March 17, 1953 C. F. BALL 2,631,477

DRIVE CONTROLLING MEANS

Filed May 22, 1947 2 SHEETS—SHEET 1

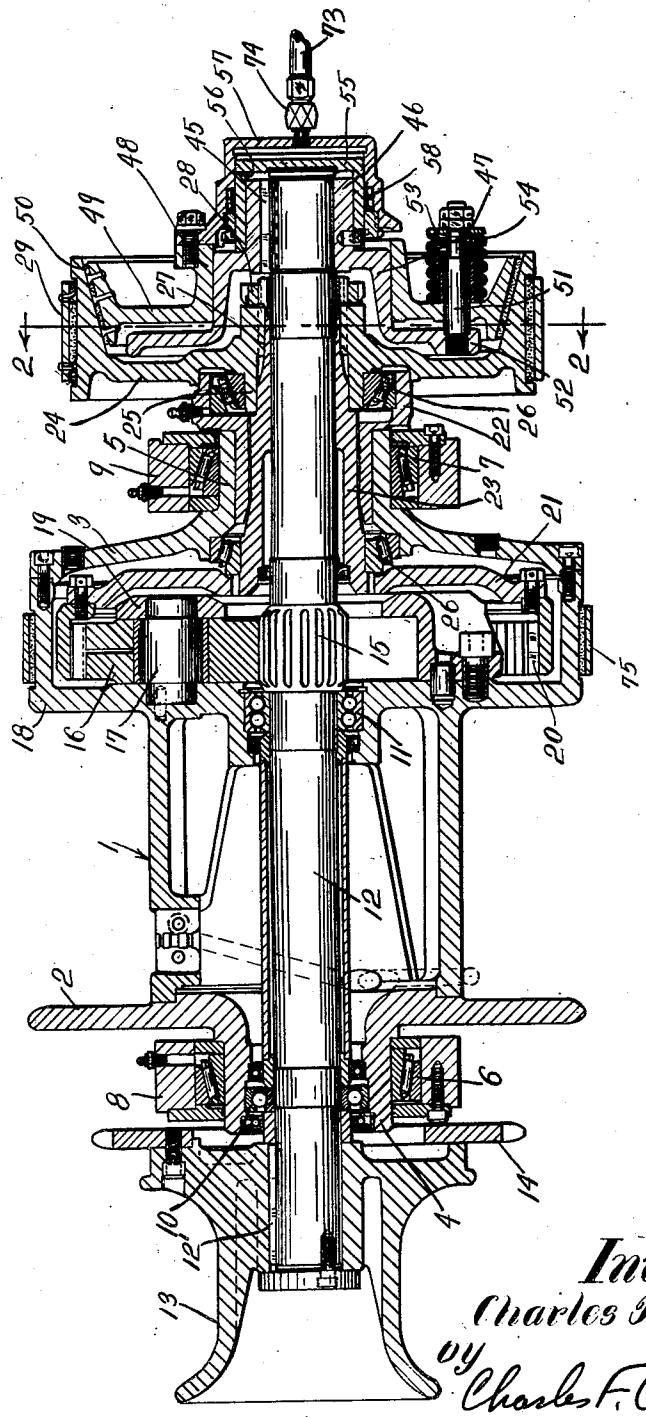

Fig. 1.

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Fig. 2.

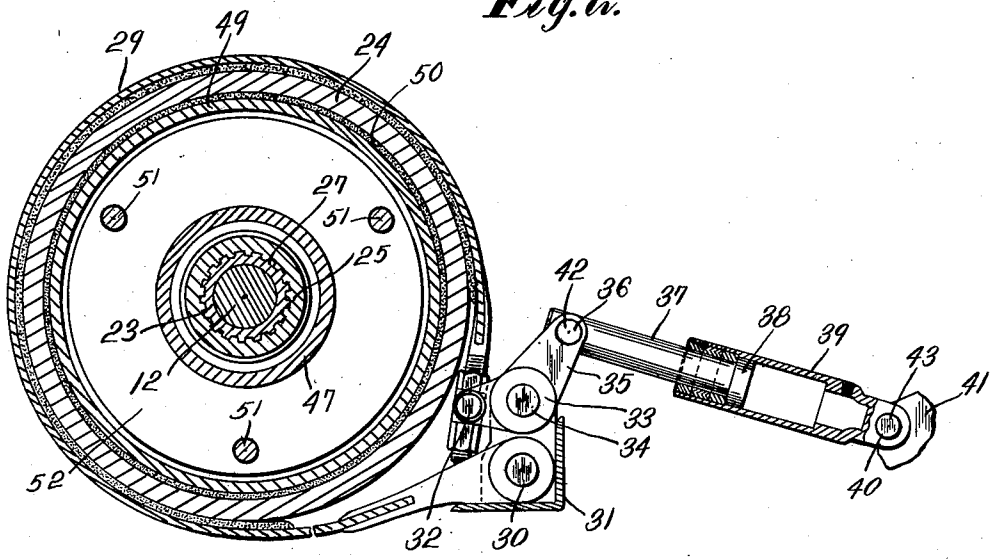
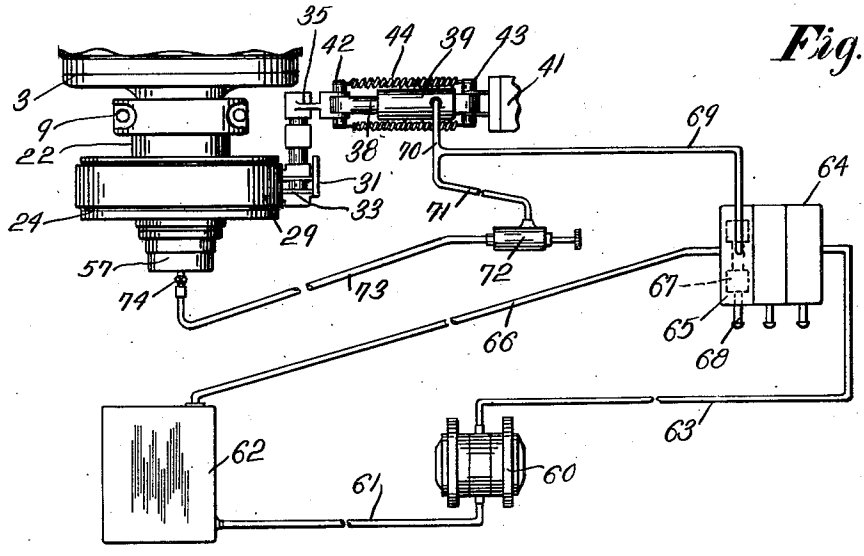


Fig. 3.



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DRIVE CONTROLLING MEANS

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5 Claims. (Cl. 74—785)

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This invention relates to winches and more particularly, but not exclusively, to an improved post pulling winch especially designed for use in removing and reclaiming posts or roof props in underground mines.

In a winch, such as a post puller for removing and reclaiming posts or roof props used in underground mining work for supporting the roof, it is desirable that a relatively powerful force be applied to the posts or props to release them from their roof-supporting position, and when a post is released, it is necessary to pull it out of the way of the falling roof at a relatively high speed. It is accordingly desirable to provide, in such winches, a two-speed drive for the cable winding drum so that the pulling cable may be wound in at a relatively low speed to apply a powerful pulling force to the post, and thereafter the cable may be wound in at a relatively high speed so that the post may be rapidly pulled out of the way. It is also desirable to provide control means for the two-speed drive so that the speed may be quickly shifted from the low to the high. In such machines, capstans, often called "niggerheads" or "gypsies," are sometimes associated with the cable winding drum, and it is desirable, at times, to drive such capstans while the cable winding drum is disconnected from its drive.

It is the contemplation of the present invention to provide an improved post pulling winch which embodies the desirable characteristics above outlined. Another object is to provide an improved winch having improved drum driving means and simplified control means. A further object is to provide an improved winch wherein the cable winding drum may be driven at either high or low speeds. Yet another object is to provide an improved drum driving means having improved fluid operated control means. A still further object is to provide an improved drum driving means embodying a high speed drive and a low speed drive and improved fluid operated means for selectively effecting drum drive at high and low speeds. Another object is to provide an improved drum driving means embodying a high speed friction control and a low speed friction control and improved fluid cylinders for effecting release of the low speed control when the high speed control is operative, and vice versa. Still another object is to provide an improved low speed planetary drive for the cable winding drum embodying a rotatable reaction gear which is controlled by a fluid actuated frictional control device. A further object is to provide an improved high speed drum drive by connecting the

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reaction member of the planetary drive directly to the drive shaft and releasing the friction band for controlling rotation of the reaction member. Another object is to provide an improved winch having a capstan associated with the cable winding drum and having improved fluid operated control means associated with the control means for the friction band and clutch whereby the capstan may be driven while the drum is disconnected from its drive. A still further object is to provide an improved drum shaft unit for a winch. Still another object is to provide an improved fluid operated control means for a winch. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings:

Fig. 1 is a central longitudinal section taken through a winch constructed in accordance with an illustrative embodiment of the invention.

Fig. 2 is a cross-sectional view taken substantially on line 2—2 of Fig. 1, showing the brake in applied position.

Fig. 3 is a diagrammatic view showing the fluid control means.

In this illustrative embodiment of the invention there is shown a winch which may be of the same general character as that disclosed in my Patent No. 2,389,177, patented November 20, 1945, and the present invention is directed to improvements over the winch of the patent. Evidently, various features of the present invention may be embodied in cable winding mechanism of other kinds, and the improved driving and control means may be embodied in mechanisms other than winches.

As shown in Fig. 1 of the drawings, a cable winding drum, on which a cable is adapted to be wound, is designated 1 and has end portions 2 and 3 providing coaxial hubs 4 and 5 respectively, herein suitably journaled in bearings 6 and 7 supported within suitable longitudinally spaced supports 8 and 9 respectively, the latter preferably mounted on a suitable base or other supporting structure. Extending centrally through the drum and journaled in bearings 10 and 11, suitably supported within the drum, is a drive shaft 12. This drive shaft projects axially in opposite directions through the drum hubs 4 and 5 outwardly beyond the supports 8 and 9 and has keyed thereto at one end at 12' a capstan or so-called "niggerhead" or "gypsy" 13, about which

a cable is adapted to be snubbed in a known manner. Secured, as by screws, to this capstan at its inner end near the support 8 is a suitable drive member, herein a drive sprocket 14, suitably operatively connected to a suitable power source. Fixed to the drive shaft 12 near the opposite end of the drum is a spur pinion 15 which meshes with spur planet gears 16 (one of which is shown in Fig. 1), each journaled on a horizontal stub shaft 17 supported at one end within the adjacent drum flange 18 and at its other end within a bracket 19 secured, as by screws, to the drum. These planet gears mesh with an internal gear 20 secured to a rotatable reaction member 21 coaxial with the drive shaft. Suitably fixed to the drum hub 5 is a bearing support 22, and the reaction member 21 has a sleeve-like shaft portion 23 projecting axially beyond the bearing support 22 and to which a friction drum 24 is secured. The shaft portion 23 of the reaction member and the hub 25 of the friction drum are journaled in bearings 26, 26 supported respectively within the drum hub 5 and the bearing support 22. The hub 25 of the friction drum is keyed at 27 to the shaft portion 23 near its outer end and is rigidly held in position on the shaft portion by a retaining ring 28 suitably locked to the outer end of the shaft portion. Cooperating with the exterior periphery of the friction drum 24 is a contractible friction band 29 and, as shown in Fig. 2, this friction band is attached at one end at 30 to a suitable support 31 which is preferably in rigid relation with the drum supports 8 and 9, and the other end of the friction band is attached at 32 to a lever 33 pivoted at 34 on the support 31. A lever 35, movable with the lever 33, is pivotally connected at 36 to a piston rod 37 of a reciprocable piston 38 contained in a fluid cylinder 39, the latter being pivotally mounted at 40 on a stationary support 41. Connected between pivot pins 42 and 43 providing the pivots for the cylinder and piston rod are coil springs 44, 44 (see Fig. 3) which constantly urge the piston 38 toward its retracted position. Thus, when the piston 38 is moved to apply the friction band 29, the reaction member 21 is held stationary, and as the drive shaft 12 is driven by the chain sprocket 14, the cable winding drum 1 is rotated in cable winding direction through spur pinion 15 and the planet gears 16 on the drum, which mesh with the internal gear 20, the planet gears 16 rolling around the then stationary internal gear as a trackway to effect low speed drum rotation.

Now referring to the clutch for connecting the cable winding drum directly to the drive shaft 12 to effect high speed drum rotation in cable winding direction, it will be noted that the drive shaft extends axially outwardly beyond the shaft portion 23 of the reaction member, and keyed at 45 to this projecting end of the shaft is a hub 46 of a cylindrical flanged member 47. Slidably mounted on the cylindrical body of the member 47 is a hub 48 of a reciprocable clutch member 49, herein preferably a clutch cone engageable with a conical surface 50 on the friction drum 24. Studs 51, secured to the flange 52 of the member 47, pass outwardly through openings in the clutch member 49, and encircling these studs and arranged between washers 53 held on the studs by nuts and the outer face of the clutch member 49 are coil springs 54 which constantly urge the clutch member toward its connected position. Rigidly secured to the hub 46 of the member 47 is a non-reciprocable sleevelike piston 55 received in a bore 56 of a reciprocable fluid cylinder 57, the latter secured, as by screws, to the hub 48 of the reciprocable clutch member 49. A fluid seal 58 surrounds the piston 55 and engages the walls of the cylinder 57 to prevent leakage. Thus, when fluid is supplied to the cylinder 57, the latter is moved axially outwardly with respect to the piston 55 to release the clutch member 49 against the action of the springs 54. When fluid is vented from the cylinder 57, the springs 54 automatically connect the clutch. Evidently, the friction band may be released by pressure fluid and the clutch may be connected by pressure fluid, and the springs may apply the friction band and disconnect the clutch. Moreover, the parts may be reversed so that the piston is reciprocable and the cylinder is held against reciprocation.

In this improved construction, suitably driven from the same power source as the cable winding drum and capstan, is a conventional fluid pump 60 having its intake connected by a conduit 61 to a fluid tank 62, herein containing a liquid such as a light lubricating oil. The pump discharge is connected by a conduit 63 to the pressure passage of a valve box 64 of a conventional valve mechanism 65 while the discharge passage of the valve box is connected by a conduit 66 back to the tank. The valve box of this valve mechanism contains a conventional reciprocable slide valve 67, preferably of the balanced spool type, operated by a handle 68. Leading from the valve box is a conduit 69 having branches 70 and 71, the former connected to the fluid cylinder 39 and the latter connected through a conventional hand valve 72 to a conduit 73 connected to the cylinder 57. The conduit 73 has a fluid tight swivel at 74 so that the cylinder may freely rotate relative to the relatively stationary portion of the conduit 73. When the valve 67 is positioned to supply fluid under pressure to the conduit 69 and through conduits 70 and 71 to the cylinders 39 and 57, the clutch member 49 is released while the friction band 29 is applied, thereby to effect drum drive in cable winding direction through the planetary reduction gearing at a relatively low speed. When the valve 67 is positioned to connect the conduit 69 to the discharge conduit 66, the springs 44 effect release of the friction band 29 while the springs 54 effect connection of the clutch member 49, thereby to drive the drum directly with the shaft 12 at a relatively high speed. When it is desired to drive the capstan 13 independently of the drum, fluid may be supplied to the fluid cylinders 39 and 57, and then the hand valve 72 may be closed to trap the fluid in the cylinder 57 with the clutch member 49 disconnected. The valve 67 may then be positioned to connect the conduit 70 to the discharge line 66 so that the springs 44 release the friction band 29. The drum drive shaft 12, to which the capstan is fixed, may then revolve freely relative to the drum, and the latter is provided with a suitable contractible brake band 75 for holding the drum stationary at that time. There may be a suitable releasable clutch between the drive sprocket 14 and its power source so that the drive sprocket may freely rotate, thereby to permit unwinding of the cable from the drum by hand.

As a result of this invention, an improved post pulling winch is provided wherein the cable winding drum may be selectively driven at either high or low speeds in an improved manner. By the provision of the fluid operating means embodying the fluid cylinders for the clutch and the

friction band, the latter is automatically released whenever the clutch is applied and vice versa. The drum may be driven at a relatively low speed through the planetary reduction gearing to impart a relatively powerful pulling force to the cable or may be driven at a relatively high speed directly from the drive shaft to effect rapid winding in of the cable. By the provision of the fluid operated friction band for controlling rotation of the reaction member of the planetary reduction gearing and the fluid operated clutch for connecting the reaction member directly to the drive shaft, the drum drive may be quickly shifted from one speed to the other, as is highly desirable in a post puller. By the provision of the improved fluid control means for the clutch and friction band, a rapid change in speed may be effected by but the single operating handle for the control valve. By the provision of the hand valve in the conduit leading to the clutch cylinder, the clutch may be held in a released position when the operating cylinder for the friction band is vented so that the capstan may be operated while the drum remains stationary. The manners of use and the advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the cope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In combination, a support, an element to be driven having a tubular portion journaled in said support, a rotatable drive shaft coaxial with said element and journaled therein, said shaft projecting at one end axially from said element through said tubular portion and said support, planetary reduction gearing between said shaft and said element including a rotatable reaction member adapted to be held stationary to effect low speed drive of said element, said reaction member being coaxial with said shaft at one side of and journaled within said support, a fluid operated friction device for holding said reaction member stationary including a friction drum secured to said reaction member at the other side of said support, a fluid controlled clutch coaxial with and supported by said shaft for connecting said friction drum directly to said shaft to effect high speed drive, manually operable control valve means for regulating the flow of pressure fluid to said device and said clutch for effecting release of one whenever the other is operated while precluding simultaneous application of said device and said clutch, and a manual control valve associated with said control valve means for effecting holding of said clutch released when said device is released whereby said drive shaft may rotate while said element to be driven remains stationary.

2. In combination, an element to be driven, a drive member coaxial with said element, a fluid released, releasable driving connection for effecting drive of said element at one speed by said member, a fluid applied, releasable driving connection for effecting drive of said element by said member at a relatively different speed, fluid operated controlling means for said driving connections respectively, control valve means controllable by the operator for supplying pressure fluid to said fluid operated controlling means and for connecting the same to exhaust for only alternatively effecting drive through said connections, said control valve means connectible either to fluid supply or exhaust and having fluid connections respectively with said fluid operated controlling means, and a separate operator controllable, control valve means in one of said fluid connections and operable at will for trapping fluid in said one speed driving connection controlling means while said other speed driving connection controlling means is connected to exhaust whereby both of said controlling means may be maintained in drive interrupting position.

3. In combination, an element to be driven, a drive member coaxial with said element, a fluid released, spring applied driving connection for effecting drive of said element at one speed by said member, a fluid applied, spring released driving connection for effecting drive of said element at a relatively different speed, fluid operated controlling means for said driving connections respectively, control valve means controllable by the operator for only alternatively supplying pressure fluid to and for venting fluid from said fluid operated controlling means, said control valve means having fluid connections respectively with said fluid operated controlling means, and a separate, operator-controllable, control valve means in one of said fluid connections and operable at will for trapping fluid in said controlling means for said one speed driving connection to hold its controlling means in releasing position while said first mentioned control valve means is positioned to vent said controlling means for said other speed driving connection to effect release of its controlling means, thereby to disconnect both driving connections from said drive member.

4. In combination, an element to be driven, a coaxial drive member, a fluid released, releasable driving connection for effecting drive of said element in one manner by said member, a fluid applied, releasable driving connection for effecting drive of said element by said member in a different manner, fluid operated controlling means for said driving connections respectively, control valve means controllable by the operator for supplying pressure fluid to said fluid operated controlling means and for connecting said controlling means to exhaust for only alternatively effecting drive through said driving connections, said control valve means connectible either to fluid supply or exhaust and having fluid connections respectively with said fluid operated controlling means, and a separate, operator controllable, control valve means in one of said fluid connections and operable at will for trapping fluid in said one fluid operated controlling means while said other fluid operated controlling means is connected to exhaust whereby both of said controlling means may be maintained in drive interrupting position.

5. In combination, an element to be driven, a coaxial drive member, a fluid released, spring applied driving connection for effecting drive of said element in one manner by said member, a fluid applied, spring released driving connection for effecting drive of said element by said member in a different manner, fluid operated controlling means for said driving connections respectively, control valve means controllable by the operator for only alternatively supplying pressure fluid to and for venting fluid from said fluid

operating controlling means, said control valve means having fluid connections respectively with said fluid operated controlling means, and a separate, operator controllable, control valve means in one of said fluid connections and operable at will for trapping fluid in the controlling means for one driving connection to hold the same in releasing position while said first mentioned control valve means is positioned to vent the controlling means for said other driving connection to effect release of its controlling means, thereby to disconnect both driving connections from said drive member.

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