Aug. 14, 1962 J. E. MAGNUSON 3,049,340

PLANETARY DRIVEN TRUCK WINCH

Filed June 23, 1959 2 Sheets-Sheet 1

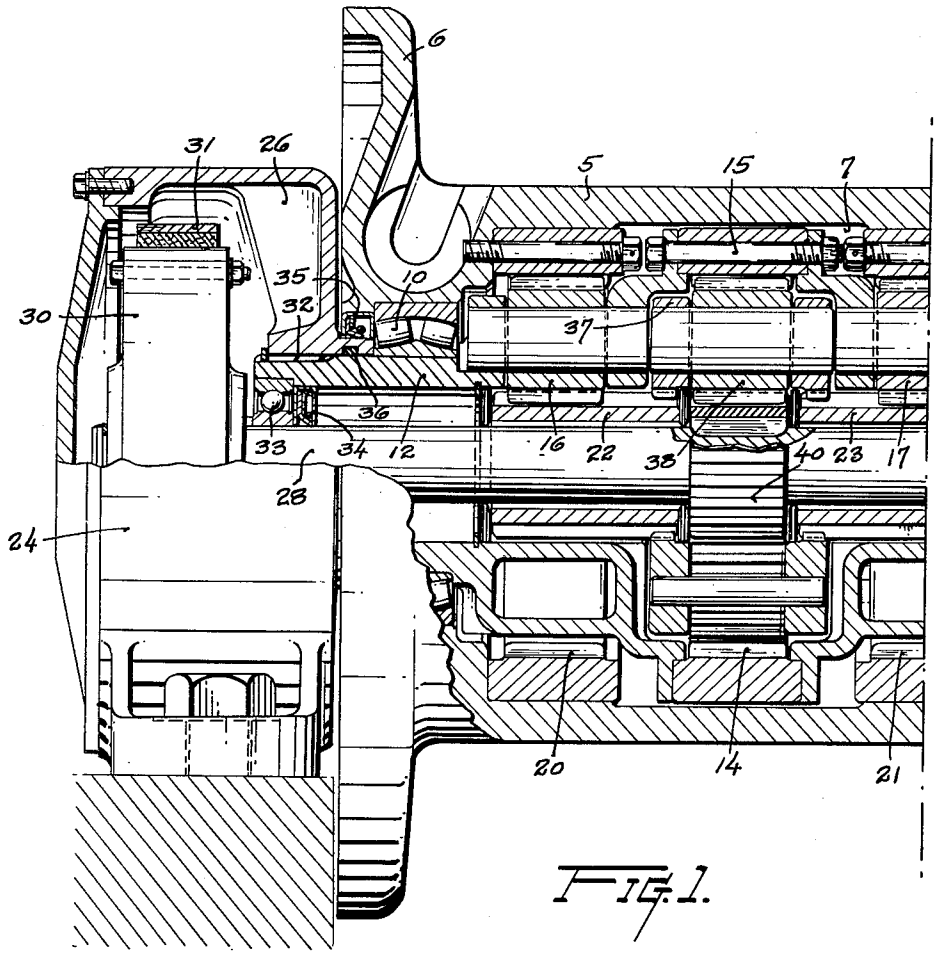


FIG. 1.

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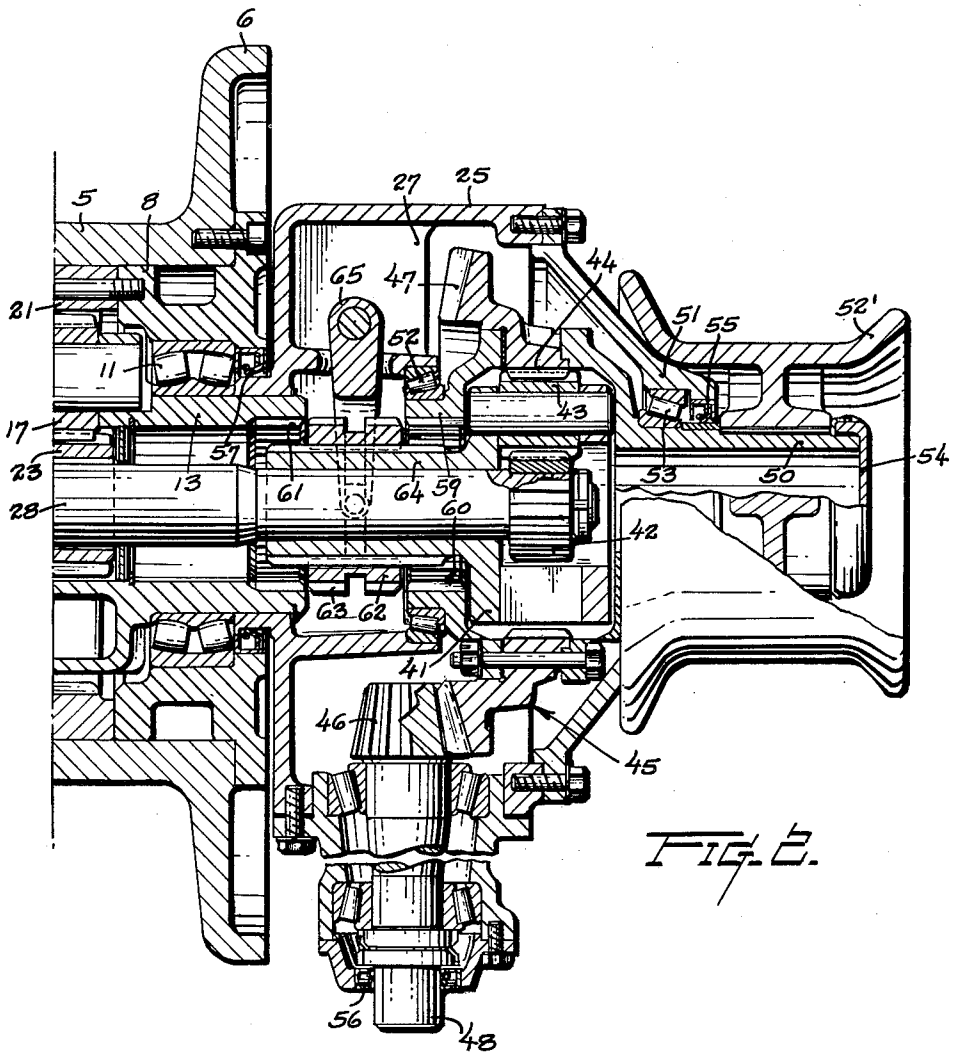


FIG. 2.

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PLANETARY DRIVEN TRUCK WINCH

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12 Claims. (Cl. 254—186)

This invention relates to a planetary driven winch, and one more especially which is compact and light in weight and hence adapts itself particularly to installations, such as an automotive truck, where space and weight are of paramount importance.

The invention has as its general object the provision of a perfected winch of the above character.

It is a further and particular object to provide a compact and light weight planetary driven winch employing a hollow winding drum supported by hollow-headed cheek bitts at the two ends thereof and characterized in that the planetary gearing of the winch is entirely contained within the hollow centers of said drum and one of the two cheek bitts, readily adapting itself to employment of oil seals so that the gearing may operate in a bath of oil.

As a further object still the invention aims to provide a planetary driven gear winch which in consequence of the employment of the drum as a housing for the bulk of the planetary gear train permits a large drum diameter offering the distinct advantage of longer wire rope life and more uniform performance from a bare drum to a full drum condition, albeit keeping the over-all size of the winch within a small compass.

It is a yet further object of the invention to provide a winch in which the mechanism for braking the winding drum is housed within the hollow center of the other of the winch's two cheek bitts.

With the foregoing objects and advantages in view and additionally purposing to provide an unusually rugged and durable winch, and one giving ready access to its housed gearing and brake mechanisms so as to be serviced with ease and expedition, the invention consists in the novel construction and in the adaptation and combination of parts hereinafter described and claimed.

In the accompanying drawings:

FIGS. 1 and 2 are each a fragmentary longitudinal vertical sectional view, with parts in elevation, which taken together portray a planetary driven truck winch constructed to embody the preferred teachings of the present invention.

Referring to said drawings, the reference numeral **5** designates a winding drum provided with the usual flanged ends **6** and having conventional means by which the root end of a cable may be affixed thereto. The drum has a through-opening **7** along its axial center. At one end, which for reference purposes may be considered the forward end, the hollow center is reduced so as to present an inwardly facing shoulder. A counterpart of this shoulder is provided at the aft end of the drum by a boltably secured journal housing **8**. Journal bearings **10** and **11**, respectively, are received in said reduced forward and aft ends of the drum, giving support in each instance to the outwardly directed terminal neck of a respective one of two hollow-centered members **12** and **13** acting in complement to produce the carrier for intermediate gears of a 3-gear reduction gear system.

The facing ends of these carrier components **12** and **13** are rigidly secured one to the other and to an intervening internal gear **14** by bolts **15**, with the parts so designed as to describe an annular space of substantial fore-and-aft length lying interiorly of the internal gear **14** between said carrier components. Intermediate pinions for the described reduction gear system are in two sets denoted by **16** and **17**. One set is carried by the carrier

component **12** and the other by the carrier component **13**. Respective identical internal gears are provided for said two sets of pinions. One such internal gear **20** is boltably secured to the drum, fitting against the inwardly facing shoulder which is provided at the forward end. The other internal gear **21** fits against the inwardly facing shoulder provided by the journal housing **8**, being secured by bolts thereto and thus with the internal gear **20** turning in concert with the drum. A respective hollow sun pinion, as **22** and **23**, is provided for each of the two said sets of pinions **16** and **17**.

24 and **25** designate front and rear cheek bitts bolted or otherwise secured to the frame of an automotive truck or other suitable support and each presenting a head from which a related end of the drum is mounted. Both heads present a chamber, as **26** and **27**. The two ends of a through center-shaft **28** extend into these chambers and a brake drum **30** which is or may be free-wheeling is fixedly secured upon the forward end of such shaft. The brake drum is provided with a full-wrap brake band **31**, and while not shown has ratchet and pawl mechanism associated therewith so that the brake will act in only one direction of rotation. The forward end of the carrier **12** is connected by a spline **32** to the mounting head of the forward bitt **24**, and a ball bearing **33** forms a journal for the forward end of the center shaft **28**. Oil seals **34** and **35** are provided at such forward end of the drum between relatively rotating parts, and an O-ring **36** is provided between non-rotating surfaces.

A carrier **37** is provided for a planetary gear system which includes planetary pinions **38** in mesh with the internal gear **14**. This carrier, with its pinions, occupies said annular space which is described between the carrier components **12** and **13**. Carrier **37** has one end splined to the sun pinion **22** and the other end splined to the sun pinion **23** so that, functionally considered, said sun pinions become quill extensions of the carrier. A sun pinion **40** for the planetary pinions **38** is keyed to the through center-shaft **28**.

Now considering the aft end of said center-shaft which, as before stated, extends into the chambered head of the aft bitt **25**, it will be seen that a carrier **41** for a planetary gear system is received for free rotation upon said end and that the shaft has a sun pinion **42** fixedly attached to its extremity. This sun pinion meshes planetary pinions **43** carried by said carrier **41**. An internal gear **44** for the planetary pinions **43** is provided by a driver member **45** reduction-driven through bevel gearing **46—47** from a motor-driven input shaft **48**. A neck section **50** is bolted to the driver member and projects rearwardly therefrom through and beyond a nose prolongation **51** of the aft bitt. A gypsy spool **52'** is splined to the exposed end of such neck. The driver member **45** and its neck extension **50** are journaled by roller bearings **52** and **53**, the latter being carried by the nose prolongation **51** and the former being carried by the bitt proper and giving support to a neck section **59** which is bolted to and extends forwardly from the driver member. A cap **54** closes the rear end of the neck **50**, and acts with seals **55**, **56** and **57** to preclude leakage of oil from the aft end of the winch.

Said neck section **59** presents internal teeth **60** and occupies a position rearwardly spaced from internal teeth **61** which are presented by the aft end of the carrier component **13**. In the space between said neck section **59** and the carrier component **13** a shuttle spool **62** having mating complements **63** of the teeth **60** and **61** is splined upon a forwardly extending hub prolongation **64** of the carrier **41** for endwise motion from the neutral position in which it is shown in the drawing into selective mesh either with the internal teeth **60** or the internal teeth

61. The forked end of a manually controlled shift lever 65 activates the shuttle spool.

It will be apparent from the foregoing that the winch may be driven in either forward or reverse by shifting the shuttle spool into mesh with the internal teeth 60 or the teeth 61, respectively. In the former instance, carrier 41 becomes locked to the driver member and a direct (1 to 1) forward drive is passed by the planetary pinions 43 from internal gear 44 to the sun pinion 42. Sun pinion 40, connected by the through center-shaft 28 to turn with said pinion 42, passes power to the planetary pinions 38 of the carrier 37. The output from this carrier is divided between the two final reduction gear sets, with sun gears 22 and 23, which turn in concert with carrier 37, turning the internal gears 20 and 21 by rotation of the localized pinions 16 and 17. A 10 to 1 reduction occurs between sun gear 40 and the drum 5. Upon shifting the shuttle spool into its said reverse position, the carrier 41 becomes locked to the cheek bitt 24 by the non-rotary carrier components 12 and 13 so that pinions 43 turn about fixed axes, driving the sun pinion 42 at a speed somewhat faster in a direction opposite to that in which it was previously driven, the speed increase being 4 to 1. The bevel gearing 46—47 provides a 6 to 1 reduction and this perforce becomes a multiple of both the referred-to forward and reverse reductions so that the complete train provides a 60:1 forward reduction and a 24:1 reverse reduction. A centered position of the shuttle spool produces a neutral condition of the drum 5 in that the carrier 41 is then free to rotate both with respect to the driver member 45 and the center shaft 28, which allows pinions 43 to walk freely about the sun gear 42 as the same are caused to spin about their axis under influence of the driver member's rotation. The gypsy 52 rotates continually, unidirectionally, upon rotation of the driver member.

While I have illustrated and described the now-preferred embodiment of the invention, changes in the details of construction can be resorted to without departing from the spirit of the invention. It is accordingly my intention that no limitations be implied and that the hereto annexed claims be given the broadest interpretation to which the employed language fairly admits.

What I claim, is:

1. In a reversible winch, a winding drum having a gear chamber in the center open at each of its two ends, fore and aft cheek bitts for the drum each presenting a chamber communicating with a respective end opening of said drum, a respective identical internal gear fixed to the drum at each end of said gear chamber, respective identical sets of pinions in mesh with said internal gears, a single hollow carrier for both of said sets of pinions received in said gear chamber and presenting at each of its two ends a respective neck projecting through a related end opening of the drum into the head chamber of a related said cheek bitt, the cheek bitts each providing a hub section fitting a related said end of the carrier, said carrier providing a journal mounting for the drum, being secured to at least one of the cheek bitts so as to hold the carrier against rotation, and presenting teeth upon its aft end, an internal gear fixed to the carrier in the hollow center thereof, a set of planetary pinions in mesh with the last-named internal gear, a hollow carrier for said last-named pinions, hollow sun pinions for the first-named pinions connected to the last-named carrier so as to rotate therewith, a center-shaft extending axially through the drum with its ends projecting beyond said necks of the first-named carrier into the head chambers of the two cheek bitts, said center-shaft having a sun pinion thereon for the planetary pinions of said last-named carrier and also having a sun pinion on the aft end, a set of planetary pinions received within the chamber of the aft cheek bitt and meshing with said aft sun pinion, a normally free-turning carrier for the last-named planetary pinions, a motor-driven driver member surrounding the last-named carrier and its planetary pinions, providing an internal gear for the last-named planetary pinions, and presenting a forwardly extending toothed neck spaced from the aft end of said non-rotary carrier, and a manually controlled toothed shuttle-spool received in the space last mentioned and splined to said normally free-turning carrier for fore-and-aft movement from an intermediate neutral position into selective positions whereat its teeth engage either the teeth of the non-rotary carrier or the teeth of said neck of the driver member.

2. A winch according to claim 1 having a member fixed to the driver member and projecting as an axial prolongation rearwardly therefrom beyond the aft end of the rear cheek bitt, the exposed portion of said projecting prolongation permitting a gypsy to be mounted thereon.

3. In a winch, a winding drum having a gear chamber in the center reduced in diameter at the two ends to provide facing shoulders, cheek bitts supporting the drum, a pair of axially spaced identical internal gears fitting against and bolted one to one and the other to the other of said shoulders, a respective identical set of pinions in mesh with each of said internal gears, a pair of non-rotary axially spaced carriers one supporting one and the other supporting the other of said sets of pinions, an internal gear occupying a position in the space between said first-named internal gears and connected to said carriers so as to be held against rotation, a set of planetary pinions meshing said non-rotary internal gear, a carrier for said planetary pinions, a pair of axially spaced open-center quill elements made to rotate in unison with the last-named carrier, one of said quill elements meshing one and the other meshing the other of said first-named two sets of pinions to serve as a sun gear therefor, a center-shaft received through said open centers of the quill elements and having a pinion fixed thereon to occupy the space between said quill elements and meshing the set of planetary pinions to function as a sun gear therefor, one of said cheek bitts being hollow, a planetary system housed in said hollow cheek bitt for driving the center-shaft and comprising planetary pinions, a carrier therefor, a sun gear for the pinions fast to an end of the center-shaft, and a motor-driven internal gear meshed by the pinions, and means also housed in said hollow cheek bitt shiftable at will from a normal inactive position into either of two operating positions one of which couples the carrier for the last-named planetary pinions to the last-named internal gear and the other of which immobilizes said carrier.

4. In a winch, a winding drum having a gear chamber in the center, a co-axial series of at least two reduction gear systems housed in said gear chamber, one of said gear systems being a divided system including two axially spaced sun gears together with a respective set of pinions surrounding each sun gear, a respective carrier for each of said sets of pinions, and a respective internal gear for each of said sets of pinions meshed by the pinions and held stationary with respect to the drum, an internal gear surrounding the space between said sun gears and securely connecting the two carriers one to the other, the other of said two reduction gear systems being a planetary system and including the last-named internal gear together with a set of planetary pinions in mesh therewith, a carrier for the planetary pinions, and a sun gear in mesh with the planetary pinions and occupying said space between the first-named sun gears, and means for driving the sun gear of the planetary gear system, a connection being provided between the first-named sun gears and the carrier of the planetary gear system so that said sun gears and the carrier turn in unison.

5. Structure according to claim 4 in which the winding drum has an opening at one end permitting bodily insertion and removal of said gear systems to and from the gear chamber.

6. In a transmission, in combination with input and

output members, and an internal gear fast to the output member so as to turn in unison therewith, a co-axial series of at least a first-acting and a second-acting reduction gear system, said second-acting gear system being divided into two axially spaced sections including, for each, a respective sun gear, a respective set of surrounding pinions, and a respective stationary carrier for the pinions, said two sections being identical so that the sun gear, the pinions, and the carrier of one section are each a twin of the corresponding part of the other section, the pinions of said sets of pinions of said two sections being each in mesh with the related sun gear, said first-acting gear system being a planetary system and including a respective sun gear, a set of planetary pinions surrounding the sun gear, a carrier for the planetary pinions, and an internal gear surrounding the planetary pinions, the planetary pinions being in mesh with the sun gear and with the internal gear of said planetary gear system, said sun gear of the first-acting gear system being driven from the input member, said internal gear of the first-acting gear system being fast to the twin carriers of said second-acting gear system, the twin sun gears of said second-acting gear system being formed as quill extensions of the carrier of the first-acting gear system, the pinions of the twin sets of pinions of said second-acting gear system being in mesh with said internal gear which is fast to the output member.

7. Structure according to claim 6, and a forward-and-reverse control co-axial with said transmission at one end thereof comprising a planetary gear system including a sun gear, a set of planetary pinions, a normally free-running carrier for the pinions, and an internal gear driven from a source of power, with said pinions being in mesh with the sun gear and with the internal gear, the sun gear of said forward-and-reverse control planetary system being operatively connected to the sun gear of said first-acting reduction gear system so that the two rotate in unison, means being provided for selectively coupling said normally free-running carrier either to the power-driven gear or to the stationary carriers of the second-acting reduction gear system.

8. Structure according to claim 7 in which the sun gear of the forward-and-reverse control system and the sun gear of the first-acting reduction gear system, are fixedly secured upon a center-shaft, a brake drum of a brake mechanism being fixed to said center-shaft.

9. In a reversible winch, a winding drum having a gear chamber in the center open at each of its two ends, fore and aft cheek bitts for the drum each presenting a chamber communicating with a respective end opening of said drum, coaxial #2 and #3 reduction gear systems housed in said open center of the drum and including in each instance a respective sun gear together with a respective set of surrounding pinions and a respective carrier for said set of pinions, means fixing the #3 carrier to at least one of the two cheek bitts so as to hold the #3 carrier stationary, means connecting the #2 carrier to the #3 sun gear so that the two rotate in unison, said #2 system being a planetary system, respective internal gears for the #2 and #3 pinions fast to the #3 carrier in the instance of the #2 internal gear and fast to the drum in the instance of the #3 internal gear, a #1 planetary gear system housed in the chamber of one of the cheek bitts and including a sun gear together with a set of planetary pinions and a carrier for said set of pinions, a center-shaft extending through the drum from one to the other chamber of the two cheek bitts and having the #1 and #2 sun gears each fast thereto, a motor-driven driver member having an internal gear in mesh with the planetary pinions of the #1 planetary system, and means operable at will for either locking the #1 carrier against rotation or bringing the same into couple with the driver member.

10. The winch recited in claim 9 having brake mechanism housed in the chamber of the other of the two cheek bitts and including a brake drum fast to the center-shaft.

11. In a winch, a winding drum having a gear chamber in the center which is reduced in diameter at the two ends to provide facing shoulders, a pair of axially spaced identical internal gears fitting against and bolted to said shoulders, a respective identical set of pinions in mesh with each of said internal gears, a respective non-rotary carrier for each of said sets of pinions bolted one to the other, an internal gear occupying a position between said first-named internal gears and bolted to said carriers, a set of planetary pinions meshing with the last-named internal gear, a carrier for the planetary pinions presenting quill extensions at the two ends each meshing with a respective one of the first-named two sets of pinions to function as sun gears therefor, a through center-shaft having a pinion thereon serving as a sun gear for the planetary pinions, and means for driving the center-shaft.

12. The winch recited in claim 11 in which the two non-rotary carriers provide neck prolongations, journal bearings for the drum fitting said prolongations, a ring member housing one of said journal bearings and boltably secured to the drum so as to be removable therefrom, said ring member producing one of said facing shoulders for the gear chamber, the external diameter of the ring member being at least as large as the external diameter of the internal gears.

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