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NFC ANTENNA

TECHNICAL FIELD

The present disclosure involves to an antenna, and in particular to a NFC antenna.

BACKGROUND

Near Field Communication (NFC) technology is a kind of short-range wireless communication technology, which is suitable for e-commerce such as e-wallets and EasyCards, as well as identity identification such as access control.

As mentioned above, some mobile phones are now equipped with NFC technology and can provide convenient e-commerce services such as e-wallets and EasyCards. In this way, users can carry the mobile phone when they go out, and they do not need to carry a separate wallet, so that they can make purchases and use the public transportation system.

This type of mobile phone with NFC technology is usually equipped with a NFC antenna. It is known that the NFC antenna is mostly installed directly on the motherboard of the mobile phone, and will occupy a large area on the motherboard, so that NFC antenna will affect the arrangement of multiple electronic elements (such as capacitors, inductors, resistors, diodes and transistors, etc.) on the motherboard. Therefore, this kind of mobile phone will encounter a lot of difficulties in circuit design.

SUMMARY

The present disclosure is to provide a NFC antenna to solve the problem that the NFC antenna occupies a large area on the motherboard.

In the present disclosure, a NFC antenna disposed on a display panel is provided. The NFC antenna comprises a flexible substrate and an antenna circuit. The flexible substrate is disposed on the display panel, while the antenna circuit is disposed on the flexible substrate and comprises a pair of electrodes and a coil assembly that connects to the electrodes.

According to the NFC antenna in an embodiment of the present disclosure, the display

panel has a first surface and a display area located on the first surface. The coil assembly surrounds the display area.

According to the NFC antenna in an embodiment of the present disclosure, the flexible substrate has an opening, and the display area is located in the opening.

According to the NFC antenna in an embodiment of the present disclosure, the coil assembly and the flexible substrate are located on the first surface.

According to the NFC antenna in an embodiment of the present disclosure, the display panel further has a second surface opposite to the first surface, and the electrodes are located on the second surface.

According to the NFC antenna in an embodiment of the present disclosure, the display panel further has a side surface connected between the first surface and the second surface, and the electrodes extend from the second surface to the side surface.

According to the NFC antenna in an embodiment of the present disclosure, the flexible substrate is adhered on the display panel.

According to the NFC antenna in an embodiment of the present disclosure, the flexible substrate and the antenna circuit are integrated into a flexible circuit board.

According to the NFC antenna in an embodiment of the present disclosure, the coil assembly comprises a plurality of coils.

According to the NFC antenna in an embodiment of the present disclosure, one coil surrounds another coil.

According to the NFC antenna in an embodiment of the present disclosure, the shape of these coils is rectangular.

According to the NFC antenna in an embodiment of the present disclosure, the display panel is a liquid crystal display panel (LCD panel) or an organic light-emitting diode panel (OLED panel).

According to the NFC antenna in an embodiment of the present disclosure, the material of the aforesaid flexible substrate is a polymer material.

According to the NFC antenna in an embodiment of the present disclosure, the aforesaid polymer material comprises polyimide (PI) or polyethylene terephthalate (PET).

According to the NFC antenna in an embodiment of the present disclosure, it is electrically connected to a circuit board, wherein the display panel is disposed between the circuit board and the NFC antenna.

The NFC antenna according to the present disclosure is disposed on the display panel without affecting the arrangement of multiple electronic elements on the circuit board (e.g., the motherboard of a mobile phone or a personal digital assistant). As a result, the present disclosure can reduce the difficulties encountered in the circuit design of mobile phones.

In order to make the above and other purposes, features and advantages of the present disclosure more obvious and easy to be understood, the following embodiments are specially given, and described in detail together with the attached drawings as follows.

DETAILED DESCRIPTION

Fig. 1 is a top schematic view of the NFC antenna in an embodiment of the present disclosure. Referring to Fig. 1, the NFC antenna 100 of the present embodiment comprises a flexible substrate 110 and an antenna circuit 120, wherein the antenna circuit 120 is disposed on the flexible substrate 110 and comprises a pair of electrodes 122 and a coil assembly 124 connecting to the electrodes 122.

Specifically, the coil assembly 124 may comprise a plurality of coils 124a and 124b, wherein the coil 124a, e.g., surrounds the coil 124b. That is, the coil 124b is located inside coil 124a. The coils 124a and 124b can induce electromagnetic wave signals, such as NFC signals or wireless signals, and convert these electromagnetic wave signals into telecommunication signals, wherein the frequency of the NFC signals is e.g., 13.56MHz.

Following the above, the coil assembly 124 can thus receive and transmit electromagnetic wave signals. In addition, depending on the electromagnetic wave signals of different frequencies or different circuit designs, these coils 124A and 124B can have geometric shapes such as rectangular (as shown in Fig. 1), round, oval, etc.

The flexible substrate 110 may have an opening H, and the flexible substrate 110 may be integrated with the antenna circuit 120 into a flexible printed circuit board (FPC

board), which has a very thin thickness. That is to say, the NFC antenna 100 can be made into a flexible circuit board with a very thin thickness. The flexible substrate 110 can be made of polymer material, which includes polyimide (PI) or polyethylene terephthalate (PET). In addition, the NFC antenna 100 can be made by the manufacturing method of general flexible circuit boards, for example, the NFC antenna 100 can be made by the build-up method.

Fig. 2A is a perspective schematic view of the NFC antenna in Fig. 1 assembled on the display panel, and Fig. 2B is an explosive view of Fig. 2A. Referring to Fig. 2A and Fig. 2B, the NFC antenna 100 is disposed on a display panel 200, and the display panel 200 can be a liquid crystal display panel (LCD panel) or an organic light-emitting diode panel (OLED panel), wherein the NFC antenna 100 and the display panel 200 can be installed in portable electronic apparatus such as mobile phones or personal digital assistants (PDAs).

Specifically, the flexible substrate 110 is disposed on the display panel 200, and in this embodiment, the flexible substrate 110 may be adhered to the display panel 200, for example, the flexible substrate 110 may be adhered onto the display panel 200 through double-sided tape, resin or other adhesives. In this way, the coil assembly 124 and these electrodes 122 are fixed on the display panel 200.

Following the above, the display panel 200 has a first surface 201, a second surface 202 and a display area 204, wherein the first surface 201 is located opposite to the second surface 202, and the display area 204 is located on the first surface 201. The image displayed by the display panel 200 is displayed in the display area 204, so the display area 204 can be regarded as the screen of the display panel 200. The coil assembly 124 surrounds the display area 204, and the display area 204 may be located in the opening H. In this embodiment, the coil assembly 124 and the flexible substrate 110 may be located on the first surface 201, that is, the coil assembly 124 and the flexible substrate 110 are both located on the same surface of the display panel 200.

These electrodes 122 are located on the second surface 202, and in the present embodiment, the display panel 200 further has a side surface 206 connected between

the first surface 201 and the second surface 202, wherein the electrodes 122 may extend from the second surface 202 to the side surface 206. Specifically, a portion of the flexible substrate 110 can be folding along the first surface 201, the side surface 206 and the second surface 202. In this way, the electrodes 122 can be located on the second surface 202, and the edge between the side surface 206 and the second surface 202 can fold the electrodes 122 so that the electrodes 122 can extend onto the side surface 206. It should be noted that, in the present embodiment, the NFC antenna 100 can be electrically connected to a circuit board 300. The circuit board 300 may be the motherboard of a portable electronic apparatus such as mobile phones or personal digital assistants, and the NFC antenna 100 can be electrically connected to the circuit board 300 through these electrodes 122, wherein the circuit board 300 may be a rigid printed circuit board.

Following the above, the display panel 200 is disposed between the circuit board 300 and the NFC antenna 100. That is to say, the circuit board 300 and the NFC antenna 100 are respectively positioned on the second surface 202 and the first surface 201 of the display panel 200, that is, the circuit board 300 and the NFC antenna 100 are respectively positioned on the opposite two surfaces of the display panel 200.

Thus, it can be seen that there is also a display panel 200 between the NFC antenna 100 and the circuit board 300. Therefore, when multiple electronic elements (not shown) located on the circuit board 300 are operated, the electromagnetic interference (EMI) generated by these electronic elements affects the operation of the NFC antenna 100 less, thereby ensuring the quality of electromagnetic wave signal reception and transmission.

In summary, the NFC antenna of the present disclosure can be fixed on the display panel of a mobile phone and does not occupy a large area on the circuit board (e.g. the motherboard of a mobile phone or personal digital assistant). Therefore, the NFC antenna of the present disclosure does not affect the arrangement of multiple electronic elements on the circuit board. In this way, the present disclosure can reduce the difficulties encountered in the circuit design of mobile phones.

Secondly, current portable electronic apparatus such as mobile phones or personal digital assistants are developing towards a trend of small size, thin thickness and light weight, and the NFC antenna of the present disclosure can be made into a thin flexible circuit board. In other words, the NFC antenna of the present disclosure has the advantage of being thin and not occupying much space inside the portable electronic apparatus. Therefore, the present disclosure can make portable electronic apparatus to develop towards the trend of small size, thin thickness and light weight.

In addition, the NFC antenna of the present disclosure does not need to be mounted directly on the circuit board (e.g. the motherboard of a mobile phone or personal digital assistant), and the NFC antenna is spaced from the circuit board by a display panel. Compared with the prior art, the present disclosure can reduce the impact of electromagnetic interference from the circuit board on the NFC antenna, so as to maintain the quality of electromagnetic wave signal reception and transmission.

Although the present disclosure has been disclosed in the embodiments as above, it is not intended to limit the present disclosure, and any person skilled in the art to which the disclosure belongs may make some changes and modification without departing from the spirit and scope of the creation, so the protection scope of the present disclosure shall be subjected to the definition of the scope of the claims of patent application.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a top schematic view of the NFC antenna of one embodiment of the present disclosure.

Fig. 2A is a perspective schematic view of the NFC antenna in Fig. 1 assembled on the display panel.

Fig. 2B is an explosive view of Fig. 2A.

Reference numerals for main components

100... NFC antenna

110... flexible substrate

120... antenna circuit

122... electrode
124... coil assembly
124a, 124b... coils
200... display panel
201... first surface
202... second surface
204... display area
206... side surface
300... circuit board
H... opening

WHAT IS CLAIMED:

1. A NFC antenna disposed on a display panel, comprising:
a flexible substrate disposed on the display panel; and
an antenna circuit disposed on the flexible substrate and comprising a pair of electrodes and a coil assembly connecting to the electrodes.
2. The NFC antenna according to claim 1, wherein the display panel has a first surface and a display area located on the first surface, and the coil assembly surrounds the display area.
3. The NFC antenna according to claim 2, wherein the flexible substrate has an opening and the display area is located in the opening.
4. The NFC antenna according to claim 2, wherein the coil assembly and the flexible substrate are both located on the first surface.
5. The NFC antenna according to claim 2, wherein the display panel has a second surface opposite to the first surface and the electrodes are located on the second surface.
6. The NFC antenna according to claim 5, wherein the display panel has a side surface connected between the first surface and the second surface, and the electrodes extend from the second surface to the side surface.
7. The NFC antenna according to claim 1, wherein the flexible substrate is adhered to the display panel.
8. The NFC antenna according to claim 1, wherein the flexible substrate and the antenna circuit are integrated into a flexible circuit board.
9. The NFC antenna according to claim 1, wherein the coil assembly comprises a plurality of coils.

10. The NFC antenna according to claim 9, wherein one of these coils surrounds another coil.
11. The NFC antenna according to claim 9, wherein the shape of the coils is rectangular.
12. The NFC antenna according to claim 1, wherein the display panel is a liquid crystal display panel or an organic light-emitting diode panel.
13. The NFC antenna according to claim 1, wherein the material of the flexible substrate is a polymer material.
14. The NFC antenna according to claim 13, wherein the polymer material comprises polyimide (PI) or polyethylene terephthalate (PET).
15. The NFC antenna according to claim 1, being electrically connected to a circuit board, wherein the display panel is arranged between the circuit board and the NFC antenna.

ABSTRACT

A near field communication (NFC) antenna disposed on a display panel is provided. The NEC antenna includes a flexible substrate and an antenna circuit. The flexible substrate is disposed on the display panel. The antenna circuit is disposed on the flexible substrate and includes a pair of electrodes and a coil assembly connecting to the electrodes.

(FIG. 2A)

ATTACHED DRAWINGS

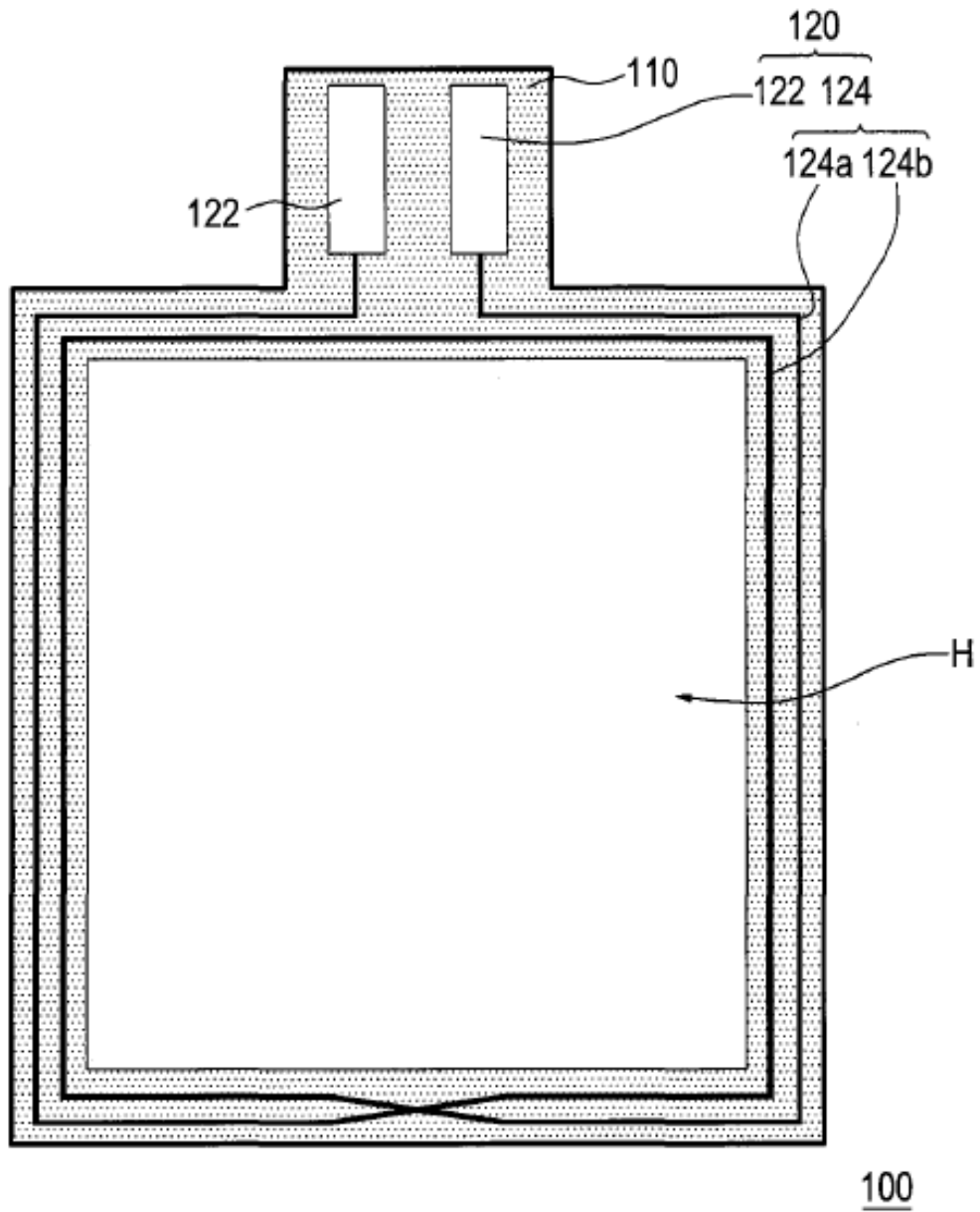


FIG. 1

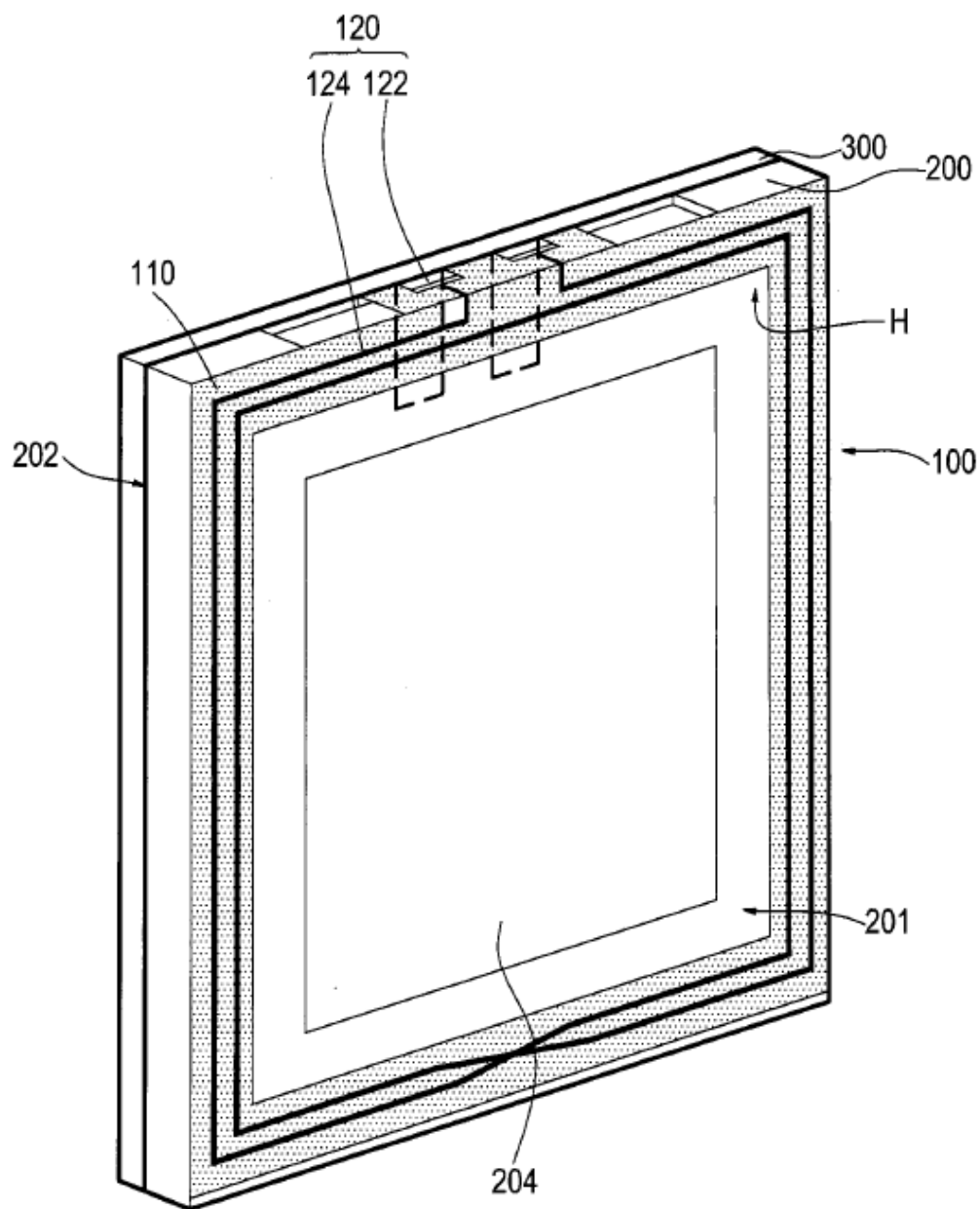


FIG. 2A

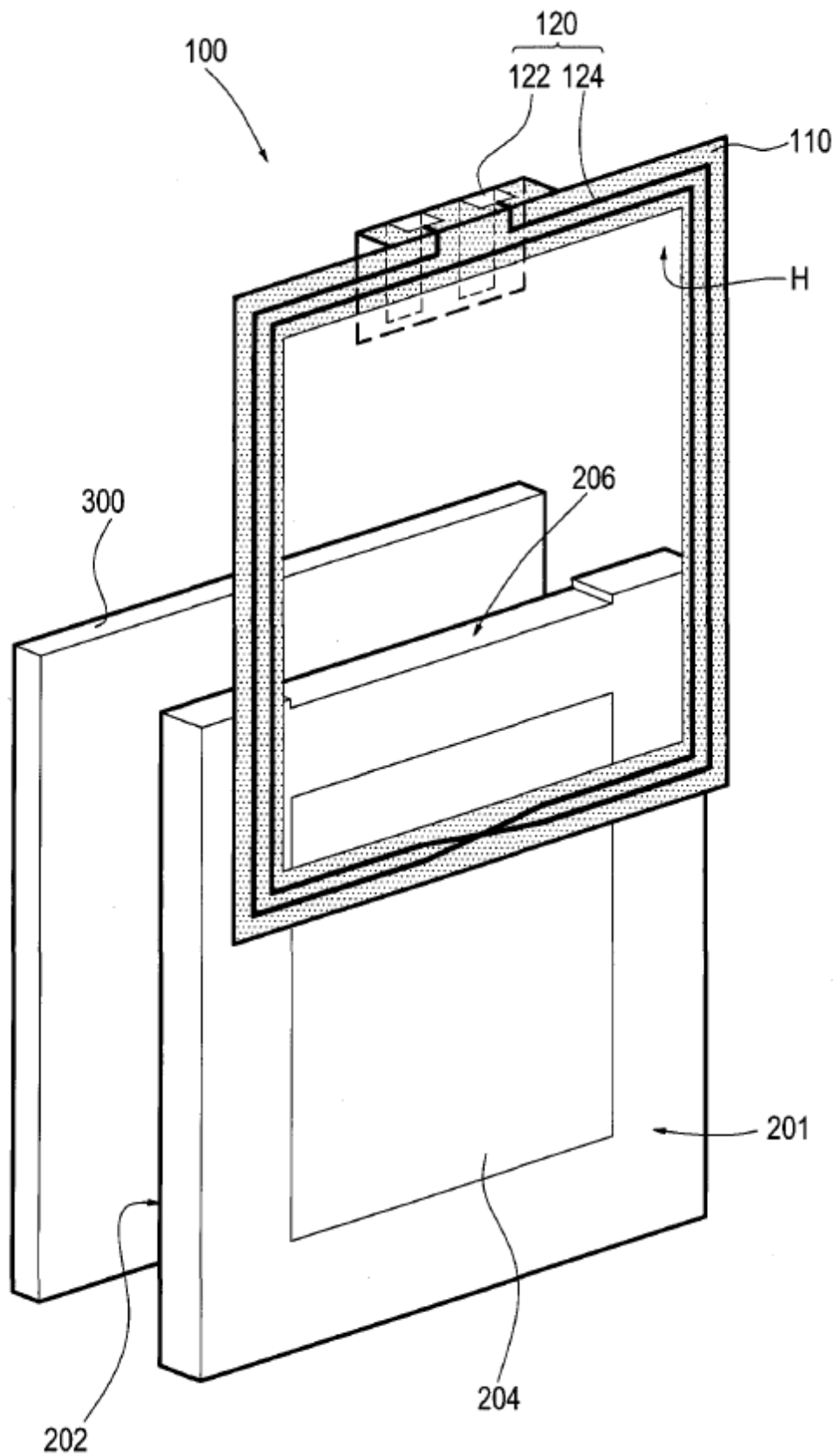


FIG. 2B