



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.06.2014 Bulletin 2014/23

(51) Int Cl.:
H01Q 1/24 (2006.01) **H01Q 3/24 (2006.01)**
H01Q 21/28 (2006.01)

(21) Application number: **13164832.1**

(22) Date of filing: **23.04.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventors:
• **Chang, Yao-Wen**
114 Taipei City (TW)
• **Hsu, Liang-San**
247 New Taipei City (TW)

(30) Priority: **28.11.2012 TW 101223029 U**

(74) Representative: **Becker Kurig Straus**
Bavariastrasse 7
80336 München (DE)

(71) Applicant: **Compal Broadband Networks Inc.**
114 Taipei City (TW)

(54) **Switchable antenna system**

(57) A switchable antenna system includes an antenna control circuit and at least one switchable antenna module coupled to the antenna control circuit. Each switchable antenna module includes a built-in antenna; a joint, for connecting an external antenna; a switching circuit, coupled to the built-in antenna and the joint, for

being switched between a first mode of using the built-in antenna and a second mode of using the external antenna; and a switch, coupled to the switching circuit, for controlling the switching circuit to be switched between the first mode and the second mode.

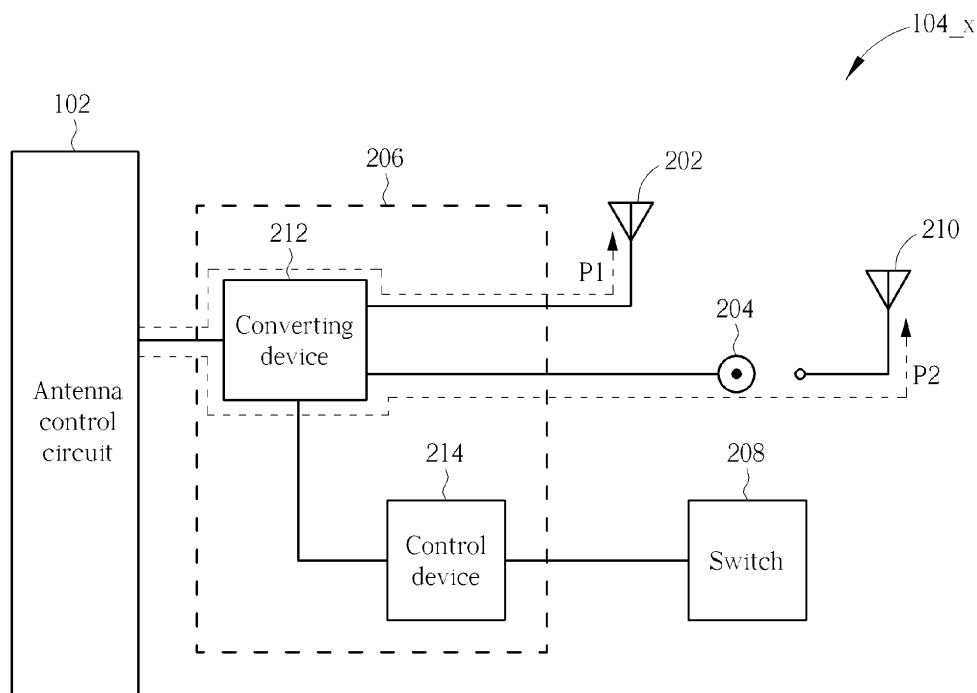


FIG. 2

Description

Field of the Invention

[0001] The present invention relates to an antenna system, and more particularly, to a switchable antenna system capable of being switched arbitrarily between a built-in antenna mode and an external antenna mode.

Background of the Invention

[0002] An antenna is an essential wireless communication device for transmitting and receiving electromagnetic signals. Conventionally, a transmitter of a wireless communication system outputs a radio frequency (RF) signal to the antenna via a conducting wire, and the antenna emits the RF signal in an electromagnetic form. After the electromagnetic signal is transmitted to a destination, an antenna of the destination senses RF signals, and transmits the RF signals to a receiver of a wireless communication system via a conducting wire. Thus, the signal transmission is accomplished.

[0003] In order to comply with transmissions of various frequencies, functions and circumstances, the industry has developed various types of antennas. These types of antennas can be classified in different ways. If the classification is based on functionality, the antennas can be divided into communicative antennas, television antennas, radar antennas, etc. If the classification is based on operating frequency, the antennas can be divided into short wavelength antennas, ultra-short wavelength antennas, microwave antennas, etc. If the classification is based on directionality, the antennas can be divided into omni antennas, directional antennas, etc. If the classification is based on appearance, the antennas can be divided into linear antennas, planar antennas, horn antennas, etc. In general, the antennas can be built-in or external, and the user can select a desired antenna type according to requirements or using purposes.

[0004] No matter whether a built-in antenna or an external antenna is utilized, the wireless communication system may only support one antenna mode. In other words, the wireless communication system utilizing the built-in antenna may not support the external antenna, and the wireless communication system in which the external antenna is required may not possess functionality of the built-in antenna. For example, when the user wants to change to use an external high power antenna because performance of the built-in wireless antenna is poor, or wants to use a directional antenna in order to enhance signal coverage due to special topography, since the above limitation of the antennas, the user is not allowed to arbitrarily change the working status of the antenna. Thus, there is a need for improvement over the prior art.

Summary of the Invention

[0005] This in mind, the application aims at providing a switchable antenna system in order to solve the above-mentioned problems.

[0006] This is achieved by a switchable antenna system according to claim 1. The dependent claims pertain to corresponding further developments and improvements.

[0007] As will be seen more clearly from the detailed description following below, the claimed switchable antenna system comprises an antenna control circuit; and at least one switchable antenna module, coupled to the antenna control circuit. Each switchable antenna module comprises a built-in antenna; a joint, for connecting an external antenna; a switching circuit, coupled to the built-in antenna and the joint, for being switched between a first mode of using the built-in antenna and a second mode of using the external antenna; and a switch, coupled to the switching circuit, for controlling the switching circuit to be switched between the first mode and the second mode.

Brief Description of the Drawings

[0008]

FIG. 1 is a schematic diagram of a switchable antenna system according to an embodiment of the present invention.

FIG. 2 is a schematic diagram of a switchable antenna module according to an embodiment of the present invention.

FIG. 3 and FIG. 4 are schematic diagrams of an embodiment of the switch.

Detailed Description

[0009] Please refer to FIG. 1, which is a schematic diagram of a switchable antenna system 10 according to an embodiment of the present invention. As shown in FIG. 1, the switchable antenna system 10 includes an antenna control circuit 102 and switchable antenna modules 104_1-104_N. The antenna control circuit 102 is utilized for controlling the operations of the switchable antenna modules 104_1-104_N, and may be a radio frequency control circuit or other control circuits capable of controlling the operations of antennas. In general, the antenna control circuit 102 may include a transmitter and a receiver. The transmitter is utilized for controlling the antenna to emit wireless signals, and the receiver is utilized for receiving wireless signals received by the antenna.

[0010] Please refer to FIG. 2, which is a schematic diagram of the switchable antenna modules 104_1-104_N according to an embodiment of the present invention. Since each of the switchable antenna modules 104_1-104_N has a similar structure, only one switchable

antenna module 104_x is illustrated in FIG. 2 for simplicity. As shown in FIG. 2, the switchable antenna module 104_x includes a built-in antenna 202, a joint 204, a switching circuit 206 and a switch 208. The built-in antenna 202 is an antenna built in the switchable antenna module 104_x, and can be of any type. In general, when the built-in antenna 202 is an omni antenna, signals can be transmitted to every corner of the room, which complies with the basic requirements of a wireless communication system. The joint 204 is utilized for connecting an external antenna 210. In general, the external antenna 210 is usually utilized for specific purposes or specific requirements. For example, when the switchable antenna system 10 is located in a place with more shelter, more interference or weaker wireless signal, a high power antenna or a directional antenna may be implemented as the external antenna 210, in order to overcome the limitation of environment. The switching circuit 206, coupled to the built-in antenna 202 and the joint 204, can be switched between a built-in antenna mode and an external antenna mode according to user requirements and using purposes. The switch 208, coupled to the switching circuit 206, is provided as a control interface for the user to control the switching circuit 206 to be switched between the built-in antenna mode and the external antenna mode.

[0011] In detail, in one embodiment, the user may set the built-in antenna 202 to be an omni antenna, and set the external antenna 210 to be a directional antenna. When the switchable antenna system 10 is located in a common environment, the user may control the switching circuit 206 to be switched to the mode utilizing the built-in antenna 202 via the switch 208. When the switchable antenna system 10 is located in a special environment and a specific magnitude of wireless signal is required, the user may control the switching circuit 206 to be switched to the mode utilizing the external antenna 210 via the switch 208. As a result, the user can arbitrarily control the switchable antenna module 104_x to be switched between the built-in antenna mode and the external antenna mode according to requirements and using purposes, to achieve flexibility and convenience for antenna utilization.

[0012] Please keep referring to FIG. 2. As shown in FIG. 2, an implementation of the switching circuit 206 is also illustrated in FIG. 2. The switching circuit 206 may include a converting device 212 and a control device 214. The converting device 212, coupled to the antenna control circuit 102, the built-in antenna 202 and the joint 204, is utilized for providing paths for connecting the antenna control circuit 102 with the antennas. The paths include a path P1 for the antenna control circuit 102 to be connected with the built-in antenna 202 and a path P2 for the antenna control circuit 102 to be connected with the external antenna 210. The control device 214, coupled to the converting device 212, is controlled by the switch 208 and utilized for controlling the converting device 212 to turn on one of the path P1 and the path P2. When the

control device 214 controls the converting device 212 to turn on the path P1 and turn off the path P2, the antenna control circuit 102 can be connected to the built-in antenna 202, such that the switchable antenna module 104_x can be operated in the built-in antenna mode. When the control device 214 controls the converting device 212 to turn on the path P2 and turn off the path P1, the antenna control circuit 102 can be connected to the external antenna 210, such that the switchable antenna module 104_x can be operated in the external antenna mode. As a result, when the switch 208 is switched, the switchable antenna module 104_x can be switched arbitrarily between the built-in antenna mode and the external antenna mode, to achieve flexibility and convenience for antenna utilization.

[0013] Please refer to FIG. 3 and FIG. 4, which are schematic diagrams of an embodiment of the switch 208. As shown in FIG. 3 and FIG. 4, the switch 208 is a sliding control switch, which includes a sliding track 302, a slider 304 and a casing 306. The slider 304 slides between two terminals E1 and E2 in the sliding track 302. As shown in FIG. 2 and FIG. 3, when the slider 304 is pushed to the terminal E1, the switch 208 may control the converting device 212 to turn on the path P1 and turn off the path P2 via the control device 214, such that the antenna control circuit 102 can be connected to the built-in antenna 202. At this moment, the switchable antenna module 104_x is operated in the built-in antenna mode. As shown in FIG. 2 and FIG. 4, when the slider 304 is pushed to the terminal E2, the switch 208 may control the converting device 212 to turn on the path P2 and turn off the path P1 via the control device 214, such that the antenna control circuit 102 can be connected to the external antenna 210. At this moment, the switchable antenna module 104_x is operated in the external antenna mode.

[0014] The sliding control switch shown in FIG. 3 and FIG. 4 may further control the joint 204. As shown in FIG. 3 and FIG. 4, the joint 204 may move along with the slider 304; hence the joint 204 can be pushed out of the casing 306 or pulled back and hidden in the casing 306. In FIG. 3, when the slider 304 is pushed to the terminal E1, the joint 204 is not in use and may be hidden in the casing 306. At this moment, the switchable antenna module 104_x is operated in the built-in antenna mode. In FIG. 4, when the slider 304 is pushed to the terminal E2, the joint 204 is pushed out of the casing 306. At this moment, if the external antenna 210 is connected to the joint 204, the switchable antenna module 104_x can be operated in the external antenna mode.

[0015] If the external antenna 210 is required to be connected to the joint 204, a spiral wire joint 308 can be utilized as the connection interface, in order to rotate and lock the external antenna 210 on the joint 204. In some embodiments, other methods may also be utilized for connecting the external antenna 210 with the joint 204, which are not limited herein. In comparison with the conventional method of connecting the external antenna via a snap dome which may easily become loose, the spiral

wire joint 308 utilized in the above embodiment can lock the external antenna 210 on the joint 204 solidly. In addition, the spiral wire joint 308 may easily be set up and disassembled. As a result, the switchable antenna module 104_x can be switched between the built-in antenna mode and the external antenna mode more easily. In some embodiments, a baffle or a dust cover can be fitted on the location where the joint 204 reaches out of the casing 306, in order to prevent the joint 204 from being damaged since the joint 204 is exposed even if it is not in use.

[0016] The present invention provides a switchable antenna system capable of being switched arbitrarily between the built-in antenna mode and the external antenna mode. Those skilled in the art can make modifications and alterations accordingly. For example, in the above switchable antenna system 10, the number of the switchable antenna modules 104_1-104_N may be determined according to system requirements. Besides, the above switchable antenna module 104_x has one built-in antenna 202 and one joint 204, but in other embodiments, there may be two or more joints implemented in the switchable antenna module, which are not limited herein. For example, when there are various types of antennas required to be utilized in the switchable antenna module 104_x, multiple joints may be utilized, and the switching circuit 206 and the switch 208 should be designed according to the number of joints, such that the switchable antenna module 104_x can be switched between one built-in antenna mode and multiple external antenna modes. In addition, the switching circuit 206 may be realized by electronic circuits and switching elements on a circuit board, and may also be realized by mechanical switching circuits and elements, which is not limited herein.

[0017] In some embodiments, a button may replace the sliding control switch to be implemented as the switch 208 of the switchable antenna module 104_x. For example, when the user pushes the button, the switchable antenna module 104_x can be switched between the built-in antenna mode and the external antenna mode. Similarly, the button may also be utilized for controlling the joint 204. When the user pushes the button in order to switch the switchable antenna module 104_x to the built-in antenna mode, since the joint 204 is not in use, it can be hidden in the casing; when the user pushes the button in order to switch the switchable antenna module 104_x to the external antenna mode, the joint 204 may move out of the casing, in order to facilitate the connection with the external antenna 210.

[0018] In the prior art, no matter whether the built-in antenna or the external antenna is utilized, the wireless communication system may only support one working mode of the antenna. Since the antennas possess utilizing limitation, the user may not arbitrarily change the working status of the antenna. In comparison, the present invention provides a switchable antenna system capable of being switched arbitrarily between the built-in antenna

mode and the external antenna mode. The switchable antenna module of the switchable antenna system can be switched between the built-in antenna mode and the external antenna mode, to achieve flexibility and convenience for antenna utilization.

Claims

1. A switchable antenna system (10), **characterized by** the switchable antenna system (10) comprising:
 - an antenna control circuit (102); and
 - at least one switchable antenna module (104_1-104_N), coupled to the antenna control circuit (102), each switchable antenna module (104_x) comprising:
 - a built-in antenna (202);
 - a joint (204), for connecting an external antenna (210);
 - a switching circuit (206), coupled to the built-in antenna (202) and the joint (204), for being switched between a first mode of using the built-in antenna (202) and a second mode of using the external antenna (210); and
 - a switch (208), coupled to the switching circuit (206), for controlling the switching circuit (206) to be switched between the first mode and the second mode.
2. The switchable antenna system (10) of claim 1, **characterized in that** the built-in antenna (202) is an omni antenna and the external antenna (210) is a directional antenna.
3. The switchable antenna system (10) of claim 1, **characterized in that** the joint (204) comprises a spiral wire joint (308), for locking the external antenna (210).
4. The switchable antenna system (10) of claim 1, **characterized in that** the antenna control circuit (102) comprises:
 - a transmitter, for controlling the built-in antenna (202) or the external antenna (210) to deliver a wireless signal via the switching circuit (206); and
 - a receiver, for receiving a wireless signal received by the built-in antenna (202) or the external antenna (210) via the switching circuit (206).
5. The switchable antenna system (10) of claim 1, **characterized in that** the antenna control circuit (102) is a radio frequency control circuit.

6. The switchable antenna system (10) of claim 1, **characterized in that** the switching circuit (206) comprises:
- a converting device (212), for providing a first path (P1) for the antenna control circuit (102) to be coupled to the built-in antenna (202) and a second path (P2) for the antenna control circuit (102) to be coupled to the joint (204); and a control device (214), coupled to the converting device (212), for controlling the converting device (212) to turn on one of the first path (P1) and the second path (P2).
7. The switchable antenna system (10) of claim 1, **characterized in that** the switch (208) comprises a button, and the switching circuit (206) is switched from the first mode to the second mode when the button is pressed.
8. The switchable antenna system (10) of claim 7, **characterized in that** the button further controls the joint (204), and the joint (204) is moved out of a casing when the button is pressed.
9. The switchable antenna system (10) of claim 1, **characterized in that** the switch (208) comprises a button, and the switching circuit (206) is switched from the second mode to the first mode when the button is pressed.
10. The switchable antenna system (10) of claim 9, **characterized in that** the button further controls the joint (204), and the joint (204) is moved into a casing when the button is pressed.
11. The switchable antenna system (10) of claim 1, **characterized in that** the switch (208) comprises a sliding control switch, and the sliding control switch comprises a sliding track (302) and a slider (304).
12. The switchable antenna system (10) of claim 11, **characterized in that** the switching circuit (206) is switched from the first mode to the second mode or from the second mode to the first mode when the slider (304) is pulled from one terminal of the sliding track (302) to the other terminal.
13. The switchable antenna system (10) of claim 11, **characterized in that** the sliding control switch further controls the joint (204) and the joint (204) is pulled back and hidden in a casing (306) when the sliding control switch controls the switching circuit (206) to be switched to the first mode, and the joint (204) is pushed out of the casing (306) when the sliding control switch controls the switching circuit (206) to be switched to the second mode.
14. The switchable antenna system (10) of claim 1, **characterized in that** the switching circuit (206) comprises an electronic circuit on a circuit board.
15. The switchable antenna system (10) of claim 1, **characterized in that** the switching circuit (206) comprises a mechanical switching circuit.

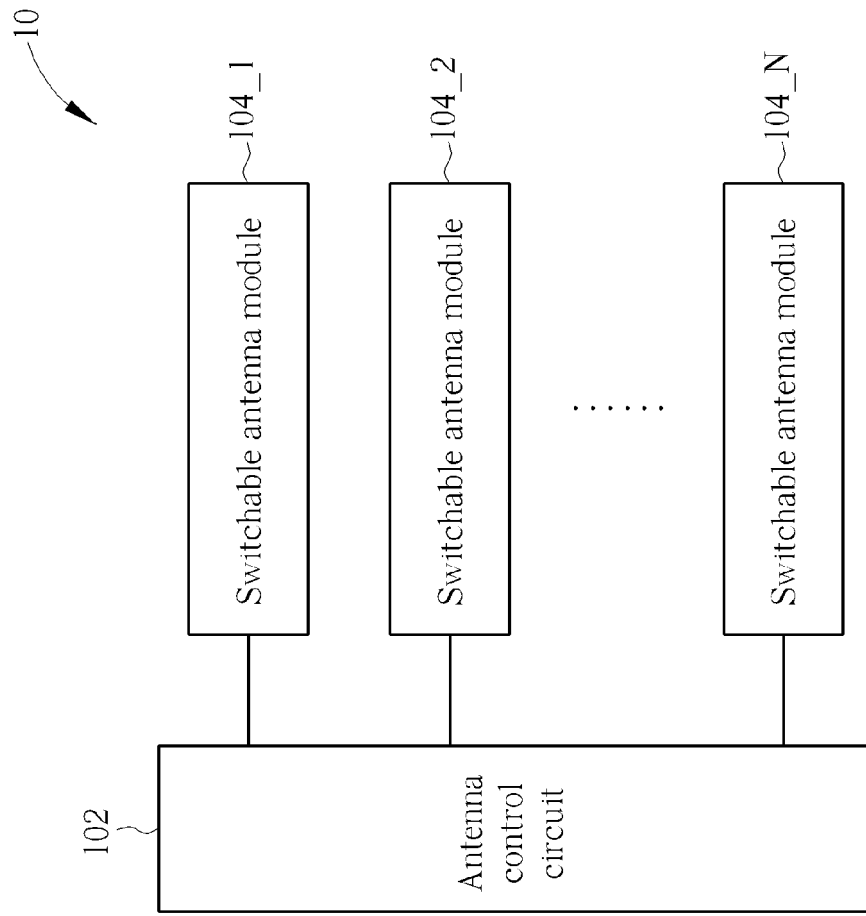


FIG. 1

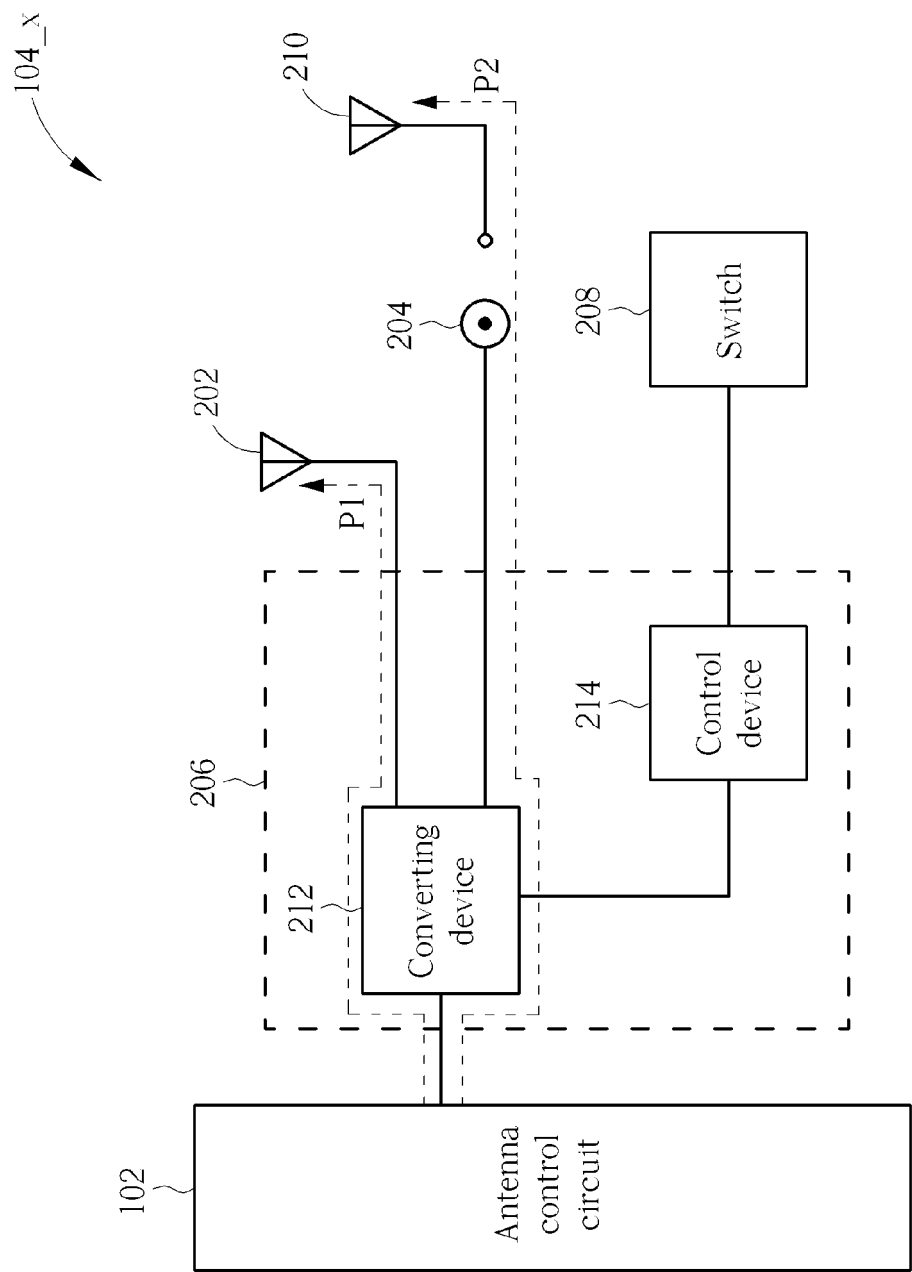


FIG. 2

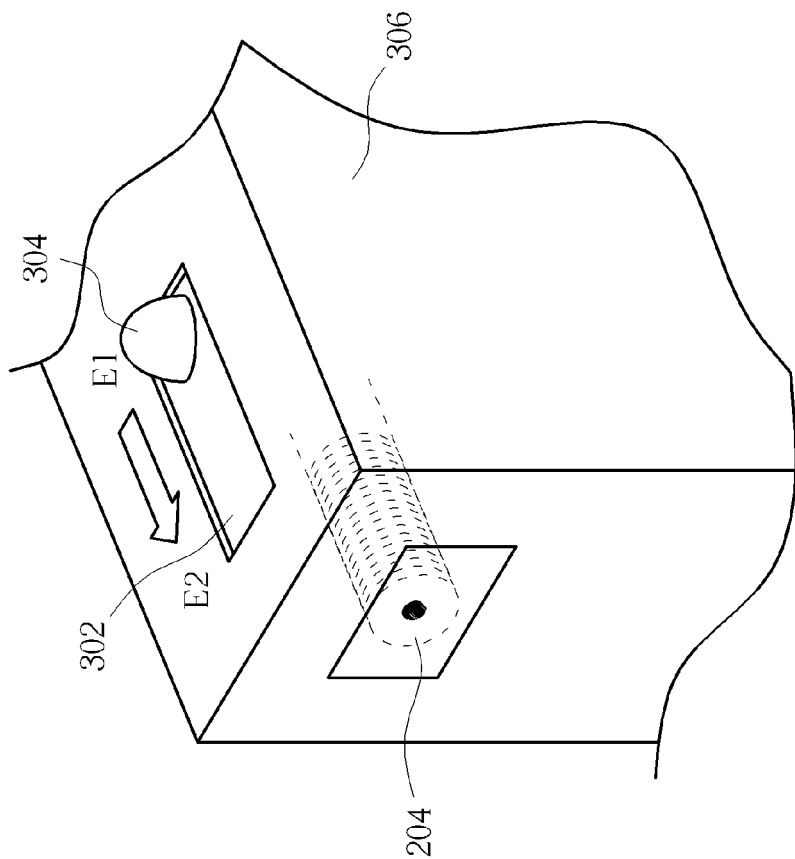


FIG. 3

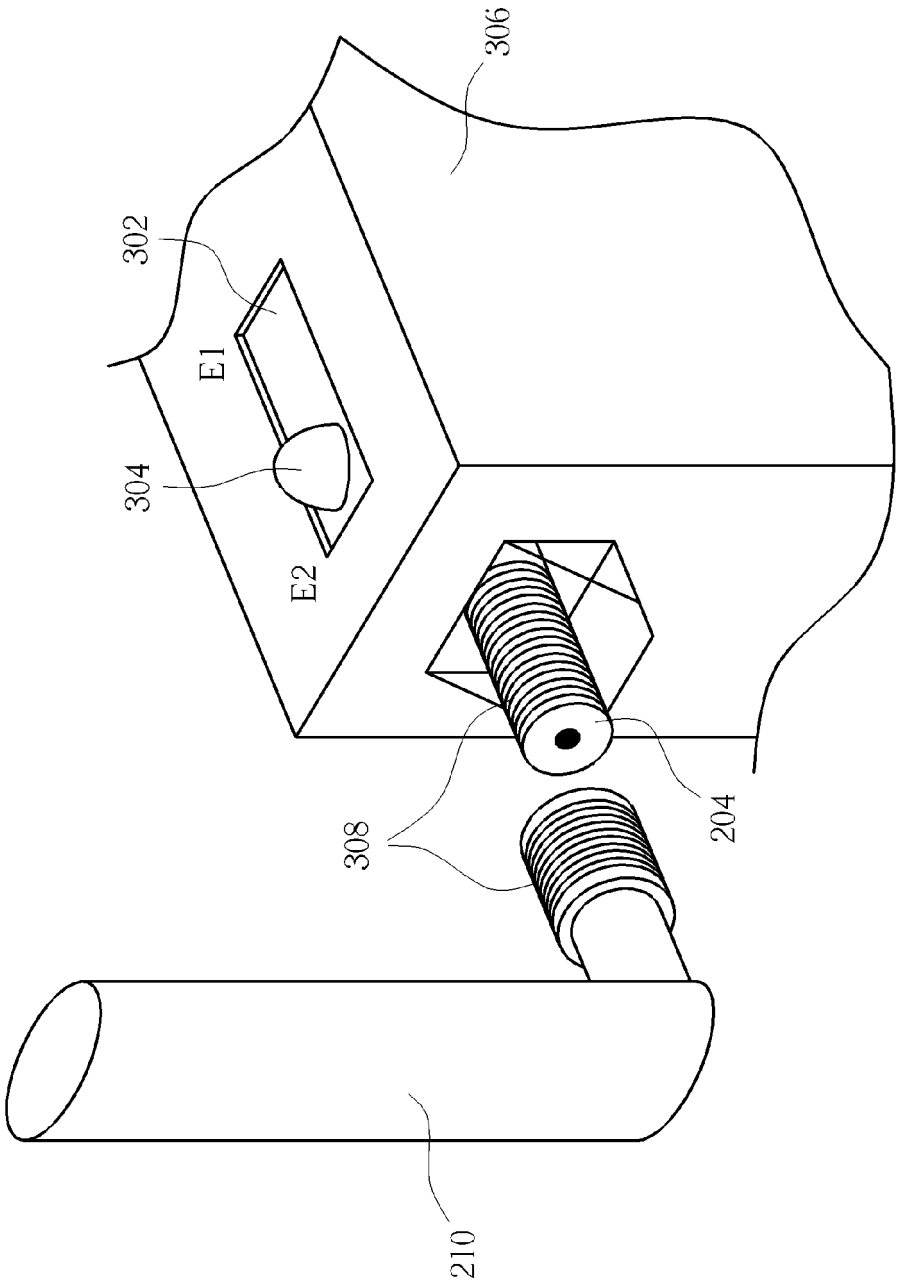


FIG. 4