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RETRACTABLE DAMPENER FOR VESSELS

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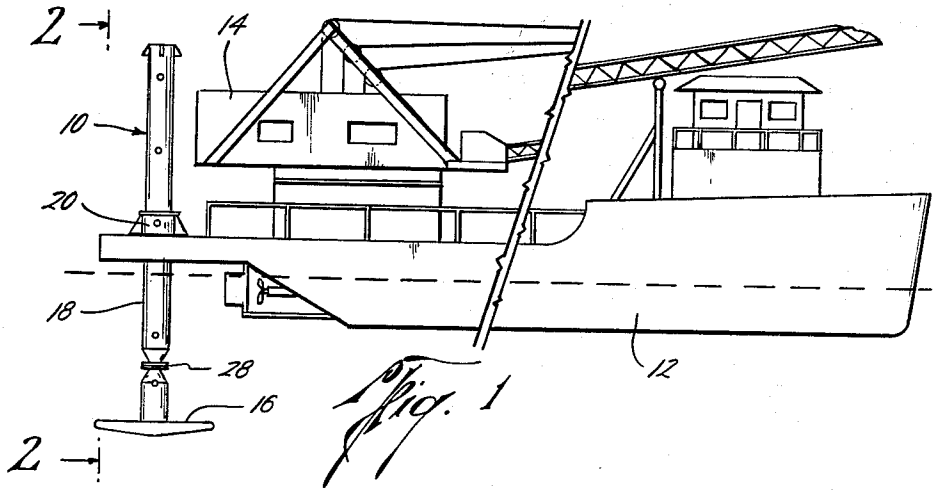


Fig. 1

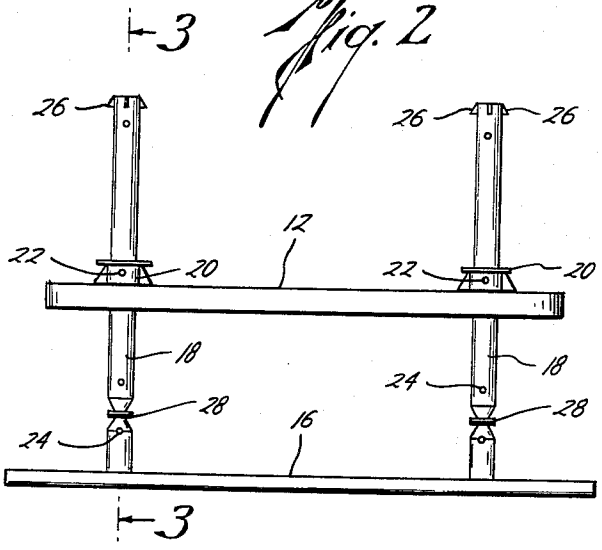


Fig. 2

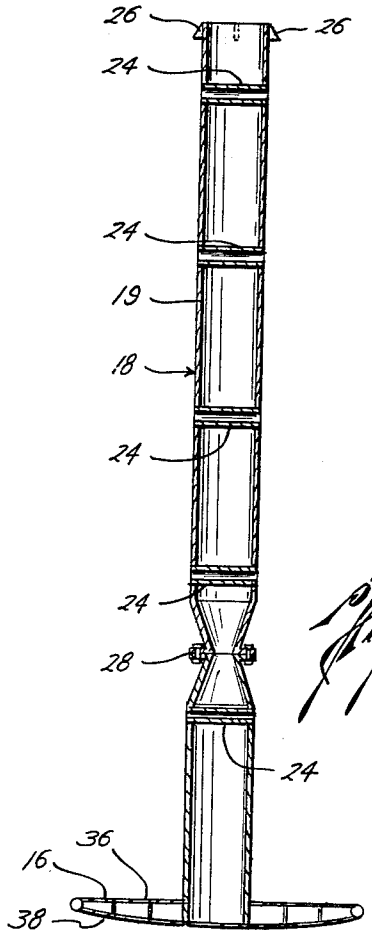


Fig. 3

Maurice Bowman Thomas
James L. Steitle
INVENTORS

BY James F. Weiler
Jefferson D. Geller
William A. Stout
Paul L. De Vester II
ATTORNEYS

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RETRACTABLE DAMPENER FOR VESSELS

Maurice B. Thomas and James L. Steitle, Houston, Tex., assignors to Movible Offshore, Inc., Houston, Tex., a corporation of Delaware

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The present invention relates to a rectractable dampener for vessels, and more particularly, relates to a retractable dampener which is positioned beneath one end only of the vessel for reducing the pitching motion of that one end of the vessel.

At the present time vessels, such as a crane vessel, are used in transferring materials from one location to another while in offshore waters. At the present time it takes a vessel of relatively long length to overcome the pitching and rolling due to the wave action in order to sufficiently stabilize the crane so that it may be used. If the pitching and rolling action of the vessel could be reduced a smaller vessel and therefore a much less expensive vessel could be utilized to carry and operate the crane.

Therefore, it is a general object of the present invention to provide a dampener which is horizontally positioned beneath a vessel having a crane and adjacent the base of the crane at one end of the vessel which reduces the vertical movement of the crane and which also reduces the angle of pitch of the crane.

A still further object of the present invention is the provision of a horizontal dampener that may be vertically adjusted under one end of a vessel so as to be positioned in relatively quiet water and substantially below the depth of the greatest wave action of the water and thereby provide the maximum dampening action to steady said one end of the vessel.

A still further object of the present invention is the provision of a retractable and releasable dampener which is adjustably connected in a vertical direction to a vessel for submergence to depths which exceed the draft of the vessel and which is positioned only under one end of the vessel to dampen the motion of that one end of the vessel due to the inertia and frictional resistance of the dampener and of the water surrounding the dampener thereby stabilizing that end of the vessel when the vessel is moored.

A still further object of the present invention is the provision of a horizontally extending dampener under one end of the vessel having a crane where the dampener is positioned in the vicinity of the crane base and which is thereby effective in reducing the pitch of the vessel with regard to the amplitude as well as the phase delay of the wave motion.

A still further object of the present invention is the provision of a pitch dampener for a vessel which is releasably connected to the vessel in such a way that it can be jettisoned in case of emergencies so as to avoid danger to the ship in situations such as adverse weather conditions or which can be released when its use is not desired.

A still further object of the present invention is the provision of a retractable horizontal dampener positioned beneath one end only of a vessel, positioned at a depth greater than the draft of the vessel, and sized in a horizontal plane with reference to the size of the vessel to provide an inertia force to reduce the vertical motion of the vessel about the one end.

Other and further objects, features and advantages will be apparent from the following description of a presently preferred embodiment of the invention, given for the purpose of disclosure, and taken in conjunction with

the accompanying drawing, where like character references designate like parts throughout the several views, and where

FIGURE 1 is a fragmentary elevational view of the present invention shown connected to a vessel having a crane.

FIGURE 2 is a cross-sectional view taken along the line 2—2 of FIGURE 1, and

FIGURE 3 is an enlarged cross-sectional view taken along the line 3—3 of FIGURE 2.

The present invention is particularly directed to providing for the use of a smaller floating vessel having a crane at one end for performing the offshore work of transferring equipment from one location to another while the vessel generally remains at anchor and motionless and will be pointing into the waves. For example, at the present time for water depth greater than 100 feet and in exposed open sea, 300 foot length vessels are normally used for this type of work, and it has been found that with the use of the present invention a 150 foot vessel may be provided to serve the same purpose and will still have the stability of the longer vessel, but will of course be much less expensive, both in original and operating costs.

Generally, the pitching motion of a vessel follows closely the wave pattern of the water with a phase lag of usually not more than 20 degrees. Since the particular crane vessel desired to be used with the present dampener will be motionless and pointing generally into the waves, the dampener is provided to be effective in waves having a significant curvature over the length of the vessel. That is, the vessel itself generally will not respond to waves which are much shorter than its own length and in the case where the length of waves is much more than twice the length of the vessel the wave curvature can be neglected. Therefore, the pitch dampener should be designed to reduce the vertical movement of the one end of the vessel having the crane where the length of the waves is in the range of the length of the vessel to twice the length of the vessel. The dampening forces produced with a pitch and roll dampener consist partly of hydrodynamic lift forces due to flow past the dampener, but mainly of inertia forces resisting relative acceleration. Since the motion of the water due to wave action decreases rapidly with depth, the inertia forces will be more effective when the pitch dampener is positioned at greater depths. Therefore, it is desirable that the dampener be adjusted to the proper depth which will make it most effective and retracted when it is not in use. Therefore, the optimum effectiveness of this dampener is not only obtained by installing it at the proper location on the vessel, but in submerging it to the proper depth. The proper depth is determined by the particular response characteristics of the vessel to heave and pitch in combination with the state of the water encountered.

Referring now to the drawing and particularly to FIGURE 1 the reference numeral **10** generally indicates the retractable dampener of the present invention connected to a vessel **12**. While of course, the dampener **10** may be utilized on any type vessel for dampening a particular section thereon it has been found extremely useful in dampening the area beneath the base of a crane **14** positioned on the stern of a vessel **12** so as to dampen the pitch of the portion of the vessel **12** adjacent to the crane base and thereby not only reduce the vertical movement of the crane but also the angle of the pitch of the crane by reducing the angle of pitch of that portion of the vessel adjacent the crane.

A dampening body **16** is provided which causes the actual inertia or dash pot dampening, and may include

any suitable substantially flat horizontal body, here shown as being rectangular, which is horizontally positioned beneath the vessel when in use. Connected to and supporting the body **16** are a plurality of support members **18**, preferably tubular, which are slidable through tubular wells **20** which are secured to the vessel **12**. As the support members **18** are slidable in the wells **20**, the dampening body **16** may be vertically positioned in the water to the optimum depth. Any suitable means for adjusting the vertical position of the tubular supports **18** with the wells **20** may be used such as passing a fastening pin (not shown) through the positioning holes **22** in the wells **20** and through the positioning tubes **24** in the tubular members **18**. Of course, any suitable or conventional means may be used for raising and lowering the tubular members **18** as desired. However, for simplicity, the crane **14** may be used for connection to the top lugs **26** on the tubular members **18** for raising and lowering the dampener **16**. The lugs **26** also act as stop lugs for normally limiting the downward movement of the tubular members **18** through the wells **20**.

Preferably, both the pitch dampener **16** and the support members **18** are hollow and tend to float thereby partially offsetting their weight and making it easier to raise and lower these members.

As generally the dampener **16** will be in a retracted position when the vessel is traveling to or from a location, in order not to adversely affect the handling of the vessel, it may be desirable to disconnect the upper ends **19** of the tubular support columns **18**. Therefore, construction flanges **28** are provided in each of the tubular columns **18** above one of the positioning tubes **24** whereby the upper ends **19** of the tubular columns **18** may be disconnected when the apparatus **10** is in a retracted position if desired. It is to be noted that the construction flanges **28** are of no greater diameter than the diameter of the tubular members **18** so that they may readily pass through the wells **20**.

Referring particularly to FIGURE 3, it is noted that preferably the top of the dampener **16** presents a flat horizontal surface **36** while the lower horizontal surface **38** is curved. Since the dampening effect of the pitch dampener **16** is accomplished due to inertia of the dampener acting against the surrounding water it is desirable to have the upper surface **36** flat or concave so as to resist upward movement of the vessel to a greater degree than downward movement around the curved surface **38**. This makes full use of the structural strength of the apparatus **10** and also allows full retraction under the vessel **12** which has essentially a flat contour under the wells **20** that is, it is desirable that the dampener have a shape such that it forms an integral part of the hull of the vessel when it is retracted against the underside of the hull. Also, unsymmetrical response in dampening due to the differences in shapes **36** and **38** is also advantageous in certain states of confused seas where short crest sections are separated by long troughs, as this reverse aerodynamic design will tend to pull the dampener and vessel downwardly by the flow of water passing over the dampener.

In use, it is noted that the present invention provides a pitch dampener **16** at a single location on a vessel and is positioned beneath the vessel and below the draft of the vessel, and in a horizontal direction transverse to the longitudinal axis of the vessel. By placing the dampener **16** adjacent the base of the crane **14** the point of maximum dampening occurs adjacent this end such that the crane foundation has a minimum vertical movement and angular pitch.

The resulting advantage of placing the pitch dampener **16** adjacent one end of the vessel, as compared to placing it midship at approximately the center of gravity of the vessel, is that the pivot point of the pitch will be at the one end and the angle of the pitch will be less and the rise and fall of that one end will be less than if the dampener was positioned at or symmetrically about the center

of gravity or midship of the vessel. For instance, assuming that in each case, the wave conditions cause the bow of the vessel to rise and fall six feet, in the present invention the rise and fall of the stern adjacent the crane **14** would be negligible while the rise and fall of the stern in the latter case would be approximately six feet. Likewise, for any given length of vessel, the angle of pitch will be approximately one-half utilizing the present invention as compared with placing the dampening means **16** at or symmetrical to the center of gravity of the vessel. In the operation of the crane **14** both the angle of pitch and the rise and fall of the crane foundation adversely affects the crane operation. An ancillary benefit from the pitch dampener **18** is that it will to some extent, depending upon the size of the vertical surface presented to the water, also reduce the roll of the vessel **12**. It will also dampen motions of the crane caused by the application and release of heavy loads.

During travel to and from a location on which the crane **14** is to be used, the pitch dampener **16** will be in a retracted position and thus will not be subjected to adverse water forces or interfere with the maneuverability of the vessel **12**. When the vessel **12** has arrived at the location, the pitch dampener **16** is lowered, the preferably below the wave action and into the relatively quiet water where it becomes effective in reducing movement at the stern end of the vessel and adjacent the crane **14** in order to stabilize the working position of the crane **14**. The pitch dampener **16** can be adjusted to whatever is the proper depth and of course can be used in various depths of waters because of its adjustability. As a general rule the dampener **16** is more effective when submerged to a greater depth. The single horizontally positioned dampener **16**, since it is designed to only stabilize a particular portion of the vessel **12** is only required to have a relatively small effective area and thereby the structural requirements are less reducing the strain on both the apparatus **10** and the vessel **12** as compared to a large area dampener or a plurality of dampeners attempting to stabilize the entire vessel. For example, in using the present dampener **16** on a 150 foot vessel having a beam of 50 feet, the dampener used was 10 feet by 50 feet. Since the dampener **16** is designed to stabilize against pitch and not heave of the vessel **12**, it need only be of a relatively small size as compared with the vessel. For instance, the ratio of area of the dampener to the ship of 1/15 has been found to be desirable. While this ratio provides a dampener of sufficient size to provide the inertia dampening, the forces created on both the dampener **16** and on the vessel **12** will be well within the structural abilities of the dampener and the vessel. And one important reason for this effective dampening force with a structure which is able to withstand the created stresses is the fact that the dampener is designed to stabilize only a relatively small portion of the vessel at the stern. If dampeners were attempted to be placed on both the stern and the bow and stabilize all of the vessel, the large forces created by the large dampeners required may exceed the strength of both the dampeners and the vessel.

Since the dampener **16** will be in use only during periods of normal weather it can be installed on any vessel without impairing the seaworthiness and without subjecting it to extreme stresses. And of course, it may be disconnected from the vessel when its use is not needed.

Of course, the nonsymmetric contour presented to the water by the flat surface **36** and the curved surface **38** provides a higher resistive movement in an upward direction than in the downward direction thereby making full use of the structural strength of the tubular members **18**.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned as well as others inherent therein. While a presently preferred embodiment of the invention has been given for the purpose of disclosure, numerous changes in the details of construction, arrangement of parts may be

made which will readily suggest themselves to those skilled in the art and which are encompassed within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A pitch dampening apparatus for dampening the vertical movement of a crane positioned on and at one end of a vessel comprising,

a single elongate hollow body horizontally disposed beneath the hull of the vessel at said one end,

said body being positioned eccentrically of the midship of the vessel and adjacent said crane for dampening only the vertical movement of said one end of the vessel and the crane due to the pitch of the vessel,

a plurality of elongate vertical tubular support members connected to the body for supporting and vertically positioning said body,

tubular wells connected to said vessels for receiving said tubular support members, and

vertical positioning means connected between said tubular wells and said tubular support members for slidably and adjustably positioning the horizontal body in a vertical direction for positioning at various depths.

2. A pitch dampening apparatus for dampening the vertical movement of a crane positioned on and at one end of a vessel comprising,

an elongate hollow body horizontally disposed beneath the hull of said vessel only at said one end and adjacent the lower end of said crane and eccentrically of the midship of the vessel for stabilizing said crane,

the horizontal area of the body being approximately 1/15 of the longitudinal horizontal cross-sectional area of the vessel, and

slidable means for vertically positioning and supporting said horizontal body from the vessel for positioning said body at various depths.

3. The invention of claim 2 wherein the upper surface of the body is flat and the lower surface of the body is curved convexly downwardly.

4. A pitch dampening apparatus for dampening the vertical movement of a crane positioned at the stern of a vessel comprising,

a single rectangular hollow body horizontally disposed beneath the hull of a vessel adjacent the stern, the longitudinal axis of said body being positioned transversely to the longitudinal axis of the vessel,

the upper surface of the body being flat while the lower surface is curved,

the area of the body being approximately one-fifteenth of the longitudinal cross sectional area of the vessel,

a plurality of elongate vertically positioned tubular support members connected to said body for supporting and vertically positioning said body,

tubular wells in said vessel for receiving and supporting said tubular support members,

vertical positioning means connected to said tubular support members for adjustably positioning the body in a vertical direction,

a releasable joint in each of said tubular members so that the upper part of said members may be disconnected when the body is in an elevated position, said joint having a diameter no greater than the tubular wells.

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FERGUS S. MIDDLETON, *Primary Examiner.*