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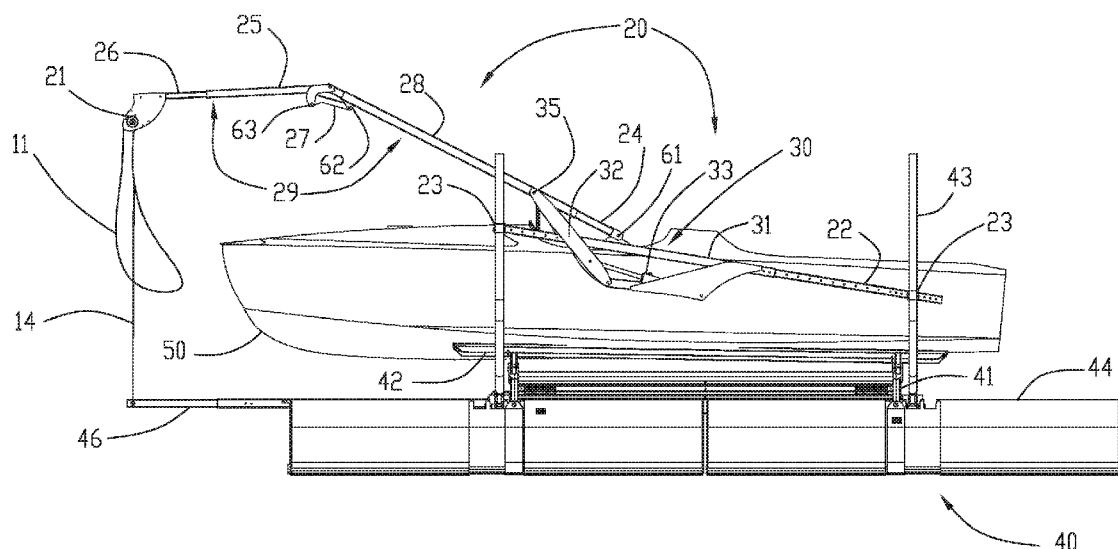


FIG. 1

(57) Abstract: A watercraft lift with hydraulically actuated arms which self-installs a fitted three-dimensional watercraft cover on a powerboat. A mechanism enables a linear actuator to drive a swing arm up to 180 degrees. The upper end of a two part arm articulates mechanically as the arm moves to reduce vertical elevation while operating. A spring-tensioned elongated roller keeps the cover tight and self-rolls the cover on the elongated roller when the actuated arms are pivoted forward. The mechanism can be attached to the guides of most watercraft lifts.



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AUTOMATIC WATERCRAFT COVER

CROSS REFERENCE TO RELATED APPLICATION(S)

This application claims the benefit of U.S. Provisional Patent Application No. 5 62/337,307, filed May 16, 2016, entitled Universal Automatic Boat Cover and U.S. Nonprovisional Patent Application No. 15/596,870, filed May 16, 2017 entitled Automatic Watercraft Cover.

BACKGROUND OF THE INVENTION

10 Field of the Invention

The present invention relates to watercraft covers for use with watercraft lifts, watercraft trailers, watercraft storage, vehicles and mechanical devices.

Description of the Related Art

15 The use of watercraft covers to protect watercrafts is well known. A number of designs are currently known to perform this basic operation. Many watercrafts have multi-section covers, often with one covering the bow section and another covering the aft section. The covers are typically shaped to cover at least portions of the three-dimensional shape of a watercraft and are manually spread out over
20 the watercraft and then manually attached using snap or other fasteners. The bow section is attached with fasteners around the perimeter of the bow section especially when there is a bow opening. The aft section is attached to fasteners on the windshield frame, or in front of the windshield, as well with fasteners around the perimeter of the aft section. This common cover system has several negative
25 aspects for the user. The large number of snaps or other fasteners used make the covers time consuming to install. The covers are often difficult to install after the cover material ages. The covers are large and awkward to store on-board. The covers can be dirty, and unpleasant to handle. The covers tend to lose shape, causing pockets of water, which further cause a loss of shape and pools of water.
30 The covers do not cover a significant amount of hull surface surrounding the covers, and do not cover significant portions of the sides of the watercraft with

which used, which causes fading in the sun of the uncovered portions of the watercraft and does not protect these areas from dirt. The covers provide no security, which makes the contents of the watercraft and the watercraft itself vulnerable to theft.

5 US Patent 8,291,810 solves many of these problems by having a mechanism automatically installing a three dimensional cover. This design is for use on a free-standing watercraft lift, and has much of the mechanism installed underwater. The arm of this design swings high above the watercraft, which limits the use under boat house roofs. The underwater structure requires a diver to install
10 and service. The required cover mechanism structure under the boat also prevents it from being used on many types of watercraft lifts.

Several two-dimensional automatic cover designs are currently known. U.S. Patent 3,549,198 uses a rotating arm to pull a flat cover over the top of a dump truck to secure the contents. This design would not be ideal for use with a
15 watercraft lift since the cover is two-dimensional, non-adjustable and would be impractical to fit the three-dimensional shapes of various watercraft types with which the lift might be used.

It is known to use a two dimensional cover design similar to the one of the 3,549,198 patent for application on a portable watercraft lift with a pontoon boat.
20 As such, the design does not provide protection to the sides of the boat. It also is more vulnerable to side wind, since it has exposed edges that catch the wind. Both designs use a roller fixed to the front, and a set of arms which pull the cover rearward like a window shade. This type of design is undesirable for an application on a boat, since the cover slides over parts of the boat, causing cover wear, and
25 potential boat damage. The fixed cover in the front also blocks views and is not attractive since the roller remains visible at the front even when the cover is deployed. Pulling the cover from a fixed roller in the front also can cause damage to the cover and watercraft by dragging the cover on the watercraft. Further, the lift with the cover similar to the 3,549,198 patent does not provide any protection
30 against operation of the lift when the cover is deployed, which can cause cover or watercraft damage, especially if installed on lifts that translate rearward when lowering, such as the lift of patent 5,908,264. Since the lift with the cover similar to

the 3,549,198 patent is not remote controlled, another drawback is that the user is required to operate it from the location of a control box. It is desirable to be able to manually adjust the cover when operating in case it is not seating correctly.

U.S. Patents such as 4,019,212 and 6,786,171 describe a cover system that does not touch the watercraft. These systems have a fixed roof with structure and retractable sides that completely surround the watercraft. The tall sides of these systems block views and are more vulnerable to wind. For use on a free-standing or free-floating watercraft lift, the fixed roof structure can make the lift vulnerable to tipping. Because of the fixed roof, these systems often require permitting and are highly regulated.

US Patent 4,019,212 is a device that attaches to a free-standing watercraft lift and lifts the cover off vertically. This design requires an external frame and overhead structure to lift the frame. The design is not conducive to cover the full sides of the watercraft. Since the cover still creates a shadow over the water when the watercraft is off the lift, this design would often be regulated as a canopy or covered moorage vs. a watercraft cover. Driving a swing arm directly from a linear actuator has limitations, since the starting and ending swing arm angles need to be more than 20 degrees in practice since the loads jump exponentially as the angle becomes more shallow. This limits the stroke of the swing arms to be a maximum of 140 degrees, which makes the geometry difficult to uncover the entire boat if the swing arm pivot location is not under the boat. This creates a need for a means of driving a swing arm up to 180 degrees, so the pivot point can be lateral to the watercraft, the starting roller position aft of the boat, and the ending position forward of the boat.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

FIG 1 is a side view of a watercraft on a lift in accordance with an embodiment of the present invention with the cover in an "Off" position with the articulating configuration.

FIG 2 is a side view of the watercraft on the lift with cover in a "Partially On" position with the articulating configuration.

FIG 3 is a side view of the watercraft on the lift with cover in an "On" position with the articulating configuration.

FIG 4 is an isometric view of the lift and cover without a watercraft with the articulating configuration.

5 FIG 5 is an enlarged view of the cover mechanism with articulating configuration.

FIG 6 is a side view of a cover mechanism configuration without articulation.

FIG 7 is an isometric view of a cover mechanism configuration for partial side loading.

10 FIG 8 is an enlarged view of the reversible mounting bracket showing two angle options.

FIG 9 is a side view of a cover mechanism configuration using a rotary actuator to drive the swing arm.

FIG 10 is an exploded view of elongated roller, showing spring, clutch.

15 FIG 11 is an isometric view of an elongated roller track and cover keder bead.

FIG 12 is an isometric view of a cover mechanism configuration of the front of the cover being supported by front cover support.

20 FIG 13 is a side view of a cover mechanism configuration using a linear actuator to articulate the swing arm.

FIG 14 is an isometric view of a cover mechanism configuration where the roller is fixed and the cover end is pulled by the swing arms.

FIG 15 is an isometric view of a cover mechanism configuration using a motor to apply torsion to the elongated roller.

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DETAILED DESCRIPTION OF THE INVENTION

The invention generally relates to a watercraft lift system, generally lifting powerboats under 50 feet long, however, the design could be applied to other type boat and watercraft lift systems and other types of boats and watercraft or boat

storage options. The mechanism that actuates a swing arm up to 180 degrees can also be used on a wide variety of vehicles and mechanical devices.

The disclosed embodiments of the invention are illustrated for a watercraft lift that allows for simple installation and removal of the cover, better protection for the watercraft, less view blockage, and better theft prevention. The combination of these features saves the boater time before and after boating, reduces hull cleaning, reduces hull fading, and allows the owner to store equipment, such as water skis inside the watercraft more securely.

As shown in the drawings for purposes of illustration, a watercraft 50 is supported by a watercraft lift 40 using port and starboard (left and right side) watercraft lift bunks 42. However the cover mechanism can be mounted to a dock, dry stack, or the ground. The watercraft lift may use bunks 42, rollers or other means for supporting the watercraft thereon. The watercraft lift 40 shown includes floats 44, guides 43, frame 41.

Port and starboard swing arms 24 are, respectively, pivotally connected to the port and starboard mechanism base 31 at arm pivot 61 (in Figs. 1-3) and are each simultaneously moved by operation of a corresponding port and starboard follower 32. The upper sections of the swing arm assemblies 29 are connected with a lateral anti-racking bar 38, which provides lateral stability of the cover system 10. In the preferred embodiment, the forward and aft sections of the mechanism base 31 is attached to mount brackets 23 on the forward and aft guides 43.

FIG 6 shows the non-articulating embodiment, the port and starboard linear actuators 33 have a lower end pivotally connected to the port and starboard mechanism base 31, respectively, and an upper end pivotally connected to the starboard and port followers 32, respectively. The upper ends of the port and starboard followers 32 have port and starboard driving pins 35, respectively, which are connected to slots 64 in the port and starboard swing arm assemblies, respectively. The lower ends of the port and starboard followers are pivotally connected to the port and starboard mechanism base 31, respectively. This mechanism enables up to 180 degrees of arm stroke.

In another embodiment shown in FIG 9, the swing arms are actuated with a rotary actuator 75, which applies torque to the port and starboard swing arm assemblies from a mechanism base.

In a preferred embodiment shown in FIG 1, the cartridge assembly 30, which may include the mechanism base 31, follower 32, linear actuator 33, and swing arm assembly with elongated roller 21, can be more easily adjusted fore and aft with the port and starboard mechanism base 31 telescoping over a port and starboard side rail 22, respectfully.

In a preferred embodiment, shown in FIG 1, the swing arm can articulate to reduce vertical height. In this embodiment, the port and starboard slider sleeves 28 telescope over the port and starboard lower swing arm 24, respectfully. Anti-friction tape on the inside of the slider sleeves or outside the lower swing arm prevent galling. Port and starboard links 27 are pivotally connected to a lug 62 on the upper end of the port and starboard slider sleeves 28, respectfully. The other end of the port and starboard links are attached to lugs 63 on the lower end of the upper swing arms 25. As the linear actuator 33 pushes the follower 32 in one direction, the swing arm assembly 24 rotates, and the slider sleeve 28 slides on the lower swing arm 24, which moves the link 27 which pivots the upper swing arm 25 relative to the lower swing arm 24 which reduces the elevation of the roller tube 21 over the watercraft compared to if the swing arm 24 did not articulate when operating. This is beneficial for less wind load, and for clearance for overhead roof structures. The articulating arm enables the pivot point of the swing arm to be laterally located to the side of the boat in windy environments, and enables use for larger boats. Not having any cover mechanism under the watercraft elevation enables use on most any watercraft lift, or boat storage.

In a preferred embodiment, the linear actuator is controlled via remote control, and the actuator is a hydraulic cylinder powered by a hydraulic power unit.

In another embodiment, the linear actuator is an electric linear actuator.

In a preferred embodiment, each of the port and starboard upper swing arms includes a telescoping tube 26 telescopically disposed with respect to the upper swing arm portion and by which the length of the swing arm can be selectively adjusted to fit the watercraft 50.

An elongated roller tube 21 extends laterally between and is rotatable relative to the upper end portions of the swing arm assembly 29.

In a preferred embodiment shown in FIG 8, an internal torsional spring 67 is within a roller tube 26 and applies adjustable rotation force to the roller tube and hence a pulling force to a cover 22 attached thereto.

In an alternative embodiment, shown in FIG 13, an linear actuator controls the angle of the upper swing arm 25 to the lower swing arm 24.

In a preferred embodiment shown in FIG 8, a slip clutch 66 prevents the torsional spring 27 from being torqued beyond a predetermined value.

In an alternative embodiment shown in FIG 15, an electric or hydraulic roller motor 77 is used to apply torque from the telescoping tube 26 to the roller tube 21. An alternative embodiment without the articulating upper swing arm 25, slider sleeve 28 or link 27 is shown in Fig. 6, with the telescoping tube 26 inserted into the lower swing arm 24 instead of the upper swing arm 25, shown in FIG 6.

In a preferred embodiment shown in FIG 3, the front of the cover 11 has a bow pocket 16 sized to accept therein the bow of the watercraft 50 when the cover is deployed to cover the watercraft. A forward cover line 14 extends between the front wings 13 of the cover and a forward end portion of a bow sprit 46 which has a rearward end portion attached to the watercraft lift frame 41 of the watercraft lift 40. In the preferred embodiment, the bow sprit 46 has a spreader bar 47 to position the forward cover lines so the cover can more easily slide over the watercraft rub rail forward shoulders 51. Another embodiment secures the forward cover lines to the dock in front of the watercraft. Another embodiment secures the front of the cover to a front cover support 48 in front of the bow so a bow pocket 16 and forward cover lines 14 are not needed.

The watercraft 50 is protected from the cover system 10 with rollers 36 mounted on the side rails 22, and with a port and starboard guide plates 37 mounted to the inboard port and starboard followers 32, respectfully, shown in FIG 4. The guide plate is constructed with a flexible material, such as plastic, and cantilevers beyond the follower 32 so it will not cause damage to the rub rail of the

watercraft 50 when operating cover system 10. Additional guide wheels 36 can also be added for protecting the watercraft when loading.

The cover 11 is uniquely designed to operate with the cover system. The cover is shaped to fit the watercraft and cover most the sides. The aft end of the cover is straight and has a keder bead 12 shape sewn into the cover that indexes into a track 65 on the elongated roller 21 to secure the cover to the elongated roller, shown in FIG 11. The perimeter of the cover 11 has a perimeter pocket 18, shown in FIG 3 with an elastic cord 15 extending through. When the cover is fully deployed on watercraft 50, the elastic is tightened by being wrapped around the roller tube 21 in the opposite direction than the cover for the first few wraps so that the elastic cord 15 is tensioned when the roller tube is pulled aft, and is loosened when roller tube moves forward and the cover begins to be rolled up on the roller tube.

The preferred embodiment of the cover 11 has forward side wings 13 near the forward shoulder of the watercraft rub rails 51 which are designed to better secure the cover to the sides of the watercraft and to prevent the cover from being stopped on the forward shoulders of the watercraft rub rail 51. The preferred embodiment has the forward lines 14 configured so they are generally pointing toward the watercraft rub rail forward shoulders 51 when the cover is sliding over the watercraft rub rail forward shoulders 51, as shown in FIG 2. The aft end of the cover 11 is attached to the roller tube 21 with the cover end sliding into a lateral track on the roller, shown in FIG 11.

A preferred embodiment designs the cover 11 with a slight catenary curve 19 which pulls the center of the cover tight laterally as the elastic cord 15 is tightened, shown in FIG 3.

A preferred embodiment includes at least one control handle 17, shown in FIG 2 inside the cover toward the forward end of the cover to assist positioning the cover if needed, and is sometimes needed in certain wind conditions.

Another embodiment, shown in FIG 7, allows for improved access for loading the watercraft when approaching the lift at a steep angle, which is common for watercraft lifts side mounted in canals. In this embodiment, there is no outboard rear guide 43. Instead, longitudinal beams 69 spanning from the forward and aft

lateral beams of the watercraft lift 49, located parallel and outboard of the watercraft lift bunks 42.

Another embodiment enables the side rail 22 to be installed on an upright watercraft guide 43, or one on a slight angle, shown in FIG 8. The at least two part bracket 23 is configured such that if one part is installed in an opposite direction, the angle of installation changes. The two parts of the brackets include a clamp 71, which secures to a watercraft guide or other upright member, and a reversible block 72, with a first and second side.

Another embodiment attaches the cover system to a dock, watercraft trailer, the ground, or watercraft storage stand. Another embodiment has the mechanism and cover reversed to the depiction, with the roller in the front when the cover is on. Another embodiment uses the mechanism 20 other than as a boat covers, such as for covering dump trucks, shown in FIG 14. Another embodiment uses the mechanism for uses besides with covers.

- 15 10 Cover system
- 11 Cover
- 12 Keder bead
- 13 Forward wing of cover
- 14 Forward cover line
- 20 15 Elastic cord
- 16 Bow pocket
- 17 control handle
- 18 Perimeter pocket
- 19 Side catenary of cover
- 25 20 Cover mechanism
- 21 Elongated Roller
- 22 Side rail
- 23 Mount bracket

- 24 Lower Swing arm
- 25 Upper swing arm
- 26 Telescoping tube
- 27 Link
- 5 28 Slider sleeve
- 29 Swing arm assy
- 30 Cartridge assembly
- 31 mechanism base
- 32 Follower
- 10 33 Linear Actuator
- 35 Driving pin
- 36 Guide wheels
- 37 Guide plates
- 38 Anti-racking bar
- 15 40 Watercraft lift
- 41 Watercraft Lift frame
- 42 Watercraft Lift bunks
- 43 Watercraft lift guides
- 44 Watercraft Lift Floats
- 20 46 Bow sprit
- 47 Spreader bar
- 48 Front Cover support
- 49 Lateral beam of watercraft lift
- 50 Watercraft
- 25 51 Watercraft rub rail forward shoulders
- 61 Lower arm pivot

- 62 Slider sleeve lug
- 63 Upper swing arm lug
- 64 Swing arm slot
- 65 Elongated roller track
- 5 66 Slip clutch
- 67 Torsional Spring
- 68 Connecting member
- 69 Longitudinal beam
- 71 Clamp
- 10 72 Reversible block
- 75 Rotary actuator
- 76 Swing arm linear actuator
- 77 Roller motor

From the foregoing it will be appreciated that, although specific

15 embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without deviating from the spirit and scope of the invention. Accordingly, the invention is not limited except as by the appended claims.

CLAIMS

1. A watercraft covering apparatus for use with a frame adapted to accommodate a watercraft having a bow and a stern, characterized in that the watercraft covering apparatus comprises:

at least one swing arm having a lower end portion pivotally attached to the mechanism base located outboard to the lateral sides of a watercraft, and the upper end portion; the at least one mechanism base with a forward and aft end, with

the forward end being connected to a forward upright member, with the aft end of the mechanism base being connected to an aft upright member;

the at least one swing arm being pivotable between a first position wherein the upper end portion of the swing arm is positioned proximate to a first end of the watercraft when the watercraft is supported by the frame and the second position wherein the upper end portion of the pivot arm is positioned proximate to a second end of the watercraft when the watercraft is supported by the frame;

the swing arm with the second position is more than 140 degrees from the first position.

at least one actuation member pivotally connected to the mechanism base and the other end connected to the at least one swing arm;

an elongated roller having a side portion rotatably supported by the upper end portion of the swing arm for travel with the upper end portion of the swing arm as the swing arm is pivotally moved between the first position and the second position; and

a watercraft cover with a first and second end, with a first end attached to a securing member, and the second end attached to an elongated roller

a watercraft cover substantially fully wound about the elongated roller when the upper end portion of the swing arm is in the first position, the cover being sized to lengthwise extend over and cover the watercraft when the swing arm is moved to the second position and the watercraft is supported by the frame,

a torsion member configured so that the elongated roller is rotated in a first rotational direction when the swing arm is moved to a first position, and rotated the

opposite direction when the swing arm is moved to a second position with sufficient torque to roll the cover on the elongated roller;

2. The watercraft covering apparatus of claim 1, characterized in that the actuation member is comprised of: an actuation member with one end pivotally
5 connected to the mechanism base, with the second end pivotally connected to a follower member; a follower member with a lower end pivotally connected to the mechanism base and an upper portion pivotally connected to a driving pin; the driving pin is connected to a longitudinal slot in the swing arm; when the follower is in a first position the swing arm is in a first position, and when the follower is in a
10 second position, the swing arm is in a second position.

3. The watercraft cover apparatus of claim 2, characterized in that a guide plate is mounted on the watercraft side of at least one of the followers, the guide plate is constructed of a flexible material and extends beyond at least one edge of the follower to allow for deflection.

15 4. The watercraft covering apparatus of claim 2, characterized in that the swing arm is comprised of at least two separate members, a lower swing arm member is pivotally connected to an upper swing arm member; an slider sleeve around the lower swing arm with an upper and lower portion, with the drive pin being pivotally connected to the lower portion of the slider sleeve, at least one lug is
20 located on the side of the upper end of the telescoping sleeve, and another lug is located on one the same side of the upper swing arm, a link is pivotally connected to the lower swing arm lug and the upper swing arm lug, with holes positioned such that the angle between the upper swing arm and lower swing arm changes to one another when the lower arm pivots.

25 5. The watercraft covering apparatus of claim 1, characterized that the swing arm is comprised of at least two separate members, a lower swing arm member is pivotally connected to an upper swing arm member; at least one lug is located on one side of the upper end of the telescoping sleeve, and another lug is located on one the same side of the upper swing arm, a linear actuator is pivotally
30 connected to the lower swing arm lug and the upper swing arm lug, configured such that angle between the lower swing arm and upper swing arm can change.

6. The watercraft covering apparatus of claim 2, characterized with the upper swing arm is comprised of at least two telescoping tubes that can be secured in multiple positions to change the length of the swing arm.

7. The watercraft covering apparatus of claim 4, characterized with the swing arm is comprised of at least two telescoping tubes that can be secured in multiple positions to change the length of the swing arm.

8. The watercraft covering apparatus of claim 4, characterized that the watercraft cover has a first attachment member having a first portion attached to the forward end portion of the cover and a second end portion attachable to a securing member; and the front of the cover is secured to the bow of the watercraft using a bow pocket in the cover to catch the bow,

9. The watercraft covering apparatus of claim 2, characterized that the mechanism base has a reversible bracket between the forward end of the mechanism base and the forward upright member, and a reversible bracket between the aft and of the mechanism base and the aft upright member, at least two holes are located on the reversible bracket such that by reversing the bracket changes the mounting angle.

10. The watercraft covering apparatus of claim 2, characterized with a mechanism base comprised of a movable cartridge and a fixed side rail, the movable cartridge includes the pivotally attached linear actuator, follower, and pivot for the swing

11. A mechanical apparatus for use to move a swing arm up to 180 degrees using a linear actuator, comprising of:

at least one swing arm having a lower end portion pivotally attached to the mechanism base; the one swing arm being pivotable between a first position to a second position; an actuation member with one end pivotally connected to the mechanism base, with the second end pivotally connected to a follower member; a follower member with a lower end pivotally connected to the mechanism base and an upper portion pivotally connected to a driving pin; the driving pin is connected to a longitudinal slot in the swing arm; when the follower is in a first position the swing

arm is in a first position, and when the follower is in a second position, the swing arm is in a second position.

12. The apparatus of claim 11, characterized that the swing arm is comprised of at least two separate members, a lower swing arm member is
5 pivotally connected to an upper swing arm member; a sliding sleeve around the lower swing arm with an upper and lower portion, with the drive pin being pivotally connected to the lower portion of the sliding sleeve, at least one lug is located on one side of the upper end of the sliding sleeve, and another lug is located on one
10 the same side of the upper swing arm, a link is pivotally connected to the lower swing arm lug and the upper swing arm lug, with holes positioned such that the angle changes to one another when the lower arm pivots.

13. The apparatus of claim 11, characterized that the an elongated roller is attached to the upper portion of at least one swing arm, an internal torsional spring applies torque to the elongated roller to roll up the cover as the swing arm
15 moves in one direction, and deploys the cover in the other direction.

14. The apparatus of claim 11, characterized that one end of a cover is attached to the upper portion of at least one swing arm, an elongated roller is secured in a fixed position, and a torque device applies sufficient torque to roll up a cover, the other end of the cover is secured to the elongated roller.

20 15. The apparatus of claim 12, characterized that the an elongated roller is attached to the upper portion of at least one swing arm, a torque device applies torque to the elongated roller to roll up the cover as the swing arm moves in one direction, and deploys the cover in the other direction.

25 16. The apparatus of claim 12, characterized that one end of a cover is attached to the upper portion of at least one swing arm, an elongated roller is secured in a fixed position, and a torque device applies sufficient torque to roll up a cover, the other end of the cover is secured to the elongated roller.

17. The apparatus of claim 1, characterized that the torsion member is an rotational roller motor

18. A watercraft covering apparatus for use for a watercraft having a bow and a stern, characterized in that the watercraft covering apparatus comprises:

at least one swing arm having a lower end portion pivotally attached to the mechanism base located near the lateral sides of a watercraft, and the upper end

5 portion;

at least one rotary actuation member connected to the mechanism base and the other end connected to the at least one swing arm so that the elongated roller is rotated in a first rotational direction when the swing arm is moved to a first position, and rotated the opposite direction when the swing arm is moved to a second

10 position with sufficient torque to roll the cover on the elongated roller tube;

an elongated roller having a side portion rotatably supported by the upper end portion of the swing arm for travel with the upper end portion of the swing arm as the swing arm is pivotally moved between the first position and the second position; and

15 a watercraft cover substantially fully wound about the elongated roller when the upper end portion of the swing arm is in the first position, the cover being sized to lengthwise extend over an cover the watercraft when the swing arm is move to the second position and the watercraft is supported by the frame,

20 a torsion member configured so that the elongated roller is rotated in a first rotational direction when the swing arm is moved to a first position, and rotated the opposite direction when the swing arm is moved to a second position with sufficient torque to roll the cover on the elongated roller;

19. The apparatus of claim 18, whereby the swing arm is comprised of at least two separate members, a lower swing arm member is pivotally connected to an upper swing arm member; at least one lug is located on one side of the upper end of the slider sleeve, and another lug is located on one the same side of the upper swing arm, a linear actuator is pivotally connected to the lower swing arm lug and the upper swing arm lug, with changes in actuator length causes changes of angle between the lower pivot arm and the upper pivot arm.

20. A watercraft cover for use on an automatic cover apparatus comprising of:

a watercraft cover with a front end and aft end

at least one securing detail in the front section of the cover;

the aft portion of the cover is a longitudinal sewn shape keder bead for the purpose of securing the cover to a track on the elongated roller to secure the cover on the elongated roller.

- 5 a perimeter pocket sewn into the perimeter of the aft section of the cover
 an elastic member on the port and starboard sides in the perimeter pocket with one end attached to the cover and the other end extended out of the cover.

21. The cover of claim 20, with at least one control handle attached to the inside of the cover.

- 10 22. The cover of claim 20, with the port and starboard sides having a catenary shape that pulls the cover tight laterally when perimeter cord is tightened.

23. The cover of claim 20, with a pocket in the front of the cover, configured to accept a bow of a boat; and; an attachment point for a forward cover line configured to point towards the forward shoulder of the watercraft rub rail when
 15 cover is being deployed.

24. The apparatus of claim 2, with a slip clutch that slips if the torque being applied to the spring exceeds a set amount.

25. A watercraft covering apparatus for use for a watercraft having a bow and a stern, characterized in that the watercraft covering apparatus comprises:

- 20 at least one swing arm connected pivotally to the mechanism base;
 an actuator that moves the swing arm from a first position to a second position;

 an elongated roller having a side portion rotatably supported by the upper end portion of the port and starboard swing arms; and

- 25 a watercraft cover with a first and second end, with the second end substantially fully wound about the elongated roller when the upper end portion of the swing arm is in the first position, the cover being sized to lengthwise extend over an cover the watercraft when the swing arm is move to the second position and the watercraft is supported by the frame,

a torsion member configured so that the elongated roller is rotated in a first rotational direction when the swing arm is moved to a first position, and rotated the opposite direction when the swing arm is moved to a second position with sufficient torque to roll the cover on the elongated roller tube;

5 the second end of the watercraft cover being attached to a securing member.

26. A watercraft covering apparatus for use for a watercraft having a bow and a stern, characterized in that the watercraft covering apparatus comprises:

at least one swing arm connected pivotally to the mechanism base;

an actuator that moves the swing arm from a first position to a second

10 position;

an elongated roller having a side portion rotatably supported by the upper end portion of the port and starboard swing arms; and

a watercraft cover with a first and second end, with the second end substantially fully wound about the elongated roller when the upper end portion of the swing arm is in the first position, the cover being sized to lengthwise extend over an cover the watercraft when the swing arm is move to the second position and the watercraft is supported by the frame,

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the second end of the watercraft cover being attached to a securing member;

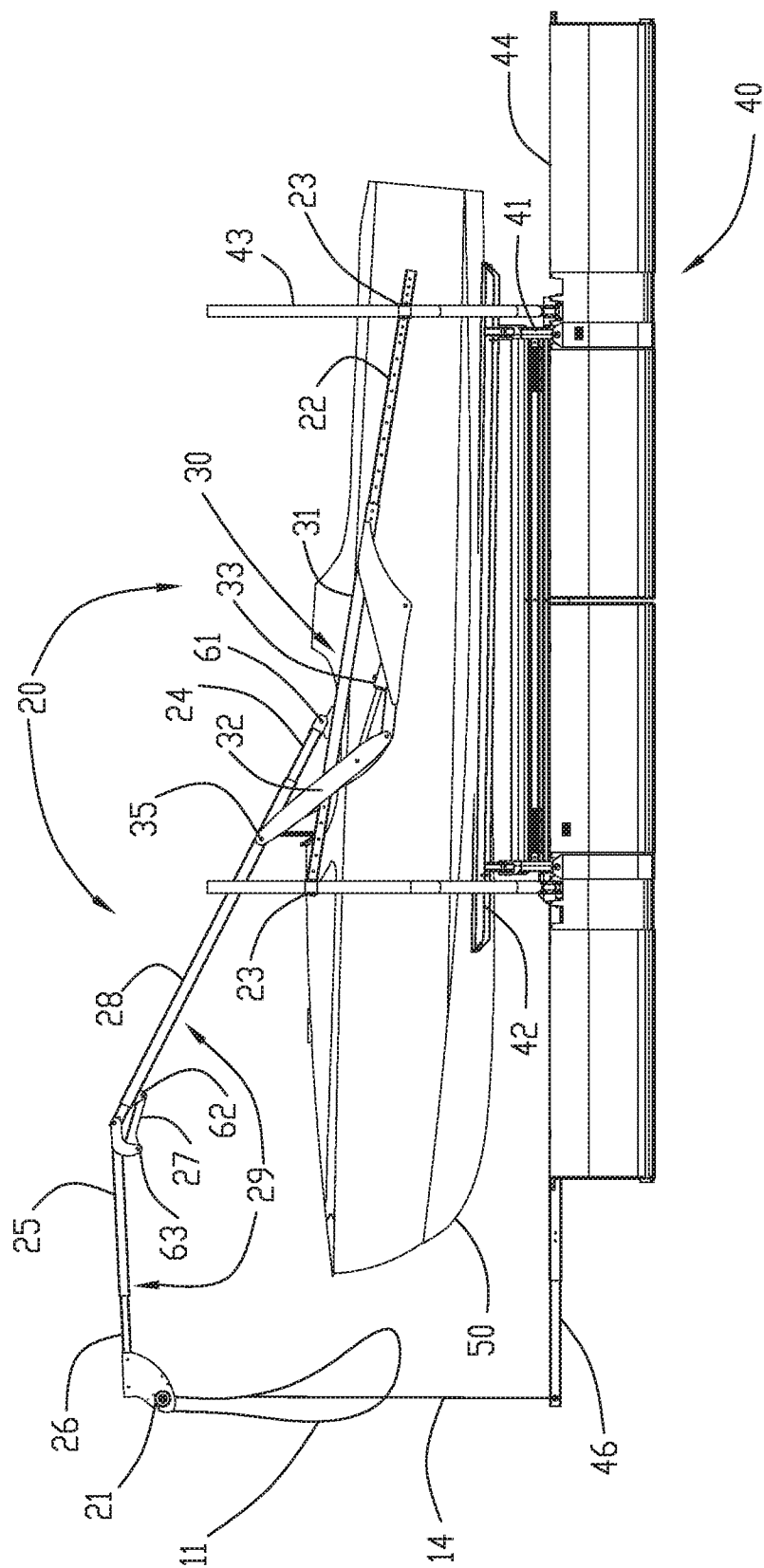
an motor configured so that the elongated roller is rotated in a first rotational direction when the swing arm is moved to a first position, and rotated the opposite direction when the swing arm is moved to a second position with sufficient torque to roll the cover on the elongated roller tube.

20

27. The watercraft covering apparatus of claim 1, with a watercraft lift with a front lateral beam and an aft lateral beam; a port and starboard longitudinal beams; and connecting members extending laterally connecting the port and starboard longitudinal beams to the port and starboard mechanism bases.

25

28. The watercraft covering apparatus of claim 27, whereby the longitudinal position of the mechanism base is adjusted by the longitudinal position of the connecting members on the port and starboard longitudinal beams.



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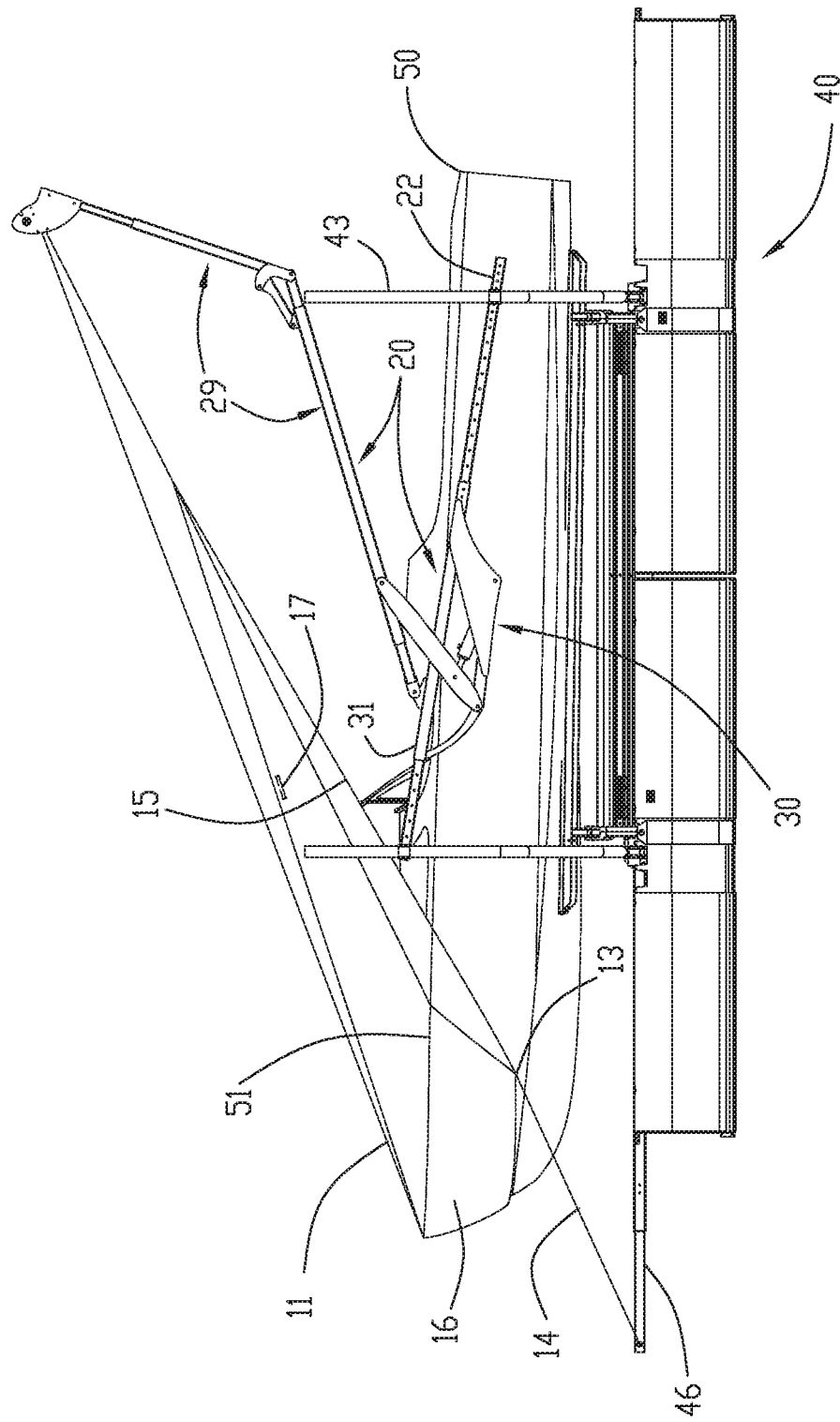


FIG. 2

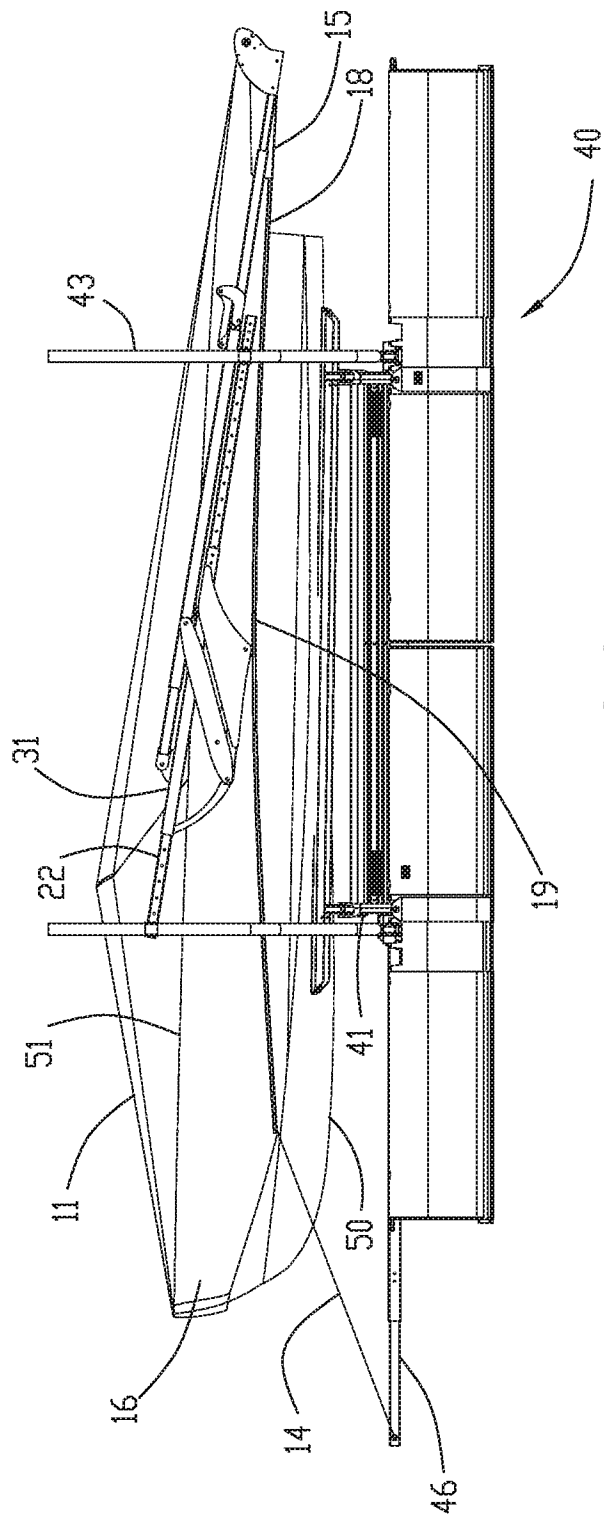


FIG. 3

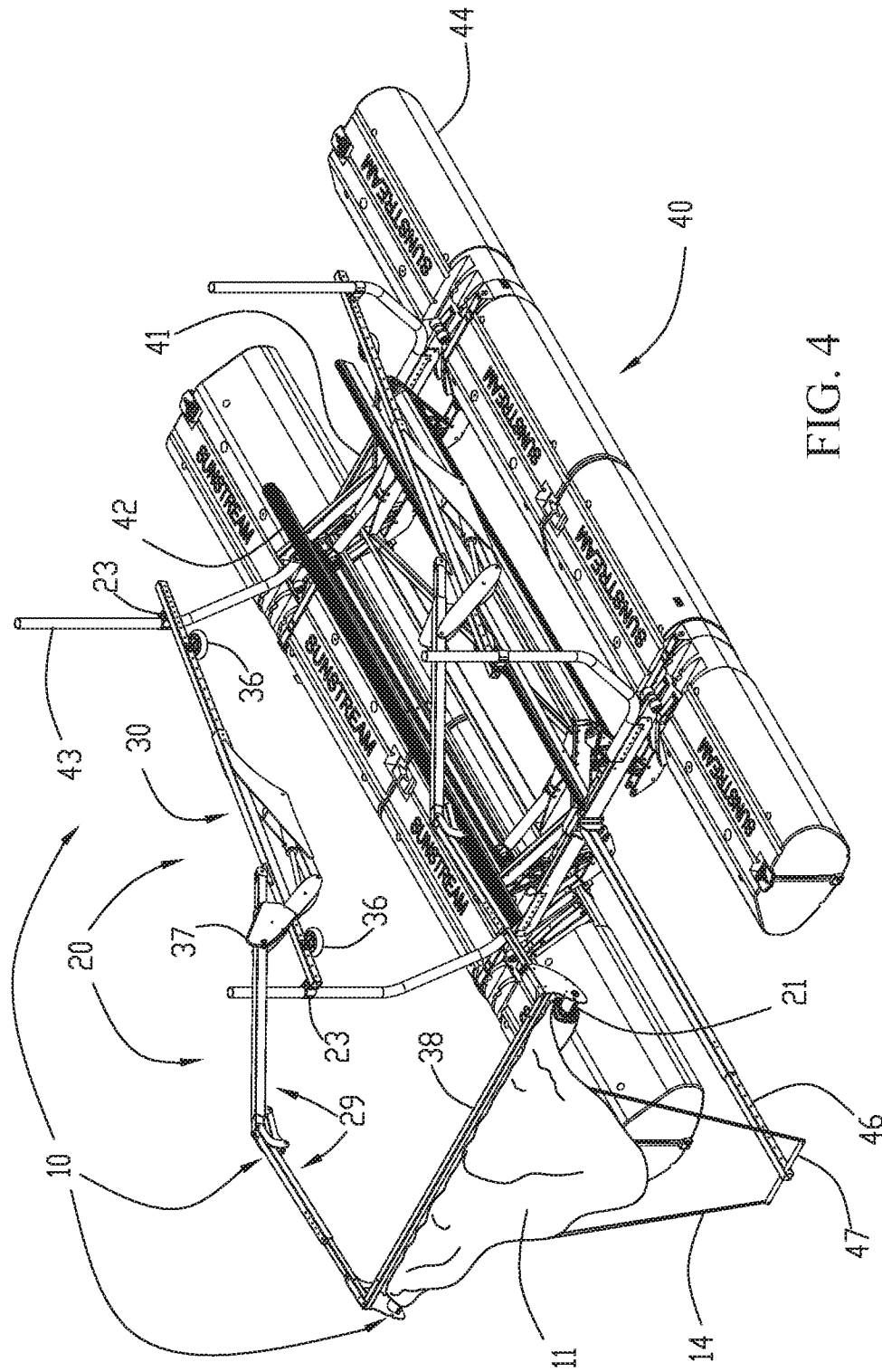
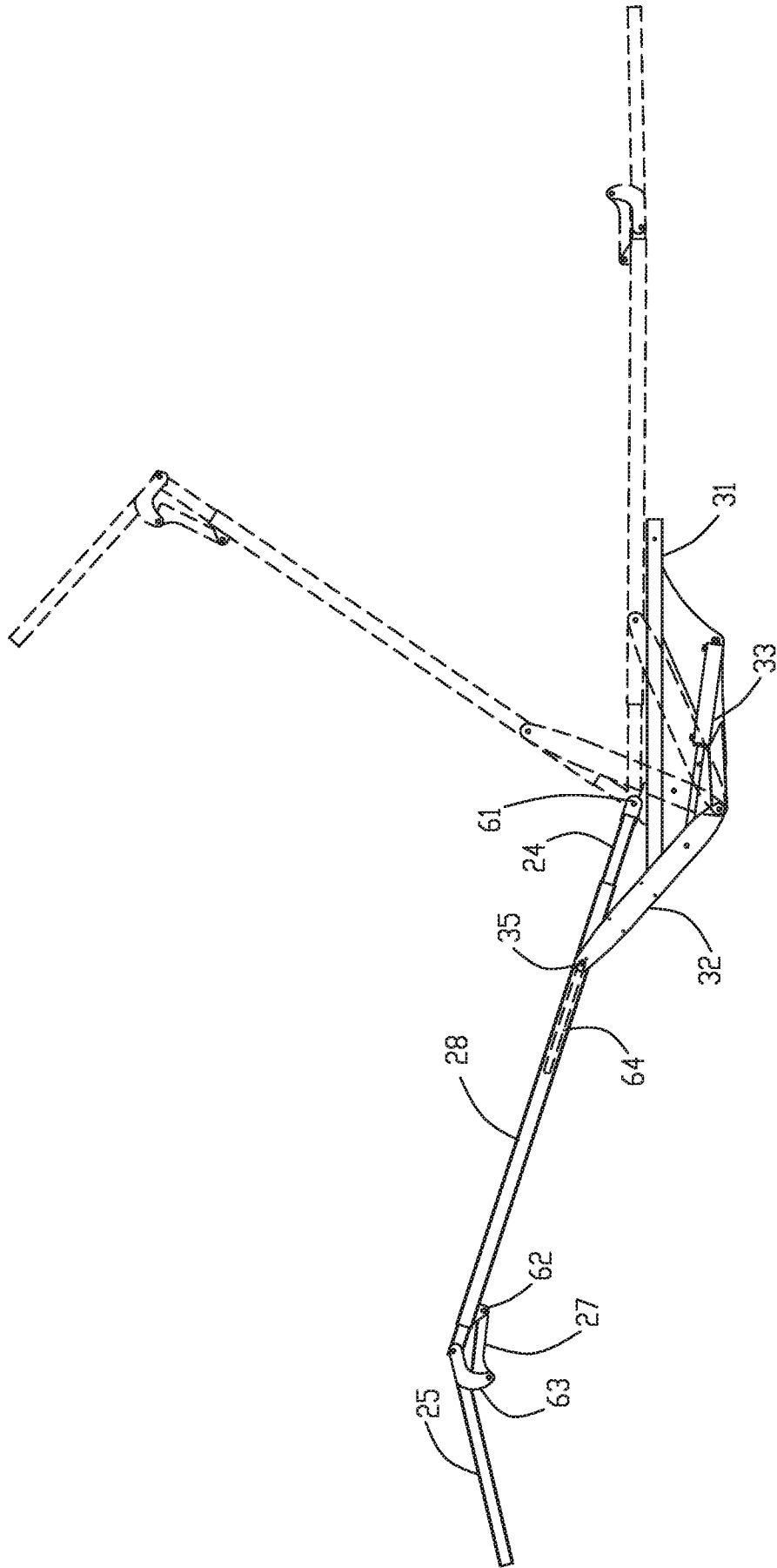


FIG. 4



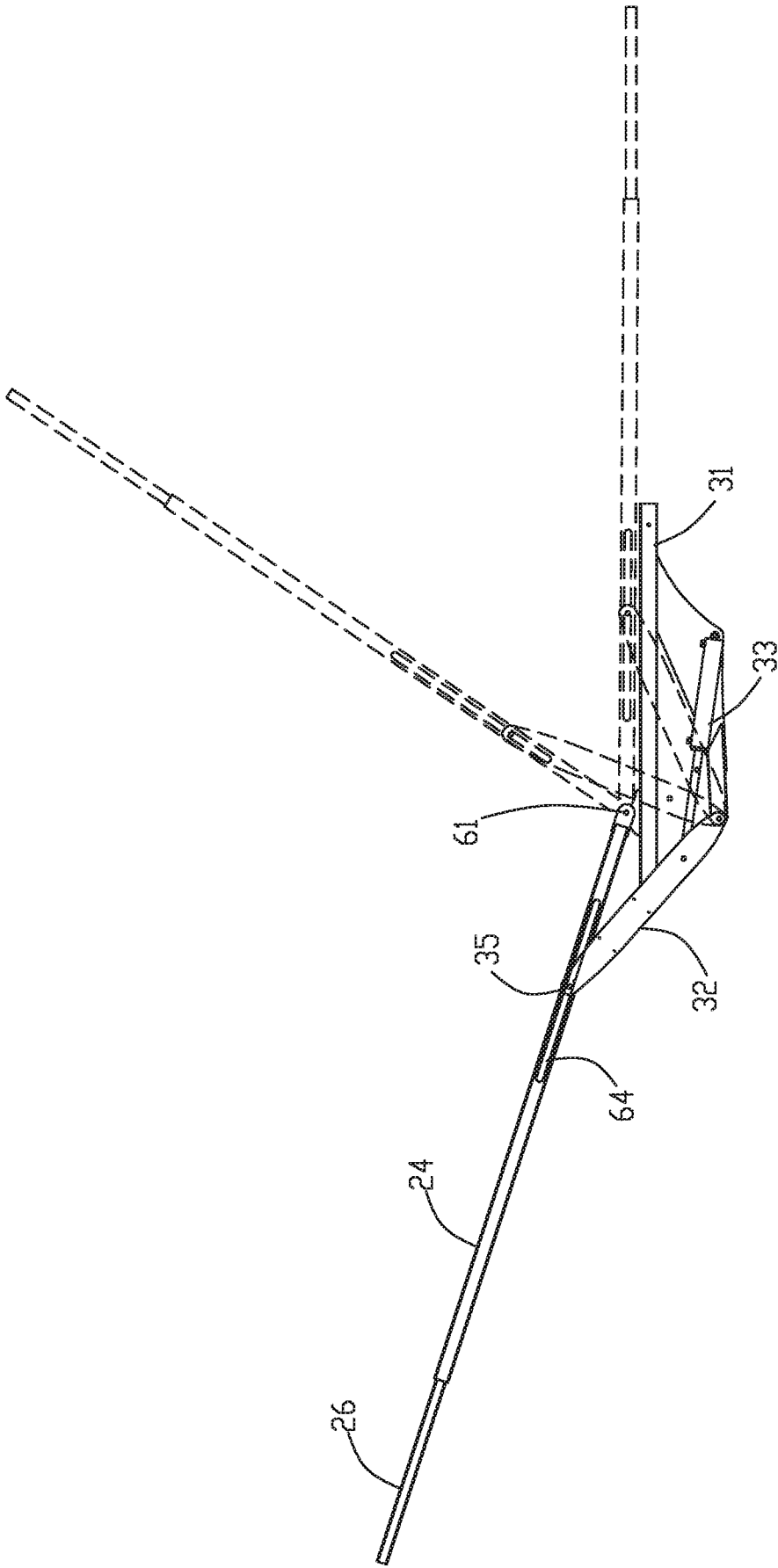


FIG. 6

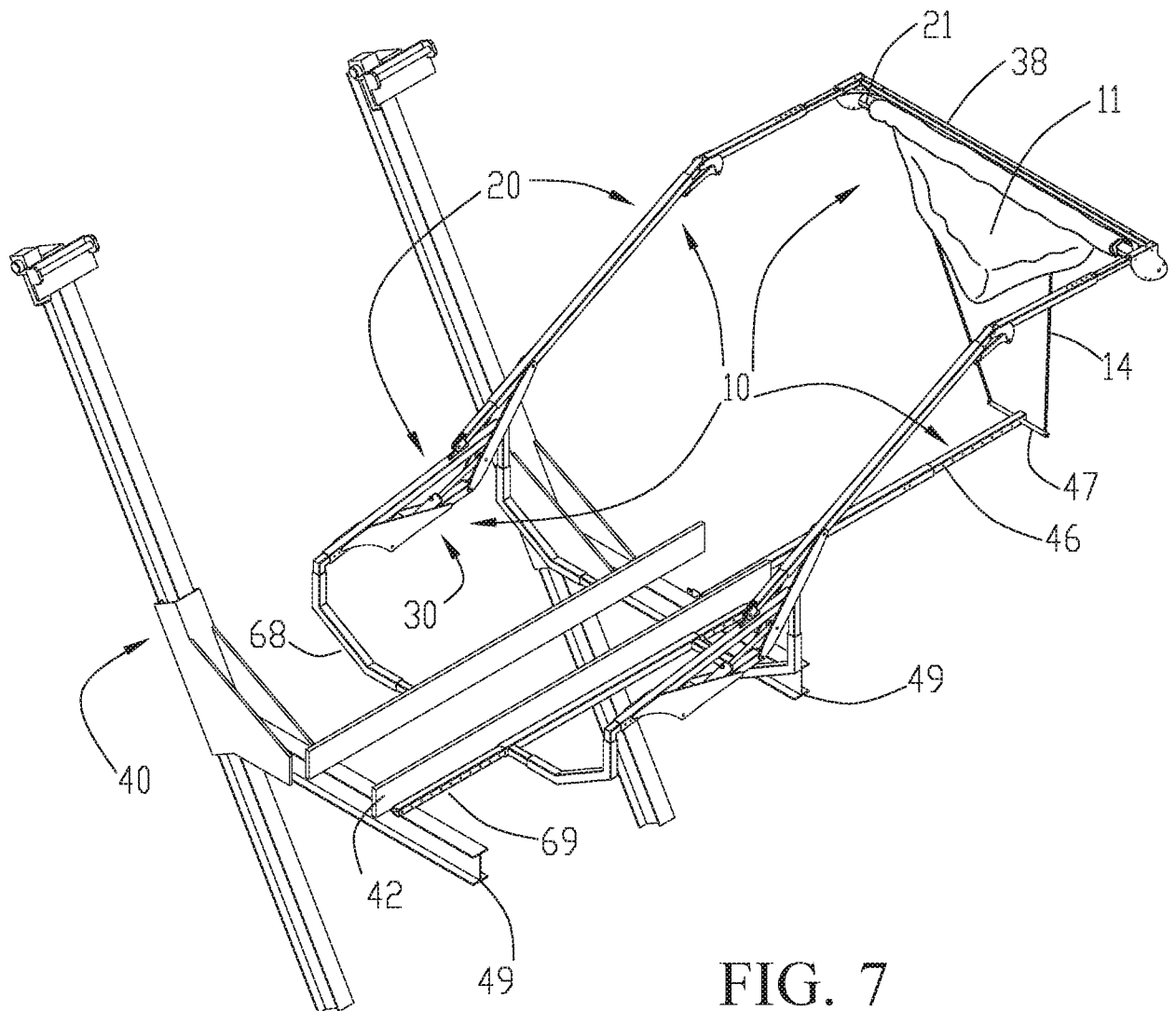


FIG. 7

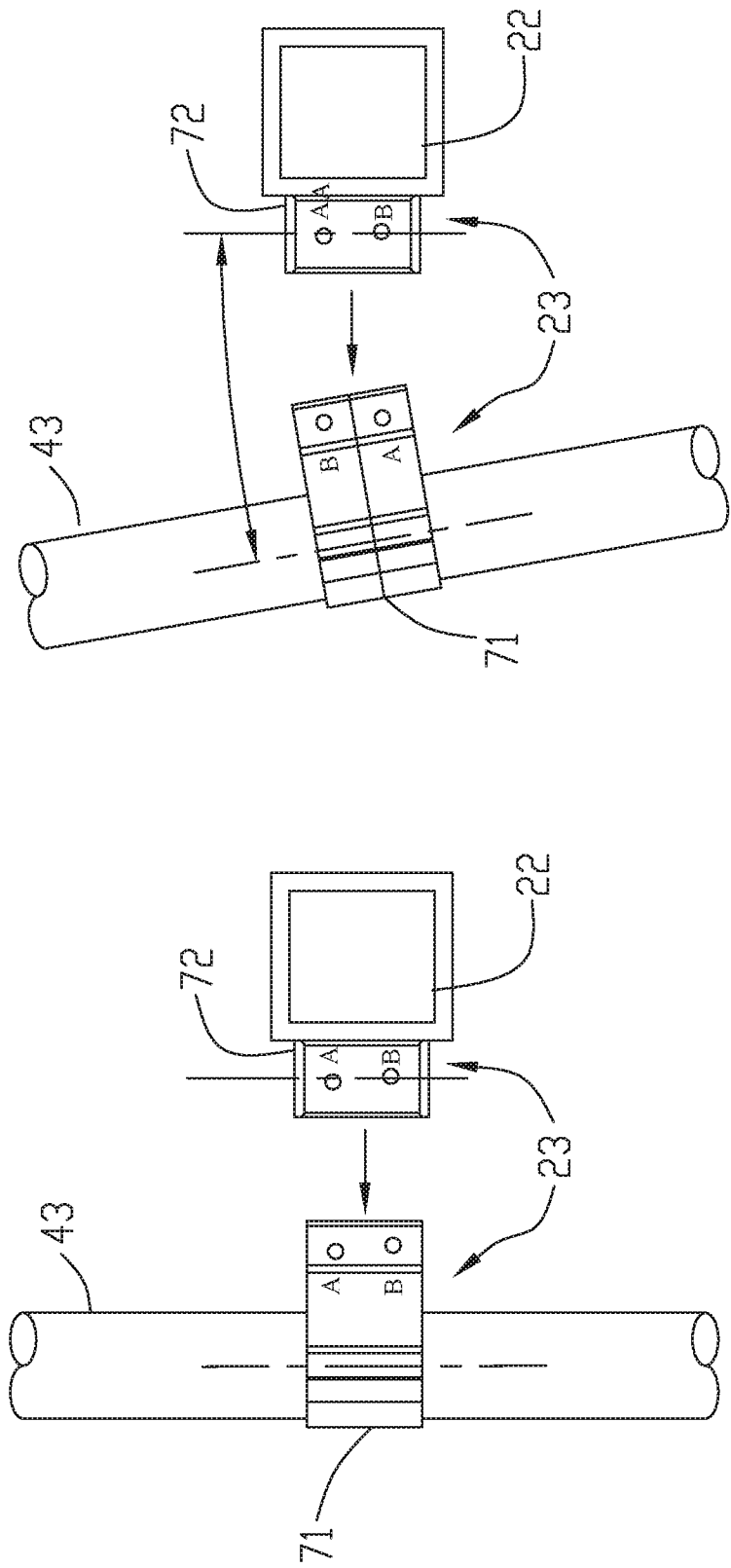


FIG. 8

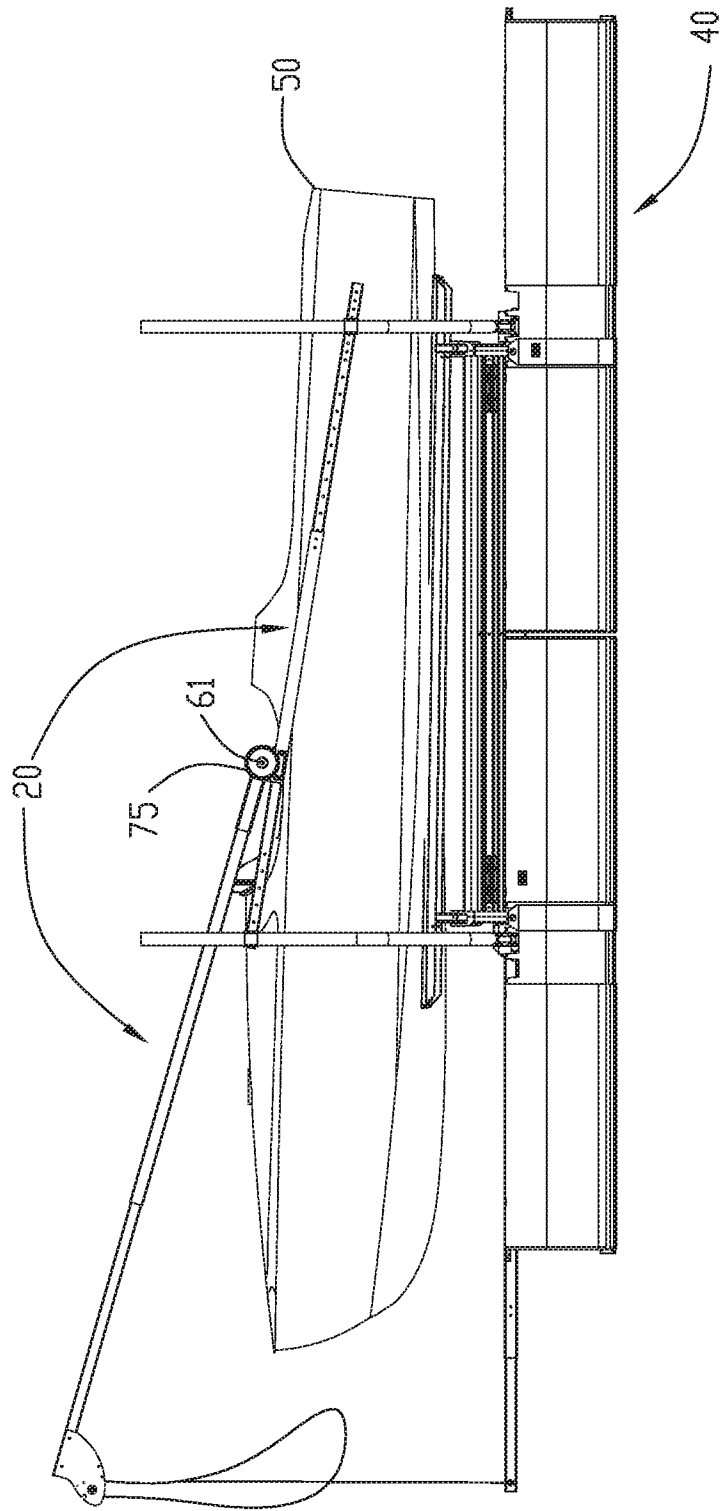


FIG. 9

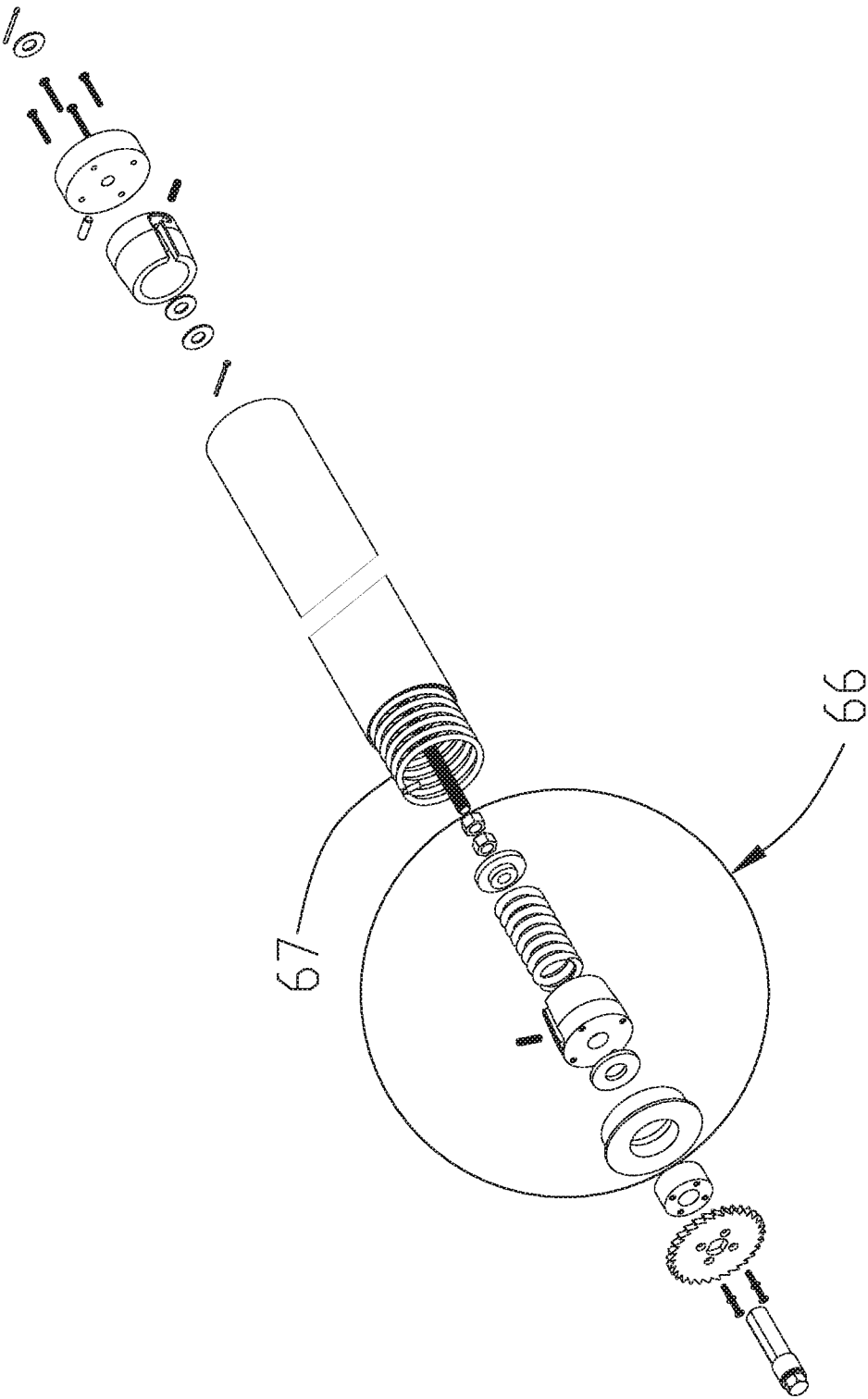


FIG. 10

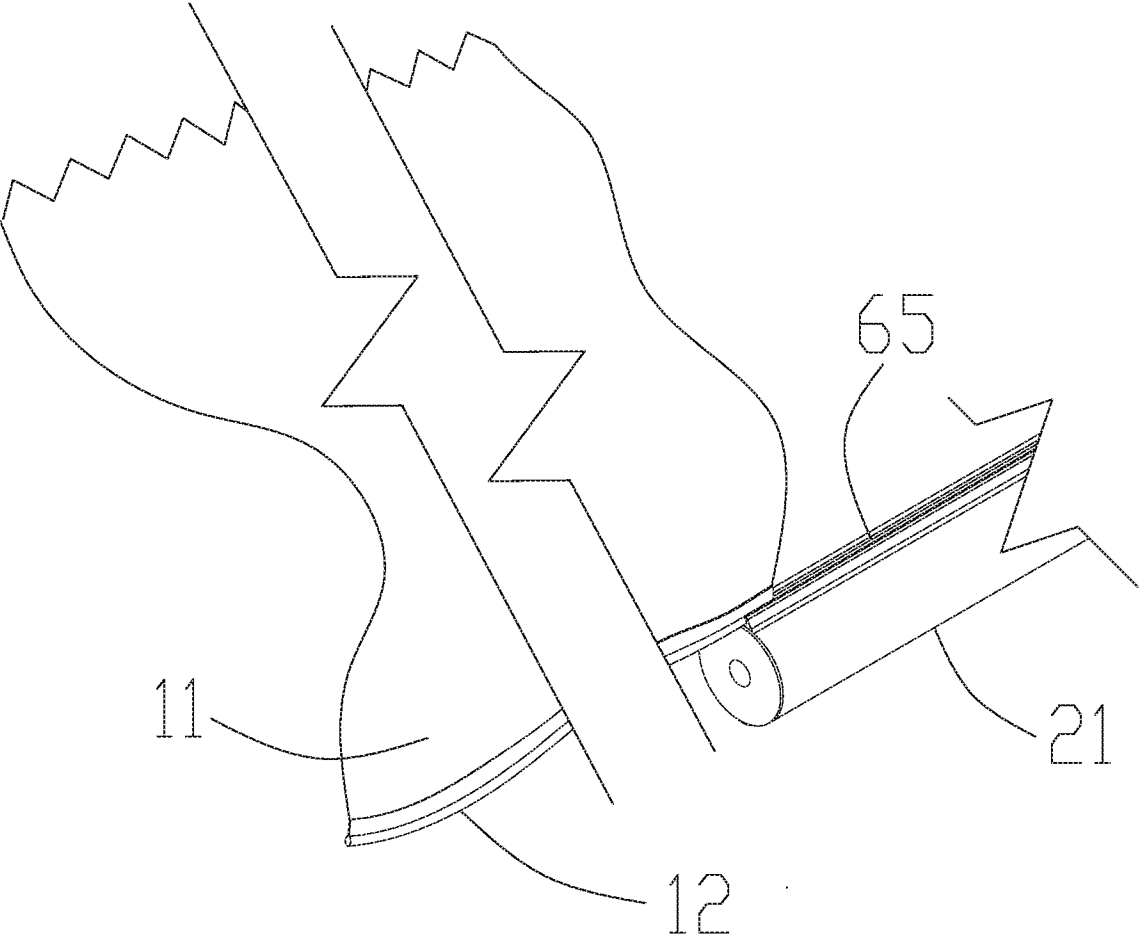


FIG. 11

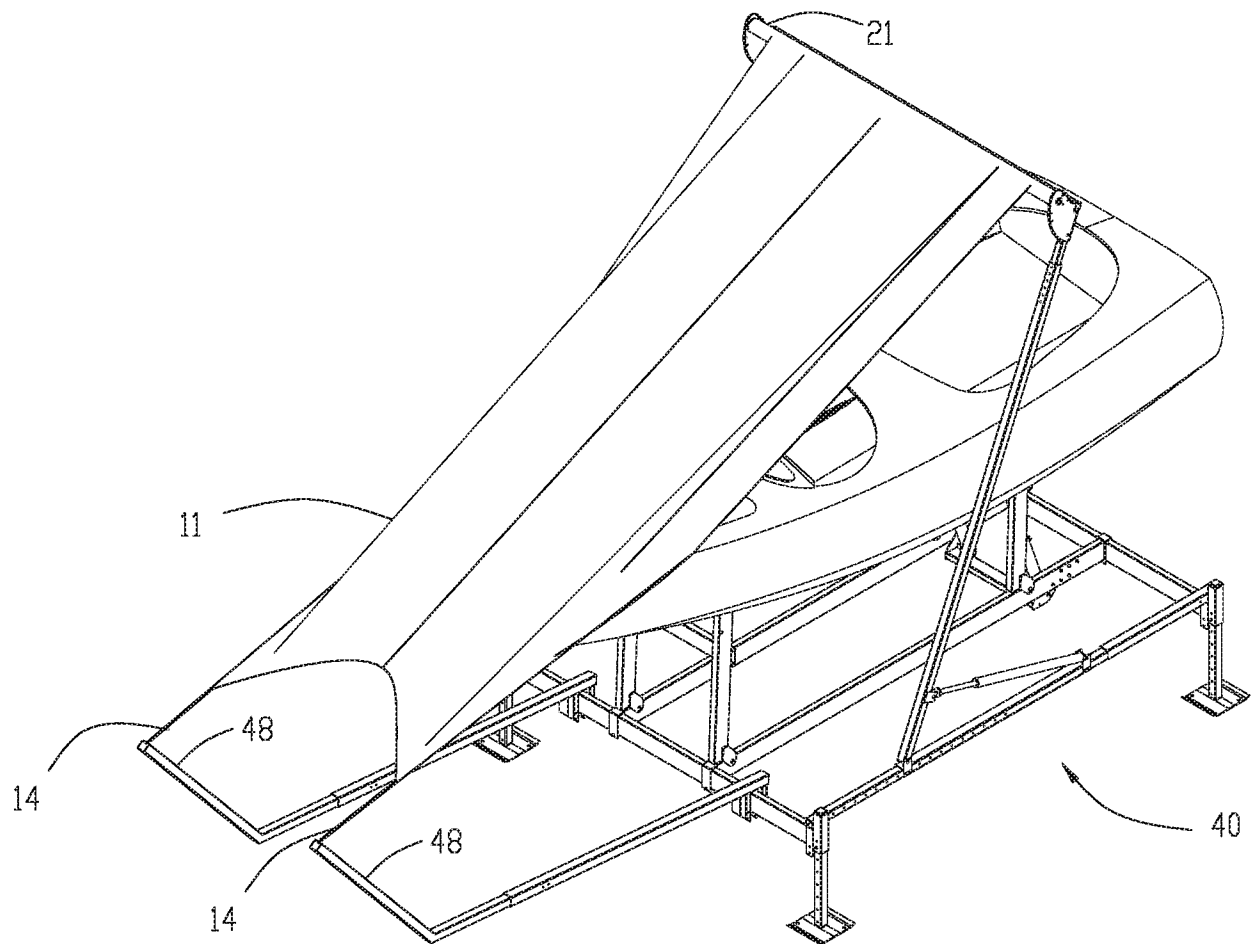


FIG. 12

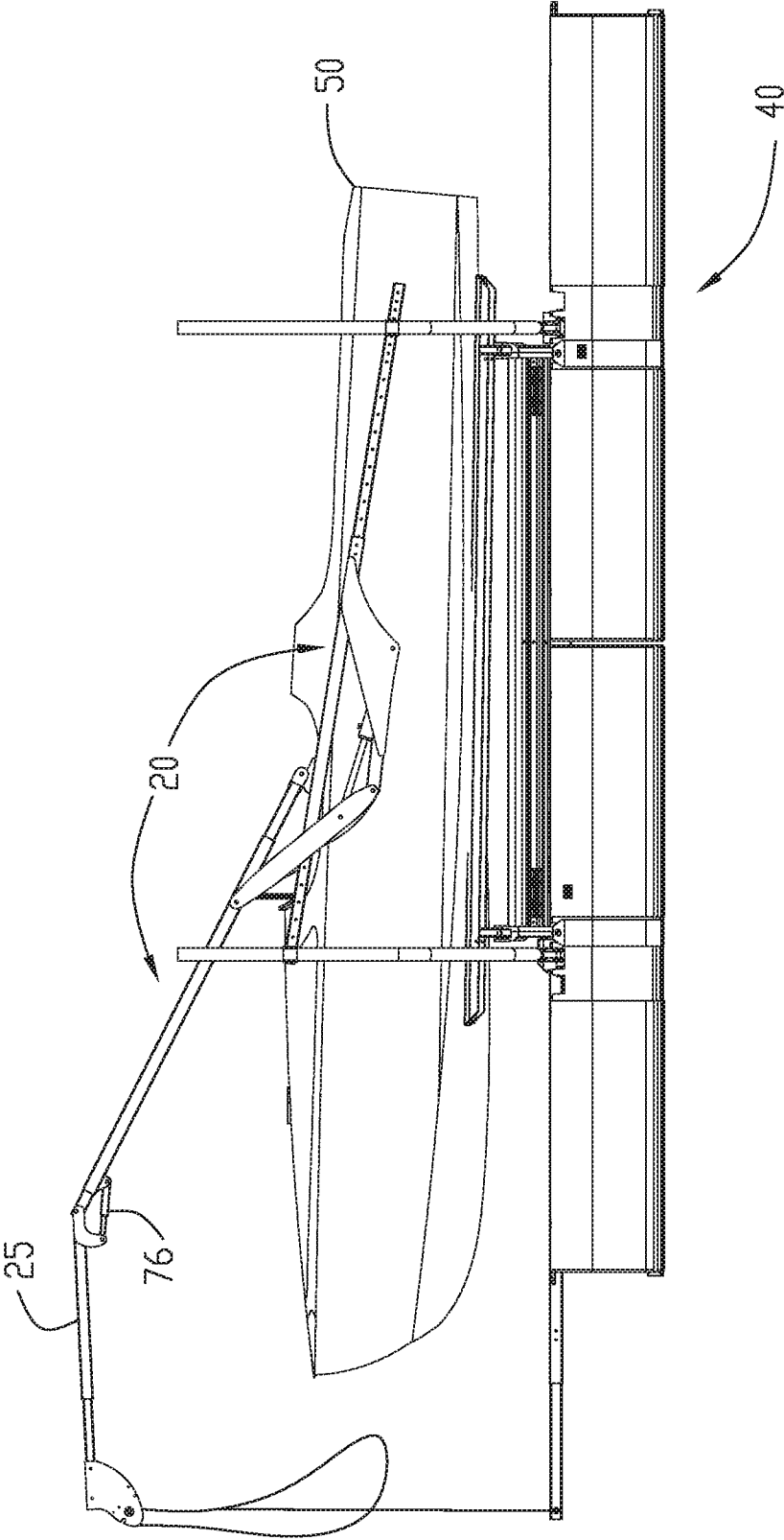


FIG. 13

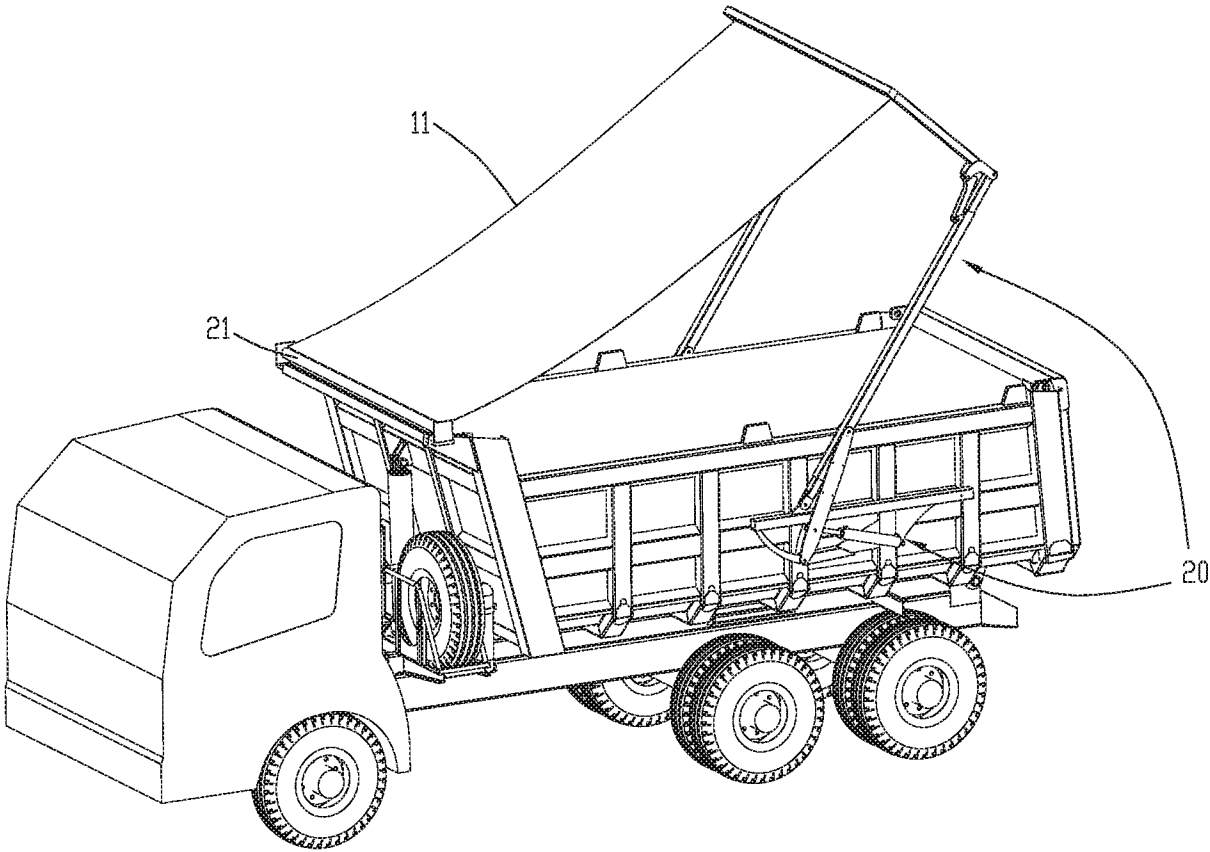


FIG. 14

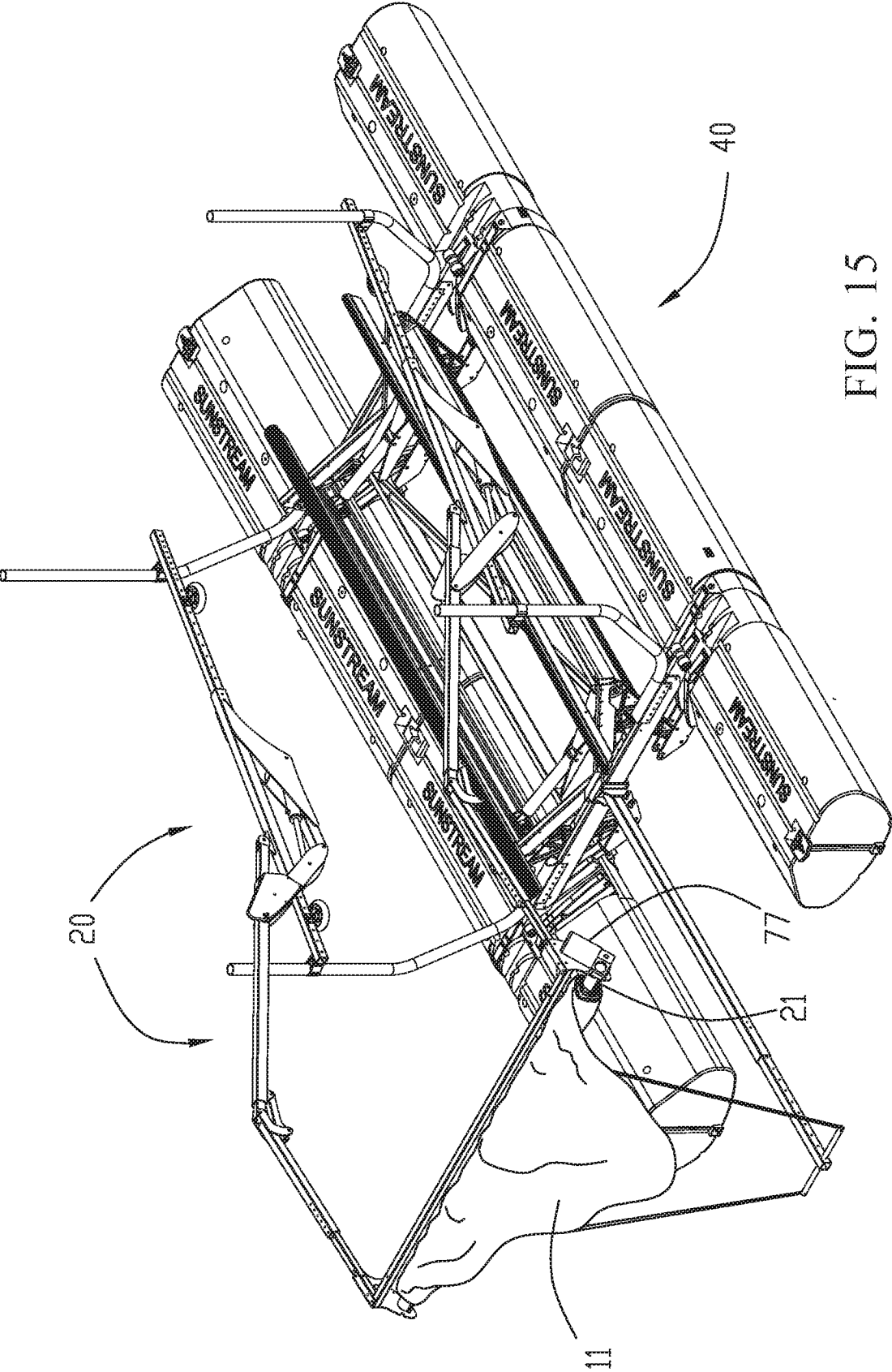


FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/032963

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B63C 3/06; B60J 7/08; B63B 17/02; E04H 6/04 (2017.01)

CPC - B63C 3/06; B60J 7/08; B63B 17/02; E04H 6/04 (2017.08)

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)

See Search History document

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

USPC - 114/361; 135/90; 135/156; 296/98; 296/100.14; 405/3 (keyword delimited)

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

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2015/0321730 A1 (SUNSTREAM CORPORATION) 12 November 2015 (12.11.2015) entire document	1, 17, 18, 25-27 --- 5, 19
Y	US 5,292,169 A (O'BRIAN) 08 March 1994 (08.03.1994) entire document	5, 19
A	US 5,813,360 A (DICKEY, JR.) 29 September 1998 (29.09.1998) entire document	1-10, 17-19, 25-28
A	US 7,001,104 B2 (EDSON) 21 February 2006 (21.02.2006) entire document	1-10, 17-19, 25-28
A	US 5,269,332 A (OSBORNE) 14 December 1993 (14.12.1993) entire document	1-10, 17-19, 25-28

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

31 August 2017

Date of mailing of the international search report

19 OCT 2017

Name and mailing address of the ISA/US

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P.O. Box 1450, Alexandria, VA 22313-1450

Facsimile No. 571-273-8300

Authorized officer

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/032963

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
See extra sheet(s).

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-10, 17-19, 25-28

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/032963

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees need to be paid.

Group I, claims 1-10, 17-19, 25-28 are drawn to a watercraft covering apparatus for use with a frame.

Group II, claims 11-16, 24 are drawn to a mechanical apparatus for use to move a swing arm up to 180 degrees using a linear actuator.

Group III, claims 20-23 are drawn to a watercraft cover comprising a perimeter pocket.

Note, Claim 24 is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because claim 24 is indefinite for the following reason: Claim 24 originally depends from claim 2. However, there is no antecedent basis for "the spring." Claim 13 introduces a spring, and therefore, it is best understood for the purpose of this written opinion that claim 24 depends from claim 13 and has been treated as such.

The inventions listed in Groups I, II, and III do not relate to a single general inventive concept under PCT Rule 13.1, because under PCT Rule 13.2 they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I, a watercraft covering apparatus for use with a frame adapted to accommodate a watercraft having a bow and a stern comprising an elongated roller having a side portion rotatably supported by an upper end portion of a swing arm for travel, a watercraft cover substantially fully wound about the elongated roller when the upper end portion of the swing arm is in a first position, the cover being sized to lengthwise extend over and cover the watercraft when the swing arm is moved to a second position and the watercraft is supported by the frame, a torsion member configured so that the elongated roller is rotated in a first rotational direction when the swing arm is moved to a first position, and rotated the opposite direction when the swing arm is moved to a second position with sufficient torque to roll the cover on the elongated roller, are not present in Groups II, III; the special technical features of Group II, a mechanical apparatus for use to move a swing arm up to 180 degrees using a linear actuator comprising at least one swing arm, an actuation member with a second end pivotally connected to a follower member, a follower member with a lower end pivotally connected to a mechanism base and an upper portion pivotally connected to a driving pin; the driving pin is connected to a longitudinal slot in the swing arm, when the follower is in a first position the swing arm is in a first position, and when the follower is in a second position, the swing arm is in a second position, are not present in Groups I, III; and, the special technical features of Group III, a watercraft cover, an aft portion of the cover is a longitudinal sewn shape keder bead for the purpose of securing the cover to a track, a perimeter pocket sewn into the perimeter of the aft section of the cover an elastic member on the port and starboard sides in the perimeter pocket with one end attached to the cover and the other end extended out of the cover, are not present in Groups I, II.

Groups I, II share the technical features of at least one swing arm having a lower end portion pivotally attached to a mechanism base, the one swing arm being pivotable between a first position to a second position, an actuation member with one end pivotally connected to the mechanism base. However, these shared technical features do not represent a contribution over the prior art.

Specifically, US 8,911,174 B2 to Hey et al. teaches of at least one swing arm (26, Fig. 1) having a lower end portion pivotally attached (at 61, Fig. 1) to a mechanism base (30, Fig. 1), the one swing arm being pivotable between a first position (Fig. 1) to a second position (Fig. 3), an actuation member (34, Fig. 1) with one end pivotally connected (at 62, Fig. 1) to the mechanism base (30, Fig. 1).

Groups I, III share the technical features of a watercraft cover with a front end and aft end, at least one securing detail in the cover, and the aft portion secured on the elongated roller to secure the cover on the elongated roller. However, these shared technical features do not represent a contribution over the prior art.

Specifically, US 8,911,174 B2 to Hey et al. teaches of a watercraft cover (22, Fig. 2) with a front end (left 22, Fig. 2) and aft end (right 22, Fig. 2), at least one securing detail in the cover (44, 45, Figs. 2, 5), and the aft portion secured on the elongated roller (24, Fig. 3) to secure the cover on the elongated roller (see Figs. 1-3).

Since none of the special technical features of the Groups I, II, and III inventions are found in more than one of the inventions, unity is lacking.