Dec. 7, 1943. E. S. FOX ET AL 2,335,851

BULLDOZER

Filed March 5, 1942 3 Sheets-Sheet 1

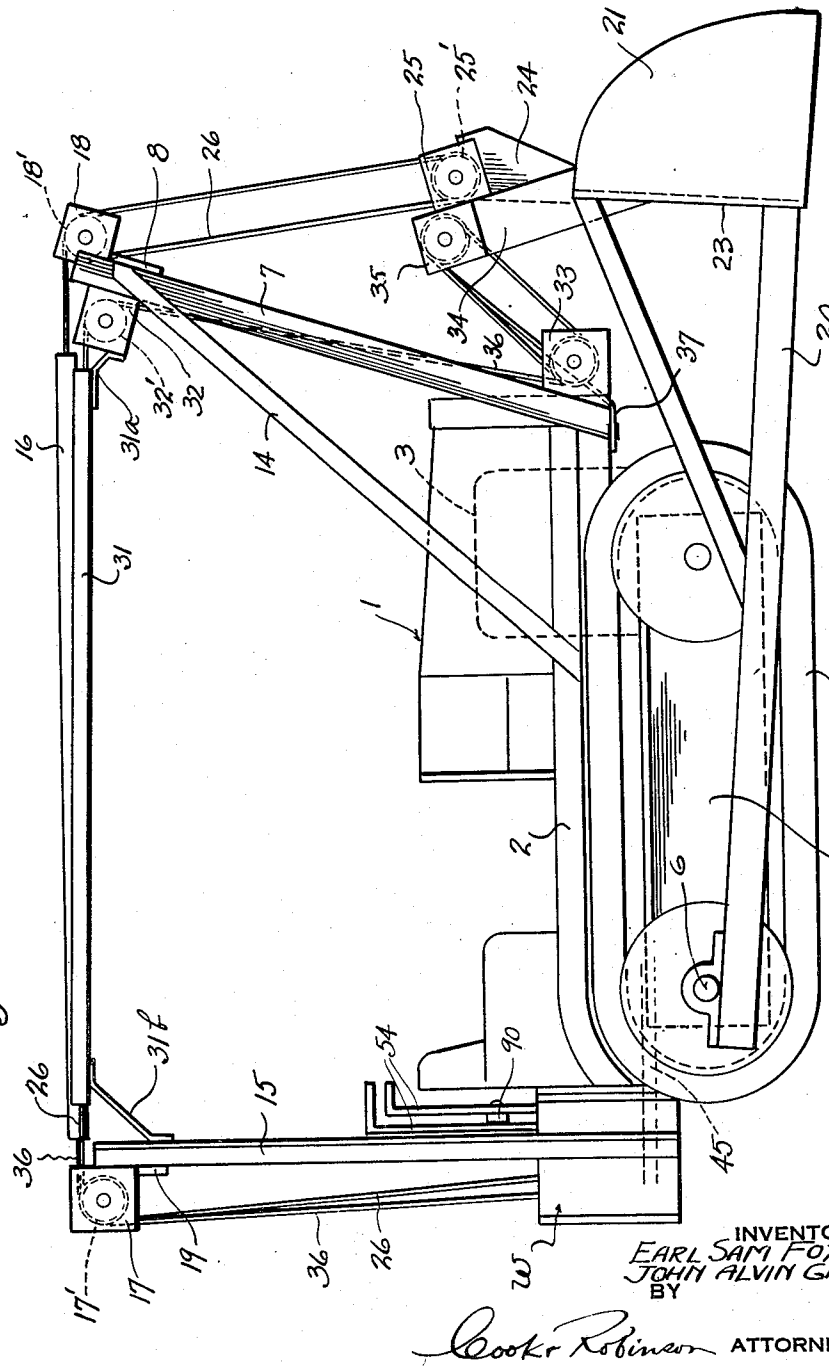


Fig. 1

INVENTOR
EARL SAM FOX
JOHN ALVIN GREENWOOD
BY
Cook & Robinson ATTORNEYS

Dec. 7, 1943. E. S. FOX ET AL 2,335,851

BULLDOZER

Filed March 5, 1942 3 Sheets-Sheet 2

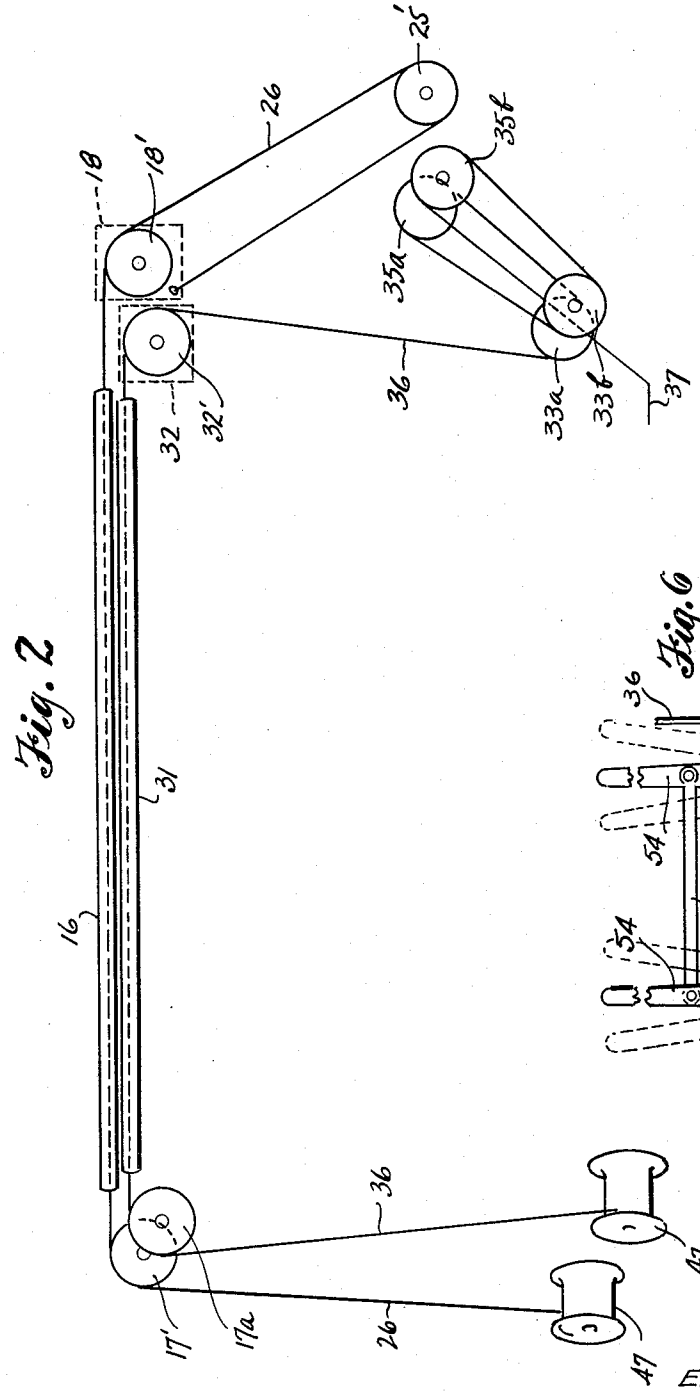


Fig. 2

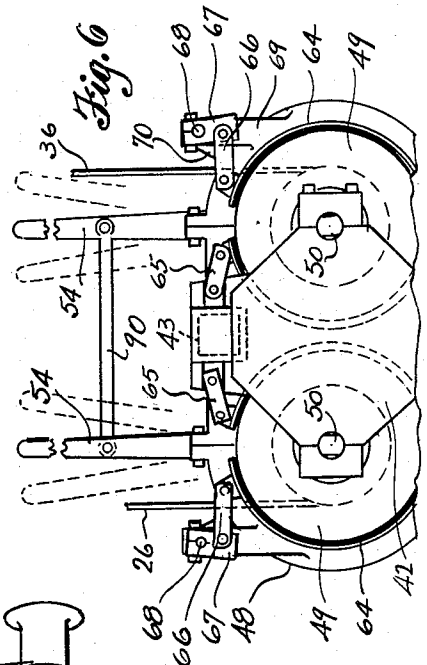


Fig. 6

INVENTOR
EARL SAM FOX
JOHN ALVIN GREENWOOD
BY
Cooke & Robinson ATTORNEYS

Dec. 7, 1943. E. S. FOX ET AL 2,335,851

BULLDOZER

Filed March 5, 1942 3 Sheets-Sheet 3

Fig. 4

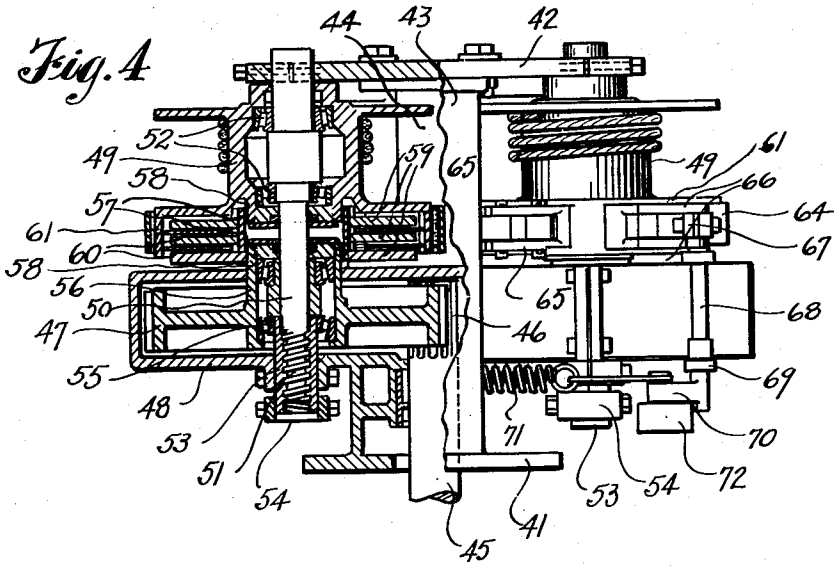


Fig. 3

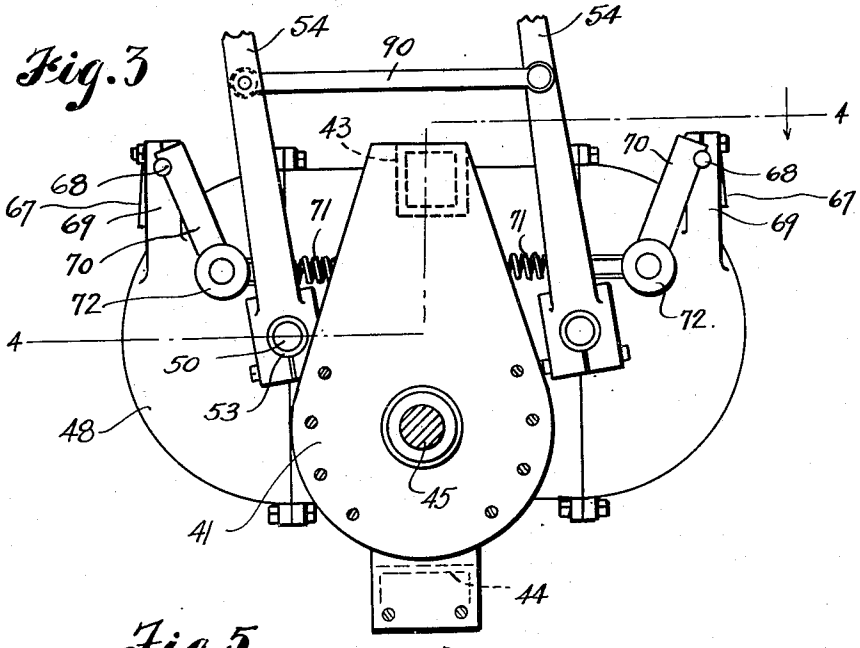
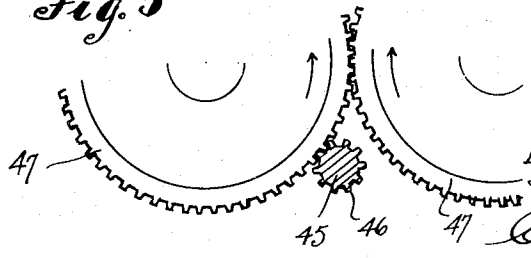


Fig. 5



INVENTOR
EARL SAM FOX
JOHN ALVIN GREENWOOD
BY
Cook & Robinson
ATTORNEYS

Patented Dec. 7, 1943 2,335,851

UNITED STATES PATENT OFFICE

2,335,851

BULLDOZER

Earl Sam Fox, Vale, and John Alvin Greenwood, Portland, Oreg.

Application March 5, 1942, Serial No. 433,486

4 Claims. (Cl. 37—144)

This invention relates to implements of the bulldozer type, and it has reference more particularly to improvements in machines commonly referred to as cable controlled bulldozers; this application being a continuation in part of our pending application filed under Serial No. 284,-612 on July 15, 1939 and since abandoned.

Explanatory to the present invention, it will here be stated that today there are many tractors of various makes, equipped with bulldozer blades. Also, an appreciable percentage of these machines are of that class known as cable controlled bulldozers; that is, the bulldozer blade is adapted to be lifted from the ground or held suspended at certain selected working depths by a cable that is paid out or wound onto a drum mounted on the tractor and powered by connection with the tractor engine.

While it has been quite common heretofore to lift and suspend the bulldozer blade by a cable and winding drum, there has not heretofore, to our knowledge, been any means for effecting positive down pressure on the blade to force it into the ground or to hold it at a definite working depth against tendency to lift, except through the weight of the blade and its supports. The absence of any positive, controllable down pressure means has been detrimental and the reasons for this will be quite well understood by those familiar with the art or with the working of a bulldozer.

It will also be here stated that practically all present-day tractors are equipped with double drum winding mechanisms to adapt them, through the use of cables, for the control and manipulation of road working or dirt handling equipment of various kinds which might be drawn by the tractor when it is not being used exclusively for bulldozing purposes.

Therefore, it is quite obvious that while one of these drums and its cable could be used for the usual lifting and suspension of the bulldozer blade, the other could quite conveniently be employed as a means for obtaining the positive and controllable down pressure that is desirable.

In view of the foregoing, it has been the principal object of this invention to supplement the usual cable equipment of bulldozers with a practical, effective and relatively inexpensive cable controlled down pressure means. Furthermore, to provide a practical and complete cable controlled bulldozer through the utilization of dual cable winding drums as may be applied and/or as are now ordinarily provided on tractors for use in the operation or control of drawn road working and dirt handling machines.

A further object of this invention is to utilize the cable from one drum of the dual cable winding system for lifting or suspending the bulldozer blade, and to use the other for effecting a desired down pressure. Furthermore, it is an object of the invention to simplify the control and operation of such a cable equipped bulldozer by a novel interconnection of the controls for the cable winding drums whereby an application of down pressure through one cable can only be effected coincident with release for the paying out of the other cable, and likewise, the shifting of controls to effect the winding in of the lifting cable will result in the coincident release of the drum carrying the down pull cable for unwinding of the cable therefrom.

Still further objects of the invention reside in the details of construction of parts used in the cable control and winding devices, and in the cable guiding equipment as applied both to the tractor and bulldozer.

In accomplishing these and other objects of the invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Fig. 1 is a side view of a tractor, equipped with a cable controlled bulldozer mechanism in accordance with the objects of this invention; parts of the tractor being only diagrammatically indicated.

Fig. 2 is a view diagrammatically showing the arrangement of the down pressure cable and its mounting sheaves at the forward end of the tractor, also indicating the cable winding drums.

Fig. 3 is a rear end view of the tractor and cable winding devices.

Fig. 4 is a horizontal section taken on line 4—4 in Fig. 3.

Fig. 5 is a fragmentary end view of the driving gear arrangement.

Fig. 6 is a partial rear view of the cable winding mechanism indicating the control lever movements.

Referring more in detail to the drawings—

In Fig. 1, I have shown, somewhat diagrammatically, a common make of tractor, indicated in its entirety by reference numeral 1. This tractor is of the crawler or track laying type, and comprises a main frame structure, designated generally by reference numeral 2, and an engine 3 mounted thereby. Each track 4 is mounted by a track frame 5, and the track frames are mount-

ed to oscillate on the opposite ends of a transverse pivot axle 6 whereby the rear end of the main frame is supported; the forward end of the main frame being resiliently mounted by an equalizer spring, not here shown, the opposite ends of which rest upon the oscillating ends of the track frames.

Suitably fixed to the forward end portion of the main frame of the tractor, at opposite sides thereof, are paired, upwardly directed and somewhat forwardly inclined standards or beam supports 7, connected across their upper ends by a cross bar 8. Brace beams 14 are fixed to the standards near their upper ends, and extend downwardly and rearwardly and have fixed connection with the main frame at their lower ends.

At the rear end of the main frame of the tractor, and fixed thereto at opposite sides, are paired standards or uprights 15, joined across their upper ends by a cross beam 19, and extending longitudinally of the tractor, and bridging the two sets of supports 7 and 15, is a tubular member or beam 16, the opposite ends of which are rigidly connected by a suitable means, not shown, with the supports.

Supported by the paired standards 15, at their upper ends, is a sheave block 17. Likewise, mounted by the paired standards 7, at their upper ends, is a sheave block 18.

Extended laterally from the track frames at opposite sides of the tractor are transversely alined trunnions on which the rearward ends of the side beams 20 of the bulldozer are pivotally mounted. These trunnions, in this instance, are the extended ends of the pivot axle 6; however, they might be independent thereof, and fixed to the track frames. At their forward ends, the side beams 20 mount a bulldozer designated generally by reference numeral 21.

Fixedly mounted on the rear wall 23 of the bulldozer is an upwardly directed bracket 24, which, at its upper end, mounts a sheave block 25. The bulldozer lifting cable, designated by reference numeral 26, is dead-ended in the sheave block 18, and is then extended downwardly therefrom, about a sheave 25' in the block 25, then extends upwardly, over a sheave 18' in block 18, then rearwardly, passing lengthwise of and through the tubular beam 16, then over a sheave 17' in block 17 and downwardly for winding on a drum of the cable winding mechanism presently to be described in detail, and which is designated in its entirety in Fig. 1, by reference character W.

When this cable 26 is wound in on its drum, the bulldozer will be lifted, moving arcuately about the trunnions 6, as will be quite apparent.

Now, in order that the bulldozer blade, in use, may be positively held against lifting from the ground, or may be actuated downwardly and held at a desired working depth, I have provided the down pressure cable mechanism which will now be described.

Bridging the supports 7 and 15, and extending along and adjacent the tubular beam 16, is a second tubular beam 31, connected at its forward end by suitable means, as at 31a, to the upper ends of the supports 7 and at its rearward end may be supportingly attached by suitable means, such as the bracket 31b, to the upper ends of the rear supports 15.

Attached to the upper ends of the forward standards 7, facing the open forward end of the tubular beam 31, is a sheave block 32. Also, suitably mounted, centrally on the forward end of the tractor main frame, is a double sheave block 33, and suitably attached to the bulldozer 21 in the plane of the bracket 24, is a rearwardly inclined bracket 34 carrying at its upper end, a double sheave block 35.

The sheave block 17 includes two separate sheaves, one being a sheave 17' which carries the cable 26 thereover, and the other being a sheave 17a over which a down pressure cable 36, leading from a drum of the cable winding mechanism W, extends. The cable 36 extends forwardly through the tubular beam 31, over the sheave 32' in block 32, thence down and about the under side of a sheave 33a in block 33, thence upwardly and over the top side of a sheave 35a in block 35, thence downwardly and about a sheave 33b in blocks 33, thence again upward about a sheave 35b in block 35 and downwardly, to be dead-ended as at 37 in the tractor frame 11.

The cable winding means which is indicated in Fig. 1 by character W, will now be described, reference being directed particularly to Figs. 3, 4, 5 and 6.

The cable winding mechanism comprises front and rear plates 41 and 42, respectively, which are vertically disposed and are rigidly connected to and extend between the top and bottom beams 43 and 44 respectively. The plate 41 is adapted to abut against and be rigidly secured to the rear end of the transmission housing or to the frame structure of the tractor, from which housing or frame, a longitudinally extending shaft 45, driven from the engine of the tractor projects rearwardly. This shaft 45 is disposed above the lower beam 44, and on its rear end, is formed with a pinion 46. This pinion continually meshes with one only of a pair of spur gears 47 which mesh with each other, as shown in Fig. 5. These gears, of course, rotate in opposite directions, and turn away from each other at the top. The gears and pinion are in a housing unit 48 secured to the frame beams. Each gear is associated with a cable winding drum 49 disposed axially therewith but separate therefrom; there being a clutch and brake structure between the drum and its corresponding gear.

Since the mechanism associated with one gear is a duplicate of that associated with the other, only one will herein be described, with the understanding that the description relates equally to both.

The axial shaft 50 of each gear, drum and clutch unit, which is parallel to the shaft 45, is clamped at one end in connection with the plate 42, and at its other end projects beyond the front end of the housing 48, and is provided with a multiple lead thread 51. The drum, which is just forwardly of the rear plate 42, turns on the shaft 50 with anti-friction bearings 52 disposed between the drum and shaft, and arranged so that the drum can have no movement lengthwise of the shaft.

A sleeve 53 is mounted on the shaft 50, ahead of the drum which, at its forward end, has threaded engagement with the threaded portion of the shaft. An upstanding lever 54 is clamped on the outer end of the sleeve, so as to turn the sleeve, which will cause a longitudinal movement in one direction or the other, to be imparted to the sleeve in accordance with the direction of movement of the lever.

The gear 47 rotates about the sleeve upon anti-friction bearings 55, arranged so that, with the longitudinal movement of the sleeve, the gear will be correspondingly moved back and forth.

The hub 56 of the gear projects beyond the rear end of the housing 48, and is there provided with an extension 57 which overlaps the adjacent end of the hub 58 of the drum 49. Clutch plates 59 are splined on the extension 57, while similar cooperating plates 60 are slidably splined in the brake drum 61 which is mounted on the adjacent end of the drum 49 in overhanging relation to the extension 57.

With the movement of the gear 47 along the shaft, the various clutch plates will be either engaged or disengaged, and the drum will be driven or will be freely turnable relative to the gear, as the case may be.

An automatic functioning brake structure is associated with the brake drum 61 which acts to release the brake drum when the latter is driven, and to grab the same when the driving connection is discontinued. This brake structure is arranged as follows:

A brake band 64 is disposed about the brake drum, having its separate ends on the upper side of the drum. The band, at its end nearest the beam 43, is connected thereto by substantially tangentially disposed, upwardly sloping links 65. Similar links 66 are connected at one end to the other end of the band; said links, at their opposite ends, being connected to the lower end of an arm 67. The upper end of this arm is fixed on a shaft 68 which extends parallel to the axis of the drum, and is journaled in standard 69, fixed on the housing 48. Another arm 70 depends from this shaft ahead of the housing, and is engaged by a tension spring 71. Although a separate spring may be used for the arm of each brake unit, we preferably employ a single spring extending between the two arms, as shown.

A roller 72 on the lower end of the arm 70 is positioned in the transverse plane of the adjacent lever 54 to be engaged thereby only after said lever has been turned to fully disengage the corresponding clutch. Since the periphery of the brake drum, when driven, turns outwardly relative to the central beam 43, it will be seen that such movement, acting through the band, tends to exert a pull on the links 65 to straighten the same, and exerts a push on the links 66, tending to move them away from the brake drum. The band is thus held clear of the drum, or at least sufficiently so that it will not frictionally engage the drum with sufficient force to retard the driving of the same.

When the driving of the drum is discontinued, and the drum tends to rotate in the opposite direction, the spring 71 acts to push on the links 66, causing the adjacent end of the band to grab the drum. The band tends to turn on the drum, thereby tending to deflect or clamp the links 65 toward the drum, and causing the adjacent end of the band to also grab the drum. The drum and its connected parts are thus locked against rotation.

When it is desired to allow the cable to be freely paid out from the drum, the corresponding lever 54 is shifted so that it will engage with the roller 72 and push the arms 70 and 67 outwardly. This pulls the links 66 away from the drum, and will cause the brake band to be likewise moved clear of the drum.

It will here be mentioned that the threaded portions 51 of the shafts 50 are respectively right and left-hand threads. Thus, by connecting the upper end portions of the control levers 54 together by the transverse link 90 shown in Figs. 3 and 6, it will be understood that the movement of either lever to engage its clutch will effect the release of the clutch of the opposite drum.

In Fig. 6, we have diagrammatically indicated the various adjustments of the control levers 54 to determine the action of the clutches and brakes. Assuming the levers to be in upright or what may be referred to as a neutral position, then both clutches will be released, and both brakes will be set, holding both cables against movement. Should the levers be moved to the left, the clutch at the right will be engaged to wind in the cable on the corresponding drum while the opposite drum still runs free to pay out the cable therefrom. Should the levers be moved from neutral position to the right, then the left-hand clutch will be set to wind in the cable on the corresponding drum, while the other drum runs free. After any adjustment of the bulldozer, it may be held by bringing the levers back to neutral position.

Therefore, it will be understood that with the bulldozer so equipped with the present cable control, it is possible for the operator, through the manipulation of either control lever, to adjust and maintain the position of the bulldozer blade, and it will be understood that, when down pressure is applied through the winding in of the down pressure cable 36, the lifting cable 26 will be free to unwind, as necessary.

When the bulldozer is not in use, and it is desired to use the cable winding drums for their ordinary purposes, this can be accomplished with the removal of the connecting link 90 which joins the control levers 54.

Having thus described our invention, what we claim as new therein and desire to secure by Letters Patent is:

1. The combination with a tractor having a bulldozer blade operatively mounted thereon and vertically adjustable, of a cable winding mechanism mounted on the tractor for effecting and retaining the working adjustment of the bulldozer blade, and powered by the tractor engine; said mechanism comprising a dual set of cable winding drums, each with a cable wound thereon and said cables having ends operatively connected to the bulldozer, respectively, for lifting and for applying down pressure on the blade; each cable drum having a normally disengaged driving clutch and a normally set brake and a control lever movable from a neutral position in opposite directions for releasing and applying the said clutch and brake, means operatively joining the two control levers of the mechanism to insure their movement in unison from their neutral positions, thereby to selectively engage the driving clutch of either cable drum for the winding of its cable thereon, with a coincident release of the brake of the other drum for the unwinding of the cable therefrom in accordance with the adjustment of the bulldozer blade.

2. The combination with a tractor having a bulldozer operatively mounted forwardly thereof and including a vertically adjustable blade, of a cable-winding mechanism mounted at the rear of the tractor frame and powered by the tractor engine, and comprising a dual set of cable winding drums, cable guiding means on the tractor and bulldozer, and cables wound on said drums and carried therefrom by said guiding means to the bulldozer and operatively connected thereto and whereby the blade may be lifted, and held suspended or down pressure applied thereto by the selective winding in of the

cables; each of said cable winding drums having a normally disengaged driving clutch, a normally set brake, and a control lever movable from a neutral position in opposite directions for the release of the brake and setting of the clutch, means operatively joining the two control levers, to insure their movement in unison from their neutral positions and whereby their movement in one direction effects the setting of the clutch of the lifting cable drum and the release of the brake for free unwinding of the cable from the down pull cable drum, and the shifting of the controls from the normal position in the opposite direction, causes the clutch of the down pull cable drum to be set for winding in the cable and the brake of the lifting cable drum to be released for the unwinding of its cable.

3. In a tractor comprising a frame and an engine, a bulldozer extending forwardly of the tractor and pivotally mounted for vertical adjustment of the bulldozer blade, an elevated beam support structure on the tractor frame, a cable guide sheave fixed thereto at the front of the tractor, a blade lifting cable passing over said sheave and having one connection with the bulldozer for vertical adjustment of the blade, and a down pressure attachment comprising a second cable sheave fixed to the beam support at the forward end of the tractor, an upwardly directed bracket fixed to the bulldozer, a sheave block at the upper end thereof, another sheave block fixed to the front end of the tractor frame below the sheave block first mentioned, a down pressure cable passing over the second mentioned cable guide sheave and extending downwardly to the sheave block on the tractor frame, thence over sheaves in the sheave block fixed on the said bracket to a dead end connection; and a dual drum cable winding means mounted on the tractor and powered by the tractor engine; said cables having ends wound respectively on said drums, and said drums each having a normally disengaged driving clutch and a normally set brake, and said drums having individual control levers, means operatively connecting the levers for coincident operation from normal setting whereby the shifting of levers in either direction from normal setting for the selective driving of one drum to wind in its cable will effect the releasing of the brake of the other drum.

4. The combination with a tractor comprising a frame structure, an engine for propelling the tractor and a cable winding means powered by the engine and comprising two winding drums, each operable independently of the other for the winding in of a cable thereon, and having a normally disengaged driving clutch and a normally set brake and a control lever movable from normal setting in one direction to set the clutch and release the brake, of a bulldozer mounted on the tractor frame for vertical adjustment, and cables extending from said drums to the bulldozer, one for lifting the bulldozer and for holding it in suspension and the other for applying down pressure thereto, and means operatively connecting said control levers to insure their movement coincidentally from normal setting for a selective energization of either drum and the release of the other drum by its brake.

EARL SAM FOX.
JOHN ALVIN GREENWOOD.