

[54] ANCHOR HOIST WITH MANUAL OR MOTOR DRIVE

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**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 101,287, Dec. 24, 1970.

[57] **ABSTRACT**

**Foreign Application Priority Data**

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An anchor hoist with manual and/or motor drive in which the winch drum is rotatable upon its shaft and is coupled therewith by a servo-tightened cone-type clutch driven axially by a mechanism cooperating with a sleeve carried by the shaft. The tubular member or sleeve is provided with locking means for retaining it against rotation as the shaft is rotated and includes a camming arrangement for lifting a detent holding the sleeve against rotation.

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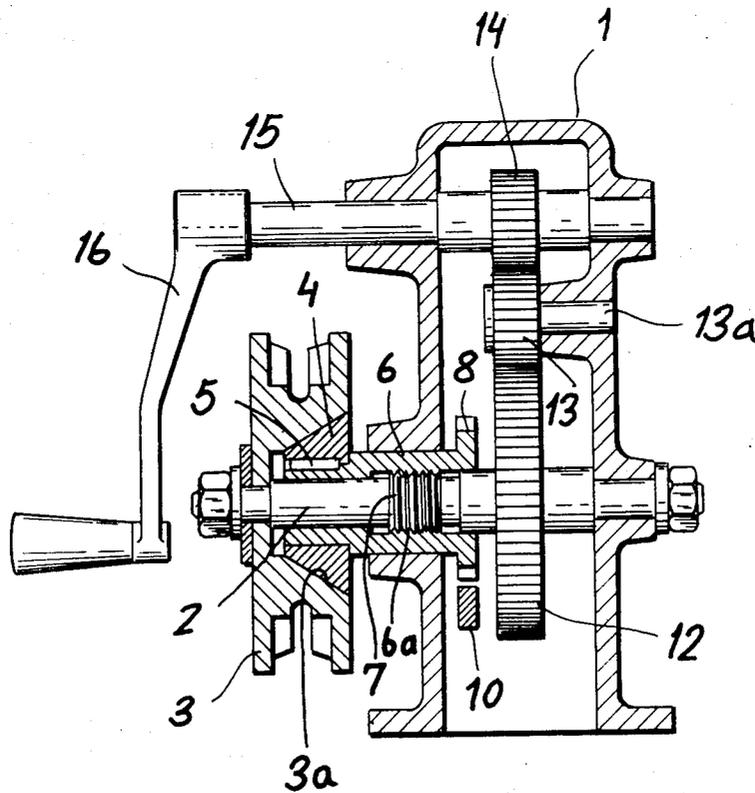
[58] Field of Search ..... 254/150 R, 187 R;  
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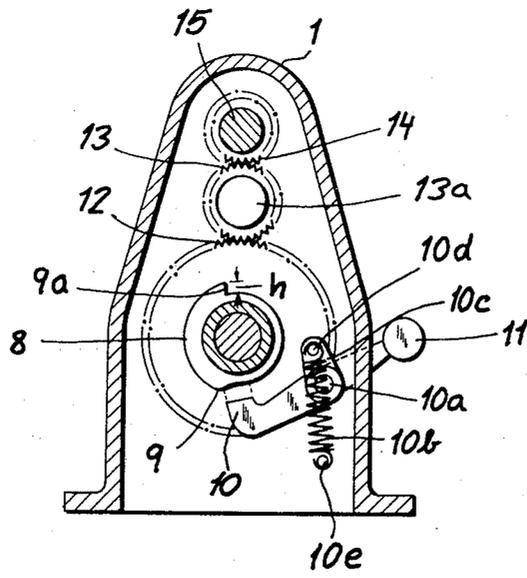
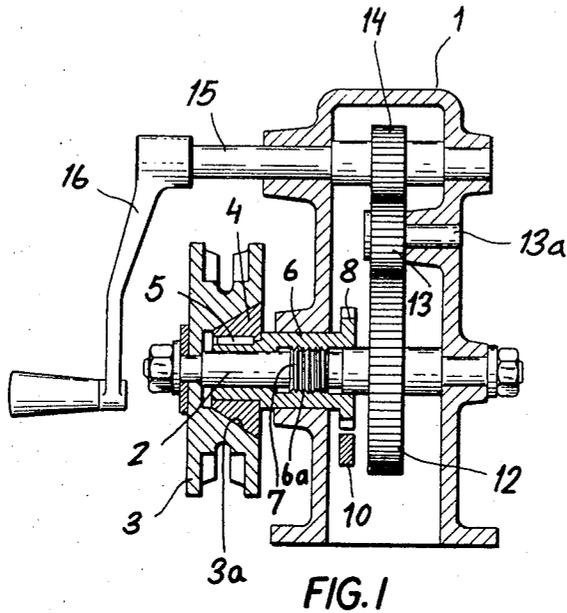
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**10 Claims, 5 Drawing Figures**





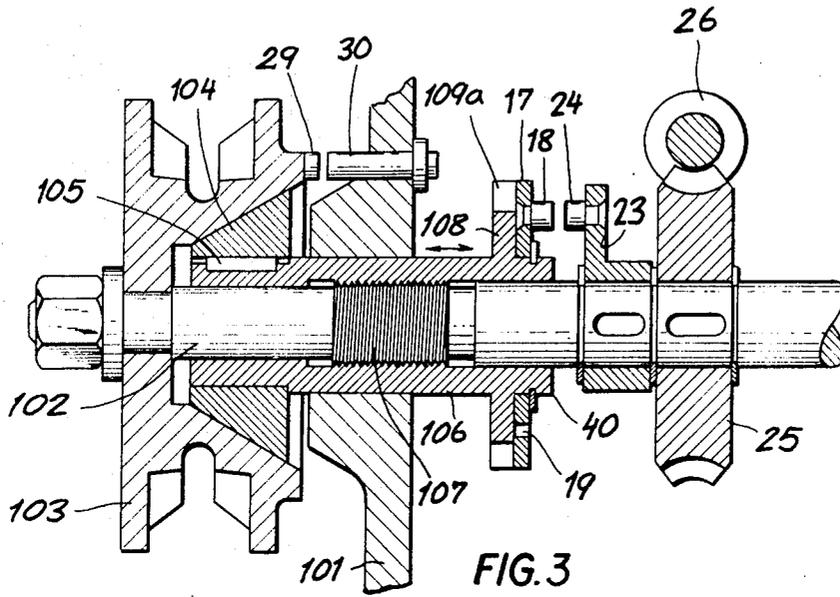


FIG. 3

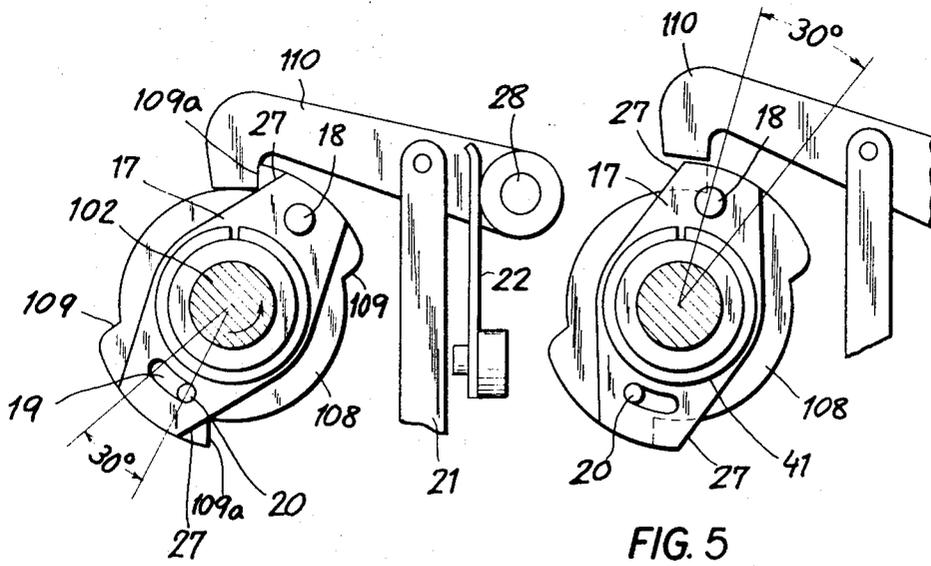


FIG. 4

FIG. 5

## ANCHOR HOIST WITH MANUAL OR MOTOR DRIVE

### CROSS-REFERENCE TO RELATED APPLICATION

The present application is a continuation-in-part of my copending application Ser. No. 101,287 filed 24 Dec. 1970 and entitled "ANCHOR HOIST."

### FIELD OF THE INVENTION

My present invention relates to an anchor hoist, windlass or capstan which may be driven by hand or by a motor for raising or lowering an anchor.

### BACKGROUND OF THE INVENTION

In my copending application mentioned earlier, there is described an improvement in the art of anchor-hoist mechanisms whereby manual and/or motor drive may be provided, via a clutch, to a windlass drum, pulley or sprocket to raise the anchor and/or control the lowering thereof. Prior to that development, there had been proposed various means for elevating the anchor, including a windlass whose housing was mounted upon the deck of a ship and contained a drive mechanism which may be operated manually or by power means such as an electric motor. The windlass drum was in the form of an anchor-chain sprocket adapted to draw in an anchor chain and lower it into the hold, an anchor-chain locker or a chest provided on or below the deck. The anchor, fastened to an end of the chain is thereby raised. When the device is released, the anchor chain is paid out freely with gravity as the important propelling force.

To permit release of the anchor chain for free fall, or substantially free fall, a clutch mechanism was provided. The drive for the windlass generally included a crank mechanism for rotating the sprocket and a device for operating such clutch means. Because of the fact that considerable effort was required to operate the clutch, these prior-art devices were unsatisfactory. Thus it was an object of my earlier system as described in application Ser. No. 101,287, to provide a mechanism for the raising and lowering of an anchor, especially an anchor on a chain, whereby the strength necessary for operating the clutch could be reduced and, in general, the effort required for controlling the windlass diminished. It was also desired to facilitate the raising and lowering operation, to minimize the labor power and inconvenience which would be required for this purpose, and to provide a hoist or winch which could be readily controlled and would be of low cost.

To achieve this result, the winch or hoist of the prior application comprised a rotatable body (chain sprocket) engageable with the chain and rotatably mounted upon a drive shaft which was connected by suitable gearing with a drive source such as a manually operable crank and/or an electric or hydraulic motor. The shaft carried one member of the clutch while the sprocket wheel was provided with the other member, a screw-thread arrangement being provided between the first member and the shaft for axially shifting this member to engage the clutch. The screw thread, of course, represented any camming means for transforming the relative angular displacement of the axially shiftable clutch member and the shaft into a linear displacement (along the shaft) for engagement or disengagement of the clutch. The clutch-actuating system

which was capable of manual, electrical or hydraulic operation, included a locking pawl engageable with the rotatable element connected with the axially shiftable member for retaining same against angular displacement in one position to permit the aforementioned axial displacement and releasing the element when rotation of the shaft and sleeve together was desired, e.g. when the anchor-chain sprocket was coupled with the shaft. The engagement of disengagement of the clutch was effected by retaining or releasing this element via the pawl while the clutch power or force derived from the screw thread or cam arrangement as described.

The prior application also provided for a clutch system which included an outer friction cone formed as a socket in the anchor-chain sprocket and widening in the direction of the housing from which the shaft projected to carry the sprocket. The inner cone, converging axially in the direction of the sprocket, was axially shiftable along the shaft but rotatably entrained therewith, e.g., via spline or key arrangement. The clutch-actuating system then comprised a sleeve mounted upon this shaft and bearing axially upon this shaft and bearing axially upon this inner cone while being threadedly connected therewith to urge the frustocones together with a friction fit.

The sleeve was internally threaded to engage a mating thread on the shaft such that the sleeve and shaft are normally rotatable together although the shaft is axially fixed while the sleeve is axially displaceable. One end of this sleeve is adapted to bear axially upon the broad base of the inner frustocone to urge the same into frictional engagement with the female frustoconical surface of the chain-sprocket wheel. Along the periphery of the threaded sleeve, moreover, and preferably on a disk-shaped angular flange formed at an inner end of the sleeve within the housing, there was provided means for immobilizing the sleeve (angularly) relative to the shaft. This means could include a friction brake of the band, shoe or disk type, or a more positive engagement means such as a plurality of recesses engaged by the hook-shaped end of a latching pawl swingable in a plane parallel to the plane of the disk and mounted on the housing. The engagement of the threaded element with the pawl was arranged so as to permit axial displacement of the sleeve within the housing.

The housing was so constructed and arranged as to be flooded with oil so that the only mechanisms external of the housing are the crank, the anchor and sprocket wheel and its clutch, and any electric or other motor used to power the hoist. Typical of the other camming means which could be substituted for the screw-thread clutch actuator, were camming arrangements of the slot and pin type. The screw thread had the advantage that, with a number of turns being engaged simultaneously, the axial stress is distributed.

The pawl was manually actuated by a lever having a handle located externally of the assembly although fluid-responsive piston-and-cylinder arrangements and electrically energized solenoids are also described. The pawl is advantageously biased away from the toothed periphery of the disk-shaped member by a spring.

The drive system was provided, as described earlier, with a crankshaft mounted in the housing and having externally thereof a crank with a relatively long lever arm. Within the housing the shaft of the crank is connected by gear means with the drive shaft, advanta-

geously including a driving gear on the shaft of the crank and a driven gear on the sprocket-wheel shaft. The gears may mesh directly, if counter-rotation of the shafts poses no problem or may be interconnected by direction-changing means such as a toothed or cogged belt, a chain or an idler gear when unidirectional rotation of the two shafts is required.

It will be apparent that, while my prior system represented a major advance over the art with respect to the operation of the clutch mechanism, some considerable force nevertheless might have been required to release the locking pawl.

#### OBJECTS OF THE INVENTION

The principal object of the present invention is to provide an improved anchor hoist which will extend the principles sets forth in my copending application Ser. No. 101,287 and to provide, in accordance therewith, improvements in clutch-actuating arrangements therefor.

Another object of the invention is to provide a lightweight and relatively inexpensive anchor hoist which will more easily be operated than conventional structures and will not require as massive drive systems as earlier arrangements.

Yet another object of the invention is to provide an anchor hoist requiring less effort on the part of the operator.

#### SUMMARY OF THE INVENTION

These objects and others which will become apparent hereinafter are attained, in accordance with my present invention which, while provided with many elements in common with those of my earlier application, is modified so that some of the prior-art disadvantages may be avoided. More particularly, I have discovered that, when the shiftable cone of the clutch arrangement is angularly and axially fixed to the clutch-actuating sleeve and the friction forces acting upon the shiftable clutch member act in the same sense as the pawl, there is provided a servotightening of the clutch to the point that the frictional interengagement of the clutch members will suffice to enable the anchor to be raised without any substantial effort on the part of the operator.

The anchor hoist, according to the present invention, thus comprises, in common with the anchor hoist of the earlier application, a housing which may be sealed and flooded with a suitable lubricant, a main shaft journaled in this housing and having an end projecting therefrom, a chain-sprocket wheel or other rotatable body engaging the anchor cable, rope or chain and rotatable on the aforementioned end of the shaft while being axially fixed relative thereto and provided with a frustoconical socket forming one clutch member, and an axially and angularly displaceable second clutch member mounted on the shaft and receivable in the socket. The shaft also carries a clutch-actuating sleeve which, unlike the earlier system, does not only bear upon the shiftable clutch member, but is angularly and axially fixed thereto. The portion of the sleeve within the housing is provided with an outwardly extending annular flange having at least one formation engageable by a hook-shaped pawl pivotally mounted within the housing. In addition, the housing contains some drive means for the main shaft, e.g., in the form of a crankshaft coupled by appropriate gear, chain or belt means to the main shaft and/or a motor operating on

the main shaft by a worm and worm-wheel arrangement.

The pawl acts upon the sleeve to restrain angular displacement thereof with the shaft in the clutch-tightening direction and, according to the invention, the load upon the sprocket wheel acts to resist displacement of the sprocket wheel in this sense as well. Hence the pawl may be lightly applied to the flange as the shaft is rotated, e.g., in an anchor-lifting sense, to axially shift the sleeve and its clutch member toward engagement with the sprocket wheel. As soon as contact is achieved between the clutch members, the friction developed acts in the same direction as the pawl to resist angular displacement of the sleeve and allow the axial displacement to continue until the friction force is equal to the torque necessary to lift the chain. As soon as this threshold torque is achieved, the sprocket wheel, sleeve and shaft are frictionally locked together and the anchor is raised. In practice, the pawl can be released as soon as frictional engagement commences. This servo-operation guarantees that no excess axial stress will be developed and that no strain will be applied to the motor beyond that which is necessary to raise the chain. Motor overloads by failure to release the pawl are eliminated and the entire apparatus can be of smaller dimensions since it need not resist inadvertent axial stresses.

According to another feature of the invention, the cam means is provided at the flange of the sleeve to release the pawl once it has engaged the self-tightening or self-locking formation of the flange when the shaft is rotated in a clutch-disengaging sense. This cam means may include a surface on the flange or a camming disk mounted thereon and provided with a finger engaging a finger of an entraining member fixed to the shaft.

#### DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a vertical cross sectional view through the housing and other parts of an anchor hoist according to the present invention;

FIG. 2 is a transverse vertical cross section through the hoist;

FIG. 3 is a detail sectional view of the main shaft showing means for driving same from a motor;

FIG. 4 is a transverse cross section through this shaft representing a detail of FIG. 3, and illustrating the camming arrangement for displacing the pawl or latch member; and

FIG. 5 is a detailed view of the cam arrangement similar to FIG. 4 but with the parts in another position.

#### SPECIFIC DESCRIPTION

In the description below, various portions of the anchor hoist of the present invention fully described in my copending application, Ser. No. 101,287, have not been illustrated or discussed in detail. It should be noted that the present improvement is directed to one portion only of such apparatus and that otherwise all of the structure illustrated and described in the copending application may be provided in the anchor hoist of the present disclosure as well. For example, in the prior application, I have described a crank arrangement

whereby the crank-rotated shaft is connected by a cogged belt to the driven shaft of the winch sprocket. Furthermore, the crank of that arrangement was provided with a crankshaft, a rod extending through the crankshaft and a brake member of frustoconical configuration displaceable by this rod for disengagement from the housing, and a spring urging the brake member into engagement with the housing. Thus, the crankshaft is locked by a friction brake when it is released by the user.

In the prior application, I have also described manual means for driving the motor-driven shaft as an alternative to the motor drive. In this arrangement, the main shaft carries a clutch which is keyed to the shaft and may be coupled by jaw-clutch elements with the worm wheel of the motor drive or may be disengaged therefrom. In the other position, as controlled by a lever, the clutch member may have its gear teeth engaged in an idler gear rotated by the crank through a gear carried thereby. In this arrangement, either motor power or hand power may be used.

Also in the aforementioned application, I disclosed means for facilitating the lifting of the latch member or pawl on the rotatable members and/or means for remotely operating the winch or hoist. All such mechanisms should be considered within the ambit of the present disclosure with the various parts used interchangeably with those described below.

In FIGS. 1 and 2 of the present case, however, I have shown a manually operated anchor hoist which comprises a housing 1 adapted to be mounted upon a deck plate and which may be filled with oil or some other lubricating substance. The housing 1 is provided in opposite walls with journals for a main shaft 2, one end of which projects outwardly of the housing and carries a sprocket wheel 3 adapted to engage the anchor chain for controlling the release thereof and raising the anchor. The sprocket wheel 3 is axially fixed on the shaft 2 but is rotatable relative thereto. The sprocket wheel 3 is formed with a frustoconical recess 3a diverging in the direction of the housing and thus opening inwardly, this frustoconical recess forming one of a pair of cone-type friction-clutch member. The other clutch member 4 is frustoconically convergent axially in the direction of the sprocket wheel 2 and can be received therein. The frustocone 4 is shown to be keyed at 5 to an internally threaded sleeve 6 projecting through the wall of the housing 1 and axially bearing upon the frustocone 4 to entrain the latter in the axial direction, the key 5 prevents relative rotation and axial displacement of the frustocone and the sleeve.

The shaft 2 is provided with an external thread 7 engaging the internal thread 6a of the sleeve 6 so that, when sleeve 6 is angularly fixed, rotation of the shaft 2 relative thereto will axially advance or retract the sleeve. The latter is provided, within the housing 1, with an annular flange 8 formed along its periphery with a recess arrangement 9 adapted to be engaged by a latching pawl 10 for angularly restraining the sleeve 6. The pawl 10 is pivoted in the housing about the pin 10a and is urged in the counter-clockwise sense by a spring 10b anchored to an arm 10c of the pawl at a location 10d, the other end of the tension spring is anchored at 10e. It will be apparent that the points 10d and 10e define a line which can coincide with the axis of the pin 10a in a "dead-center" position of the pawl. When this imaginary line lies to the left of the axis of

rotation of the pawl the spring acts in the counter-clockwise sense to urge the pawl out of engagement with the flange 8. When, however, the pawl is displaced to swing the location 10d and the lines 10d - 10e to the right of the axis of pin 10a, the spring is effective to bias the pawl in the clockwise sense and hold it in an engagement with the flange. The pawl is provided with a lever 11 external of the housing for manual release and engagement of the pawl.

The shaft 2 also carries a driven gear 12 which meshes with an idler gear 13 journaled on a stud 13a in the housing. The idler gear or direction-changing gear 13, moreover, is in mesh with the drive pinion 14 keyed to a shaft 15 journaled in the housing 1 parallel to the shaft 2. The shaft 15 also projects from the housing and is provided on an outer portion with a crank 16.

According to the principles of the present invention, the flange 8 is provided with a camming surface adapted to deflect the pawl 10 out of locking engagement when the shaft 2 is rotated in a sense adapted to raise the anchor. The cam 9, 9a is effective to release the pawl.

In normal operation, assuming the anchor has been lowered and it is desired to raise the same, the clutch 4 being engaged with the clutch surface 3a of the sprocket wheel, the crank 16 is simply rotated to release the pawl without causing relative rotation of the sleeve and the shaft so that the sprocket wheel 3 rotates with shaft 2 and lifts the chain. When it is desired to lower the chain, however, the pawl 10 is brought into engagement with the flange 9 to hold the sleeve 6 as the crank 16 is rotated to release the clutch member 3a and 4, thereby permitting the sprocket wheel 3 to rotate relatively freely as the anchor descends.

The servo operation of the device is a consequence of the frictional engagement of the cone 4 with the sprocket wheel. Thus, when pawl 10 is held against the recess 9 as shown in dot-lines in FIG. 2, the flange 8 is held only by the light pressure applied by this pawl. The crank 16 is then rotated to axially shift the sleeve 6 to the left, there being no load of significance on the shaft at this time. However, as soon as the cone frictionally engages the recess 3a, the friction force is effective in the same sense as the pawl 10 to retard the rotation of the sleeve 6, thereby allowing the clutch pressure to build up automatically to the point that the torque developed at the clutch is sufficient to raise the anchor. This servo operation is effective whenever the sleeve 6 is frictionally retarded by engagement with the loaded sprocket wheel 3 or a relative rotation is permitted between the sprocket wheel 3 and the shaft 2. When the opposite rotation of the shaft 2 is desired to release the clutch, the crank is rotated until the steep crank 9a engages the hook of pawl 10, whereby the latch means retains the sleeve until the servo effect has loosened the clutch.

In FIGS. 3 through 5, I have shown an arrangement wherein a motor (e.g., an electric motor) is used along with or in addition to a manual drive, for the sprocket wheel 103. In this embodiment, the housing is represented at 101 and receives the shaft 102 which, within the housing, carries a worm wheel 25 driven by a worm 26 connected to the outer shaft of an electric motor as described in my copending application mentioned earlier.

In this embodiment, the flange 108 of the internally threaded sleeve 106, which engages at thread 107 of

the shaft 102, is fixed to the clutch cone 104 by a key arrangement represented at 105 and is formed with notches or recesses 109 and 109a as previously described. These notches cooperate with a pawl 110 which may be rotated about the stud 28.

The sleeve 106 is also formed with a cylindrical step 40 upon which a cam disk 17 is mounted for limited angular displacement, the cam disk being held in place by a spring clip 41. The flange 108 is provided with a pin 20 received in a slot 19 of the cam disk 17 to allow angular displacement through about 30° as illustrated in FIG. 4. The flanks 27 of the cam disk 17 are so shaped that, in one position, the steep-flank formations 109a are exposed as shown in FIG. 4. Thus the hook-shaped end of pawl 110 may engage these formations 109a to positively retain the flange 108 against rotation. In the other position of the cam disk, the flanks 27 obstruct the formations 109a and serve to shift the pawl 110 outwardly as illustrated in FIG. 5.

The pawl 110 can be manually displaced by a lever such as that shown at 11 in FIG. 2, or electromagnetically by a solenoid acting upon the rod 21.

The cam disk 17 is provided with an axially extending but eccentric pin 18 which projects toward an entrainer 23 axially and angularly fixed to the shaft 2. The entrainer 23 also carries an axially extending eccentric pin 24 in the path of pin 18.

In the close condition of the clutch 103, 104, a space is provided between the pins 18 and 24 as will be apparent from FIG. 3. When the shaft 102 is rotated in a clutch-disengaging sense, the hook of pawl 110 engages one of the formations 109a and restricts rotation of the sleeve 106. The sleeve is thereby shifted axially to the right to disengage clutch member 104 from member 103. The pin 18 approaches and finally engages the pin 24. At this point, the camming member 17 is thereby entrained with the shaft 102 (FIG. 5) to drive the pawl 110 out of engagement with the steep-flank 109a. The flange 108 is thereby released and can rotate together with the shaft 102.

To close the clutch 3, 4 the shaft 2 is driven (by reversal of the motor) in the opposite direction and the pawl 110 is brought into engagement with the flange. The pawl rests against the non-selftightening formation 109 to restrain the sleeve 106 which is shifted to the left until the aforementioned servo operation tightens the clutch to the desired extent. The pawl 110 may even be released during this self-tightening operation and can be held in this position by a friction spring bearing against the hub of this pawl.

For indicating the length of chain released, a counterarrangement may be provided as described in the aforementioned application and can make use of a pulse generator 29, 30, e.g., a permanent magnet and a stationary coil.

An important advantage of the present invention resides in the facts that the tractive force at the sprocket 3 is limited only by the maximum capacity of the motor and the motor cannot be overloaded by application of the clutch. The servo-clutching arrangement will match any load requirements. The locked formations 9 and 109 are of the non-selftightening type whereas formations 9a and 109a are selftightening, i.e., will not release without some additional force as long as the two parts are urged together in the tangential direction.

I claim:

1. An anchor hoist comprising a housing:

a hoist shaft journaled in said housing and having an end projecting therefrom;

a hoist body engaging the anchor and rotatably mounted on said end of said shaft while being formed with one clutch member;

a second clutch member mounted on said shaft end axially and angularly shiftable thereon while being juxtaposed with the first clutch member for engagement therewith;

a clutch-operating sleeve mounted on said shaft and operatively connected with said second clutch member for axially displacing same;

motion changing means between said sleeve and said shaft for converting relative angular displacement of said sleeve and said shaft into a relative axial displacement thereof upon angular mobilization of said sleeve, said sleeve being provided with at least one formation;

a locking pawl mounted on said housing and engageable with said formation for retaining said sleeve against angular displacement; and

drive means for rotating said shaft, said sleeve being formed with at least one camming surface for biasing said pawl out of engagement with said sleeve upon rotation of said shaft in a direction tending to disengage said clutch members from one another.

2. The anchor hoist defined in claim 1 wherein said sleeve is formed with a flange in said housing, said formation selflockingly engaging said pawl.

3. The anchor hoist defined in claim 2 wherein said camming surface includes a surface formed on said flange for lifting said pawl out of engagement with said flange.

4. The anchor hoist defined in claim 2 wherein said camming surface is formed by a camming disk mounted on said sleeve and limitedly angularly displaceable relative thereto and means on said shaft engageable with said disk for entraining same to bias said pawl out of engagement with said formation.

5. The anchor hoist defined in claim 4 wherein said camming disk is provided with an axially extending pin offset from said shaft, said shaft being provided with an entrainer having an axially extending pin engageable with the pin of said disk.

6. The anchor hoist defined in claim 2 wherein said pawl is provided with spring means for retaining said pawl in at least two operative positions including a position wherein said pawl is out of engagement with said flange.

7. The anchor hoist defined in claim 6 wherein said body is a chain-sprocket wheel formed with an axially diverging frustoconical recess open toward said housing and forming said first clutch member, said sprocket wheel being axially fixed to said shaft but rotatable freely on said end thereof, said second clutch member comprising a cone converging frustoconically in the direction of said sprocket wheel, said second clutch member being axially and angularly fixed to a portion of said sleeve projecting outwardly from said housing.

8. The anchor hoist defined in claim 7 wherein said motion changing means includes mating screwthreads on said sleeve and said shaft.

9. The anchor hoist defined in claim 8 wherein said drive means includes a crankshaft journaled in said housing, gear means within said housing coupling said crank shaft with the shaft carrying said sprocket wheel, and a crank mounted on said crankshaft externally of said housing.

10. The anchor hoist defined in claim 8 wherein said drive means includes a worm wheel on said shaft and a motor-driven worm meshing with said worm wheel.

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