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(54) **ULTRASONIC DIAGNOSTIC APPARATUS**

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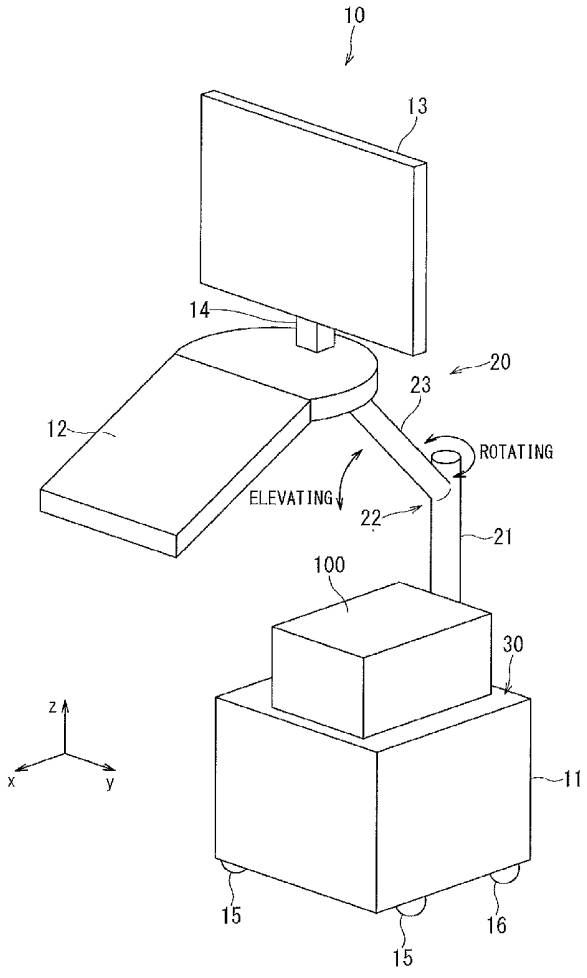
(57) **ABSTRACT**

According to one embodiment, the ultrasonic diagnostic apparatus includes a main body housing, an arm, a device, a table, and an avoiding mechanism. The arm is mounted to the main body housing so as to be capable of ascending and descending and pivotable about a predetermined axis. The device is supported by the arm so as to be capable of ascending and descending and pivotable according to the movement of the arm. The table has a surface which is positioned in a descending direction of the arm and the device, and an object is placed on the surface. The avoiding mechanism changes a relative position between the object and a support position of ascending and descending movement of the arm such that interference between the object and at least one of the arm and the device due to the descending movement of the arm is avoided.



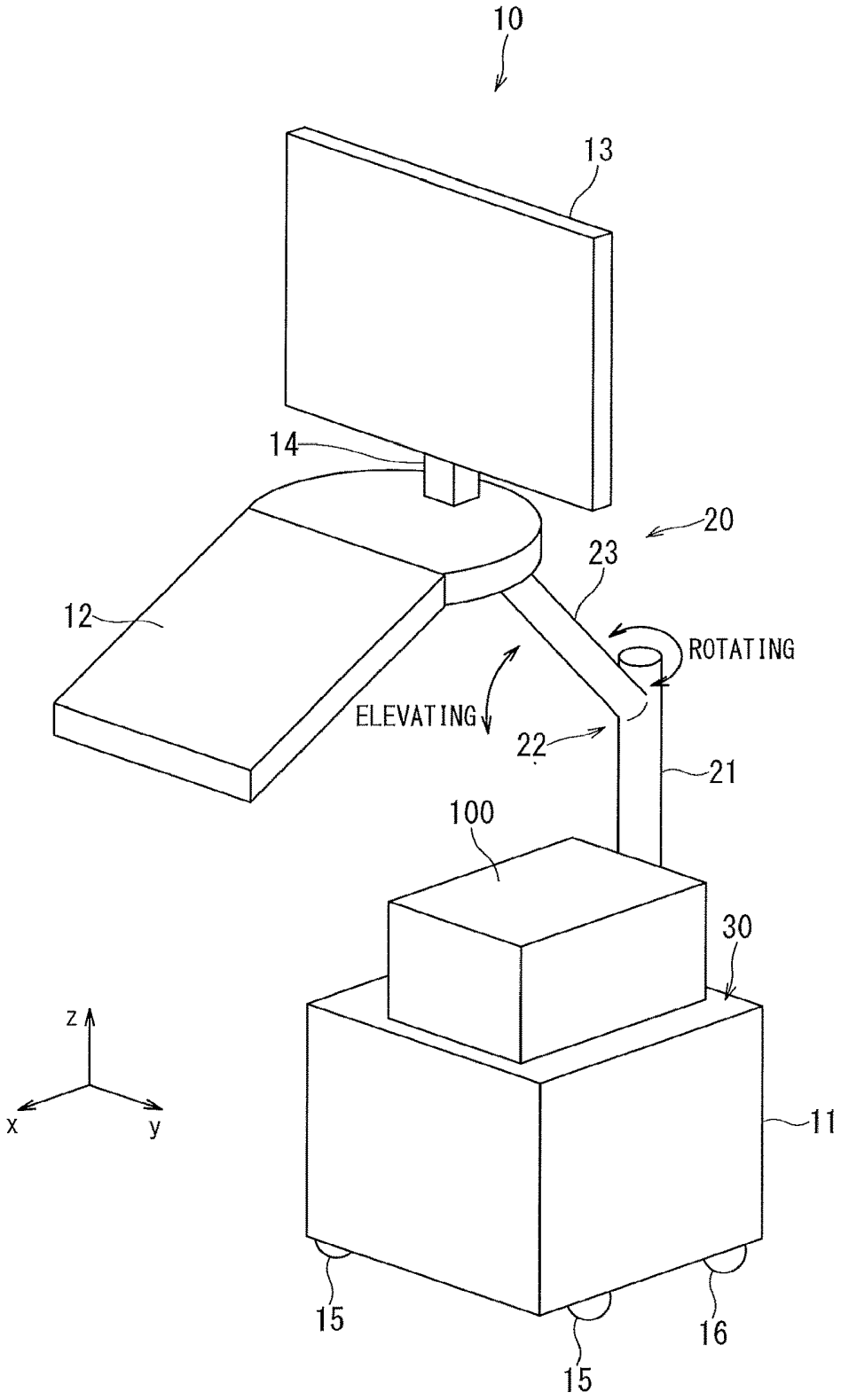


FIG. 1

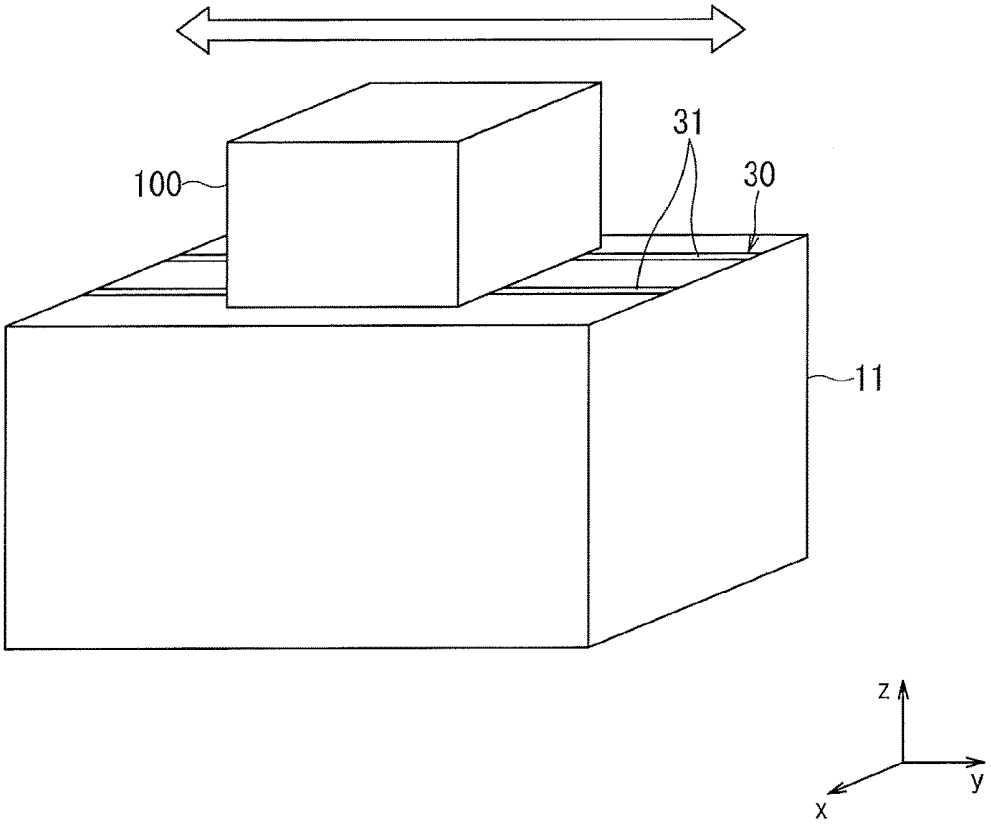


FIG. 2

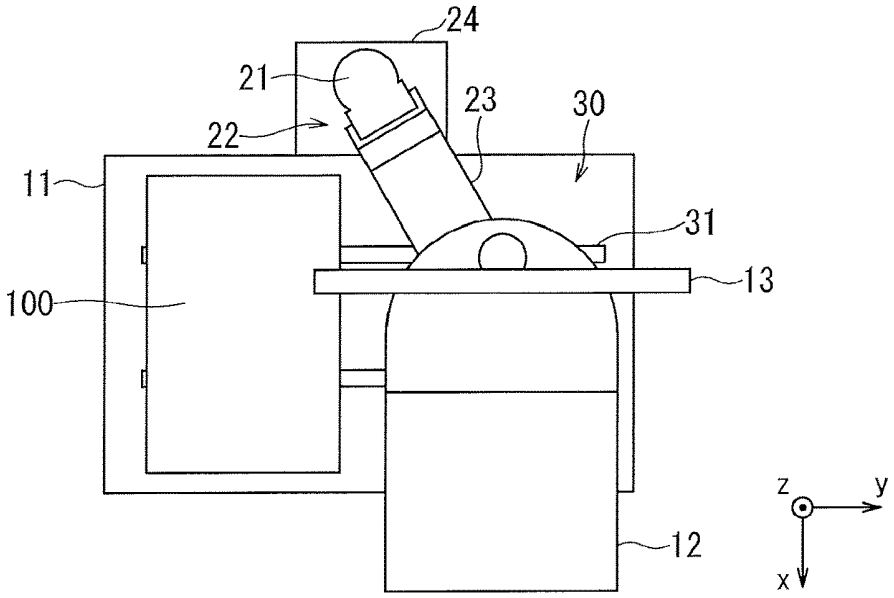


FIG. 3A

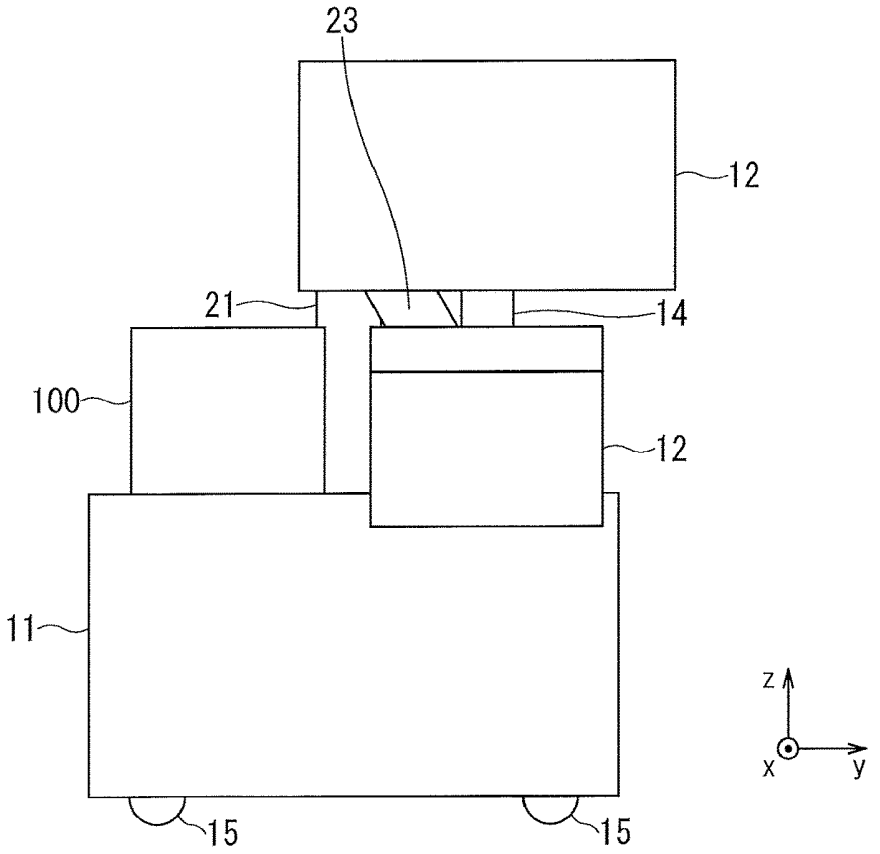


FIG. 3B

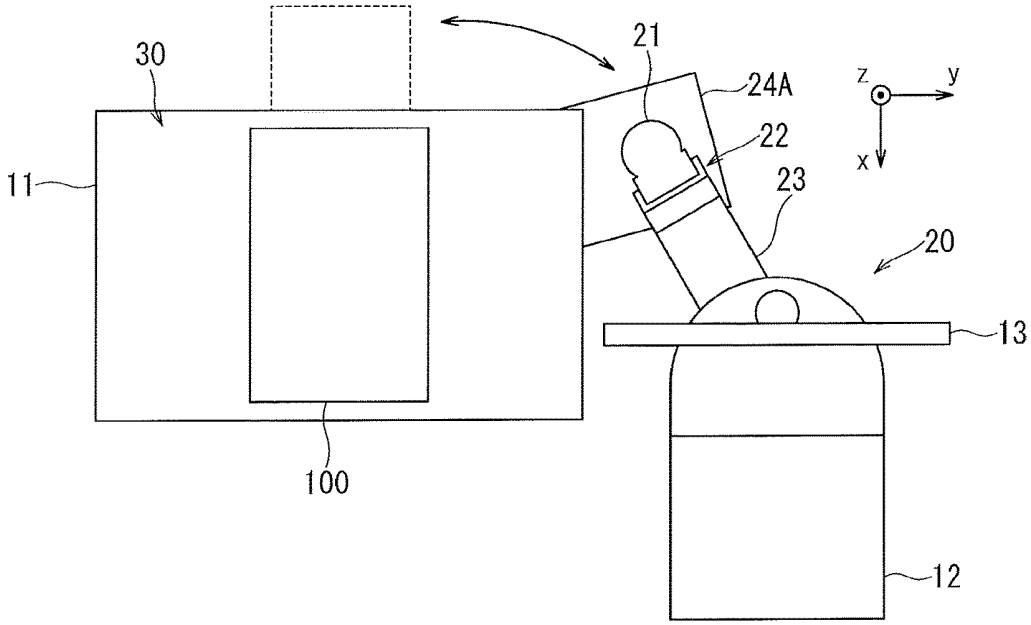


FIG. 4

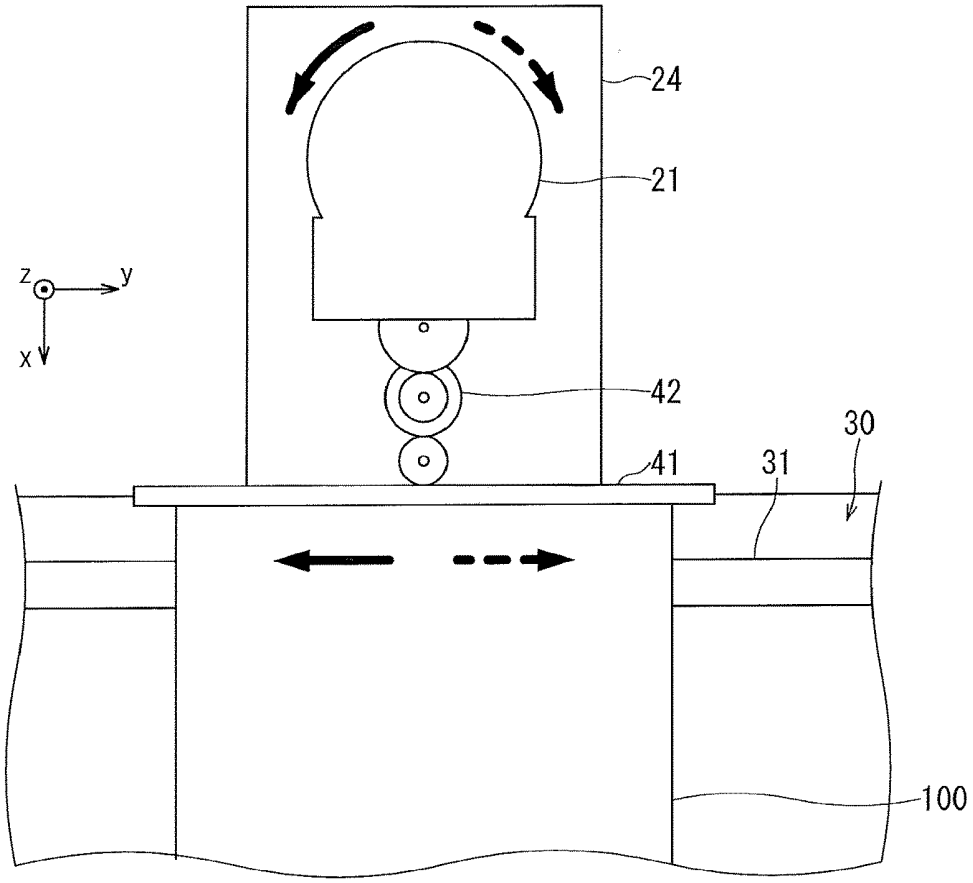


FIG. 5

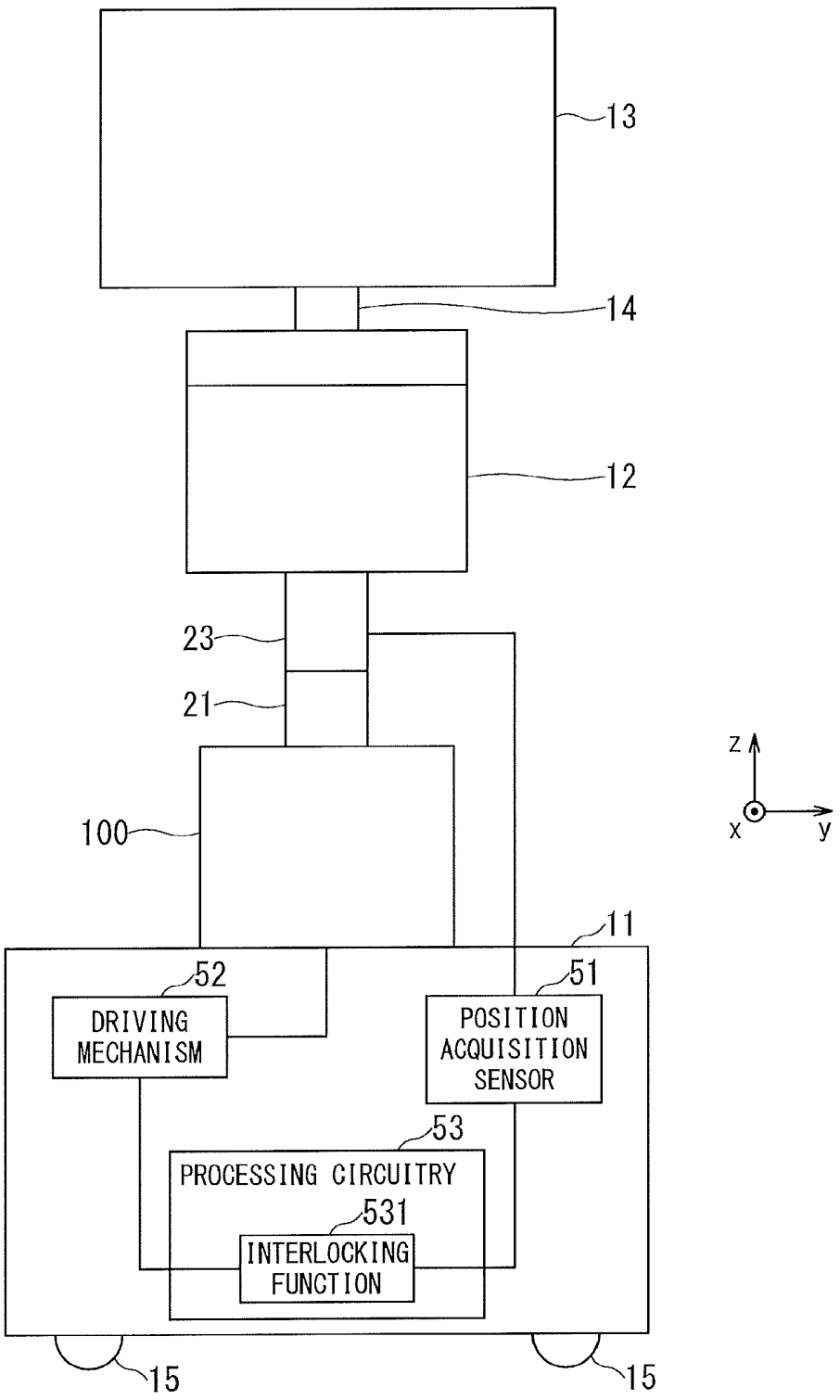

13
14
12
23
21
100
11
52
DRIVING MECHANISM
51
POSITION ACQUISITION SENSOR
53
PROCESSING CIRCUITRY
531
INTERLOCKING FUNCTION
15
15
z
x
y

FIG. 6

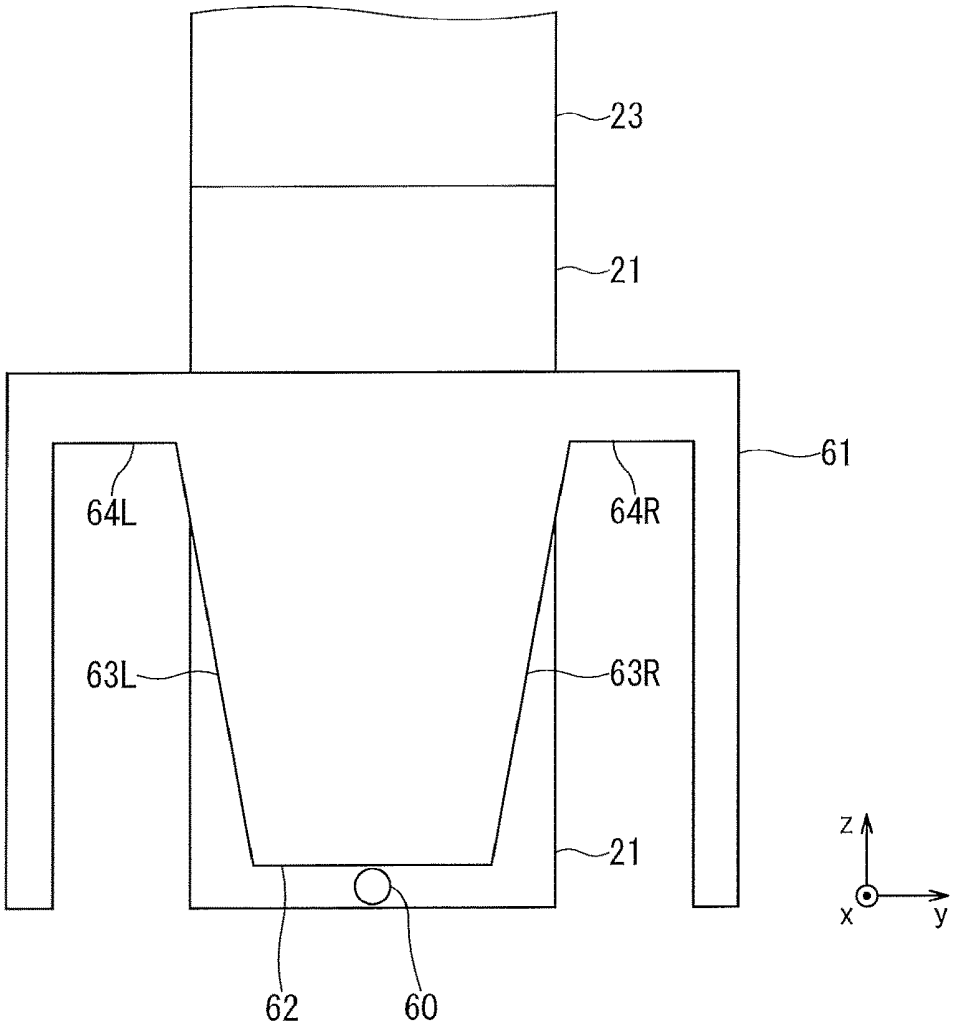


FIG. 7

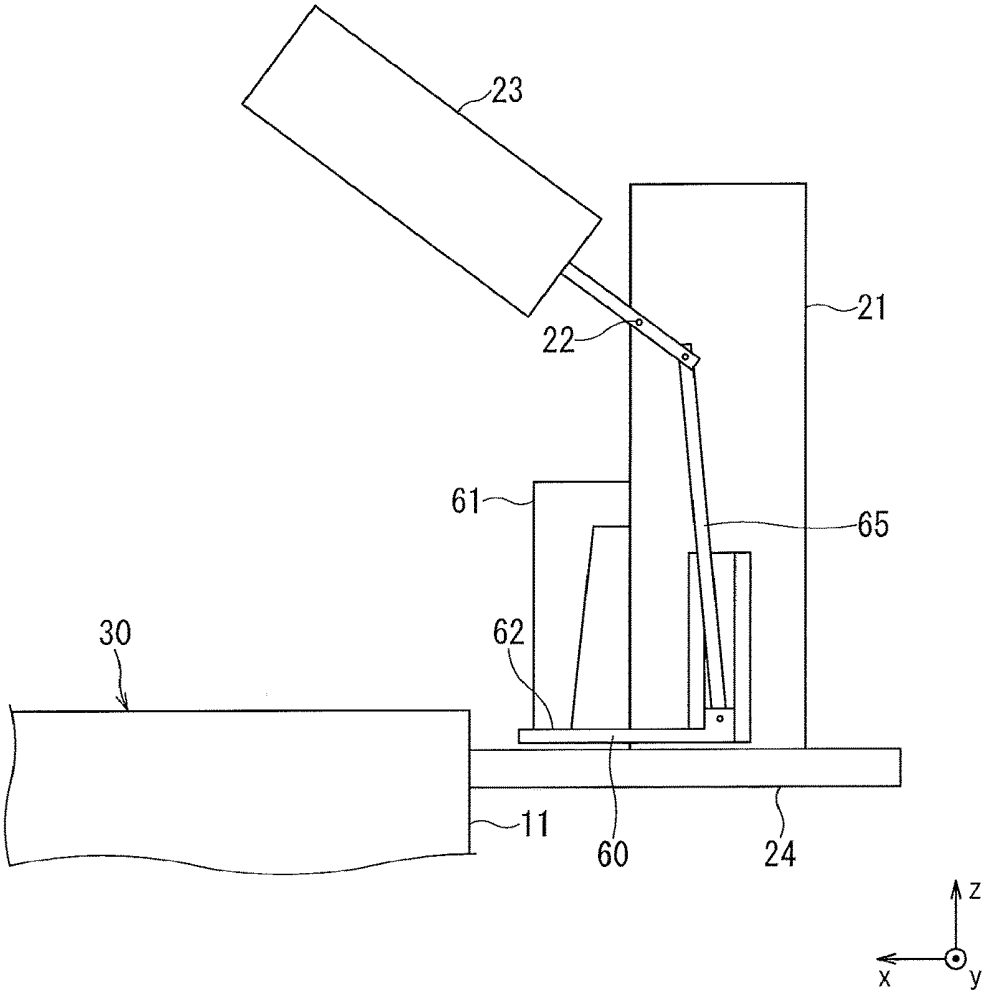


FIG. 8

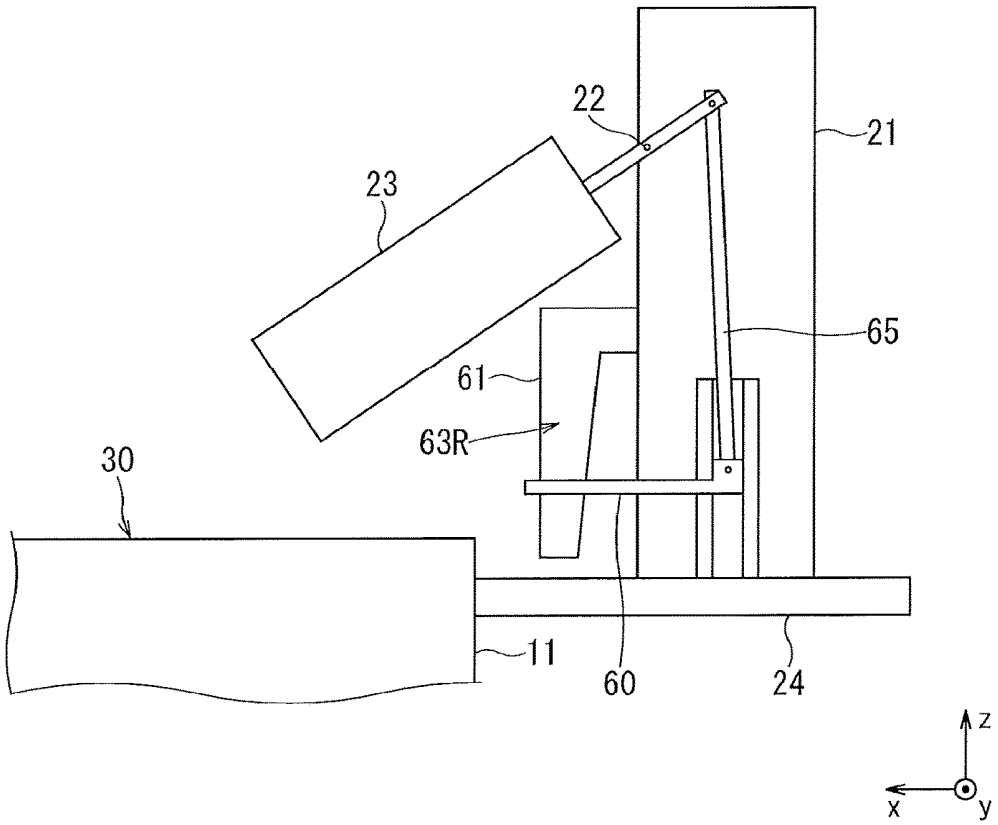


FIG. 9

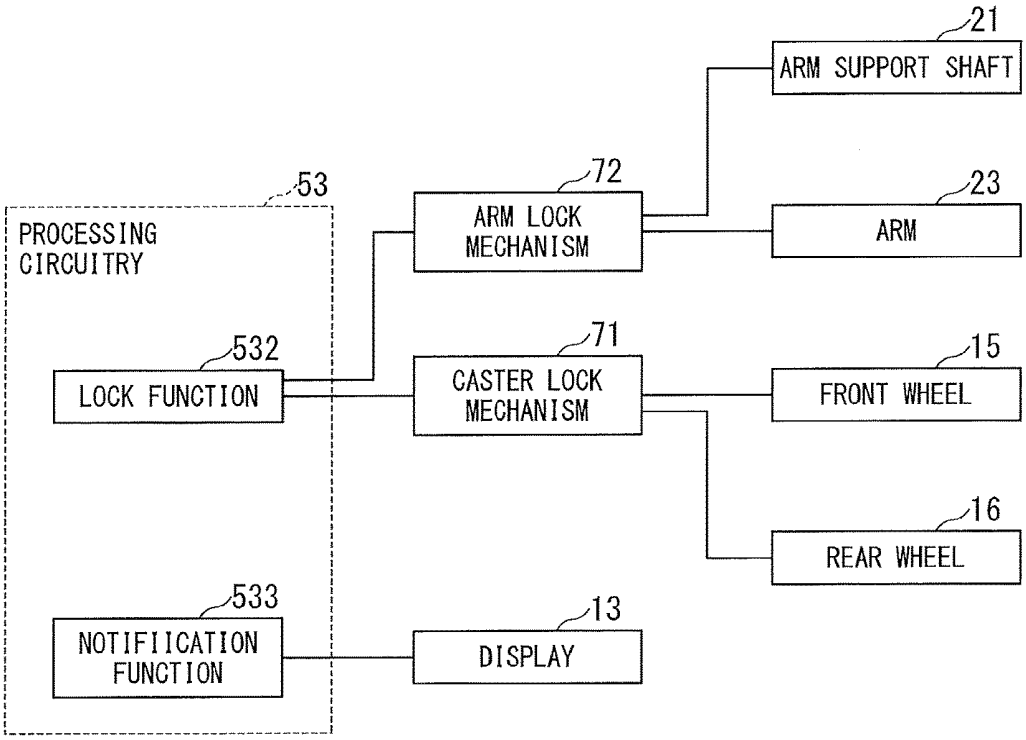

21
ARM SUPPORT SHAFT
72
ARM LOCK MECHANISM
23
ARM
53
PROCESSING CIRCUITRY
532
LOCK FUNCTION
71
CASTER LOCK MECHANISM
15
FRONT WHEEL
16
REAR WHEEL
533
NOTIFIICATION FUNCTION
13
DISPLAY

FIG. 10

ULTRASONIC DIAGNOSTIC APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority of Japanese Patent Application No. 2017-123154, filed Jun. 23, 2017, the entire contents of which are incorporated herein by reference.

FIELD

[0002] Embodiments described herein relate generally to an ultrasonic diagnostic apparatus.

BACKGROUND

[0003] Some ultrasonic diagnostic apparatuses have objects including peripheral devices such as printers, recording/reproducing apparatuses such as DVD recorders, placed near the main body of the apparatus. The ultrasonic diagnostic apparatus having a peripheral device placed near the main body, can be connected to the peripheral device by wire or wirelessly and can record or save the ultrasonic diagnostic image in the peripheral device.

[0004] Meanwhile, some ultrasonic diagnostic apparatus is configured to support a device such as a monitor and an operation panel via an arm, and the device supported by the arm is movable vertically and laterally on the front side of the main body of the apparatus via the arm. According to the ultrasonic diagnostic apparatus having this kind of arm, an user can easily change the position and posture of the monitor and the operation panel.

[0005] However, when the objects like peripheral devices are installed in the vicinity of the main body of the ultrasonic diagnostic apparatus having the arm, there are cases where the arm and the objects, or the monitor and the operation panel, collide with each other when the arm is moved. For example, when an object is placed on the right side or the left side of the main body of the apparatus so as to prevent a collision with the arm, depending on the positional relationship between the bed and the main body of the apparatus, the distance between the bed and the main body of the apparatus is increased by being disturbed by the object. When the object is installed on the rear side of the main body of the apparatus so as to prevent a collision with the arm, the distance from the object to the user operating the device is increased, and the convenience of the object including the peripheral device is greatly deteriorated.

[0006] In addition, when the object is installed in the descending direction of the arm, it is very inconvenient because it is difficult to lower the arm since the object limits the movement of the arm, whereby it suffers great restrictions on the range of change of the position and posture of the monitor and the operation panel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention, and together with the general description given above and the detailed description of the embodiments given below, serve to explain the principles of the invention.

[0008] FIG. **1** is a perspective view showing an example of an ultrasonic diagnostic apparatus according to the present embodiment;

[0009] FIG. **2** is an explanatory diagram showing a configuration example of a rail as an example of an avoiding mechanism;

[0010] FIG. **3**A is a plan view showing an example of a state in which interference between an arm or the like and a peripheral device due to a descending movement of the arm is avoided by the peripheral device moving along the rail;

[0011] FIG. **3**B is a front view of FIG. **3**A;

[0012] FIG. **4** is an explanatory diagram showing a configuration example of a movable arm support base as another example of the avoiding mechanism;

[0013] FIG. **5** is an explanatory diagram showing an example of a case where a rack-and-pinion mechanism is used as an interlocking mechanism;

[0014] FIG. **6** is an explanatory diagram showing an example of a case where a mechanism utilizing position information of the arm or the like is used as the interlocking mechanism;

[0015] FIG. **7** is an explanatory diagram showing an example of a case where a slide pin and a cam are used as a limiting movement mechanism;

[0016] FIG. **8** is an explanatory diagram showing an example of a relationship between the arm and the slide pin when the slide pin is within a range of the lower side of the inner periphery of the cam;

[0017] FIG. **9** is an explanatory diagram showing an example of a relationship between the arm and the slide pin when the slide pin is within a range of the right oblique side; and

[0018] FIG. **10** is a block diagram showing a configuration example of a lock mechanism.

DETAILED DESCRIPTION

[0019] Hereinbelow, a description will be given of an ultrasonic diagnostic apparatus according to embodiments of the present invention with reference to the drawings.

[0020] In general, according to one embodiment, the ultrasonic diagnostic apparatus includes a main body housing, an arm, a device, a table, and an avoiding mechanism. The arm is mounted to the main body housing so as to be capable of ascending and descending and pivotable about a predetermined axis. The device is supported by the arm so as to be capable of ascending and descending and pivotable according to the movement of the arm. The table has a surface which is positioned in a descending direction of the arm and the device supported by the arm and an object is placed on the surface. The avoiding mechanism changes a relative position between the object and a support position of ascending and descending movement of the arm such that interference between the object and at least one of the arm and the device supported by the arm due to the descending movement of the arm is avoided.

(Entire Configuration)

[0021] FIG. **1** is the perspective view showing the example of the ultrasonic diagnostic apparatus **10** according to the present embodiment. The ultrasonic diagnostic apparatus **10** includes the main body housing **11**, the operation panel **12**, the display **13**, the display rotating shaft **14**, the front wheel **15**, the rear wheel **16**, the arm supporting shaft **21**, and the arm **23** supported by the arm supporting shaft **21** at the support position **22** so as to be capable of ascending and descending.

[0022] In the present embodiment, the direction perpendicular to the floor surface is defined as the z-axis, the depth direction of the main body housing **11** and the direction orthogonal to the z-axis is defined as the x-axis, and the width direction of the main body housing **11** and the direction orthogonal to the z-axis is defined as the y-axis direction (see FIG. **1**).

[0023] The main body housing **11** incorporates a main body of the apparatus. The main body of the apparatus generates an ultrasonic image based on an echo signal from a subject received by an ultrasonic probe (not shown).

[0024] The operation panel **12** functions as a touch command screen and includes a display, a touch input circuit provided in the vicinity of the display, and a hard key. The touch input circuit gives the information of the indicated position on the touch input circuit by the user to the main body of the apparatus housed in the main body housing **11**. The hard key includes a keyboard, a mouse, a foot switch, a track ball, various buttons, and the like. The touch input circuit and the hard key constitute an input circuit, and accept various instructions from the user of the ultrasonic diagnostic apparatus **10**.

[0025] The display **13** is composed of a general display output device such as a liquid crystal display or an organic light emitting diode (OLED) display, for example, and displays ultrasound images of a living tissue image or the like generated by the main body of the apparatus incorporated in the main body housing **11**. Further, the display **13** displays an image for a user of the ultrasonic diagnostic apparatus **10** to input various instructions with the use of the operation panel **12**. Further, the display **13** displays notification information for the user received from the main body of the apparatus. The display **13** may be rotationally moved with respect to the operation panel **12** about the display rotation shaft **14** independently of the movement of the arm **23**.

[0026] The front wheels **15** and the rear wheels **16** are wheels provided under the main body housing **11**. The front wheel **15** is a freely rotatable wheel, and is composed of a pair of casters or the like, for example. The rear wheel **16** is a drive wheel connected to a drive device such as a motor, and is driven by receiving a power assist from the motor according to the operation by the user.

[0027] The arm **23** is attached to the main body housing **11** so as to be capable of ascending and descending, and so as to be pivotable about a predetermined axis. In addition, the arm **23** supports various devices such that the supported device is capable of ascending and descending, and is pivotable, according to the movement of the arm **23**.

[0028] In the present embodiment, an example is shown in which the devices, that is supported by the arm **23** so as to capable of elevating (ascending and descending) and is pivotable according to the movement of the arm **23**, are the operation panel **12** and the display **13** (see FIG. **1**). Further, in the present embodiment, an example is shown in which the arm **23** is attached to the main body housing **11** via the arm support shaft **21**.

[0029] More specifically, the arm support shaft **21** is attached to the arm support base **24** (see FIG. **3**A) of the main body housing **11** so as to be rotatable about the z axis. The arm **23** pivots about the z axis when the arm support shaft **21** rotates about the z axis, and the operation panel **12** and the display **13** pivot about the z axis. Further, the arm support shaft **21** supports one end of the arm **23** at the support position **22** such that the other end of the arm **23** can swing (ascend and descend) around the support position **22** in the plane including the arm support shaft **21** and the arm **23**. By elevating (ascending and descending, swinging) the arm **23** around the support position **22**, the operation panel **12** and the display **13** can be moved ascending and descending.

[0030] The object is placed on the surface of the table positioned in the descending direction of the arm **23**. The object placed on the surface of the table includes peripheral devices **100** such as a printer and a DVD recorder, books such as instruction manuals, jelly used for ultrasonic probe, wiping papers, and the like. In the embodiment, an example is shown in which the main body housing **11** is used as the table, and the upper face **30** of the main body housing **11** is used as the surface of the table. As this type of table, besides the main body housing **11**, a plate attached above the main body housing **11** can be used. Further, in the following description, an example is shown in which the object placed on the upper surface **30** of the main body housing **11** is the peripheral device **100**.

[0031] As shown in FIG. **1**, when the peripheral device **100** is positioned in the descending direction of the arm **23**, and when the arm **23** is lowered, at least one of the arm **23** and the devices supported by the arm **23** collides with the peripheral device **100**. In the following description, the devices (the operation panel **12** and the display **13**) supported by the arm **23** and the arm **23** are referred to as an arm and the like **20**.

(Avoiding Mechanism)

[0032] Therefore, the ultrasonic diagnostic apparatus **10** according to the present embodiment is provided with an avoiding mechanism for changing the relative position between the peripheral device **100** and the support position **22** of the ascending and descending movement of the arm **23** in order to avoid interference between the peripheral device **100** and the arm and the like **20** due to the descending movement of the arm **23**.

[0033] FIG. **2** is the explanatory diagram showing the configuration example of the rail **31** as an example of the avoiding mechanism.

[0034] The ultrasonic diagnostic apparatus **10** may include the rail **31** as the avoiding mechanism as shown in FIG. **2**. The rail **31** is provided on the upper surface of the main body housing **11** and supports the peripheral device **100** so as to be movable along the rail **31**.

[0035] FIG. **3**A is the plan view showing an example of a state in which interference between the arm or the like **20** and the peripheral device **100** due to the descending movement of the arm **23** is avoided by the peripheral device **100** moving along the rail **31**, and FIG. **3**B is a front view of FIG. **3**A.

[0036] FIGS. **2**, **3**A and **3**B show an example in which the rail **31** is provided along the y axis on the upper surface of the main body housing **11** so as to support the peripheral device **100** being movable along the y axis. Further, the rail **31** may be provided on the upper surface of the main body housing **11** so as to movably support the peripheral device **100** along a direction inclined with respect to the y axis, and may be provided on the upper surface of the main body housing **11** along the x axis. When the rail **31** is provided along the direction inclined with respect to the y axis or

along the x axis, the peripheral device **100** can move to the front, the back, or both along the rail **31**.

[0037] For example, when the arm support shaft **21** is located at a position closer to one side than the center in the y axis direction of the upper surface **30**, the rail **31** is preferably provided along the direction inclined with respect to the y axis so as to avoid the arm support shaft **21**, or is preferably provided along the X axis on the side opposite to the arm support shaft **21** with respect to the center in the y axis direction of the upper surface **30**.

[0038] Further, the rail **31** is not limited to a linear shape, and a part or all of the sections may be curved.

[0039] When the ultrasonic diagnostic apparatus **10** includes the rail **31** as the avoiding mechanism, the user moves the peripheral device **100** positioned in the descending direction of the arm **23** along the rail **31** away from the support position **22**, so that interference due to the descending movement of the arm **23** between the peripheral device **100** and the arm and the like **20** (at least one of the operation panel **12**, the display **13**, and the arm **23**) is avoided. For example, when the rail **31** is provided along the y axis as shown in FIGS. **3**A and **3**B, the user moves the peripheral device **100** located in the descending direction of the arm **23** along the rail **31** in the y axis direction away from the support position **22**, whereby it is possible to avoid interference due to the descending movement of the arm **23** between the arm and the like **20** and the peripheral device **100**.

[0040] FIG. **4** is an explanatory diagram showing a configuration example of a movable arm support base **24**A as another example of the avoiding mechanism.

[0041] The ultrasonic diagnostic apparatus **10** may have the movable arm support base **24**A as the avoiding mechanism as shown in FIG. **4**. The movable arm support base **24**A supports the arm support shaft **21** so as to be rotatable around the z axis. Further, the movable arm support base **24**A is mounted to the main body housing **11** so as to be movable in the xy plane, in a direction perpendicular to the z axis, by at least one of parallel movement and rotational movement with respect to the main body housing **11**.

[0042] As the arm support base **24**A moves in the direction perpendicular to the z axis, the arm support shaft **21** and the support position **22** move together with the arm support base **24**A. Therefore, when the ultrasonic diagnostic apparatus **10** has the movable arm support base **24**A as the avoiding mechanism, by moving the arm support base **24**A in the direction perpendicular to the z axis, the support position **22** can be kept away from the peripheral device **100**, and it is possible to avoid interference between the arm and the like **20** and the peripheral device **100** due to the descending movement of the arm **23**.

[0043] When the movable arm support base **24** is used as the avoiding mechanism, the peripheral device **100** may be fixed to the upper surface **30** of the main body housing **11**, or may be configured to be movable in the y-axis direction in combination with the rail **31**.

[0044] It is possible to change the positional relationship between the support position **22** and the peripheral device **100** by the avoiding mechanism such that the peripheral device **100** is not positioned in the descending direction of the arm **23**. Therefore, even when the peripheral device **100** is provided above the main body housing **11**, it is possible to easily descending the arm **23** with avoiding interference between the arm and the like **20** and the peripheral device **100**.

(Interlocking Mechanism)

[0045] The ultrasonic diagnostic apparatus **10** may be provided with an interlocking mechanism for moving the peripheral device **100** away from the arm and the like **20** in conjunction with the pivoting of the arm **23** about the z axis.

[0046] FIG. **5** is an explanatory diagram showing an example of a case where a rack-and-pinion mechanism is used as the interlocking mechanism. The arm **23** is omitted in FIG. **5**.

[0047] As shown in FIG. **5**, the rack and pinion mechanism may be used as the interlocking mechanism. The rack and pinion mechanism has a rack **41** and one or a plurality of gears **42**.

[0048] One or the plurality of gears **42** rotate in accordance with the pivoting of the arm **23** about the z-axis. In accordance with the rotation of the gear **42**, the rack **41** moves the peripheral device **100** in a direction away from the arm and the like **20** along a direction orthogonal to the z axis (in FIG. **5**, along the y axis direction). For example, when the arm support shaft **21** rotates in the direction of the solid line arrow in FIG. **5**, this rotation is transmitted to the rack **41** via the gears **42**, and the peripheral device **100** moves in the solid line direction (the y axis negative direction). Meanwhile, when the arm support shaft **21** rotates in the direction of the broken line arrow in FIG. **5**, the peripheral device **100** moves in the direction of the broken line (the y axis positive direction).

[0049] When the arm support shaft **21** rotates in the direction of the solid line arrow in FIG. **5**, the arm **23** also pivots in the same direction, and the operation panel **12** pivots to the right side in FIG. **5**. Therefore, according to the rack and pinion mechanism shown in FIG. **5**, when the user turns the operation panel **12** to the right side in FIG. **5**, the peripheral device **100** moves to the left side of the drawing by the interlocking mechanism so as to move away from the operation panel **12**.

[0050] Although FIG. **5** shows an example in which the rack and pinion mechanism is used in combination with the rail **31**, the rack and pinion mechanism may be used without the rail **31**.

[0051] The interlocking mechanism may have a configuration to move the peripheral device **100** away from the arm and the like **20** using the position information of the arm and the like **20**.

[0052] FIG. **6** is an explanatory diagram showing an example of a case where a mechanism utilizing position information of the arm or the like **20** is used as the interlocking mechanism.

[0053] As shown in FIG. **6**, the interlocking mechanism using the position information of the arm and the like **20** includes, for example, a position acquisition sensor **51**, a driving mechanism **52**, and a processing circuitry **53**.

[0054] The position acquisition sensor **51** is a sensor for acquiring position information of the arm and the like **20**, and may be constituted by a position switch or the like.

[0055] The driving mechanism **52** is a mechanism for moving the peripheral device **100** and has, for example, a motor or the like. The driving mechanism **52** may use air

pressure, hydraulic pressure or the like as the motive power for moving the peripheral device **100** in addition to or separately from the motor.

[0056] The processing circuitry **53** includes at least a processor and a storage medium readable by the processor. The processing circuitry **53** functions as at least an interlocking function **531** according to a program stored in the storage medium. The functions implemented by the processor are stored in the storage medium in the form of a program.

[0057] The interlocking function **531** acquires the position information of the arm and the like **20** from the position acquisition sensor **51**, and controls the driving mechanism **52** so as to move the peripheral device **100** away from the arm and the like **20** in conjunction with the position information of the arm and the like **20**.

[0058] According to the ultrasonic diagnostic apparatus **10** provided with the interlocking mechanism shown in FIGS. **5** and **6**, the user can move the peripheral device **100** away from the arm and the like **20** by only pivoting the arm and the like **20**. According to the interlocking mechanism, since the user can avoid interference between the arm and the like **20** and the peripheral device **100** without paying attention to the position of the peripheral device **100**, the burden on the user can be reduced.

[0059] Further, it is preferable to provide a movement limit of the peripheral device **100** so that the peripheral device **100** does not fall from the upper surface **30** of the main body housing **11**. In the case where the movement limit of the peripheral device **100** is provided and the interlocking mechanism is mounted, and when the peripheral device **100** being moved in conjunction with the pivoting of the arm **23** about the z-axis reaches the movement limit, linkage of the interlocking may be released, thereby further pivoting of the arm **23** is permitted while the peripheral device **100** places still at the movement limit.

(Limiting Movement Mechanism)

[0060] The ultrasonic diagnostic apparatus **10** may also include a limiting movement mechanism that limits the ascending and descending movement of the arm **23** so as to reliably prevent collision between the arm and the like **20** and the peripheral device **100**.

[0061] FIG. **7** is an explanatory diagram showing an example of a case where a slide pin **60** and a cam **61** are used as the limiting movement mechanism.

[0062] The slide pin **60** pivots around the z axis with the rotation of the arm support shaft **21** about the z axis.

[0063] The inner periphery of the cam **61** includes, for example, a lower side **62** located in a predetermined range in the y-axis direction including the center of the arm support shaft **21** and positioned lower in the z-axis direction, a right oblique side **63**R and a left oblique side **63**L extending from the lower side **62** in the upper right direction and the upper left direction, respectively, a right upper side **64**R connected to the right oblique side **63**R, and a left upper side **64**L connected to the left oblique side **63**L (see FIG. **7**).

[0064] FIG. **8** is an explanatory diagram showing an example of a relationship between the arm **23** and the slide pin **60** when the slide pin **60** is within a range of the lower side **62** of the inner periphery of the cam **61**. FIG. **9** is an explanatory diagram showing an example of a relationship between the arm **23** and the slide pin **60** when the slide pin **60** is within a range of the right oblique side **63**R.

[0065] As shown in FIG. **8**, when the slide pin **60** is within the range of the lower side **62**, the slide pin **60** cannot move upward obstructed by the lower side **62**. Therefore, the link **65** connected to the slide pin **60** cannot move upward either. Hence, in this case, the arm **23** cannot descend.

[0066] Meanwhile, when the slide pin **60** is outside the range of the lower side **62**, the slide pin **60** is permitted to move upward. For example, as shown in FIG. **9**, when the slide pin **60** is within the range of the right oblique side **63**R, the slide pin **60** can move upward, with the position of the right oblique side **63** as the upper limit. Therefore, as shown in FIG. **9**, as the slide pin **60** moves upward, the link **65** can move upward. Therefore, when the slide pin **60** is outside the range of the lower side **62**, the arm **23** can descend about the support position **22**.

[0067] That is, when the ultrasonic diagnostic apparatus **10** has the limiting movement mechanism shown in FIG. **7**, the range where the descending movement of the arm **23** is prohibited can be determined according to the position, range and shape of the lower side **62**, the right oblique side **63**R, and the left oblique side **63**L. Therefore, the ultrasonic diagnostic apparatus **10** can limit the pivoting range and the ascending and descending movement range of the arm **23** by the limiting movement mechanism, whereby interference between the arm and the like **20** and the peripheral device **100** can be easily prevented, and the burden on the user can be reduced.

(Lock and Notification)

[0068] The ultrasonic diagnostic apparatus **10** may also include a lock mechanism that locks the wheel, or locks the peripheral device **100** and the arm and the like **20**, according to the position of the arm and the like **20** and the peripheral device **100**.

[0069] FIG. **10** is a block diagram showing a configuration example of the lock mechanism. The caster lock mechanism **71** is a mechanism for locking the front wheel **15** and the rear wheel **16** under the control of the processing circuitry **53**, and is constituted by, for example, a brake or the like.

[0070] The arm lock mechanism **72** is a mechanism for inhibiting the rotation of the arm support shaft **21** and the ascending and descending movement of the arm **23** under the control of the processing circuitry **53**, and is constituted by, for example, a lock pin or the like.

[0071] The processing circuitry **53** functions as a lock function **532** and a notification function **533** according to a program stored in the storage medium. It should be noted that the processing circuitry **53** may further functions as the interlocking function **531** shown in FIG. **6**.

[0072] When the position of the arm **23** and the position of the peripheral device **100** are deviated from respective predetermined initial positions (see FIG. **6**, for example), the lock function **532** locks the front wheel **15** and the rear wheel **16** via the wheel lock mechanism **71**. Here, the predetermined initial positions are positions suitable to transfer the ultrasonic diagnostic apparatus **10**.

[0073] For example, the lock function **532** unlocks the front wheel **15** and the rear wheel **16** so as to allow traveling of the ultrasonic diagnostic apparatus **10** when the arm **23** and the peripheral device **100** are in the respective predetermined initial positions. Meanwhile, when they deviate from the predetermined initial positions, the lock function **532** locks the front wheel **15** and the rear wheel **16** such that the ultrasonic diagnostic apparatus **10** cannot move, consid-

ering the risk of falling due to the fact that the center of gravity is shifted due to the peripheral device **100** being, for example, at the end of the main body housing **11**, and considering the risk of collision caused by the protruding arm **23**.

[0074] The notification function **533** notifies the user of the lock status of the lock function **532**. For example, when the lock function **532** locks the front wheel **15** and the rear wheel **16**, the notification function **533** notifies the user of the information to that effect. As a notification method, for example, a method of displaying on the touch command screen of the display **13** or the operation panel **12**, a method of outputting sound via a speaker (not shown), or the like can be used. The user can understand that the ultrasonic diagnostic apparatus **10** is prohibited from traveling by notified the fact that the front wheels **15** and the rear wheels **16** are locked and can avoid unnecessary confusion by notified the fact that the front wheels **15** and the rear wheels **16** are locked.

[0075] Further, when the position of the arm **23** and the position of the peripheral device **100** are at predetermined initial positions, the lock function **532** may prohibit the rotation of the arm support shaft **21** and the ascending and descending movement of the arm **23**, via the arm lock mechanism **72**. In addition, when the peripheral device **100** is movable by the avoiding mechanism, the interlocking mechanism, and the like, the lock function **532** may also prohibit the movement of the peripheral device **100**.

[0076] As described above, the lock function **532** unlocks the front wheel **15** and the rear wheel **16** so as to allow traveling of the ultrasonic diagnostic apparatus **10** when the arm **23** and the peripheral device **100** are in predetermined initial positions. That is, when the arm **23** and the peripheral device **100** are in the predetermined initial positions, there is a possibility that the ultrasonic diagnostic apparatus **10** travels. Therefore, in this case, the lock function **532** further prohibits the rotation of the arm support shaft **21** and the ascending and descending movement of the arm **23** such that the arm and the like **20** and the peripheral device **100** do not move during the traveling of the ultrasonic diagnostic apparatus **10**. At this time, the notification function **533** may notify the user of information that the arm and the like **20** and the peripheral device **100** are locked.

[0077] Meanwhile, when the arm **23** and the peripheral device **100** are deviated from the predetermined initial positions, since the lock function **532** locks the front wheel **15** and the rear wheel **16** to prohibit the traveling of the ultrasonic diagnostic apparatus **10**, the rotation of the arm support shaft **21** and the ascending and descending movement of the arm **23** can be allowed.

[0078] The lock function **532** further includes a function that, automatically returns the arm and the like **20** and the peripheral device **100** to the predetermined initial positions in accordance with the power-off operation of the ultrasonic diagnostic apparatus **10** or a predetermined button operation, and then locks the arm and the like **20** and the peripheral device **100**, and unlocks of the front wheel **15** and the rear wheel **16**.

[0079] According to the ultrasonic diagnostic apparatus **10** of the present embodiment, even when the peripheral device **100** is provided on the upper surface **30** of the main body housing **11**, it is possible to easily prevent interference between the arm and the like **20** and the peripheral device **100** while descending the arm **23**, it is possible to reduce the burden of attention when the user operates the arm **23**. In addition, as compared with the case where the peripheral device **100** is provided on the side surface of the main body housing **11**, the main body housing **11** can be brought closer to the bed on which the subject is placed without being disturbed by the peripheral device **100**. Further, as compared with the case where the peripheral device **100** is provided on the back side of the main body housing **11**, the user can easily access to the peripheral device **100**, and is provided with high convenience.

[0080] According to at least one of the above-described embodiments, it is possible to easily descending the arm **23** with avoiding interference between the arm and the like **20** and the peripheral device **100** even when the peripheral device **100** is provided above the main body housing **11**.

[0081] The processing circuitry **53** in the above-described embodiments is an example of the processing circuitry described in the claims. In addition, the term "processor" used in the explanation in the above-described embodiments, for instance, refer to circuitry such as dedicated or general purpose CPUs (Central Processing Units), dedicated or general-purpose GPUs (Graphics Processing Units), or ASICs (Application Specific Integrated Circuits), programmable logic devices including SPLDs (Simple Programmable Logic Devices), CPLDs (Complex Programmable Logic Devices), and FPGAs (Field Programmable Gate Arrays), and the like. The processor implements various types of functions by reading out and executing programs stored in the memory circuitry.

[0082] In addition, instead of storing programs in the memory circuitry, the programs may be directly incorporated into the circuitry of the processor. In this case, the processor implements each function by reading out and executing each program incorporated in its own circuitry. Moreover, although in the above-described embodiments an example is shown in which the processing circuitry configured of a single processor implements every function, the processing circuitry may be configured by combining plural processors independent of each other so that each processor implements each function of the processing circuitry by executing corresponding program. When a plurality of processors are provided for the processing circuitry, the memory medium for storing programs may be individually provided for each processor, or one memory circuitry may collectively store programs corresponding to all the functions of the processors.

[0083] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

What is claimed is:

1. An ultrasonic diagnostic apparatus comprising:

a main body housing;

an arm mounted to the main body housing so as to be capable of ascending and descending and pivotable about a predetermined axis;

a device supported by the arm so as to be capable of ascending and descending and pivotable according to the movement of the arm;

a table having a surface which is positioned in a descending direction of the arm and the device supported by the arm, on the surface an object being placed;

an avoiding mechanism changing a relative position between the object and a support position of ascending and descending movement of the arm such that interference between the object and at least one of the arm and the device supported by the arm due to the descending movement of the arm is avoided.

2. The ultrasonic diagnostic apparatus of claim **1**, wherein the object is a peripheral device associated with the ultrasonic diagnostic apparatus.

3. The ultrasonic diagnostic apparatus of claim **1**, wherein

the avoiding mechanism includes a rail provided on the surface of the table and supporting the object so as to be movable in a predetermined direction, and

the object moves in the predetermined direction along the rail and moves away from the support position of the ascending and descending movement of the arm such that the interference between the object and at least one of the arm and the device supported by the arm due to the descending movement of the arm is avoided.

4. The ultrasonic diagnostic apparatus of claim **1**, wherein

the avoiding mechanism supports the arm so as to be capable of ascending and descending and includes an arm support shaft attached to the main body housing so as to be rotatable about the predetermined axis and movable with respect to the main body housing in a direction perpendicular to the predetermined axis, and

the arm support shaft moves in the direction perpendicular to the predetermined axis thereby the support position of the ascending and descending movement of the arm moving away from the object such that the interference between the object and at least one of the arm and the device supported by the arm due to the descending movement of the arm is avoided.

5. The ultrasonic diagnostic apparatus of claim **1**, further comprising an interlocking mechanism for moving the object away from the arm and the device supported by the arm in conjunction with the position of the arm and the device supported by the arm.

6. The ultrasonic diagnostic apparatus of claim **5**, wherein the interlocking mechanism includes a gear that rotates in response to the pivoting movement of the arm about the predetermined axis and a rack for moving the object in a direction away from the arm and the device supported by the arm in accordance with the rotation of the gear.

7. The ultrasonic diagnostic apparatus of claim **5**, wherein the interlocking mechanism includes a driving mechanism for moving the object, a sensor configured to acquires position information of at least one of the arm and the device supported by the arm, and a processing circuitry configured to control the driving mechanism so as to move the object away from the arm and the device supported by the arm in conjunction with the position information.

8. The ultrasonic diagnostic apparatus of claim **1**, further comprising a limiting movement mechanism limiting a range of the ascending and descending movement of the arm according to the position of the object.

9. The ultrasonic diagnostic apparatus of claim **1**, further comprising:

a wheel provided on the main body housing; and

a processing circuitry configured to lock the wheel when a position of the arm and a position of the object deviate from respective predetermined initial positions.

10. The ultrasonic diagnostic apparatus of claim **9**, wherein the processing circuitry locks movement of the arm so as to prohibit the ascending and descending movement and a pivoting movement when the position of the arm and the position of the object are at the respective predetermined initial positions.

11. The ultrasonic diagnostic apparatus of claim **9**, wherein the processing circuitry notifies a user of lock status.

12. The ultrasonic diagnostic apparatus of claim **1**, wherein the device supported by the arm includes at least one of a display and an operation panel.

13. The ultrasonic diagnostic apparatus of claim **1**, wherein the table is the main body housing, and the surface is the upper surface of the main body housing.

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摘要(译)

根据一个实施例，超声诊断设备包括主体壳体，臂，装置，工作台和避让机构。臂安装在主体壳体上，以便能够绕预定轴线上升和下降并可枢转。该装置由臂支撑，以便能够根据臂的运动上升和下降以及可枢转。桌子具有沿臂和装置的下降方向定位的表面，并且物体放置在表面上。避让机构改变物体与臂的上升和下降运动的支撑位置之间的相对位置，从而避免了由于臂的下降运动而导致的物体与臂和装置中的至少一个之间的干涉。