Feb. 28, 1933. S. N. NICKLISS 1,899,901

CROWDING AND RACKING IN MECHANISM FOR EXCAVATOR CRANES

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Fig. 1.

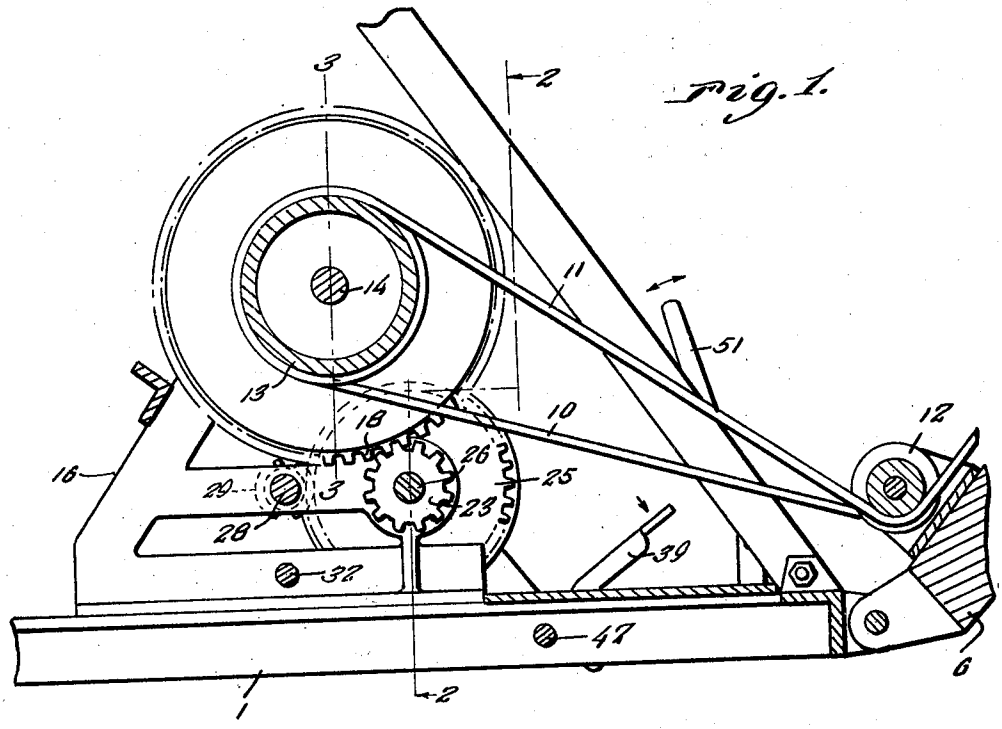


Fig. 4.

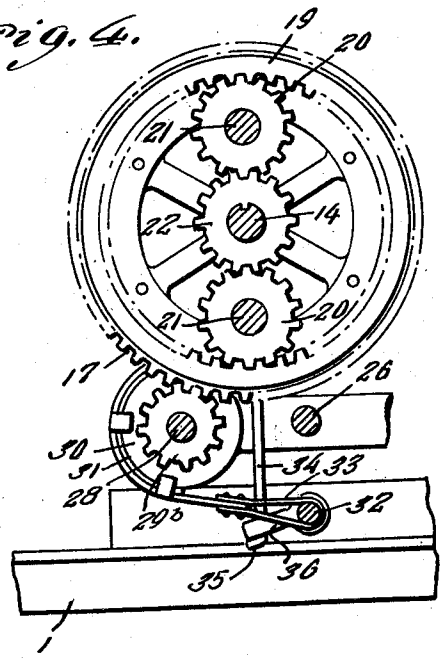
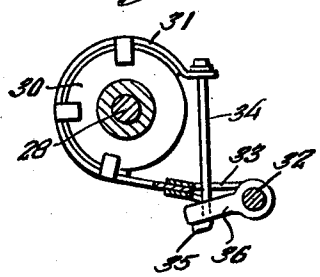


Fig. 5.



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CROWDING AND RACKING IN MECHANISM FOR EXCAVATOR CRANES

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Fig. 2.

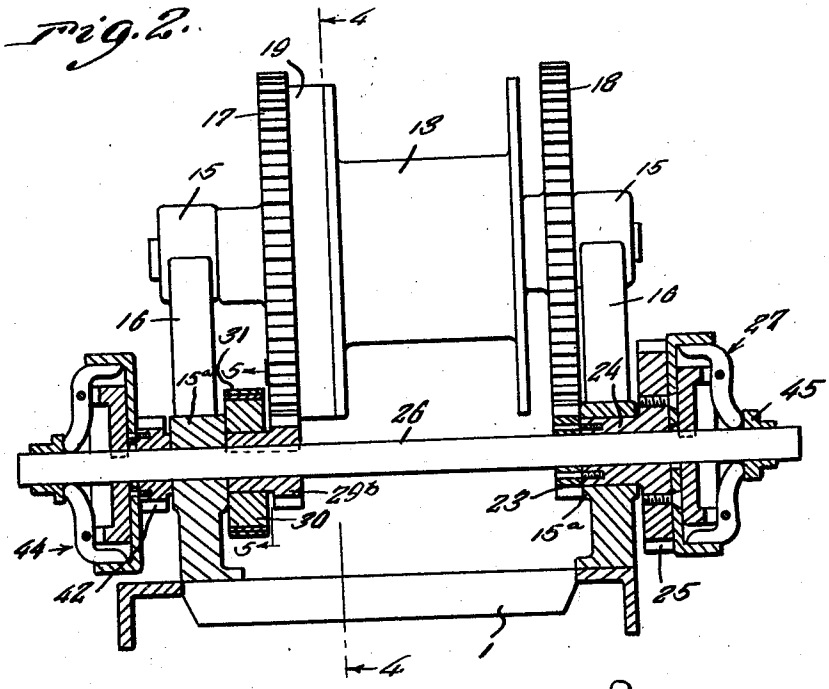
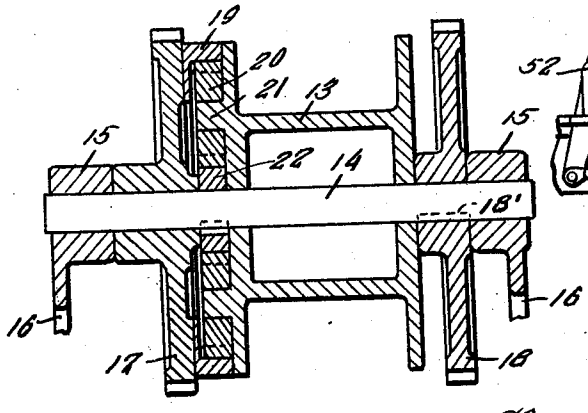


Fig. 3.



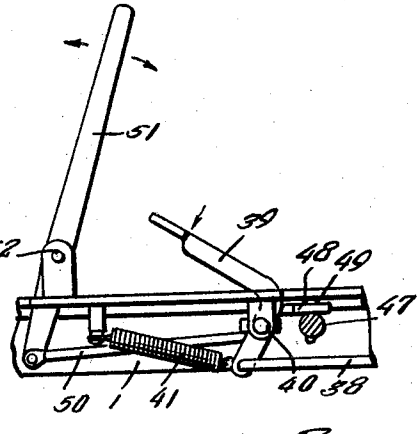


Fig. 7.

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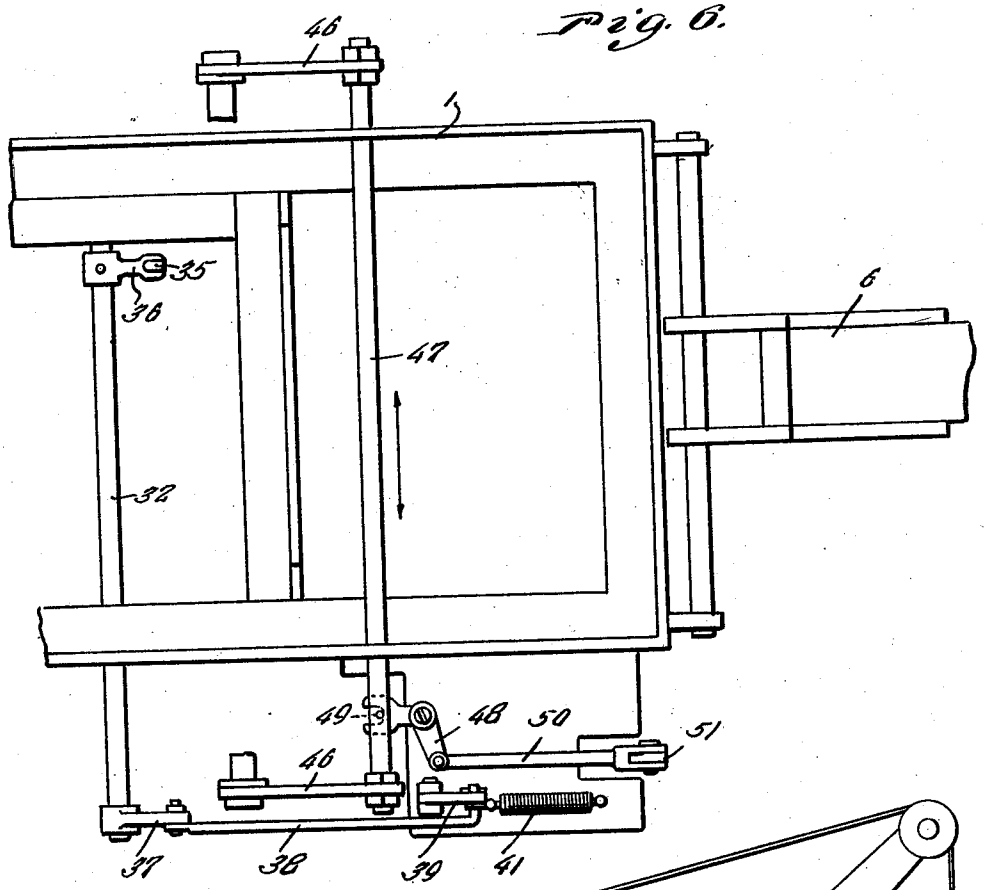
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CROWDING AND RACKING IN MECHANISM FOR EXCAVATOR CRANES

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Fig. 6.



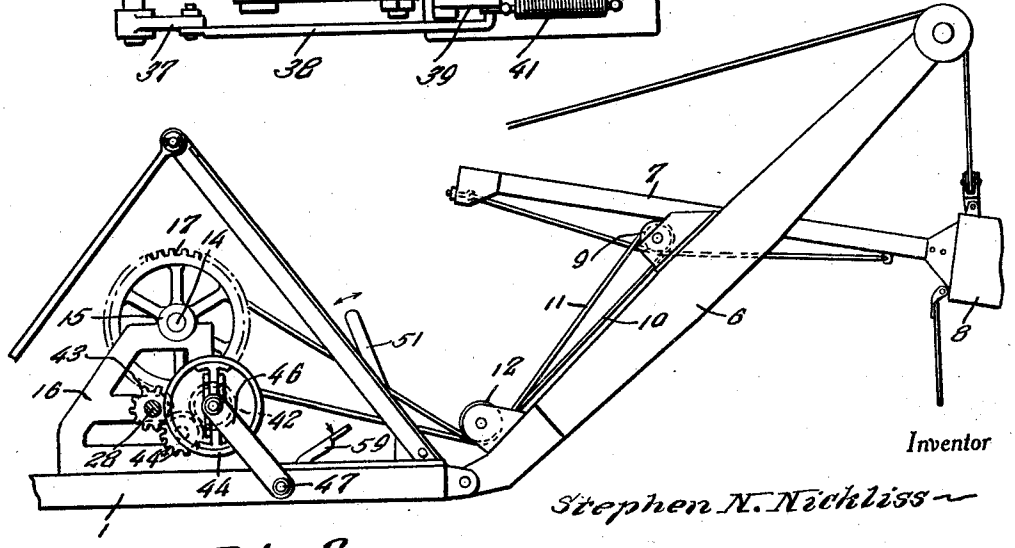


Fig. 8.

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UNITED STATES PATENT OFFICE

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CROWDING AND RACKING-IN MECHANISM FOR EXCAVATOR CRANES

Application filed March 29, 1932. Serial No. 601,820.

This invention relates to improvements in excavator cranes and more particularly to the crowding and racking in mechanism and apparatus of such cranes.

In accordance with the present invention, while the crowding and racking in mechanism and apparatus is well adapted for embodiment in a power shovel, it is also adapted for universal use, and especially, and in addition to the shovel type of locomotive or portable crane will be found efficient as a part of the equipment of the other two main classes into which cranes of the locomotive or portable type as commonly used today may be divided, namely those for clam shell work and secondly drag line excavating cranes.

The crowding and racking in mechanism and apparatus of the present invention is designed for direct drive from the motor and characterized by a special planetary drive gearing and clutch mechanism whereby high and low speed of drum drive may be obtained for crowding out or projecting the dipper stick of a shovel, and a reverse drive for racking in said stick as necessary for shovel operations.

Briefly then the invention consists primarily in the provision of a reversible combined crowding and racking in mechanism characterized by a two speed drive and receiving its power direct from the motor whereby maximum digging power is obtained with minimum waste of motor power. Further, in accordance with the present invention excessive clutches and gearing are eliminated, the crowding and racking in of the dipper stick is simplified, the slipping of clutches is overcome, and in general an increase in power and efficiency of the crane is obtained.

The invention together with its numerous objects and advantages will be best understood from a study of the following description, taken in connection with the accompanying drawings wherein:

Figure 1 is a fragmentary sectional elevational view illustrating the application of the crowding and racking in mechanism and apparatus as part of the equipment of a power shovel.

Figures 2 and 3 are sectional views taken substantially on the lines 2—2 and 3—3 respectively of Figure 1.

Figure 4 is a sectional elevational view taken substantially on the line 4—4 of Figure 2.

Figure 5 is a sectional elevational view showing a brake and a portion of the control mechanism therefor.

Figure 6 is a fragmentary bottom plan view for illustrating certain parts of the crowding and racking in control.

Figure 7 is a fragmentary sectional elevational view showing in side elevation a clutch control lever and brake control pedal respectively.

Figure 8 is a fragmentary elevational view on a reduced scale of the crowding and racking in mechanism and other such parts of the power shovel with which the present invention is concerned.

In the present embodiment the invention is shown as applied to a conventional power shovel which includes among other parts a platform, a portion of which is shown in the drawings and designated by the reference character 1; a boom designated by the reference character 6 and pivoted at its lower end to the platform 1 in the usual manner; a dipper stick 7 which is provided with and carries a shovel or bucket 8 in the usual manner, a shipper device designated generally by the reference character 9 crowding and racking in cables 10 and 11 respectively passing under the usual fleeting sheaves 12; and passing upwardly to the operating drum 13 of the crowding and racking in mechanism embodying the features of this invention.

The structure as above set out is conventional equipment of the locomotive or portable shovel type crane which employs a dipper arm and bucket equipment and is commonly known as a power shovel.

In accordance with the present invention the operating drum 13 is loose on a shaft 14 journalled in bearings 15 provided on relatively spaced opposed supports 16 rising from the platform 1.

The drum 13 is arranged on shaft 14 between gears 17, 18; gear 17 being loose on shaft 14 and gear 18 being fast on said shaft as indicated at 18'.

The gears 17 and 18 form part of a driving means for the drum 13 enabling it to be reversibly actuated, and also to be actuated at varied speeds in accord with the demands of the work, which driving means in accordance with the present invention includes certain planetary gearing representing an important feature of this invention.

The planetary gearing includes an internal gear 19 suitably provided on one side of the floating gear 17, and the internal gear 19 meshes with idler planetary gears 20 supported on a proximate side of the drum 13 by means of the bearing pins 21. The idler gears 20 mesh with the inner or central driving gear 22 which is keyed to the shaft 14 so that it revolves with the gear 18 that is also keyed on the shaft 14 as before mentioned.

The gear 18 is in mesh with a pinion 23 made fast to the end of the hub 24 of a high speed gear 25 loose on a counter shaft 26 suitably journalled in bearings 15^a provided on the standards or supports 16 forwardly of shaft 14 and in a plane below said shaft 14. To operatively connect the gear 25 with the shaft 26 a friction clutch 27, conventionally illustrated in the drawings is employed.

A power shaft designated by the reference character 28 is suitably mounted between the support or standards 16 and is provided adjacent one end with a driving gear 29 meshing with the gear 25. Shaft 28 is driven from a suitable motor through a chain and sprocket drive or other suitable mechanism (not shown). The gear 17 is in mesh with a pinion 29^b keyed on shaft 26 and provided with a brake drum 30 about which is disposed a brake band 31. Brake band 31 has one end thereof engaged with a rock shaft 32 as at 33 and the other end thereof engaged with one end of a rod 34 that in turn is engaged as at 35 with an arm 36 fast on shaft 32. Shaft 32 adjacent one end thereof is provided with an arm 37 that is connected through the medium of a link 38 with a pedal 39 pivotally mounted on the platform 1 as at 40. Suitable spring means 41 is provided for normally retaining the pedal 39 in a raised position or in the position shown in Figure 7, and consequently the band 31 loose about the drum 30.

A gear 42 is loose on shaft 26 and meshes with another gear $44a$ which in turn meshes with a gear 43 on shaft 28. To operatively connect the gear 42 with the shaft 26 a conventional friction clutch 44 similar to the clutch 27 is provided.

For controlling the clutches 27, 44, there is provided on shaft 26 for each clutch a sliding collar 45, with which are engaged forks 46 provided on the ends of a shiftable rod 47 that is slidably mounted and extends transversely of platform 1.

For shifting rod 47 there is provided a suitably mounted bell crank 48 one end of which is forked and engages a pin 49 on rod 47. The other end of the bell crank 48 is pivotally connected through the medium of a link 50 with a hand lever 51 that is pivotally mounted on the platform 1 as at 52.

In operation, and from the description of the invention thus far, it will be seen that a turning of the drum 13 in one direction will compel a crowding out of the dipper 7, and a reverse turning of the drum 13 will effect a racking in of the dipper. A turning of the drum 13 in a counter-clockwise direction will cause the crowding out of the dipper 7 and for this purpose a high speed drive for the drum 13 as well as a low speed of drum drive may be obtained as desired; a high speed drive being secured by shifting lever 51 to the left in Figures 7 and 8 respectively causing a shifting of rod 47 from the top to the bottom of Figure 6 to render clutch 27 active and obtaining a drive through gears 29, 25, 23, gear 18, shaft 14, gear 22 meshing with the idler planetary gears 20, and under these conditions gear 17 being loose on shaft 14 and being driven by gear $29b$ rotates drum 13 at speed equal to speed of shaft 14 which is a relatively high speed. To secure low speed lever 51 remains in neutral or normal position, and pedal 39 is depressed for drawing the brake band 31 into frictional engagement with the drum 30 whereupon shaft 26 and gear $29b$ will be held against rotation as will also gear 17, and under these conditions of course gear 25 continuing to revolve by reason of being in mesh with gear 29 on the motor driven shaft 28 the idler gears 20 continue to rotate and transmit movement from the shaft 14 to the drum 13 so that the latter is then driven at a relatively low speed, i. e. at a speed lower than speed of shaft 14.

Reverse drive for drum 13 to compel a racking in of the dipper stick 7 is secured by shifting lever 51 to the right in Figures 7 and 8, causing a reverse shifting movement of the rod 47 thereby rendering active clutch 44, so that drive, (clutch 27 being now inactive as also brake 30) is obtained through gear 43, idle gear $44a$, and gears 42, $29b$, and gear 17, driving gear 19 and pinions 20 moving in a clockwise direction with gear 22 revolving in a counter-clockwise direction whereby the drum 13 rotates in a clockwise direction, to compel a racking-in of the dipper stick at a relatively high speed.

From the foregoing it will be evident that the special feature of this invention is of course the provision of a simplified change speed drive gearing intermediate the engine shaft (not shown) and the drum 13 of the power shovel whereby the drum is operable in reverse directions, one direction for crowd-

ing out, and the opposite direction for racking in the dipper. It will be also understood that the present invention provides for the use of the planetary gearing for obtaining reverse movement of the drum in effecting a racking in of the dipper while at the same time the number of clutches employed is at a minimum; further a change from a high to a low speed or vice versa during actual crowding operation may be effected, and also the clutches being easily engaged or disgaged while the crane is in actual use thereby permitting the operator to change from a crowding out to a racking in operation with ease and facility, without excessive strain on the clutches and without slipping of the clutches or excessive labor or strain on the part of the operator, all of which renders the present invention advantageous over known cranes in use today. The organization also provides for a direct drive from the motor, and by use of the planetary gearing a reduction of one half or more of the original operating speed of the crowd may be effected to thereby develop tremendous digging power.

Even though I have herein shown and described the preferred embodiment of my invention I am aware that in actual practice changes may be resorted to without departing from the spirit of the invention and accordingly I claim all such forms of the invention to which I am entitled in view of the prior art and scope of the appended claims.

Having thus described my invention, what I claim as new is:

1. An excavator crane comprising in combination, a main operating drum, and means for operating the drum in one direction at variable speeds and in the opposite direction at one speed, and including a shaft on which said drum is loosely mounted, a gear on said shaft adjacent each end of said drum, one of said gears being fast and the other of said gears being loose relative to the shaft, a counter shaft, a gear loose on the counter shaft and meshing with the gear fast on the first named shaft, a second gear fast on said counter shaft and meshing with the gear loose on the first named shaft, a brake operatively associated with the gear fast on said counter shaft, clutch control means for driving said counter shaft, means for driving the said gear loose on said counter shaft, means for clutching the last mentioned gear to said counter shaft, and planetary gearing for driving said drum from the first named shaft at variable speeds in one direction and at one speed in the opposite direction.

2. In a crowding out and racking in mechanism for a crane, a rotary shaft, a gear fast on the shaft, a second gear spaced from the first gear and loose on said shaft, a drum loose on said shaft between said gears, a counter shaft, a pinion loose on the counter shaft and meshing with the first gear on the rotary shaft, a clutch for connecting the pinion in driving relation with the counter shaft, a planetary gearing connection between the second gear and the drum, a second pinion fast on the counter shaft and meshing with said second gear, brake means for the counter shaft and cooperative with the second pinion to retard said second gear for effecting rotation of said drum at a speed reduced from the speed of the rotary shaft; driving means for the counter shaft including driven gears loose on the counter shaft, clutch means for connecting the driven gears in driving relation with the counter shaft; and means for simultaneously operating the clutches for controlling the direction of rotation of said drum.

3. In a power crane, a dipper stick, and a crowding out and racking in apparatus for the stick including a rotary shaft, a drum loose on the rotary shaft, cable means windable in opposite directions on the drum and connected with the stick, a gear fast on the rotary shaft adjacent one end of the drum, a second gear loose on the shaft adjacent the other end of the drum, a planetary gearing connection between the second gear and the drum, a counter shaft, driven gears loosely mounted on the counter shaft, a pinion connected with one of said driven gears and meshing with the gear fast on the rotary shaft, a second pinion fast on the counter shaft and meshing with the second gear on the rotary shaft, a brake connected with said second pinion, and means for selectively connecting the driven counter shaft gears in driving relation with the counter shaft.

4. In a device of the character described, a driven member, a driven shaft, a planetary gearing connection between the driven member and the driven shaft including a gear upon the driven shaft, a second gear fast on the driven shaft, a counter shaft, driven gears loosely mounted upon the counter shaft, a pinion connected with one of the counter shaft gears and meshing with the second driven shaft gear, a second pinion fast on the counter shaft and meshing with the first named driven shaft gear, brake means connected with the second pinion for retarding rotation of the counter shaft and causing reduced rotation of said driven member by said planetary gearing, and clutch means for selectively connecting the driven counter shaft gears in driving relation with the counter shaft.

5. In a crane of the class described, a platform, a boom pivotally mounted thereon, a dipper stick mounted upon the boom, shipper mechanism mounted on the boom for crowding out and racking in the dipper stick, a driven shaft mounted on the platform, a reversible drum loosely mounted on the shaft for actuating the shipper mechanism, cable

means winding in opposite directions about the reversible drums and connected with the shipper mechanism to operate the dipper stick, a gear loose on the driven shaft, a second gear fast to the driven shaft, a counter shaft, driven gears loosely mounted upon the counter shaft, pinions on the counter shaft meshing with the driven shaft gears, one of said pinions being fast to the counter shaft and another of said pinions being loose on the counter shaft and connected with one of the driven gears of the counter shaft, brake means for retarding rotation of the counter shaft, a planetary gearing connection between the second gear loose on the driven shaft and said drum for rotating the latter at a speed reduced from the speed of the driven shaft when the rotation of the counter shaft is retarded, and for rotating the drum at a high speed in a reverse direction, and means for selectively connecting the driven gears on the counter shaft in driving relation with the counter shaft for controlling the direction of rotation of the drum.

6. In an apparatus of the class described, a driven shaft, a reversible driven member, a counter shaft, gearing connecting said driven shaft, driven member, and said counter shaft including fast and loose gears respectively on the driven shaft, loose and fast pinions respectively on the counter shaft meshing with the driven shaft gears, a planetary gearing connection between the gear loose on the driven shaft and said driven member, brake means for retarding rotation of the counter shaft to cause reduced rotation of the driven member by said planetary gearing, a driven gear loosely mounted on said counter shaft and connected with the loose pinion, a second driven gear loosely mounted on said counter shaft, a clutch for each driven gear for connecting it in driving relation with the counter shaft, and means for simultaneously operating the clutches to change the direction of rotation of the driven member.

In testimony whereof I affix my signature.

STEPHEN N. NICKLISS.