Nov. 20, 1945. C. F. BALL 2,389,177

WINCH

Filed March 18, 1944 3 Sheets-Sheet 1

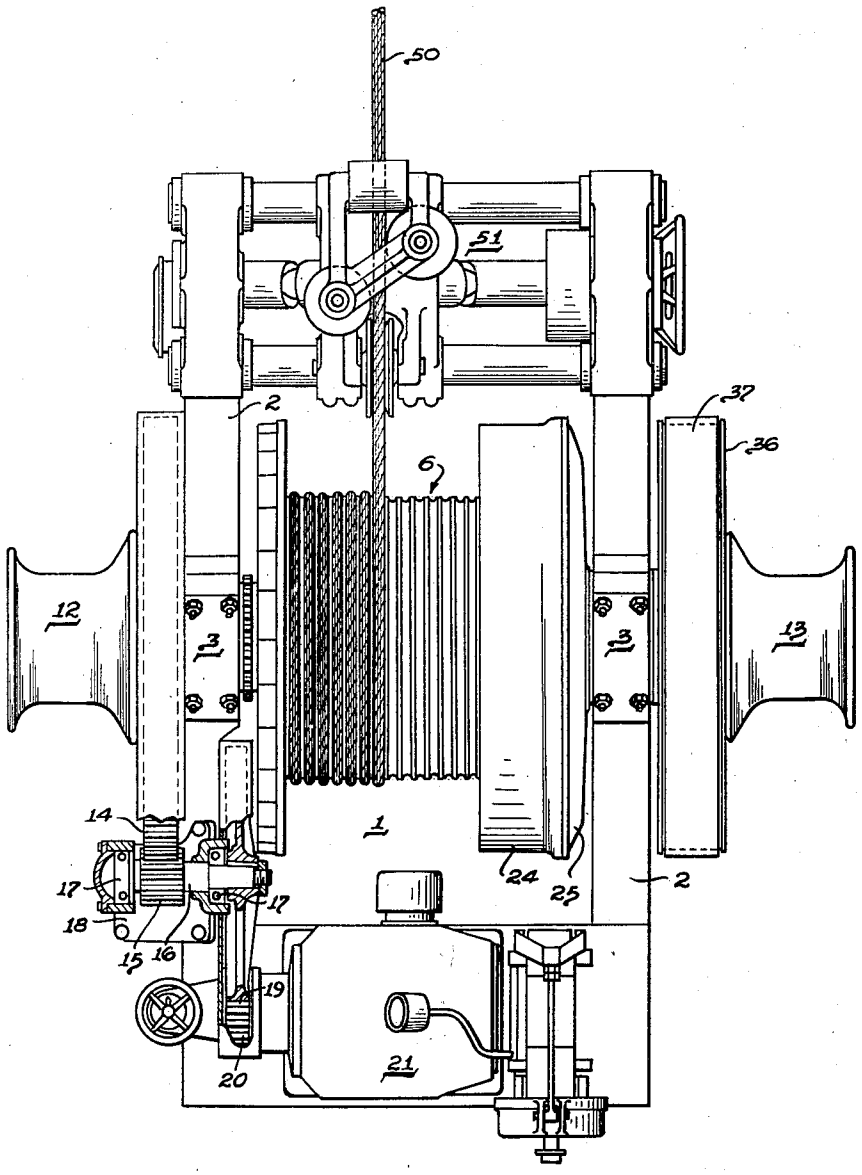


Fig. 1.

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WITNESSES.
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WINCH

Filed March 18, 1944 3 Sheets-Sheet 2

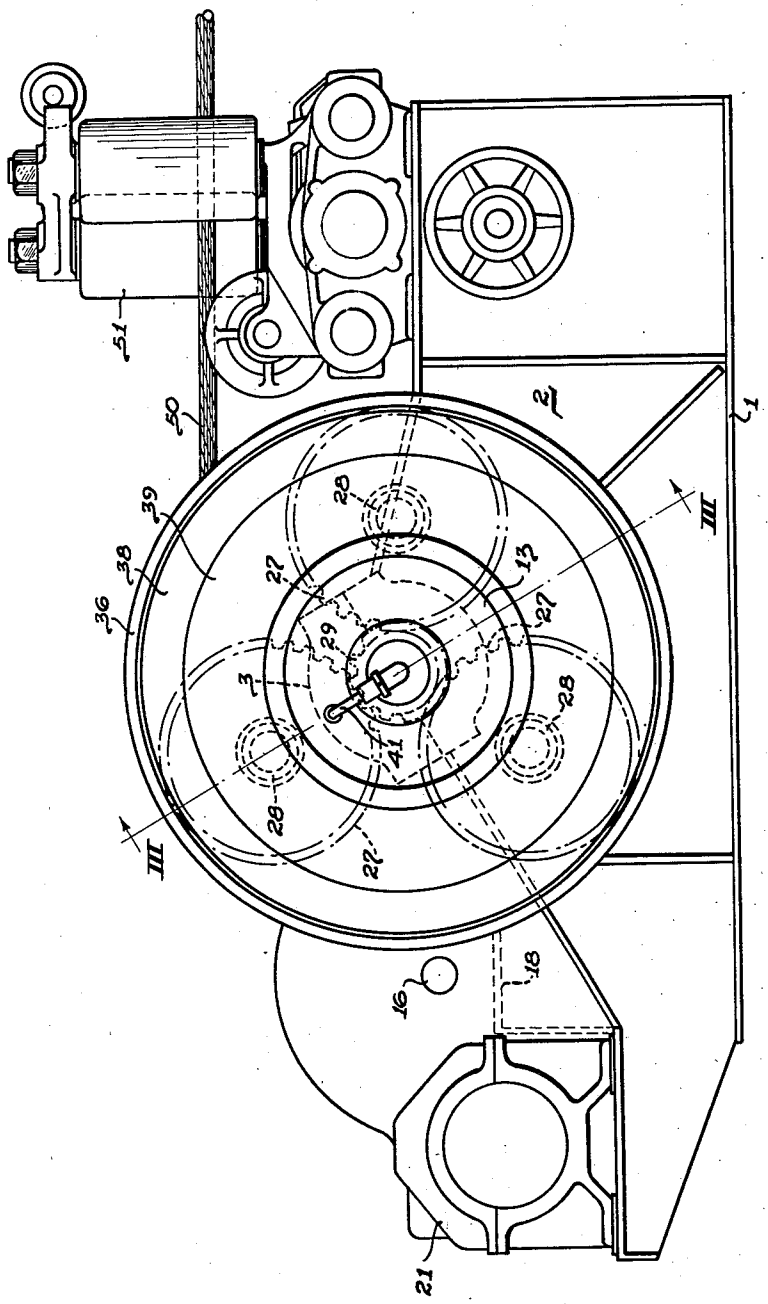


Fig. 2.

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WINCH

Filed March 18, 1944 3 Sheets-Sheet 3

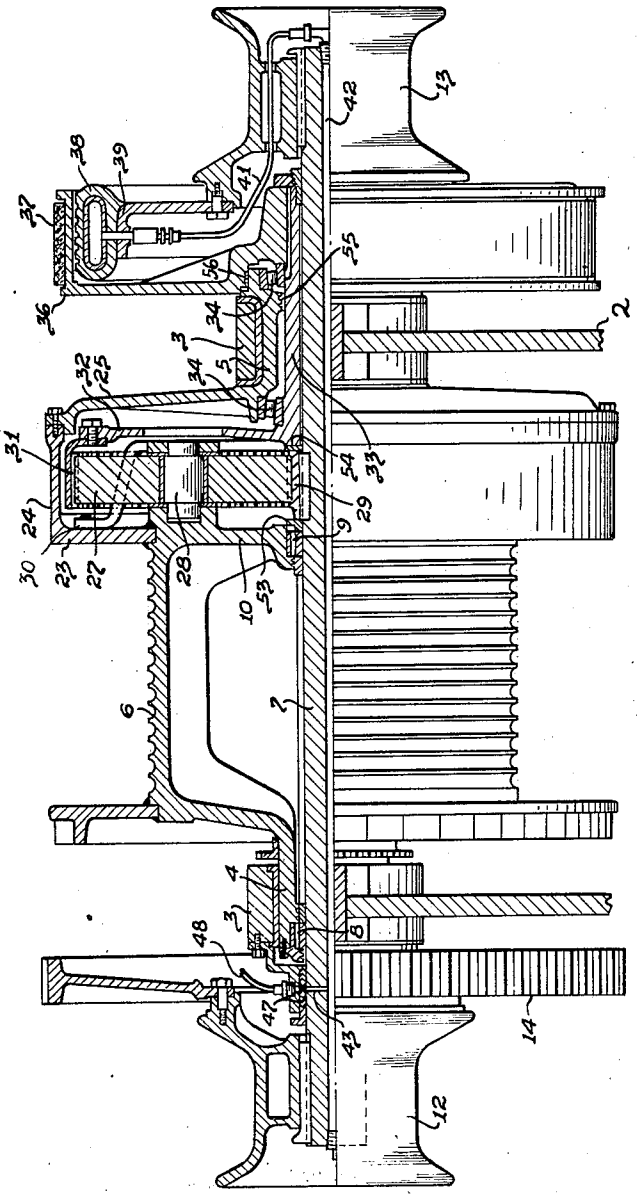


Fig. 3.

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UNITED STATES PATENT OFFICE

2,389,177

WINCH

Charles F. Ball, Franklin, Pa., assignor to Joy Manufacturing Company, Franklin, Pa., a corporation of Pennsylvania

Application March 18, 1944, Serial No. 527,087

7 Claims. (Cl. 254—187)

This invention relates to winches, and more particularly to those that can operate at different speeds.

It is among the objects of this invention to provide a powerful winch of relatively simple construction that has two speeds of operation in both of which the drum rotates in the same direction. My present invention is an improvement over the winch described and claimed in United States Patent No. 1,599,739, issued to me on September 14, 1926, in which the drum is rotated at different speeds but in opposite directions.

In accordance with this invention, a rotatable drum is supported by bearings at its opposite ends, and a drive shaft extends through the drum and is rotatable therein. Planetary gears are rotatably connected to one end of the drum and mesh with a pinion rigidly mounted on the drive shaft. The gears also mesh with a ring gear which encircles them. Manually controlled means is provided for stopping rotation of the ring gear so that the drive shaft will rotate the drum at reduced speed through the pinion and planetary gears. There is also manually controlled means for directly coupling the ring gear to the drive shaft so that the ring gear, and therefore the drum, will be driven at the same speed as the shaft. In both cases the drum rotates in the same direction. The drum is mounted in its own bearings to relieve the drive shaft of all of the load on the drum. The shaft can therefore be of small diameter, thereby permitting the pinion on it to be made small in comparison with the planetary gears. By reason of such a gear ratio the pulling power of the drum is increased. The coupling means mentioned above preferably includes a fluid actuated clutch carried by the drive shaft. Both the clutch and the braking means may engage the same member, which is rigidly connected to the ring gear. The planetary gears most suitably are sealed in a housing where they can be kept running in oil.

The preferred embodiment of the invention is illustrated in the accompanying drawings in which Fig. 1 is a plan view of my winch; Fig. 2 is an end view thereof; and Fig. 3 is a view, partly in section, taken on the line III—III of Fig. 2.

Referring to the drawings, a frame has a rectangular base 1 and a pair of upwardly extending side walls 2 on top of which bearings 3 are mounted. These bearings encircle and support hollow journals 4 and 5 which carry a hollow drum 6. The right hand journal 5 has a larger diameter than the other journal for a purpose that will become evident later. Extending axially through the drum and projecting from its hollow journals or tubular extensions is a drive shaft 7. As shown in Fig. 3 this shaft is rotatably mounted in a roller bearing 8 housed in the outer end of journal 4, and in a similar bearing 9 supported by a radial wall 10 at the right end of the cable-receiving portion of the drum.

Keyed on the opposite ends of the shaft are niggerheads 12 and 13. Secured to the inner end of niggerhead 12 at the left end of the shaft is a spur gear 14 that encircles the driven shaft. As shown in Fig. 1, this gear is rotated by a pinion 15 keyed on a short shaft 16 journaled in bearings 17 mounted on a pedestal 18 attached to a seat formed on the adjacent side wall 2 of the frame. The inner end of this shaft projects from the inner bearing 17 and carries a gear 19 which is rotated by a pinion 20 driven by an electric motor 21 on the rear end of frame base 1. Thus, the motor, when running continuously, rotates drive shaft 7 at relatively low speed through the gear train just described.

A radial flange 23 (Fig. 3) is secured to the right hand end of the drum's cable-receiving portion and has an annular wall 24 formed integrally therewith to which a circular member or disc 25 carrying the journal 5 is bolted. The flange 23, wall 24, disc 25, and wall 10 therefore form an annular housing around the drive shaft between journal 5 and the cable-receiving portion of the drum. Disposed in this housing are several, preferably three, planetary gears 27 (Figs. 2 and 3) each of which is rotatably mounted on a short shaft 28 projecting part way across the housing from wall 10 and having its outer end supported in a spider 30 bolted to the flange 23 between the planetary gears. These gears mesh with a small pinion 29 keyed on or cut integral with the drive shaft. They also mesh with the internal teeth of a ring gear 31 which encircles them close to the annular wall 24 of the housing. This gear is supported by a spider 32 formed integrally with an elongated sleeve 33 that encircles drive shaft 7 and extends outwardly through the hollow journal 5 in which it is supported by roller bearings 34.

Rigidly, but removably, mounted on the outer end portion of this sleeve is a brake drum 36 provided with the usual peripheral annular flange having an outer braking surface. The drum is encircled by a manually operable brake band 37, and the drum flange encircles a clutch. This clutch consists of a flexible annular tube 38, similar to an automobile tire, mounted on a rim 39 that is fastened to the inner end of the adjoining niggerhead 13. The clutch tube is connected by a pipe 41 to the adjacnt end of a passage 42 extending through the center of the drive shaft as shown in Fig. 3. The other end of this passage is plugged, but there is a radial passage 43 connecting it with the outside of the shaft at a point just beyond journal 4. The outer end of

this radial passage opens into an annular recess formed in a packing member **47** attached at its inner end to the journal bearing. This packing recess is connected by a hose **48** to a suitable source of fluid under pressure controlled in any suitable manner by the operator of the winch.

When the clutch tube is expanded by fluid pressure it frictionally engages the encircling drum flange so that the drum is directly coupled to the drive shaft and must rotate with it at the same speed. As ring gear **31** and the pinion **29** on the drive shaft must then both rotate at the same axial speed and in the same direction, planetary gears **27** can not rotate relative to either of them, so they all act as a unit to rotate the drum at the same speed as the drive shaft.

When the clutch is allowed to contract away from the drum flange, and the brake band is tightened against that flange, rotation of drum **36** and the ring gear connected to it is prevented. The planetary gears are therefore rotated on their axes and also around the inside of the stationary ring gear by means of pinion **29**, and their travel around the ring gear causes them to rotate the drum at low speed in the same direction as at high speed.

When both the brake band and clutch are released from the drum, rotation of the drive shaft will merely cause the planetary gears and the ring gear to rotate idly without moving the drum which will be held stationary by friction and the cable **50** wrapped around it. The cable extends through a spooling device **51** mounted on the front ends of side walls **2**. This device is of known construction, and as it forms no part of this invention it will not be described in detail.

The planetary gear housing completely encloses the gears therein, while that housing in cooperation with drum journal **5** and brake drum **36** encloses bearings **34** that support sleeve **33**. Consequently, the planetary parts of the winch can be continuously lubricated with a suitable fluid lubricant which is retained in lubricating relation with them by sealing rings **53** and **54** on the drive shaft and by labyrinth seals **55** and **56** formed in the hollow journal and brake drum, respectively.

Since the drum is journaled in bearings **3**, integral with the frame, and the shaft **7** is journaled in bearings **8** and **9** in the bore of the drum, it is apparent that the shaft does not carry any of the load on the drum. Its sole function is that of driving the drum at either high or low speeds. Consequently, in my improved winch, it is possible to use a drive shaft of small diameter in comparison with the diameter of the drive shaft which must be used in a winch where the drum is supported by the shaft. This construction permits the use of a relatively small pinion in the planetary drive and I am, therefore, able to secure a greater ratio between high and low speeds than can be obtained in a conventional winch where a larger pinion must be used. For example, by using an 18-tooth removable pinion in the planetary drive and a 108-tooth internal gear I am able to secure a ratio of 7 to 1 between high and low speeds, whereas, in the conventional type of winch of the same capacity, it would be necessary to use a 24-tooth pinion with the 108-tooth internal gear and the ratio would be 5½ to 1. However, with a small integral pinion on the drive shaft, I can increase the ratio and secure a ratio as great as 10 to 1. This high ratio is extremely desirable in winches of the character used to handle the stern anchor on landing craft of all types and sizes. Such an anchor is employed to pull the boat off the beach after unloading, so extreme power is required. After the boat has been pulled away from the beach, the speed of the winch must be high enough to keep a taut line until the anchor is pulled free. With my improved winch, the high speed obtained also assists in accelerating the speed of the boat, and the winch can be readily thrown into high gear by disengaging the brake band **37** and engaging the high speed clutch **38**.

When both the clutch and the brake are released and motor **21** is stopped, the drum can operate as a free spooling device to play out the cable. In such a case, the speed of rotation of the drum and the stopping of it can be controlled either by the brake or by the clutch.

While I have pointed out the advantages of my invention in connection with a special embodiment, marine winches, it is to be understood that it can also be used to advantage wherever pulling speeds ranging from a ratio of 2½ to 1 to 10 to 1 are required. For example, my invention can be used in the pulling and reclaiming of posts and timbers used in underground mine chambers to support partially the over-burden. The posts normally are wedged between the mine floor and roof, and great force is required to loosen those props. Speed is required to reduce the time consumed in pulling and reclaiming the props. With my invention, I have provided a post puller, having a pulling power of 30,000 pounds in low gear and 4,000 pounds in high gear, in the form of a winch that has a total weight of 4,800 pounds including a self-propelled carriage on which it is mounted.

According to the provisions of the patent statutes, I have explained the principle and construction of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A winch comprising a frame, a drum rotatably journaled on said frame, a drive shaft extending through the drum and projecting from its ends, said drum having a tubular extension at one end spaced from said shaft, bearings mounted in the drum and rotatably supporting said shaft, planetary gears inside the drum rotatably connected to one end of the drum, a pinion rigidly mounted on the shaft and meshing with said gears, a ring gear rotatable inside the drum and meshing with the planetary gears, a rotatable sleeve surrounding said shaft and journaled within said drum extension and supporting said ring gear, an extension member outside the drum rigidly connected to the outer end of said sleeve, manually controlled means engageable with said extension member for stopping rotation of the sleeve and ring gear to cause said shaft to drive the drum at low speed through said pinion and planetary gears, and manually controlled means for directly coupling the extension member and ring gear to the drive shaft for driving the drum at the same speed as the shaft.

2. A winch comprising a frame, a drum rotatably journaled on said frame, said drum having a tubular extension at one end thereof, a drive shaft extending through the drum and projecting through said extension in spaced relation thereto, bearings mounted in the drum and rotatably supporting said shaft, planetary gears inside the drum rotatably connected to the end of the drum

carrying said extension, a pinion rigidly mounted on the shaft and meshing with said gears, a ring gear rotatable inside the drum and meshing with the planetary gears, a support for the ring gear rotatably mounted in said tubular extension, said support being provided outside the drum with an annular flange, the outer ends of said support and tubular extension being formed to cooperate to form a rotary seal, a brake band adapted to engage one side of said flange for stopping rotation of the ring gear to cause said shaft to drive the drum at low speed through said pinion and planetary gears, and a clutch connected to said shaft and adapted to engage the opposite side of said flange to operatively connect the ring gear to the drive shaft whereby the drum is driven at the same speed as the shaft.

3. A winch comprising a frame, a drum rotatably journaled on said frame, said drum having a tubular extension at one end thereof, a drive shaft extending through the drum and projecting through said extension, bearings mounted in the drum and rotatably supporting said shaft, planetary gears inside the drum rotatably connected to the end of the drum carrying said extension, a pinion rigidly mounted on the shaft and meshing with said gears, a ring gear rotatable inside the drum and meshing with the planetary gears, a support for the ring gear having a cylindrical portion disposed within said tubular extension and surrounding the drive shaft, bearings encircling said cylindrical portion and rotatably supporting it in the extension, said ring gear support having a pair of friction surfaces exposed outside the drum, manually controlled means engageable with one of said friction surfaces for stopping rotation of the ring gear to cause said shaft to drive the drum at low speed through said pinion and planetary gears, and manually controlled means carried by the drive shaft and engageable with the other of said friction surfaces for directly coupling the ring gear to the drive shaft for driving the drum at the same speed as the shaft.

4. A winch comprising a frame, a drum rotatably journaled on said frame, a drive shaft extending through the drum and projecting from its ends, bearings rotatably supporting said shaft, said drum having a cable-receiving portion provided at one end with a wall, an annular flange connected to said wall, a circular member secured to said flange and having a tubular extension surrounding said drive shaft, said circular member and flange and wall forming an annular housing, planetary gears rotatably mounted within the housing, a pinion rigidly mounted on said shaft and meshing with said gears, a ring gear in said housing meshing with the planetary gears, a support for the ring gear having a sleeve journaled in the tubular extension of said circular member, an extension member outside the drum rigidly connected to the outer end of said sleeve, manually controlled means engageable with said extension member for stopping rotation of the ring gear to cause said shaft to drive the drum at low speed through said pinion and planetary gears, and manually controlled means carried by the drive shaft and adapted to be connected to said extension member for directly coupling the ring gear to the drive shaft for driving the drum at the same speed as the shaft.

5. A winch comprising a frame, a drum rotatably journaled on said frame, a drive shaft extending through the drum and projecting from its ends, bearings mounted in said drum for rotatably supporting said shaft, said drum having a cable-receiving portion between two end walls one of which has an annular flange formed integrally therewith, a circular member secured to said flange and having a central tubular extension surrounding said drive shaft, said circular member and flange and end wall forming a gear housing, planetary gears rotatably mounted in said housing, a pinion rigidly mounted on said shaft and meshing with said gears, a ring gear in said housing meshing with the planetary gears, a support for the ring gear having a sleeve journaled in said tubular extension, an annular flange carried by said sleeve outside the drum, a brake adapted to engage one side of said annular flange for stopping rotation of the ring gear, and a clutch connected to said shaft and adapted to engage the opposite side of said annular flange to operatively connect the ring gear to the drive shaft whereby the drum is driven at the same speed as the shaft.

6. A winch comprising a frame, a pair of spaced bearings carried thereby, a hollow drum having hollow journals mounted in said bearings, a drive shaft rotatably disposed in the drum and extending through one of said journals with an annular space between them, planetary gears inside the drum and rotatably connected thereto, a pinion rigidly mounted on said shaft and meshing with said gears, a ring gear inside the drum meshing with the planetary gears and rotatable around the shaft independently of the drum, supporting means for the ring gear extending out of the drum through said annular space, means engageable with said supporting means outside the drum for stopping rotation of the ring gear to cause said shaft to drive the drum at low speed through said pinion and planetary gears, and means carried by the drive shaft and adapted to be connected with said supporting means outside the drum for directly coupling the ring gear to the drive shaft for driving the drum at the same speed as the shaft.

7. A winch comprising a frame, a pair of spaced bearings carried thereby, a hollow drum having end walls with hollow journals projecting outwardly therefrom and mounted in said bearings, a drive shaft rotatably disposed in the drum and extending through one of said journals with an annular space between them, said drum being provided inside with a radial wall spaced from said end walls, planetary gears rotatably mounted on said radial wall, a pinion rigidly mounted on said shaft and meshing with said gears, a ring gear inside the drum meshing with the planetary gears and rotatable around the shaft independently of the drum, supporting means for the ring gear extending out of the drum through said annular space, means engageable with said supporting means outside the drum for stopping rotation of the ring gear to cause said shaft to drive the drum at low speed through said pinion and planetary gears, and means carried by the drive shaft and adapted to be connected with said supporting means outside the drum for directly coupling the ring gear to the drive shaft for driving the drum at the same speed as the shaft.

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