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Dual axis adjustable speaker mount

Abstract

An apparatus (**100**), including: an upper connection assembly (**120**) having an adapter (**402**) configured to be secured to a boat tower, an upper rotor body (**400**), and an upper joint assembly (**404**) therebetween that is configured to permit rotation of the upper rotor body about a first axis (**106**); a first lateral connection assembly (**900**) having a first outer side rotation body (**902**), a first inner side rotation body (**904**) configured to be secured to a speaker housing, and a first lateral joint assembly (**908**) therebetween that is configured to permit rotation of the first inner side rotation body about a second axis (**108**); and a frame (**122**) that secures the first lateral connection assembly to the upper connection assembly and that is configured to orbit the first lateral connection assembly around the first axis when the upper rotor body is rotated about the first axis.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS (1) This application claims the benefit of U.S. provisional patent application Ser. No. 63/342,327 titled “Dual Axis Adjustable Speaker Mount”, filed on May 16, 2022, the entire disclosure of which is incorporated herein by reference.

FIELD OF THE INVENTION
(1) The invention relates to a speaker mount configured to provide selective positioning of a speaker housing about two perpendicular rotation axes.
BACKGROUND OF THE INVENTION
(2) Mounting arrangements that secure speakers to boat towers are known to permit selectively adjustable positioning about a single, typically vertical, axis. This allows one to selectively aim the speaker at various locations lateral to the speaker. However, instances exist where greater flexibility would be advantageous. Consequently, there is room in the art for improvement.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) The invention is explained in the following description in view of the drawings that show:
(2) FIG. **1** shows an example embodiment of a dual axis adjustable speaker mount in a variety of angular positions about a first rotational axis.
(3) FIG. **2** shows the dual axis adjustable speaker mount of FIG. **1** in a variety of angular positions about a second rotational axis.
(4) FIG. **3** shows the dual axis adjustable speaker mount of FIG. **1** secured to a tower.
(5) FIG. **4** to FIG. **8** show an example embodiment of an upper connect assembly of the dual axis adjustable speaker mount of FIG. **1**.
(6) FIG. **9** to FIG. **11** show an example embodiment of a first lateral rotation assembly of the dual axis adjustable speaker mount of FIG. **1**.
(7) FIG. **12** shows an example embodiment of the first lateral connection assembly and the second lateral connection assembly from the rear.
(8) FIG. **13** shows an alternate example embodiment of the frame of the dual axis adjustable speaker mount.
DETAILED DESCRIPTION OF THE INVENTION
(9) The present inventor has devised a unique and innovative dual axis adjustable speaker mount that permits adjustment of a speaker housing around a first axis as well as around a second axis that is perpendicular to the first axis. When mounted to, for example, an overhead tower of a marine

vessel, the dual axis adjustable speaker mount enables a user to select targets that are lateral to the speaker as well as at various locations below the speaker.

(10) FIG. **1** shows an example embodiment of a dual axis adjustable speaker mount **100** secured to, for example, a tower **102** of a marine vessel. The dual axis adjustable speaker mount **100** is secured to a speaker housing **104** and is configured to permit rotation of the speaker housing **104** through a variety of angular positions about a first rotational axis **106**. The dual axis adjustable speaker mount **100** includes an upper connection assembly **120** secured to the tower **102**. A frame **122** having a first lateral arm **124** and a second lateral arm **126** is secured to the upper connection assembly **120**. The upper connection assembly **120** is configured to rotate the frame **122** about the first axis **106**.

(11) A first lateral connection assembly **130** is secured to a distal end of the first lateral arm **124** and is configured to be secured to a first side "1" of a speaker housing **132**. A second lateral connection assembly **134** is secured to a distal end of the second lateral arm **126** and is configured to be secured to second side "2" of the speaker housing **132**. In an example embodiment, the second side "2" is opposite the first side "1". In an example embodiment, the first lateral arm **124** is configured to orbit the first lateral connection assembly **130** about the first axis **106** and the second lateral arm **126** is configured orbit the second lateral connection assembly **134** about the first axis **106** when the frame **122** rotates about the first axis **106**.

(12) FIG. **2** shows the dual axis adjustable speaker mount **100** secured to the tower **102** and in a variety of angular positions about a second rotational axis **108** (in and out of the page in FIG. **2**). Rotation about the second axis **108** is made possible by the first lateral connection assembly **130** and the second lateral connection assembly **134**, which each permit the speaker housing **104** to rotate about the second axis **108**.

(13) As shown in FIG. **1**, in position A, the speaker **140** points to the right (and a translucent light cover **142** points to the left). After rotating the frame **122** about the first axis **106** by 180 degrees as shown, the speaker **140** reaches position B and the speaker **140** points to the left. If the speaker housing **104** remains horizontal during this 180-degree rotation, then the speaker **140** sweeps **180** horizontal degrees out of the page from right to left. If the speaker **140** in position A is rotated about the second axis **108** to point to the left, and then the frame is rotated about the first axis **106** by 180 degrees, the speaker again reaches position B, but would be pointing to the right. In this case, the speaker **140** would sweep **180** horizontal degrees into the page from left to right. In this manner, the speaker **140** can sweep **360** horizontal degrees.

(14) As shown in FIG. **2**, in position C (the three o'clock position), the speaker **140** points to the right. After rotating the speaker housing **104** about the second axis **108** by 180 degrees as shown, the speaker housing **104** reaches position D (the nine o'clock position) and the speaker **140** points to the left. The speaker **140** thereby moves through a 180-degree downward oriented sweep. Since the speaker **140** can be pointed in any 360-lateral direction by virtue of the frame's rotation about the first axis **106**, and since in every lateral position the speaker housing **104** can be rotated from horizontal (e.g., a three o'clock position), to downward pointing (e.g., a six o'clock position), to horizontal (e.g., a nine o'clock position) by virtue of the speaker housing's rotation about the second axis **108**, the speaker **140** can be pointed in a hemisphere that is anywhere horizontal and below.

(15) FIG. **3** shows the dual axis adjustable speaker mount **100** secured to a tower **300**.

(16) FIG. **4** to FIG. **8** show an example embodiment of the upper connection assembly **120** and its components. FIG. **4** shows all components of the upper connection assembly **120**. In FIG. **5** to FIG. **8**, various components have been removed for clarity.

(17) In an example embodiment, the upper connection assembly **120** includes an adapter **400** configured to be secured to the boat tower **102**, an upper rotor body **402**, and an upper joint assembly **404** therebetween that is configured to permit rotation of the upper rotor body **402** about the first axis **106**. In an example embodiment, an upper threaded spindle **410**, an upper nut **412***a*, and an upper cap **412***rb* (in respective upper recesses **414***a*, **414***rb*) are concentric with the first axis

106 and secure the adapter **400** to the upper rotor body **402**. Optional upper friction washers **416***a*, **416***rb* are disposed between the upper nut **412***a* and the adapter **400**, and the upper cap **412***rb* and the upper rotor body **402** respectively.

(18) In an example embodiment, the upper threaded spindle **410** may have a hollow, cylindrical shape that acts as a conduit to allow wires **420** (e.g., speaker wires, light signal wire, light power wire etc.) to pass through the upper connection assembly **120**. In an example embodiment, at least one of the first lateral arm **124** and the second lateral arm **126** is also hollow and configured to act as a conduit through which the wires **420** pass.

(19) In an example embodiment, upper plate locating plate screws **422** secure an upper locating plate **424** to the adapter **400**. The upper locating plate **424** may be concentric with the upper threaded spindle **410** and may be surrounded by an upper washer **426** (e.g., rubber) concentric with the upper locating plate **424** that forms an upper seal **428** between the upper rotor body **402** and the adapter **400**. The upper locating plate **424** and optional upper washer **426** center the upper rotor body **402** relative to the adapter **400** about the first axis **106**.

(20) In an example embodiment, an upper detent assembly **440** is configured to selectively secure the upper rotor body **402** in a plurality of upper clocking positions about the first axis **106**. In an example embodiment, the upper detent assembly **440** includes a plurality of upper detent holes **442** disposed on an underside of the upper locating plate **424** in an annular array about the first axis **106**. The upper detent assembly **440** further includes at least one upper plunger assembly **444** disposed in the upper rotor body **402** and configured to selectively align with a respective upper detent hole **442** as the upper rotor body **402** is rotated about the first axis **106**. When the upper plunger assembly **444** aligns with a respective upper detent hole **442**, a rounded plunger **446** of the upper plunger assembly **444** protrudes into the respective upper detent hole **442**. This holds the upper rotor body **402** in a respective clocking position about the first axis **106** until the retention force is manually overcome. An upper detent assembly **440** is not necessary, however. In an alternate example embodiment, the clocking position may be held via any suitable mechanism, including merely via friction between the upper locating plate **424** and the adapter **400** and the upper rotor body **402**.

(21) In an example embodiment, the upper joint assembly **404** further includes an upper limiting slot **450** disposed in the upper locating plate **424** and an upper limiter pin **452** secured to the upper rotor body **402** and configured to orbit the first axis **106** while in the upper limiting slot **450** as the upper rotor body **402** is rotated about the first axis **106**. The upper limiting slot **450** and the upper limiter pin **452** limit an amount of rotation of the upper rotor body **402** about the first axis **106**. FIG. **4** to FIG. **7** show the upper connection assembly **120** and its components from the front. In contrast, FIG. **8** is a rear view. In this example embodiment, the upper limiting slot **450** has a semicircular arcuate shape that permits the upper rotor body **402** to rotate 180 degrees about the first axis **106**. However, the upper limiting slot **450** may permit more than 180 degrees or less than 180 degrees. In various alternate embodiments, the upper limiting slot **450** and the upper limiter pin **452** may not be present.

(22) In contrast to the above, it is equally possible to have the upper locating plate **424** be secured to the upper rotor body **402**, to have the plurality of upper detent holes **442** be disposed in the upper surface of the upper locating plate **424** and the upper plunger assembly **444** be disposed in the adapter **400**, and to have the upper limiter pin **452** be disposed in the adapter **400**. Any combination of these various embodiments is possible. In an example embodiment, the adapter **400** may be secured to the tower **102** via fasteners **460**.

(23) FIG. **9** to FIG. **11** show an example embodiment of a first lateral connection assembly **900** of the dual rotation speaker mount of FIG. **1**.

(24) The first lateral connection assembly **900** includes a first outer side rotation body **902**, a first inner side rotation body **904** configured to be secured to the speaker housing **906**, and a first joint assembly **908** therebetween that is configured to permit rotation of the first inner side rotation body

904 about the second axis **108** that is perpendicular to the first axis **106**.
(25) In this example embodiment, the first lateral connection assembly **900** is configured like the upper connection assembly **120**. The first inner side rotation body **904** is secured to the speaker housing **906** like the adapter **400** is secured to the tower **102**. The first outer side rotation body **902** is secured to the frame **122** (the distal end of the first lateral arm **124**) like the upper rotor body **402** is secured to the frame **122**. In the upper connection assembly **120**, the upper rotor body **402** rotates relative to the "stationary" adapter **400**. In the first lateral connection assembly **900**, the first inner side rotation body **904** and associated speaker housing **906** rotate relative to the "stationary" first outer side rotation body **902**. While the orientation of the upper connection assembly **120** can thereby be seen as reversed relative to the first lateral connection assembly **900** in an example embodiment, the components may otherwise be identical.
(26) The first joint assembly **908** includes a first threaded spindle **930**, a first nut (not visible), and a first cap **932***f* (in respective recesses) that are concentric with the second axis **108** and secure the first inner side rotation body **904** to the first outer side rotation body **902**. Optional friction washers **934** are disposed between the nut and the first inner side rotation body **904** and between first cap **932***f* and the first outer side rotation body **902**.
(27) In an example embodiment, the first threaded spindle **930** may have a hollow, cylindrical shape that acts as a conduit to allow wires **420** to pass through the first lateral connection assembly **900** and into the speaker housing **906**. In an example embodiment, at least one of the first lateral arm **124** and the second lateral arm **126** is also hollow and configured to act as a conduit through which the wires **420** pass to reach the respective lateral connection assembly.
(28) In an example embodiment, a first locating plate **940** is secured to the first inner side rotation body **904** via first securing plate screws **942**. The first locating plate **940** may be concentric with the first threaded spindle **930** and may be surrounded by a first washer **944** (e.g., rubber) concentric with the first locating plate **940** that forms an upper seal **946** between the first outer side rotation body **902** and the first inner side rotation body **904**. The first locating plate **940** and optional first washer **944** center the first inner side rotation body **904** relative to the first outer side rotation body **902** and about the second axis **108**.
(29) In an example embodiment, a first detent assembly **950** includes a plurality of first detent holes **952** disposed on an outer side of the first locating plate **940** in an annular array about the second axis **108**. The first detent assembly **950** further includes at least one first plunger assembly **954** disposed in the first outer side rotation body **902** and configured to selectively align with a respective first detent hole **952** as the first inner side rotation body **904** is rotated about the second axis **108**. When the first plunger assembly **954** aligns with a respective first detent hole **952**, a rounded plunger of the first detent assembly **950** protrudes into the respective first detent hole **952**. This holds the first inner side rotation body **904** in a respective clocking position about the second axis **108** until the retention force is manually overcome. A first detent assembly **950** is not necessary, however. In an alternate example embodiment, the clocking position may be held via any suitable mechanism, including merely via friction between the first locating plate **940** and the first outer side rotation body **902** and the first inner side rotation body **904**.
(30) In an example embodiment, the first joint assembly **908** further includes a first limiting slot **960** disposed in the first locating plate **940** and a first limiter pin **962** secured to the first outer side rotation body **902** and configured to remain in the first limiting slot **960** as the first inner side rotation body **904** is rotated about the second axis **108**. The first limiting slot **960** and first limiter pin **962** limit an amount of rotation of the first inner side rotation body **904** about the second axis **108**. The first limiting slot **960** may permit more than 180 degrees or less than 180 degrees. In various alternate embodiments, the first limiting slot **960** and the first limiter pin **962** may not be present.
(31) In contrast to the above, it is equally possible to have the first locating plate **940** be secured to the first outer side rotation body **902**, to have the plurality of first detent holes **952** be disposed in

the inner surface of the first locating plate **940** and the first plunger assembly **954** be disposed in the first inner side rotation body **904**, and to have the first limiter pin **962** be disposed in the first inner side rotation body **904**. Any combination of these various embodiments is possible.
(32) FIG. **12** shows the first lateral connection assembly **900** and the second lateral connection assembly **1200** from the rear. In this example embodiment, the second lateral connection assembly **1200** includes the same components and functions the same way as the first lateral connection assembly **900**. Visible are the second outer side rotation body **1202** the second inner side rotation body **1204**.
(33) In an example embodiment, the first detent assembly **950** is configured to selectively secure the speaker housing **906** in a first plurality of clocking positions about the second axis **108**. A second detent assembly of the second lateral connection assembly **1200** is similarly configured to selectively secure the speaker housing **906** in a second plurality of second clocking positions about the second axis **108**. In an example embodiment, the first plurality of clocking positions and the second plurality of second clocking positions are the same clocking positions. In an alternate example embodiment, the first plurality of clocking positions and the second plurality of second clocking positions are different clocking positions. In such an example embodiment, the detent holes of the first detent assembly **950** may be circumferentially offset from the detent holes of the second detent assembly. Such a configuration can double the amount of available clocking positions about the second axis **1-8**.
(34) FIG. **12** also shows a connecting bracket **1206** connected to the first inner side rotation body **904** and to the second inner side rotation body **1204** that is configured to prevent relative rotation between the first inner side rotation body **904** and the second inner side rotation body **1204** about the second axis **108**. When an operator manually repositions the speaker housing **906** about the second axis **108**, the connecting bracket **1206** helps distribute the forces imparted by the operator on the speaker housing **906** among the first inner side rotation body **904** and to the second inner side rotation body **1204**. This, in turn, helps ensure smooth operation and longer life by reducing force and associated stress mismatches on the components. The connecting bracket **1206** may also, for example, be a mount for a light that illuminates the translucent light cover **142**.
(35) The speaker housing may be secured to the first inner side rotation body **904** and to the second inner side rotation body **1204** by, for example, lateral connection fasteners **1210**. The speaker **1220** may be secured to the speaker housing **906** via, for example, speaker fasteners **1222**.
(36) FIG. **13** shows an alternate example embodiment of the frame **1300** of the dual axis adjustable speaker mount holding a speaker housing **1302** and speaker **1304**. The frame **1300** has a different shape than the frame **122** of FIG. **1**, but the remainder of the components may be the same.
(37) While various embodiments of the present invention have been shown and described herein, it will be obvious that such embodiments are provided by way of example only. Numerous variations, swapping of features among embodiments, changes, and substitutions may be made without departing from the invention herein. Accordingly, it is intended that the invention be limited only by the spirit and scope of the appended claims.

Claims

1. An apparatus, comprising: an upper connection assembly comprising an adapter configured to be secured to a boat tower, an upper rotor body, and an upper joint assembly therebetween that is configured to permit rotation of the upper rotor body about a first axis; a first lateral connection assembly comprising a first outer side rotation body, a first inner side rotation body configured to be secured to a speaker housing, and a first lateral joint assembly therebetween that is configured to permit rotation of the first inner side rotation body about a second axis that is perpendicular to the first axis; a frame that secures the first lateral connection assembly to the upper connection assembly and that is configured to orbit the first lateral connection assembly around the first axis

when the upper rotor body is rotated about the first axis; wherein the upper joint assembly further comprises an upper detent assembly configured to selectively secure the upper rotor body in a respective upper clocking position of a plurality of upper clocking positions about the first axis; and wherein the upper joint assembly further comprises an upper locating plate that is disposed between the adapter and the upper rotor body and that aligns the upper rotor body with the adapter.
2. The apparatus of claim 1, wherein the upper detent assembly comprises a plurality of upper detent holes disposed in the upper locating plate and an upper plunger assembly configured to selectively align with a respective upper detent hole of the plurality of upper detent holes as the upper rotor body is rotated about the first axis.
3. The apparatus of claim 2, wherein the upper locating plate is secured to the adapter, and wherein the upper plunger assembly is secured to the upper rotor body.
4. The apparatus of claim 1, wherein the upper joint assembly further comprises an upper spindle that is concentric with the first axis and that secures the adapter to the upper rotor body.
5. The apparatus of claim 1, wherein the upper joint assembly further comprises an upper limiting slot disposed in the upper locating plate and an upper limiter pin configured to orbit the first axis while in the upper limiting slot as the upper rotor body is rotated about the first axis, wherein the upper limiting slot and the upper limiter pin limit an amount of rotation of the upper rotor body about the first axis.
6. The apparatus of claim 5, wherein the upper limiting slot limits the amount of rotation to 180 degrees.
7. The apparatus of claim 1, wherein the upper joint assembly further comprises an upper spindle that secures the adapter to the upper rotor body and that comprises a hollow cylinder shape configured to provide a conduit for wires through the upper joint assembly.
8. The apparatus of claim 1, wherein the upper joint assembly further comprises an upper washer that forms an upper seal between the upper rotor body and the adapter.
9. The apparatus of claim 1, wherein the first lateral joint assembly further comprises a first detent assembly configured to selectively secure the first inner side rotation body in a respective second clocking position of a plurality of second clocking positions about the second axis.
10. The apparatus of claim 9, wherein the first lateral joint assembly further comprises: a first locating plate that is disposed between the first outer side rotation body and the first inner side rotation body; a first limiting slot disposed in the first locating plate; and a first limiter pin configured to orbit the second axis while in the first limiting slot as the first inner side rotation body is rotated about the second axis, wherein the first limiting slot and the first limiter pin limit an amount of rotation of the first inner side rotation body about the second axis.
11. The apparatus of claim 10, wherein when the first axis is vertical and the second axis is horizontal, the first limiter slot limits the amount of rotation of the first inner side rotation body to 180 degrees about the second axis, including a three o'clock position, a six o'clock position, and a nine o'clock position.
12. The apparatus of claim 9, further comprising a second lateral connection assembly further comprising a second outer side rotation body, a second inner side rotation body configured to be secured to the speaker housing, and a second joint assembly therebetween that is configured to permit rotation of the second inner side rotation body about the second axis; wherein the frame is configured to orbit the second lateral connection assembly around the first axis when the upper rotor body is rotated about the first axis.
13. The apparatus of claim 12, further comprising a connecting bracket that is connected to the first inner side rotation body and to the second inner side rotation body and that is configured to prevent relative rotation therebetween about the second axis.
14. The apparatus of claim 1, further comprising the speaker housing.
15. The apparatus of claim 14, further comprising a speaker secured to the speaker housing.
16. An apparatus, comprising: an upper connection assembly comprising an adapter configured to

be secured to a boat tower, an upper rotor body, and an upper joint assembly therebetween that is configured to permit rotation of the upper rotor body about a first axis; a frame secured to the upper rotor body and comprising a first lateral arm and a second lateral arm; a first lateral connection assembly secured to the first lateral arm and configured to be secured to a speaker housing; a second lateral connection assembly secured to the second lateral arm and configured to be secured to the speaker housing; wherein the first lateral connection assembly and the second lateral connection assembly are configured to permit rotation of the speaker housing about a second axis that is perpendicular to the first axis; wherein the first lateral connection assembly comprises a first lateral detent assembly configured to selectively secure the speaker housing in a respective second clocking position of a first plurality of second clocking positions about the second axis; wherein the second lateral connection assembly comprises a second lateral detent assembly configured to selectively secure the speaker housing in a respective second clocking position of a second plurality of second clocking positions about the second axis; and wherein second clocking position of the first plurality of second clocking positions are circumferentially offset from second clocking positions of the second plurality of second clocking positions.

17. The apparatus of claim 16, wherein the upper joint assembly further comprises an upper detent assembly configured to selectively secure the upper rotor body in a respective upper clocking position of a plurality of upper clocking positions about the first axis.

18. The apparatus of claim 17, wherein the upper joint assembly further comprises an upper washer that forms an upper seal between the upper rotor body and the adapter.

19. The apparatus of claim 16, wherein at least one of the first lateral connection assembly and the second lateral connection assembly comprises a lateral detent assembly configured to selectively secure the speaker housing in a respective second clocking position of a plurality of second clocking positions about the second axis.

20. The apparatus of claim 16, wherein the first lateral connection assembly comprises a first inner side rotation body configured to be secured to the speaker housing; wherein the second lateral connection assembly comprises a second inner side rotation body configured to be secured to the speaker housing; and wherein the apparatus further comprises a connecting bracket connected to the first inner side rotation body and to the second inner side rotation body that is configured to prevent relative rotation therebetween about the second axis.

21. The apparatus of claim 16, wherein the frame comprises a u-shape, and wherein the upper rotor body is secured to an apex of the u-shape.

22. The apparatus of claim 16, further comprising the speaker housing.

23. An apparatus, comprising: an upper connection assembly comprising an adapter configured to be secured to a boat tower, an upper rotor body, and an upper joint assembly therebetween that is configured to permit rotation of the upper rotor body about a first axis; a first lateral connection assembly comprising a first outer side rotation body, a first inner side rotation body configured to be secured to a speaker housing, and a first lateral joint assembly therebetween that is configured to permit rotation of the first inner side rotation body about a second axis that is perpendicular to the first axis; a frame that secures the first lateral connection assembly to the upper connection assembly and that is configured to orbit the first lateral connection assembly around the first axis when the upper rotor body is rotated about the first axis; and wherein the upper joint assembly further comprises an upper spindle that secures the adapter to the upper rotor body and that comprises a hollow cylinder shape configured to provide a conduit for wires through the upper joint assembly.