United States Patent Application Publication	20250266607
Kind Code	A1
Publication Date	August 21, 2025
Inventor(s)	YAMAGATA; KENJI et al.

IMAGE PICKUP APPARATUS WITH WIRELESS ANTENNA

Abstract

Image pickup apparatuses capable of ensuring sufficient wireless performance while suppressing an increase in size of the image pickup apparatuses, are provided. An image pickup apparatus includes a rectangular wireless antenna with an antenna pattern in a planar shape, a housing having a substantially hexahedral shape and including a conductive member, and a wireless cover that forms a part of a ridge extending between a rear surface and an upper surface of the housing. The wireless cover is formed of a non-conductive member. The wireless antenna is arranged inside the image pickup apparatus while facing the wireless cover at a predetermined angle with respect to the housing around an axis extending in a width direction of the image pickup apparatus.

Inventors: **YAMAGATA; KENJI (Kanagawa, JP), TERUYA; YUKO (Kanagawa, JP), NAKAMURA; YUTA (Kanagawa, JP)**

Applicant: **CANON KABUSHIKI KAISHA** (Tokyo, JP)

Family ID: **1000008463745**

Appl. No.: **19/045758**

Filed: **February 05, 2025**

Foreign Application Priority Data

JP	2024-021149	Feb. 15, 2024

Publication Classification

Int. Cl.: **H01Q1/22** (20060101); **H01Q1/00** (20060101); **H01Q1/42** (20060101); **H01Q9/04** (20060101); **H04N5/77** (20060101); **H04N23/51** (20230101)

U.S. Cl.:

CPC **H01Q1/22** (20130101); **H01Q1/002** (20130101); **H01Q1/42** (20130101); **H01Q9/0407** (20130101); **H04N5/772** (20130101); **H04N23/51** (20230101);

Background/Summary

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to image pickup apparatuses, such as cameras and video cameras, that are equipped with wireless antennas.

Description of the Related Art

[0002] An increasing number of image pickup apparatus models are equipped with wireless capabilities in order to allow users to operate the image pickup apparatuses remotely or to transfer picked up image data. An image pickup apparatus with wireless capabilities is typically equipped with a wireless antenna, communication circuit, and the like for sending and receiving wireless signals. In electronic devices such as image pickup apparatuses, in order to improve the strength of their housings, an exterior member is often made of a high-rigidity material such as a resin mixed with a metal, a conductive filler, or the like.

[0003] When a wireless antenna is provided inside such an image pickup apparatus, wireless performance may deteriorate because of the influence of conductive members surrounding the wireless antenna, and there is room for improvement in obtaining desired wireless communication characteristics. To improve this point, Japanese Patent No. 6520509 discloses a technique of arranging an antenna around which an exterior member is open in three directions.

[0004] According to the disclosed technique, for the purpose of making the exterior member around the antenna open in three directions, a convex part is protruded from an image pickup apparatus and a wireless antenna is arranged as the antenna inside the convex part. This can result in increased size of the image pickup apparatus.

SUMMARY OF THE INVENTION

[0005] The present invention provides image pickup apparatuses capable of ensuring desired wireless performance while suppressing an increase in size of the image pickup apparatuses.

[0006] According to an aspect of the invention, an image pickup apparatus includes a wireless antenna in a rectangular shape, extending in the width direction of the image pickup apparatus, the wireless antenna including an antenna pattern in a planar shape; a housing in a substantially hexahedral shape, including a conductive member; and a wireless cover that forms a part of a ridge extending between a rear surface and an upper surface of the housing. The wireless cover is formed of a non-conductive member. The wireless antenna is arranged inside the image pickup apparatus, facing the wireless cover at a predetermined angle with respect to the housing around an axis extending in the width direction of the image pickup apparatus.

[0007] According to the present invention, it is possible to obtain an effect of making it possible to ensure desired wireless performance while suppressing an increase in size of an image pickup apparatus.

[0008] Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is an external perspective view of an image pickup apparatus **100** as viewed from a

front upper side.
[0010] FIG. **2** is an external perspective view of the image pickup apparatus **100** as viewed from a rear upper side.
[0011] FIG. **3** is a rear view of the image pickup apparatus **100**.
[0012] FIG. **4** is a sectional view of a part including the speaker **105** of the image pickup apparatus **100**.
[0013] FIG. **5** is a perspective view of an internal structure **500** as viewed from the front.
[0014] FIG. **6** is a perspective view of an internal structure **500** as viewed from the rear.
[0015] FIG. **7** is an exploded perspective view of the internal structure **500** as viewed from the front.
[0016] FIG. **8** is an exploded perspective view of the internal structure **500** as viewed from the rear.
[0017] FIG. **9** is a top view of the internal structure **500**.
[0018] FIGS. **10**A and **10**B are a rear view and a sectional view of the internal structure **500**.
[0019] FIG. **11** is a right side view of the image pickup apparatus **100**.
[0020] FIGS. **12**A and **12**B are exploded perspective views of an audio operation system storage lid **310** and a mounting board **346** on a right side surface **103**.
[0021] FIGS. **13**A and **13**B are a configuration diagram and a sectional view of the vicinity of the audio operation system storage lid **310**.
[0022] FIGS. **14**A and **14**B are explanatory diagrams of a cutout **380** formed in a rotary shaft **342***a*.
[0023] FIG. **15** is an explanatory diagram of a wireless antenna **110**.
[0024] FIG. **16** is a perspective view illustrating an arrangement position of the wireless antenna **110**.
[0025] FIG. **17** is a partial sectional view of the image pickup apparatus **100** on a plane that is orthogonal to an X axis and passes through the wireless antenna **110**.
[0026] FIG. **18** is a rear view of the image pickup apparatus **100** with a wireless cover **114** removed.
[0027] FIG. **19** is a partial top view of the image pickup apparatus **100** with the wireless cover **114** removed.
[0028] FIG. **20** is a schematic explanatory diagram illustrating an arrangement position of the wireless antenna **110**.
[0029] FIG. **21** is a perspective view of the image pickup apparatus **100** for illustrating the wireless cover **114**.
[0030] FIG. **22** is a schematic explanatory diagram illustrating radio waves emitted from the wireless antenna **110**.
[0031] FIG. **23** is a rear view of the image pickup apparatus **100** for illustrating the wireless cover **114**.

DESCRIPTION OF THE EMBODIMENTS

[0032] The present invention will now be described in detail below with reference to the accompanying drawings showing embodiments thereof.
[0033] First, a configuration of an image pickup apparatus **100** will be described with reference to FIGS. **1** and **2**. FIG. **1** is an external perspective view of the image pickup apparatus **100** of the present embodiment as viewed from a front upper side, and FIG. **2** is an external perspective view of the image pickup apparatus **100** of the present embodiment as viewed from a rear upper side.
[0034] To clarify the configuration of the image pickup apparatus **100**, coordinate axes (XYZ) orthogonal to each other as illustrated in FIGS. **1** and **2** are used. The "Z axis" indicates a front-rear direction of the image pickup apparatus **100**, which is an optical axis direction perpendicular to an imaging surface (front surface) of an image pickup element **510**. The direction from the rear surface side to the front surface side of the image pickup apparatus **100** is defined as a positive direction of the Z axis. The "Y axis" indicates an up-down direction of the image pickup apparatus **100**. The direction from the lower surface side toward the upper surface side of the image pickup

apparatus **100** is defined as a positive direction of the Y axis. The "X axis" indicates a left-right direction of the image pickup apparatus **100**. The direction from the left side surface toward the right side surface of the image pickup apparatus **100** as viewed from the front is defined as a positive direction of the X axis. The "X axis" can also be understood to indicate a "width direction" of the image pickup apparatus **100**. Thus, a direction around the X axis can be regarded as "a direction around the axis extending in a width direction of the image pickup apparatus **100**". Hereinafter, the description will be appropriately made with reference to the directions of the X, Y, and Z axes defined as described above.

[0035] As illustrated in FIGS. **1** and **2**, the image pickup apparatus **100** includes a lens mounting part **102** exposed at the front surface of the image pickup apparatus **100**, and an image pickup element **510** fixed at a position behind a lens mounted on the lens mounting part **102** as viewed from the front. The image pickup element **510** is configured to generate image data based on an optical image formed thereon by an optical system such as a lens. The lens mounting part **102** is configured such that any of a plurality of types of lenses having different optical characteristics is mountable thereon and dismountable therefrom. Light incident on one or more lenses mounted on the lens mounting part **102** forms an image on the imaging surface of the image pickup element **510**.

[0036] Operation members such as various buttons are provided on a right side surface **103** (+X side surface) of the image pickup apparatus **100**, which allows users operating the operation members to perform various operations such as switching the power of the image pickup apparatus **100** ON/OFF, image pickup, and audio adjustment. A housing formed of an exterior member of the image pickup apparatus **100** is basically composed of one or more conductive members.

[0037] As illustrated in FIG. **2**, on the rear surface of the image pickup apparatus **100**, four general-purpose accessory attachment parts **104** to which a general-purpose accessory or accessories can be attached and a speaker **105** for emitting sound are provided. These will be described later.

[0038] The upper surface of the image pickup apparatus **100** is flat, and the upper surface is provided with an accessory attachment electrical contact **106** to which an accessory can be attached. The accessory attachment electrical contact **106** is a member having a "U" shape in plan view, in which a main member is made of metal, and includes an electrical contact part for an external accessory. The accessory attachment electrical contact **106** is configured to perform communication of various signals for performing communication and control between the image pickup apparatus **100** and an external accessory. The accessory attachment electrical contact **106** is capable of firmly holding an external accessory.

[0039] It should be noted that the image pickup apparatus **100** further includes various components used for storing moving images. However, since the components and the functional details thereof are not related to the essence of the present embodiment, the description thereof will be omitted.

[0040] Next, the rear surface of the image pickup apparatus **100** will be described with reference to FIG. **3**. FIG. **3** is a rear view of the image pickup apparatus **100**. As illustrated in FIGS. **2** and **3**, the general-purpose accessory attachment parts **104** to which a general-purpose accessory or accessories can be attached and the speaker **105** are provided on the rear surface of the image pickup apparatus **100**, as described above. The general-purpose accessory attachment part **104** includes a female screw capable of fastening a male screw of M4 (screw thread size according to the Japanese Industrial Standards or JIS metric screw thread standard), and a plurality of (four in this example) general-purpose accessory attachment parts **104** is provided on the rear surface of the image pickup apparatus **100**. With this structure, a user is allowed to attach a plurality of accessories freely to the image pickup apparatus **100** or firmly fix a heavy and large accessory to the image pickup apparatus **100** using a plurality of screws.

[0041] Since it is preferable to fix a general-purpose accessory at a position that does not affect image pickup or operation of various buttons, the general-purpose accessory attachment parts **104** are provided on the rear surface of the image pickup apparatus **100**. Since the speaker **105** is used

when a user (person who picks up images) checks the sound of a stored image, the speaker **105** is preferably provided on the user side, that is, on the rear surface of the image pickup apparatus **100**, from the viewpoint of usability.

[0042] FIG. **4** is a transverse sectional view of a part including the speaker **105** of the image pickup apparatus **100**. As illustrated in FIGS. **3** and **4**, the speaker **105** is arranged while being sandwiched between a pair of left and right general-purpose accessory attachment parts **104** on the lower side (−Y side) of the four general-purpose accessory attachment parts **104**. As illustrated in FIG. **3**, the speaker **105** is located below (lower by an amount corresponding to a distance L from) a straight line extending in the horizontal direction, the straight line connecting both centers of the pair of left and right general-purpose accessory attachment parts **104** on the lower side. The distance L is set sufficiently large, so that a general-purpose accessory does not cover the entire surface of the speaker **105** even when the general-purpose accessory is attached to the general-purpose accessory attachment part **104**. That is, at least a part of the sound emission region of the speaker **105** is exposed below the general-purpose accessory. This allows a user to satisfactorily listen to the sound emitted from the speaker **105**.

[0043] Next, an internal structure **500** of the image pickup apparatus **100** will be described with reference to FIGS. **5** to **8**. FIG. **5** is a perspective view of the internal structure **500** as viewed from the front, FIG. **6** is a perspective view of the internal structure **500** as viewed from the rear, FIG. **7** is an exploded perspective view of the internal structure **500** as viewed from the front, and FIG. **8** is an exploded perspective view of the internal structure **500** as viewed from the rear.

[0044] As illustrated in FIG. **7**, the image pickup apparatus **100** internally includes the image pickup element **510**, a sensor duct unit **520**, a control circuit board **530**, a main duct unit **540**, and a power supply board **550**, which are arranged in the optical axis direction (+Z direction) in order from the front and are substantially parallel to each other. Further, the image pickup apparatus **100** internally includes a blower **560**, an exhaust duct unit **570**, a media duct unit **580**, a media board **590**, a sub-media board **600**, and a wireless board **610**, which are arranged in the optical axis direction in order from the front and are substantially parallel to each other. A wireless antenna **110** is arranged in the upper (+Y side) rear (−Z side) side in the image pickup apparatus **100**. The arrangement position of the wireless antenna **110** will be described later.

[0045] The main components of the internal structure **500** will be described. The image pickup element **510** is configured to convert light incident on the imaging surface from a lens (which is not illustrated) into an electric signal. The control circuit board **530** is a board on which a plurality of integrated circuits (ICs) that controls the entire image pickup apparatus **100** are mounted, and occupies the largest area inside the image pickup apparatus **100**. On the control circuit board **530**, an IC for performing image processing on an electric signal (image signal) from the image pickup element **510**, an IC for performing color adjustment of an image, and a memory used when various types of processing are executed by these ICs are mounted. The ICs mounted on the control circuit board **530** include, for example, a CPU, a RAM, and a ROM. The CPU is configured to execute various types of control and processing by loading programs stored in the ROM into the RAM and then executes the programs. The power supply board **550** is mounted with a power supply part that supplies power to electric devices in the image pickup apparatus **100** which include the control circuit board **530**.

[0046] The media board **590** is a board on which a recording medium that records image information is mounted. The recording medium is a smart card, a USB memory, or the like. The recording medium is dismountable by a user from the media board **590**. On the sub-media board **600**, a storage device is mounted to store setting information at the time of image pickup performed by a user and store backup images. This storage device has a capacity smaller than the data capacity of a main image to be recorded on the recording medium mounted on the media board **590**. Examples of the storage device include a flash memory. The wireless board **610**, on which a wireless control IC for controlling the wireless antenna **110** is mounted, is electrically connected to

the wireless antenna **110** via a wire **112** which will be described later. The wireless antenna **110** is configured to perform wireless communication with an external device.

[0047] Next, a forced air cooling system of the image pickup apparatus **100** will be described with reference to FIGS. **9**, **10**A, and **10**B.

[0048] FIG. **9** is a top view of the internal structure **500**, FIG. **10**A is a rear view of the internal structure **500**, and FIG. **10**B is a sectional view taken along the line XB-XB in FIG. **10**A.

[0049] The image pickup apparatus **100** dissipates heat from various heat sources of the image pickup apparatus **100** through forced air cooling with a heat dissipation duct and the blower **560**. The heat dissipation duct includes the sensor duct unit **520**, the main duct unit **540**, the media duct unit **580**, and the exhaust duct unit **570**. The sensor duct unit **520** takes in outside air from a sensor duct intake port **521**, and the taken outside air flows into the main duct unit **540** through a sensor duct connection part **542**. The media duct unit **580** takes in outside air from a media duct intake port **581**, and the taken outside air flows into the main duct unit **540** through a media duct connection part **543** (see FIG. **8**).

[0050] The main duct unit **540** takes in outside air from the main duct intake port **541**, and the taken outside air flows to a blower connection part **544** (see FIG. **8**). The blower **560** is configured to take in air from the blower connection part **544** of the main duct unit **540** and exhaust the air to the outside of the image pickup apparatus **100** via the exhaust duct unit **570**. The flow paths with the forced air cooling of the image pickup apparatus **100** described above are indicated by the broken lines in FIGS. **9** and **10**B.

[0051] The heat generated in the image pickup element **510** is transferred to the sensor duct unit **520** via a heat conductive member such as a graphite sheet (which is not illustrated). The heat generated on the +Z side surface of the control circuit board **530** is transferred to the sensor duct unit **520** via a heat conductive member such as a heat dissipation rubber (which is not illustrated). The heat generated on the −Z side surface of the control circuit board **530** is transferred to the main duct unit **540** via a heat conductive member such as a heat dissipation rubber (which is not illustrated). The heat generated in the power supply board **550** illustrated in FIG. **8** is transferred to the main duct unit **540** via a heat conductive member such as a heat dissipation rubber (which is not illustrated).

[0052] The media board **590** is attached into an opening **582** (see FIG. **8**) formed in a central part of the media duct unit **580**, and thus is partially exposed within the media duct unit **580**. Because the air flowing in the media duct unit **580** directly touches the media board **590**, the dissipation of heat from the media substrate **590** itself promotes the dissipation of heat from a recording medium mounted onto the media board **590**. As a result, it is possible to efficiently dissipate the heat from the recording medium and thus to stably store images on the recording medium despite the increase in power consumption of recording media in order to handle high bit rate data due to the recent trend towards higher resolution images.

[0053] The sub-media board **600** is arranged on the rear side (−Z side) of the media board **590** and substantially parallel to the media board **590**. As described above, the sub-media board **600** is mounted with a storage device for storing image data having a small capacity, so the sub-media board **600** generates a small amount of heat and can dissipate heat without forced air cooling. The wireless board **610** is substantially flush with (located on the substantially same plane or level as) the sub-media board **600** and is located on the −X side (left side) of the sub-media board **600**. The heat generated in the wireless control IC mounted on the wireless board **610** is transferred to the media duct unit **580** via a heat conduction member (which is not illustrated).

[0054] The wireless control IC mounted on the wireless board **610** has a lower guaranteed temperature than other heat sources (image pickup element **510**, control circuit board **530**, power supply board **550**, media board **590**, and the like) in the image pickup apparatus **100**. Thus, the wireless control IC is not mounted on the control circuit board **530** but on the wireless board **610** independent of other heat sources in the present embodiment, whereby the wireless control IC is

not affected by other heat sources having high power consumption, and a sufficient heat dissipation effect is ensured.

[0055] It should be noted that, in the flow paths of the media duct unit **580**, the heat dissipation position (see NA in FIGS. **9** and **10**B) for the media board **590** is located on the upstream side of (closer to the media duct intake port **581** than) the heat dissipation position (see NB in FIG. **10**B) for the wireless board **610**. That is, the media duct unit **580** (heat dissipation duct) includes the media duct intake port **581**, and the wireless board **610** is thermally connected to the media duct unit **580** (heat dissipation duct) via a heat conduction member at a position farther from the media duct intake port **581** than the media board **590**.

[0056] In general, the recording medium mounted on the media board **590** has higher power consumption than the wireless control IC mounted on the wireless board **610**, so that the media board **590** has a larger required heat dissipation amount than the wireless board **610**. Thus, in consideration of the relative heat dissipation positions for the media board **590** and the wireless board **610** and the relative magnitudes of their power consumption, the heat dissipation duct is configured so that the media board **590**, which is closer to the media duct intake port **581**, can exchange heat with cold air, thereby achieving efficient heat dissipation.

[0057] The wireless board **610** is arranged between the media duct unit **580** and the wireless antenna **110** in the optical axis direction (Z direction). This makes it possible to reduce the distance between the wireless board **610** and the wireless antenna **110** while ensuring the heat dissipation from the wireless board **610**. In general, wireless signals are weak and easily affected by electrical noise, so the wire **112** that electrically connects the wireless circuit board **610** and the wireless antenna **110** is made short to reduce the influence of noise and stabilize its wireless characteristics. The reason why the wire **112** is allowed to be shortened is because the distance between the wireless board **610** and the wireless antenna **110** is shortened.

[0058] In this manner, the wireless board **610** is parallel to the media duct unit **580** serving as a heat dissipation duct, is arranged between the media duct unit **580** and the wireless antenna **110**, and is thermally connected to the media duct unit **580**. Thus, the wire **112** can be shortened, and the heat generated in the wireless board **610** is efficiently dissipated.

[0059] With the heat dissipation structure of the image pickup apparatus **100** described above, the heat from the various heat sources in the image pickup apparatus **100** is transferred to the respective heat dissipation ducts at positions facing and adjacent to the corresponding heat sources, and heat exchange with the air is carried out through the above-described flow path configuration. This makes it possible to efficiently dissipate the heat from each heat source outside of the image pickup apparatus **100**.

[0060] FIG. **11** is a right side view of the image pickup apparatus **100**. The right side surface **103** of the image pickup apparatus **100** is provided with a main body operation part that allows a user to operate the image pickup apparatus **100** to execute a predetermined operation. The main body operation part includes a REC button **300** for recording a picked up image, a power switch **301** for turning on and off the power, and a main body operation button group **302** for performing various operations such as designation of an image pickup mode. The right side surface **103** of the image pickup apparatus **100** is also provided with a recording medium storage lid **321** for openably closing an opening formed in the image pickup apparatus **100** for attaching and detaching a recording medium.

[0061] The right side surface **103** of the image pickup apparatus **100** is also provided with an audio operation system storage lid **310** which is adjacent to the recording medium storage lid **321** and can be opened and closed. When the audio operation system storage lid **310** is in an open position, audio operation dials **311***a* and **311***b* and audio operation switches **312***a* and **312***b* become operable. The audio operation dials **311***a* and **311***b* are dials for a user to operate the audio system, and the audio operation switches **312***a* and **312***b* are switches for a user to operate the audio system. Examples of the audio system operation include, but are not limited to, mute, volume adjustment,

and balance operation of left and right stereo sound.
[0062] When a user performs basic operations of the image pickup apparatus **100** such as power on/off, various setting operations, recording, and media card insertion and removal, the user typically stands on the right side of the image pickup apparatus **100**. When a user puts the image pickup apparatus **100** on the right shoulder and picks up images, the right side of the user's face and the right side surface **103** of the image pickup apparatus **100** face each other. Thus, by arranging the main body operation part which is the operation system of the image pickup apparatus **100**, the recording medium, the audio operation dials **311***a* and **311***b*, and the audio operation switches **312***a* and **312***b* on the right side surface **103** of the image pickup apparatus **100**, this allows users to perform almost all operations can be performed from the right side, and improves the operability for users.
[0063] Next, a configuration of the audio operation system storage lid **310** will be described with reference to FIGS. **12**A and **12**B. FIGS. **12**A and **12**B are exploded perspective views of the audio operation system storage lid **310** and the mounting board **346** on the right side surface **103** of the image pickup apparatus **100**. A configuration including the audio operation system storage lid **310** will be described below by describing how to assembly the configuration. While the audio operation system storage lid **310** is attached to a right exterior cover **340**, a rotary shaft **342***a* and a rotary shaft **342***b* is inserted into a shaft groove **341** inside the right exterior cover **340** illustrated in FIG. **12**B. The rotary shaft **342***a* is located above (in +Y direction) the rotary shaft **342***b*. The rotary shaft **342***a* and rotary shaft **342***b* inserted into the shaft groove **341** are further inserted and fitted into respective shaft holes **360** formed on the front side (+Z side) of the audio operation system storage lid **310**.
[0064] Next, while an axial projection **353** formed on a pressing component **343** is fitted in the shaft groove **341**, the axial projection **353** is fixed by one screw **344** in the Y-axis direction between the audio operation dial **311***a* and the audio operation dial **311***b*. An elastic member **345** is compressed and sandwiched between the rotary shaft **342***a* and the pressing component **343**. The pressing component **343** may deform in the "+X" direction by a reaction force due to the compression of the elastic member **345**. Next, a configuration for suppressing this deformation will be described.
[0065] FIG. **13**A is an explanatory diagram of a configuration in the vicinity of the audio operation system storage lid **310**, and FIG. **13**B is a sectional view taken along the line XIIIB-XIIIB (see FIG. **13**A) corresponding to the rotary axis position of the audio operation system storage lid **310**. As illustrated in FIGS. **13**A and **13**B, the pair of upper and lower protrusions **354** of the pressing component **343** and the mounting board **346**, which are in contact with each other, are fixed to the right exterior cover **340** with four pressing member fixing screws **347**.
[0066] With such a configuration, the elastic member **345** is reliably compressed by the pressing component **343** and the rotary shaft **342***a*, and this ensures that the rotary shaft **342***a* is biased toward the audio operation system storage lid **310**. As a result, it is possible to prevent the occurrence of sound or the like formed by the audio operation system storage lid **310** moving by its own weight and colliding with the right exterior cover **340**.
[0067] FIGS. **14**A and **14**B are explanatory diagrams of a cutout **380** formed in a rotary shaft **342***a*, and illustrate a configuration in the vicinity of the shaft groove **341** (see FIG. **12**B) with the pressing component **343** and the mounting board **346** in FIGS. **13**A, **13**B omitted from. As illustrated in FIG. **14**A, the cutout **380** is formed substantially at the center of the rotary shaft **342***a*. As described above, the rotary shaft **342***a* is used by being inserted into the shaft groove **341** of the right exterior cover **340** and then into the shaft hole **360** of the audio operation system storage lid **310**. In the state where the insertion is made, the cutout **380** does not enter the shaft hole **360** but is exposed as viewed from the inside of the right exterior cover **340**, and the rotary shaft **342***a* abuts against the elastic member **345** within a "range W" from the exposed cutout **380** to an end of the rotary shaft **342***a*. As a result, the cutout **380** clarifies the application range of a lubricant for

preventing abnormal noise caused by the contact between the elastic member **345** and the rotary shaft **342***a*.

[0068] In addition, as illustrated in FIG. **14**B, when the audio operation system storage lid **310** is to be replaced because of damage or the like, a tool **390** such as tweezers can be hooked on the cutout **380** of the rotary shaft **342***a*, and the rotary shaft **342***a* can be removed in the direction of the arrow. In this way, the cutout **380** improves reworkability.

[0069] As described with reference to FIGS. **11** to **14**B, the configuration in the vicinity of the audio operation system storage lid **310** is as follows. The audio operation system storage lid **310** is provided on the right side of the image pickup apparatus **100** so as to be openable and closable as viewed from the front of the image pickup apparatus **100**, and as illustrated in FIG. **12**B, the image pickup apparatus **100** includes the pressing component **343** that prevents the pair of upper and lower rotary shafts **342***a* and **342***b* inserted into the audio operation system storage lid **310** from coming off. Further, the image pickup apparatus **100** includes the elastic member **345** compressed between the pressing component **343** and the rotary shafts **342***a* and **342***b*, and the mounting board **346** (see FIGS. **13**A and **13**B) located at a position overlapping with the audio operation system storage lid **310** as viewed from the right side of the image pickup apparatus **100**. The pressing component **343** is fixed at one point to the right exterior cover **340** (see FIG. **12**B) forming the housing of the image pickup apparatus **100**, and the protrusions **354** and **354** provided on both sides of the part where the pressing component **343** is fixed to the right exterior cover **340** are located between the mounting board **346** and the right exterior cover **340**. As described above, such a configuration can prevent the occurrence of abnormal noise or the like that occurs when the audio operation system storage lid **310** freely moves and collides with the right exterior cover **340**.

[0070] More specifically, the pressing component **343** is fixed by the pair of upper and lower audio operation dials **311***a* and **311***b*, and the audio operation system storage lid **310** can be opened and closed to expose the pair of upper and lower audio operation dials **311***a* and **311***b*. The pressing component **343** is biased by the compressed elastic member **345**, and the protrusion **354** of the biased pressing component **343** abuts against and is fixed to the mounting board **346**. As illustrated in FIG. **14**A, the upper rotary shaft **342***a* includes the cutout **380**, and one end portion of the rotary shaft **342***a* is fitted into the shaft hole **360** (see FIG. **12**A) provided in the audio operation system storage lid **310** while the cutout **380** is exposed. On the other end portion, the elastic member **345** abuts against an area between the cutout **380** and the other end of the rotary shaft **342***a*. As described above, this configuration makes it possible to pull out the rotation shaft **342***a* by hooking the tool **390** (see FIG. **14**B) on the cutout **380** of the rotary shaft **342***a*, when the audio operation system storage lid **310** is replaced.

[0071] Next, the wireless antenna **110** will be described with reference to FIGS. **15** to **23**. FIG. **15** is an explanatory diagram of the wireless antenna **110**, FIG. **16** is a perspective view illustrating an arrangement position of the wireless antenna **110**, FIG. **17** is a partial sectional view of the image pickup apparatus **100** on a plane that is orthogonal to the X axis and passes through the wireless antenna **110**, and FIG. **18** is a rear view of the image pickup apparatus **100** with the wireless cover **114** removed. FIG. **19** is a partial top view of the image pickup apparatus **100** with the wireless cover **114** removed, FIG. **20** is a schematic explanatory diagram illustrating the arrangement position of the wireless antenna **110**, and FIG. **21** is a perspective view of the image pickup apparatus **100** for illustrating the wireless cover **114**. FIG. **22** is an explanatory diagram illustrating radio waves emitted from the wireless antenna **110**, and FIG. **23** is a rear view of the image pickup apparatus **100** for illustrating the wireless cover **114**.

[0072] As illustrated in FIG. **15**, the wireless antenna **110** is formed in a horizontal rectangular shape. An antenna pattern **111** is formed in a planar shape, and is located close to one of the short sides of the rectangular wireless antenna **110**. The antenna pattern **111** of the wireless antenna **110** functions as an antenna that transmits and receives wireless signals. Further, the wireless antenna **110** includes a wire **112** for electrically connecting to the wireless board **610** (see FIG. **7**), and a

fixing part **113** for fixing the wire **112**. The antenna pattern **111**, the wire **112**, and the fixing part **113** are located in the wireless antenna **110** so as to entirely divide the wireless antenna **110** into two portions in the longitudinal direction. That is, the antenna pattern **111** is formed on one side (one short side) in the longitudinal direction of the wireless antenna **110**, and the wire **112** and the fixing part **113** are provided on the other side (the other short side). Specifically, the fixing part **113** is provided at the right end of the wireless antenna **110** in FIG. **15**. It should be noted that the antenna pattern **111** of the wireless antenna **110** can be produced, for example, by forming a conductor constituting a power feeding point, a radiation device, or the like on a dielectric board stacked on a ground conductor plate, but the wireless antenna **110** is not limited to such antennas.

[0073] As illustrated in FIGS. **16** and **17**, the wireless antenna **110** is arranged on the inside of a ridge formed by two surfaces of the rear surface and the upper surface of the housing of the image pickup apparatus **100**, where the housing is formed of a conductive member. The wire **112** of the wireless antenna **110** is fixed using the fixing part **113** while being electrically connected to the wireless board **610**. As illustrated in FIG. **17**, the wireless antenna **110** is fixed inside the image pickup apparatus **100**, in a position inclined by a predetermined angle "α" around the X axis with respect to the image pickup apparatus **100** (specifically, the housing of the image pickup apparatus **100**), with the antenna pattern **111** facing both the upper surface and the rear surface of the image pickup apparatus **100**. More specifically, the wireless antenna **110** is arranged inside the image pickup apparatus **100**, facing the wireless cover **114** at a predetermined angle (acute angle) with respect to the upper surface of the housing (or a plane parallel to the upper surface of the housing of the image pickup apparatus **100**, indicated by a one-dot chain line in FIG. **17**) around the axis extending in the width direction of the image pickup apparatus **100**. The wireless antenna **110** is fixed to an appropriate member inside the image pickup apparatus **100** with the front surface on which the antenna pattern **111** is formed facing upward.

[0074] Next, how the wireless antenna **110** is fixed will be described. The wireless antenna **110** is fixed to an appropriate member inside the image pickup apparatus **100** with the front surface on which the antenna pattern **111** is formed facing upward. For example, the wireless antenna **110** is fixed to a fixing member **700** in FIG. **17**. The fixing member **700** is a member attached to the top of the housing in parallel with the upper surface of the housing, and the upper surface of an end of the fixing member **700** in the "−Z direction" is inclined. The wireless antenna **110** is fixed to the inclined upper surface (fixing surface) of the end of the fixing member **700**. The manner of fixing the wireless antenna **110** to the fixing member **700** is screwing, bonding, or the like, but is not limited to these. The fixing member **700** is fixed in a position such that the wireless antenna **110** faces the wireless cover **114** when the wireless antenna **110** is fixed to the fixing member **700**. The fixing member **700** (in particular, the fixing surface) has a predetermined angle with respect to the upper surface and the rear surface of the housing as viewed from the "X+" direction. Specifically, the fixing member **700** (fixing surface) and the upper surface of the housing form an acute angle α measured clockwise from the upper surface of the housing, and the fixing member **700** and the rear surface of the housing form an obtuse angle of (90+α) degrees measured clockwise from the rear surface (Y direction) of the housing. The member for fixing the wireless antenna **110** is not limited to the fixing member **700**.

[0075] That is, as long as the wireless antenna **110** is fixed in the position facing the wireless cover **114** as a whole (in FIG. **17**, the position facing a part of the ridge extending between two surfaces of the upper surface and the rear surface of the housing), the shape, the size, the fixing mode, and the like of the member for fixing the wireless antenna **110** are not particularly limited. It should be noted that, in FIG. **17**, the wireless cover **114** is illustrated and described to have a corner part. However, in practice, the corner part may be eliminated, for example, by cutting the corner part of the wireless cover **114** in parallel with the upper surface of the wireless antenna **110** so as to achieve downsizing of the apparatus. Here, being parallel to the upper surface of the wireless antenna **110** means being parallel to the downward-sloping dashed-two dotted line in the upper

right of FIG. **17**.
[0076] By arranging the wireless antenna **110** in the inclined position with facing the ridge as described above, the exterior surface (housing surface) of the image pickup apparatus **100** can be formed to extend along the wireless antenna **110** as illustrated in FIG. **20**. Thus, as described above, in FIG. **17**, the wireless cover **114** is illustrated to have a corner part, but a design in which the corner part of the apparatus is removed can be adopted. Specifically, as illustrated in FIG. **20**, a triangular area M can be cut off from the corner part of the exterior member in a side view of the image pickup apparatus **100**, and this downsizes the image pickup apparatus **100**. It should be noted that the area M illustrated in FIG. **20** actually has a three-dimensional triangular prism shape.
[0077] As illustrated in FIGS. **17** and **21**, the wireless cover **114** constitutes an exterior surface of the image pickup apparatus **100** while covering the front side (the surface on which the antenna pattern **111** is positioned) of the wireless antenna **110**. The exterior member of the image pickup apparatus **100** is mainly formed of a conductive resin material into which a conductive filler such as carbon or metal is kneaded. On the other hand, the wireless cover **114** is formed of a non-conductive resin material. That is, the image pickup apparatus **100** includes the rectangular wireless antenna **110** in a horizontal rectangular shape (which has a rectangular shape and extends in the width direction of the image pickup apparatus **100**) with the planar antenna pattern **111**, and a substantially hexahedral (substantially cubic shape, substantially rectangular parallelepiped shape, or the like) housing composed of a conductive member. The wireless cover **114** is formed of a non-conductive member and forms a part of the ridge extending between the two surfaces of the rear surface and the upper surface of the housing of the image pickup apparatus **100**. Non-conductive materials, such as resin materials, do not affect the radio wave performance, and thus the non-conductive wireless cover **114** covering the front side of the wireless antenna **110** does not cause any wireless transmission loss, thereby almost eliminating the influence on the wireless performance.
[0078] In FIGS. **18** and **19**, the +ZY plane indicates a plane passing through the +X side end of the wireless antenna **110**, and the −ZY plane indicates a plane passing through the −X side end of the wireless antenna **110**. Here, the +ZY plane and the −ZY plane respectively include the ends in the longitudinal direction of the wireless antenna **110**, and they are both parallel to the optical axis direction of the image pickup apparatus **100**. In the image pickup apparatus **100**, any conductive member made of a metal material, a conductive resin material, or the like is not located in a region sandwiched between the +ZY and −ZY planes and above a plane including the antenna pattern **111** of the wireless antenna **110** (see the arrow N in FIG. **17**).
[0079] The image pickup apparatus **100** has a plurality of functions in addition to the wireless function, and thus includes the board **115** mounted with a circuit for realizing the functions and a plurality of internal component fixing screws **116** for fixing various components. However, as illustrated in FIG. **17**, all of these are located inside the image pickup apparatus **100** further than the wireless antenna **110** (antenna pattern **111**).
[0080] By adopting such a configuration, the radio waves are emitted from the antenna pattern **111** to the outside of the image pickup apparatus **100** in various directions without being obstructed as indicated by the arrows in FIG. **22**. This makes it possible for the image pickup apparatus **100** to communicate with a farther electronic device with radio waves.
[0081] In addition, as described above, the wireless antenna **110** is located on the rear side in the image pickup apparatus **100**. When image data picked up at an actual image pickup location is transmitted to a receiving device on a reception location using the wireless antenna **110**, it is common that the receiving device is not installed on the subject side of the image pickup apparatus **100**, but is installed on the rear of the image pickup apparatus **100** where a user is present. Thus, it is possible to more reliably perform wireless communication when the wireless antenna **110** is located on the rear side in the image pickup apparatus **100**. Therefore, it is preferable to arrange the wireless antenna **110** on the rear side as in the image pickup apparatus **100** of the present

embodiment.
[0082] In addition, to propagate wireless radio waves farther, it is more efficient to emit wireless radio waves above the image pickup apparatus **100**. Thus, it is preferable to arrange the wireless antenna **110** on the upper side in the image pickup apparatus **100** as in the present embodiment. Further, as illustrated in FIGS. **15** and **18**, the antenna pattern **111** is located close to one side in the wireless antenna **110**. The radio waves emitted from the antenna pattern **111** can be attenuated by being affected by the wire **112**, the fixing part **113**, and the like in the vicinity. Thus, the intensity of the radio waves emitted from the antenna pattern **111** does not uniformly spread, but becomes weak on the side where the wire **112** is present and strong on the opposite side where the wire is not present. Thus, as can be seen with reference to FIGS. **15** and **18**, the wireless antenna **110** of the present embodiment is arranged so that the antenna pattern **111** is located on the "+X side".
[0083] With reference to FIG. **23**, the length of the wireless cover **114** covering the wireless antenna **110** of the present embodiment in the X-axis direction will be described. In FIG. **23**, the distance from the center of the wireless antenna **110** in the X-axis direction to the outer edge of the wireless cover **114** on the "−X side" is defined as "P", and the distance to the outer edge of the wireless cover **114** on the "+X side" is defined as "Q". Under this definition, the lengths of the wireless cover **114** in the X-axis direction are set such that "Q>P" is satisfied, and the wireless cover **114** is arranged accordingly.
[0084] That is, the wireless cover **114** is arranged such that its length in the X direction satisfies the following condition. The wireless cover **114** is located so that the length in the X direction from the center in the longitudinal direction of the wireless antenna **110** to the end on one side (+X side) of the wireless cover **114** is longer than the length in the X direction from the center in the longitudinal direction of the wireless antenna **110** to the end on the other side (−X side) of the wireless cover **114**. In addition, as illustrated in FIGS. **15** and **21**, the antenna pattern **111** is located inside the image pickup apparatus **100** with facing a portion on the one side of the wireless cover **114**.
[0085] The wireless antenna **110** also includes the wire **112** for electrically connecting to the wireless board **610** mounted with the wireless control IC that controls the wireless antenna **110**, and the wire **112** faces a portion on the other side of the wireless cover **114**. With such a configuration, there are fewer objects shielding the radio waves in an area where the intensity of the radio waves is strong, and the radio performance becomes very efficient.
[0086] As described above, the wireless performance of the wireless antenna **110** can be ensured while downsizing the image pickup apparatus **100** by arranging the wireless antenna **110** as described in the present embodiment.
[0087] While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.
[0088] This application claims the benefit of Japanese Patent Application No. 2024-021149, filed Feb. 15, 2024, which is hereby incorporated by reference wherein in its entirety.

Claims

1. An image pickup apparatus comprising: a wireless antenna in a rectangular shape, extending in the width direction of the image pickup apparatus, the wireless antenna comprising an antenna pattern in a planar shape; a housing in a substantially hexahedral shape, comprising a conductive member; and a wireless cover that forms a part of a ridge extending between a rear surface and an upper surface of the housing, the wireless cover being formed of a non-conductive member, wherein the wireless antenna is arranged inside the image pickup apparatus, facing the wireless cover at a predetermined angle with respect to the housing around an axis extending in the width

direction of the image pickup apparatus.

2. The image pickup apparatus according to claim 1, wherein no conductive member included in the housing is present in a region above a plane including the antenna pattern of the wireless antenna, the region being sandwiched between two planes both parallel to an optical axis direction of the image pickup apparatus, the two planes respectively including ends in a longitudinal direction of the wireless antenna.

3. The image pickup apparatus according to claim 1, wherein the antenna pattern is located close to one of short sides of the wireless antenna in the rectangular shape.

4. The image pickup apparatus according to claim 3, wherein the wireless cover is located so that a length in the width direction of the image pickup apparatus from a center in a longitudinal direction of the wireless antenna to an end on one side of the wireless cover is longer than a length in the width direction of the image pickup apparatus from the center in the longitudinal direction to an end on an other side of the wireless cover.

5. The image pickup apparatus according to claim 4, wherein the antenna pattern of the wireless antenna is located inside the image pickup apparatus while facing a portion on the one side of the wireless cover.

6. The image pickup apparatus according to claim 5, wherein the wireless antenna comprises a wire for electrically connecting to a wireless board on which a wireless control IC that controls the wireless antenna is mounted, the wire facing a portion on the other side of the wireless cover.

7. The image pickup apparatus according to claim 6, wherein the wireless antenna further comprises a fixing part for fixing the wire.

8. The image pickup apparatus according to claim 7, wherein the fixing part is arranged close to the other of the short sides of the wireless antenna in the rectangular shape.

9. The image pickup apparatus according to claim 1, wherein the wireless antenna is arranged inside the image pickup apparatus, facing the wireless cover at an acute angle with respect to the upper surface of the housing around the axis extending in the width direction of the image pickup apparatus.

10. The image pickup apparatus according to claim 1, further comprising: a wireless board on which a wireless control IC that controls the wireless antenna is mounted; and a heat dissipation duct configured to dissipate heat, wherein the wireless board is parallel to the heat dissipation duct, is arranged between the heat dissipation duct and the wireless antenna, and is thermally connected to the heat dissipation duct.

11. The image pickup apparatus according to claim 10, further comprising a media board on which a recording medium that records image information is to be mounted in a dismountable manner, wherein the heat dissipation duct comprises an intake port through which outside air is taken in, and the wireless board is thermally connected to the heat dissipation duct via a heat conduction member at a position farther from the intake port than the media board.

12. The image pickup apparatus according to claim 11, further comprising a sub-media board on which a storage device having a capacity smaller than that of the recording medium is to be mounted, the sub-media board being arranged substantially in parallel with the media board, wherein the wireless board is substantially flush with the sub-media board.