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(54) **Title:** SYSTEMS AND METHODS FOR INSTALLING A BOWLING CENTER ON A SHIP

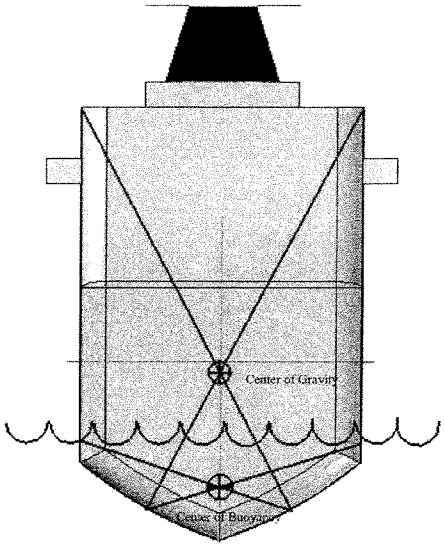

Figure 2

(57) **Abstract:** The present invention relates to the placement and installation of a bowling lane or bowling center on a ship. In particular, the invention relates to installing a bowling center on cruise ships.

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SYSTEMS AND METHODS FOR INSTALLING A BOWLING CENTER ON A SHIP

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit, under 35 U.S.C. §119, of provisional U.S. Application Serial No. 60/949,916, filed July 16, 2007, the entire contents and substance of which is hereby incorporated by reference.

FIELD OF THE INVENTION

The present invention relates to the placement and installation of a bowling center on a ship. In particular, the invention relates to installing and using a bowling center on cruise ships. The bowling center may comprise one or more bowling lanes, and may additionally comprise arcade games, a disk jockey station, a full bar and the like. The bowling lanes may also be strategically placed in the ship to minimize the angular and/or translational motion of the lanes. Additionally, the bowling center, or portions therein, may be stabilized to prevent angular and/or translational motion to the extent practicable.

BACKGROUND OF THE INVENTION

The cruise industry is an incredibly competitive one. Cruise providers constantly vie for customers by adding amenities. In the beginning, cruise ships were basically large passenger ships that had added facilities such as bars, restaurants, sun decks, swimming pools, and the like. As the industry developed, cruise ships increased in size and the amenities and activities offered became progressively more opulent.

Today, cruise ships offer their passengers a plethora of activities, both on and off the ship. Common onboard activities include sunbathing, swimming, shuffleboard, dancing, rock climbing, and skeet shooting. In addition to a surfeit of onboard activities, cruises may also offer activities external to the ship such as jet skiing, parasailing, scuba diving, and excursions to local attractions.

The increased number of activities onboard, in addition to an increased number of passengers, has resulted in an increase in the size of cruise ships. Modern cruise ships are extremely large and extremely heavy. For example, the Pride of America®, put into service by Norwegian Cruise Lines Corporation Ltd. in 2005, is 920.6 feet long, 105.6 feet wide, and weighs approximately 81,000 tons. The sheer size and mass of a cruise ship is, in itself, somewhat stabilizing. In addition, most modern cruise ships are also equipped with computer controlled stabilization systems to counteract, as much as possible, the pitching and rolling of the ship that does occur. However, while the motion may be imperceptible to passengers, it may still have an effect on certain onboard activities.

In the past, due to the amount of motion experienced at sea, some amenities were thought to be ill-suited for installation on cruise ships. In particular, cruise ships have traditionally not included bowling lanes because bowling requires a great deal of stability and precision. In order to be able to bowl successfully, one would prefer a relatively flat and relatively motionless bowling lane.

The present invention is intended to add yet another activity to the already impressive list of activities offered by the modern cruise provider. Bowling, heretofore thought to be incompatible with cruising, can now be added to the arsenal of entertainment available on today's cruise ships. A combination of factors have made this possible including the increased size of cruise ships and the effectiveness of onboard computer-controlled ship stabilization systems. In addition, the present invention provides a method for the appropriate placement and use of the bowling lanes on the ship and, if desired, a system for stabilizing said bowling lanes, to achieve an enjoyable bowling experience while underway.

Bowling is one of the most popular participation sports in the United States and is also extremely popular in the United Kingdom and many other countries. Bowling lanes are 60 ft long from the foul line to the front of the pin deck (the area the 10 pins sit on) and 62 ft 10 3/16 inches from the foul line to the back of the pin deck. All wooden bowling lanes are made of hard maple for the first 12 ft and for the pin deck. The remainder of the lane is usually pine. Bowling lanes can also be made

of synthetic materials that are designed to withstand the impacts and wear and tear of use. Synthetic materials may be desirable on a ship due to their superior weather resistance.

Bowling lanes are generally built by installing wooden or synthetic flooring over a stable sub floor. The sub floor is built, and the wooden flooring is installed, such that the surface formed is as close to flat and level as can be achieved. This creates a surface that has little or no effect on the trajectory of the bowling ball as it travels down the lane.

The same techniques for building a bowling lane on land apply equally to building one on a ship. However, on a ship other factors are also involved. These factors may include placing the bowling lane in a location on the ship calculated to minimize angular and/or translational motion. Additionally, if a perfectly stable (or nearly so) bowling surface is desired, it may also be desirable to build the bowling lane such that it can be actively stabilized. The present invention provides methods and apparatus toward that end.

SUMMARY OF THE INVENTION

In one embodiment, the present invention relates to a bowling lane located on a ship. In another embodiment, the ship is a cruise ship. In yet another embodiment the ship is ocean going. In yet another embodiment, the present invention relates to a bowling center located on a ship, where the bowling center comprises a bowling lane and one or more of the group consisting of bowling lanes; arcade games; a disk jockey booth; a full bar; a dance floor; a snack bar; and video screens.

In another aspect of the current invention, the invention relates to an apparatus for stabilizing bowling lanes mounted on a moving surface comprising: a bowling surface; a bowling surface frame; a mounting surface frame; one or more bowling surface frame actuators; one or more accelerometers; one or more gyroscopes; and a bowling surface frame actuator control system; wherein said bowling surface is attached to said bowling surface frame; wherein said bowling

surface frame is attached to one or more bowling surface frame actuators; wherein said bowling surface frame actuators are attached to said mounting surface frame; wherein one or more accelerometers are mounted on said bowling surface frame; wherein one or more gyroscopes are mounted on said bowling surface frame; wherein one or more accelerometers are mounted on said mounting surface frame; wherein one or more gyroscopes are mounted on said mounting surface frame; and wherein said bowling surface frame actuator control system maintains said bowling surface frame motionless relative to the earth using feedback from said bowling surface frame gyroscopes and accelerometers and said mounting surface frame gyroscopes and accelerometers and moving said bowling surface frame actuators. In one embodiment, the moving surface is a ship. In another embodiment, the ship is a cruise ship. In another embodiment, the cruise ship is ocean going.

In yet another aspect the stabilization system uses solid-state digital gyroscopes. In another aspect, the stabilization system uses solid-state digital accelerometers. In another embodiment said stabilization system uses hydraulic actuators for said bowling surface frame actuators. In another aspect, said stabilization system uses pneumatic actuators for said bowling surface frame actuators. In yet another embodiment, said stabilization system uses electric actuators for said bowling surface frame actuators. In another embodiment said bowling surface frame actuator control system is loaded with a program to move said bowling surface frame actuators in response to inputs from said accelerometers and gyroscopes. . In one embodiment, the moving surface is a ship. In another embodiment, the ship is a cruise ship. In another embodiment, the cruise ship is ocean going.

Yet another embodiment of the present invention relates to a method for locating a bowling lane on a ship comprising the steps of: locating the bowling lane as far as possible away from one or more of the group consisting of the bow of the ship, the stern of the ship, the starboard edge of the ship, and the port edge of the ship to minimize the transfer of angular and/or translational motion from the ship to the bowling lane. In another embodiment, the ship is a cruise ship. In yet another embodiment the ship is ocean going.

Another embodiment of the present invention relates to a method for locating a bowling lane on a ship comprising the steps of: locating the longitudinal axis of the bowling lane as close as possible to the lateral axis of the ship to minimize the transfer of angular and/or translational motion from the ship to the bowling lanes. In yet another embodiment the present invention relates to a method for stabilizing a bowling lane comprising using the apparatus. In another embodiment, the ship is a cruise ship. In yet another embodiment the ship is ocean going.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram of a bowling lane and a depiction of the forces that can act upon it.

FIG. 2 is a depiction of the cross section of a ship in order to demonstrate the locations of the center of gravity and the center of buoyancy.

FIG. 3 is a plan view of a ship and depicts the x-z plane of the ship.

FIG. 4 is a cross-section of a ship and depicts the x-y plane of the ship.

FIG. 5 is a side view of the ship and depicts the y-z plane of the ship.

FIG. 6 is a picture of the bowling stabilization system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

It is understood that the present invention is not limited to the particular methodologies, protocols, systems and methods, etc., described herein, as these may vary. It is also to be understood that the terminology used herein is used for describing particular embodiments only, and is not intended to limit the scope of the present invention. It must be noted that as used herein and in the appended embodiments, the singular forms "a," "an," and "the" include the plural reference

unless the context clearly dictates otherwise. Thus, for example, a reference to "a system" is a reference to one or more systems and includes equivalents thereof known to those skilled in the art and so forth.

Unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one of ordinary skill in the art to which this invention belongs. Specific methods, devices, systems and materials are described, although any methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention.

In one embodiment, the present invention relates to a bowling lane and/or a bowling center located on a ship and methods for placing them on a ship. More specifically, in one embodiment the present invention relates to placing the bowling lane and/or bowling center on a ship to minimize the effects of the motion of the ship on the bowling lane and/or bowling center and those games that require stability. In one embodiment, bowling lane and/or bowling center and the games may also be stabilized using an active stability system to render the games motionless with respect to the earth (rather than with respect to the ship).

The bowling center may be designed with a total entertainment experience in mind. The center may be designed to provide a traditional "bowling alley" experience during the day with, for example, one or more bowling lanes, bowling, arcade games, a snack bar, and may offer additional activities for kids. For instance, kids may have bowling sessions using special bumpers in the gutters to prevent "gutter balls." At night, the bowling center may become more of a nightclub experience with bowling one of many activities available. Other activities may include, for example, dancing, drinking, and special events such as "disco" or "midnight" bowling.

For the purposes of this invention, terms relating to the placement and location of the bowling lane and/or bowling center on the ship are defined as those locations where there is sufficient space in which to place a bowling lane and/or bowling center in the first place. For example, placing the bowling lane and/or bowling center at the bow of the ship may not possible because it may be too narrow.

In the context of describing the placement of the bowling lanes or alleys, it is convenient to define a coordinate system for the ship. For this purpose, the x-axis is defined as the axis that relates to the width of the ship. The y-axis refers to the axis that relates to the height of the ship. Finally, the z-axis refers to the axis that relates to the length of the ship. All axes are defined as originating at the center of gravity (CG) of the ship.

Additionally, in the context of describing the motion of the ship, it is convenient to define the motion of the ship about said axes. To this end, rolling is defined as side-to-side motion, or motion about the z-axis. Pitching is defined as front to back motion or motion about the x-axis. Finally, yawing is defined as rotational motion, or motion about the y-axis.

The present invention relates to the placement of bowling lanes on a ship. For all practical purposes, forces that act longitudinally on a bowling lane have a minimal effect on the enjoyment of the game. These longitudinal forces would have the effect of slightly slowing down or speeding up the ball. ***See* FIG. 1.** However, due to a number of factors, including the weight of a bowling ball, the velocity at which a bowling ball is thrown, and the length of time it take for the ball to traverse the lane, this negligible change in speed would have only a slight effect on the outcome of the throw.

There are some instances where the effects of longitudinal forces may be more significant. For example, as the speed at which the ball is thrown goes down, if thrown by a small child for instance, the effect of these forces becomes more significant. Additionally, someone who throws the ball with a "hook" may see a change in the trajectory of the ball as the forces may cause the ball to begin hooking earlier or later depending on the direction of the longitudinal force. However, due to the long periods and relatively slow motion of the ship, these effects will still be minimal if the bowling lanes are properly located.

On the contrary, lateral forces on a bowling lane may have a significant effect on the outcome of the throw. Lateral forces on the bowling lane tend to change the trajectory of the ball as it travels down the lane, as depicted by the dotted lines in **FIG. 1**. Because bowling requires a certain amount of precision regarding where the ball hits the pins, this change in trajectory has a significant effect on the outcome of the throw.

Therefore, in a specific embodiment, the bowling lane may be placed or located on a ship such that the direction in which the ship has the greatest motion exerts a longitudinal force on the bowling lane. To that end, ships in general, and cruise ships in particular, are significantly longer than they are wide (a 9:1 ratio in the case of the Pride of America®). This means that, in general, there is more rolling movement than either pitching or yawing. And while even very large ships both pitch and yaw to some extent, this motion is usually minor in comparison to roll. In this instance, placing the bowling lane such that the rolling of the ship is associated with a longitudinal force on the bowling lane, in one embodiment, may be desirable.

In a specific embodiment, the bowling lane may be placed or located close to the CG. Ships have two primary forces acting on them. One is gravity pushing down at the CG, which is roughly at the center of the entire cross section of the ship. The other is buoyancy pushing back up on the ship at the center of buoyancy (CB) which is roughly at the center of the underwater portion of the ship. *See* **FIG. 2.** If the ship is constructed properly and onboard equipment and cargo are stowed properly, the location of the CG remains relatively unchanged as the ship rolls or pitches in the water. For this reason, placing the bowling lanes at or near the center of gravity, in one embodiment, may be desirable.

FIG. 3 depicts the plan view of a cruise ship defined as the x-z plane. On the z-axis, or the longitudinal axis of the ship, there is little or no rolling motion. In a specific embodiment, the bowling lanes (depicted in gray and enlarged for clarity) may be placed such that the longitudinal center of the bowling lanes (approximately at the 30 ft. mark) is aligned with or near the z-axis of the ship. ***See* FIG. 3.** Moreover,

this placement of the lane may limit the effect of any yawing motion (motion about the y-axis) on the bowling lanes (and thus the ball's trajectory).

FIG. 4 depicts a cross section of a cruise ship. This cross section is defined for the purposes of this invention as the x-y plane. In a specific embodiment, from a height perspective, the bowling lanes (again depicted in gray and enlarged for clarity) may be placed at or near the center of gravity (at the origin of the y-axis) and may be placed on or near the x-axis such that the center of the bowling lanes (approximately the 30 ft mark) may be on or near the origin of the x-axis (defined to be at the CG). ***See* FIG. 4.** This means that the motion of the lanes about the z-axis, or rolling, is minimized. This also means that motion about the z-axis exerts a longitudinal, and largely harmless, force on the bowling lanes, as mentioned above.

FIG. 5 depicts a side view of a cruise ship. This cross section is defined for the purposes of this invention as the y-z plane. In a specific embodiment, **FIG. 5** shows a cross section of the end of the bowling lanes centered at or near the center of gravity (i.e., at the intersection of the y and z-axes) such that the pitching motion of the ship may have a minimal lateral force on the bowling lane and that the motion that exerts a direct lateral force on the bowling lanes is related to pitching. However, due to their immense length, cruise ships have very little pitching motion thus minimizing lateral forces acting on the bowling lanes.

While placing the bowling center at or near the center of gravity of the ship is a specific embodiment from a bowling stability standpoint, this may not be an ideal location from a practical standpoint. It is likely that the shipbuilder would locate much of the heavy machinery of the ship at or near the center of gravity to promote the stability of the ship. However, a significant amount of stability can still be obtained by using as many of the placement parameters mentioned as possible.

For instance, it may be desirable to place the bowling lanes closer to the top of the ship, either for packaging reasons or for closer proximity to entertainment and other facilities. While this placement would tend to increase the rolling motion of the ship transferred to the bowling lanes, if the lanes are placed laterally as described

above, this would merely increase longitudinal forces on the bowling lanes. This has very little effect on the trajectory of the ball and only slightly increases the small effect on the speed of the ball.

An important aspect of the placement of the bowling center is, in a specific embodiment, that it be placed away from one or more of the extremities of the ship. The closer to the center of gravity the lanes are placed, on any axis, the less translational and/or angular motion the lanes will experience. In addition, while placing the lanes closer to the bow or stern will increase motion due to pitching, the massive length of a modern cruise ship obviously provides a large area that is sufficiently close to the CG to minimize motion.

The present invention may be adapted for use in other circumstances. For instance, not all ships are significantly longer than they are wide, and not all ships are ocean going, as is the case with cruise ships. In many areas, river barges, that provide gambling and other entertainment, are prevalent. A riverboat, proportionately, is significantly wider than a cruise ship. However, one need only to analyze the motion of the boat and, as mentioned above, locate the bowling lane in such a way that the predominant motion of the river barge creates a longitudinal force on the bowling lanes and such that the bowling lanes are located as close as possible to the CG.

If it becomes necessary or desirable to place the bowling lanes in an area that increases its overall motion, this could also be compensated for using a stabilizing system **5**, shown in **FIG. 6**. This system comprises a bowling surface **10**, a bowling surface frame **20**, a mounting surface frame **40**, a sensor package containing one or more accelerometers and one or more gyroscopes **50**, one or more bowling frame actuators **30**, and a bowling surface frame actuator control system **60**.

Instead of being laid directly on the floor of the ship, the bowling lane surface **10** is constructed in a bowling surface frame **20** of sufficient stiffness and strength to support the weight of the bowling surface and the weight of bowlers. Next, the bowling surface frame **20** is connected to a system of actuators **30**. Finally, the actuators are attached to a mounting surface frame **40** that is attached directly to the ship.

In one embodiment, an accelerometer and gyroscope package **50** is mounted on both the bowling surface frame **20** and the mounting surface frame **40**. Generally, one accelerometer and one gyroscope are used in each of the three axes of motion (x, y, and z). The accelerometers measure angular acceleration and the gyroscopes measure angular position. Therefore, there would be three accelerometers and three gyroscopes on each of the two frames (12 instruments). However, the accelerometers and gyroscopes may be installed in one box for each frame (i.e. 6 instruments per box, two boxes) for ease of service and installation, as shown in **FIG. 6,** or in any appropriate combination.

In one embodiment the control system **60** uses the inputs from the accelerometers and gyroscopes **50** attached to the mounting frame **40** to measure the motion of the ship. It is then a simple matter of moving the bowling surface frame **20** in the equal and opposite direction, using the bowling surface frame actuators **30,** to keep the bowling surface motionless with respect to the earth. The accelerometers and gyroscopes **50** attached to the bowling surface frame are used as a redundant input. If the system is working properly, the accelerometers on the bowling surface frame should always read zero (no angular acceleration) and the gyroscopes should remain constant (at the starting angle).

In one embodiment, the bowling frame actuators **30** can be of several types, including but not limited to, hydraulic, pneumatic, or electric. All that is required is enough power and speed to move the bowling surface in response to the motion of a ship. However due to the size of a cruise ship, and the use of onboard stabilization systems, this is a very low frequency periodic motion. This requires relatively low power settings and allows for relatively slow reaction times. In addition to bowling lanes, other activities requiring stability, such as pinball, may be stabilized with a similar, albeit smaller, stabilization system.

Using the above described system, one skilled in the art would easily be able to maintain a motionless (or relatively so) bowling surface provided the ship's motion does not exceed certain parameters. Given the size of the modern cruise ship, it

would be an extraordinary circumstance, such as a hurricane or similarly significant event, in which the surface could not be stabilized.

While specific embodiments of the present invention have been described, other and further modifications and changes may be made without departing from the spirit of the invention. For instance, it is not necessary to place the bowling center exactly on the center of gravity of the ship. Many of the benefits of the placement system can be utilized even with less than ideal placement. All further and other modifications and changes are included that come within the scope of the invention as set forth in the embodiments. The disclosure of all publications cited above is expressly incorporated by reference in their entireties to the same extent as if each were incorporated by reference individually.

I claim:

1. A bowling lane located on a ship.

1. The bowling lane of claim 1, wherein the ship is a cruise ship.

2. The bowling lane of claim 1, wherein the ship is ocean going.

3. A bowling center located on a ship comprising a bowling lane and one or more of the group consisting of arcade games, a disk jockey booth, a full bar, a dance floor, a snack bar, and video screens.

4. An apparatus for stabilizing bowling lanes mounted on a moving surface comprising:

a bowling surface;

a bowling surface frame;

a mounting surface frame;

one or more bowling surface frame actuators;

one or more accelerometers;

one or more gyroscopes; and

a bowling surface frame actuator control system;

wherein said bowling surface is attached to said bowling surface frame;

wherein said bowling surface frame is attached to one or more bowling surface frame actuators;

wherein said bowling surface frame actuators are attached to said mounting surface frame;

wherein one or more accelerometers are mounted on said bowling surface frame;

wherein one or more gyroscopes are mounted on said bowling surface frame;

wherein one or more accelerometers are mounted on said mounting surface frame;

wherein one or more gyroscopes are mounted on said mounting surface frame; and

wherein said bowling surface frame actuator control system maintains said bowling surface frame motionless relative to the earth using feedback from said bowling surface frame gyroscopes and accelerometers and said mounting surface frame gyroscopes and accelerometers and moving said bowling surface frame actuators.

5. The apparatus of claim 4, wherein the stabilization system uses solid state digital gyroscopes.

6. The apparatus of claim 5, wherein the stabilization system uses solid state digital accelerometers.

7. The apparatus of claim 5, wherein said stabilization system uses hydraulic actuators for said bowling surface frame actuators.

8. The apparatus of claim 5, wherein said stabilization system uses pneumatic actuators for said bowling surface frame actuators.

9. The apparatus of claim 5, wherein said stabilization system uses electric actuators for said bowling surface frame actuators.

10. The apparatus of claim 5, wherein said bowling surface frame actuator control system is loaded with a program to move said bowling surface frame actuators in response to inputs from said accelerometers and gyroscopes.

11. A method for locating a bowling lane on a ship comprising the steps of:

locating the bowling lane away from one or more of the group consisting of the bow of the ship, the stern of the ship, the starboard edge of the ship, and the port edge of the ship to minimize the transfer of angular and/or translational motion from the ship to the bowling lanes.

12. A method for locating a bowling lane on a ship comprising the steps of:

locating the longitudinal axis of the bowling lane as close as possible to the lateral axis of the ship to minimize the transfer of angular and/or translational motion from the ship to the bowling lanes.

13. A method for stabilizing a bowling lane comprising the steps of using the apparatus of claim 5.

14. The apparatus of claim 4, wherein the moving surface is a ship.

15. The apparatus of claim 14, wherein the ship is a cruise ship.

16. The apparatus of claim 15, wherein the cruise ship is ocean going.

17. The method of claim 11, wherein the ship is a cruise ship.

18. The method of claim 18, wherein the cruise ship is ocean going.

19. The method of claim 12, wherein the ship is a cruise ship.

20. The method of claim 19, wherein the cruise ship is ocean going.

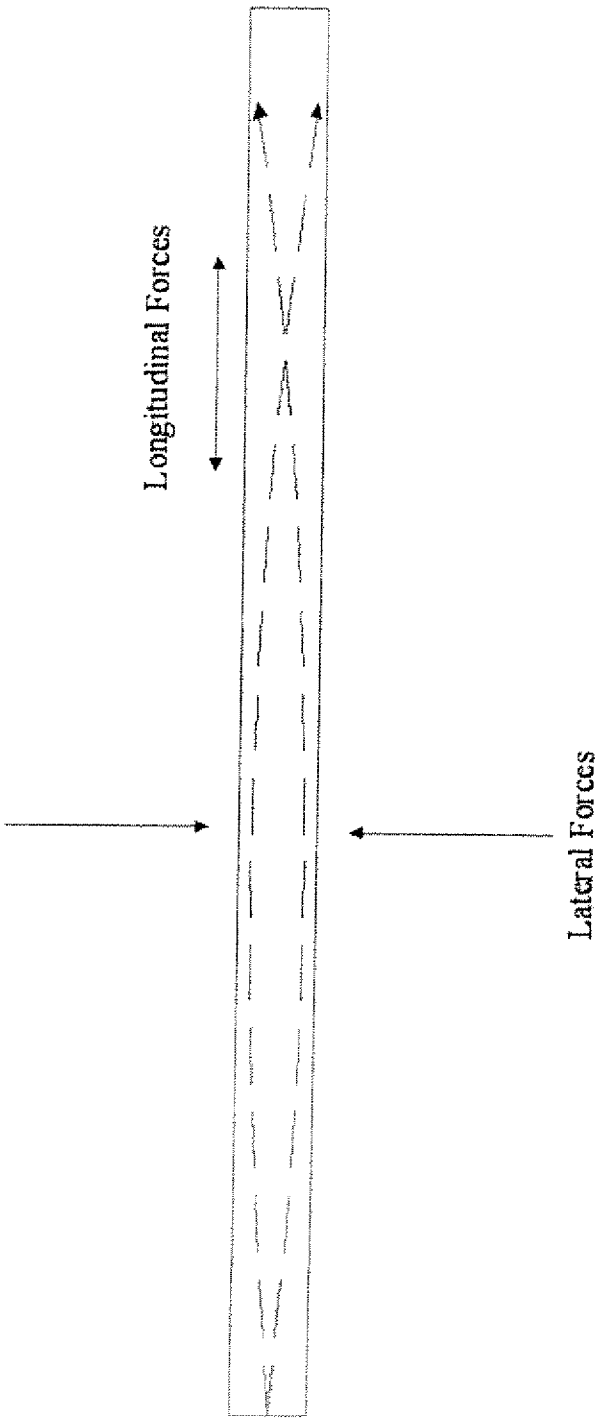

Figure 1

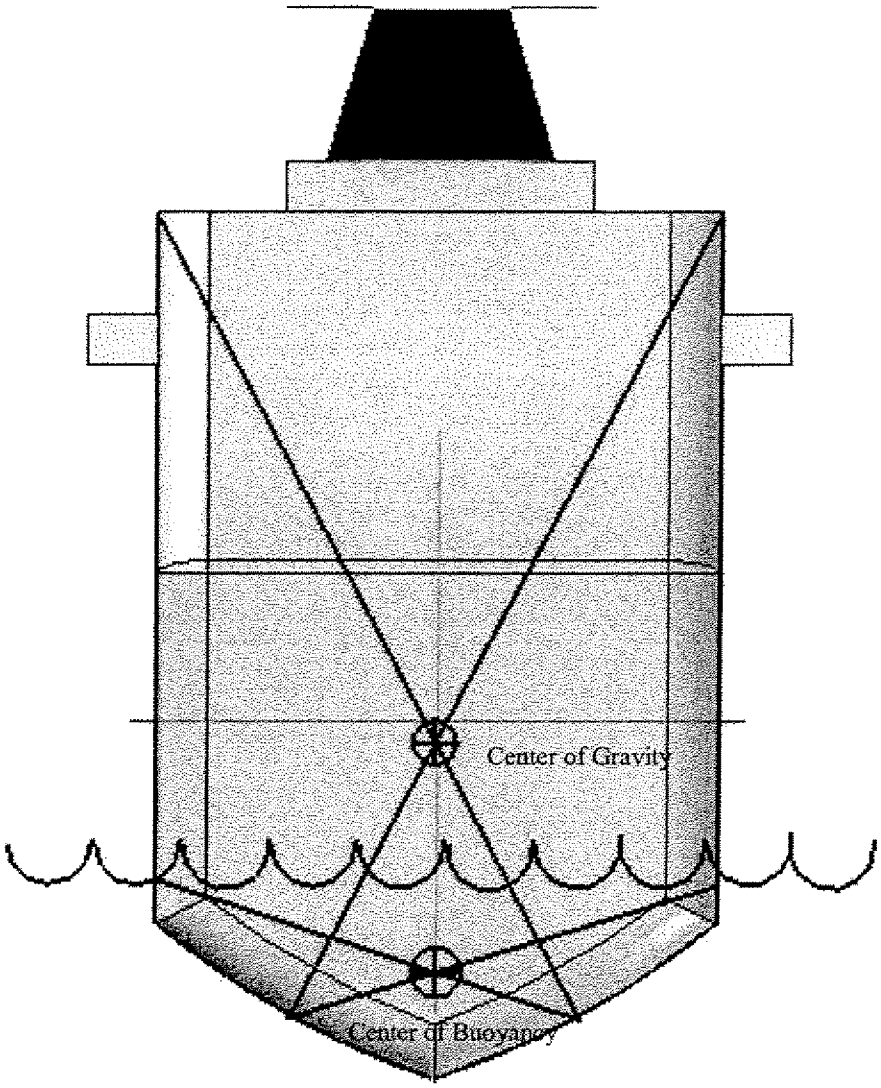

Figure 2

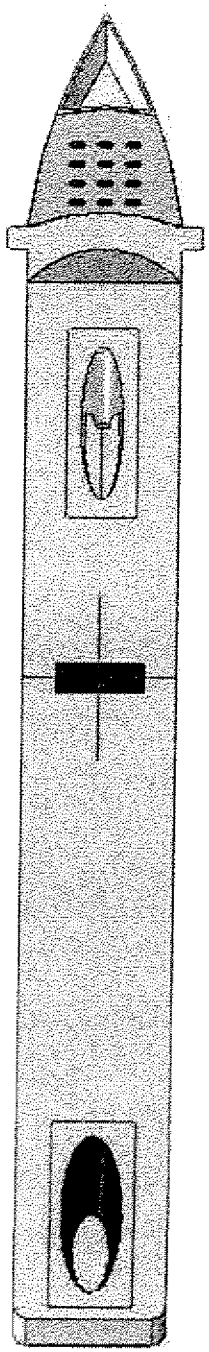

Figure 3

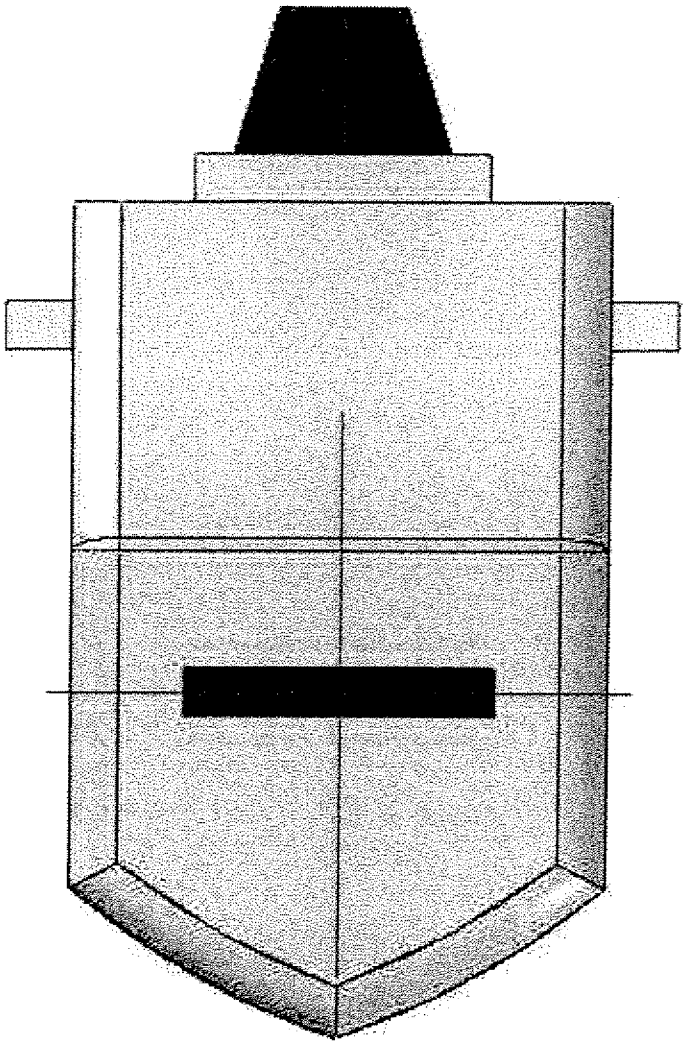

Figure 4

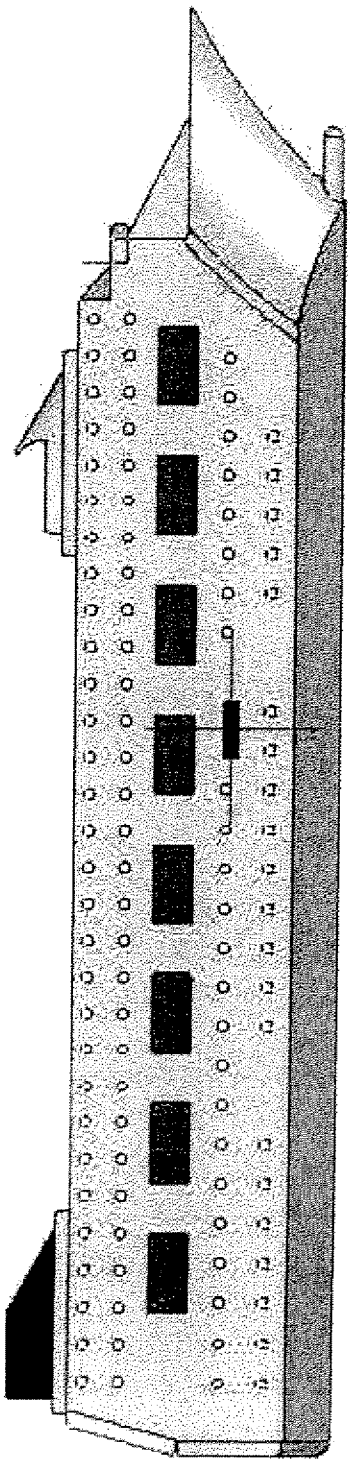

Figure 5

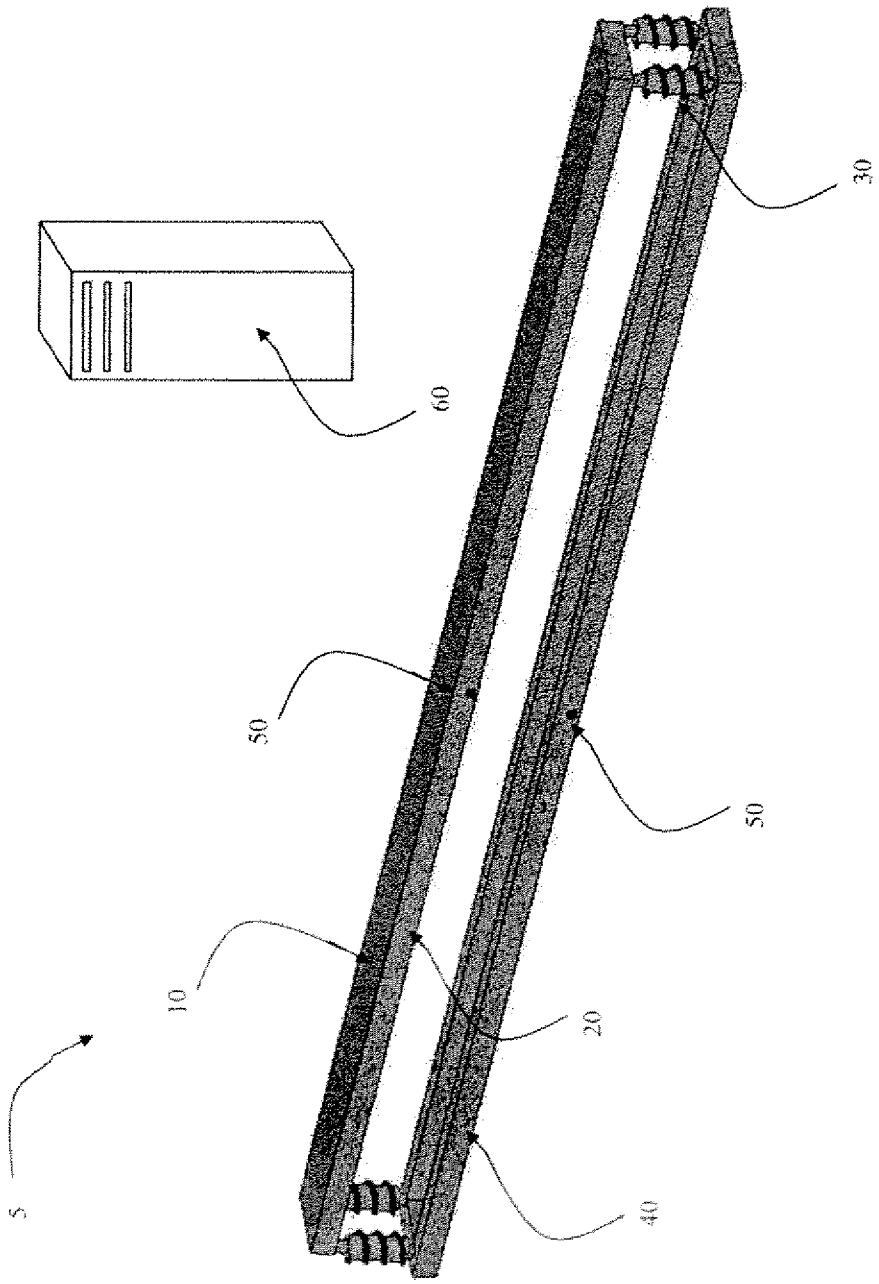

Figure 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/070155

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G09B 9/14 (2008.04)
USPC - 434/55
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - G09B 9/14 (2008.04)
USPC - 5/118; 434/55

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Internet (Yahoo and Google)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	www.directlinecruises.com/news_nclpearlbowling.htm - NCL's NEW NORWEGIAM PEARL TO OFFER CRUISE INDUSTRY FIRST: ONBOARD BOWLING ALLEY [accessed on 2008-09-26 *using www.archive.org using the February 7, 2006 dated site]*	1-3 ---------- 15-16, 18-20
X ----- Y	US 5,822,813 A (POWELL) 20 October 1998 (20.10.1998) entire document	4, 14 ---------- 5-10, 13, 15-16, 18
X ----- Y	US 1,021,276 A (STOKER) 26 March 1912 (26.03.1912) entire document	12 ---------- 11, 17, 19-20
Y	US 4,755,051 A (CAHILL et al) 05 July 1988 (05.07.1988) entire document	5-10, 13
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☐ Further documents are listed in the continuation of Box C. ☐

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