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(54) Title: APPLIANCE MOUNTED POWER OUTLETS

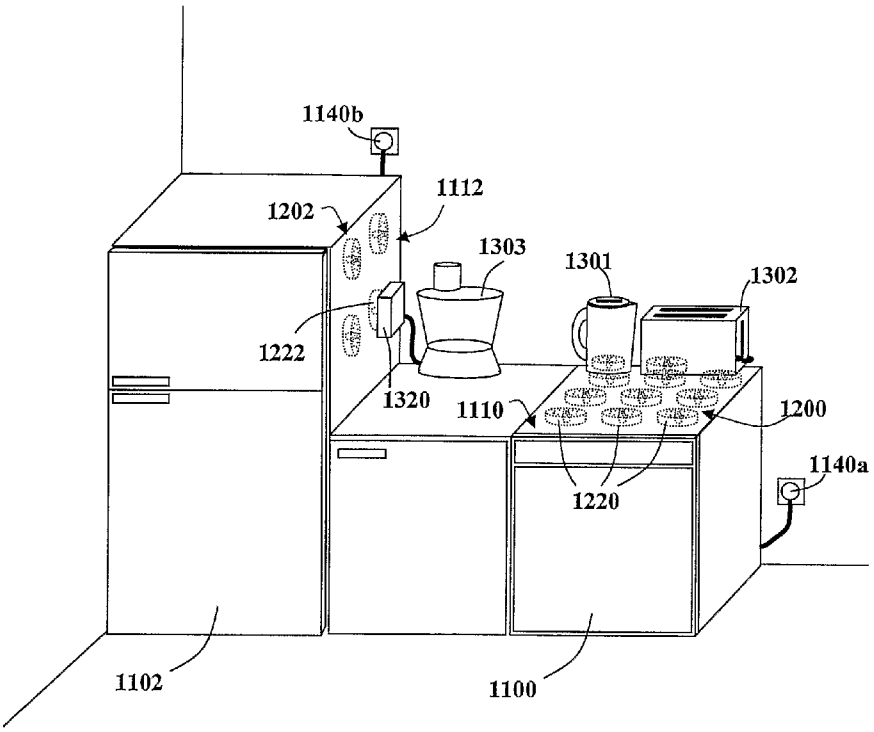

Fig. 2

[Continued on next page]

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(57) Abstract: An electrical appliance, having a principle electrical load for performing a principle function, which further includes an inductive power outlet for inductively coupling with a secondary inductive coil wired to an external electrical load.

APPLIANCE MOUNTED POWER OUTLETS

Field of the Invention

The present invention relates to inductive power provision. More specifically, the invention relates to inductive power outlets mounted upon host electrical devices.

Background

Electrical devices need to be connected to an electrical power source in order to be operated. Unless the electrical device carries an internal power supply such as a battery, the device is dependant upon significant infrastructure to provide it with power. The power providing infrastructure typically includes a power outlet wired to a mains power line. Power cables connected to electrical devices typically draw power from a mains line via plug-and-socket connectors.

In recent times, there has been a rapid proliferation of electrical devices in both the home and work environments. In a modern kitchen for example, there is need to provide electricity to numerous high power appliances such as ovens, refrigerators, dishwashers, washing machines and dryers, as well as to various worktop gadgets such as toasters, kettles, mixers and the like which are increasingly considered necessities rather than luxury items. The high power devices are usually stationary, hard-wired to high current mains outlets, whereas gadgets are often movable, being stored away in cupboards and brought out to the worktop when necessary.

The infrastructure required to provide power to these devices has not always been able to keep up with the increased demand for power. In many kitchens, such devices often need to share a single power outlet. In order to connect many electrical devices to the mains, power strips may be used. Power strips, provide many sockets all of which connect to the mains via a single plug-and-socket connector.

Although convenient, power strips can represent a significant hazard. A single plug-and-socket connector is usually designed to provide power to a single appliance. By plugging in a number of appliances to a single connector, the connector may become overloaded which can cause overheating or even fire. This is a particular problem where devices are regularly plugged and unplugged into the socket. Disconnecting an electrical load from a power source by unplugging a plug-and-socket connector can produce sparking which damages the connectors and may cause them to heat up excessively. Some small gadgets, such as kettles, which require

unplugging to be filled, nevertheless require high currents. Especially in the kitchen environment, the greater the number of power sockets, the greater the chance that water may spill into them. It has been proposed that inductive rather than conductive power connectors may be used to reduce this hazard.

Inductive power coupling allows energy to be transferred from a power supply to an electric load without any conduction path therebetween. An inductive coil and a driver is wired to a power supply. The driver applies an oscillating electric potential across the inductive coil which serves as the primary coil of an inductive couple. The oscillating electric potential induces an oscillating magnetic field which may induce an oscillating electrical current in a secondary coil placed close to the primary coil. In this way, electrical energy is transmitted from the primary coil to the secondary coil by electromagnetic induction without the two coils being conductively connected. An electric load wired in series with the secondary coil may draw energy from the power source when the secondary coil is inductively coupled to the primary coil.

Because there is no conductive path between the connectors, inductive power connectors do not spark. Furthermore because electrical components of inductive power outlets may be sealed to prevent water from penetrating the connection, they are safer in wet environments. Nevertheless, inductive power outlets require additional infrastructure, such as drivers and inductive coils, which are not generally available with existing mains power lines.

There is a need for inductive power outlets which can be integrated with existing mains power lines without the need for additional infrastructure. The present invention addresses this need.

Summary of the Invention

It is an aim of the current invention to provide a solution to providing an electrical appliance comprising a connection to a power source and a principle electrical load, wherein the appliance additionally comprises at least one inductive power outlet, the inductive power outlet comprising: at least one driver, connectable to the power source, the driver for providing an oscillating voltage supply; and at least one primary inductive coil connected to the driver, the primary inductive coil for inductively coupling with an external secondary inductive coil wired to a second electrical load.

Typically, the power source comprises a mains electricity line. Alternatively, the power source is integral to the electrical appliance. For example, the power source may comprise at least one electrochemical power cell.

Preferably, the parasitic power outlet additionally comprises at least a first ferromagnetic core for providing flux guidance between the primary inductive coil and the secondary inductive core.

According to various embodiments, the principle load may be selected from the group consisting of: electrical heaters, electrical motors, refrigeration units, compressors, display units, loudspeakers, electrical clocks, electromagnetic transducers and computers.

In particular embodiments of the invention the appliance is selected from the group comprising: refrigerators, freezers, dishwashers, ovens, microwaves, washing machines, dryers, photocopiers, computers, printers, scanners, televisions, home entertainment centers, audio players and video players. Optionally, the parasitic power outlet is incorporated into a substantially flat portion of the appliance.

Optionally, the appliance comprises an attachment means for mechanically attaching the external secondary inductive coils in alignment with the primary inductive coils.

In certain embodiments the parasitic power outlets additionally comprise data channels for allowing data exchange between the power outlets and secondary units comprising the secondary coils.

In accordance with further embodiments of the invention the appliance of claim 1 comprises an array of the parasitic power outlets. Optionally the driver may be connected to a plurality of the primary inductive coils.

In still further embodiments, the power source comprises a further secondary inductive coil wired to the appliance for coupling with an external primary inductive coil wired to a second power source.

A second aim of the invention is to provide a method for distributing power from an electrical power source wired to a first electrical load, the method comprising the steps of

a. wiring at least one inductive power outlet in parallel with the first electrical load, the inductive power outlet comprising:

at least one primary inductive coil; and

at least one driver for providing an oscillating voltage supply to the primary inductive coil; and

b. inductively coupling the primary inductive coil with an external secondary inductive coil wired to a second electrical load.

Brief Description of the Figures

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

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 the preferred embodiments of the present invention 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 the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention; the description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice. In the accompanying drawings:

Fig. 1 is a block diagram showing the main elements of an inductive power outlet mounted upon an electrical appliance according to a first embodiment of the invention;

Fig. 2 is a schematic diagram of a kitchen including multi-coiled inductive power outlets incorporated into the flat surfaces of large kitchen appliances according to other embodiments of the invention;

Fig. 3 is a schematic diagram of a laptop computer including an inductive power outlet being used to charge a mobile phone, according to still another embodiment of the invention, and

Fig. 4 is a schematic diagram of a television including an inductive power outlet being used to power a DVD player itself inductive power outlet used charge a remote control unit.

Description of the Preferred Embodiments

Reference is now made to Fig. 1 which is a block diagram showing the main elements of an inductive power outlet 200 mounted upon a host electrical appliance 100 according to a first embodiment of the invention. The appliance 100 is designed to perform a particular function and includes a principle electric load 120 which is connectable to a power source 240.

The power source 240 may be connected to the host appliance 100 via power a conventional plug-and-socket connector to a mains line (not shown). The inductive power outlet 200 may be incorporated into a domestic appliance such as a refrigerator, freezer, dishwasher, hob, oven, microwave, washing machine, dryer, television, home entertainment center, video player, audio player or the like. In an office environment such an inductive power outlet 200 may be incorporated into equipment such as photocopiers, computers, printers and scanners for example.

According to the function of the appliance, the principle load 120 of the appliance may be, for example, an electrical heater, an electrical motor, a refrigeration unit, a compressor, a display unit, a loudspeaker, an electrical clock, an electromagnetic transducer and a computer processor.

In other embodiments the power source 240 is integral to the host appliance, for example, an internal electrical power cell of a laptop computer or an electric generator driven by an internal combustion engine.

It is a particular feature of embodiments of the present invention that the inductive power outlet 200 includes at least one primary inductive coil 220 connected to the power source 240 via a driver 230. The driver 230 is configured to provide the electronics necessary to drive the primary coil 220. Driving electronics typically includes a switching unit for providing a high frequency oscillating voltage supply.

A secondary inductive coil 320 wired to a second electrical load 340, typically housed in an external movable secondary unit 300, may be brought into proximity with the inductive power outlet 200. The primary inductive coil 220 is configured to inductively couple with the secondary inductive coil 320 aligned therewith. The second electrical load 340 is configured to draw power from the secondary inductive coil 320.

According to preferred embodiments of the invention, the inductive power outlet 200 includes a ferromagnetic core for providing flux guidance between the primary inductive coil 220 and the secondary inductive coil 320.

It will be appreciated that the present invention is of particular utility in a domestic kitchen environment. A large number of electrical labor saving devices are commonly used in the modern kitchen, such as, inter alia, mixers, blenders, egg beaters, bread-makers, liquidizers, orange juice extractors, vegetable juicers, food-processors, electric knives, toasters, sandwich toasters, waffle makers, electrical

barbecue grills, slow cookers, hot-plates, deep-fat fryers, electrical frying pans, knife sharpeners, domestic sterilizers, kettles, urns, radios, televisions, computers, cassette players, CD players, media players, steamers, egg boilers, coffee makers, rice maker and electrical tin-openers and the like. However, kitchens are hazardous environments for using electricity as water can easily enter conventional electrical sockets. In contradistinction to conventional sockets, inductive power outlets can be sealed to make them waterproof, thereby preventing water from making contact with the conducting elements therewithin. Indeed, electrical devices adapted to receive power inductively may be designed to be cleaned by loading into a dishwasher.

Although, it may be useful to provide a dedicated inductive power outlet surface for use in the kitchen environment, it is particularly useful to incorporate such a power providing surface to an existing electrical appliance which is already being plugged into a mains power outlet because no additional power outlets are required.

An exemplary embodiment of the invention for use in a domestic kitchen environment is shown in Fig. 2. An array of inductive power outlets 1200 is incorporated into the flat top surface 1110 of a domestic kitchen appliance 1100 such as a dishwasher, for example, which is itself connected to a conventional plug-and-socket mains power outlet 1140a. The inductive power outlets 1200 are used to provide power to worktop kitchen appliances such as a kettle 1301 or toaster 1302, for example.

A second array of inductive power outlets 1202 is incorporated into the side 1112 of a fridge-freezer 1102, also connected to a conventional plug-and-socket mains power outlet 1140b. Inductive power receivers 1320 may be attached magnetically to the side 1112 of the fridge-freezer 1102 or via suction means or the like. An electrical device, such as a food processor 1303 for example, wired to such inductive power receivers 1320 may draw power from the power outlet 1222.

It will be appreciated that the provision of inductive power outlets 1200, 1202 incorporated into large electrical appliances 1100, 1102 require no special infrastructure. The power is drawn from the mains via conventional plug-and-socket power outlets 1140a, 1140b.

It is further noted that in multicoil power outlets 1200, the driving unit 230 (Fig. 1) may also regulate the power delivered to the primary coils 1220 in order to prevent overloading. A controller (not shown) could monitor the power delivered to

the multicoil power outlet 1200 and provide power to more than one primary coil 1220 such that the total power drawn by the system remains within an acceptable range. Multiple coils may be activated simultaneously, sequentially or intermittently, for example as required.

Another embodiment of the invention is shown in Fig. 3 for use, for example, in an office environment. An inductive power outlet 2200 is incorporated into a computer 2100. The primary inductive coil 2220 of the computer 2100 may be used to charge an external device such as a mobile phone 2300, a PDA, a media player or the like wired to secondary inductive coil 2320. For convenience, the power outlet 2200 may be provided upon a drawer 2120 which extends from the computer 2100. Alternatively, the power outlet 2200 may be incorporated into a DVD/CD drive which is retrofittable to the computer 2100.

It is noted that, when a laptop computer 2100 is disconnected from the mains, the internal power cells 2240 may serve as the power source for the power outlet 2200. An analogous use is already made of computers 2100 to charge external devices such as media players, mobile phones, mice, Bluetooth devices and the like, generally using dedicated cables such as via USB (universal serial bus) ports. One advantage of the inductive power outlet 2200 is that no such dedicated cables are needed

It is noted that the inductive power outlet 2200 may additionally include data channels for communicating between the computer 2100 and the external device 2300. A signal transfer system may therefore be incorporated into the outlet 2200. Various transmitters and receivers may be used with the signal transfer system. For example, a light emitting diode may serve as a transmitter which sends encoded optical signals over short distances to a photo-transistor which serves as a receiver. In systems where alignment between the transmitter and receiver may be problematic, alternative systems may be preferred such as ultrasonic signals transmitted by piezoelectric elements or radio signals such as Bluetooth, WiFi and the like. Alternatively the primary and secondary coils may themselves serve as the transmitter and receiver.

With reference now to Fig. 4, another embodiment of the invention is shown in which the host appliance is a television set 3100. The television set 3100 is connected to the mains via a conventional plug-and-socket mains power outlet 3140. An inductive power outlet 3200 is incorporated into the television set 3100 for

inductively providing power to auxiliary appliances 3102, such as a DVD player, which is configured to receive power inductively via a secondary inductive coil 3320. Optionally the auxiliary appliance 3102 additionally includes a second inductive outlet 3202 for coupling with one or more further auxiliary appliances, such as a remote control unit 3300, for example. It will be apparent that, the embodiment described hereabove is extendable to include further host appliances which may be daisy chained such that power may be provided to all devices from a single mains outlet.

Thus, an inductive power distributor is described which is incorporated into a host appliance connected to a power source. The inductive power distributor is convenient, safe and can be integrated into existing electrical power infrastructure.

The scope of the present invention is defined by the appended claims and includes both combinations and sub combinations of the various features described hereinabove as well as variations and modifications thereof, which would occur to persons skilled in the art upon reading the foregoing description.

In the claims, the word "comprise", and variations thereof such as "comprises", "comprising" and the like indicate that the components listed are included, but not generally to the exclusion of other components.

Claims

1. An electrical appliance comprising a connection to a power source and a principle electrical load, wherein said appliance additionally comprises at least one inductive power outlet, said inductive power outlet comprising:

    a. at least one driver, connectable to said power source, said driver for providing an oscillating voltage supply, and

    b. at least one primary inductive coil connected to said driver, said primary inductive coil for inductively coupling with an external secondary inductive coil wired to a second electrical load.

2. The appliance of claim 1, wherein said power source comprises a mains electricity line.

3. The appliance of claim 1, said power source being integral to said electrical appliance.

4. The appliance of claim 1, said power source comprising at least one electrochemical power cell.

5. The appliance of claim 1, said inductive power outlet additionally comprising at least a first ferromagnetic core for providing flux guidance between said primary inductive coil and said secondary inductive core.

6. The appliance of claim 1 wherein said principle load is selected from the group consisting of: electrical heaters, electrical motors, refrigeration units, compressors, display units, loudspeakers, electrical clocks, electromagnetic transducers and computers.

7. The appliance of claim 1 being selected from the group consisting of: refrigerators, freezers, dishwashers, ovens, microwaves, washing machines, dryers, photocopiers, computers, printers, scanners, televisions, home entertainment centers, audio players and video players.

8. The appliance of claim 1 wherein said inductive power outlet is incorporated into a substantially flat portion thereof.

9. The appliance of claim 1 further comprising an attachment means for mechanically attaching said external secondary inductive coils in alignment with said primary inductive coils.

10. The appliance of claim 1, wherein said inductive power outlets additionally comprise data channels for allowing data exchange between said power outlets and secondary units comprising said secondary coils.

11. The appliance of claim 1 comprising an array of said inductive power outlets.

12. The appliance of claim 1 wherein said driver is connected to a plurality of said primary inductive coils.

13. The appliance of claim 1 wherein said power source comprises a further secondary inductive coil wired to said appliance for coupling with an external primary inductive coil wired to a second power source.

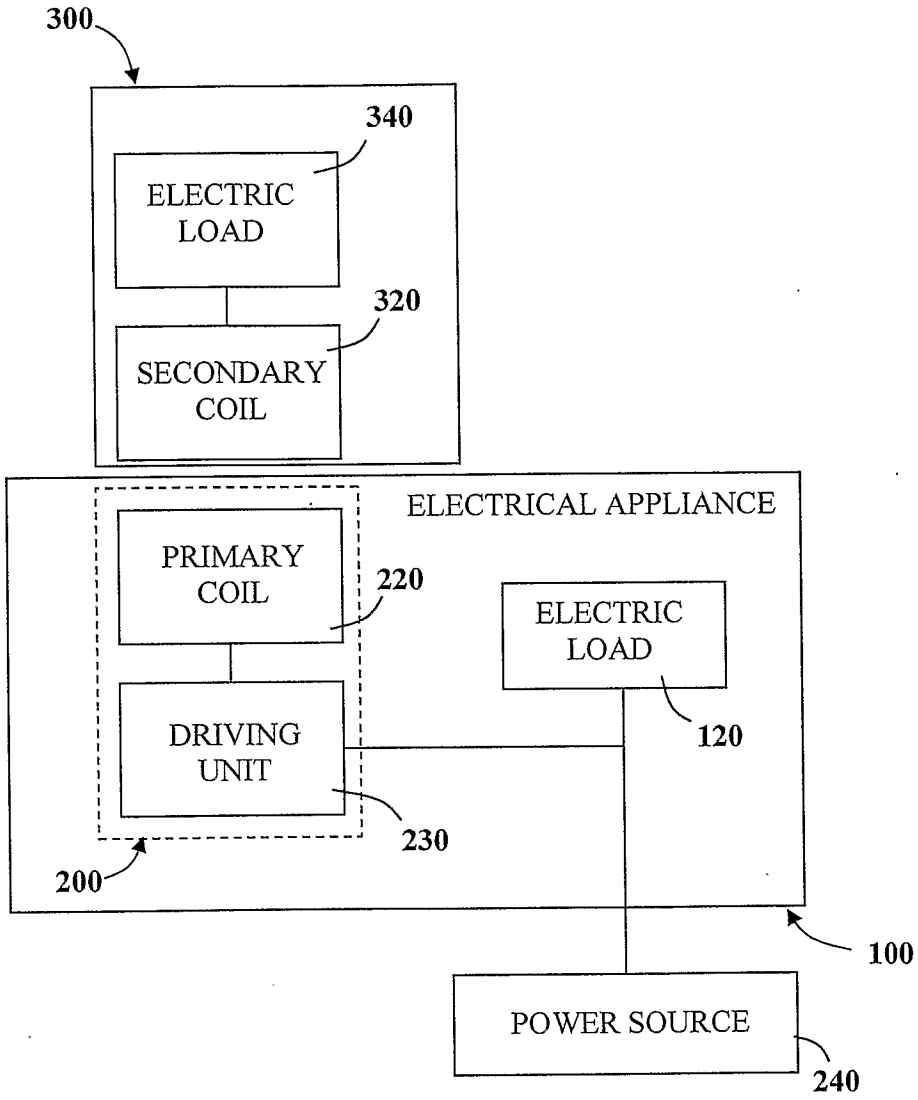
14. A method for distributing power from an electrical power source wired to a first electrical load, said method comprising the steps of

    a. wiring at least one inductive power outlet in parallel with said first electrical load, said inductive power outlet comprising:

        i. at least one primary inductive coil;

        ii. at least one driver for providing an oscillating voltage supply to said primary inductive coil; and

    b. inductively coupling said primary inductive coil with an external secondary inductive coil wired to a second electrical load.


300
340
ELECTRIC LOAD
320
SECONDARY COIL
ELECTRICAL APPLIANCE
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220
ELECTRIC LOAD
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DRIVING UNIT
230
200
100
POWER SOURCE
240

Fig. 1

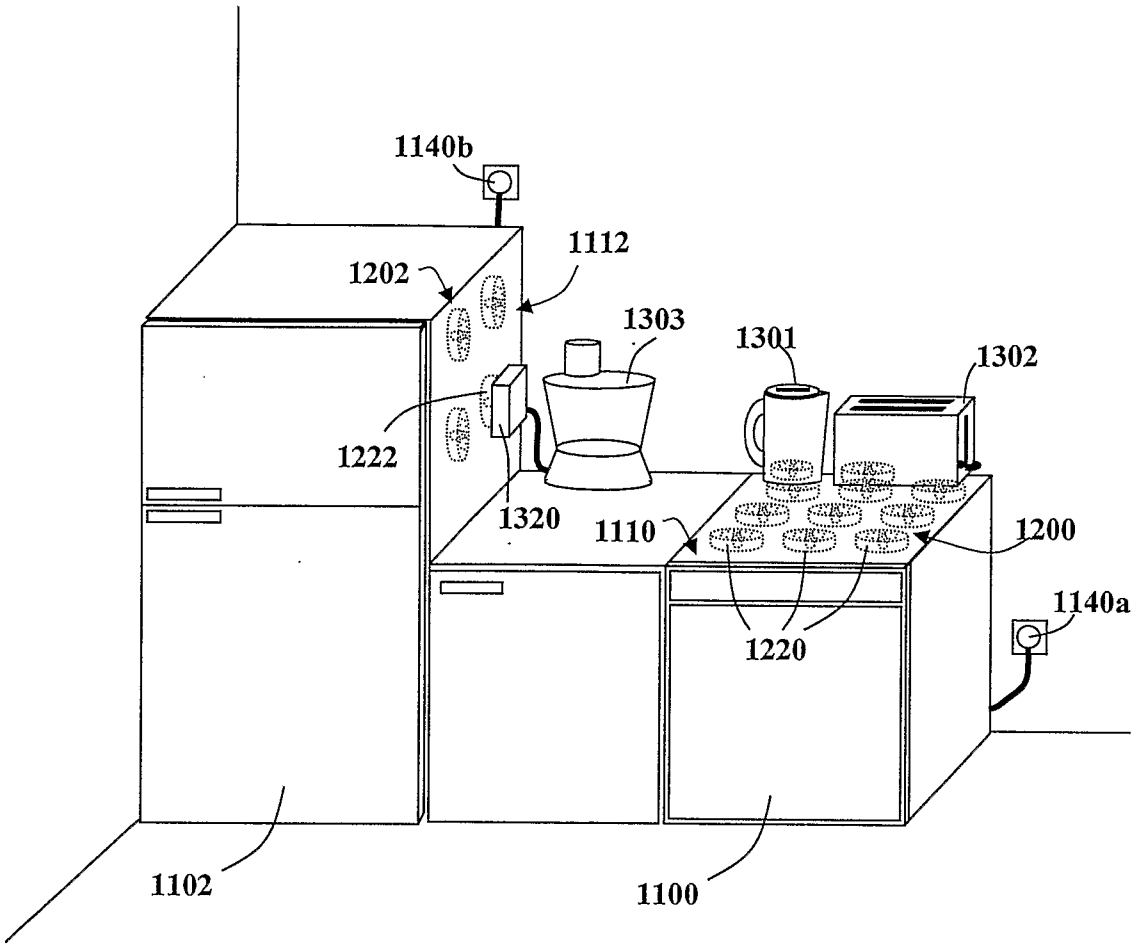
1140b
1112
1202
1303
1301
1302
1222
1320
1110
1200
1140a
1220
1102
1100

Fig. 2

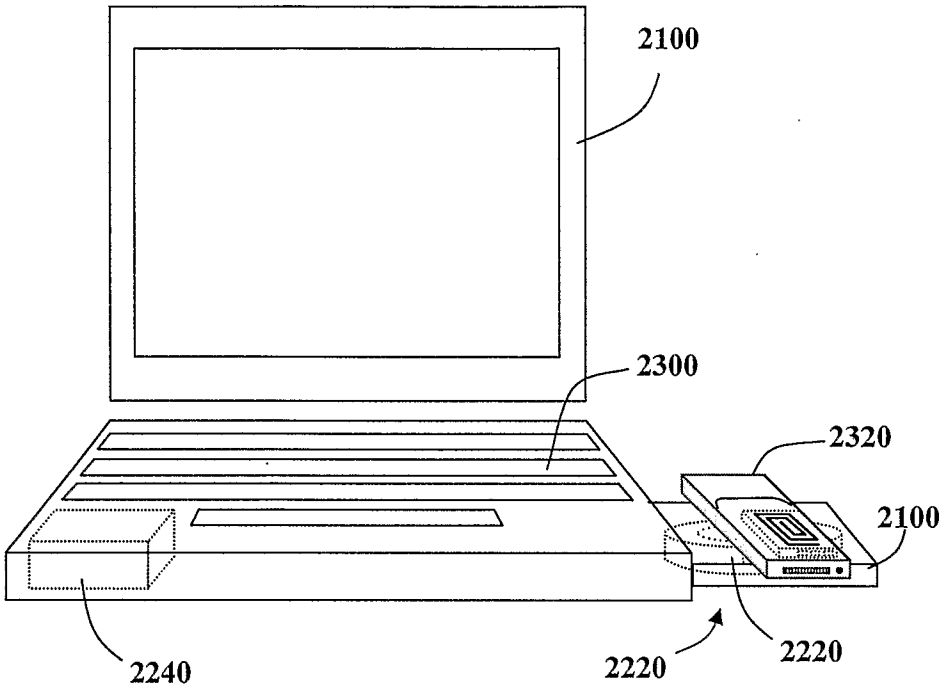

Fig. 3

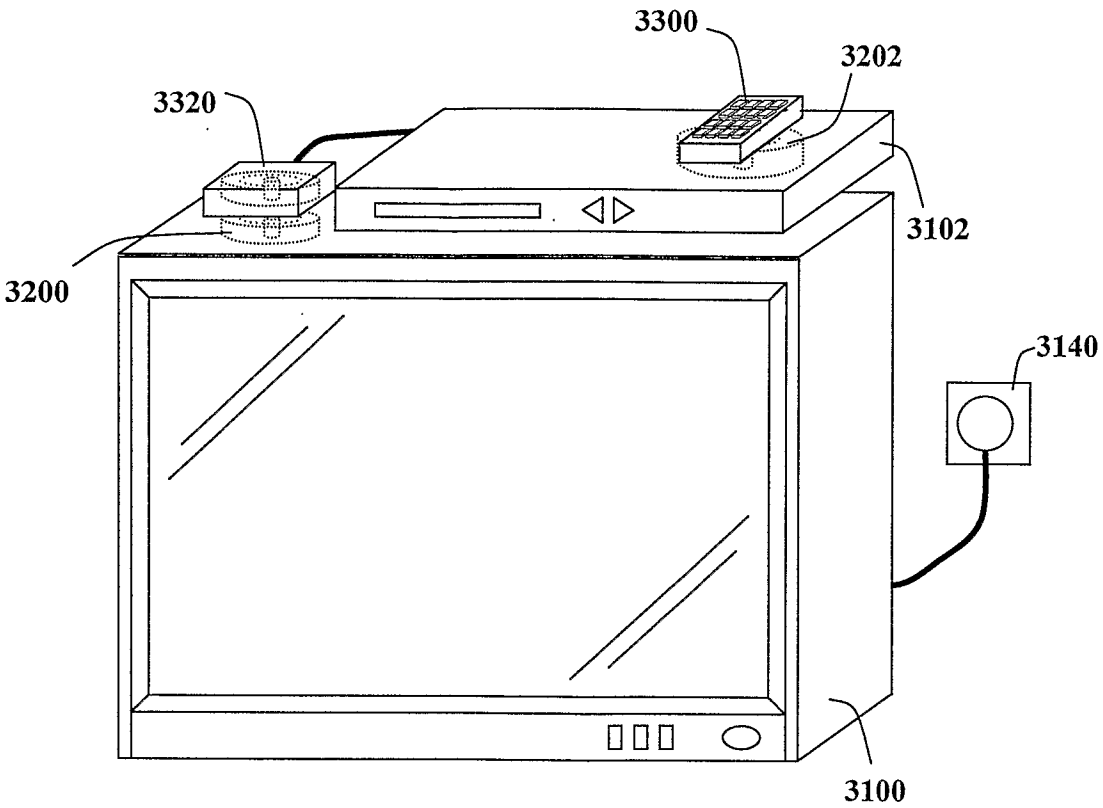

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL 09/00544

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H01F 17/00 (2009.01)
USPC - 323/355
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)
USPC: 323/355

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 336/65,177; 323/205,355 (see terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST(PGPB,USPT,USOC,EPAB,JPAB), GOOGLE SCHOLAR
terms: inductive, coil, cordless, power, battery, wireless, contactless, cord/wire/contact free, energy, electricity, appliance, flux, windings, flat, array, driver, data channel, electrochemical, ferromagnetic, refrigerator, laptop, notebook, PC, computer, internal, dishwashing, etc.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/0279002 A1 (Partovi) 06 December 2007 (06.12.2007), fig. 1, 8, 10, 19, para [0041]-[0063], [0087]-[0125], [0138]-[0168].	1-14
A	US 7,262,700 B2 (Hsu) 28 August 2007 (28.08.2007), entire document.	1-14
A	US 7,019,620 B2 (Bohler et al.) 28 March 2006 (28.03.2006), entire document.	1-14

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 September 2009 (16.09.2009)	29 SEP 2009
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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