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T. A. SHORT

3,145,974

DECK WINCH

Filed May 31, 1963

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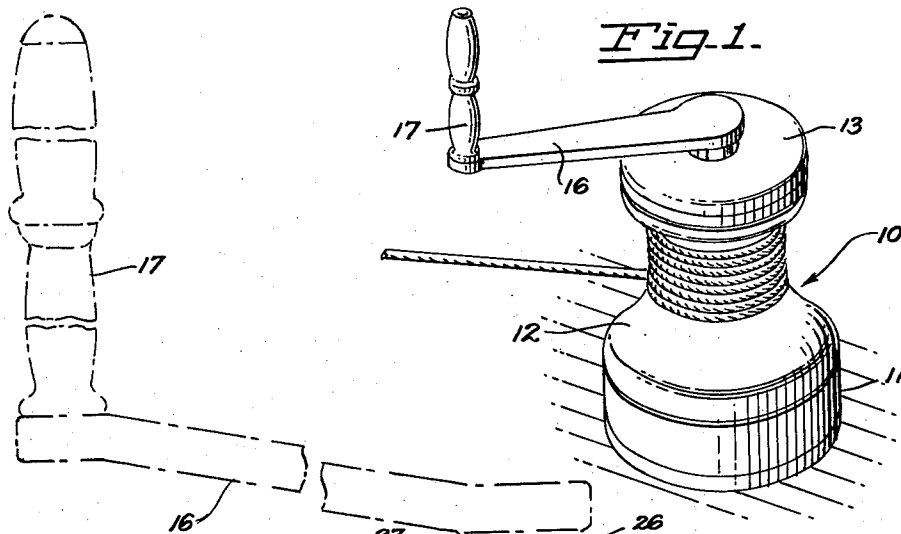
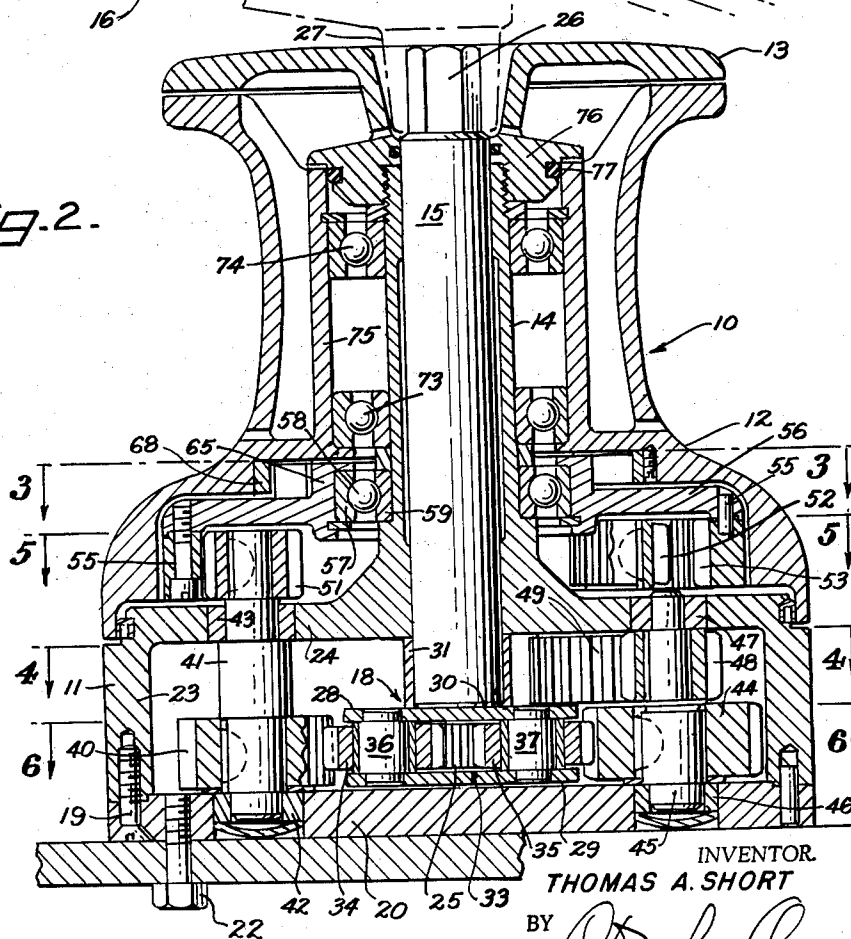


Fig. 2.



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Fig. 3.

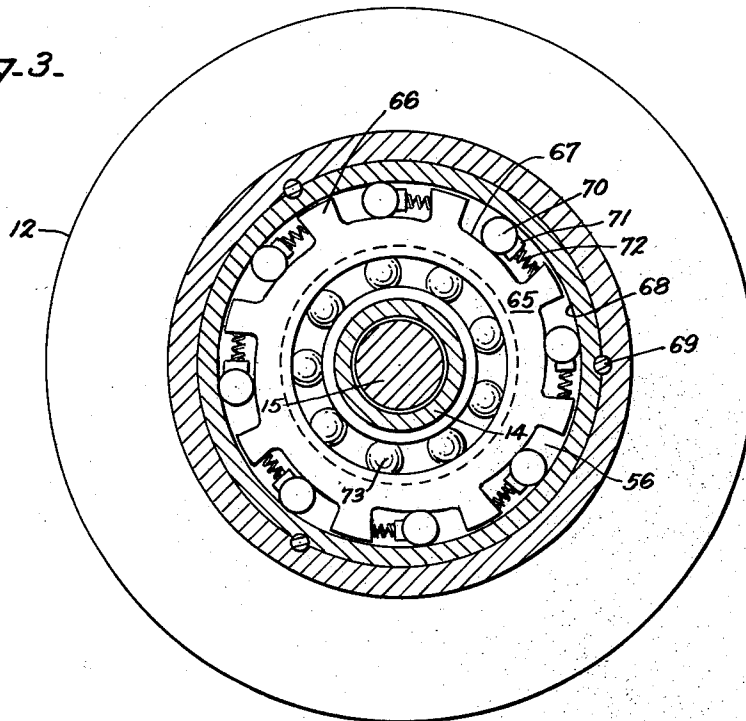
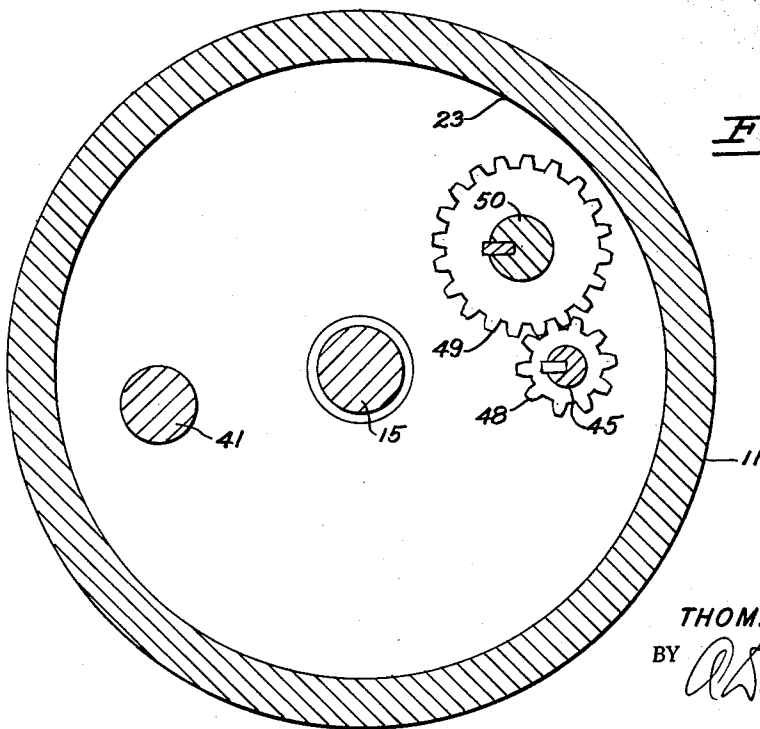


Fig. 4.



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Fig. 5.

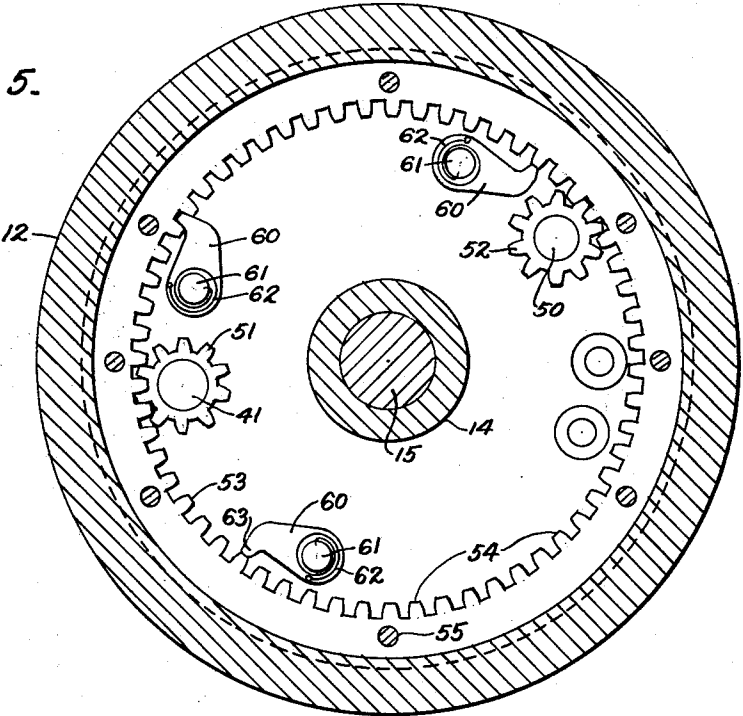
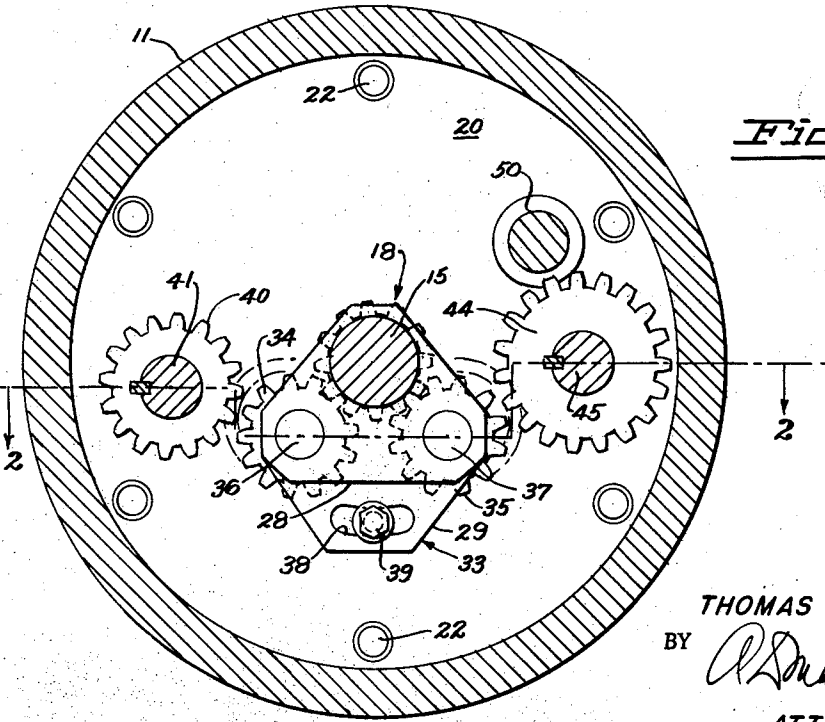


Fig. 6.

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DECK WINCH

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7 Claims. (Cl. 254—150)

This invention relates to an improved winch particularly adaptable for use as a capstan on various types of marine craft or wherever it is necessary to provide increased power for hauling or hoisting heavy weights with ropes or cables.

The capstan has long been used on ships to provide a means for winding in ropes or cables. In its most familiar form it comprises a drum or cylinder rotatably mounted on a spindle and having a bar installed diametrically through the drum with end portions extending outwardly and serving as lever arms to turn the drum. On modern day pleasure sailing boats the need arose for a capstan-like winch for pulling in the sheets, hoisting the halyards, controlling the position of the boom and many other such functions where a controllable wind-up power is needed. Basically, the problem was to provide a winch that was compact in size and yet having sufficient power and versatility to handle the various cable or rope pulling jobs on sailing craft. A general object of the invention is to provide a winch that will solve this problem, and more specifically, an improved deck winch for boats which is compact, reliable and capable of providing adequate wind-up power and speed for the various rope pulling jobs on the boat.

A particularly important object of my invention is to provide a deck winch for boats with a large mechanical advantage that will produce a large wind-up torque to pull a line at a relatively rapid rate, and yet one which can be quickly manipulated if necessary to increase the mechanical advantage, with nothing more than a momentary pause in the winding.

Another object of the present invention is to provide a deck winch for boats that has an unusually clean and attractive appearance and which can be readily installed in any convenient location on the boat.

Still another object of the invention is to provide a deck winch that is unusually strong and durable and requires a minimum of maintenance even after long periods of use.

More specifically, an object of my invention is to provide a deck winch for boats which will provide a wind-up of force to a drum through one gear train when turned on one direction and will automatically be engaged through another gear train to provide an increased mechanical advantage when the winch is driven in the opposite direction.

Still another object of the invention is to provide a deck winch that is particularly well adapted for ease and economy of manufacture.

Other objects, advantages and features of the invention will become apparent from the following detailed description of one embodiment thereof presented in accordance with 35 U.S.C. 112.

In the drawings:

FIG. 1 is a view in perspective showing a deck winch embodying the principles of the invention;

FIG. 2 is an enlarged view in elevation and in section showing the internal details of the deck winch of FIG. 1;

FIG. 3 is a plan view in section taken along line 3—3 of FIG. 2;

FIG. 4 is a plan view in section taken along line 4—4 of FIG. 2;

FIG. 5 is a plan view in section taken along line 5—5 of FIG. 2;

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FIG. 6 is a plan view in section taken along line 6—6 of FIG. 2.

FIG. 1 shows a capstan or deck winch 10 embodying the principles of the invention as it appears when installed in a convenient location on the deck of a boat. In outward appearance my deck winch has the more or less traditional capstan configuration and comprises generally a housing 11 at its lower end adapted to be rigidly attached to the deck of the boat. Mounted directly above the lower housing is a rotatable drum 12 that tapers to a smaller diameter. On top of the drum is a cover member 13 that is connected to an upstanding sleeve portion 14 of the housing 11, extending through the drum (FIG. 2). The housing 11, the drum 12 and the cover member 13 are all preferably made of a suitable metal material that is strong, durable and also noncorrosive, such as brass. Connected to a central shaft 15 extending through the sleeve portion 14 is a crank member 16 having an upright handle portion 17 at its end which thereby enables the shaft 15 to be rotated. In accordance with the present invention the shaft 15 is connected at its lower end to a unique drive mechanism 18 supported within the housing 11 which enables the drum to be driven at either of two different gear ratios depending on the direction which the shaft 15 is turned by the crank member 16. For example, with the crank 16 being turned clockwise the gear ratio between the shaft 15 and the drum may be 4 to 1, but if the crank is turned counterclockwise, the gear ratio of that of the drive mechanism 18 is immediately increased to 20 to 1 or some other ratio depending on the specific sizes of the various gears used.

Describing now my invention in greater detail, with particular reference to FIG. 2, the lower housing 11 is attached by a series of screws 19 to a circular base plate 20 which has a plurality of spaced apart threaded bore holes 21 near its periphery to accommodate a series of anchor bolts 22 for fixing the winch 10 to a deck. The housing 11 has a cylindrical shaped lower wall 23 that is integrally connected with the upstanding sleeve 14 by an annular plate portion 24 and in which is retained the drive mechanism 18. The central drive shaft 15 within the sleeve portion 14 extends downward into the lower housing portion 23 and is connected at its lower end to a central drive pinion 25. The upper end of the shaft 15 has a nut portion 26 adapted to fit within an end socket 27 on the crank 16. Fitted around the central shaft 15 and spaced apart above and below the drive pinion 25 are a pair of parallel plates 28 and 29. The upper plate 28 is retained above the pinion 25 by an annular shoulder 30 and an oil impregnated cylindrical bearing sleeve 31 around the shaft 15 that engages at its upper end the annular portion 24 of the lower housing member 23. The lower plate 29 is fitted around the lower end of the shaft 15 and is spaced slightly above the upper surface of the base plate 20 by a flat spacer ring 32 preferably made from some low friction material such as Teflon. The upper and lower plates 28 and 29 together form a movable cage 33 at the lower end of the shaft 15 and between the plates are mounted a pair of idler gears 34 and 35 that are meshed with the drive pinion 25.

The idler gears which are preferably of equal size are spaced apart and rotatably supported on separate short shafts 36 and 37 that extend vertically between the plates 28 and 29. Thus, when the shaft 15 is rotated the support cage 33 containing the idler gears 34 and 35 pivot horizontally in the same direction. Near the outer edge of the lower plate 29 is a curved guide slot 38, and extending upward therethrough is a pin member 39 fixed to a base plate 20 that supports the cage 33 as it pivots horizontally.

As shown in FIG. 6, when the shaft 15 is rotated

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clockwise, the idler gear 34 is brought into mesh with a spur gear 40 that forms a low ratio portion of the drive mechanism 18 and which is keyed to a vertical shaft 41 extending upright through the lower housing portion 23. The shaft 41 is supported at its lower end by a bearing 42 in the circular base plate 20 and at its upper end by a bearing 43 in the annular portion 24 of the lower housing 23.

On the opposite side of the shaft 15 within the lower housing portion 23 is another gear 44 having a larger number of teeth than the gear 40 and which forms part of a high ratio portion of the drive mechanism 18. The gear 44 is mounted on a shaft 45 which, like the shaft 41, is supported at its lower end in a bearing 46 in the base plate 20 and at its upper end in a similar bearing 47 in the annular plate portion 24 of the lower housing 23. Attached to the shaft 45 above the gear 44 is another smaller spur gear 48 which is in mesh with still another larger spur gear 49 mounted on another upright shaft 50 fixed within the housing 23 (see FIG. 4).

The shaft 41 for the low ratio gear 40 and the latter shaft 50 for the gear 49 both extend upward through the annular portion 24 of the lower housing 23. To the upper ends of the shafts 41 and 50 are fixed a pair of drive gears 51 and 52, respectively, each of which is in mesh with an annular ring gear 53 having gear teeth 54 around its inner wall. The ring gear 53 is connected by a series of machine screws 55 to an annular plate 56 that is fixed to the outer race 57 of a ball bearing 58 whose inner race 59 is fixed to the sleeve portion 14 of the housing 11 around its lower end (see FIG. 2).

On the upper side of the annular plate 55, as shown in FIG. 5, are a number of circumferentially spaced apart pawls 60 each of which is rotatably mounted on an upright pin 61. A helical spring 62 is attached at one end to the pin 61 and at the other end to the pawl 60 to bias it radially outwardly toward the ring gear 53. Each pawl 60 has a transverse end portion 63 shaped somewhat like a gear tooth so that it can readily drop between and engage the teeth 54 of ring gear 53 when the drum 12 is not turning and thereby prevent any reverse rotation of the drum. When the drum is rotated in the wind-up direction the ring gear 53 constantly moves clockwise in FIG. 5 and away from the end portions 63 of the pawls 60 so they in no way interfere with the drum movement. However, should the drum tend to rotate in the opposite direction one or more of the pawls 60 would drop between the teeth 54 of the ring gear to prevent any rotation in this direction.

In order to transfer the rotational force of the ring gear 53 to the drum 12, the annular plate 56 has an upper portion 65, as shown in FIGS. 2 and 3, which is provided around its periphery with a series of outwardly extending projections 66 spaced apart circumferentially extending slots 67. The outside edges of the projections 66 are adjacent to a frictional ring insert 68 fixed to an inner annular wall of the drum 12. The frictional ring 68 is made of a particularly hard and durable metal material and is attached to the drum 12 by a series of set screws 69 or by any other suitable means. The slots 67 are tapered circumferentially and mounted within each one is an upright cylindrical roller bearing 70 which is rotatably seated within a curved guide member 71 preferably made of some low friction material. Each guide member 71 is biased in a substantially tangential direction toward the narrow end of its slot 67 by a compression spring 72 that is seated in an adjacent projection 66. Thus, in essence, the slotted upper plate portion 65 in combination with the roller bearings 70 and the frictional ring 68 cooperate to function as a clutch means between the drum 12 and the drive mechanism 18. When the central shaft 15 is rotated to rotate the ring gear 53 through the drive mechanism 18 the attached upper gear plate 56 always rotates in a clockwise direction as shown in FIG. 3 toward the open

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end of the slots 67. The roller bearings 70, biased by their compression springs 72, are thereby forced against the frictional ring 68 of the drum 12 causing the drum to rotate. The drum is rotatably supported on the upright sleeve portion 14 by a pair of ball bearings 73 and 74 which are retained within an inner wall portion 75 of the drum. Extending between the wall portion 75 and threaded to the sleeve 14 at its upper end is an internal annular portion 76 of the cover member 13. An O-ring 77 provides a seal between the annular portion 76 and the inner drum wall 75 to prevent moisture from reaching the bearings 73 and 74.

In operation of my deck winch 10, when installed on a boat, a rope or cable is looped around the drum 12 and tightened to frictionally engage it. The crank 16 is now moved in either direction depending on the amount of winching power needed. As shown in FIG. 6, when maximum power is desired, the crank 16 is rotated in the clockwise direction which causes the low ratio gear train to be operated. The central shaft 15 rotates the drive pinion 25 which causes the dual plate cage 33 to pivot and the idler gear 34 mounted therein to move horizontally and engage the stationary gear 40. This turns the upper drive gear 51 meshed with the ring gear 53. As the ring gear rotates, the rollers 70 in the slots 67 of its upper plate portion 65 are forced smoothly into engagement with the frictional ring 68. The greater the strain of the cable on the drum, the more firmly the rollers grip the frictional ring and maintain the driving connection, thereby causing the drum to rotate in the wind-up direction as the crank is turned. If an increased speed of wind-up for the rope on the drum is desired, the crank can immediately be rotated in the opposite direction. This causes the gear cage 33 to pivot so that the idler gear 35 will engage the gear 44 of the high ratio gear train portion of the drive mechanism 18. This in turn rotates the meshed gears 18 and 49 and drives the ring gear 53 in the same clockwise direction at an increased speed. The transition from the low gear ratio to the high gear ratio or vice versa is accomplished quickly with little effort and with only a small interruption in the winding process. In most situations, the drive mechanism 18 is initially engaged in the high ratio train and if an increased load on the rope occurs the cranking direction is reversed to engage the low ratio gear train and thereby increase the winding power.

When the drum is free from any torsional force from an attached rope it will be completely free wheeling in the clockwise direction as the roller bearings 70 move towards the wider ends of the slots 67 and release their frictional engagement with the ring 68.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. A winch for providing a wind-up force on a rope or cable comprising:
 - a fixed base means;
 - a drum rotatably mounted on said base means;
 - a rotatable central shaft extending vertically through said drum;
 - means attached to the upper end of said shaft above said drum for turning said shaft in either direction;
 - a drive pinion attached to the lower end of said shaft;
 - a first gear means having a relatively low gear ratio and drivingly connected with said drum;
 - a second gear means having a relatively high gear ratio and drivingly connected with said drum;
 - and means at the end of said shaft for selectively connecting said drive pinion with either said first or said

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second gear means depending on the direction of rotation of said shaft.

2. A deck winch for use on boats for providing a wind-up force on a rope or cable, comprising:

- a fixed base means for securing said winch to a flat deck surface;
- a drum rotatably mounted on said base means;
- a rotatable drive shaft extending vertically through said drum;
- a hand crank attached to the upper end of said shaft above said drum for turning said shaft in either direction;
- a drive pinion attached to the lower end of said shaft;
- a first gear means for driving said drum at a relatively low gear ratio;
- a second gear means for driving said drum at a relatively high gear ratio;
- and means pivotally mounted at the lower end of said shaft for selectively connecting said drive pinion with either said first or said second gear means depending on the direction of rotation of said shaft.

3. A deck winch for supplying pulling power to ropes on boats, comprising:

- a fixed lower housing for securing said winch to a flat surface;
- a rotatable drum mounted above said housing;
- a central shaft extending vertically through said drum;
- a hand crank attached to the upper end of said shaft above said drum;
- a drive pinion attached to the lower end of said shaft;
- a first low ratio gear means mounted in said housing and including a drive gear at its upper end;
- a second high ratio gear means mounted in said housing also including a drive gear at its upper end;
- a ring gear rotatably mounted above said housing and constantly in mesh with both of said drive gears;
- clutch means for drivingly engaging said ring gear with said drum;
- a gear cage movably mounted on the lower end of said shaft;
- a pair of spaced apart idler gears mounted in said cage and in mesh with said drive pinion;
- whereby when said shaft is rotated said gear cage is moved horizontally in the same direction so that one of said idler gears becomes engaged with either said first or said second gear means to drive said ring gear and the drum.

4. A deck winch for supplying pulling power to ropes on boats, comprising:

- a fixed housing having a lower portion for securing said winch to a flat deck surface and an upright sleeve portion;
- a drum member rotatably mounted on said sleeve portion;
- a central shaft extending vertically through said sleeve portion;

- a hand crank attached to the upper end of said shaft above said drum;
- a drive pinion attached to the lower end of said shaft within said lower housing portion;
- a first low ratio gear means mounted on a fixed shaft in said lower housing portion and having a fixed drive gear at its upper end;
- a second high ratio gear means mounted within said lower housing portion and also having a fixed drive gear at its upper end;
- a ring gear rotatably mounted on said sleeve portion above said lower housing portion, said ring gear being constantly in mesh with both of said drive gears;
- clutch means for drivingly engaging said ring gear with said drum;
- a movable gear cage on the lower end of said shaft;
- a pair of spaced apart idler gears mounted in said cage and in mesh with said drive pinion;
- whereby when said shaft is rotated said gear cage is moved horizontally in the same direction so that one of said idler gears becomes engaged with either said first or said second gear means to drive said ring gear and the drum.

5. The device as described in claim 4 wherein said gear cage comprises a pair of parallel vertically spaced apart members and spaced apart shaft means extending between said members for supporting said idler gears.

6. The device as described in claim 4 wherein said clutch means includes an annular means attached to said ring gear and having circumferentially spaced apart projections closely adjacent an inner surface of said drum and forming a series of tapered slots along the periphery of said annular means, and roller means movably retained in said slots, said roller means extending beyond the periphery of said annular means when pushed to the narrow ends of said slots due to rotation of said ring gear, said roller means thereby engaging the inner surface of said drum and causing it to rotate also.

7. The device as described in claim 4 including pawl means pivotally mounted within said housing having end portions for engaging the teeth of said ring gear to prevent reverse rotation of said drum.

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