Aug. 12, 1969 V. I. PRIKHODKO ET AL 3,460,807

WINCH

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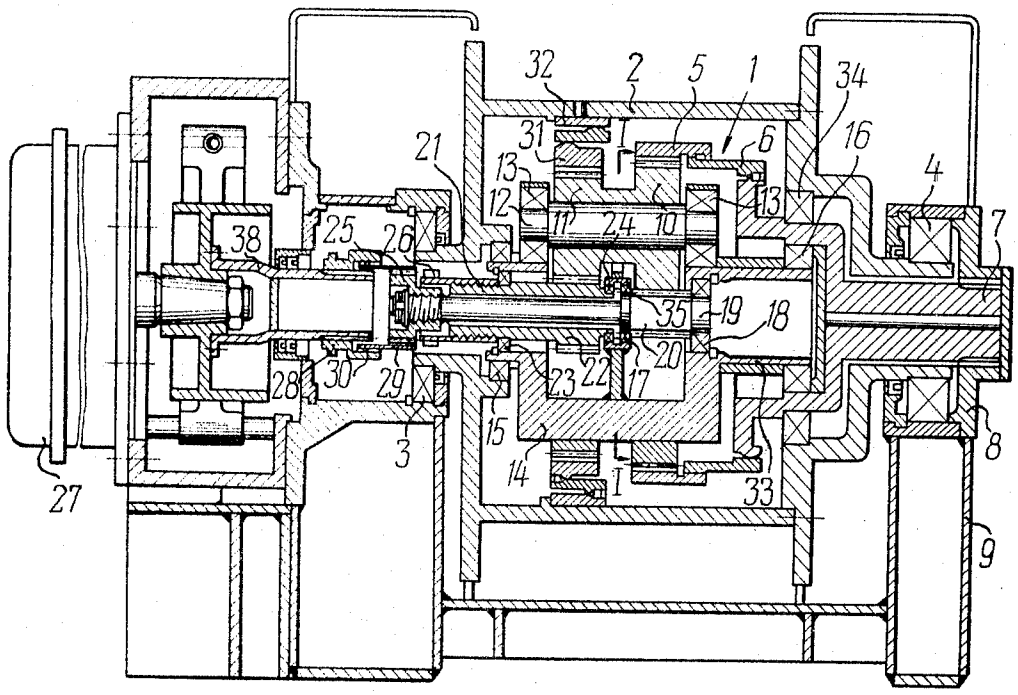

Fig. 1

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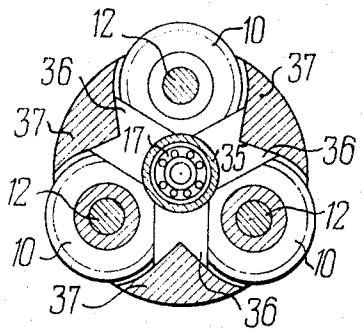

Fig. 2

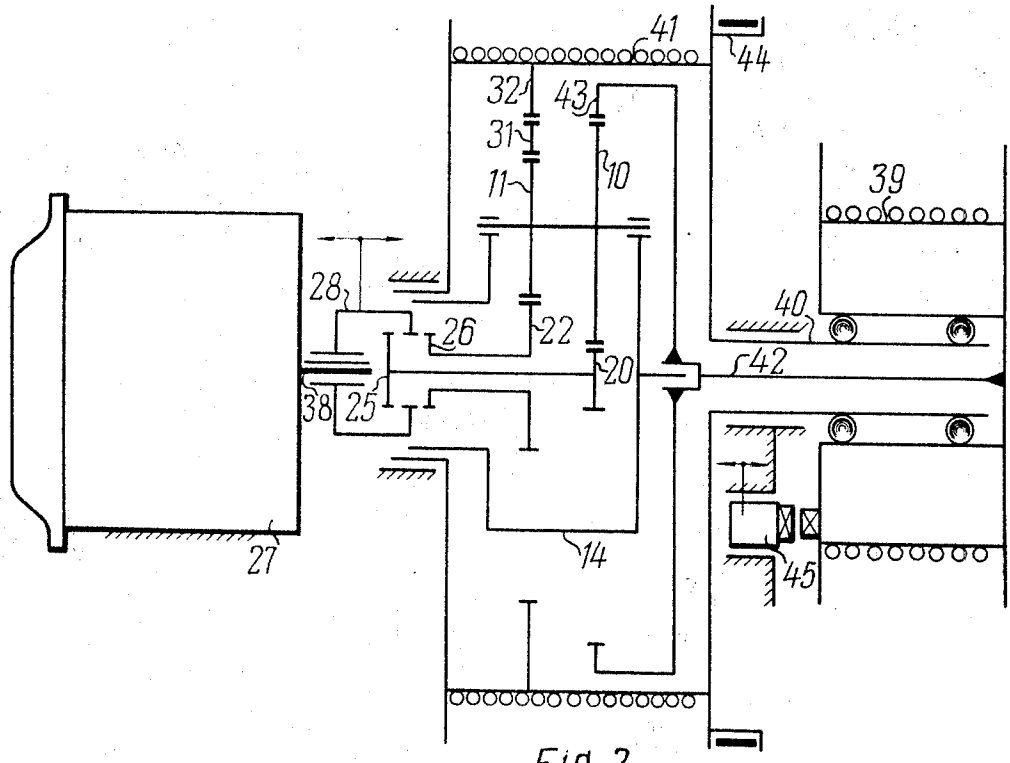

Fig. 3

United States Patent Office

3,460,807

Patented Aug. 12, 1969

3,460,807

WINCH

Viktor Ivanovich Prikhodko, poselok imeni M. Gorkogo, ulitsa Gagarina, 2, kv. 19, and Boris Vasilievich Pankov, poselok imeni M. Gorkogo, ulitsa Lomonosova, 18, kv. 13, both of Khabarovsk, U.S.S.R.

Filed Feb. 21, 1967, Ser. No. 617,647

Int. Cl. B66d 1/26; F16h 3/44

U.S. Cl. 254—185

11 Claims

ABSTRACT OF THE DISCLOSURE

A planetary reduction gear built into the drum of a single-drum winch. The gear includes sun wheels of different diameters, interconnected planet pinions on a common carrier and engaged with the sun wheels, epicycles of different diameters respectively connected to the drum and to the winch frame and respectively engaged with the sun wheels, a winch drive, and a coupling selectively engaged between the drive and one of the sun wheels.

The present invention relates to hoisting machinery and mechanisms and, more particularly, to planetary reduction gears employed in a winch and built into the drum thereof.

Known in the art are winches with a planetary reduction gear built into the winch drum, two epicycles of said reduction gear being of different diameters with one of said epicycles connected to the drum and the other to the winch frame.

A conventional reduction gear provides for the drum rotation at a single speed only.

Main disadvantages of the known reduction gears of the conventional design lie in a restricted application of said reduction gears due to the availability of a single gear speed; enlarged overall dimensions due to a complicated design of a pinion carrier, and unreliable operation due to a complicated design of the clutch coupling.

It is, therefore, an object of the present invention to eliminate said disadvantages and develop a planetary reduction gear employed in a winch and built into the drum thereof, said reduction gear featuring two speeds of rotation with a small gear ratio of one speed to the other, simple in design and reliable in operation.

According to the invention, said object is accomplished owing to the fact that two planet pinions of the reduction gear are interconnected and mounted on a common pinion carrier. Said planet pinions are in constant mesh with two sun wheels of different diameters on one side and with epicycles on the other. A claw coupling is installed between the sun wheels and the winch drive with the purpose to alternatively engage said sun wheels. One of the epicycles is connected to the winch drum, whereas the other to the winch frame.

In an embodiment of the reduction gear, according to the invention, in the case the winch possesses two drums, that is the main and the auxiliary one, two planet pinions, interconnected and arranged on a common pinion carrier, are provided constantly meshing two sun wheels of different diameters on one side and epicycles on the other; a claw coupling is installed between the sun wheels and the winch drive to alternatively engage said sun wheels, whereas the second epicycle is connected to the auxiliary drum.

In the preferred embodiment of the reduction gear, according to the invention, it is desirable that the claw coupling should be provided with three claw half-couplings, two of which are rigidly installed on the sun wheel shafts while the third is loosely set on the drive shaft, a movable half-coupling alternatively coming in mesh with stationary half-couplings through an intermediate member made as a sleeve with two rows of claws, one of said rows being constantly in mesh with the claws of the movable half-coupling. It is desirable that said meshing should provide for a certain clearance, whereas the claws should be articulated to one another by means of a ring passing through openings in said claws.

It is expedient that one of the pinion carrier journals, installed inside the hollow shaft of one of the epicycles, should be arranged in the bearing coaxially with the bearing of the hollow shaft of said epicycle and the planes of symmetry of both bearings normal to the axis of the hollow shaft should be matched.

It is desirable to place a sleeve in the middle portion of the pinion carrier of the reduction gear coaxially therewith between the planet pinions, which is made with the help of radial stays interposed between said planet pinions, with a part of supporting bearings of the sun wheel shafts located inside the sleeve.

It is expedient that movable couplings be used to connect the epicycles either to the winch drum and frame or to two drums.

In the case of a double-drum winch the reduction gear thereof should be advantageously built into the main drum, whereas the auxiliary drum should be installed on a journal of the main drum to preclude the effect of the bending moment upon the shaft of the epicycle the auxiliary drum is connected to.

The winch, according to the invention, is designed to provide for two speeds of rotation, the ratios between said speeds being within the range from 1:1.2 to 1:2.

Exemplary embodiments of the winch designs, according to the invention, are given in the accompanying drawings, wherein:

FIG. 1 is a longitudinal section of a single-drum winch according to the invention;

FIG. 2 is a section taken on line I—I of FIG. 1; and

FIG. 3 is a mechanical diagram of a double-drum winch according to the invention.

The winch comprises a planetary reduction gear **1** (FIG. 1) built into its drum **2**, said drum rotating in bearings **3** and **4**. A stationary epicycle **5** of the reduction gear **1** is connected to a winch frame **9** through a movable coupling **6**, a hollow shaft **7** and a splined disk **8**.

A planet pinion **10** of a larger diameter made integral with a planet pinion **11** of a smaller diameter meshes stationary epicycle **5**. The blocks of planet pinions **10** and **11** are fixed on small shafts **12** which rotate in bearings **13**. Bearings **13** are mounted in a pinion carrier **14** rotating in bearings **15** and **16**. A shaft **19** is installed in bearings **17**

and 18 inside pinion carrier 14, said shaft being made integral with a sun wheel 20 of a smaller diameter which is in constant mesh with planet pinions 10. Installed concentrically to shaft 19 is a hollow shaft 21 made integral with a sun wheel 22 of a larger diameter, said wheel being in constant mesh with planet pinion 11. Shaft 21 rotates in bearings 23 and 24. Claw half-couplings 25 and 26 are fixed at the left-hand ends of shafts 19 and 21 with the purpose to alternatively engage sun wheels 20 and 22 with an electric motor 27 through a movable claw half-coupling 28 and an intermediate member 29.

Intermediate member 29 is essentially a sleeve with two rows of claws, some of said claws being in constant mesh with the claws of movable half-coupling 28, said meshing provides for a certain clearance, whereas the engaging claws are articulated to one another by means of a ring 30 passing through openings in said claws.

An output member of reduction gear, that is planet pinion 11, through an epicycle 31 and a movable claw coupling 32 and which is rigidly connected to the drum 2, imparts rotation to drum 2 of the winch.

The ratio of the diameters of the reduction gear wheels is so selected that the ratios of the drum speeds of rotation are applicable within the range up to 1:2 with either of the sun wheels being engaged.

Installed inside hollow shaft 7 is a journal 33 of pinion carrier 14, said journal being placed in the bearing 16 coaxially with a bearing 34 of hollow shaft 7, the longitudinal planes of symmetry of both bearings being matched. This fact eliminates the harmful run-out of the shafts and reduction gear wheels.

To increase the reliability of sun wheels 20 and 22 a number of their bearings, that is bearings 17 and 24, is located inside a sleeve 35 (FIGS. 1 and 2) installed between the blocks of planet pinions 10 and 11 coaxially with pinion carrier 14, said sleeve being welded to stays 36. Stays 36 are in turn welded to longitudinal links 37 (FIG. 2) of cheeks of pinion carrier 14.

The movable half-coupling 28 is capable of shifting along a splined shaft 38 by means of the yoke of the winch gearshift lever (not shown in the drawings).

Unlike the single-drum winch, the double-drum one (FIG. 3), according to the invention, is provided with an auxiliary drum 39 installed on a journal 40 of a main drum 41 to preclude the effect of the bending moment upon a shaft 42 of an epicycle 43 to which drum 39 is connected.

To make the double-drum winch operative it is required that drums 41 and 39 are engaged non-simultaneously. To this end provision is made in drum 41 for a brake pulley 44, whereas drum 39 is provided with a movable stop 45.

The location of auxiliary drum 39 on journal 40 enables shaft 42 of a comparatively small diameter to be used, which considerably reduces the overall dimensions of the winch.

What we claim is:

1. A planetary reduction gear for a winch including a frame and a single drum, the gear being located within said drum and comprising: two sun wheels of different diameters; a pinion carrier; two interconnected planet pinions mounted in common on said pinion carrier and constantly in mesh with said sun wheels; two epicycles of different diameters, one of which is connected to the winch drum and is in constant mesh with one of said sun wheels, the other epicycle being connected to the winch frame and being in constant mesh with the other sun wheel; a drive for said winch; and a claw coupling to alternatively engage one of said sun wheels, said coupling being interposed between said wheels and the winch drive.

2. A planetary reduction gear for a winch including a frame and main and auxiliary drums, said gear being located in the main drum and comprising: two sun wheels of different diameters; a pinion carrier; two interconnected planet pinions mounted in common on said pinion carrier and constantly in mesh with said sun wheels; two epicycles of different diameters, one of which is connected to the main drum of the winch and is in constant mesh with one of said sun wheels, the other epicycle being connected to the auxiliary drum and being in constant mesh with the other sun wheel; a drive for said winch; a claw coupling to alternatively engage one of said sun wheels, said coupling being interposed between said sun wheels and the winch drive; and brakes to alternatively lock either of said drums in position with respect to the winch frame.

3. A planetary reduction gear as claimed in claim 1, comprising shafts for the sun wheels and drive, an intermediate member, and a ring, and wherein said claw coupling comprises three claw half-couplings which are respectively rigidly installed on the shafts of said sun wheels and loosely set on the shaft of said drive, the loosely set half-coupling being adapted for coming alternatively into mesh with either of said rigidly mounted half-couplings through said intermediate member, said intermediate member including a sleeve including two rows of claws, some of the latter said claws being in constant mesh with the claws of the loosely set half-coupling, the latter said mesh being provided with clearance, the engaging claws being articulated to one another by said ring, said ring passing through openings provided in said claws.

4. A planetary reduction gear as claimed in claim 2, comprising shafts for the sun wheels and drive, an intermediate member, and a ring, and wherein said claw coupling comprises three claw half-couplings which are respectively rigidly installed on the shafts of said sun wheels and loosely set on the shaft of said drive, the loosely set half-coupling being adapted for coming alternatively into mesh with either of said rigidly mounted half-couplings through said intermediate member, said intermediate member including a sleeve including two rows of claws, some of the latter said claws being in constant mesh with the claws of the loosely set half-coupling, the latter said mesh being provided with clearance, the engaging claws being articulated to one another by means of said ring, said ring passing through openings provided in said claws.

5. A planetary reduction gear as claimed in claim 1, comprising journals for said pinion carrier, a hollow shaft for one of said epicycles, a bearing for said hollow shaft, and bearings for said journals, one of the journals of said pinion carrier being mounted inside said hollow shaft of said one of said epicycles and being located in one of the latter said bearings which is coaxially disposed with the hollow shaft bearing of said epicycle, the planes of symmetry of both said bearings normal to said hollow shaft being matched.

6. A planetary reduction gear as claimed in claim 2, comprising journals for said pinion carrier, a hollow shaft for one of said epicycles, a bearing for said hollow shaft, and bearings for said journals, one of the journals of said pinion carrier being mounted inside said hollow shaft of said one of said epicycles and being located in one of the latter said bearings which is coaxially disposed with the hollow shaft bearing of said epicycle, the planes of symmetry of both said bearings normal to said hollow shaft being matched.

7. A planetary reduction gear as claimed in claim 1, comprising a sleeve, radial stays, and bearings for said sun wheels, said sleeve being supported in the middle of said pinion carrier coaxially therewith and between said planet pinion by said radial stays, said sleeve including part of a shaft supporting said bearings of said sun wheels.

8. A planetary reduction gear as claimed in claim 2, comprising a sleeve, radial stays, and bearings for said sun wheels, said sleeve being supported in the middle of said pinion carrier coaxially therewith and between said planet pinions by said radial stays, said sleeve including part of a shaft supporting said bearings of said sun wheels.

9. A planetary reduction gear as claimed in claim 1, comprising movable couplings and wherein said epicycles are connected to said drum and to said winch frame through said movable couplings.

10. A planetary reduction gear as claimed in claim 2, comprising movable couplings and wherein said epicycles are connected to said drum and to said winch frame through said movable couplings.

11. A planetary reduction gear as claimed in claim 2, comprising a joint member, and a hollow journal for said main drum, and wherein one of said epicycles is connected to said auxiliary drum through said joint member, said joint member including a shaft mounted inside said hollow journal of said main drum, said journal accommodating said auxiliary drum.

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EVON C. BLUNK, Primary Examiner

HARVEY C. HORNSBY, Assistant Examiner

U.S. Cl. X.R.

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