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(54) **IMAGE FORMING APPARATUS**

(57) An image forming apparatus includes a wireless tag of a part detachable from/to this image forming apparatus, and a main-body-side antenna. The main-body-side antenna is configured to communicate with the wireless tag. Further, the wireless tag includes an antenna in parallel with a mounting direction of the part.

The main-body-side antenna has a width larger by a predetermined width than a width of the antenna in the mounting direction of the part. The predetermined width is an allowable width of a mounting position of the part, and the allowable width corresponds to a tolerance of mechanical detachable mechanism of the part.

EP 4 826 458 A1

Description

BACKGROUND

1. FIELD OF THE PRESENT INVENTION

[0001] The present invention relates to an image forming apparatus.

2. DESCRIPTION OF THE RELATED ART

[0002] An image forming apparatus includes an antenna capable of communication with an RFID tag in a detachable ink tank unit, and reads identification information from the RFID tag using the antenna.

[0003] Fig. 3 shows a top-view diagram that indicates an example of a configuration of an ordinary image forming apparatus. As shown in Fig. 3 for example, if a wireless tag 111 of an ink tank unit 101 is fixed on an upper surface of the ink tank unit 101 substantially in parallel with a mounting direction of the ink tank unit 101, then in general, a mechanical design of it is done in consideration of transmission efficiency of a radio wave or a magnetic field between an antenna 111a of the wireless tag 111 and an antenna 121 of a reader/writer 102 side such that (a) a width W_r of the antenna 121 of the reader/writer 102 side agrees with a width W_t of the antenna 111a of the wireless tag 111, and (b) when the ink tank unit 101 is mounted, a position of a center C_t of the antenna 111a of the wireless tag 111 and a position of a center C_r of the antenna 121 of the reader/writer 102 side agree with each other.

[0004] However, there is a tolerance in a design of such mechanical detachable mechanism of the ink tank unit 101, and therefore, when the ink tank unit 101 is actually mounted, a position of the center C_t of the antenna 111a of the wireless tag 111 and a position of the center C_r of the antenna 121 of the reader/writer 102 side do not agree with each other in a mounting direction of the ink tank unit 101 and consequently, the transmission efficiency may be decreased between the antenna 111a of the wireless tag 111 and the antenna 121 of the reader/writer 102 side.

[0005] This feature may occur on a wireless tag of a part detachable from/to the image forming apparatus other than the ink tank unit 101 as well.

SUMMARY

[0006] An image forming apparatus according to the present invention includes a wireless tag of a part detachable from/to this image forming apparatus, and a main-body-side antenna. The main-body-side antenna is configured to communicate with the wireless tag. Further, the wireless tag includes an antenna in parallel with a mounting direction of the part. The main-body-side antenna has a width larger by a predetermined width than a width of the antenna in the mounting direc-

tion of the part. The predetermined width is an allowable width of a mounting position of the part, the allowable width corresponding to a tolerance of mechanical detachable mechanism of the part.

[0007] These and other objects, features and advantages of the present invention will become more apparent upon reading of the following detailed description along with the accompanied drawings.

10 BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 shows a perspective-view diagram that indicates a configuration of an image forming apparatus according to an embodiment of the present invention;

Fig. 2 shows a top-view diagram that indicates a configuration of an image forming apparatus according to an embodiment of the present invention; and

Fig. 3 shows a top-view diagram that indicates an example of a configuration of an ordinary image forming apparatus.

DETAILED DESCRIPTION

[0009] Hereinafter, an embodiment according to an aspect of the present invention will be explained with reference to drawings.

[0010] Fig. 1 shows a perspective-view diagram that indicates a configuration of an image forming apparatus according to an embodiment of the present invention. Fig. 2 shows a top-view diagram that indicates a configuration of an image forming apparatus according to an embodiment of the present invention. The image forming apparatus shown in Figs. 1 and 2 is an inkjet printer, an inkjet multi function peripheral or the like, for example, and in this image forming apparatus, an ink tank unit 1 is detachable. The ink tank unit 1 has a substantially cuboid shape and contains ink in an internal ink storage unit of it.

[0011] The ink tank unit 1 includes a wireless tag 11 (here, RFID). In the wireless tag 11, stored are identification information, property information (Point of Production information, toner counter information, and/or the like) and the like of the ink tank unit 1. Here, in the ink tank unit 1, the wireless tag 11 is fixed on an upper surface of the ink tank unit 1 parallel with a mounting direction (detachable direction) of the ink tank unit 1 (Y axis direction in the figure).

[0012] Further, this image forming apparatus includes a main-body-side antenna 21 on a printed wiring board 2. The main-body-side antenna 21 is used for communication with the wireless tag 11 of the mounted ink tank unit 1. The main-body-side antenna 21 may be formed as a printed wiring. The printed wiring board 2 is fixed to an internal structure (frame or the like) of this

image forming apparatus such that the main-body-side antenna 21 faces the wireless tag 11 of the mounted ink tank unit 1.

[0013] In particular, as shown in Fig. 1 for example, the wireless tag 11 includes an antenna 11a in parallel with a mounting direction of the ink tank unit 1. Further, as shown in Fig. 2 for example, the main-body-side antenna 21 has a width W_r that is larger by a predetermined width PR than a width W_t of the antenna 11a, and the predetermined width PR is an allowable width of a mounting position of the ink tank unit 1 such that the allowable width corresponds to a tolerance of mechanical detachable mechanism of the ink tank unit 1 to a main body of the image forming apparatus.

[0014] Furthermore, in this embodiment, the main-body-side antenna 21 and the antenna 11a are loop antennas that have substantially-rectangular shapes, and the wireless tag 11 is a wireless tag for an HF (High Frequency) band (i.e. for a frequency band of short-waves of which wave lengths are in a range from 10 meters to 100 meters).

[0015] Furthermore, in this embodiment, the antenna 11a is a loop antenna that has a substantially-square shape, and the main-body-side antenna 21 is a loop antenna that has a substantially-rectangular shape; and in a perpendicular direction to the mounting direction (X axis direction in the figure), a width of the main-body-side antenna 21 and a width of the antenna 11a are substantially same as each other.

[0016] Here, a width W_b of a wiring bunch of the aforementioned loop antenna in the aforementioned mounting direction may be equal to or larger than the aforementioned predetermined width PR and thereby high transmission efficiency of the radio wave or the magnetic field may be kept wherever the mounting position of the ink tank unit 1 is in the aforementioned allowed range.

[0017] Here, the image forming apparatus further includes a printing device, a controller, and the like. The printing device performs printing using the ink in the ink tank unit 1. The controller includes a microcomputer, an ASIC (Application Specific Integrated Circuit) and/or the like, causes the printing device to perform printing, and reads and writes data (the aforementioned identification information and/or the property information) from/to the wireless tag 11 of the ink tank unit 1 using the main-body-side antenna 21. This controller may not have an anti-collision function, and may perform communication between the main-body-side antenna 21 and the wireless tag 11 in a one-on-one manner without an anti-collision function and thereby may read/write data.

[0018] The following part explains a behavior of the aforementioned image forming apparatus.

[0019] When the ink tank unit 1 is mounted to the main body of the image forming apparatus, the center C_t of the antenna 11a of the wireless tag 11 of the ink tank unit 1 is located at any position in the predeter-

mined allowed range PR . At that time, the center C_t of the antenna 11a may be shifted from the center C_r of the main-body-side antenna 21 due to a tolerance of detachable mechanism of the ink tank unit 1.

[0020] The controller communicates with the wireless tag 11 of the ink tank unit 1 using the main-body-side antenna 21 and thereby performs reading/writing of the aforementioned data. At that time, a radio wave or a magnetic field is emitted from the main-body-side antenna 21 and sensed by the antenna 11a of the wireless tag 11.

[0021] For example, the controller applies a carrier wave of a predetermined intensity to the main-body-side antenna 21 and thereby the carrier wave is emitted from the antenna 21 to the wireless tag 11. Further, the wireless tag 11 changes an impedance of the antenna 11a correspondingly to data to be transmitted and changes a reflection intensity, and thereby emits a modulated wave. Further, the main-body-side antenna 21 senses the modulated wave from the wireless tag 11, and the controller acquires data from the wireless tag 11 on the basis of the modulated wave.

[0022] Here, even if the center C_t of the antenna 11a of the wireless tag 11 is shifted from the center C_r of the main-body-side antenna 21 in the allowed range, the transmission efficiency of the radio wave or the magnetic field does not easily decrease because the antenna 11a of the wireless tag 11 falls in a range of the main-body-side antenna 21 (i.e. within the width W_r).

[0023] As mentioned, in the aforementioned embodiment, the main-body-side antenna 21 communicates with the wireless tag 11 of the mounted ink tank unit 1 detachable to the image forming apparatus. The wireless tag 11 includes an antenna 11a in parallel with a mounting direction of the ink tank unit 1. The main-body-side antenna 21 has a width that is larger by a predetermined width than a width of the antenna 11a, and the predetermined width is an allowable width of a mounting position of the ink tank unit 1 such that the allowable width corresponds to a tolerance of mechanical detachable mechanism of the ink tank unit 1 to the main body of the image forming apparatus.

[0024] Consequently, it is restrained to decrease the transmission efficiency of a radio wave or a magnetic field between the antennas 11a and 21 of the ink tank unit 1 and the main body side due to a tolerance in a detachable mechanism of the detachable ink tank unit 1.

[0025] It should be understood that various changes and modifications to the embodiments described herein will be apparent to those skilled in the art. Such changes and modifications may be made without departing from the spirit and scope of the present subject matter and without diminishing its intended advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

[0026] For example, in the aforementioned, the wireless tag 11 may be fixed on a side surface or a bottom

surface of the ink tank unit 1 parallel with the mounting direction.

[0027] Further, in the embodiment, the ink tank unit 1 is shown as an example of a detachable part, but alternatively, for a detachable part other than the ink tank unit 1, the same configuration of the wireless tag and the main-body-side antenna may be applied. It should be noted that the aforementioned image forming apparatus may be an electrophotographic image forming apparatus, and in such a case, the aforementioned detachable part may be a toner cartridge or the like.

Claims

1. An image forming apparatus, comprising:
 - a wireless tag (11) of a part (1) detachable from/to this image forming apparatus; and
 - a main-body-side antenna (21) configured to communicate with the wireless tag (11);
 - wherein the wireless tag (11) comprises an antenna (11a) in parallel with a mounting direction of the part (1);
 - the main-body-side antenna (21) has a width larger by a predetermined width than a width of the antenna (11a) in the mounting direction of the part (1); and
 - the predetermined width is an allowable width of a mounting position of the part (1), the allowable width corresponding to a tolerance of mechanical detachable mechanism of the part (1).
2. The image forming apparatus according to claim 1, wherein the main-body-side antenna (21) and the antenna (11a) are loop antennas that have substantially-rectangular shapes; and the wireless tag (11) is a wireless tag for an HF band.
3. The image forming apparatus according to claim 1, wherein the antenna (11a) is a loop antenna that has a substantially-square shape;
 - the main-body-side antenna (21) is a loop antenna that has a substantially-rectangular shape; and
 - in a perpendicular direction to the mounting direction, a width of the main-body-side antenna (21) and a width of the antenna (11a) are substantially same as each other.

FIG. 1

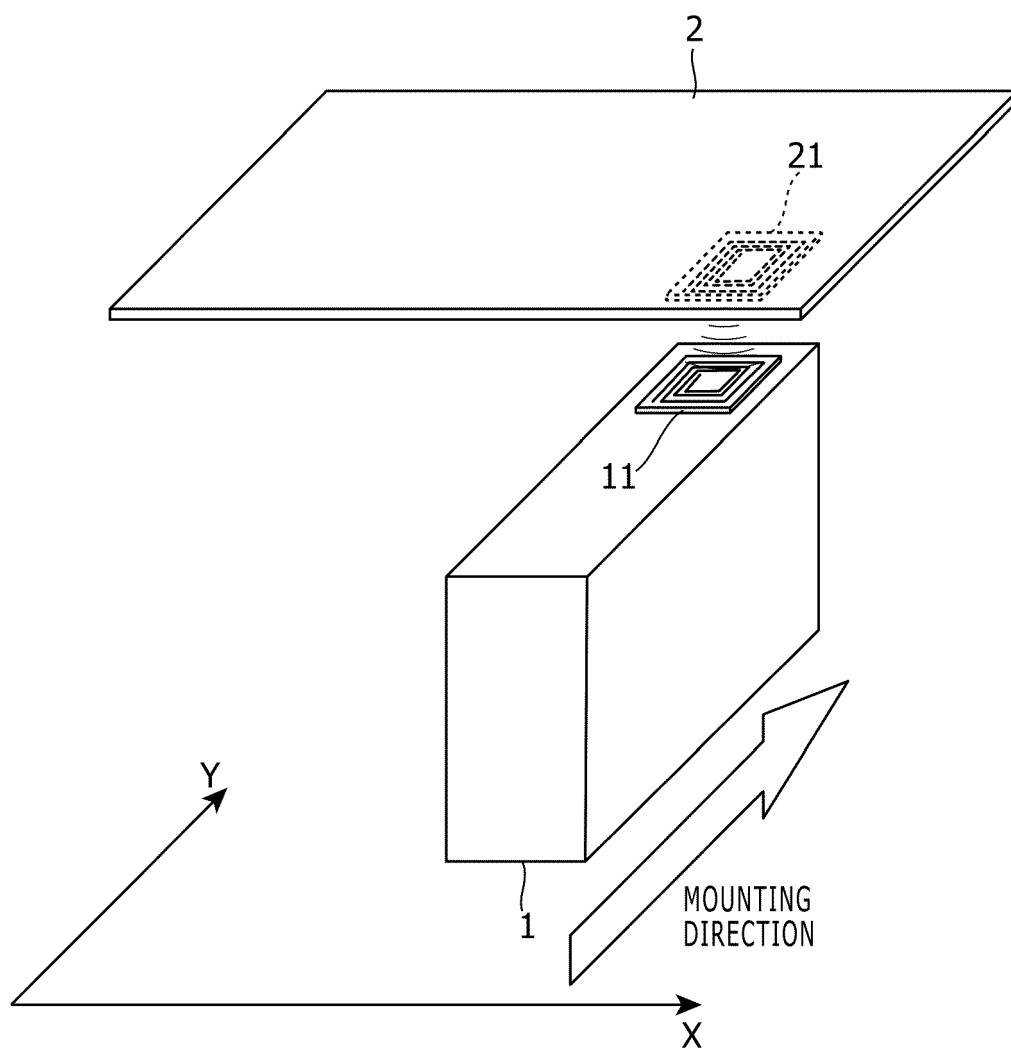


FIG. 2

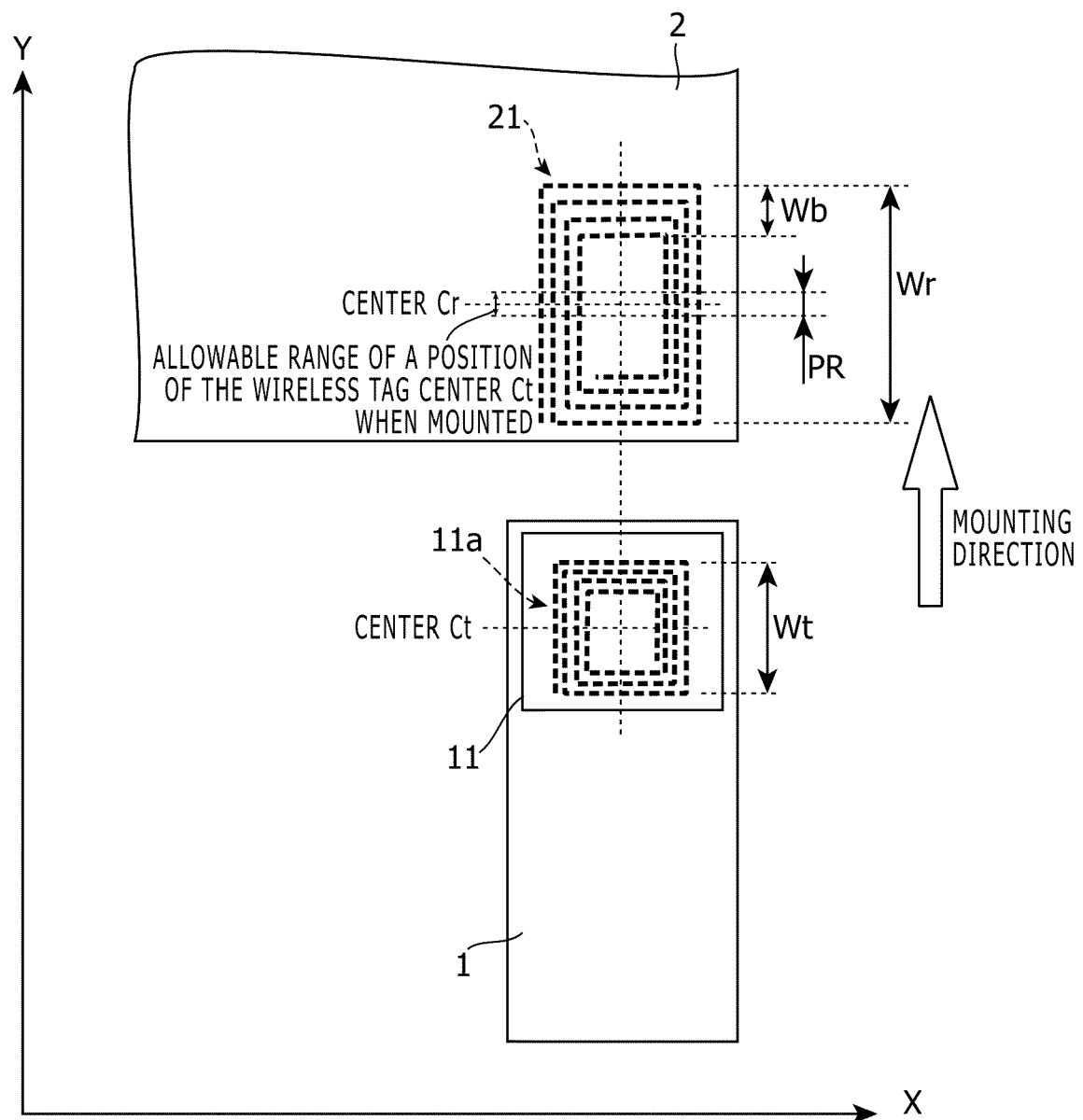
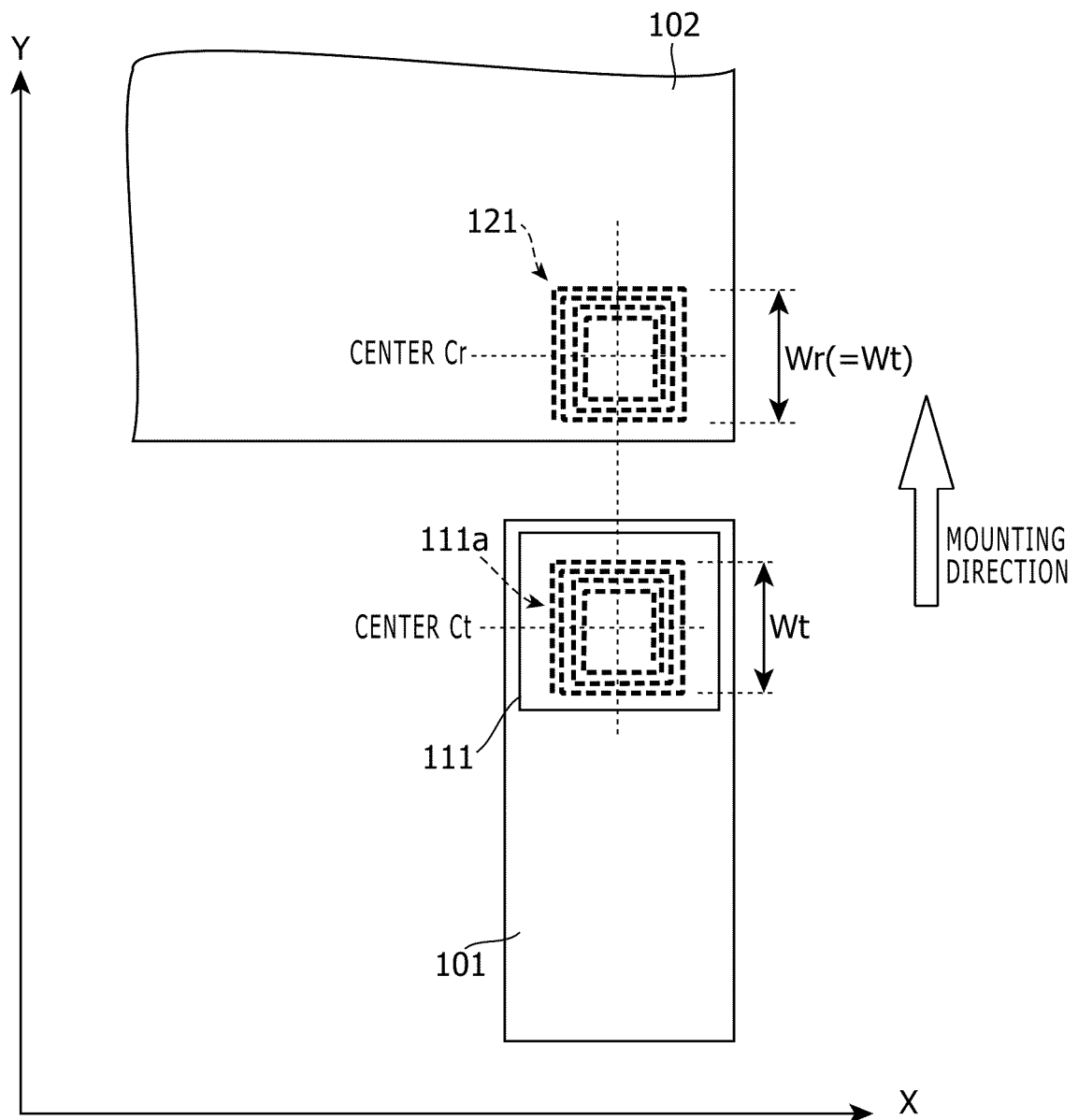


FIG. 3

PRIOR ART





EUROPEAN SEARCH REPORT

Application Number

EP 26 17 2291

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			G03G
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		17 July 2026	Camerer, Stephan
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 26 17 2291

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