June 7, 1955 C. A. ROBERTSON 2,710,168

WINCH

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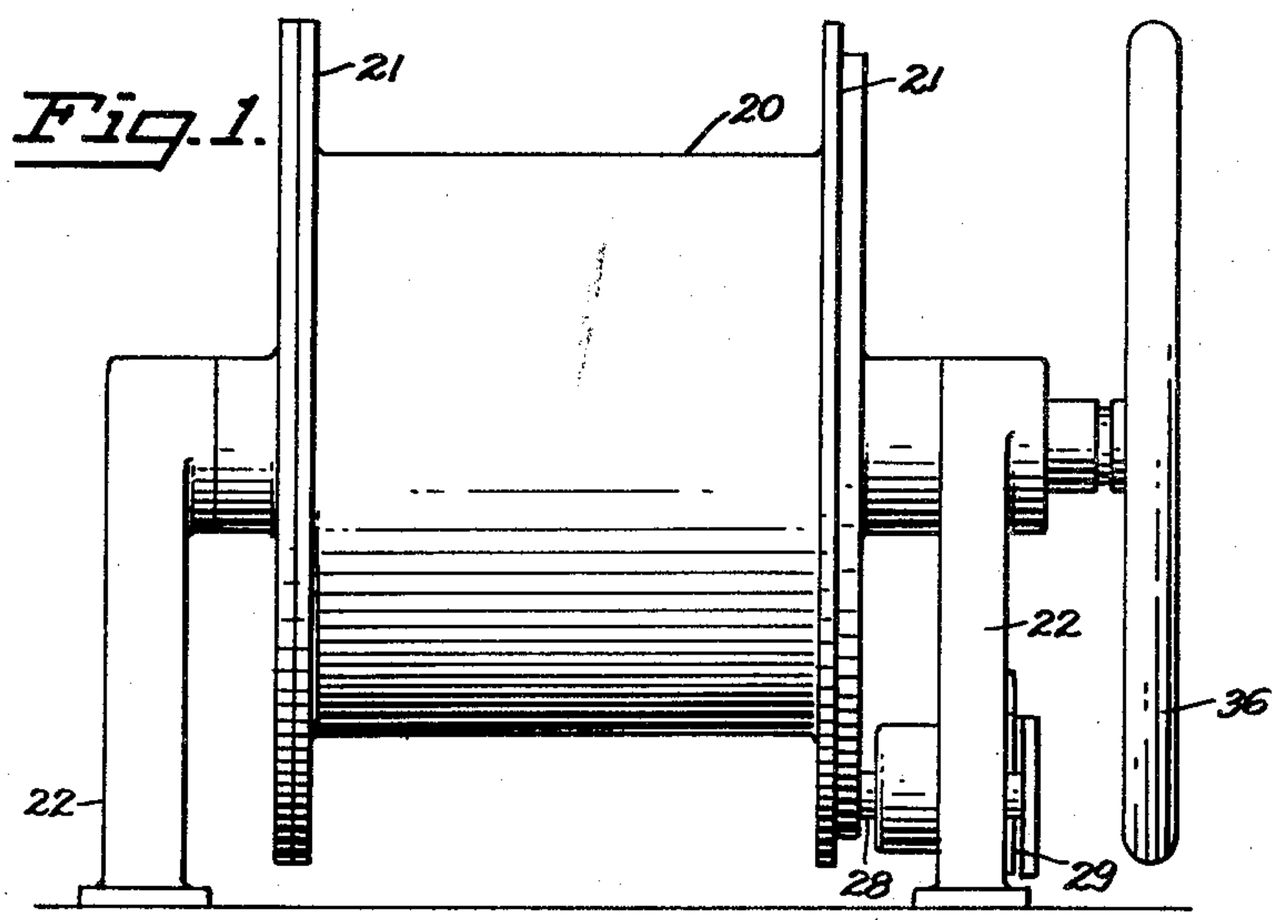
Fig. 1.



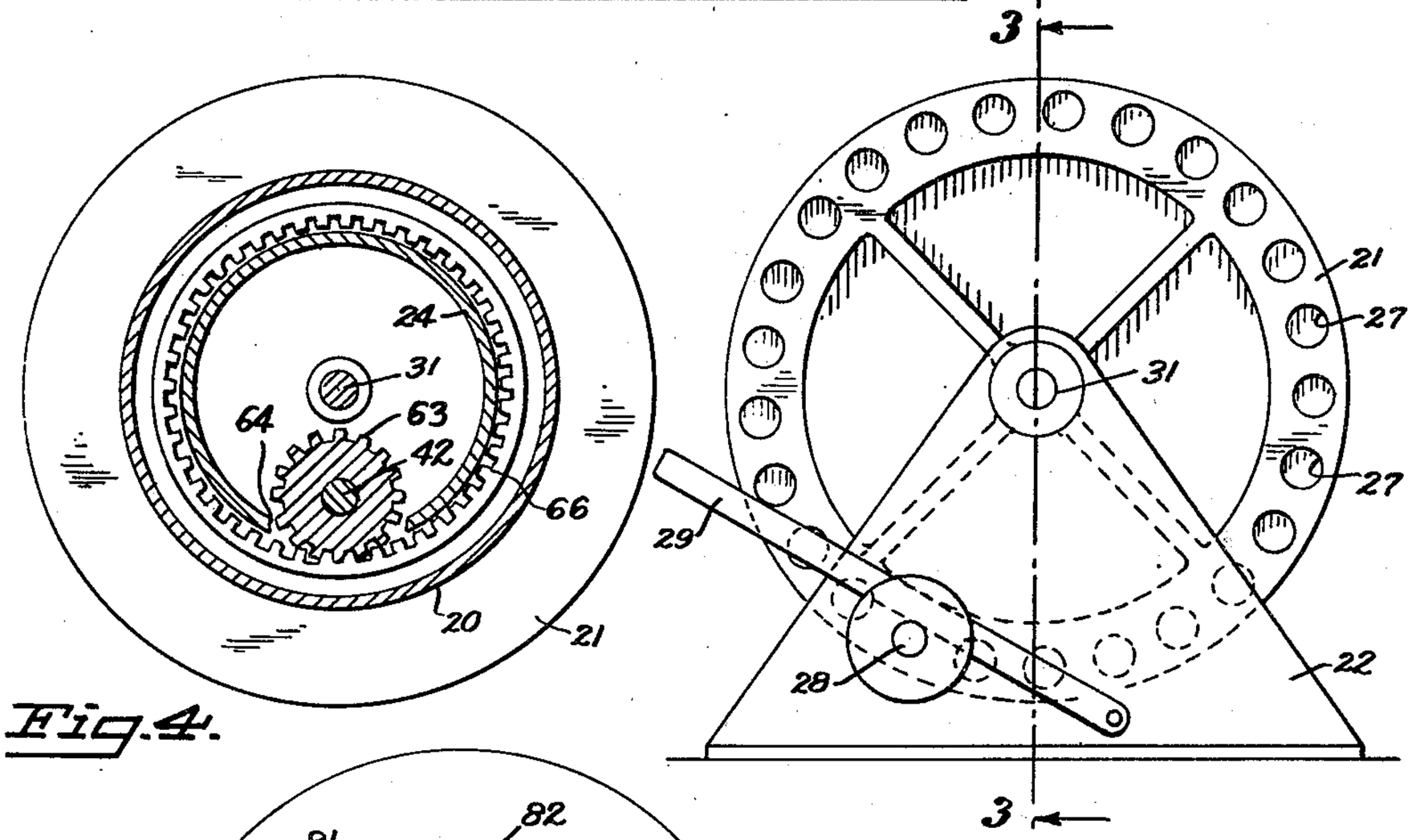


Fig. 2.

Fig. 4.

Fig. 5.

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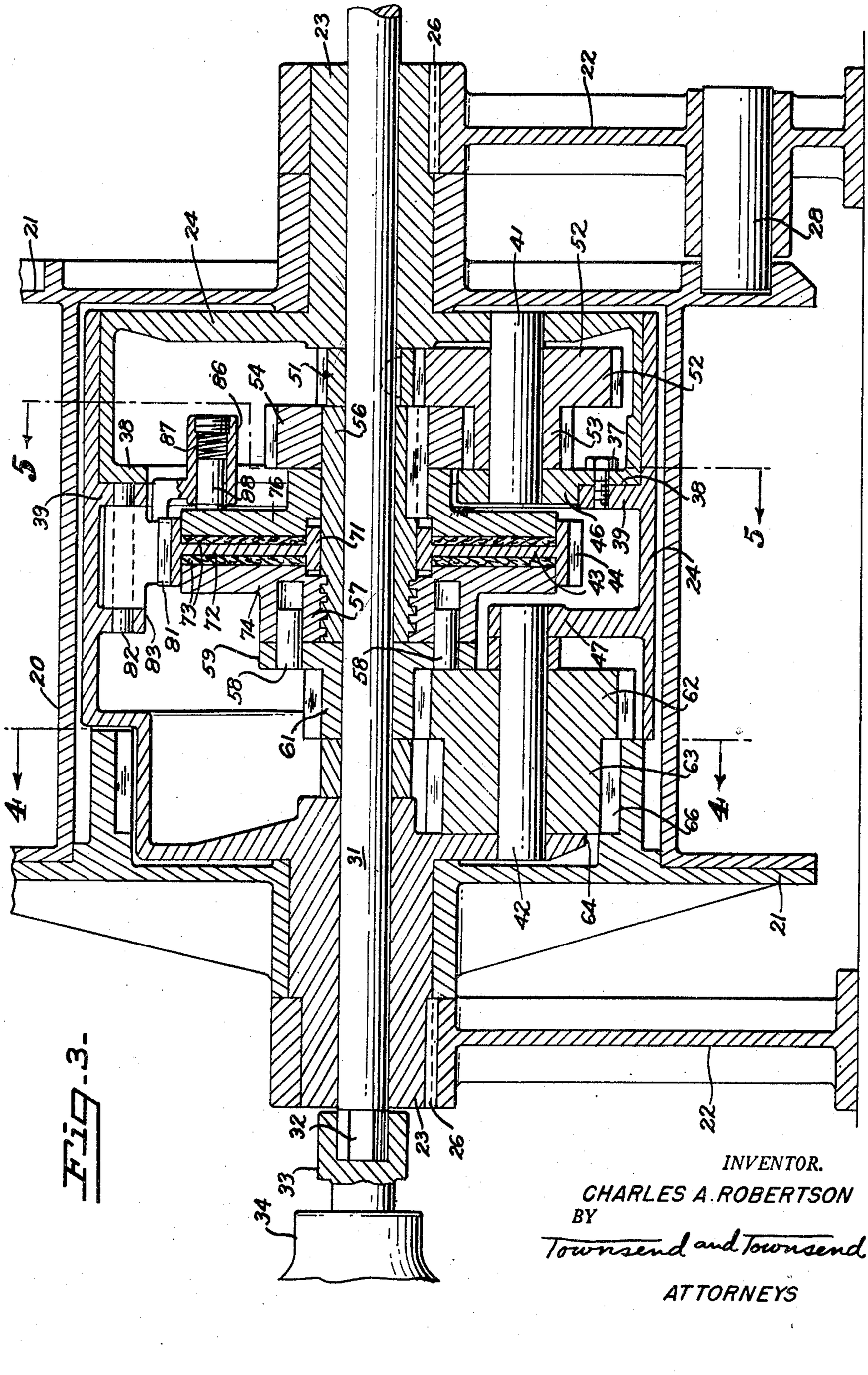

Fig. 3.

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WINCH

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8 Claims. (Cl. 254—186)

This invention relates to new and useful improvements in winches. More particularly the invention relates to a winch 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 in an exposed position.

The invention employs a load brake incorporated in the winch structure which operates to prevent accidental dropping of the boom. By reason of the construction of the winch drive mechanism, as hereinafter set forth, space is provided within the drum to accommodate a braking surface far in excess of that available in conventional winches of this character. One of the important features of this invention is the provision of two separate counter-shafts located within the winch casing, said counter-shafts being spaced apart so that a gap exists therebetween, said gap accommodating the brake disk hereinbefore referred to.

Conventional winches are driven from a central shaft which operates a pinion which in turn meshes with a gear train located within a casing inside the winch drum. Customarily the gear train employs a counter-shaft disposed parallel to the main shaft of the winch and journaled in the casing inside the winch drum. The instant invention has for one of its principal points of novelty the provision of two separate counter-shafts which are spaced apart axially.

Further features of the invention reside in the construction of the casing which fits inside the drum and which provides support for each end of each section of the counter-shaft.

By this arrangement there is an internal gear connected to the winch drum and a pinion meshing with the internal gear. A support or bearing for each end of the pinion shaft is provided, thereby greatly increasing the life of the pinion over conventional pinions, which are unsupported at one end.

The instant invention has been illustrated and is hereafter described installed in a winch structure. It will be understood that 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 front elevation of the exterior of the winch.

Fig. 2 is an end elevation as viewed from the right in Fig 1, the hand wheel being removed.

Fig. 3 is a vertical mid-section taken substantially along the line 3—3 of Fig. 2.

Fig. 4 is a vertical section taken substantially along the line 4—4 of Fig. 3.

Fig. 5 is a vertical section taken substantially along the line 5—5 of Fig. 3.

The instant invention comprises a winch having 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 on an inner casing 24 mounted within said drum, the drum being rotatably journalled 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 holes 27 through any one of which fits a pin 28 axially slidable in the corresponding standard 22 upon manual actuation of lever 29. Thus, when it is desired to hold the winch stationary the operator projects pin 28 into one of the apertures 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 non-circular cross-section 32 to receive a corresponding chuck 33 attached to a portable motor 34, such as an electric drill motor equipped with a reduction gear. Thus when it is desired to actuate the winch, the chuck 33 is placed over hexagon 32 on the end of the shaft 31, and, on rotation of the motor, shaft 31 is likewise rotated. A hand wheel 36 is also fixed to shaft 31 to permit manual rotation thereof.

Shaft 31 is journaled within bosses 23 on opposite ends of internal casing 24 which fits inside the central portion of drum 20. Said casing 24 is split to provide access to the interior, the two halves being bolted together by means of bolts 37 which join internal projecting flanges 38 and 39 on the two halves.

The interior of casing 24 houses the gear train which drives the winch. Accordingly, inside the winch are two countershaft sections 41 and 42. Said 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 peripheral ratchet 44 which are concentric with central shaft 31. Each of the counter shaft sections 41 and 42 is supported at each end, this being one of the important features of the invention. Thus, section 41 is supported at its inner end by an internal extension 46 integral with flange 38 and at its outer end in the end wall of the right half of casing 24. The other counter shaft section 42 is supported at its inner end by an integral extension 47 of the left half of casing 24 and its outer end is supported in the end wall of said left half of the casing.

The gear train and drive of the winch is mounted on the main shaft 31 and on the two counter shaft sections 41 and 42. Thus pinion 51 is keyed to main shaft 31. Said pinion 51 meshes with the larger gear 52 of a composite gear on counter shaft section 41. The smaller gear 53 of said composite gear meshes with a gear 54 keyed to a sleeve 56 which is 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 pinned by pins 58 to apertured disc 59, which is in turn welded to pinion 61. Hence pinion 61 and nut 57 rotate together, but axial play therebetween is permitted by the pin connection, 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 on counter shaft section 42. The pinion 63 of said composite gear partially projects through a gap 64 in casing 24 and the portion of said pinion 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 a considerable speed reduction by reason of the fact that the driving gears are of a smaller diameter than the driven gears with which they mesh.

Brake wheel 43 is rotatably mounted about sleeve 56, said wheel 43 having an enlarged hub 71 which maintains said wheel perpendicular to the axis of sleeve 56. The web 72 of wheel 43 comprises two oppositely facing annular faces which are lined with brake lining 73. The opposite 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 keyed to sleeve 56. Sufficient clearance is provided to permit endwise movement of discs 74 and 76 toward and away from engagement with brake linings 73. As nut 57 is tightened on sleeve 56 by reason of relative rotation of these two members, disc 74 and disc 76 are moved toward each other, thereby clamping web 72 between them and requiring brake wheel 43 to rotate with sleeve 56.

The periphery of brake wheel 43 is provided with ratchet 44, said ratchet 44 being engaged by pawl 81, which is mounted on pivot 82 received in apertures in extension 83 of stationary casing 24. In order to insure constant engagement of said pawl 81 with said ratchet, an arm 84 is fixed to the outer end of said ratchet, said arm 84 being provided with boss 86 having an internal bore receiving a spring 87 and a wooden plug 88, the action of the spring 87 being such as to force the plug 88 into engagement with the surface of brake disk 76 opposite that which engages lining 73. This arrangement insures the 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 rachet 44 and pawl 81, which locks drum 20 against unwinding. Nut 57 may be loosened from sleeve 56 and brake discs 74 and 76 disengaged from brake wheel 43 by turning shaft 31 in the proper direction either by motor 34 or by manual actuation of hand wheel 36. 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.

In operation, when it is desired to operate the winch, the operator removes plug 28 from one of the holes 27 in the flange 21 of drum 20 by manual actuation of lever 29. Thereupon shaft 31 is caused to rotate by electric motor 34, or such other means as may be desired. Rotation of shaft 31 causes rotation of pinion 51 keyed thereto, which in turn causes rotation of the composite gear 53—54 and sleeve 56, thereby turning pinion 61 which meshes with composite gear, 62—63, the pinion 63 of which projects through aperture 64 in casing 24 and meshes with and causes rotation of internal gear 66 on winch drum 20, thereby turning the drum. During winding movement, if discs 74 and 76 are locked on wheel 43, nevertheless the direction of teeth of ratchet 44 on the periphery of brake wheel 43 permits rotation of the brake wheel in a winding direction. When the winch is wound to proper position, the operator inserts plug 28 in the adjacent hole 27 in the flange 21 of drum 20, thereby locking the drum in position.

When it is desired to lower the boom, wheel 36 or motor 34 rotates shaft 31 in the opposite direction. So long as drum 20 unwinds at the speed corresponding to the speed of shaft 31 (as reduced by the gear ratios of the gear train), nut 57 does not cause clamping of brake wheel 43 and hence pawl 81 does not stop the unwinding of the drum. If the drum commences to unwind too fast, then wheel 43 is locked for movement with the gear train, and pawl 81 prevents rotation of the drum.

What is claimed is:

1. A winch comprising an apertured stationary casing, a drum rotatable about said casing, a central shaft extending through said casing, means for revolving said central shaft, a first countershaft parallel to said central shaft and journaled in said casing adiacent one end thereof,

a second countershaft parallel to said central shaft and journaled in said casing adjacent the opposite end thereof, the inner ends of said countershafts being spaced apart, a gear train comprising driving and driven gears disposed partly on each of said three shafts, a gear outside said casing connected to drive said drum, said last mentioned gear being driven from one of the gears of said gear train through the aperture in said casing, a brake wheel mounted concentric with said central shaft and extending into the space between the inner ends of said countershafts, a ratchet on said brake wheel, a pawl on said casing, and means for applying braking pressure to said brake wheel when said drum tends to unwind at a speed greater than the corresponding relative speed at which said central shaft is turned.

2. A winch comprising an apertured stationary casing, a drum rotatable about said casing, a central shaft extending through said casing, means for revolving said central shaft, a first countershaft parallel to said central shaft and journaled in said casing adjacent one end thereof, a second counter shaft parallel to said central shaft and journaled in said casing adjacent the opposite end thereof, the inner ends of said counter shafts being spaced apart, a gear train comprising driving and driven gears disposed partly on each of said three shafts, a gear outside said casing connected to drive said drum, said last mentioned gear being driven from one of the gears of said gear train through the aperture in said casing, a sleeve concentric with said central shaft connected to one of said driven gears, said sleeve being threaded at one end, a nut meshing with said threaded sleeve and connected to one of said driving gears, a brake wheel mounted concentric with said sleeve and extending into the space between the inner ends of said countershafts, a ratchet on said brake wheel, a pawl on said casing, and a pair of brake discs on opposite sides of said brake wheel, one of said discs being fixed for rotation with said sleeve, the other of said discs being fixed for rotation with said nut whereby braking pressure is applied to said brake wheel when said drum tends to unwind at a speed greater than the corresponding relative speed at which said central shaft is turned.

3. A winch comprising an apertured stationary casing, a drum rotatable about said casing, a central shaft in said casing, means for revolving said central shaft, a first countershaft parallel to said central shaft and journaled in said casing adjacent one end thereof, a second countershaft parallel to said central shaft and journaled in said casing adjacent the opposite end thereof, the inner ends of said countershafts being spaced apart, a first pinion fixed on said central shaft, a meshing first driven gear on said first countershaft, a second pinion fixed for rotation with said first driven gear, a meshing second driven gear, a sleeve concentric with said central shaft to which said second gear is fixed, said sleeve being threaded at one end, a nut meshing with said threaded sleeve and connected to one of said driving gears, a brake wheel mounted concentric with said sleeve and extending into the space between the inner ends of said countershafts, a ratchet on said brake wheel, a pawl on said casing, a pair of brake discs on opposite sides of said brake wheel, one of said discs being fixed for rotation with said sleeve, the other of said discs being fixed for rotation with said nut, a third pinion concentric with said central shaft fixed for rotation with said nut, a meshing third driven gear on said second countershaft, a fourth pinion fixed for rotation with said third driven gear and projecting through the aperture in said casing, and a gear outside said casing meshing with said fourth pinion connected to drive said drum.

4. A winch comprising an apertured stationary casing, said casing having two parts, means for attaching said two parts together, each said part having an end wall and an internal boss, said internal bosses being spaced apart axially of said casing with a gap therebetween, a

drum rotatable about said casing, a central shaft in said casing, means for revolving said central shaft, a first countershaft journaled in the first of said casing parts and supported at one end by the end wall of said first part and at the other end by said boss on said first part, a second countershaft journaled in the second part of said casing and supported at one end by the end wall of said second part and at the other end by the boss on said second part, the inner ends of said countershafts being spaced apart, a gear train comprising driving and driven gears disposed partly on each of said three shafts, a gear outside said casing connected to drive said drum, said last mentioned gear being driven from one of the gears of said gear train through the aperture in said casing, a brake wheel mounted concentric with said central shaft and extending into the space between the inner ends of said countershafts, a ratchet on said brake wheel, a pawl on said casing, and means for applying braking pressure to said brake wheel when said drum tends to unwind at a speed greater than the corresponding relative speed at which said central shaft is turned.

5. A winch comprising a rotatable drum, a stationary casing within said drum, a central shaft in said casing, a parallel first countershaft mounted in one end of said casing, a parallel second countershaft mounted in the opposite end of said casing, the inner ends of said countershafts being spaced apart with a gap between said inner ends, a brake wheel concentric with said central shaft and extending into said gap, and a gear train mounted within said casing and partially on each of said three shafts, cooperating means partly on said brake wheel and partly on said casing operative to slow unwinding of said drum when said drum tends to unwind faster than the corresponding speed at which said central shaft is turned in unwinding direction.

6. A winch comprising a rotatable drum, a stationary casing within said drum, a central shaft in said casing, a parallel first countershaft mounted in one end of said casing, a parallel second countershaft mounted in the opposite end of said casing, the inner ends of said countershafts being spaced apart with a gap between said inner ends, a brake wheel concentric with said central shaft and extending into said gap, a gear train mounted within said casing and partially on each of said three shafts, cooperating means partly on said brake wheel and partly on said casing operative to slow unwinding of said drum when said drum tends to unwind faster than said corresponding speed at which said central shaft is turned in unwinding direction, and means connected to said casing supporting the inner ends of each of said countershafts.

7. A gear train comprising an apertured casing, means for holding said casing stationary, a central shaft in said casing, means for revolving said central shaft, a first countershaft parallel to said central shaft and journaled in said casing adjacent one end thereof, a second countershaft parallel to said central shaft and journaled in said casing adjacent the opposite end thereof, the inner ends of said countershafts being spaced apart, a gear train comprising driving and driven gears disposed partly on each of said three shafts, an external driven means outside said casing driven from one of the gears of said gear train through the aperture in said casing, a brake wheel mounted concentric with said central shaft and extending into the space between the inner ends of said countershafts, a ratchet on said brake wheel, a pawl on said casing, and means for applying braking pressure to said brake wheel when said external driven means tends to rotate at a speed greater than the corresponding relative speed at which said central shaft is turned.

8. A gear train comprising a rotatable external driving means, a stationary casing, means for holding said casing stationary, a central shaft extending through said casing, a parallel first countershaft mounted in one end of said casing, a parallel second countershaft mounted in the opposite end of said casing, the inner ends of said countershafts being spaced apart with a gap between said inner ends, a brake wheel concentric with said central shaft and extending into said gap, and a gear train mounted within said casing and partially on each of said three shafts, means partly on said brake wheel and partly on said casing operative to slow rotation of said driven means when said driven means tends to rotate faster than the corresponding speed at which said central shaft is turned.

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