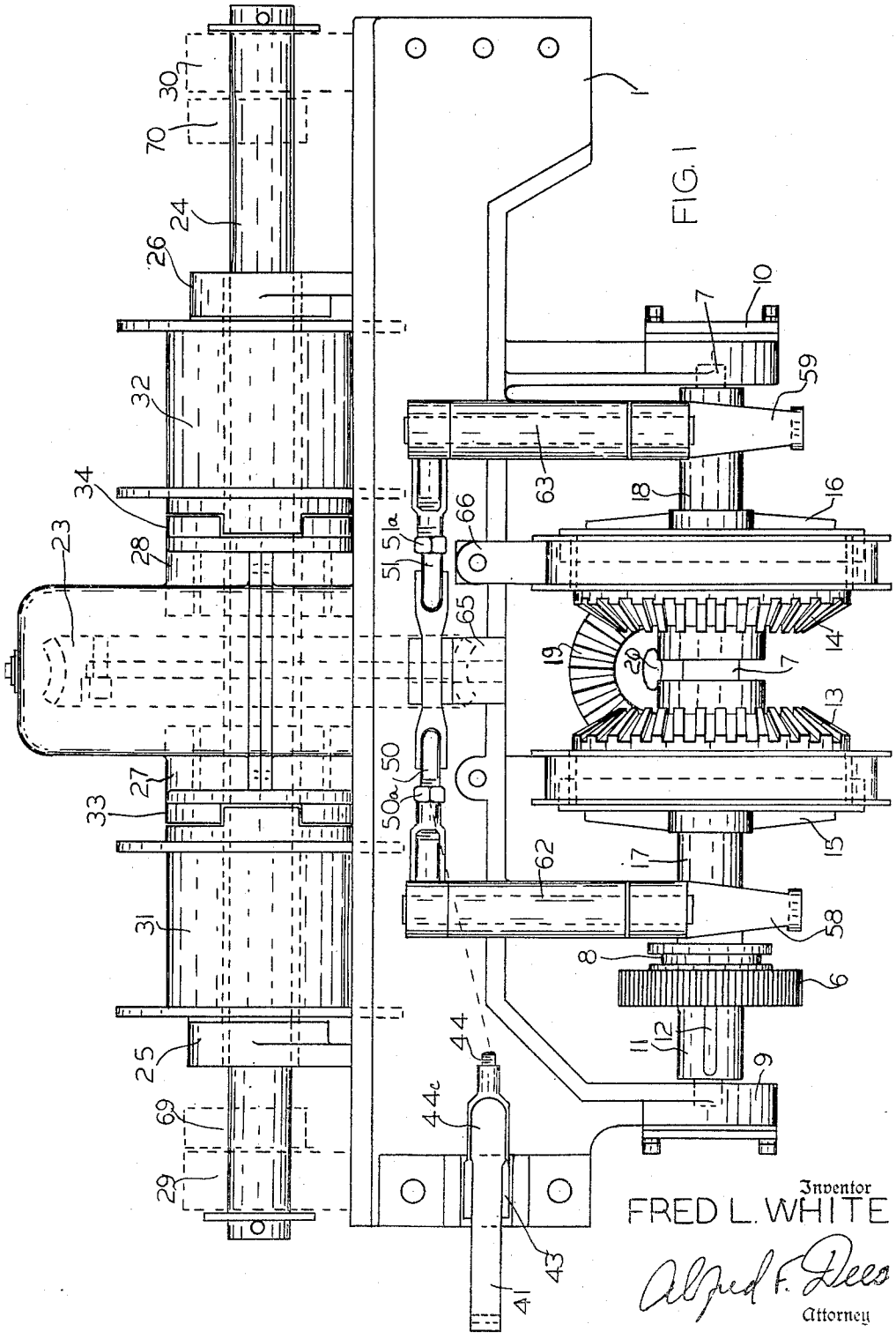
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BOOM HOIST

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BOOM HOIST

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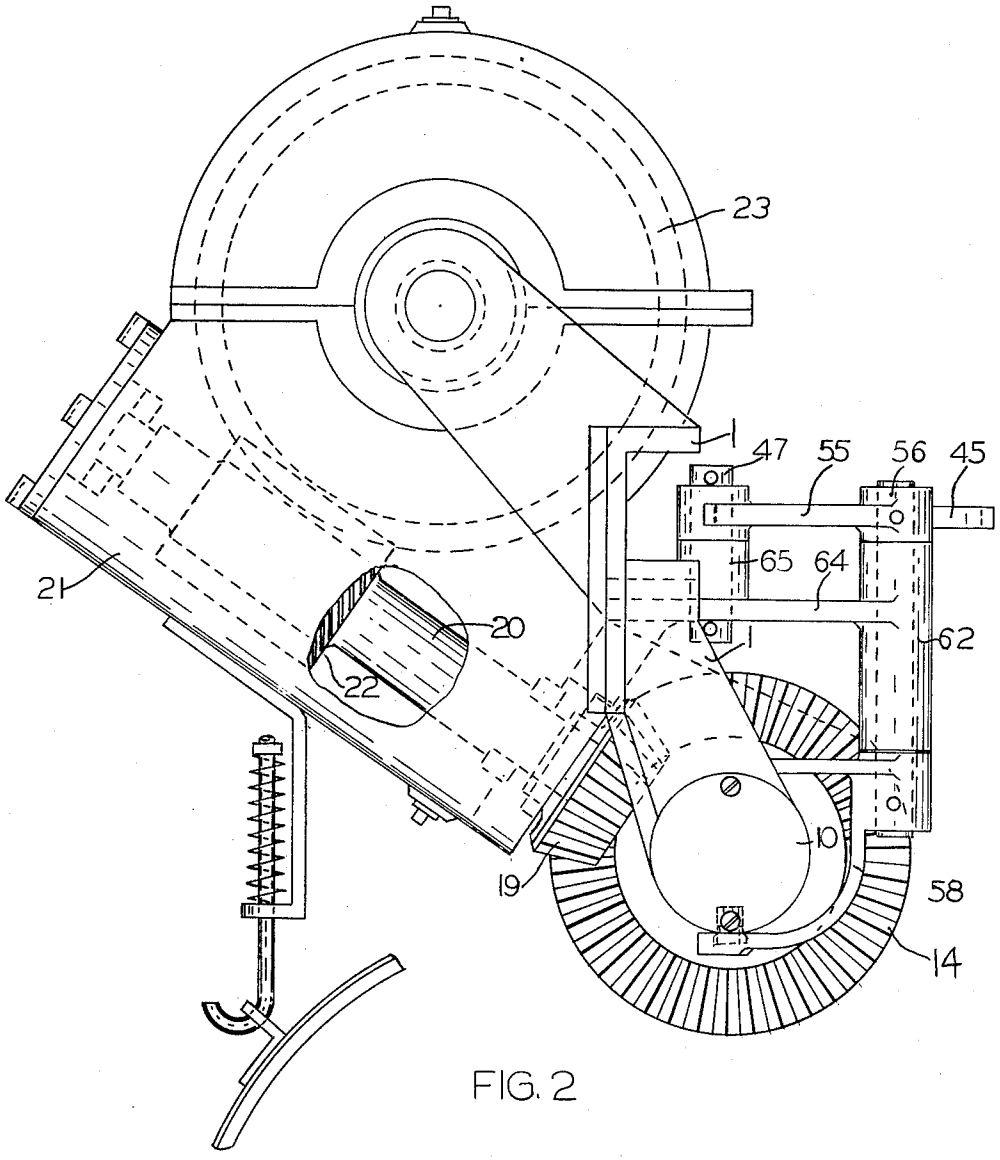


FIG. 2

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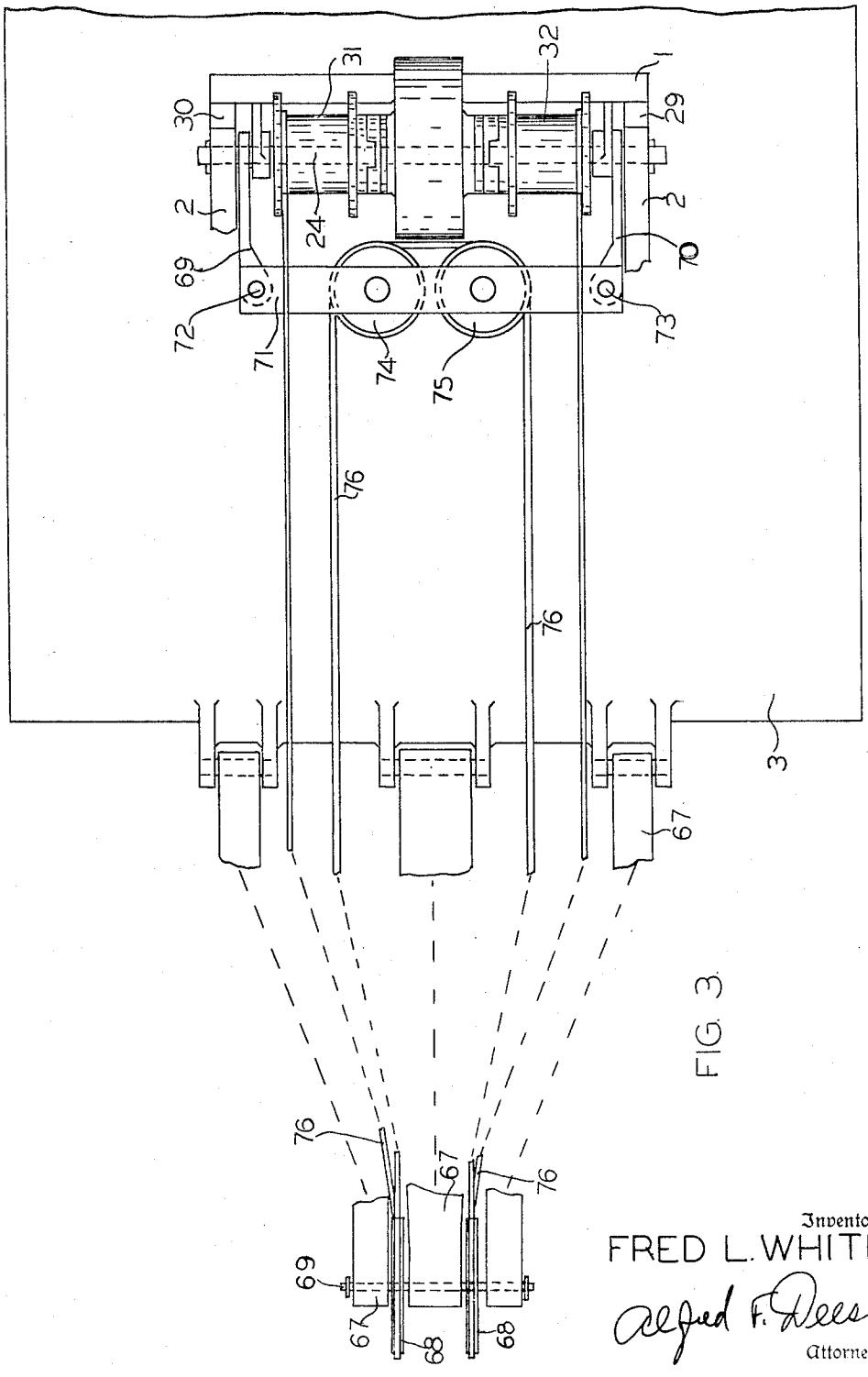


FIG. 3

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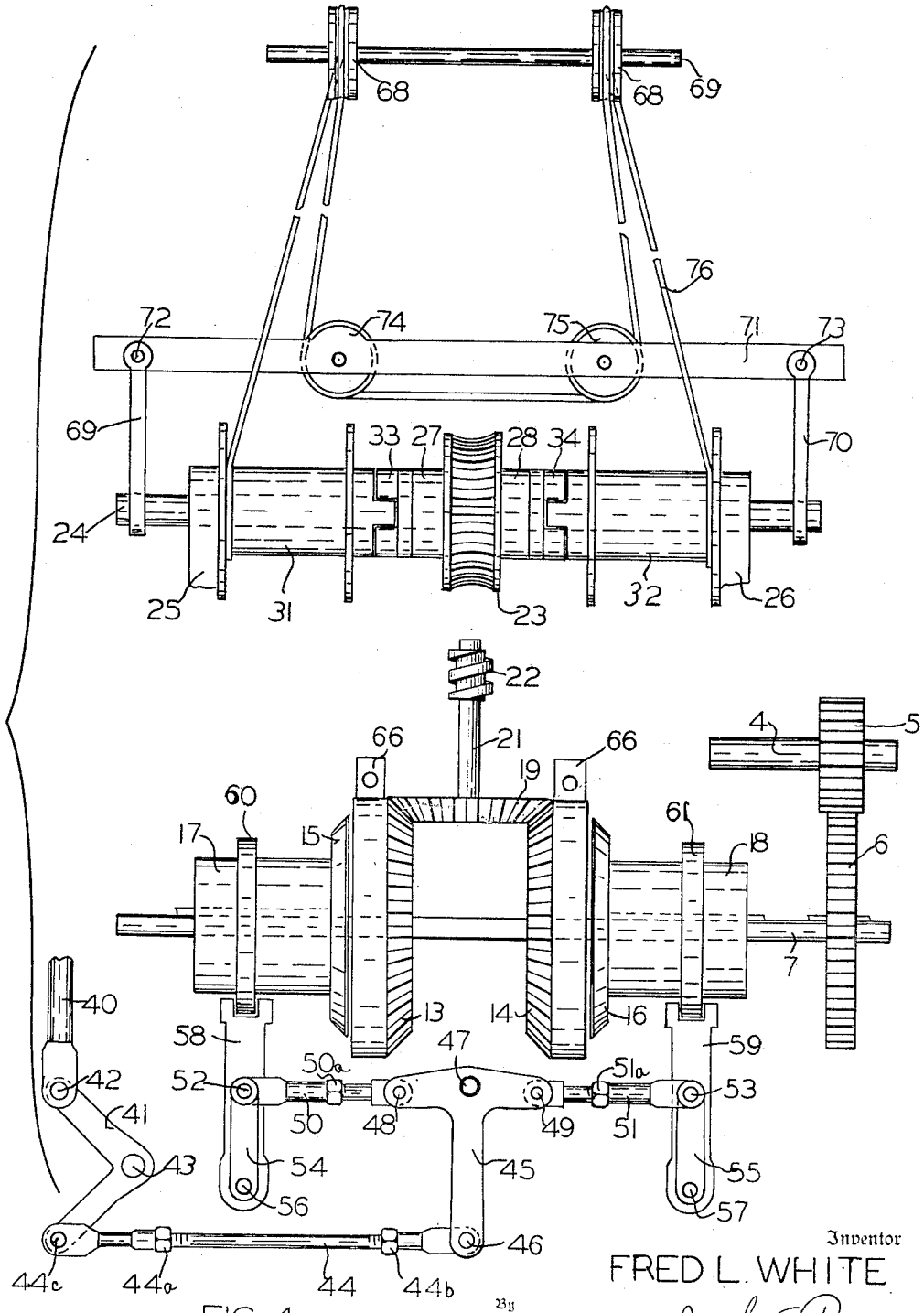


FIG. 4

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UNITED STATES PATENT OFFICE

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BOOM HOIST

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Application January 9, 1943, Serial No. 471,896

8 Claims. (Cl. 214—135)

This invention relates to hoisting mechanism generally and in its more specific aspects relates to a hoisting mechanism for the boom on a power shovel, excavator, dragline, hoist or similar apparatus.

The object of this invention is to provide a boom hoist transmission mechanism that is capable of increasing the speed of boom elevation by at least two times or more.

Another object of the invention is to reduce the time of boom elevation by at least one-half.

A further object of the invention is to provide in a boom hoist a windlass that will increase the speed of hoist elevation and thereby shorten the time for adjustments.

A still further object of the invention is to simplify the operation of the hoisting drums and to increase the operating efficiency of the device.

Another and still further object of the invention is to make possible an increase in hoisting speed by making possible an interchange in winch drums to further alter the speed or rate of boom elevation.

Other and further objects of the invention will occur to those skilled in the arts to which this invention relates as the description proceeds which taken in connection with the accompanying drawings sets forth a preferred embodiment of the invention but such disclosure is not to be construed as a limitation of the invention which is limited only by the appended claims and any and all modifications, alterations and variations of structure coming within the spirit and scope thereof are deemed to be included herein.

In the drawings:

Fig. 1 shows a forward view of the cable winding mechanism.

Fig. 2 is a side view of the essential operating mechanism with parts omitted for clarity.

Fig. 3 is a plan view showing the cable connection between the windlass or winch and the boom sheaves.

Fig. 4 shows a schematic outline of the essential operating mechanism.

The efficient operation of an excavator, hoist, dragline or similar apparatus requires among other things a quick, positive and flexible operation of the boom in order that the shovel or hook as the case may be shall be properly positioned relative to the prime mover and the load in not only a vertical direction but lateral as well, and in other words that the vertical position or point of application of the boom relative to the operating position of the shovel, bucket, or hook shall be most advantageous. In view of the fact that terrain and devices operated upon vary considerably it is necessary that the angular position of the boom relative to the operators plane or cab floor which usually is parallel to the ground must be changed rapidly in order to reduce idle time. With the ordinary type of boom hoist considerable time is lost in bringing the boom to the proper elevation but with the improved device the applicant has invented this time is reduced by one-half and even less by the choice of varying drum or windless ratios of diameters. This improvement greatly increases the efficiency of the hoist or excavator by cutting down idle time waiting for the boom to be elevated to proper position and enables the device to handle a greater amount of material in a given period of time.

The above objects and advantages are embodied in a structure initially set forth in Fig. 1 in which 1 is the principal horizontal support fixed to upright frame elements 2, 2 supported on a rotatable deck or platform 3 (Fig. 3). This supporting structure is more or less conventional in character and is present in one or more forms on all similar devices.

Power from an appropriate source is supplied to shaft 4 (Fig. 4) from a motor or internal combustion engine (not shown) mounted on platform or deck 3 and drives a gear 5 that meshes with gear 6. Shaft 7 is rotatably supported in bearings 9 and 10 which are preferably of the anti-friction variety. Gear 6 is received on a sleeve element 11 that is disposed on shaft 7 and has a key or spline 12 thereon that enables gear 6 to slide relatively axially of the shaft 7. Gear 6 is provided with a shifting collar 8 adapted to receive and operable by a shifting mechanism (not shown) well known to the art whereby gear 6 may be disengaged from gear 5 at the election of the operator.

Mounted for rotation on the shaft 7 is a pair of bevel gears 13 and 14 which form part of a reversing mechanism and each bevel has clutch elements 15 and 16 associated respectively with the gears 13 and 14. The mechanism for selectively engaging gears 13 and 14 with the shaft 7 through one of the clutches will be subsequently described. Each of the clutch elements 15 and 16 has sleeve elements 17 and 18 splined or keyed in any conventional manner to shaft 7 for reciprocation relative to the shaft 7 such that each of the clutches 15 and 16 may selectively engage their respective gears 13 or 14.

A bevel gear 19 is adapted to engage both of the gears 13 and 14 and is reversely rotated de-

pending upon which of the gears 13 and 14 is being rotated by the shaft 7. Gear 19 (Fig. 2) is shown fixed to a shaft 20 rotatably supported in a housing 21 in appropriate bearings and has a worm gear 22 fixed thereon that is adapted to mesh with a worm gear or wheel 23 fixed to a shaft 24 rotatably supported in appropriate bearings 25, 26, 27 and 28 and is additionally supported in bearings 29 and 30 indicated generally by the dotted lines of Fig. 1 forming part of the elements 2, 2 of Fig. 3. Shaft 24 has winding drums 31, 32 arranged thereon each of which is disposed respectively between bearing elements 25, 27 and 26, 28. Each of the drums has a fixed clutching arrangement adapted to engage cooperating elements 33, 34 secured to shaft 24 for the purpose of rotating drums 31 and 32 in unison with shaft 24. From the foregoing it will be apparent that drums 31 and 32 will be reversely rotated along with shaft 24 depending upon which of the gears 13 and 14 is being rotated by the shaft 7.

The means for selectively shifting clutches 15 and 16 such that they will selectively rotate or drive gears 13 or 14 to thereby reversely rotate shaft 24 and drums 31, 32 originates in a lever 40 that is moved axially of itself and terminates adjacent the operator's station in the cab or on the platform. The lever 40 is pivotally secured to one of the arms of a bell crank 41 by pivot 42 and bell crank 41 is in turn rotatably or swingably supported on pivot 43. Lever or linkage 44, extensible in character, is pivoted to the other arm of bell crank 41 by means of pivot 44c. Nuts 44a and 44b are threaded to linkage 44 and constitutes the extensible elements of the linkage briefly referred to above.

Linkage 44 is pivoted to the right angled arm of a unitary double bell crank 45 by means of pivot 46. The double bell crank 45 is pivoted at 47 and the two arms extend as shown in Fig. 4. Connected to each of the two arms of the double bell crank 45 by means of pivots 48 and 49 are extensible linkages 50 and 51 having nuts 50a and 51a respectively thereon for varying the effective length of the respective linkages.

The linkages 50 and 51 are connected by pivots 52 and 53 to crank elements 54 and 55 that are rigidly secured to the pins 56 and 57 and at the lower end of each of said pins clutch shifting elements 58 and 59 are arranged and rigidly secured thereto. These shifting levers are notched as shown in Fig. 4 to engage with collar elements 60 and 61 shown associated respectively with clutch face elements 15 and 16. The view shown in Fig. 2 sets forth a more preferable construction which employs a grooved collar or ring and in which a roller on arm 59 engages as shown by the dotted line construction in Fig. 2. Both of these constructions are old and well known in arts and the one form may be used in place of the other and producing equally satisfactory results.

Pins 55 and 56 are rotatably mounted in bearing elements 62, 63 and each bearing element is fixed to a bracket element 64 (only one of which is shown) that is secured to support 1. The pivot 47 supporting double bell crank 45 is fixed in a boss secured to or integral with support 1. Some of the parts have been omitted in Fig. 2 to more clearly show the organization but the general plan of the linkage is shown complete in Fig. 4.

The linkage for selectively engaging the clutches with the gear elements 13 and 14 is so organized and adjusted that when the double bell crank 45 is in its neutral position both clutches will be disengaged. When lever 40 is moved axially to one or the other of its extreme positions it will cause either one of the clutches to engage with its respective gear element and thereby rotate shaft 24 and its windlass winding drums 31, 32. A brake means 66, automatically actuated, is associated with one of the gears to hold the gear in any adjusted position and the boom lifted thereby in its adjusted position also when the clutches are disengaged. The brake operates automatically by a spring means (not shown) and does not require the attention of an operator.

Referring now to Fig. 3 it will be observed that the platform or deck 3 has pivotally mounted thereon a boom 67 on the free end of which a pair of sheaves 68, 68 are rotatably mounted on a shaft 69 that extends through the individual elements of the boom 67. Pivotally mounted on shaft 24 are lever or bar elements 69, 70 and shown in dotted lines in Fig. 1. Pivotally secured to these elements at 72, 73 is an equalizer bar element 71 having rotatably mounted thereon a pair of sheaves 74, 75 although one sheave could serve the purpose equally well providing the boom is of considerable length. In the case of a short boom two sheaves are preferable because they can be more perfectly aligned thereby bringing the cable grooves of each sheave into more perfect alignment. When two sheaves are used on the equalizer bar the cables will more readily clear any operating elements supported on the boom.

The free end of the boom 67 is elevated by winding a cable 76 onto each of the drums 31 and 32. This cable leads from drum 31 to which one end of the cable is secured and is then led to one of the sheaves 68, thence to sheaves 74 and 75 on equalizer bar 71, then back to the second sheave 68 on the free end of boom 67 and thence back to the sheave or drum 32 to which it is secured. By changing the diameter of the drums or increasing the diameter of one of the drums the winding speed or rate of winding may be varied. Since the winding of the cable 76 on the drums 31 and 32 will elevate the boom 67 and unwinding will lower the same it is clear that since two drums are used the rate of elevation will be doubled thereby reducing idle time consumed in waiting for the boom to be raised as contrasted with the condition when only one drum is employed as is conventional in the art. Brake 66 will hold the boom 67 when power is disengaged from gears 13 or 14 by means of the clutches 15 or 16 or by shifting gear 6 out of engagement with gear 5. Since the speed of vertical adjustment is materially increased by at least two and since it may be further varied by altering the diameter ratios of the drums 31 and 32 it is clear that the device will substantially increase the material handling ability of the device on which it is employed.

That which is regarded new, novel and useful and which is sought to be protected by Letters Patent of the United States is as follows:

1. In a boom elevational control mechanism for a power excavator or hoist; a platform; a boom pivotally mounted thereon; sheaves on the free end of said boom; a driven shaft rotatably mounted on said platform; a reversing mechanism on said shaft; a windlass and its shaft mounted on said platform; means to drive said windlass from said reversing mechanism; said windlass comprising a pair of drums; an equalizer

pivotally associated with and disposed adjacent said windlass and its shaft and having a pair of idler sheaves thereon; and a cable, the ends of which are secured to each drum and which is trained about said boom sheaves and said equalizer sheaves, adapted to be wound and unwound from both said drums as said windlass is rotated.

2. In a power device; a platform; a boom pivotally supported on said platform and having sheaves on the free end thereof; a frame element supported on said platform; a driven shaft rotatably mounted in said frame; a reversing element associated with said shaft; a windlass shaft rotatably mounted on said frame and having a pair of drums thereon; an equalizer supported on said frame and pivotally disposed on said shaft and having idler sheave means thereon; and a cable whose ends are secured to said drums and threaded about said boom sheaves and said idler sheave means, said cable winding on both said drums when said windlass is rotated by said driven shaft.

3. In a power device; a driven shaft; a windlass and its shaft driven from said shaft; means to connect said windlass and driven shaft; an equalizer pivotally associated with said windlass and its shaft; cable supporting means on said equalizer; a pair of cable winding drums on said windlass; a boom having cable receiving means on the end thereof; and a cable the ends of which are fastened to each of said drums and which is threaded about each of said cable receiving means; said windlass winding and unwinding said cable on both said drums as it is driven by said driven shaft.

4. In a power device; a platform; means on said platform to support a driven shaft and a windlass driven thereby provided with two winding drums; means operatively connecting said windlass and driven shaft; a boom pivotally mounted on said platform and having a pair of sheaves on the free end thereof; an equalizer pivotally associated with said windlass and having sheave means thereon; a cable threaded about said boom sheaves and said equalizer sheave means and having the ends thereof secured to each of said drums; said boom changing elevation as said cable is wound and unwound on both said drums.

5. In a power device; a platform device; means thereon to rotatably support a driven shaft and a double drummed windlass and its shaft; means connecting said driven shaft and said windlass and its shaft including a reversing mechanism; an equalizer mechanism pivoted to said windlass shaft means and including a sheave means thereon; a boom pivoted with respect to said platform and said means having sheave means mounted on the end thereof; and a cable threaded about said sheave means and whose ends are secured to each of said drums.

6. In a power operated boom control; a frame and platform element; a driving shaft in said frame element; a reversing element associated with said driving shaft; a windlass shaft mounting two winding drums driven from said driving shaft through said reversing element; a boom operatively associated with said platform and having a pair of sheaves on the free end thereof; an equalizer pivotally associated with said windlass and having sheave means thereon; and a cable threaded about said sheaves and sheave means and whose ends are secured respectively to each of said winding drums.

7. In a boom hoist mechanism; a platform element; a boom pivoted to said platform; frame elements on said platform; a windlass shaft having winding drums thereon rotatably mounted in said frame elements; sheave elements mounted on the free end of said boom; an equalizer element having sheave elements mounted thereon pivotally secured with respect to said windlass shaft; and a cable one end of which is fixed to one of said windlass drums and passes about said sheave means on said equalizer and on said boom, the other end of said cable fixed with respect to the other of said windlass drums.

8. In a boom hoist mechanism; a platform element: a boom element pivoted to said platform; frame elements fixed to said platform; a windlass device rotatably associated with said frame elements; an equalizer pivotally fixed to said windlass device; sheave means mounted on said equalizer; sheave means rotatably mounted on the free end of said boom; a cable one end of which is fixed to said windlass device and which passes over each of said sheave means and the other end of which is fixed with respect to said equalizer; and means to reversibly rotate said windlass device.

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