

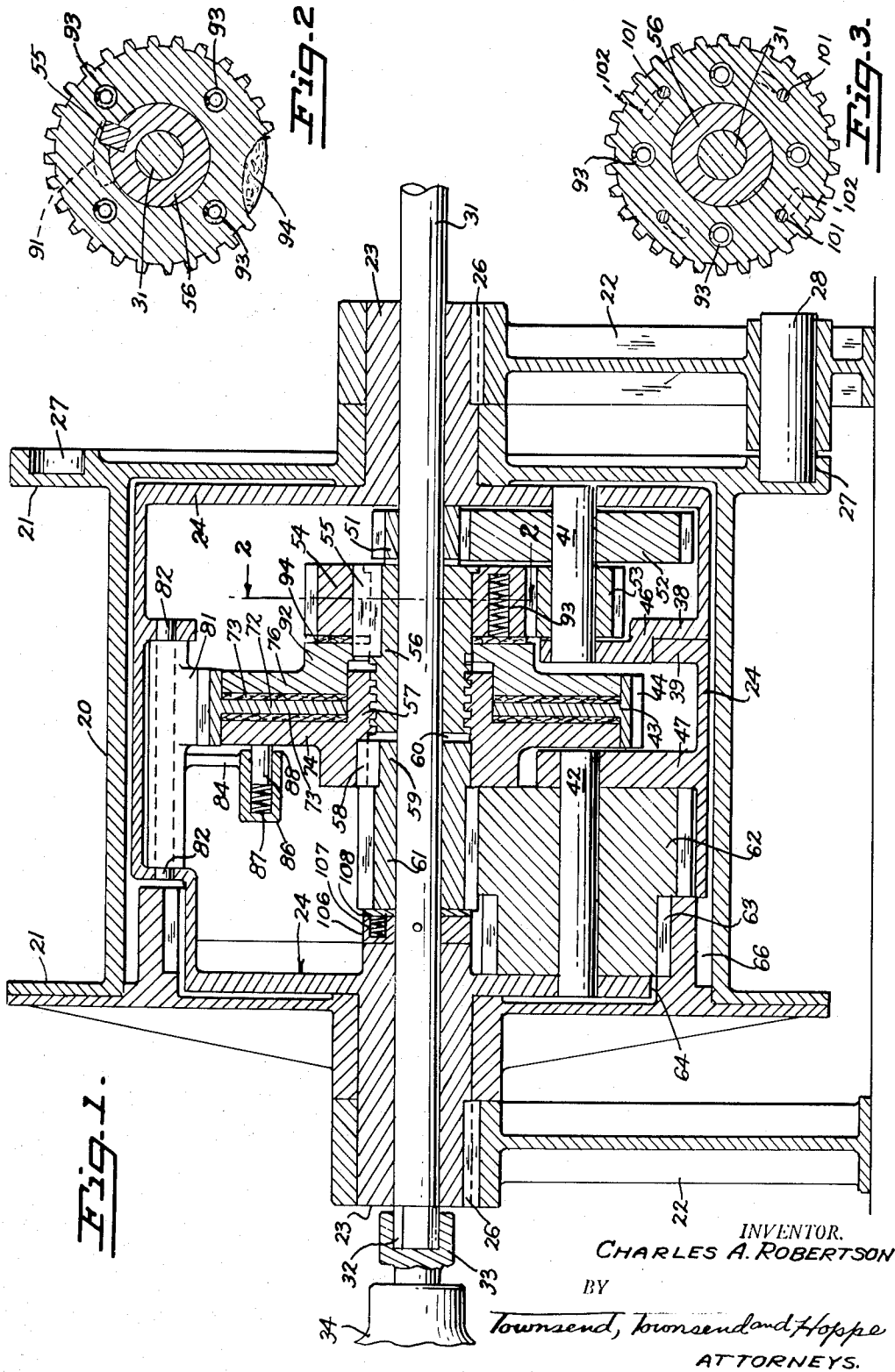
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WINCH RELEASE MECHANISM

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WINCH RELEASE MECHANISM

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This invention relates to new and useful improvements in winch release mechanism. Reference is made to my co-pending application Ser. No. 299,955, filed July 21, 1952, for Winch, on which this application is an improvement. The invention has particular application in winches which may be employed to raise or top booms and the like wherein a cable is wound around the drum of a winch located at deck level on a vessel.

The winch construction shown in my said pending application discloses a load brake incorporated in the winch structure which has a braking surface far in excess of that of conventional winches. When the brake of such a winch is engaged, difficulty may be experienced in releasing the brake because the brake discs and brake lining tend to bind. When release is attempted a momentary over-load is imposed on the motor with consequent eventual damage thereto. Accordingly, the instant invention employs a loose-play connection between one of the brake discs and the driving gear to which it is connected, which enables the gear to turn through an angle of approximately 40° without positive engagement with the brake disc, thereby preventing overload of the driving motor. At the same time that the loose play connection is operative, spring tension is applied between the gear and the disc to urge rotation of the disc, thereby biasing the brake disc toward disengagement from the brake lining.

The instant winch, in addition to the foregoing advantages, embodies all of the other advantages of the winch disclosed in my said co-pending application over prior winches. Thus, the construction of the winch drive mechanism herein disclosed provides space within the winch drum to accommodate a braking surface far in excess of that available in conventional winches of this character. Still another advantage incorporated in this winch is the provision of two separate countershafts located within the winch casing, the countershafts being spaced apart so that a gap exists within the inner ends thereof, the gap accommodating the brake disc hereinbefore referred to.

In conventional winches, the drive operates from a central shaft to which is keyed a pinion which in turn meshes with a gear train located within a casing inside the winch drum. Conventionally, such a gear train employs a countershaft parallel to the main shaft and positioned in the casing inside the drum. In the instant invention two separate countershafts parallel to the main shaft and positioned in the casing are provided, the inner ends thereof being spaced apart.

Still another advantage which the present invention enjoys in common with my said prior application resides in the construction of the casing which fits inside the drum and which provides support for each end of the two separate countershafts.

By the arrangement herein disclosed there is an internal gear connected to the winch drum and a pinion in the gear train which meshes with the internal gear. A support or bearing for each end of the shaft of the last mentioned pinion is provided, thereby differing from prior constructions and greatly increasing the life of the

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pinion over conventional corresponding pinions which are unsupported at one end.

It will be understood that where the instant invention has been illustrated and is heretofore described as installed in a winch structure, nevertheless the invention may be applied to a gear box assembly for purposes other than driving winches.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

In the drawings:

Fig. 1 is a vertical longitudinal midsection through the winch.

Fig. 2 is a vertical transverse section taken substantially along the line 2—2 of Fig. 1.

Fig. 3 is a view similar to Fig. 2 showing a modified loose play connection.

The instant invention comprises a drum 20 with end flanges 21 about which a line is customarily wound. The drum 20 is rotatably supported by standards 22 in which are fixed axially projecting bosses 23 of an inner casing 24 mounted within the drum, the drum being rotatably journaled about casing 24 and bosses 23 being keyed to standards 22 by keys 26. Customarily one of the flanges 21 of the drum is provided with a plurality of circular recesses 27 into any one of which fits a pin 28 axially slidable in the corresponding standard 22 upon manual actuation. Thus, when it is desired to hold the winch stationary, the operator projects pin 28 into one of the recesses 27 and locks the drum against rotation.

The drum 20 is driven through a central shaft 31, one end of which may be formed in a non-circular section 32 to receive a corresponding chuck 33 attached to a portable reversible motor 34, such as an electric drill motor equipped with a reduction gear. When it is desired to actuate the winch, chuck 33 is placed over section 32 at end of shaft 31, and, on rotation of motor 34, shaft 31 is rotated.

Shaft 31 is journaled within bosses 23 on opposite ends of internal casing 24 which fits inside the central portion of drum 20. Casing 24 is split to provide access to the interior, the two halves being fastened together by any conventional means connecting internal projecting flanges 38 and 39 of the two halves.

In the interior of casing 24 is mounted the gear train which drives the winch. Accordingly, inside the winch are two countershaft sections 41 and 42. These two sections are substantially in axial alignment, but a gap exists between the inner ends of the two sections, said gap providing space for the interposition of a brake wheel 43 and a peripheral ratchet 44 which are concentric with central shaft 31. Each of the countershaft sections 41 and 42 is supported at each end, this being one of the important features of this invention. Thus, section 41 is supported at its inner end by an internal extension 46 integral with flange 38 and at its outer end at the end wall at the right half of casing 24. The other countershaft section 42 is supported at its inner end by an integral extension 47 at the left half section of casing 24 and its outer end is supported in the end wall at the left end of the casing.

The gear train and drive of the winch is mounted on the main shaft 31 and on the two countershaft sections 41 and 42. Thus, pinion 51 is keyed to main shaft 31. Pinion 51 meshes with the larger gear 52 of a composite gear 52—53 on the countershaft section 41. The smaller gear 53 of said composite gear meshes with a gear 54 keyed to a sleeve 56 by means of key 55, sleeve 56 being rotatable about and relative to main shaft 31. The inner end of sleeve 56 is threaded and engages a nut 57 rotatable about shaft 31, said nut being keyed by key 58 to

an axial projection 59 of pinion 61 which is rotatable about shaft 31. Pinion 61 and nut 57 rotate together, but endwise play therebetween in an axial direction is permitted by reason of a gap between the inner ends of sleeve 56 and projection 59, thereby permitting nut 57 to be tightened or loosened on the end of sleeve 56. Pinion 61 meshes with gear 62 of a composite gear 62-63 on countershaft section 42. Pinion 63 of said composite gear partially projects through an aperture 64 in the casing 24 and the portion of said pinion 63 which projects through gap 64 meshes with an internal ring gear 66 which in turn is fixed to drum 20. From the foregoing described gear train it will be seen that, as main shaft 31 is rotated, drum 20 is caused to revolve, there being considerable speed reduction by reason of the fact that driving gears are of a smaller diameter than the driven gears with which they mesh.

Brake wheel 43 is rotatably mounted about and axially slidable relative to nut 57. The web 72 of wheel 43 comprises two oppositely facing annular faces which are lined with brake lining 73. The opposed annular brake linings 73 are engaged by brake discs 74 and 76, one said disc 74 being integral with nut 57 and the other disc 76 being rotatable with respect to nut 57. Sufficient clearance is provided to permit endwise movement of discs 74 and 76 toward and away from engagement with brake lining 73. As nut 57 is tightened on sleeve 56 by reason of relative rotation of these two members, disc 74 is moved toward disc 76, thereby clamping web 72 between discs 74 and 76 and requiring brake wheel 43 to rotate with sleeve 56.

The periphery of brake wheel 43 is provided with a ratchet 44, said ratchet 44 being engaged by a pawl 81 which is mounted on pivots 82 received in extensions of casing 24. In order to insure constant engagement of pawl 81 with said ratchet 44 an arm 84 is fixed to the outer end of pawl 81, said arm 84 being provided with a boss 86 having an internal bore receiving a spring 87 and a wooden plug 88, the action of spring 87 being such as to force the plug 88 into engagement with the surface of brake disc 74 opposite that which engages lining 73. This arrangement insures constant engagement of pawl 81 with ratchet 44 and also reduces the clicking noise characteristic of ratchets. The direction of the teeth of ratchet 44 permits free winding of drum 20, but prevents unwinding of drum 20 so long as wheel 43 is locked for rotation with sleeve 56.

The provision of nut 57 on sleeve 56 insures that the drum cannot unwind too rapidly because if there is a tendency for pinion 61 to revolve more rapidly than sleeve 56, then nut 57 screws to the right on sleeve 56 and locks brake discs 74 and 76 against web 72, which causes brake wheel 43 to rotate with sleeve 56 and thereby brings into operation functioning of ratchet 44 and pawl 81 which locks drum 20 against unwinding. So long as there is no relative movement of nut 57 with respect to sleeve 56, brake discs 74 and 76 remain disengaged and thereby the function of pawl 81 and ratchet 44 is inoperative.

The foregoing described construction is in many respects similar to that disclosed in my said application Serial No. 299,955.

Key 55 which keys gear 54 to sleeve 56 is elongated and said key 55 projects into a keyway 91 in hub 92 of disc 76. Keyway 91 is not of conventional construction, but as shown particularly in Fig. 2, is arcuate, thus permitting a considerable angular movement of sleeve 56 and gear 54 relative to disc 76 before there is positive engagement effected by key 55. The included angle of arcuate keyway 91 is approximately 40°. Bores are formed in the flank of gear 54 within which are received springs 93, said springs projecting outwardly through a disc of brake lining 94 fixed to gear 54 on the flank facing hub 92. During the loose play movement afforded by the construction of keyway 91, brake lining 94 and springs 93 bear against hub 92 and bias disc 76 in the direction of

the rotation of gear 54 particularly during the interval when there is no positive engagement between members 54 and 76. The foregoing construction reduces any potential overload on motor 34 which may be occasioned by discs 74 and 76 binding against lining 73. During the angular movement afforded by keyway 91, the motor has a chance to pick up power and, further, the functions of lining 94 and spring 93 prevent a sudden impact when key 55 abuts the end wall of arcuate keyway 91.

In Fig. 3 a modified loose play connection is shown. In lieu of the key 55 and keyway 91 a plurality of pins 101 are shrunk into holes in the flank of gear 54. These pins project out through brake lining 94 on the flank of gear 54 which is opposite hub 92 and fit into arcuate slots 102 in hub 92. Springs 93 are positioned in bores in gear 54 as in the preceding modification, said springs bearing against lining 94 and biasing gear 54 and disc 76 for rotation together. The arcuate slots 102 permit relative angular movement of the two members before positive engagement is effected, as in the preceding modification.

A spacing member 106 is fastened to shaft 31 adjacent the left hand end of casing 24, said spacing member being bored out in a plurality of places in its flank and helical springs 107 are received within the recesses thus formed. Springs 107 bear against an anti-friction collar 108 interposed between spacing member 106 and pinion 61. This arrangement maintains the pinions 51 and 61, sleeve 56 and nut 57 on shaft 31 in proper position. When the nut 57 is tightened on the threaded end of sleeve 56, springs 107 bias disc 76 to the right as shown in Fig. 1, thus maintaining hub 92 against lining 94, thus facilitating the loosening of discs 74 and 76 from lining 73. It will further be noted that the width of pinion 61 is sufficiently greater than the width of gear 62 to accommodate the axial movement of the pinion 61 which occurs under urging of springs 107 without interfering with full contact of the teeth of the respective pinion 61 and gear 62.

Operation

In operation, assuming that the boom to be lowered is down and that the discs 74 and 76 are disengaged from brake lining 73, the operator fits the chuck 33 of motor 34 over the end 32 of shaft 31 and turns shaft 31 in a winding direction. This turns pinion 51 and thence composite gear 52-53 which in turn engages gear 54 keyed to sleeve 56. The turning of sleeve 56 causes turning movement of nut 57 which causes pinion 61 to turn by reason of the fact that key 58 engages projection 59 which is integral with said pinion 61. Pinion 61 transmits rotary motion to composite gear 62-63, the pinion 63 of which projects through aperture 64 in casing 24 and meshes with internal ring gear 66 on drum 20, thereby winding the drum.

The movement heretofore described tends to cause disengagement of nut 57 with threaded sleeve 56 and hence brake discs 74 and 76 are moved away from the flange 72 of brake wheel 43. This either causes brake wheel 43 to remain stationary, or in the event brake wheel 43 revolves, the direction of the teeth of ratchet 44 and pawl 81 is such that the ratchet unwinds and hence the braking function of the winch is inoperative.

When it is desired to unwind the drum, the operator turns motor 34 driving shaft 31 in the opposite direction. So long as the drum 20 unwinds at the same or a lesser relative speed as the motor 34 is turned, nut 57 is not tightened on the threaded end of sleeve 56 and the reverse of the winding operations is performed. However, if drum 20 tends to unwind at a speed greater than the corresponding relative speed at which shaft 31 is turned by motor 34, then nut 57 is tightened on the threaded end of sleeve 56. This moves brake disc 74 to the right as viewed in Fig. 1, thereby clamping brake linings 73 carried by the flange 72 of brake wheel 43 between brake discs 74 and 76, which in turn causes said brake wheel

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43 to revolve with sleeve 56. Since pawl 81 engages ratchet 44 on the periphery of brake wheel 43 when the brake wheel is revolved in the unwinding direction, brake wheel 43 slows the mechanism as the discs 74 and 76 are tightened against brake lining 73 and when the discs 74 and 76 are clamped against the brake lining 73 the ratchet 44 functions to lock the drum against movement.

Assuming that the discs 74 and 76 have been locked against brake lining 73, and assuming that shaft 31 is again turned in an unwinding direction, the mechanism which is the subject of this invention and which prevents an overload on motor 34 begins its function. As shaft 31 is turned in an unwinding direction, gear 54 and the brake lining 94 on the flank thereof are caused to revolve. Springs 93 press brake lining 94 against the flank of the hub 92 of brake disc 76 and this biases movement of brake disc 76, brake wheel 72 and brake disc 74 in an unwinding direction and tends to loosen nut 57 on the threaded end of sleeve 56. This biasing action is a gradual rather than an abrupt action, inasmuch as slippage occurs and this prevents an overload on motor 34. In the modification shown in Figs. 1 and 2, key 55 carried by gear 54 can move through an angular direction of approximately 40° before abutting the edge of keyway slot 91 in hub 92, and during this 40° movement the biasing effect heretofore described is operative. Hence, by the time key 55 has moved completely in a counterclockwise direction as viewed in Fig. 2, nut 57 has been unloosened substantially to prevent the overload and thereafter the unwinding driving movement is carried directly by key 55 rather than by brake lining 94. In the modification of Fig. 3, the pins 101 also permit approximately 40° angular movement between gear 54 and hub 92 during which movement the biasing action heretofore described occurs.

It will thus be seen that when unwinding movement occurs subsequent to a locking action of discs 74 and 76 against brake wheel 42, approximately a 40° angular movement between gear 54 and disc 76 is permitted before positive locking of gear 54 and disc 76 occurs, and that during this 40° movement, although the two members are biased by means of springs 93 and lining 94 for movement together, nevertheless slippage occurs and this slippage prevents an overload on the motor 34 and hence prevents damage to the motor.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention and scope of the appended claims.

What is claimed is:

1. A gear train comprising a casing, a main shaft journaled in said casing, means for rotating said main shaft, at least one countershaft journaled in said casing, a plurality of driving and driven gears disposed on said main shaft and countershaft including a first gear concentric with and rotatable relative to said main shaft, a brake wheel rotatable about and relative to said main shaft, a ratchet on said brake wheel, a pawl on said casing, a first and a second brake disc concentric with and rotatable relative to said main shaft on opposite sides of said brake wheel, first threaded means fixed for

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rotation with said first gear and having a sleeve portion, said second brake disc being rotatably mounted on said sleeve portion, second threaded means engaging said first threaded means and fixed for rotation with said first brake disc, said first and second threaded means being operable to clamp said first and second discs against opposite faces of said brake wheel to brake said train against unwinding when said train tends to unwind at a speed greater than the corresponding relative speed at which said main shaft is turned in an unwinding direction, said second brake disc being formed with at least one arcuate slot, and at least one driving member fixed for rotation with said first gear, the number of driving members corresponding in number with said slots and projecting within said slots.

2. A gear train according to claim 1 which further comprises resilient means biasing said first threaded means and said first gear for rotation together before positive engagement therebetween.

3. A gear train according to claim 1 in which said first gear is mounted on said sleeve portion and which further comprises a key and keyway connection between said first gear and said sleeve portion and in which said arcuate slot comprises an arcuate keyway slot in said first brake disc into which said key projects.

4. A gear train according to claim 1 in which said driving members comprise a plurality of pins projecting from a flank of said first gear and in which a corresponding plurality of arcuate slots is formed in the opposed flank of said first brake disc into which said pins project.

5. A gear train according to claim 1 in which said first gear is fixed for rotation with said sleeve portion, which further comprises a plurality of springs recessed in the flank of said first gear opposed to said first brake disc, said springs each biasing said first brake disc for unwinding movement of said first threaded means before positive engagement therebetween.

6. A gear train according to claim 5 which further comprises brake lining on said first gear interposed between said first gear and said first brake disc, said springs bearing against said brake lining and biasing said brake lining against said first brake disc.

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