could be entirely separate from CPS power interface 34 and have its own communication antenna and communication protocol. Alternatively, it could be integral with CPS power interface and communicate with a remote device by was of any one of a number of PLC (power line communication) protocols.

Adapter 14 contains adapter controller 38. Adapter controller 38 controls the various components of adapter 14. Adapter controller 38 could be any one of a multitude of commonly available microcontrollers programmed to perform the functions hereinafter described, such as the Intel 8051 or the Motorola 6811, or any of the many variants of those microcontrollers. Adapter controller 38 could have a ROM (read only memory) and RAM (random access memory) on the chip. Adapter controller 38 could have a series of analog and digital outputs for controlling the various functions within adapter 14.

Adapter controller 38 is connected to contactless power interface 40. Alternatively, adapter controller 38 could be a microprocessor in association with a microcontroller.

Contactless power interface 40 could include a resonant tank circuit. If contactless power interface contained a resonant tank circuit, then adapter controller 38 could control, among other things, the resonant frequency of contactless power interface 40 as well as whether contactless power interface 40 is coupled to any other devices in adapter 14. To vary the resonant frequency of the tank circuit, contactless power interface 40 would adjust the

impedance of a variable impedance element. If the variable impedance element were a variable inductor, then the inductance of the variable inductor would be changed.

Contactless power interface 40 is connected to adapter rechargeable power source 42. Adapter rechargeable power source 42 is the power supply for the Adapter 14. Adapter rechargeable power source 42 could include a conventional rechargeable battery or a microcapacitor. A microcapacitor would be preferable due to its very short charging time.

Adapter transceiver 44 allows communication with CPS transceiver 36. Adapter transceiver 44 and CPS transceiver 36 would use the same protocol and method of communication. Adapter controller 38 regulates the communication through adapter transceiver 44.

Alternatively, adapter transceiver 44 could be simply a transmitter. In such a situation, only limited information would be sent to transceiver 36, such as the power consumption information for remote device 12. The power consumption information of remote device 12 or adapter 14 could be stored in memory 50. In such a situation, adapter transceiver 44 could be simply an RFID (radio frequency identification) device.

Second transceiver 46 provides a communication path with remote device 12 by connecting with remote device remote device transceiver 24. The connection with remote device remote device transceiver 24 could be physical. Thus, information could be transmitted between PC 16 and remote device 12 by way of remote device remote device transceiver 24, adapter second transceiver46, adapter transceiver 44, CPS transceiver 36, and PC interface 30.

Power regulator 48 supplies power to remote device rechargeable power source 20. Power regulator 48 could contain discrete components or it could be a single integrated circuit dedicated to voltage, current and/or power regulation. Power regulator 48 can be turned

on or off by adapter controller 38. Further, adapter controller 38 can control the voltage and current output of power regulator 48 to remote device rechargeable power source 20.

Memory 50 is coupled to adapter controller 38. Memory 50 contains information relating to remote device 12. Memory 50 also optionally contains an identification number identifying remote device 12. For example, memory 50 might contain an identification number indicating that adapter 14 is for use with a specific type of PDA, such as a Palm Pilot.

In such a situation, the identification number could then be used by CPS 10 to determine from a look-up table the power usage information about adapter 14 and remote device 12.

FIG. 4 shows the operation of CPS 10, remote device 12 and Adapter 14. CPS 10 is provided with power from an external power supply (not shown) and energizes CPS power interface 34. Placement of contactless power interface 40 within proximity of the energized CPS 10 induces charging of adapter rechargeable power source 42. Step 100. Obviously, if adapter rechargeable power source 42 is already charged, no further charging occurs. Once sufficient charge is stored within adapter rechargeable power source 42, adapter controller 38, adapter second transceiver46, and adapter transceiver 44 are energized. Step 102.

A data communication link is then established between CPS 10 and Adapter 14. Step 104. A second data communication link between adapter 14 and remote device 12 is then established. Step 106. At this time, charging information is obtained from remote device 12. Step 108. Charging information could include amount of charge remaining within rechargeable power source 20, the time to recharge the rechargeable power source 20, the voltage requirements of remote device 12 to charge rechargeable power source 20, and the current

requirements of remote device 12 to charge rechargeable power source 20. Adapter 14 then provides this charging information to CPS 10. Step 110.

CPS 10 then calculates the optimal setting for contactless power interface 40. Step 112. CPS 10 could provide that information to adapter 14. Alternatively, adapter 14 could retrieve similar information from remote device 12. Step 114. Adapter controller 38 then configures contactless power interface 40. Step 116. It could be that rechargeable power source 20 is charged or cannot be charged. In that case, CPS 10 would configure adapter 14 to supply no power to remote device 12.

If contactless power interface 40 includes an adjustable resonant tank circuit, adapter controller 38 could configure the resonant frequency of the adjustable resonant tank circuit.

At that time, if necessary, charging of the rechargeable power source 20 commences. Step 118. Adapter 14 then checks CPS 10 to determine if CPS has sufficient capacity to charge remote device 12. Step 120. If not, charging ceases. Step 122. If so, then Adapter 14 determines from remote device 12 whether charging should continue. Step 124. If not, charging ceases. Step 122.

At this time, charging information is retrieved from remote device 12, and the process is repeated. Step 108.

FIG. 5 shows another embodiment for the adapter. Housing 140 encloses a secondary winding 142, a charging circuit 144, and a rechargeable power source 146. Secondary winding 142 receives power from CPS 10. Secondary winding 142 could be a triaxial winding having three winding orthogonally disposed, as is more fully described in a patent application

entitled, Inductive Coil Assembly, assigned to the assignee of this application, and naming David W. Baarman and Terry L. Lautzenheiser as inventors.

Charging circuit 144 supplies the power in an appropriate form to rechargeable power source 146. Rechargeable power source 146 could be, for example, a super capacitor or a rechargeable battery. Connectors 148, 150 allow the adapter to be placed within the remote device as a replacement for the battery. For example, if the remote device used a 12 volt dry cell battery, then housing 140 would be of the same shape and configuration as a 12 volt dry cell battery. Thus, the adapter would be a 'drop-in' replacement for the 12 volt dry cell battery. Alternatively, if the remote device used a 600 MA lithium ion battery, then housing 140 and electrical connectors 148, 150 would be configured to look and operate similar to that particular battery.

The adapter shown in FIG. 5 could be equipped with wireless transceiver 152 if the remote device has a communication port, such as a USB or firewire port. Wireless transceiver 152 could receive and send information to a workstation by way of CPS 10. Wireless transceiver 152 is connected to dongle 154. Dongle 154 is supplied with dongle connector 156. Dongle connector 156 would be placed into the communication port of the remote device. Communication is thereby enabled between the remote device and the CPS.

FIGs. 6-8 show circuit diagrams for three embodiments of adapter 14. In these embodiments, adapter 14 supplies power only to remote device 12. The adapter 14 includes multiple coils in different orientations to provide improved coupling when the remote device is at different orientations within the electromagnetic field generated b CPS.

FIG. 6 illustrates an adapter for connection to a remote device. As shown, three coils 202, 204, 206 are connected in parallel to the load. The three coils could be orthogonally

configured, as described in patent application Inductive Coil Assembly, assigned to the assignee of this application, and filed on the same day as this application. Capacitors 206, 208, 210 and diodes 212, 214, 216 are connected in series with each coil 200, 202, 204. The values of the various components are selected to provide a resonant frequency. The power induced within each of coil 202, 204, 206 is combined at the input of power regulator 218. Alternatively, diodes 212, 214, 216 can be eliminated from the circuit 680 to provide AC power to power regulator 218. Power regulator 218 regulates the voltage and current available at terminals 220, 222. Terminals 220, 222 are for connection to the power input of a remote device.

FIG. 7 shows an adapter using a half wave rectifier receiving power from three separate coils 240, 242, 244. As shown, coils 240, 242, 244 are connected in parallel to power regulator 246 through an arrangement of diodes 248, 250, 252, 254, 256, 258 connected in series with each coil 240, 242, 244. In this embodiment, the value of each diode 248, 250, 252, 254, 256, 258 is determined based primarily on the characteristics of power regulator 246. Power regulator 246 provides a relatively constant voltage and current output at terminals 241, 243. Additionally, a capacitor 260, 262, 264 is connected in series between one side of coil 240, 242, 244 and the corresponding diodes 250, 254, 258. The value of each capacitor 260, 262, 264 is also determined based primarily on the characteristics of the load.

FIG. 8 illustrates a full wave rectifier circuit used within an adapter. As shown, coils 270, 272, 274 are connected in parallel to power regulator 276 through an arrangement of diodes 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300. In this embodiment, the value of each diode 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300 is determined based primarily on the characteristics of power regulator 276. Power regulator 276 provides a relatively constant voltage and current output at terminals 271, 273. Additionally, each capacitor

302, 304, 306 is connected in series between one side of the respective coil 270, 272, 274 and the corresponding diodes 282, 284, 290, 292, 296, 300. The value of each capacitor 302, 304, 306 is determined based primarily on the characteristics of power regulator 276.

Power regulators 218, 246, 276 are able to provide at their respective output terminals a constant voltage and constant current, even when the power derived from the coils is operating at different frequencies. CPS 10 may provide power at different frequencies. Thus, the current and voltage induced in the respective coils of the adapter could also have different currents and voltages. Power regulators 218, 246, 276 are designed to accommodate the difference in the current and voltage produced by the coils.

The above description is of the preferred embodiment. Various alterations and changes can be made without departing from the spirit and broader aspects of the invention as defined in the appended claims, which are to be interpreted in accordance with the principles of patent law including the doctrine of equivalents. Any references to claim elements in the singular, for example, using the articles "a," "an," "the," or "said," is not to be construed as limiting the element to the singular.

Apple Inc. EX1010 Page 12

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An adapter for a remote device having a remote device rechargeable source comprising:

a contactless power interface for receiving power from a contactless power supply;

a power regulator for supplying power to the remote device; and

a rechargeable power source for powering the adapter.

2. The adapter of claim 1 further comprising a transceiver for communicating with the contactless power supply.

3. The adapter of claim 2 further comprising a controller, the controller controlling the power regulator.

4. The adapter of claim 3 further comprising a communication link for communicating with the remote device.

5. The adapter of claim 4 where the contactless power interface includes a variable impedance element, the variable impedance element having an impedance.

6. The adapter of claim 5 where the controller is coupled to the variable impedance element, and the controller capable of changing the impedance of the variable impedance element.

7. The adapter of claim 6 where the variable impedance element is a variable inductor.

Apple Inc. EX1010 Page 13

8. The adapter of claim 7 where the controller varies the impedance of the variable inductor in response to instructions from the contactless power supply.

9. The adapter of claim 8 where the adapter includes a secondary winding.

10. The adapter of claim 9 where the controller is coupled to a memory.

11. The adapter of claim 10 where the memory includes an identifier.

12. The adapter of claim 11 where the adapter can obtain power requirements from the remote device.

13. An adapter for connection to a remote device, the remote device having a remote device rechargeable power source, comprising:

a contactless power interface for receiving power from a contactless power supply;

a power regulator for supplying power to the remote device for charging the remote device rechargeable power source; and

a receiver for communicating with the contactless power supply.

14. The adapter of claim 13 further comprising a secondary winding.

15. The adapter of claim 14 further comprising a power supply.

16. The adapter of claim 15 further comprising a controller, the controller controlling the power regulator.

17. The adapter of claim 16 further comprising a communication link for communicating with the remote device.

18. The adapter of claim 17 where the contactless power interface includes a variable impedance element.

Apple Inc. EX1010 Page 14

19. The adapter of claim 18 where the controller is coupled to the variable impedance element, and the controller can change the impedance of the variable impedance element.

20. The adapter of claim 19 where the variable impedance element is a variable inductor.

21. The adapter of claim 20 where the controller varies the impedance of the variable inductor in response to instructions from the contactless power supply.

22. The adapter of claim 21 where the controller is coupled to a memory.

23. A method of operating an adapter for recharging a remote device rechargeable power source contained with a remote device with power from a contactless power supply comprising the steps of:

obtaining charging information from the remote device;

providing the charging information to the contactless power supply; and

supplying power to the remote device.

24. The method of claim 23 further comprising the step of the contactless power supply receiving power requirement information from the remote device.

25. The method of claim 24 where the adapter has a first transceiver for communicating with the contactless power supply further comprising the step of establishing a first communication link between the adapter and the contactless power supply.

26. The method of claim 25 where the adapter sends the power requirement information from the remote device by way of the first communication link.

27. The method of claim 26 where the adapter has a second transceiver for communicating with the remote device further comprising the step of establishing a second communication link between the adapter and the remote device.

Apple Inc. EX1010 Page 15

28. The method of claim 27 further comprising the step of the adapter sending the power requirement information to the contactless power supply by way of the second communication link.

29. The method of claim 28 where the adapter includes a contactless power interface, and the contactless power interface has an adjustable element, further comprising the step of determining an optimal setting for the adjustable element.

30. The method of claim 29 where the adjustable element is a variable inductor, and the step of determining an optimal setting for the adjustable element comprises determining the optimal inductance setting for the variable inductor.

31. The method of claim 30 further comprising the step of determining whether the rechargeable power source is charged.

32. An adapter for supplying power to a remote device from a contactless power supply comprising:

a secondary having a first coil, a second coil and a third coil, each coil being substantially orthogonal to the other coils and

a power regulator.

33. The adapter of claim 32 further comprising a first capacitor coupled with the first coil, a second capacitor coupled with the second capacitor and a third capacitor coupled with the third capacitor.

34. The adapter of claim 33 further comprising a rectifier coupled to the secondary for converting an AC signal induced in the secondary to DC.

35. The adapter of claim 34 where the rectifier is a half-wave rectifier.

36. The adapter of claim 34 where the rectifier is a full-wave rectifier.

Apple Inc. EX1010 Page 16

37. The adapter of claim 34 where the rectifier consists of a first diode in series with the first coil, a second diode in series with the second coil and a third diode in series with the second coil.

38. The adapter of claim 37 where the first capacitor in series with the first coil and the first diode, the second capacitor is in series with the second coil and the second diode, and the third capacitor is in series with the third coil and the third diode.

39. The adapter of claim 38 further comprising a fourth diode in series with the first coil, a fifth diode in series with the second coil, and a sixth diode in series with the third coil.

40. For a remote device having a removable power supply, an adapter comprising:

electrical connectors disposed in the same configuration as that of the removable power supply; and

a secondary winding for receiving power from a contactless power supply and supplying power to the electrical connectors.

41. The adapter of claim 40 further comprising a rechargeable power source connected to the electrical connector.

42. The adapter of claim 41 further comprising a charging circuit coupled to the rechargeable power source and the secondary winding.

43. The adapter of claim 42 where the secondary winding is comprised of three orthogonal windings.

44. The adapter of claims 42 or 43, further comprising a transceiver for enabling communication between the remote device and the contactless power supply.

45. The adapter of claim 44 further comprising a dongle connected to the transceiver for connecting the transceiver to a communication port on the remote device.

46. The adapter of claim 45 further comprising a dongle connector connected to the dongle for insertion into the communication port.

Apple Inc. EX1010 Page 18

ABSTRACT OF THE DISCLOSURE

An adapter allows a remote device to use a contactless power supply. The adapter has a contactless power interface for receiving power from a contactless power supply and a power regulator for supplying power to the remote device. The adapter may have a rechargeable power source for operating the adapter and a power regulator.

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Apple Inc. EX1010 Page 19

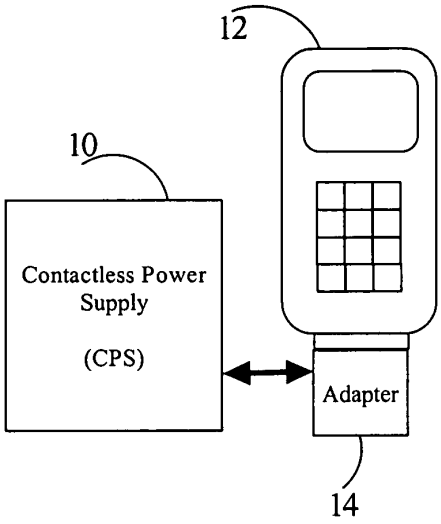

12
10
Contactless Power Supply
(CPS)
Adapter
14

FIG. 1

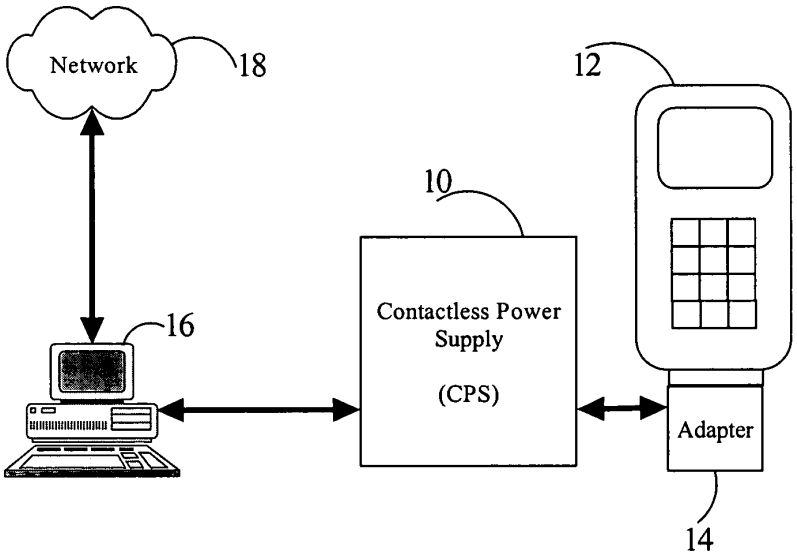

Network
18
12
10
16
Contactless Power Supply
(CPS)
Adapter
14

FIG. 2

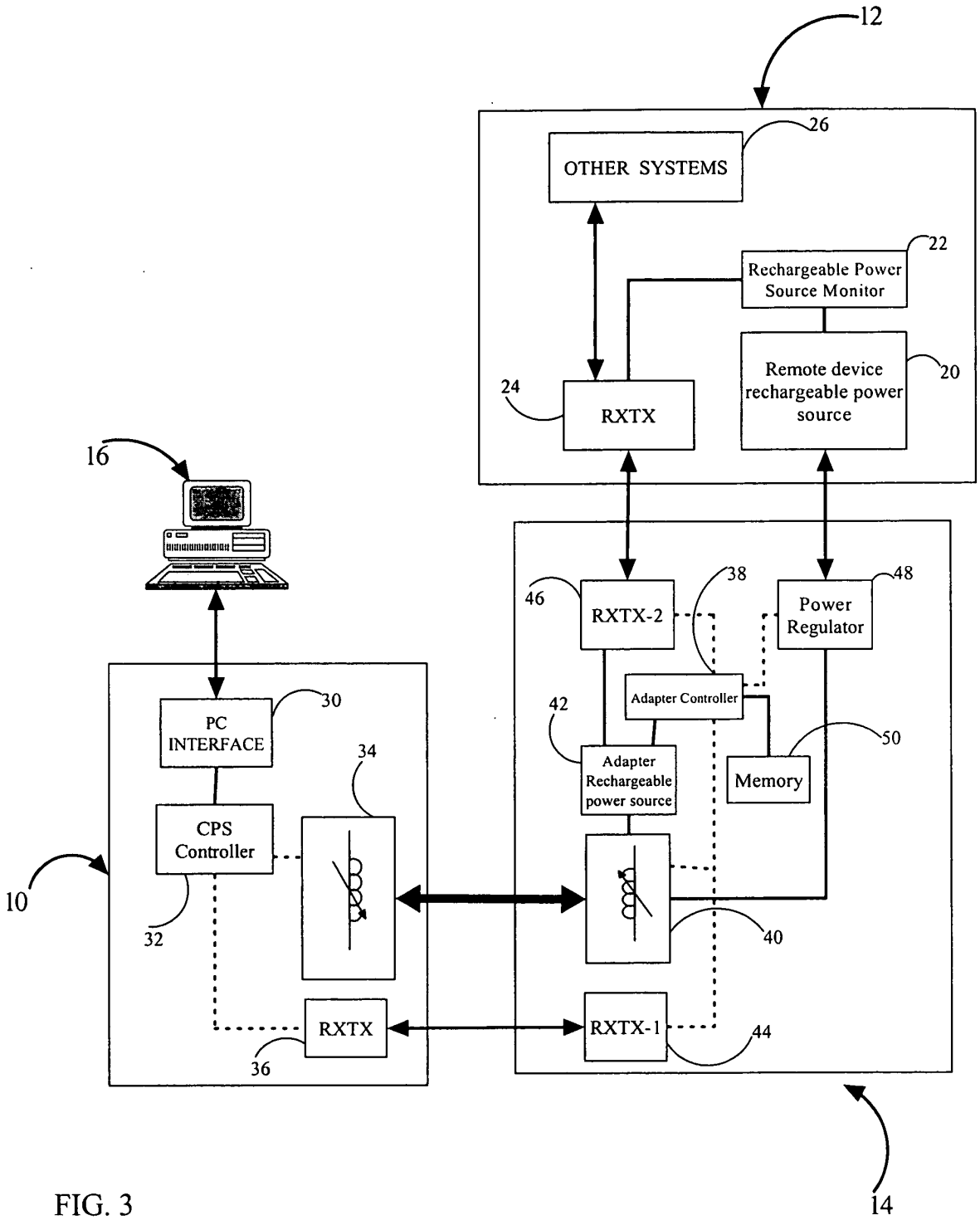

12
26
OTHER SYSTEMS
22
Rechargeable Power Source Monitor
Remote device rechargeable power source
20
24
RXTX
16
46
RXTX-2
38
Power Regulator
48
Adapter Controller
42
Adapter Rechargeable power source
Memory
50
PC INTERFACE
30
34
CPS Controller
10
32
40
RXTX
36
RXTX-1
44
14

FIG. 3

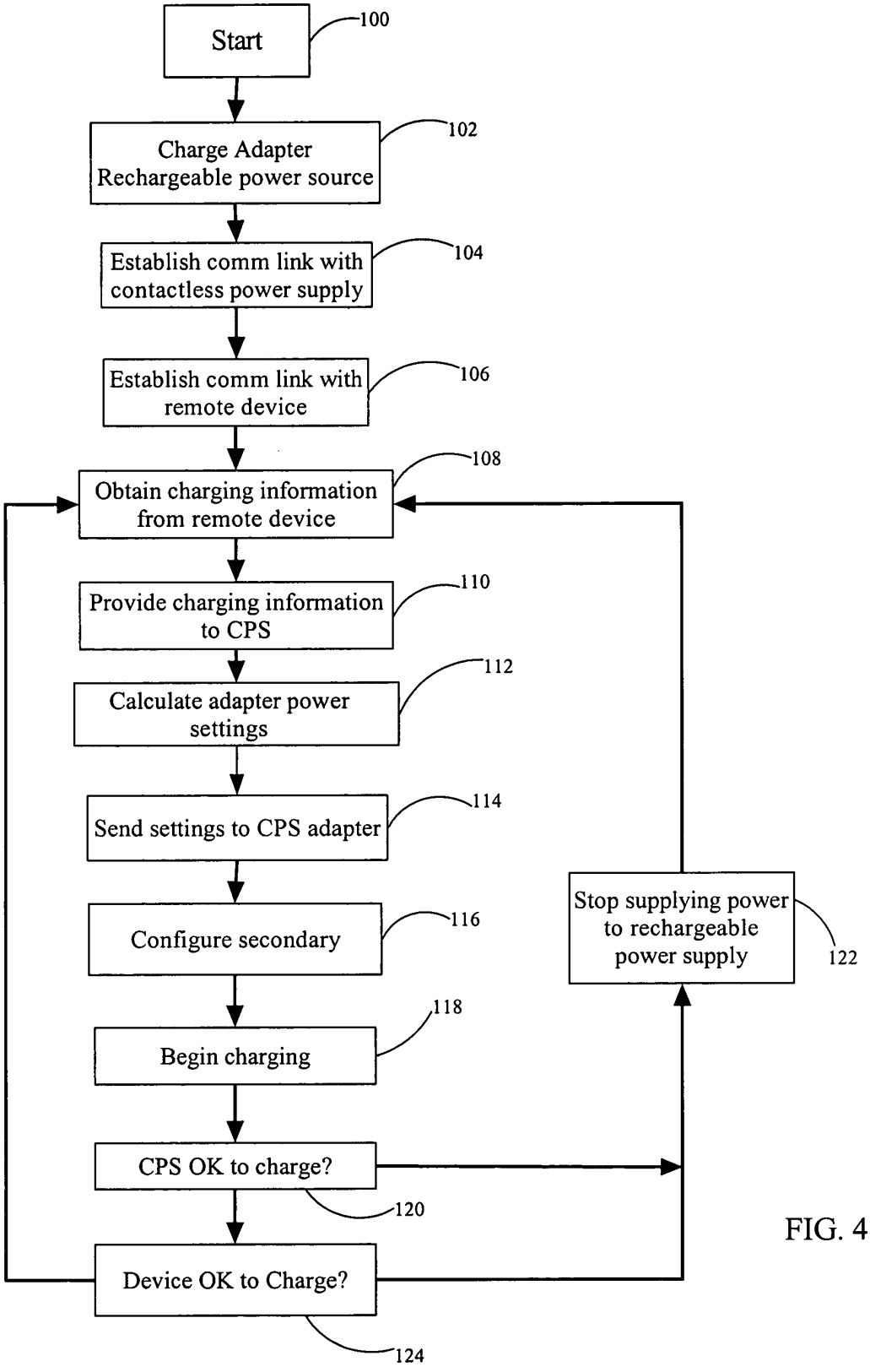

Start
100
Charge Adapter Rechargeable power source
102
Establish comm link with contactless power supply
104
Establish comm link with remote device
106
Obtain charging information from remote device
108
Provide charging information to CPS
110
Calculate adapter power settings
112
Send settings to CPS adapter
114
Configure secondary
116
Begin charging
118
CPS OK to charge?
120
Device OK to Charge?
124
Stop supplying power to rechargeable power supply
122

FIG. 4

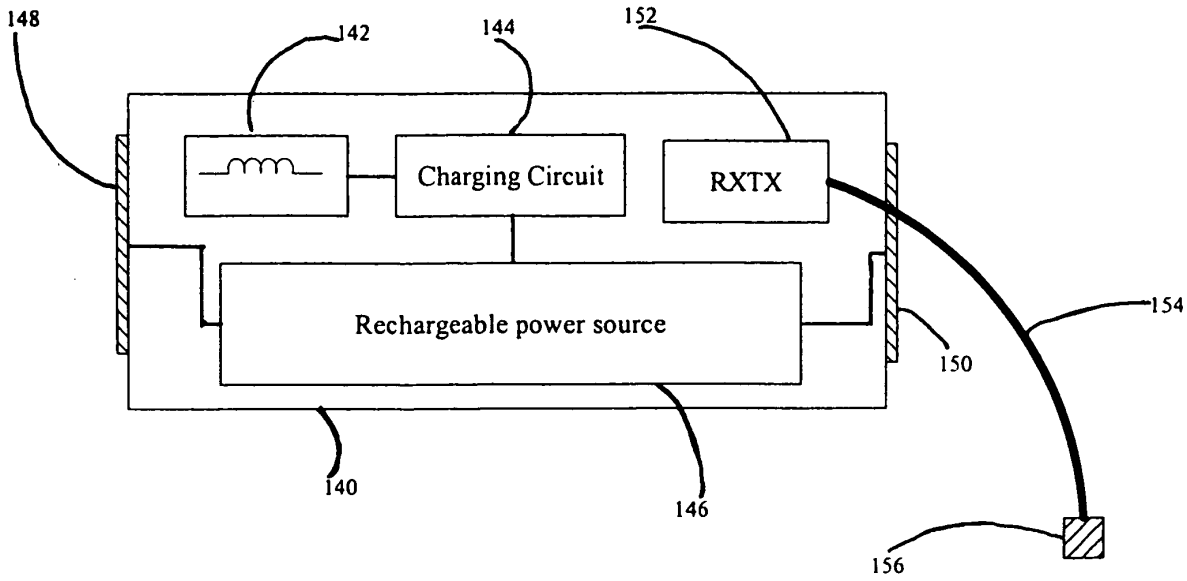
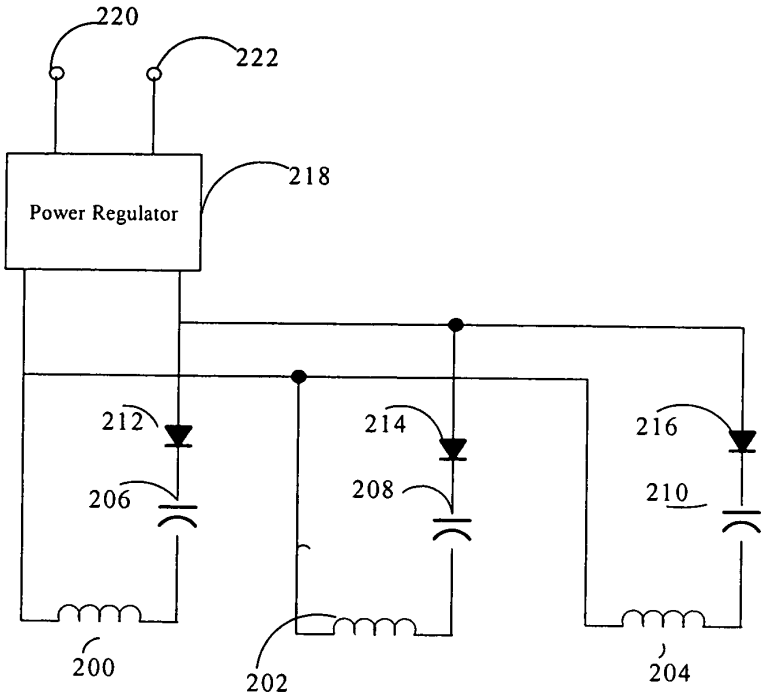

148
142
144
152
Charging Circuit
RXTX
Rechargeable power source
154
150
140
146
156

FIG. 5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222
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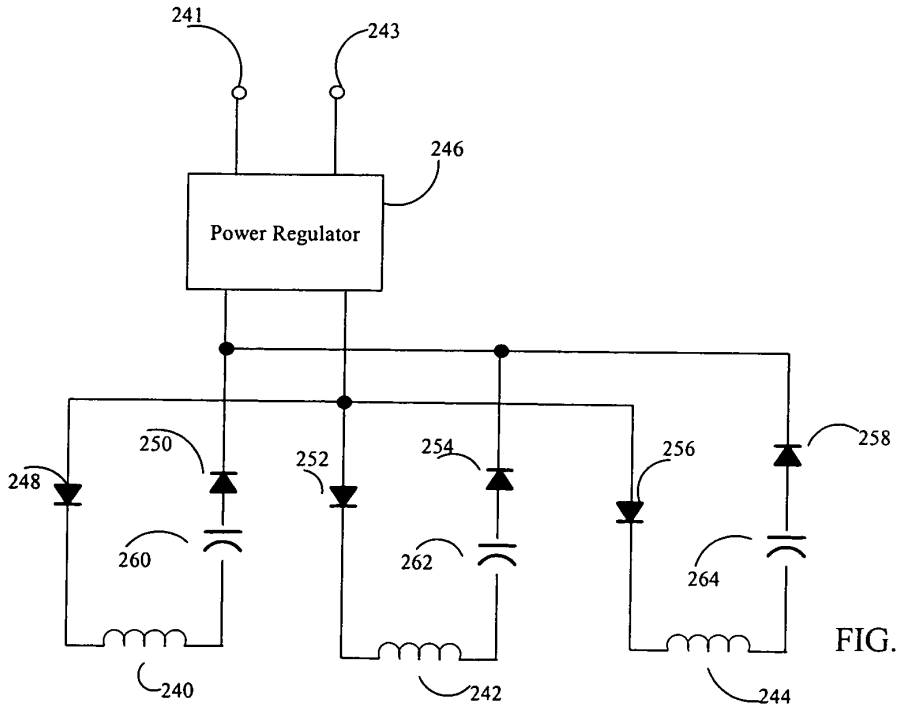
Power Regulator
212
214
216
206
208
210
200
202
204

FIG. 6


241
243
246
Power Regulator
248
250
252
254
256
258
260
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264
240
242
244

FIG. 7

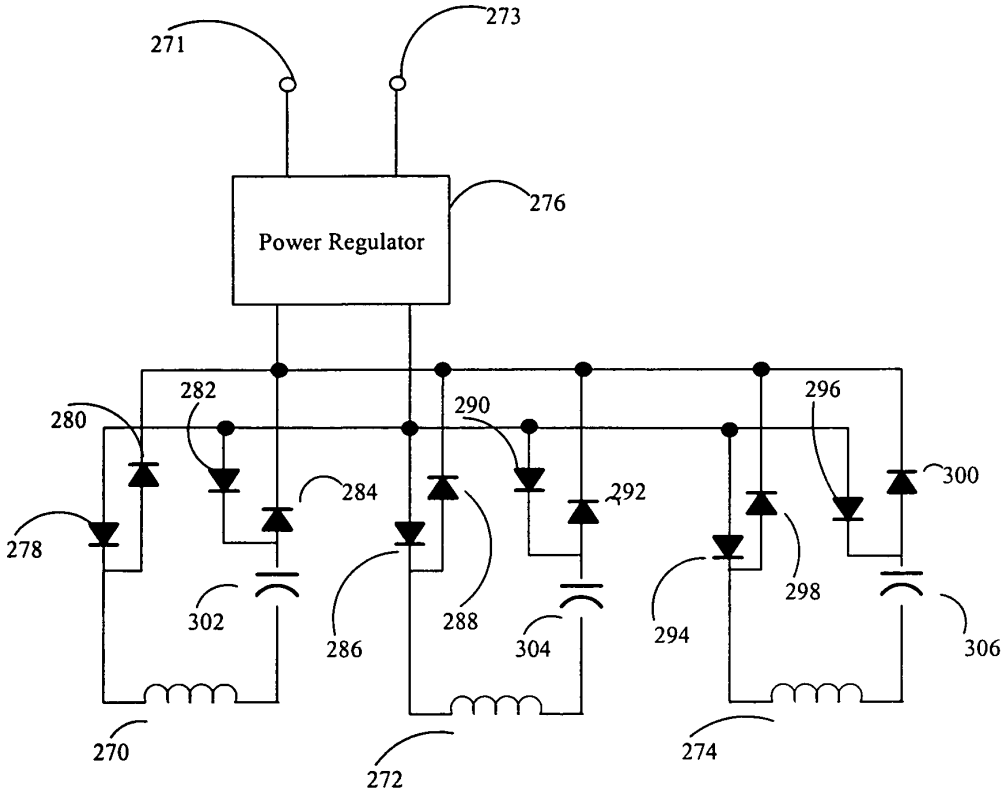
271
273
276
Power Regulator
280
282
284
290
292
296
300
278
298
302
286
288
304
294
306
270
272
274

FIG. 8

DECLARATION

Express Mail
EV 195836125 US

As a below named inventor, I declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled ADAPTER, the specification of which:

__X__ is attached hereto.

_____ was filed on _____ as Application Serial No. _____.

_____ was filed on _____ as PCT International Application No. _____.

_____ was amended on _____.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Sec. 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I claim foreign priority benefits under Title 35, United States Code, Sec. 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

			Priority Claimed	
None				
(Number)	(Country)	(Month/day/year filed)	Yes	No

I claim the benefit under Title 35, United States Code, Sec. 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Sec. 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Sec. 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

10/357,932	February 4, 2003	pending
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I claim the benefit under Title 35, United States Code, Sec. 119(e) of any United States Provisional application(s) listed below:

60/444,794	February 4, 2003	pending
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true; and these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Inventor's Signature Date	Inventor's Signature Date
David W. Baarman	
Full name of sole or first joint inventor	Full name of second joint inventor, if any
United States of America	
Citizenship	Citizenship
Fennville, Michigan	
Residence (City & State)	Residence (City & State)
6414 127th Avenue, Fennville, MI 49408	
Post Office Address	Post Office Address

Additional inventor(s) identified on attached sheet ___ Yes _x_ No

WN3076
921738-2

Express Mail
EV 195836125 US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	David W. Baarman
Attorney Docket No.	:	18716.84220-001
For	:	ADAPTER

MS PATENT APPLICATION
Commissioner for Patents
P.O. Box 1450
Arlington, VA 22313-1450

DISCLOSURE STATEMENT

Applicant wishes to advise the Patent and Trademark Office of the information listed on the attached Form PTO/SB/08A considered during the preparation of the above-identified application.

A copy of each reference listed is enclosed.

Respectfully submitted,

DAVID W. BAARMAN

By: Warner Norcross & Judd LLP

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PTO/SB/08A (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	David W. Baarman
Art Unit	
Examiner Name	
Attorney Docket Number	18716.84220-001

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 6597076	07-22-2003	Scheible et al	
		US- 6462432	10-08-2002	Seelig et al	
		US- 6301128	10-09-2001	Jang et al	
		US- 6265791	07-24-2001	Eberl et al	
		US- 5831348	11-03-1998	Nishizawa	
		US- 5814900	09-29-1998	Esser et al	
		US- 5550452	08-27-1996	Shirai et al	
		US- 5455467	10-03-1995	Young et al	
		US- 5455466	10-03-1995	Parks et al	
		US- 5428659	06-27-1995	Renner et al	
		US- 5229652	07-20-1993	Hough	
		US- 4818855	04-04-1989	Mongeon et al	
		US- 4800328	01-24-1989	Bolger et al	
		US- 3949268	04-06-1976	von Mangoldt	
		US- 3938018	02-10-1976	Dahl	
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3]Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET	SERIAL NO. 10689375	FILING DATE
	APPLICANT(S)	

CLAIMS

	AS FILED		AFTER 1ST AMENDMENT		AFTER 2ND AMENDMENT									
	IND	DEP	IND	DEP	IND	DEP		IND	DEP	IND	DEP	IND	DEP
1	1						51						
2		1					52						
3		1					53						
4		1					54						
5		1					55						
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7		1					57						
8		1					58						
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41		1					91						
42		1					92						
43		1					93						
44		2					94						
45		2					95						
46		2					96						
47							97						
48							98						
49							99						
50							100						
TOTAL IND.	5						TOTAL IND.						
TOTAL DEP.	44						TOTAL DEP.						
TOTAL CLAIMS	49						TOTAL CLAIMS						

PTO-1360 (Replication only) (3/03)

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

10/24/2003 EHAILE1 00000012 230457 10689375

01 FC:1001		770.00 OP
02 FC:1201		172.00 OP
03 FC:1202	54.00 DA	468.00 OP

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002 — 489-267/69033

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2003

Application or Docket Number: 1871/6.84220.001

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	46	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	49 minus 20=	* 29
INDEPENDENT CLAIMS	5 minus 3 =	* 2
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	385.00	OR	BASIC FEE	770.00
X$ 9=		OR	X$18=	
X43=		OR	X86=	172
+145=		OR	+290=	
TOTAL		OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.