United States Patent

Sprague

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[54] BOAT DECK WINDLASS

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[52] **U.S. Cl.** **254/150**

[51] **Int. Cl.** **B66d 1/30**

[58] **Field of Search** 254/150, 183, 184, 186; 74/416, 417, 425, 467, 468

[56] **References Cited**

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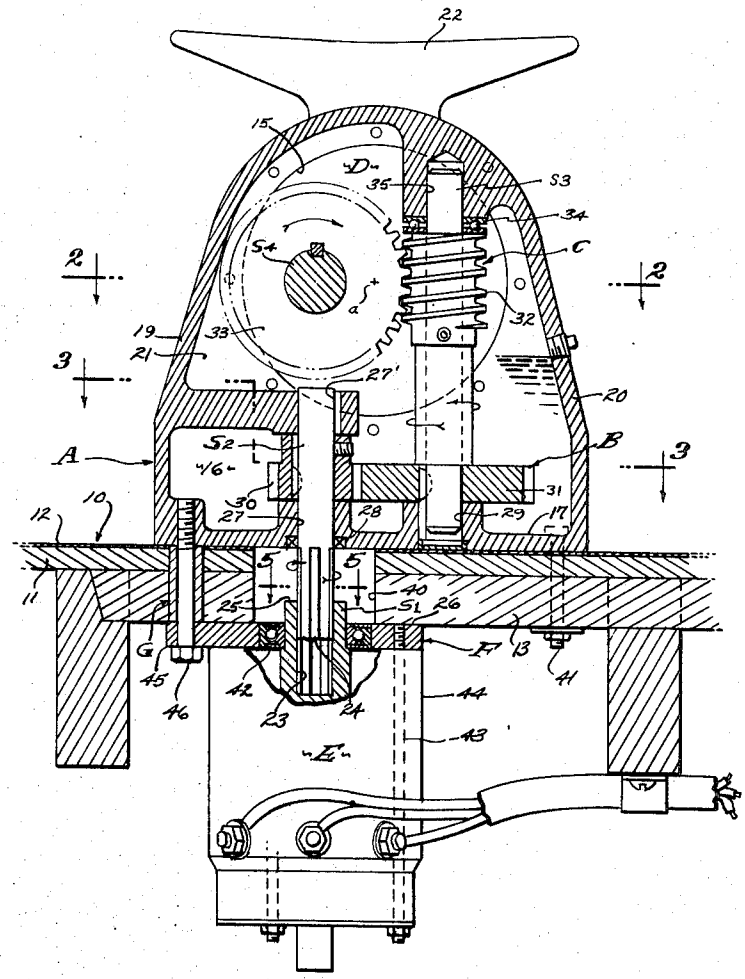
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Assistant Examiner—J. Kenneth Silverman
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[57] **ABSTRACT**

A windlass for boat decks and the like wherein the line hauling elements are exposed above deck and the prime mover therefor is protectively installed and accessible below deck, mechanical advantage being increased through two stage gearing whereby a prime mover of reduced size and weight is made possible, and there being a separation of the above and below deck elements whereby adaptability to decking of varied thickness is made possible, all the while maintaining mechanical integrity between said above and below deck elements.

17 Claims, 5 Drawing Figures

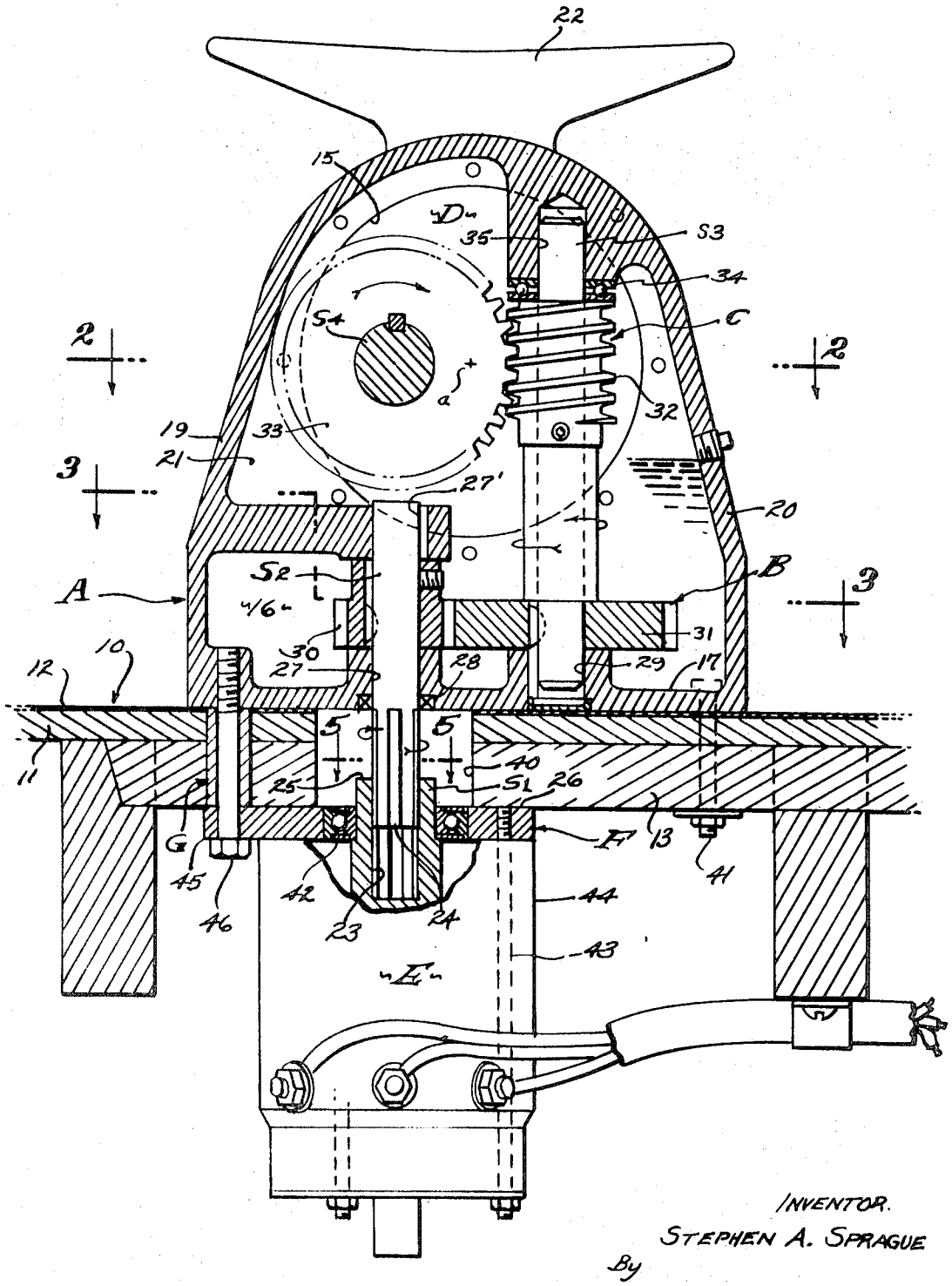


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SHEET 1 OF 2

FIG. 1.



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FIG. 2.

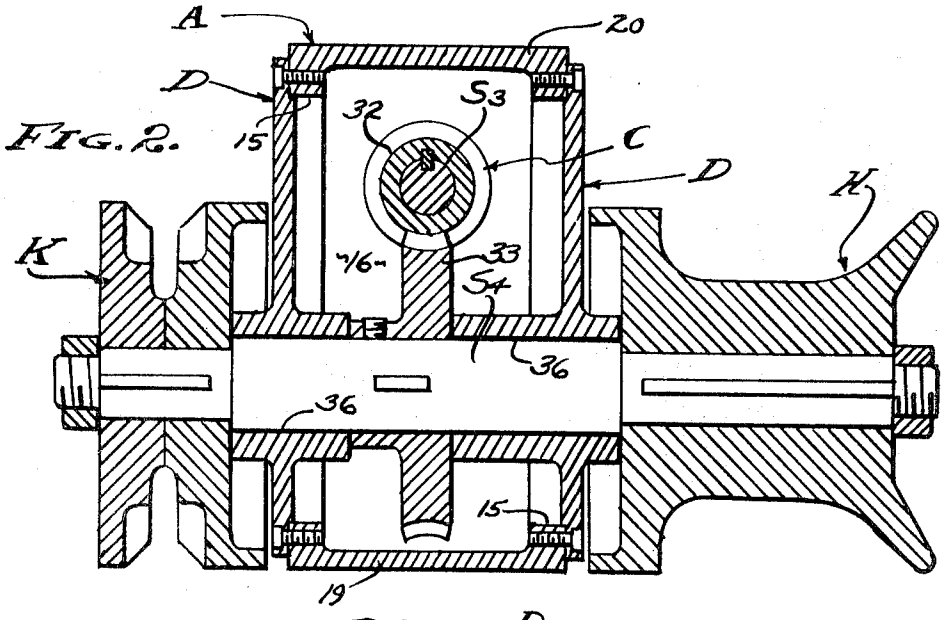


FIG. 4.

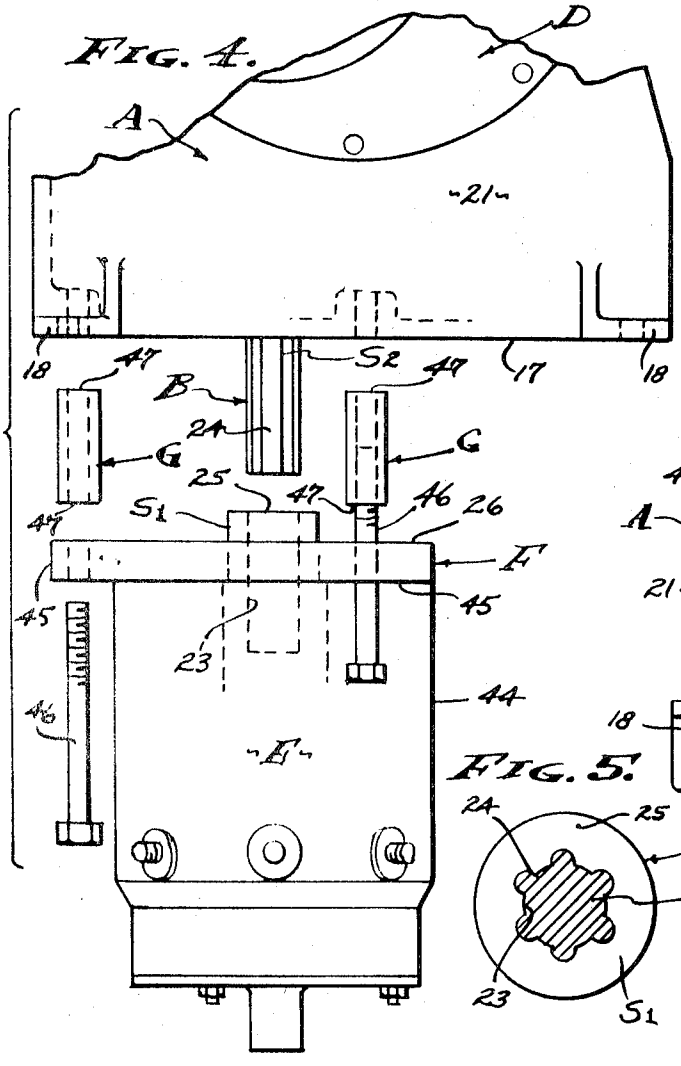


FIG. 3.

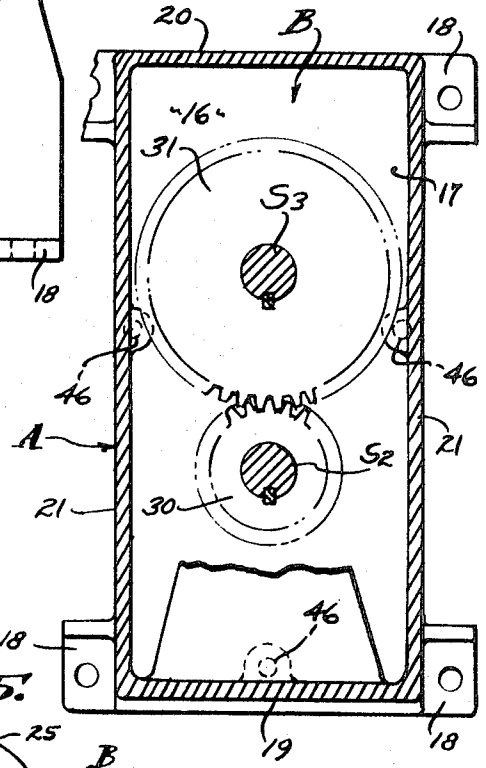


FIG. 5.

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BOAT DECK WINDLASS

The boat deck windlass of the type herein disclosed is usually characterized by direct worm and wheel gearing with its consequent gear reduction limitations. Further, the usual windlass mounts the prime mover directly upon its frame and alternately if the prime mover is removed or remote then there is the deflection of the deck structure to be concerned with. Also, a wooden deck swells and contracts and with the result that the distance and alignment between the above and below deck elements varies to great disadvantage. It is to these problems that the present invention is directed with the advantage of double reduction gearing with its reduced size prime mover that is removably spaced from the above deck elements while being mounted directly thereto and without reliance upon the deck structure for its placement and/or support. Thus, it is an object of this invention to increase the mechanical advantage of the windlass and/or to reduce the size of the prime mover employed to operate the output shaft thereof.

An object of this invention is to relate a double reduction gearing wherein the shafts and gear components thereof can be assembled with facility within the confines of a compact housing little or no larger than the housings heretofore employed with the conventional single reduction gear units.

Another object of this invention is to provide adjustability in the placement of the prime mover relative to the above deck elements, so that any reasonable deck thickness can be accommodated, the above and below deck elements being coupled by telescoped shafts that are keyed and/or splined for driving engagement, and wherein the prime mover is held positioned to the above deck elements by stand-off spacers, and all of which is fastened tightly together as a single operable unit.

It is still another object of this invention to provide a serviceable prime mover and windlass combination, wherein the said prime mover is replaceable and accessible for service without affecting the windlass installation whatsoever. The prime mover is preferably an electrical motor and is installed below deck for protection and accessibility, while the windlass per se is permanently installed above deck and is suitably fastened in working position as may be required.

The various objects and features of this invention will be fully understood from the following detailed description of the typical preferred form and application thereof, throughout which description reference is made to the accompanying drawing, in which:

FIG. 1 is a longitudinal sectional view taken through the windlass and supporting deck structure.

FIGS. 2 and 3 are transverse sectional views taken as indicated by lines 2—2 and 3—3 on FIG. 1.

FIG. 4 is an exploded view showing the separation of above deck and below deck elements of the windlass shown in FIG. 1.

FIG. 5 is an enlarged sectional view taken as indicated by line 5—5 on FIG. 1.

The boat deck windlass is illustrated throughout the drawings in its preferred form and comprises, generally, above deck elements involving the windlass per se and below deck elements involving the prime mover and its directly associated elements. Involved in the above deck windlass elements is a frame A, input transmission means B, output transmission means C, and bearing plates D. The frame A is the exposed structure that is permanently mounted to the deck, while the transmission means B and C are contained within the frame with access for installation through end openings in the frame which are closed by the bearing plates D. Involved in the below deck prime mover elements is a motor E having an end mount F, and spacers G. The prime mover is protectively housed below deck and is mounted on the windlass frame A, independent of the deck structure. As shown in FIG. 2, the windlass drives the usual line hauling elements, for example a capstan H and a cathead K. It is to be understood that the line hauling elements can vary as circumstances require, a typically desirable configuration being illustrated.

Referring now to the above deck elements, the frame A is a housing that accommodates and completely encloses the transmission means B and C. The usual deck **10** is horizontally disposed and the output shaft **S4** is journaled by the bearing plates D on an axis parallel to and spaced above the plane of the deck. As shown and as will be described the bearing plates D form enclosures for the frame A and cover the end openings **15** in the frame and through which the gearing B and C and shafting **S2** and **S3** thereof is inserted into a chamber **16** within the frame. The frame is comprised of a flat base **17** with mounting ears **18** by which it is fastened to the deck **10**, and from which there are upstanding walls, there being front and rear walls **19** and **20** and spaced and parallel side walls **21**. The top of the frame is rounded in which case the walls **19** and **20** merge on a common radius. The lower portion of the frame forms a basin or sump within which the input transmission means B operates, while the upper portion of the frame forms a head within which the output transmission means C operates. Said basin contains the grease for lubrication as indicated in FIG. 1, there being a plug in wall **20** at a fill level establishing the quantity required while said head is coextensive with the diameter of the bearing plates D and which establishes the configuration of the access openings **15**. Thus, the frame A is divided into basin and head portions, the openings **15** being turned about a locating center *a* from which the axes of the shafts **S2**, **S3** and **S4** are located. As shown, the top of the frame A, the head portion, carries a bit **22** to which a line can be tied.

The input transmission means B comprises spaced driving shafts **S2** and **S3**, the former entering the frame A from the exterior thereof and the latter operating within the chamber **16** to drive the output shaft **S4**. It is feasible to angularly relate the shafts **S2** and **S3** to the axis *a* and to shaft **S4** and to the plane of deck **10** and to each other; a most practical symmetrical arrangement being shown wherein the axes of shaft **S2** and **S3** are spaced and parallel and vertically disposed normal to the plane of deck **10** and in a plane midway between the bearing plates D. It is also preferred that the shafts **S1** and **S3** depend beneath the axis *a* or from the output shaft **S4**, for compactness. In accordance with the invention, the shafts **S1** and **S2** are coaxial and the first is driveably coupled to the second, preferably through a telescoped and splined engagement. It is a matter of choice which is the male or female shaft member, and in the preferred form the shaft **S1** is the female having a splined socket **23** and the shaft **S2** is the male having a projecting and splined stub **24**. Both the socket **23** and stub **24** are of substantial axial extent so as to accommodate variations in the thickness of deck **10**, and the shaft **S1** terminating in an end **25** spaced upwardly from the face **26** of the mount F.

In accordance with the invention, the input transmission means B extends from shaft **S2** to shaft **S3** to drive the same. In the preferred form spur gears **30** and **31** are employed having a ratio, for example, of one to two, whereby the shaft **S3** revolves at half the speed of shaft **S2**. Accordingly, the shaft **S2** extends into the frame A through a bearing **27**, there being a seal **28** to contain lubricant within the housing chamber **16**. There is also a bearing **27'** spaced above the base **17**, integral with and supported by and/or between the upstanding walls of the frame. The shaft **S3** is installed into the frame A through a bearing **29**, and which extends into the chamber **16** and carries the driven gear **31** meshed with the pinion gear **30**. Said gears **30** and **31** are keyed to the shafts **S2** and **S3**, as shown. In practice, the bearing **29** opening is closed by a plug pressed therein.

The output transmission means C comprises spaced and right angularly related driving shaft **S3** and output shaft **S4**, the former operating within the chamber **16** and the latter extending through the chamber and projecting from the sides **20** of the frame A. In accordance with the invention, the output transmission means C is a worm **32** and wheel **33** transmission, and in the preferred form employs a speed reduction ratio of thirty to one and which has an interlocking action with respect to revolvement of shaft **S4**, the worm **32** being driveably car-

ried by the shaft S3. Thus in the example shown, the gear reduction from shafts S1 and S2 to shaft S4 is sixty to one, and it will be observed that when pulling rearwardly at the top periphery of the capstan H or cathead K the worm **32** bears downward on the periphery of the wheel **33** and is consequently thrust axially upward The said upward thrust is borne by an anti-friction axial thrust bearing **34** with the upper end of shaft S3 journaled in a bearing **35** aligned with the bearing **29**. The bearings **27,27'**, **29** and **35** are integral with the frame A and are readily machined in proper position and alignment with respect to the axis *a* by means of a jig or fixture fitted into the turned openings **15**.

The bearing plates D are provided to close the turned openings **15** and are rotatably positioned therein so as to maintain alignment of the output shaft S4. In accordance with the invention, the two plates D at opposite sides **21** of the frame A are centered through bossed engagement with said turned openings and are provided with bearings **36** positioned eccentrically therein as required by the displacement of the axis of shaft S3 from the axis of the shaft S4. In the case illustrated the eccentric displacement is horizontally forward of axis *a* with the shaft S4 extending transversely through the chamber **16** and projecting through the bearings **36** to extend externally of the frame A. The bearings **36** are bossed inwardly and have opposed axial thrust faces that engage the wheel **33** and hold it positioned in alignment with the worm **32**. The opposite ends of the shaft S4 driveably carry the capstan H and cathead K respeCtively and as illustrated in FIG. **2**.

Referring now to the below deck elements, the prime mover or motor E is provided for mounted attachment to the frame A so as to operate therewith as a unit. As shown in FIG. **4** the frame A and motor E are separable, with the spacers G to be placed therebetween. Although deck structure varies widely, it suffices to recognize that a deck has variable thickness, and for example the decking can be ½ inch plywood **11** with an impervious skin **12**, and there can be an underlying blocking **13**; the total structural thickness varying depending upon the structure employed in each instance. Accordingly, an opening **40** is bored through the deck **10** so as to amply surround the projecting stub **24** of shaft S2, and the frame A is fastened to the deck by bolts **41** passing through the mounting ears **18**. As shown, the stub **24** of shaft S2 extends through the opening **40** and may or may not project from the lower plane of the blocking **13**.

The prime mover or motor E is especially prepared for cooperative coupled engagement with the above deck elements hereinabove described. Since the externally splined stub **24** of shaft S2 is of sizeable diameter, the internally splined socket **23** is also of sizeable diameter and extends into the shaft S1. In practice, the end **25** of shaft S1 is spaced a short distance above the face **26** of the mount F, in which case the socket **23** extends well below said face, thereby assuring telescoped engagement and providing a wide range of adjustment.

In accordance with the invention, the motor E is provided with a unique rotor shaft S1 that is journaled in a sealed antifriction bearing **42** centered in the mount F. The mount F is a plate that is fastened to the motor frame **44** as by means of tierods **43**, there being lateral flanges **45** projecting from the mount to pass mounting bolts **46** that extend through the deck structure and to threadedly engage in the frame A (there being three such bolts **46** indicated in FIG. **3**). In carrying out the invention, the above described installation is made with the use of tubular spacers G, cut to equal lengths at least the same or greater than the deck thickness. The opposite terminal ends **47** of the spacers are normal to the axes thereof, and being spaced and parallel said ends provide for fixed spaced attachment of the motor E onto the frame A.

From the foregoing it will be seen that the boat deck windlass is adapted to be permanently installed insofar as the above deck elements are concerned, while the below deck elements are protected and are readily accessible for servicing and/or replacement. The use of a series wound direct circuit electrical motor E is contemplated, in which case a three conductor wiring is shown to indicate reversibility, however the normal direction of rotation is that shown by the arrows in FIG. **1** of the drawings. It will be observed that the prime mover or motor E is of moderate size and which is made possible by the double reduction gearing herein disclosed. The offset position of shaft S4 with respect to the center axis *a* of frame A is negligible and no more than what is to be expected when a worm gear output drive is employed; and the normal required height of the shaft S4 above deck **10** provides the space within chamber **16** for accommodating the input transmission means B. With the windlass herein disclosed alignment of shafts S1 and S2 is assured, and coupled engagement is effected without regard to variations or changes in deck thickness.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any modifications or variations that may appear to those skilled in the art:

Having described my invention, I claim:

1. A compact windlass with compound gearing for installation upon and above a deck and with a drive shaft to be exposed through an opening in said deck, and including, a frame with a chamber therein defined by a base and upstanding walls closed at the top and with an access opening in at least one of said upstanding walls, a bearing plate closing said access opening, input transmission means comprised of a pair of shafts journaled in the frame, one of said pair of shafts being driveably accessible through a bearing opening in the base of the frame and driveably carrying a drive element within said chamber, and the other of said pair of shafts being confined within said chamber and driveably carrying a driven element within said chamber, means interengaging said two elements to effect a speed reduction of the second mentioned element and the other of said pair of shafts, and output transmission means comprised of the other of said pair of shafts and an output shaft angularly related thereto and extending transversely through said chamber, the output shaft projecting through and journaled in a bearing opening in said bearing plate and driveably carrying a line hauling element at the exterior of the frame and driveably carrying a wheel within said chamber, and the other of said pair of shafts driveably carrying a worm engageably meshed with the wheel to effect a second speed reduction multiplying the first mentioned speed reduction.

2. The windlass with speed reducing means as set forth in claim **1** wherein, the lower portion of the chamber is a sump to contain lubricant, and wherein the first mentioned driveably accessible shaft projects through a shaft seal surrounding the said opening in the base of the frame.

3. The windlass with speed reducing means as set forth in claim **1** wherein, the drive and driven elements of the input transmission means are gears, and wherein the means interengaging said two elements is intermeshed teeth thereon respectively.

4. The windlass with speed reducing means as set forth in claim **1** wherein, the access opening in the upstanding wall of the frame is sizeable to permit the entry into said chamber of the drive elements and said wheel and worm, and wherein said pair of shafts are each entered into journaled position in the frame through bearing openings through the base thereof respectively.

5. The windlass with speed reducing means as set forth in claim **1** wherein, there is an access opening in each opposite upstanding side wall of the frame, wherein a bearing plate closes each of said opposite side wall access openings, and wherein the output shaft projects through and is journaled in each of said bearing plates to carry line hauling elements at opposite exterior sides of the frame.

6. A compact windlass with compound gearing for installation upon and above a deck and with a removable motor below said deck and with a separable drive shaft extended through an opening in said deck, and including, a frame with a

chamber therein defined by a base and upstanding walls closed at the top and with an access opening in at least one of said upstanding walls, a bearing plate closing said access opening, transmission means comprised of input and output shafts journaled in the frame, the input shaft being driveably accessible through a bearing opening in the base of the frame and driveably carrying a drive element within said chamber, the output shaft extending transversely through said chamber and projecting through a bearing opening in said bearing plate and driveably carrying a line hauling element at the exterior of the frame and driveably carrying a drive element within said chamber, means interengaging said two drive elements to effect a speed reduction, the said drive shaft of the motor being slideably coupled to the said input shaft.

7. The windlass and motor as set forth in claim 6 and wherein the motor is mounted onto the frame by fastening means extending through the deck.

8. The windlass and motor as set forth in claim 6 and wherein the motor is mounted onto the frame by fasteners projecting therefrom and through spacing means extending through the deck.

9. The windlass and motor as set forth in claim 6 and wherein the motor is mounted onto the frame by circumferentially spaced and axially disposed fasteners projecting therefrom and through tubular spacers extending through the deck.

10. The windlass and motor as set forth in claim 6 and wherein at least the drive shaft of the motor or the said input shaft projects from the motor or base of the frame respectively, a distance substantially equal to a minimum deck thickness.

11. The windlass and motor as set forth in claim 6 and wherein the drive shaft of the motor projects from the end thereof opposed to the underside of the deck, a distance substantially equal to a minimum deck thickness.

12. A compact windlass with compound gearing for installation upon and above a deck and with a removable motor below said deck and with a separable drive shaft extended through an opening in said deck, and including, a frame with a chamber therein defined by a base and upstanding walls closed at the top and with an access opening in at least one of said upstanding walls, a bearing plate closing said access opening, input transmission means comprised of a pair of shafts journaled in the frame, one of said pair of shafts being driveably accessible through a bearing opening in the base of the frame and driveably carrying a drive element within said chamber, and the other of said pair of shafts being confined within said chamber and driveably carrying a driven element within said chamber, means interengaging said two elements to effect a speed reduction of the second mentioned element and the other of said pair of shafts, and output transmission means comprised of the other of said pair of shafts and an output shaft angularly related thereto and extending transversely through said chamber, the output shaft projecting through and journaled in a bearing opening in said bearing plate and driveably carrying a line hauling element at the exterior of the frame and driveably carrying a wheel within said chamber, and the other of said pair of shafts driveably carrying a worm engageably meshed with the wheel to effect a second speed reduction multiplying the first mentioned speed reduction, the said drive shaft of the motor being slideably coupled to the said driveably accessible one shaft of the input transmission means.

13. The windlass and motor as set forth in claim 12 and wherein the motor is mounted onto the frame by fastening means extending through the deck.

14. The windlass and motor as set forth in claim 12 and wherein the motor is mounted onto the frame by fasteners projecting therefrom and through spacing means extending through the deck.

15. The windlass and motor as set forth in claim 12 and wherein the motor is mounted onto the frame by circumferentially spaced and axially disposed fasteners projecting therefrom and through tubular spacers extending through the deck.

16. The windlass and motor as set forth in claim 12 and wherein at least the drive shaft of the motor or the said driveably accessible one shaft of the input transmission means projects from the motor or base of the frame respectively, a distance substantially equal to a minimum deck thickness.

17. The windlass and motor as set forth in claim 12 and wherein the drive shaft of the motor projects from the end thereof opposed to the underside of the deck, a distance substantially equal to a minimum deck thickness.

* * * * *