US 20230250602A1

(19) **United States**

(12) **Patent Application Publication**

Hooper et al.

(10) **Pub. No.: US 2023/0250602 A1**

(43) **Pub. Date: Aug. 10, 2023**

(54) **DOCK SHOCK ABSORPTION DEVICE**

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(21) Appl. No.: **17/667,737**

(22) Filed: **Feb. 9, 2022**

Publication Classification

(51) **Int. Cl.**

E02B 3/26 (2006.01)

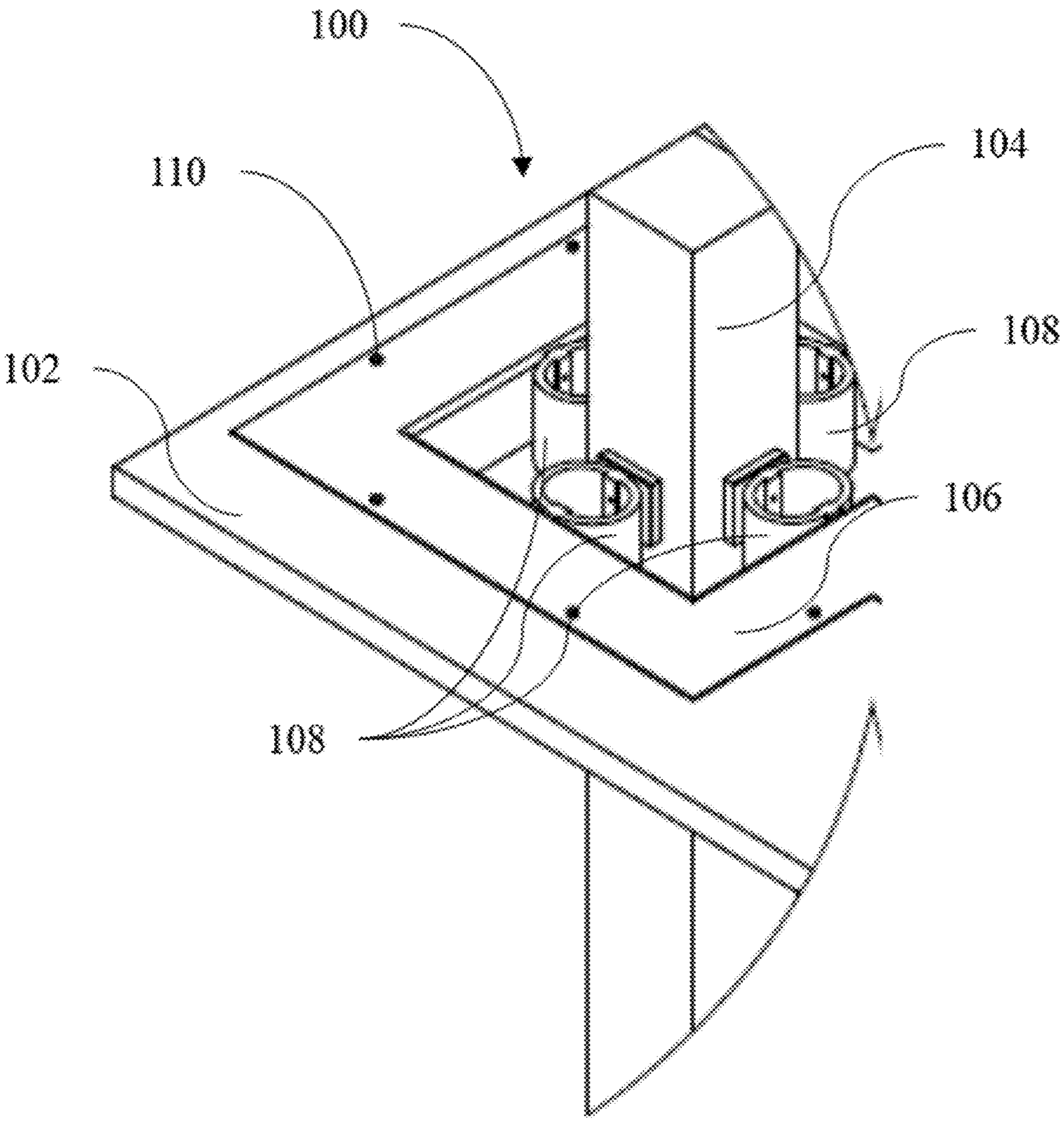
B63C 1/02 (2006.01)

(52) **U.S. Cl.**

CPC . ***E02B 3/26*** (2013.01); ***B63C 1/02*** (2013.01)

(57) **ABSTRACT**

A dock shock absorption device includes a frame and one or more energy dissipative elements. The frame is attached to a dock with the frame enclosing a pylon. The one or more energy dissipative elements attach to the frame and are equal to or less than 1 inch from the pylon.



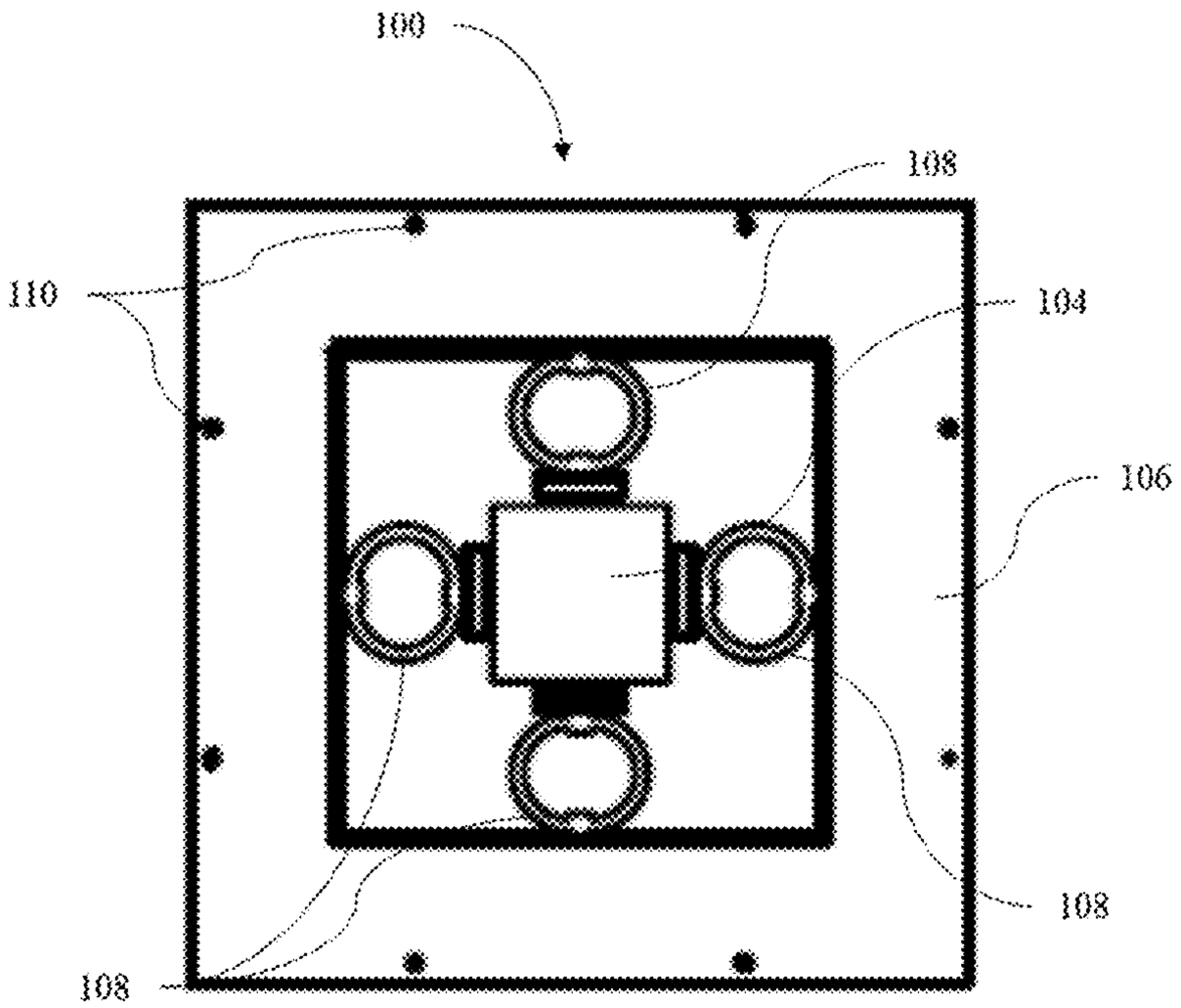


FIG. 1A

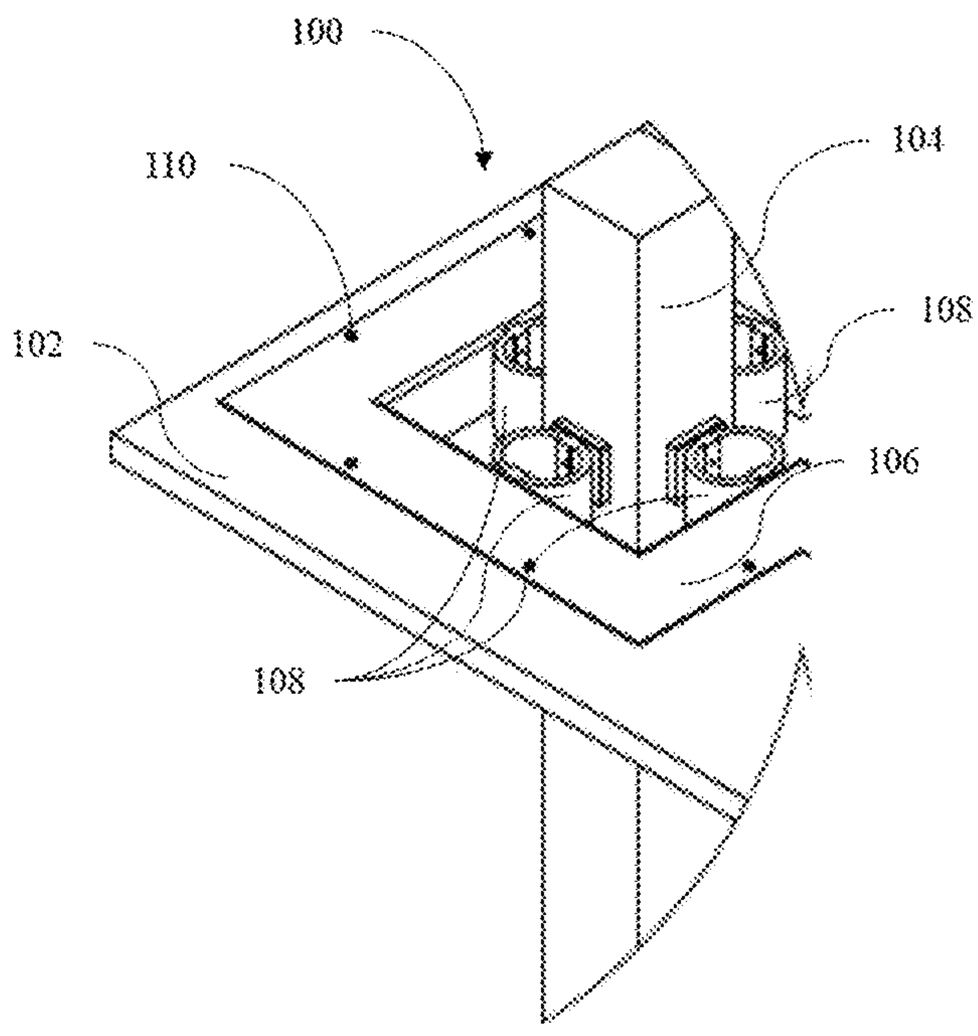


FIG. 1B

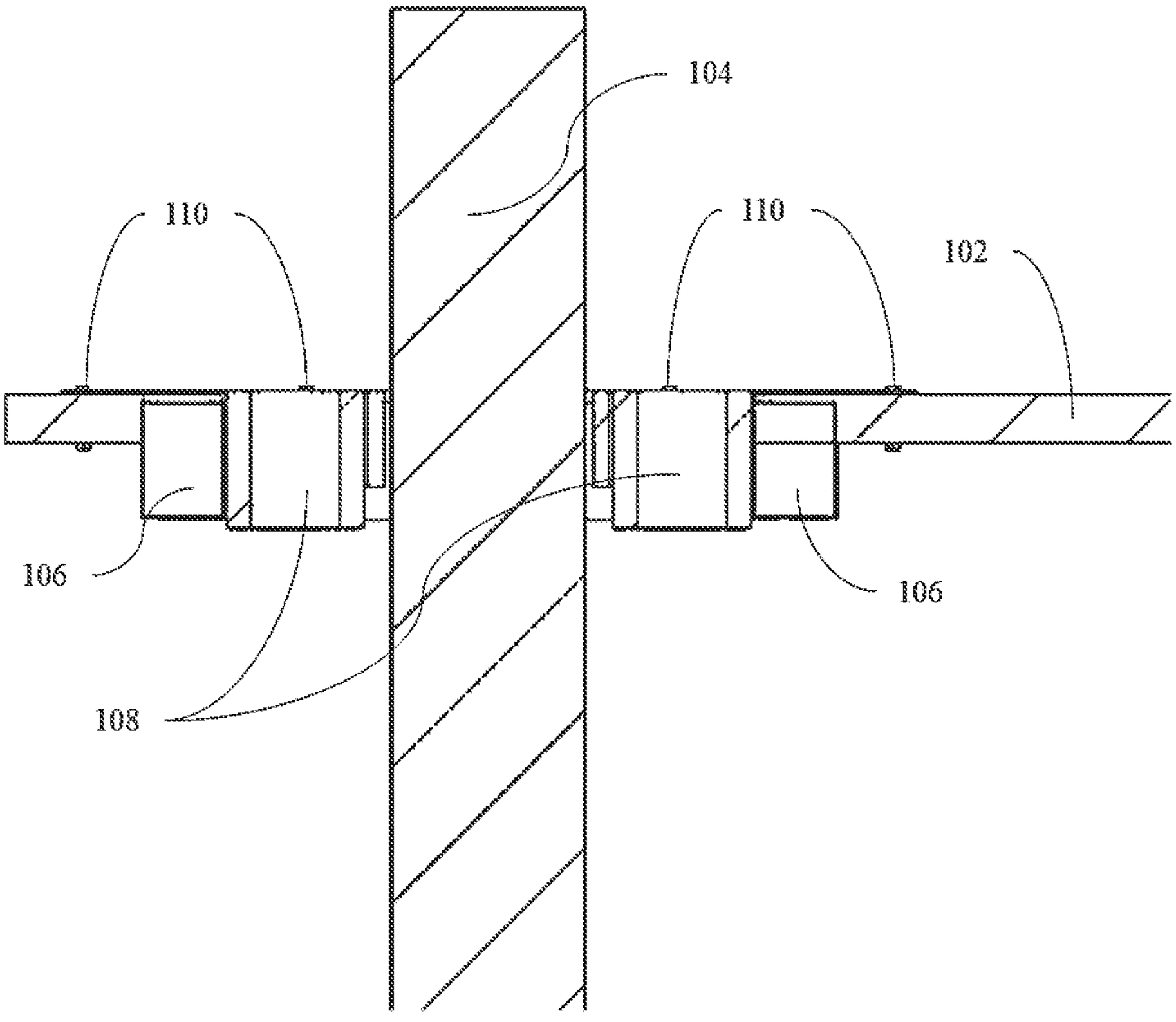


FIG. 2

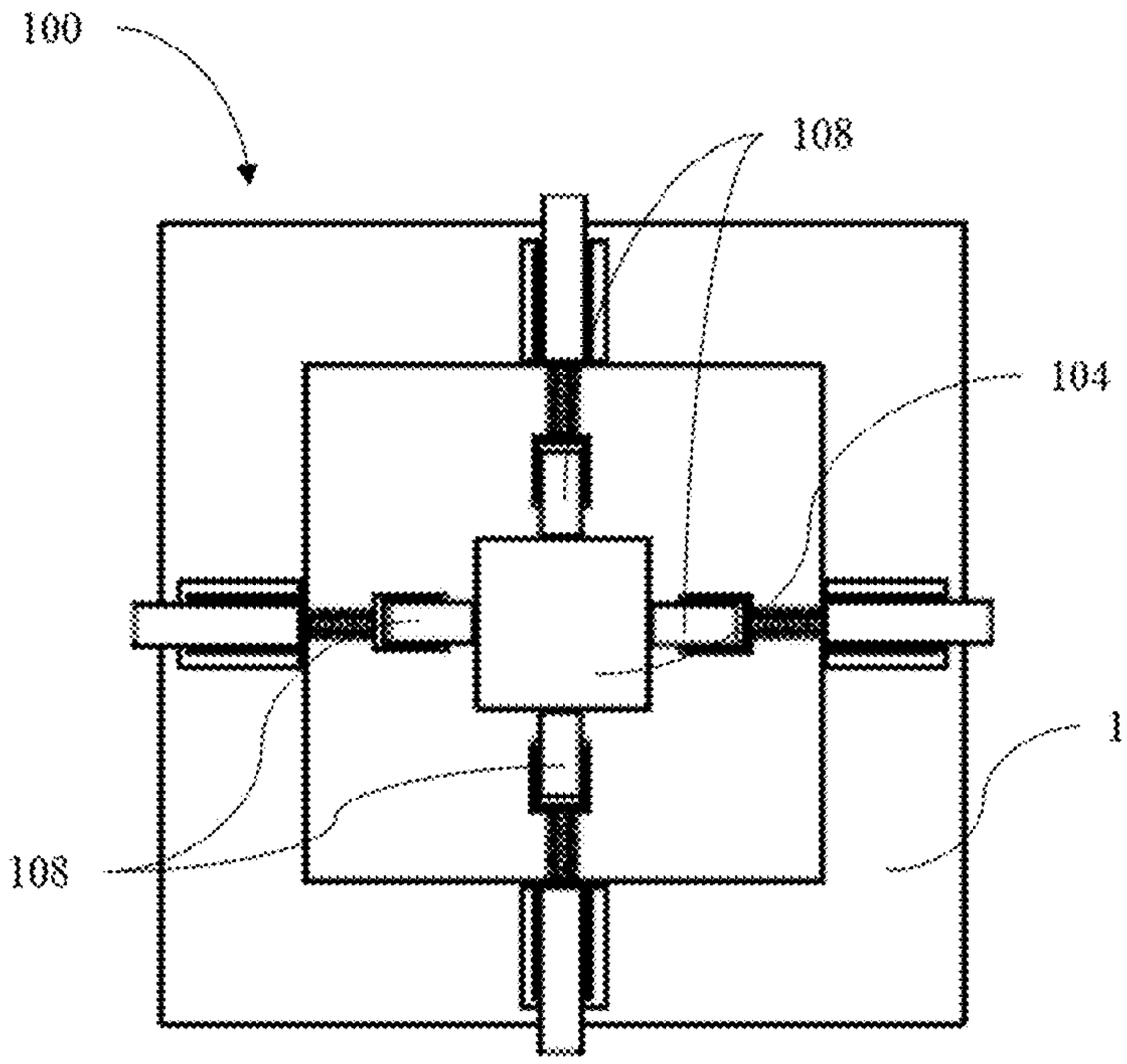


FIG. 3A

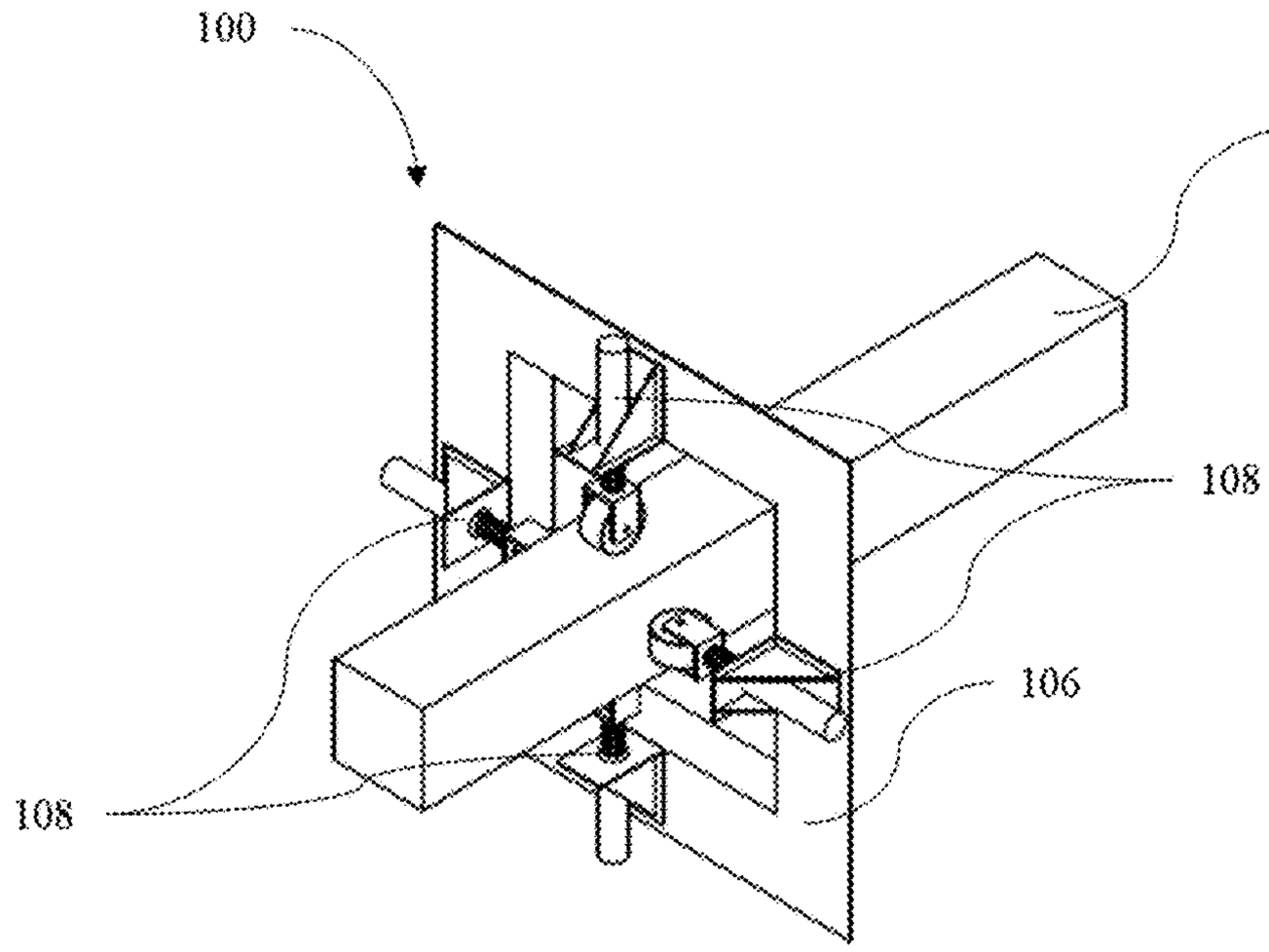


FIG. 3B

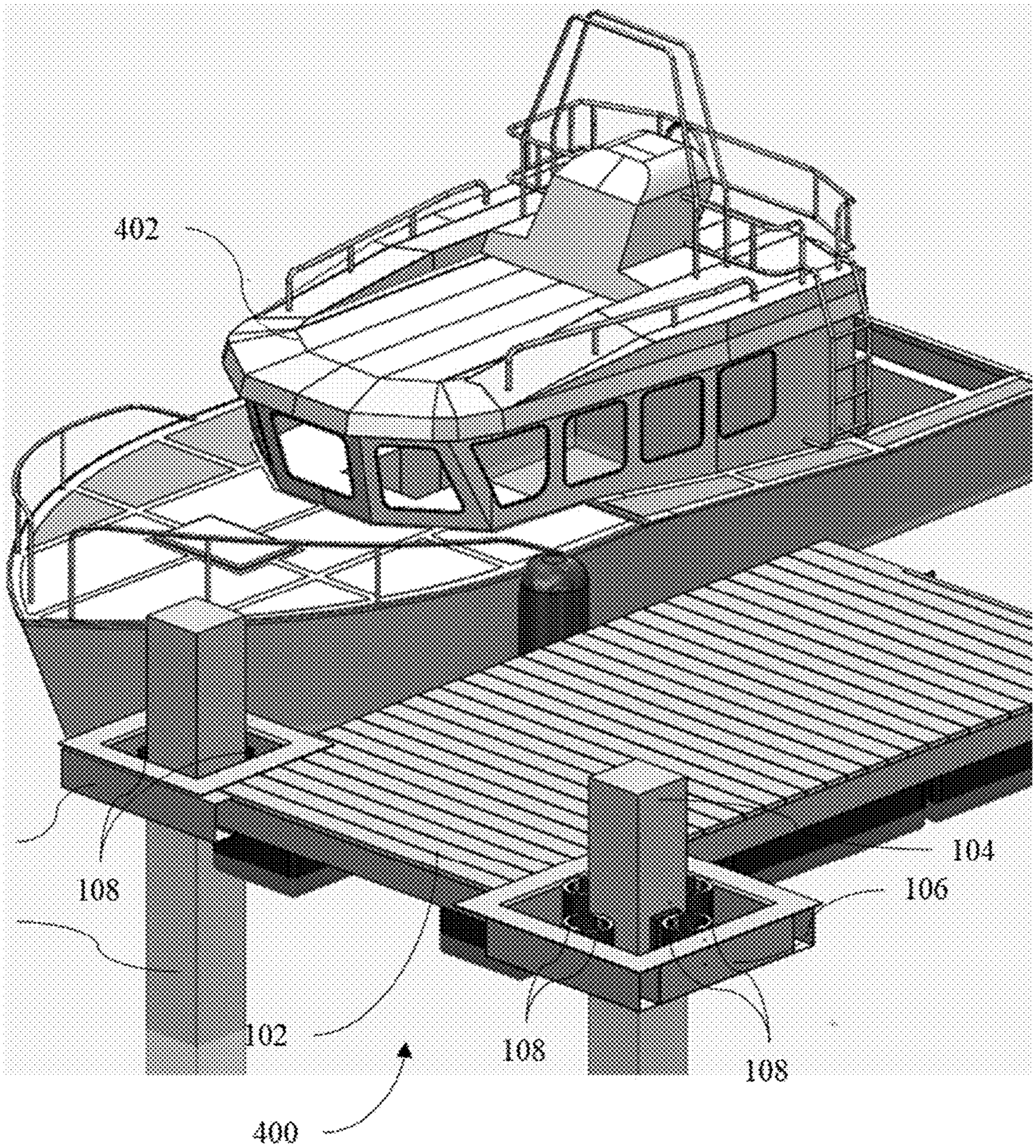


FIG. 4

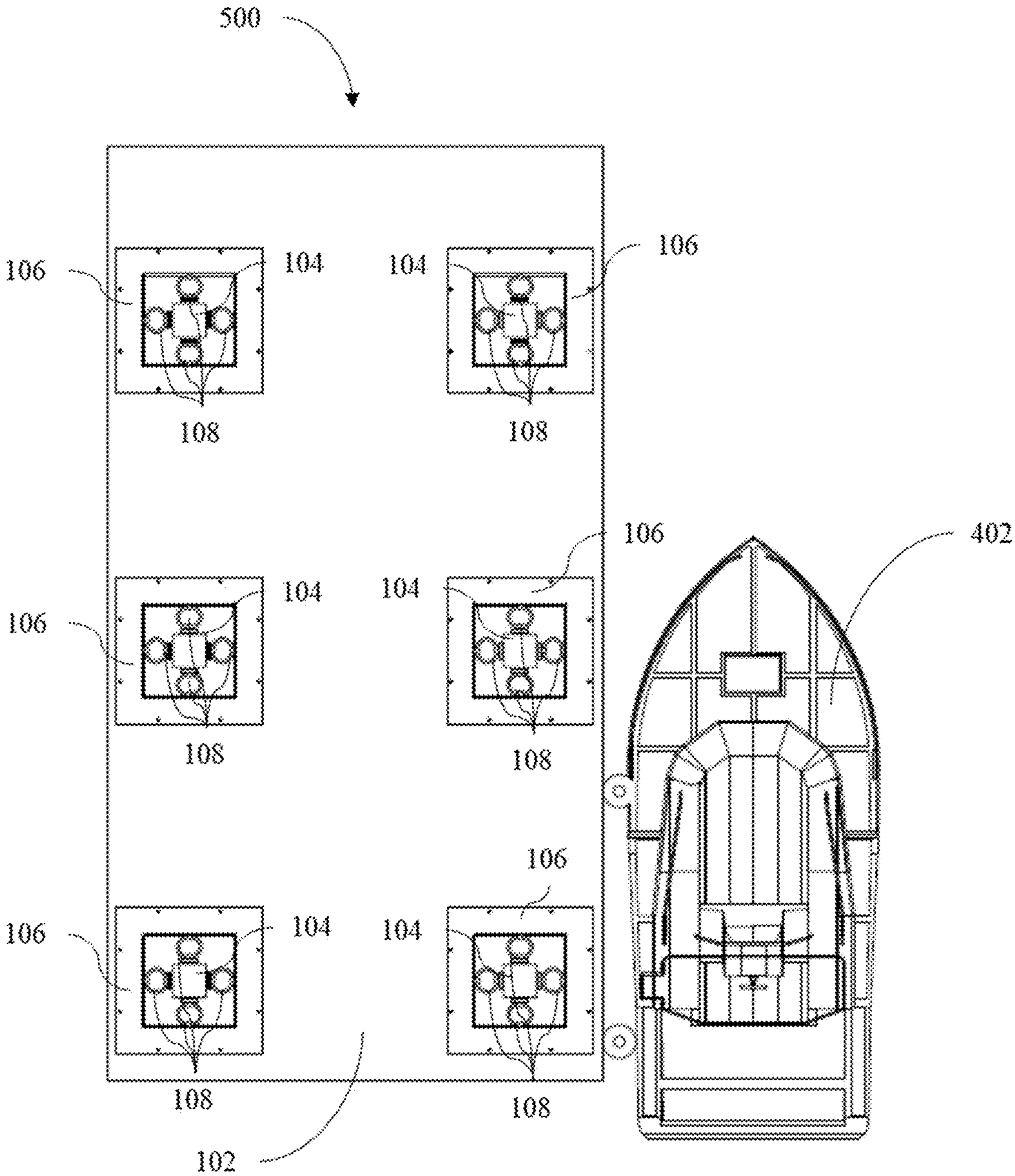


FIG. 5

DOCK SHOCK ABSORPTION DEVICE

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0001] The invention described herein may be manufactured and used by or for the government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND

[0002] Floating docks are generally used at shorelines with fluctuating water levels. Floating docks are composed, at least partially, of buoyant pontoons that allow the docks to float on the surface of the water. To prevent the docks from drifting away from shore, the floating docks are generally secured to pylons that are entrenched in the ground or attached to anchors. Floating docks are useful in that the docks can be easily modified if needed by adding, removing, or rearranging the layout of the floating dock.

DESCRIPTION OF THE DRAWINGS

[0003] Features and advantages of examples of the present disclosure will be apparent by reference to the following detailed description and drawings, in which like reference numerals correspond to similar, but in some instances, not identical, components. Reference numerals or features having a previously described function may or may not be described in connection with other drawings in which they appear.

[0004] FIG. **1**A-**1**B are examples of a top view and an isometric view of a dock shock absorption device, respectively;

[0005] FIG. **2** is an example of a cross-sectional view of the dock shock absorption device;

[0006] FIG. **3**A-**3**B are another example of a top view and a isometric view, respectively, of the dock shock absorption device;

[0007] FIG. **4** is an example of a dock shock absorption device with two frames including one or more energy dissipative elements; and

[0008] FIG. **5** is another example of a dock shock absorption device with six frames including one or more energy dissipative elements.

DETAILED DESCRIPTION

[0009] There are several means of attaching a floating dock to a pylon. The most basic approach involves a metal hoop around a wooden pylon. Another example includes surrounding the pylon with equally spaced bumpers to provide minimal impact resistance. In yet another example, rollers surround the pylon to reduce friction of the pylon onto the bumper. However, none of these current approaches significantly reduces the impact damage between the dock and the pylon.

[0010] Normally, a floating dock has pylons along the perimeter where each pylon is surrounded by bumpers with gaps. A boat can be tied to the dock with an inflatable bumper between the boat and the dock. The bumpers surrounding the pylon have sufficient gaps around the pylon to allow for motion. However, when a wave hits the dock, the dock moves with the wave until the bumper impacts the pylon. Then the boat moves with the wave and the line connecting the boat and the pylon goes taut imparting significant forces onto the boat. Simultaneously, if an individual is walking on the dock when the dock hits the bumper, the dock becomes briefly unstable, which can potentially cause injury to individuals walking on the dock if they fall.

[0011] A dock shock absorption device is disclosed herein that reduces impact loads between the floating dock and pylon, thereby reducing impact loads on pylons that the floating docks attach to, the boats tied to the floating docks, and individuals walking on the floating docks. In addition, the dock shock absorption device allows floating docks to be implemented on misaligned pylons, which can reduce the time and expense of installing new pylons.

[0012] The dock shock absorption device herein includes a frame and one or more energy dissipative elements. The frame is attached to a dock with the frame enclosing a pylon. The one or more energy dissipative elements attach to the frame and are equal to or less than 1 inch from the pylon.

[0013] Referring now to FIG. **1**A-**1**B, an example of the dock shock absorption device **100** is shown. FIG. **1**A-**1**B is for illustrative purposes only to aid in the understanding of the dock shock absorption device **100** and should not be construed as being limiting or directed to a particular material or materials. FIG. **1**A shows a top view of an example of the dock shock absorption device **100**. FIG. **1**B shows an isometric view of an example of the dock shock absorption device **100**. The dock shock absorption device **100** includes a frame **106** where the frame **106** is attached to a dock **102** with the frame **106** enclosing a pylon **104**. The frame **106** is attached to the dock **102** via attachment means **110**, such as bolts with nuts, screws, one or more fixed energy dissipative elements, one or more skids between the frame **106** and the dock **102**, or any other means of attaching the frame **106** to the dock **102**. The dock **102** may be any type of floating dock. The pylon **104** may be any sized pylon **104** that a floating dock may be attached to. The frame **106** may be any suitable material that is can withstand the impact forces from the pylon **104** and the marine environment (e.g., noncorrosive material). Some examples of the material the frame is composed of includes aluminum, stainless steel, steel, or wood. Additionally, the frame **106** may be any size that encloses the pylon **104** as shown in FIG. **1**A-**1**B.

[0014] Referring to FIG. **2**, a cross-sectional view of an example of the dock shock absorption device **100** is shown. The hatching in FIG. **2** is for illustrative purposes only to aid in the understanding of the dock shock absorption device **100** and should not be construed as being limiting or directed to a particular material or materials. As shown in FIG. **2**, in an example, the frame **106** attaches to the dock **102** with attachment means **110** as previously described herein. The frame **106** is attached such that the frame **106** extends partially below the dock **102** to attach the one or more energy dissipative elements **108**. In this example, the frame **106** is surrounded by the dock **102** rather than being attached to the side of the dock **102**. In other examples, the frame **106** may be attached to the side of the dock **102**.

[0015] Referring back to FIG. **1**A-**1**B, the dock shock absorption device **100** also includes one or more energy dissipative elements **108** attached to the frame **106** where the one or more energy dissipative elements **108** are equal to or less than **1** inch from the pylon **104**. In some examples, there is only one the energy dissipative element **108**. In another example, there is at least one energy dissipative element **108** on each side of the frame **106** as shown in FIG. **1**A-**1**B. The

one or more energy dissipative elements **108** have an energy rating ranging from about 50 lb*in to about 50,000 lb*in. The one or more energy dissipative elements **108** may be selected from the group consisting of wire rope isolators, a rubber encased wire rope isolators, pads, spring dampener, spring dampener with wheels, rollers, leaf springs, or a combination thereof. In some examples, when the one or more energy dissipative elements **108** are the pads or rollers, the pads or rollers may be made of a material selected from the group consisting of stainless steel, peek plastic, Aluminum 5086. In another example, when the one or more energy dissipative elements **108** are pads, the pads may be an ultra-high molecular weight plate that is attached to the frame **106**.

[0016] Another example of the dock shock absorption device **100** is shown in FIG. **3**A-**3**B. FIG. **3**A-**3**B is for illustrative purposes only to aid in the understanding of the dock shock absorption device **100** and should not be construed as being limiting or directed to a particular material or materials. FIG. **3**A shows a top view of the dock shock absorption device **100** with a frame **106** and four energy dissipative elements **108**. FIG. **3**B is an isometric view of the dock shock absorption device **100** with a frame **106** and four energy dissipative elements **108**. In this example, there are four energy dissipative elements **108** that are spring dampeners with wheels. In addition, the four energy dissipative elements **108** directly contact the pylon **104**. The wheels allow the energy dissipative elements **108** to roll vertically with the dock **102** when waves causes vertical movement. The spring dampeners allow the energy dissipative elements to absorb lateral movement caused by waves when the dock **102** shifts side to side.

[0017] Referring now to FIG. **4** and FIG. **5**, two examples are shown of the dock shock absorption device **400**, **500** with one or more additional frames **106** where each individual frame **106** attaches to an individual pylon **104** and the dock **102** and each individual frame **106** includes one or more energy dissipative elements **108**. In the example in FIG. **4**, an isometric view of the dock shock absorption device **400** includes two frames **106** attached to the dock **102** with each frame **106** enclosing an individual pylon **104**. Each frame **106** also includes four energy dissipative elements **108** as a rubber encased wire rope isolator attached to a pad. In the example in FIG. **5**, a top view of the dock shock absorption device **500** includes six frames **106** attached to the dock **102** with each frame **106** enclosing an individual pylon **104**. Each frame **106** also includes four energy dissipative elements **108** as a rubber encased wire rope isolator attached to a pad. In both FIG. **4** and FIG. **5**, the frames **106** of the dock shock absorption device **400**, **500** are enclosed by the dock **102**. This provides more space for boats **402** to dock at the pier and secure to the dock **102**. In other examples, the frames **106** may be attached to the side of the dock **102** rather than being enclosed by the dock **102**.

[0018] A dock shock absorption system may also be utilized herein. The dock shock absorption system includes a frame **106** and one or more energy dissipative elements **108**. The frame **106** and one or more energy dissipative elements **108** may be the same frame **106** and one or more energy dissipative elements **108** as previously described herein in reference to FIG. **1**A-**1**B.

[0019] As used herein, the term "about" is used to provide flexibility to a numerical range endpoint by providing that a given value may be "a little above" or "a little below" the endpoint. The degree of flexibility of this term can be dictated by the particular variable and would be within the knowledge of those skilled in the art to determine based on experience and the associated description herein.

[0020] As used herein, a plurality of items, structural elements, compositional elements, and/or materials may be presented in a common list for convenience. However, these lists should be construed as though each member of the list is individually identified as a separate and unique member. Thus, no individual member of a list should be construed as a de facto equivalent of any other member of the same list merely based on their presentation in a common group without indications to the contrary.

[0021] Unless otherwise stated, any feature described herein can be combined with any aspect or any other feature described herein.

[0022] Reference throughout the specification to "one example", "another example", "an example", means that a particular element (e.g., feature, structure, and/or characteristic) described in connection with the example is included in at least one example described herein, and may or may not be present in other examples. In addition, the described elements for any example may be combined in any suitable manner in the various examples unless the context clearly dictates otherwise.

[0023] The ranges provided herein include the stated range and any value or sub-range within the stated range. For example, a range from about 50 lb-in to about 50,000 lb-in should be interpreted to include not only the explicitly recited limits of from about 50 lb-in to about 50,000 lb-in, but also to include individual values, such as 3,000 lb-in, 7,000 lb-in, 35,000 lb-in etc., and sub-ranges, such as from about 5,000 lb-in to about 15,000 lb-in, etc.

[0024] In describing and claiming the examples disclosed herein, the singular forms "a", "an", and "the" include plural referents unless the context clearly dictates otherwise.

1. A dock shock absorption device, comprising:

a frame, wherein the frame is attached to a dock with the frame enclosing a pylon; and

one or more rubber encased wire rope isolators attached to the frame on a first side, wherein each rubber encased wire rope isolator includes a pad attached to a second side of each rubber encased wire rope isolator that is equal to or less than 1 inch from the pylon.

2. The dock shock absorption device of claim **1**, wherein there is at least one rubber encased wire rope isolator on each side of the frame.

3-**4**. (canceled)

5. The dock shock absorption device of claim **1**, wherein the pads are an ultra-high molecular weight plate.

6. The dock shock absorption device of claim **1**, further including one or more additional frames wherein each individual frame attaches to the dock, surrounds an individual pylon, and includes one or more rubber encased wire rope isolators.

7. The dock shock absorption device of claim **1**, wherein the frame is attached to the dock using one or more fixed energy dissipative elements or one or more skids between the frame and the dock.

8. The dock shock absorption device of claim **1**, wherein the one or more energy dissipative elements have an energy rating ranging from about 50 lb-in to about 50,000 lb-in.

9. A dock shock absorption system, comprising:

a frame, wherein the frame is attached to a dock with the frame enclosing a pylon; and

one or more rubber encased wire rope isolators attached to the frame on a first side, wherein each rubber encased wire rope isolator includes a pad attached to a second side of each rubber encased wire rope isolator that directly contacts the frame.

10. The dock shock absorption system of claim **9**, wherein there is at least one rubber encased wire rope isolator on each side of the frame.

11-12. (canceled)

13. The dock shock absorption system of claim **9**, wherein the pads are an ultra-high molecular weight plate.

14. The dock shock absorption system of claim **9**, further including one or more additional frames wherein each individual frame attaches to the dock, surrounds an individual pylon, and includes one or more rubber encased wire rope isolators.

15. The dock shock absorption system of claim **9**, wherein the frame is attached to the dock using one or more fixed energy dissipative elements or one or more skids between the frame and the dock.

16. The dock shock absorption system of claim **9**, wherein the one or more energy dissipative elements have a size ranging from about 50 lb-in to about 50,000 lb-in.

17. A dock shock absorption device, comprising:

a frame, wherein the frame is attached to a dock with the frame enclosing a pylon; and

one or more spring dampeners attached perpendicular to the frame on a first side, wherein each spring dampener includes a wheel attached to a second side of each spring dampener that is equal to or less than 1 inch from the pylon.

18. The dock shock absorption device of claim **17**, wherein there is at least one spring dampener on each side of the frame.

19. The dock shock absorption device of claim **17**, further including one or more additional frames wherein each individual frame attaches to the dock, surrounds an individual pylon, and includes one or more spring dampeners.

20. The dock shock absorption device of claim **17**, wherein the frame is attached to the dock using one or more fixed energy dissipative elements or one or more skids between the frame and the dock.

21. The dock shock absorption device of claim **17**, wherein the frame is attached to the side of the dock.

22. The dock shock absorption device of claim **1**, wherein the pads are made of a material selected from a group consisting of stainless steel, peek plastic, or Aluminum 5086.

23. The dock shock absorption device of claim **1**, wherein the frame is attached to the side of the dock.

* * * * *