

SUPPORT STAND AND CT DETECTION DEVICE

CROSS REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority to Chinese Patent Application No. 202010472922.8, filed on May 29, 2020, the entire content of which is incorporated herein in its entirety by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a field of radiation detection, and in particular, to a support stand and a CT detection device including the support stand.

BACKGROUND

[0003] In an existing CT detection device, a radiation source and a detector are installed on a rotating frame, and the rotating frame is installed on a support stand through a slip ring bearing and may rotate around its central axis so as to achieve a tomography. The support stand carries the rotating frame and components installed thereon, thus, the support stand is an important component of the CT detection device.

SUMMARY

[0004] The present disclosure provides an improved support stand and a CT detection device including the support stand, which may achieve a sufficient stiffness and strength with a low weight and may be beneficial to achieve a stability of the detection device.

[0005] According to an aspect of the present disclosure, a support stand configured to support a rotating frame of a CT detection device is provided, including: a main body portion including a bearing mounting hole, wherein a slip ring bearing of the CT detection device is arranged in the bearing mounting hole, and the rotating frame is rotatably disposed in the slip ring bearing; a pedestal located at a bottom portion of the main body portion and configured to

support the main body portion; and a connecting portion, wherein a width of a lower portion of a cross section of the connecting portion is greater than a width of an upper portion of the cross section of the connecting portion, an upper portion of the connecting portion is connected to the main body portion, and a lower portion of the connecting portion is connected to the pedestal.

[0006] According to an exemplary embodiment of the present disclosure, the cross section of the connecting portion is formed as a herringbone shape, an inverted T shape or an inverted tree branch shape.

[0007] According to an exemplary embodiment of the present disclosure, the support stand further includes: a first support plate arranged on a periphery of the main body portion and extending outward in an axial direction of the main body portion; and a plurality of first reinforcing ribs, wherein one side of each first reinforcing rib is connected to a side surface of the first support plate, and the other side of each first reinforcing rib connected with the one side is connected to the main body portion.

[0008] According to an exemplary embodiment of the present disclosure, wherein the first support plate is disposed above the bearing mounting hole and formed as a semicircle shape, and wherein the plurality of first reinforcing ribs are uniformly arranged in a circumferential direction of the first support plate.

[0009] According to an exemplary embodiment of the present disclosure, the support stand further includes a plurality of second reinforcing ribs, wherein each reinforcing rib extends downward from an outer edge of the bearing mounting hole to the pedestal via the bottom portion of the main body portion and the connecting portion.

[0010] According to an exemplary embodiment of the present disclosure, a plurality of third reinforcing ribs are disposed inside the pedestal, and the third reinforcing ribs are formed as a cross shape.

[0011] According to an exemplary embodiment of the present disclosure, the support stand is manufactured by an integral cast forming; or the main body portion and the pedestal are respectively manufactured as two separate parts, and the two parts are connected into one part.

[0012] According to another aspect of the present disclosure, a CT detection device is provided, including: a rotating frame provided with a radiation source and a detector; a slip ring bearing; and the support stand according to any one of the above-mentioned embodiments.

[0013] According to an exemplary embodiment of the present disclosure, the cross section of the connecting portion is formed as a herringbone shape, an inverted T shape or an inverted tree branch shape.

[0014] According to an exemplary embodiment of the present disclosure, the CT detection device further includes: at least one pedestal extension section assembled with the pedestal to jointly support the CT detection device.

[0015] Through the following descriptions of the present disclosure with reference to the accompanying drawings, other purposes and advantages of the present disclosure will be apparent, which is facilitate to a comprehensive understanding of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 shows a perspective view of a CT detection device according to an embodiment of the present disclosure.

[0017] FIG. 2 shows a side view of the CT detection device shown in FIG. 1.

[0018] FIG. 3 shows a front view of the CT detection device shown in FIG. 1.

[0019] FIG. 4 shows a bottom view of the CT detection device shown in FIG. 1.

[0020] FIG. 5 shows a perspective view of a support stand according to an embodiment of the present disclosure.

[0021] FIG. 6 shows a front view of the support stand shown in FIG. 5.

[0022] FIG. 7 shows a bottom view of the support stand shown in FIG. 5.

[0023] FIG. 8 shows a cross-sectional view of a support stand according to a first embodiment of the present disclosure taken along a direction AA in FIG. 6.

[0024] FIG. 9 shows a cross-sectional view of a support stand according to a second embodiment of the present disclosure taken along a direction AA in FIG. 6.

[0025] FIG. 10 shows a cross-sectional view of a support stand according to a third embodiment of the present disclosure taken along a direction AA in FIG. 6.

[0026] FIG. 11 shows a perspective view of a detection channel according to an embodiment of the present disclosure.

[0027] FIG. 12 shows a front view of the detection channel shown in FIG. 11.

[0028] FIG. 13 shows a top view of the detection channel shown in FIG. 11.

[0029] FIG. 14 shows a side view of the detection channel shown in FIG. 11.

[0030] FIG. 15 shows a cross-sectional view of a material forming the detection channel shown in FIG. 11.

Reference Numerals

100. CT detection device; 10. support stand; 11. main body portion; 12. bearing mounting hole; 13. pedestal; 14. connecting portion; 15. first support plate; 16. first reinforcing rib; 17. second reinforcing rib; 18. third reinforcing rib; 20. slip ring bearing; 30. rotating frame; 40. pedestal extension section; 50. detection channel; 50A. carbon fiber layer; 50B, aramid honeycomb paper layer; 50C, aramid layer; 51. base; 52. connecting surface; 53. annular member; 60. transmission channel; 70. channel component; 72. transmission belt channel.

DETAILED DESCRIPTION OF EMBODIMENTS

[0031] Technical solutions of the present disclosure will be further described in detail below through embodiments in combination with the accompanying drawings. In the specification, the same or similar reference numerals indicate the same or similar components. The following descriptions of embodiments of the present disclosure with reference to the accompanying drawings are intended to explain the general inventive concept of the present disclosure, and should not be construed as limiting the present disclosure.

[0032] In addition, in the following detailed descriptions, for ease of explanation, many specific details are set forth to provide a comprehensive understanding of the embodiments of the present disclosure. However, it is obvious that one or more embodiments may also be implemented without the specific details. In other cases, well-known structures and devices are

represented graphically to simplify the accompanying drawings.

[0033] In the embodiments of the present disclosure, with a continuous improvement of requirements for a passing rate of object detection, a speed of a rotor in a rotating frame is correspondingly accelerated; and with an increase of a volume of an object to be detected, a weight of the rotating frame becomes larger. Since a radiation source, a detector and other electronic apparatuses are installed on the rotating frame, and the apparatuses have certain weights and are unevenly distributed, a high-speed rotation and a frequent startup and shutdown of the rotor may inevitably lead to a vibration of the rotor. The vibration may not only affect an imaging quality, but may also be delivered to a support stand, which may cause an adverse effect on an overall stability of the detection device. Thus, a structural component including the support stand is required to have a high stiffness and strength. On the other hand, in order to improve a mobility and reduce a workload of installation and adjustment, etc., a reduction of a weight of the structural component such as the support stand or the like has also become an important demand in the art. Therefore, how to reduce the weight while ensuring the high strength and stiffness of the support stand is a technical problem to be solved urgently.

[0034] In the embodiments of the present disclosure, the support stand is used to support a slip ring bearing, the support stand is manufactured by processing after a steel plate welding, or is manufactured by processing after an integral cast forming with cast iron. After that, the support stand is generally fixed on a pedestal by screws. In this way, the pedestal interacts with the support stand so as to ensure that the rotating frame may rotate stably and reliably.

[0035] Although the above-mentioned embodiments may ensure a stability of the detection device to a certain extent, the above-mentioned embodiment may still have the following disadvantages: the support stand and the pedestal are in a split structure, and they may be connected only when high-precision mounting surfaces are respectively processed; in a case of manufacturing the support stand by using the steel plate welding, parts have a long processing cycle and a high manufacturing cost, and the support stand manufactured has a large weight, which are not beneficial to the stability of the detection device; in a case of manufacturing the

support stand by using an integral casting, a connecting plane is also required to be processed.

[0036] For at least one aspect of the above-mentioned disadvantages, another embodiment of the present disclosure provides an improved solution. The embodiments of the present disclosure will be described in more detail below in combination with the accompanying drawings.

[0037] As shown in FIG. 1 to FIG. 4, the embodiments of the present disclosure provide a CT detection device 100, including a support stand 10, a slip ring bearing 20 and a rotating frame 30. The rotating frame 30 is provided with a radiation source and a detector, and may be rotatably disposed on the slip ring bearing 20.

[0038] As shown in FIG. 5 to FIG. 10, the support stand 10 includes three components, specifically a main body portion 11, a pedestal 13 and a connecting portion 14. The main body 11 includes a bearing mounting hole 12, and the slip ring bearing 20 is arranged in the bearing mounting hole 12. The pedestal 13 is located at a bottom portion of the main body portion 11 and is configured to support the main body portion 11. A cross section of the connecting portion 14 taken along a direction parallel to a page surface in FIG. 8 includes an upper portion and a lower portion, and the lower portion of the cross section is wider than the upper portion of the cross section. An upper portion of the connecting portion 14 is connected to the main body portion 11, and a lower portion of the connecting portion 14 is connected to the pedestal 13. In such configuration, the support stand according to the embodiments of the present disclosure may achieve a sufficient stiffness and strength with a low weight, thereby a vibration of the rotating frame may be reduced.

[0039] In a first embodiment shown in FIG. 8, the cross section of the connecting portion 14 is formed as a herringbone shape, thereby reducing the weight of the support stand while providing sufficient strength and stiffness. Reducing the weight may improve the mobility of the support stand and facilitate a process of installing and adjusting the support stand.

[0040] In a second embodiment shown in FIG. 9, the cross section of the connecting portion 14 is formed as an inverted T shape.

[0041] In a third embodiment shown in FIG. 10, the cross section of the connecting portion 14 is formed as an inverted tree branch shape. The connecting portion of the present disclosure is not limited to shapes of the cross section shown, and other shapes of the cross section may be set as needed.

[0042] As shown in FIG. 5, the support stand 10 also includes a first support plate 15. The first support plate 15 is arranged on a periphery of the main body portion 11 and extends outward in an axial direction of the main body portion 11. In the embodiment, the first support plate 15 may be disposed above the bearing mounting hole 12 and formed as a semicircle shape. Certainly, although the first support plate 15 has a semicircular shape as shown in FIG. 5, those skilled in the art may design the first support plate 15 into any other suitable shape as needed, such as an ellipse, etc.

[0043] As shown in FIG. 5, the support stand 10 also includes a plurality of first reinforcing ribs 16. The first reinforcing rib 16 may enhance the strength and stiffness of the support stand 10. In the embodiment, one side of each first reinforcing rib 16 is connected to a side surface of the first support plate 15, and a second side connected with the one side is connected to the main body portion 11.

[0044] In the illustrated embodiment, the plurality of first reinforcing ribs 16 are uniformly arranged in a circumference direction of the first support plate 15. Those skilled in the art may understand that the plurality of first reinforcing ribs are not necessarily uniformly arranged in the circumference direction of the first support plate 15, but may be arranged in other rules, such as arranged at a preset interval. In addition, the plurality of first reinforcing ribs may be formed as cross-shaped mesh ribs.

[0045] As shown in FIG. 5, the support stand 10 also includes a plurality of second reinforcing ribs 17. The second reinforcing rib 17 may improve the strength and stiffness of the support stand 10. Each second reinforcing rib 17 extends downward from an outer edge of the bearing mounting hole 12 to the pedestal 13 via the bottom portion of the main body portion 11 and the connecting portion 14. In the illustrated embodiment, the plurality of second reinforcing

ribs 17 have a flat shape and are uniformly spaced from each other. The plurality of second reinforcing ribs may be formed as cross-shaped mesh ribs. However, the embodiments of the present disclosure are not limited to this, and those skilled in the art may make appropriate adjustments as needed.

[0046] As shown in FIG. 8 to FIG. 10, a plurality of third reinforcing ribs 18 are disposed inside the pedestal 13. The third reinforcing rib 18 may enhance the strength and stiffness of the support stand. In the illustrated embodiment, the third reinforcing rib 18 is formed as a cross shape.

[0047] In the embodiment, the support stand 10 may be manufactured by an integral cast forming, so that the main body portion and the pedestal are formed integrally. The method may reduce a traditional connection process between the support stand and the pedestal, thereby reducing a processing workload. The process may use a cast aluminum material, which may further reduce a weight of the support stand. In other embodiments, the process may use a cast iron material or other cast alloy materials.

[0048] Alternatively, the main body portion and the pedestal of the support stand may be manufactured as two separate parts, and then the two parts may be connected into one part. Alternatively, the support stand according to the embodiments of the present disclosure may also be made by welding.

[0049] As shown in FIG. 1 to FIG. 2, the CT detection device 100 also includes at least one pedestal extension section 40 assembled with the pedestal 13. The pedestal extension section 40 is matched with the pedestal 13 of the support stand 10 so as to jointly support the CT detection device 100.

[0050] As shown in FIG. 1 to FIG. 2, the CT detection device 100 also includes a channel component 70, and an object to be detected passes through the channel component to complete a detection process. As shown in FIG. 1 to FIG. 2, the channel component 70 includes a detection channel 50 and at least one transmission channel 60. The detection channel 50 is arranged in an installing space of the rotating frame 30. The object to be detected is irradiated by

a detection radiation in the detection channel 50 and a returned radiation signal is received by the detector, so that the detection process is completed. The at least one transmission channel 60 is connected to and communicated with at least one of two ends of a base 51 of the detection channel 50, so that the detected object is allowed to be transmitted from the transmission channel to the detection channel, or from the detection channel to the transmission channel.

[0051] As shown in FIG. 1 to FIG. 4, the support stand 10 and the detection channel 50 in the embodiments of the present disclosure may be used in conjunction, so that a flexibility of the CT detection device may be improved. When a small object is required to be detected, it is only required to connect at least one of two ends of the support stand in the embodiment to the pedestal extension section, and correspondingly connect at least one of two ends of the detection channel to the transmission channel. In addition, when maintenance is required, the pedestal extension section and the transmission channel may be disconnected from the support stand and the detection channel, respectively, so that the maintenance may be carried out respectively, which may facilitate the use of users.

[0052] As shown in FIG. 11 to FIG. 15, the detection channel 50 includes the base 51 having two open ends, and the base 51 is configured to allow the object to be detected to pass through the detection channel 50. In the embodiment, the detection channel 50 is integrally formed by a carbon fiber composite material, which is beneficial to simplify an installation process of the channel. In addition, a new detection channel is allowed to be directly replaced in a case of a failure in the detection channel, so that a cost and time of maintenance may be reduced.

[0053] As shown in FIG. 15, the carbon fiber composite material include a carbon fiber layer 50A, an aramid honeycomb paper layer 50B and an aramid layer 50C that are laminated in sequence. The carbon fiber composite material has a good wear resistance and stiffness, and has an advantage of light weight.

[0054] As shown in FIG. 11, at least one of the two ends of the base 51 is provided with a connecting surface 52 which is configured to be connected to the transmission channel 60, so

that a through channel component 70 is formed. In the embodiment, the connecting surface 52 includes a connecting hole (such as a screw hole) to fix the transmission channel 60 on the detection channel 50 through a connector (such as a screw).

[0055] As shown in FIG. 11 and FIG. 13, an outer side of the base 51 is sleeved with at least one annular member 53 for installing a lead plate. In the embodiment, the outer side of the base 51 includes a region where the lead plate is not installed, so as to allow an incidence of the detection radiation from the region. As shown in the drawing, the region where the lead plate is not installed may be provided between two annular members 53. Certainly, adjustments may also be made by those skilled in the art according to actual needs.

[0056] As shown in FIG. 12, the channel component 70 also includes a transmission belt channel 72 which is located at bottom portions of the detection channel 50 and the transmission channel 60. The transmission belt channel 72 is configured for a transmission belt to pass through, so that the detected object is allowed to pass through the detection channel and the transmission channel.

[0057] Those skilled in the art may understand that the above-described embodiments are all exemplary, and modifications may be made by those skilled in the art. The structures described in the various embodiments may be freely combined without a conflict in structure or principle.

[0058] Although the present disclosure has been described with reference to the accompanying drawings, the embodiments disclosed in the accompanying drawings are intended to provide an exemplary description of preferred embodiments of the present disclosure, and may not be construed as limiting the present disclosure.

[0059] Although some embodiments of the general inventive concept have been shown and described, those skilled in the art will understand that these embodiments may be changed without departing from the principle and spirit of the general inventive concept of the present disclosure, and the scope of the present disclosure is defined by the claims and their equivalents.

[0060] It should be noted that the word "including" does not exclude other elements or

steps, and the word "a" or "an" does not exclude more than one. In addition, any reference numeral in the claims should not be construed as limiting the scope of the present disclosure.

What is claimed is:

1. A support stand configured to support a rotating frame of a CT detection device, comprising:

a main body portion comprising a bearing mounting hole, wherein a slip ring bearing of the CT detection device is arranged in the bearing mounting hole, and the rotating frame is rotatably disposed in the slip ring bearing;

a pedestal located at a bottom portion of the main body portion and configured to support the main body portion; and

a connecting portion, wherein a width of a lower portion of a cross section of the connecting portion is greater than a width of an upper portion of the cross section of the connecting portion, an upper portion of the connecting portion is connected to the main body portion, and a lower portion of the connecting portion is connected to the pedestal.

2. The support stand according to claim 1, wherein the cross section of the connecting portion is formed as a herringbone shape, an inverted T shape or an inverted tree branch shape.

3. The support stand according to claim 1 or 2, further comprising:

a first support plate arranged on a periphery of the main body portion and extending outward in an axial direction of the main body portion; and

a plurality of first reinforcing ribs, wherein one side of each first reinforcing rib is connected to a side surface of the first support plate, and the other side of each first reinforcing rib connected with the one side is connected to the main body portion.

4. The support stand according to claim 3, wherein the first support plate is disposed above the bearing mounting hole and formed as a semicircle shape, and

wherein the plurality of first reinforcing ribs are uniformly arranged in a circumferential direction of the first support plate.

5. The support stand according to claim 3, further comprising a plurality of second reinforcing ribs, wherein each reinforcing rib extends downward from an outer edge of the bearing mounting hole to the pedestal via the bottom portion of the main body portion and the connecting portion.

6. The support stand according to claim 5, wherein a plurality of third reinforcing ribs are disposed inside the pedestal, and the third reinforcing ribs are formed as a cross shape.

7. The support stand according to claim 1 or 2, wherein the support stand is manufactured by an integral cast forming; or

the main body portion and the pedestal are respectively manufactured as two separate parts, and the two parts are connected into one part.

8. A CT detection device, comprising:
a rotating frame provided with a radiation source and a detector;
a slip ring bearing; and
the support stand according to any one of claims 1 to 7.

9. The CT detection device according to claim 8, wherein the cross section of the connecting portion is formed as a herringbone shape, an inverted T shape or an inverted tree branch shape.

10. The CT detection device according to claim 8 or 9, further comprising:
at least one pedestal extension section assembled with the pedestal to jointly support the CT detection device.