United States Patent

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[54] **ANCHOR WINDLASS FOR A MARINE VESSEL**
8 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... **254/150 R, 192/18 A, 254/187 R**
[51] **Int. Cl.** **B66d 1/30**
[50] **Field of Search** 254/150, 187; 192/18, 18.1

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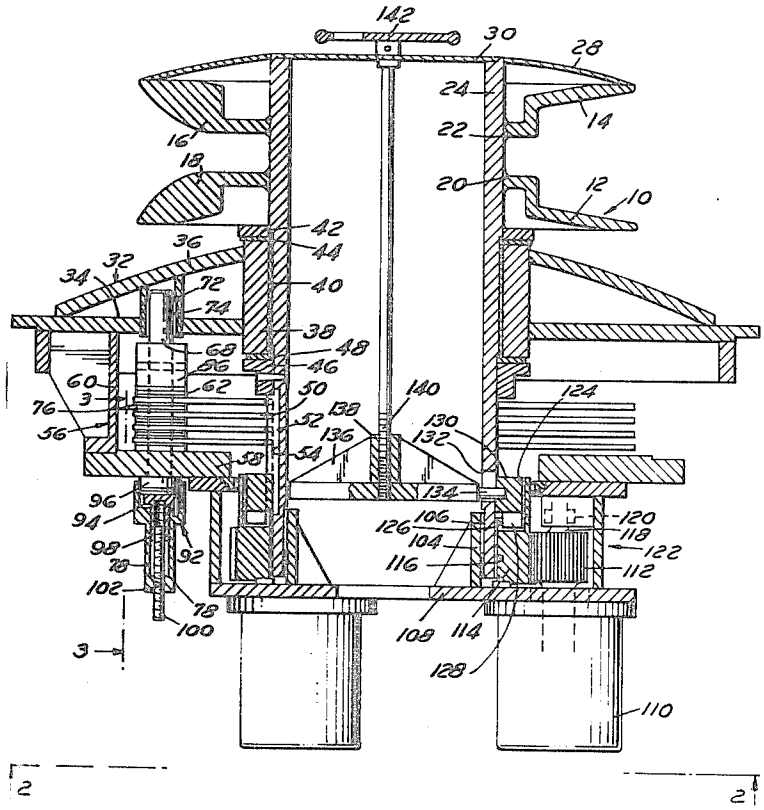
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ABSTRACT: A powered windlass mechanism comprising an anchor chain winding drum or wildcat, a main support shaft carrying at its upper end the winding drum, driving motors geared to the main support shaft at its lower end, disc brake means for anchoring the main shaft and coupling means for connecting and disconnecting the main shaft and the drive gearing, all of the elements of the windlass mechanism being located in a common housing secured to the deck of a marine vessel.

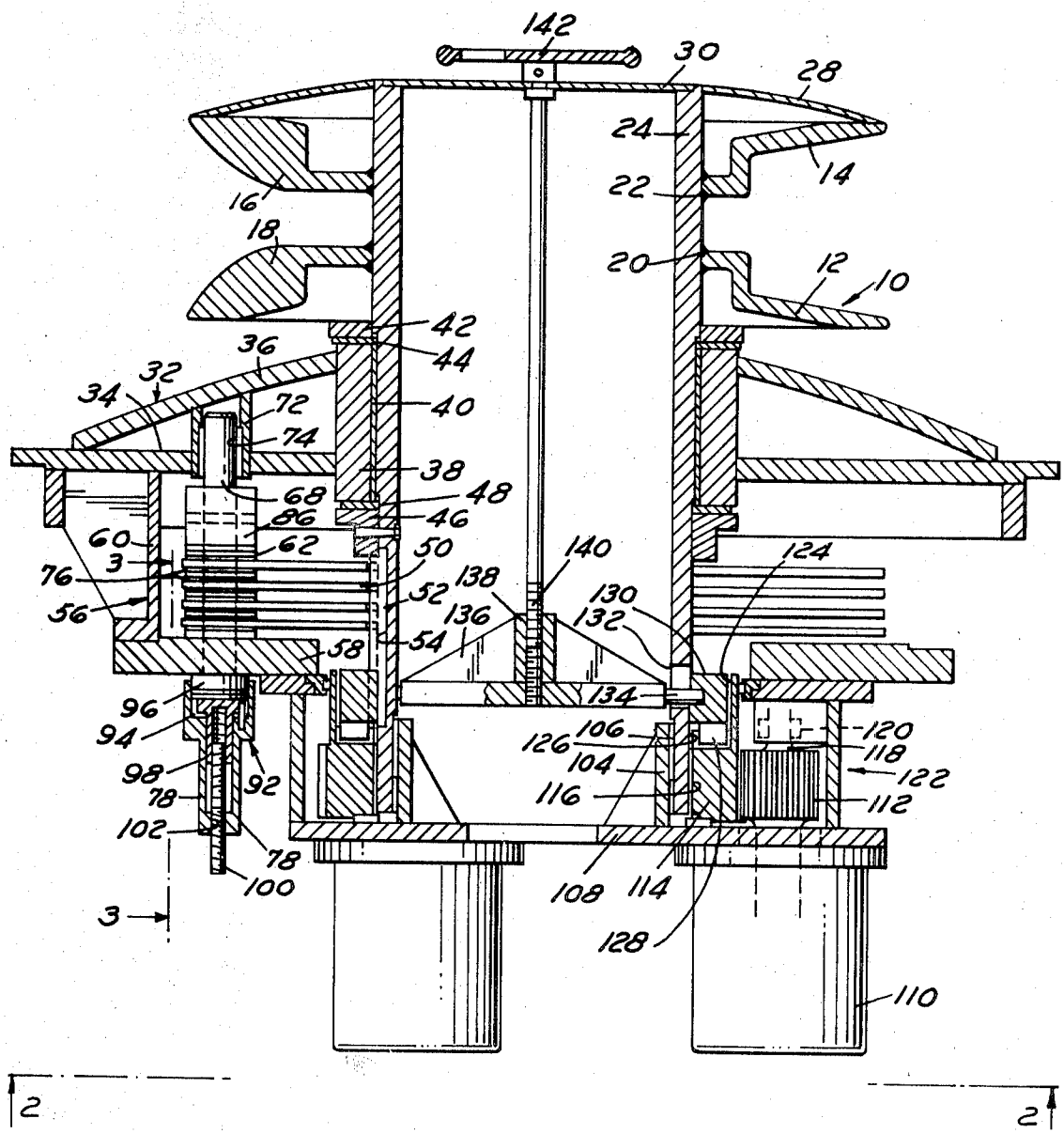


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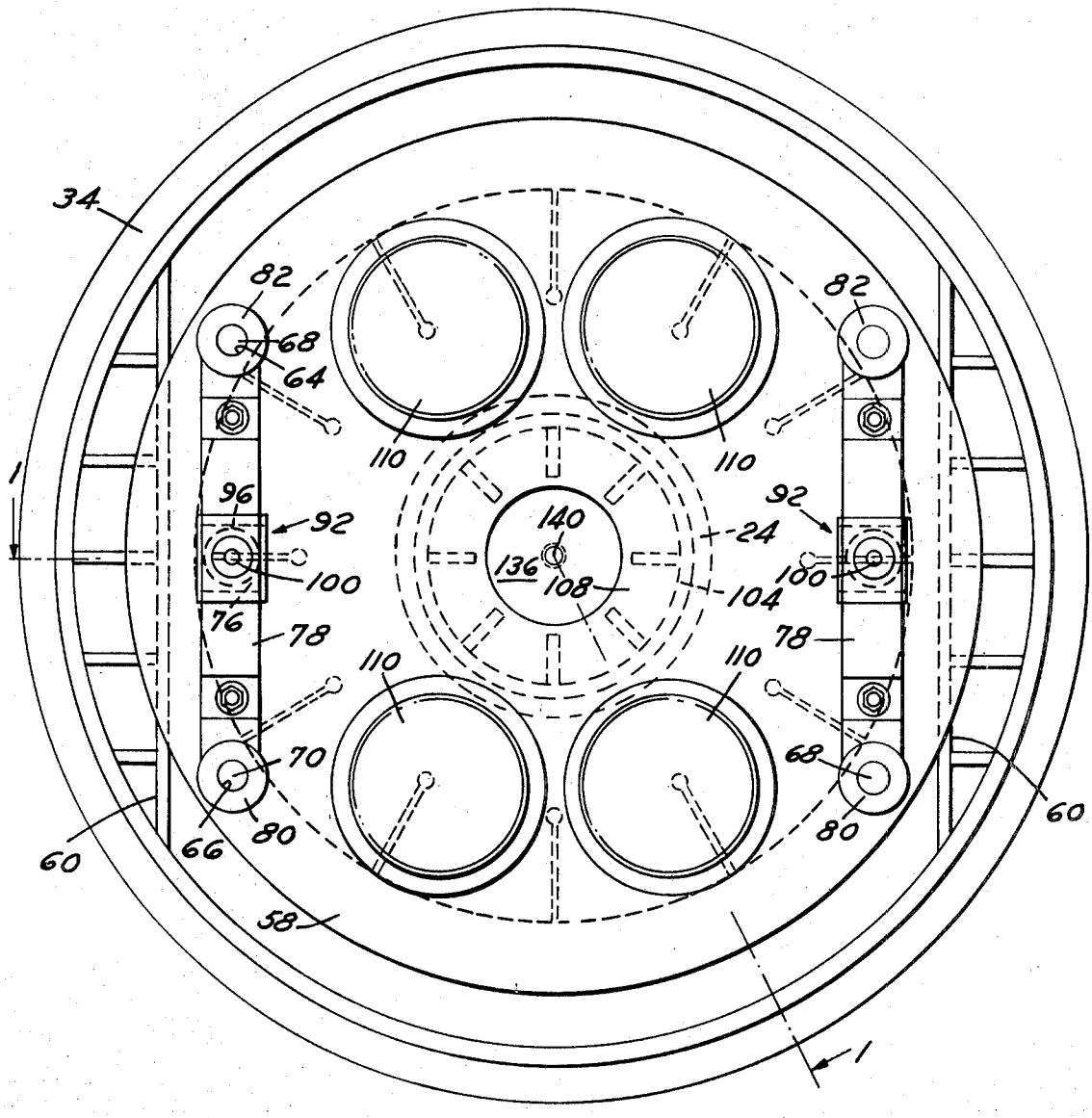
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FIG. 1



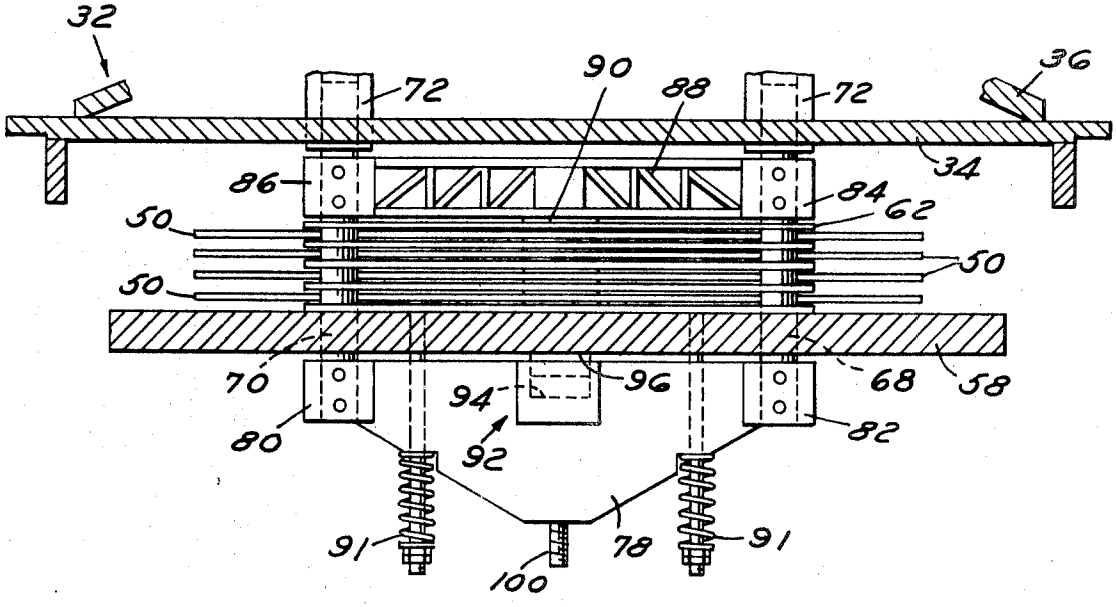
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FIG. 2



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FIG. 3



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ANCHOR WINDLASS FOR A MARINE VESSEL

This is a continuation of application Ser. No. 734,069, filed June 3, 1968 and now abandoned.

GENERAL DESCRIPTION OF THE INVENTION

In the design of an anchor windlass for a marine vessel it is usual practice to provide the anchor chain winding drum at an upper deck location. The drum is keyed directly to a main shaft which extends vertically from an upper deck location to a lower deck location. Drive gearing for the main shaft is mounted at the lower deck station together with driving motors. It is usual practice also to provide a relatively large diameter brake drum and friction brake band for anchoring the main shaft.

The brake drum and its associated brake band operators are also located at the lower deck station, thereby causing a space penalty. Alignment of the main shaft bearing at the lower deck station with respect to the main shaft bearing and the supporting structure for the wildcat assembly at the upper deck station also is a serious problem because of the wide tolerances that exist for any reference point at one deck with respect to a corresponding point at another deck. Flexure or strain of the ship's hull also causes transient misalignment conditions which reduce the reliability of the anchor windlass in its operation.

Our improved anchor windlass overcomes shortcomings in conventional designs by incorporating into a common windlass housing structure the drive gearing, the drive motors for the windlass, the main shaft for the wildcat assembly, the brake for anchoring the main shaft and the locking head for connecting and disconnecting drivably the main shaft and the torque delivery gearing.

Free falling motion of the anchor chain is permitted as the locking head disconnects the main shaft from the torque delivery gearing. The free falling motion of the anchor chain either can be retarded or interrupted by an anchor brake which comprises brake discs carried by the main shaft in registry with brake discs anchored to the common housing. A pressure servo operator for the brake assembly supplies braking force to the discs by means of a series of spot brake pads. The reaction force for the brake servo opposes and substantially balances the braking force applied to the spot brake pads.

The gearing comprises multiple, high torque, fluid motors, each of which powers a drive pinion. The drive pinions engage a common ring gear which, in turn, is drivably connected through the locking head to the main shaft.

The common housing assembly is mounted at a single deck location.

BRIEF DESCRIPTION OF THE FIGURES OF THE DRAWINGS

FIG. 1 shows in vertical cross-sectional form an assembly view of our improved windlass. It is taken along section line 1—1 of FIG. 2.

FIG. 2 is an end view as seen from the plane of section line 2—2 of FIG. 1.

FIG. 3 is a sectional view as seen from the plane of section line 3—3 of FIG. 1.

PARTICULAR DESCRIPTION OF THE INVENTION

In FIG. 1 numeral 10 designates a wildcat drum for receiving an anchor chain that comprises a pair of side flanges 12 and 14 between which is trained the anchor chain. The anchor chain links engage chain driving webs 16 and 18 which form teeth at angularly spaced intervals about the axis of the drum 10.

The hub of the drum 10 is welded as shown at 20 and 22 to the upper end of a hollow main shaft 24. The shaft extends in a vertical direction with respect to the plane of the ship's deck, the deck line being designated in FIG. 1 by reference character 26. A wildcat cover plate 28 extends over the side flange 14 and registers with the upper end of the main shaft 24. The upward open end of the shaft 24 is closed by a closure plate 30.

A windlass housing is designated generally by reference character 32. It includes a base plate 34, and a supporting plate 36. These are secured to a bearing sleeve 38 through which the main shaft 24 extends. A bushing 40 provides a journal for the shaft 24 within the sleeve 38. A bearing ring 42 is situated between the hub of the side flange 12 for wildcat wheel 10 and bushing 44 which registers with the upper surface of the bearing block 38.

A thrust ring 46 is secured to the main shaft 24 below the bearing block 38. A thrust washer 48 is mounted between block 38 and ring 46.

Keyed to lower portion of the main shaft 24 is a series of brake discs shown at 50. The inner margins of the discs 50 may be formed with keyways that receive keys 52, which in turn are carried in key slots 54 formed in the outer surface of the main shaft 24.

A brake housing 56 is joined to the base plate 34 at a location below the deck line 26. It includes a base plate 58 joined at its radially outward margin to sidewall portion 60 of the housing 56. A plurality of brake bars 62 register with the discs 50 as indicated in FIG. 1. The bars 62 extend in the direction of a secant to the outer margin of the discs, and each bar 62 is apertured at its ends as shown at 64 and 66. Brake actuator shafts 68 and 70 extend through the apertures 64 and 66, respectively.

The upper end of shaft 68 is received within a pilot portion 72 of the housing 32. Pilot portion 72 receives bushing 74 to permit sliding support for the upper end of the shaft 68. A similar pilot portion and a similar bushing for the shaft 70 is provided, although it is not illustrated in FIG. 1.

Each brake bar 62 has friction material 76 formed at intermediate locations on both its upper surface and its lower surface. The friction material forms pads that are aligned as shown in FIG. 1.

The lower ends of the shafts 68 and 70 are joined by a brake actuator member 78. The brake member 78 is provided with spaced pilots 80 and 82 in the openings that receive the lower ends of the shafts 68 and 70. Shafts are pinned or otherwise secured in the eyelets 80 and 82. The upper ends of the shafts 68 and 70 are received in eyelets 84 and 86, as indicated in FIG. 3, and are pinned or otherwise secured fast to the eyelets 84 and 85. These eyelets are joined together by a cross beam 88 which, by preference, is a structured, minimum-deflection beam. The center of the beam 88 engages a friction pad 90 which is the uppermost member of the series of friction pads formed by the friction material 76.

The brake shafts 68 and 70 and the beam 88 are supported by counterbalance springs 91 which balance the free weight of the movable brake elements.

A brake servo is shown in FIG. 1 at 92. It comprises a pressure cylinder 94 formed in the brake member 78. The cylinder receives a pressure movable wall or piston 96 which cooperates with the cylinder to define a pressure cavity. The piston 96 engages directly the base plate 58 of the brake disc housing. As fluid pressure is admitted to the cavity behind the piston member 96, a pressure force is established on the brake member 78, thereby tending to separate the member 78 from the piston 96. This causes a clamping force to be applied to the brake bars 62 through the shafts 68 and 70, thereby applying a braking effort to the friction pads. The piston member 96 is joined directly to a cylindrical extension 98 received within the lower region of the brake member 78. Extension 98 is internally threaded to receive a threaded shaft 100 which in turn is threadably received in threaded opening 102 formed in the base of the member 78. The brakes can be applied mechanically by advancing the threaded shaft 100 into the member 78 so that it can apply a force to the member 96. The reaction for the force applied to the member 96, of course, is transferred through the shafts 68 and 70 to the ends of the brake bars 62.

The ability to apply braking pressure to the brake discs mechanically makes it possible to brake the windlass regardless of whether fluid pressure is available for the hydraulic brake line that feeds braking pressure to the cylinder **94**.

The shaft **24** is received telescopically over circular base **104**. A bushing **106** is received within the lower end of the shaft **24** so that it can be piloted on the member **104**. The member **104** in turn is secured to base plate **108**. Secured to the lower end of base plate **108** is a series of fluid motors **110**, preferably four in number. These may be vane motors adapted for high torque, low speed operation.

Each motor has a rotor that is connected to a driving pinion **112**. Pinions **112** in turn engage a common ring gear **114**. This in turn is journaled by means of a bushing **116** on the outer surface of the lower end of shaft **24**. Pinions **112** are end supported by means of bearing shafts **118** journaled within bearing blocks **120**. Blocks **120** are secured to the inner surface of housing **122**.

Ring gear **114** is formed with a counterbore **124**, and forms at its base a series of dog clutch teeth **126**. These are adapted to register with dog clutch teeth **128** carried by clutch ring **130**.

The ring **130** is adapted to move vertically along the outer surface of the main shaft **24**. The main shaft **24** is formed with aligned slots **132** situated at angularly spaced positions with respect to the axis of shaft **24**. Extending through these slots are crossbars **134** which are received within openings formed in the clutch ring **130**. As the crossbars **134** are moved vertically in the slots **132** from the position shown in FIG. **1**, the dog clutch teeth **126** and **128** become disengaged. When the crossbars **134** assume the position shown in FIG. **1**, ring gear **114** becomes locked to the main shaft **24**, thereby making it possible for the motors **110** to drive the main shaft **24** through the high ration gearing.

Crossbar **134** is carried by a locking head **136** situated within the main shaft **24**. The hub of the locking head is formed with a threaded adapter **138** within which is received a threaded actuator shaft **140**.

The actuator shaft **140** extends vertically through the main shaft **24**. The upper end of the main shaft **24** is provided with a locking head actuator wheel **142** which is connected directly to the shaft **140**. When the actuator wheel **142** is rotated, the locking head **136** is raised and lowered thereby allowing the dog clutch teeth **126** and **128** to become engaged and disengaged. When they are disengaged, the wildcat drum **10** freewheels as the anchor chain is dropped. There is no feedback motion through the gearing to the motors in this instance. The brake can be controlled to stop the fall of the chain or to retard the rate of fall, whichever is desired, simply by controlling the degree of actuation of the brake servo.

Having thus described a preferred form of our invention, what we claim and desire to secure by U.S. Letters Patent is:

1. An anchor windlass comprising a winding drum, a main shaft secured to said drum, a windlass housing including a brake housing portion and a gearing housing portion, means for journaling rotatably said main shaft in said housing, a plurality of driving motors secured to said housing, a ring gear journaled for rotation about an axis coinciding with the axis of said main shaft for driving said main shaft, a plurality of driving pinions, each driving pinion being connected drivably to one of said driving motors, each pinion meshing with said ring gear, brake discs coaxially mounted with respect to said main shaft and drivably connected thereto, a plurality of brake bars situated in interdigital relationship with respect to said brake discs, an intermediate portion of each brake bar having a friction surface thereon, brake actuator shafts extending through the ends of said brake bars in a direction parallel to the axis of said main shaft, a crossbar on one side of said brake bars, said crossbar being connected to and joining together corresponding ends of said brake shafts, and a brake servo having relatively displaceable parts, one part being joined to and connecting together the other ends of said brake shafts and other part being substantially aligned with the friction surfaces formed on said brake bars whereby the braking force applied to said brake discs is opposed and balanced by a reaction force on said other displaceably part.

2. An anchor windlass comprising a winding drum, a main shaft secured to said drum, a windlass housing including a brake housing portion and a gearing housing portion, means for journaling rotatably said main shaft in said housing, a plurality of driving motors secured to said housing, a ring gear journaled for rotation about an axis coinciding with the axis of said main shaft, a plurality of driving pinions, each driving pinion being connected drivably to one of said driving motors, each pinion meshing with said ring gear, brake discs coaxially mounted with respect to said main shaft and drivably connected thereto, a plurality of brake bars situated in interdigital relationship with respect to said brake discs, an intermediate portion of each brake bar having a friction surface thereon, brake actuator shafts extending through the ends of said brake bars in a direction parallel to the axis of said main shaft, a crossbar on one side of said brake bars, said crossbar being connected to and joining together corresponding ends of said brake shafts, a brake servo having relatively displaceably parts, one part being joined to and connecting together the other end of said brake shafts and the other part being substantially aligned with the friction surfaces formed on said brake bars whereby the braking force applied to said brake discs is opposed and balanced by a reaction force on said other displaceably part, clutch means for connecting together said main shaft and said ring gear including a clutch ring surrounding said main shaft with clutch elements formed thereon, cooperating clutch elements formed on said ring gear, a locking head in said main shaft connected to said clutch ring, and means for moving said locking head in the direction of the axis of said main shaft to engage and disengage said clutch means.

3. An anchor windlass as set forth in claim **1**, wherein: said brake servo comprises a cylinder, said cylinder being defined in part by said brake servo part, a piston in said cylinder cooperating therewith to define a pressure cavity, said piston engaging said brake housing portion at a location substantially in alignment with the friction material formed on said brake bars whereby the braking force applied to said brake discs is opposed and substantially balanced by a reaction force on said piston.

4. An anchor windlass as set forth in claim **2**, wherein: said brake servo comprises a cylinder, said cylinder being defined in part by said servo brake part, a piston in said cylinder cooperating therewith to define a pressure cavity, said piston engaging said brake housing portion at a location substantially in alignment with the friction material formed on said brake bars whereby the braking force applied to said brake discs is opposed and substantially balanced by a reaction force on said piston.

5. An anchor windlass as set forth in claim **3**, wherein: said brake servo comprises a mechanical force transmitting element between said piston and said cylinder whereby said piston can be moved with respect to said servo brake part in a direction that develops a braking effort as mechanical brake actuating forces separate said piston from said servo brake part.

6. An anchor windlass as set forth in claim **4**, wherein: said brake servo comprises a mechanical force transmitting element between said piston and said cylinder whereby said piston can be moved with respect to said servo brake part in a direction that develops a braking effort as mechanical brake actuating force separate said piston from said servo brake part.

7. An anchor windlass as described in claim **3**, wherein: said driving motors are hydrostatic motors, said motors being spaced equidistantly around the axis of said main shaft whereby driving torque is delivered to said ring gear at multiple locations as the torque reaction forces are substantially balanced.

8. An anchor windlass as described in claim 4, wherein: said driving motors are hydrostatic motors, said motors being spaced equidistantly around the axis of said main shaft whereby driving torque is delivered to said ring gear at multiple locations as the torque reaction forces are substantially balanced.