

Jan. 21, 1958

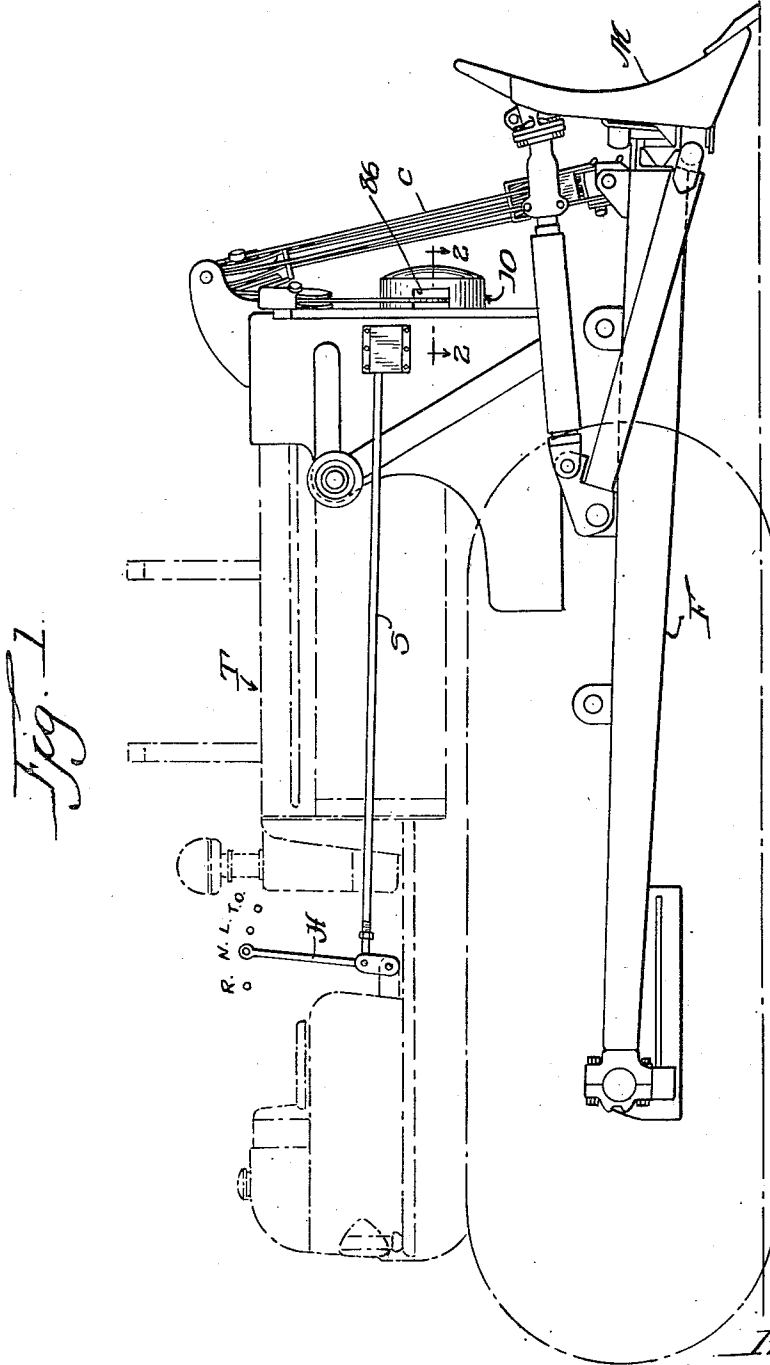
G. E. BOCK ET AL

2,820,609

WINCH STRUCTURE

Filed Nov. 20, 1953

8 Sheets-Sheet 1



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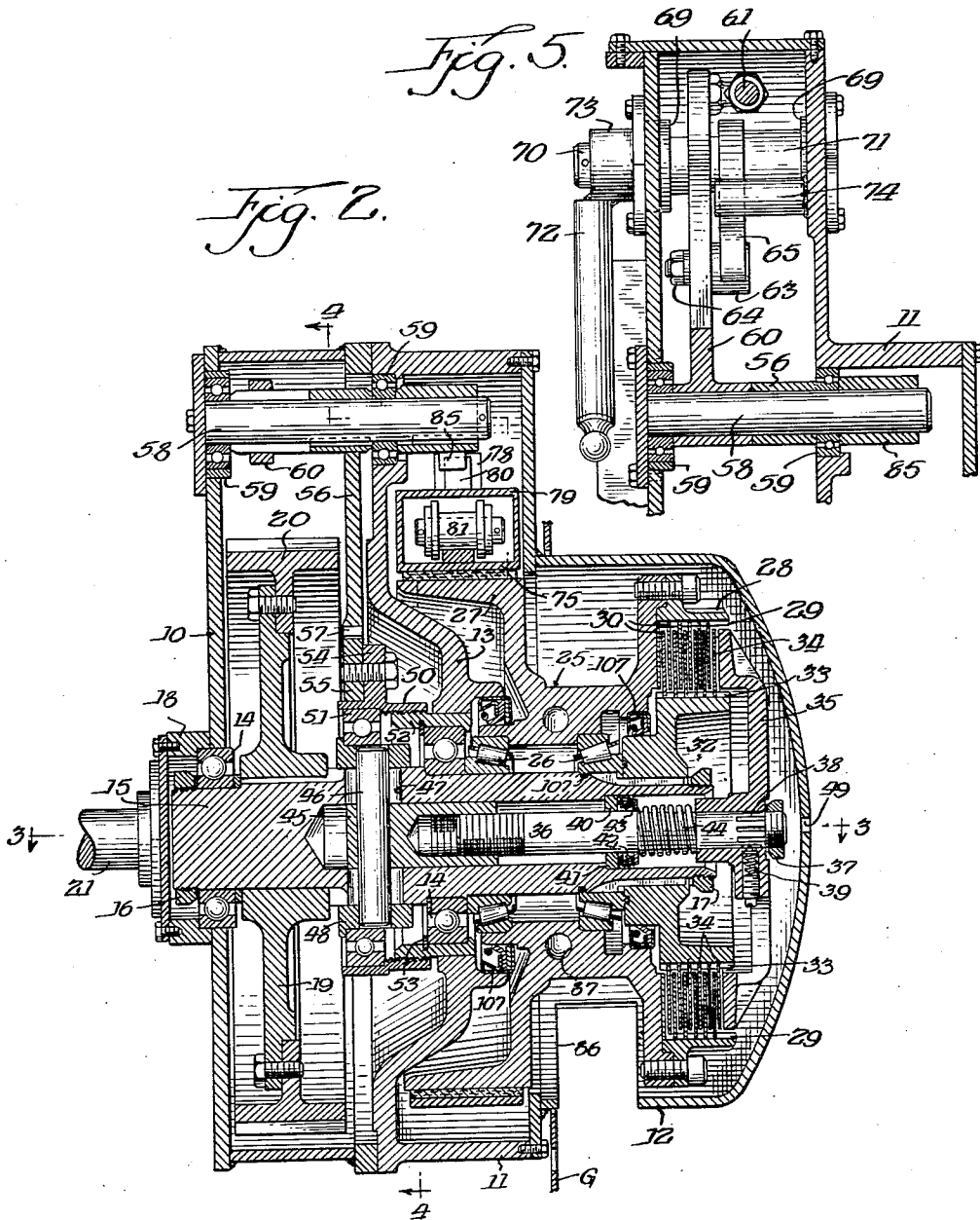
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WINCH STRUCTURE

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8 Sheets-Sheet 2



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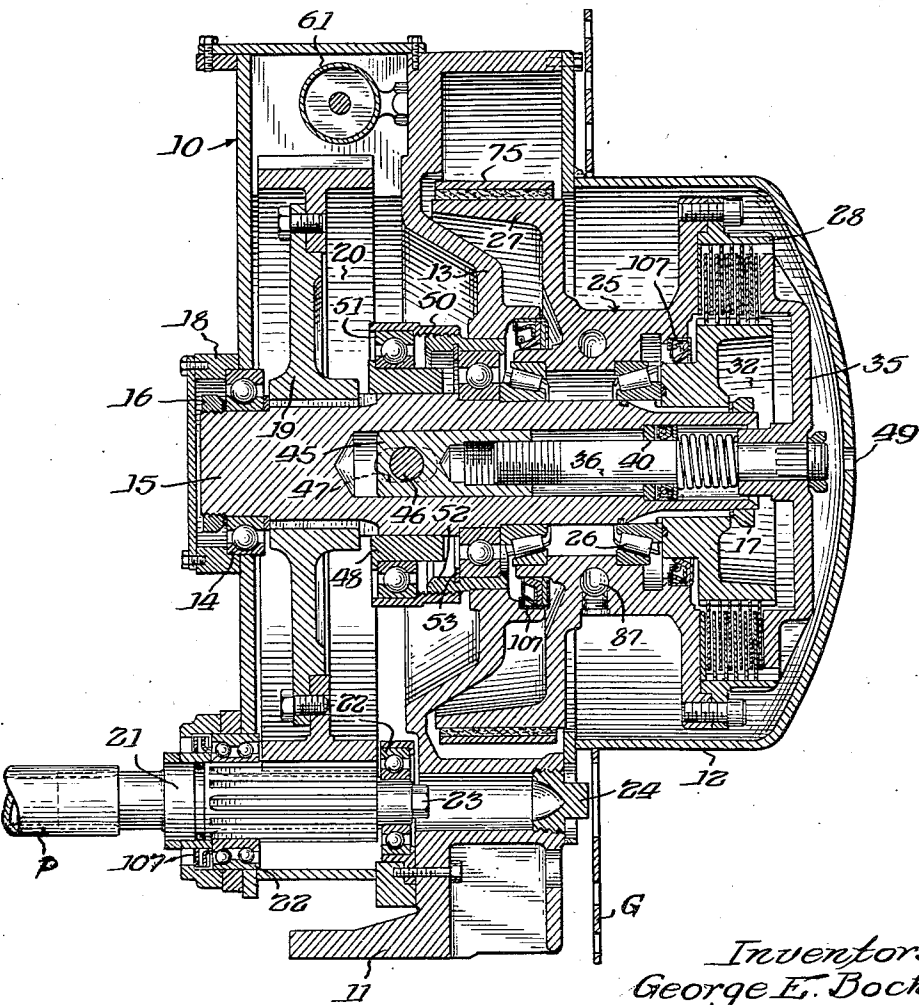
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Fig. 3.



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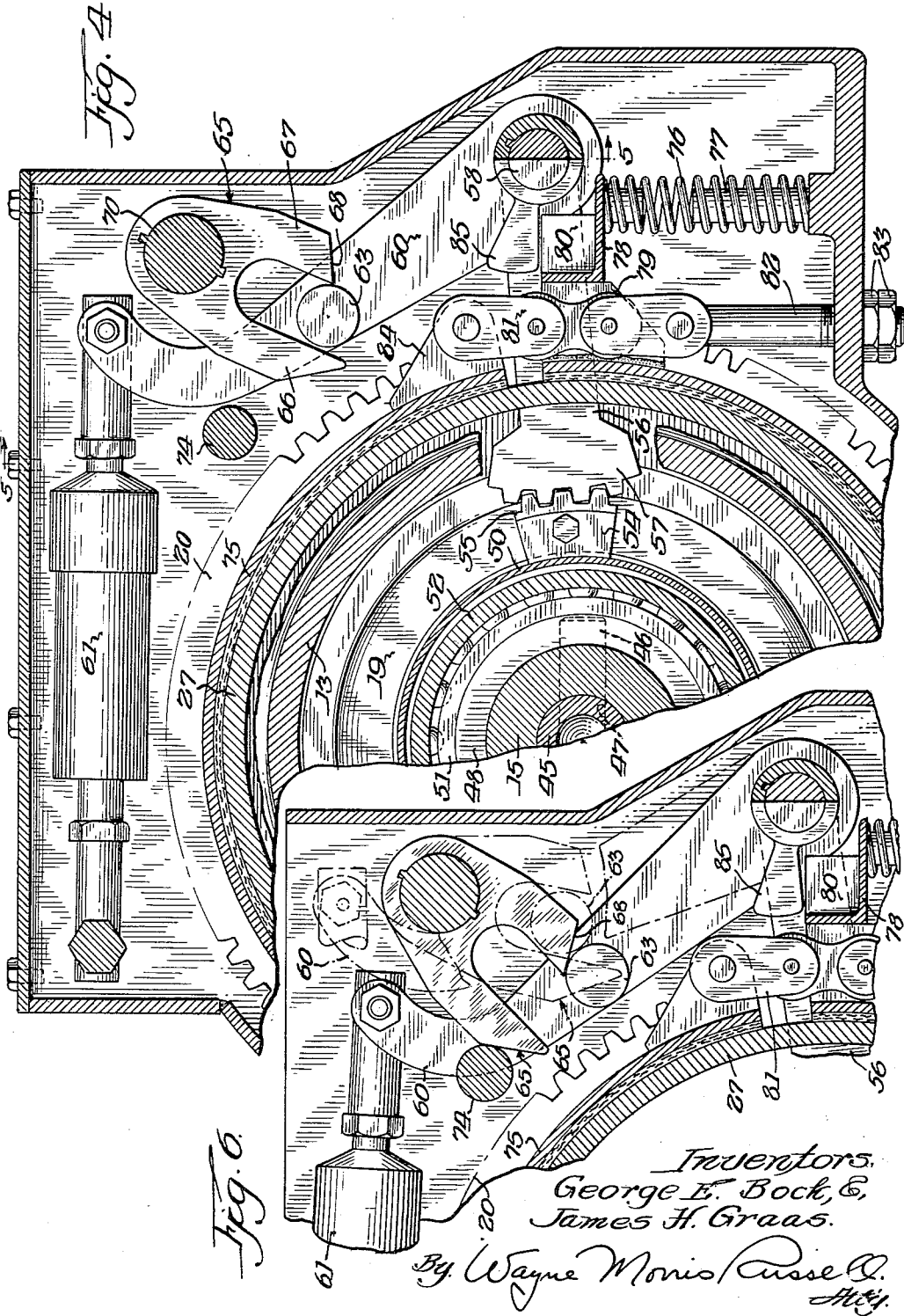
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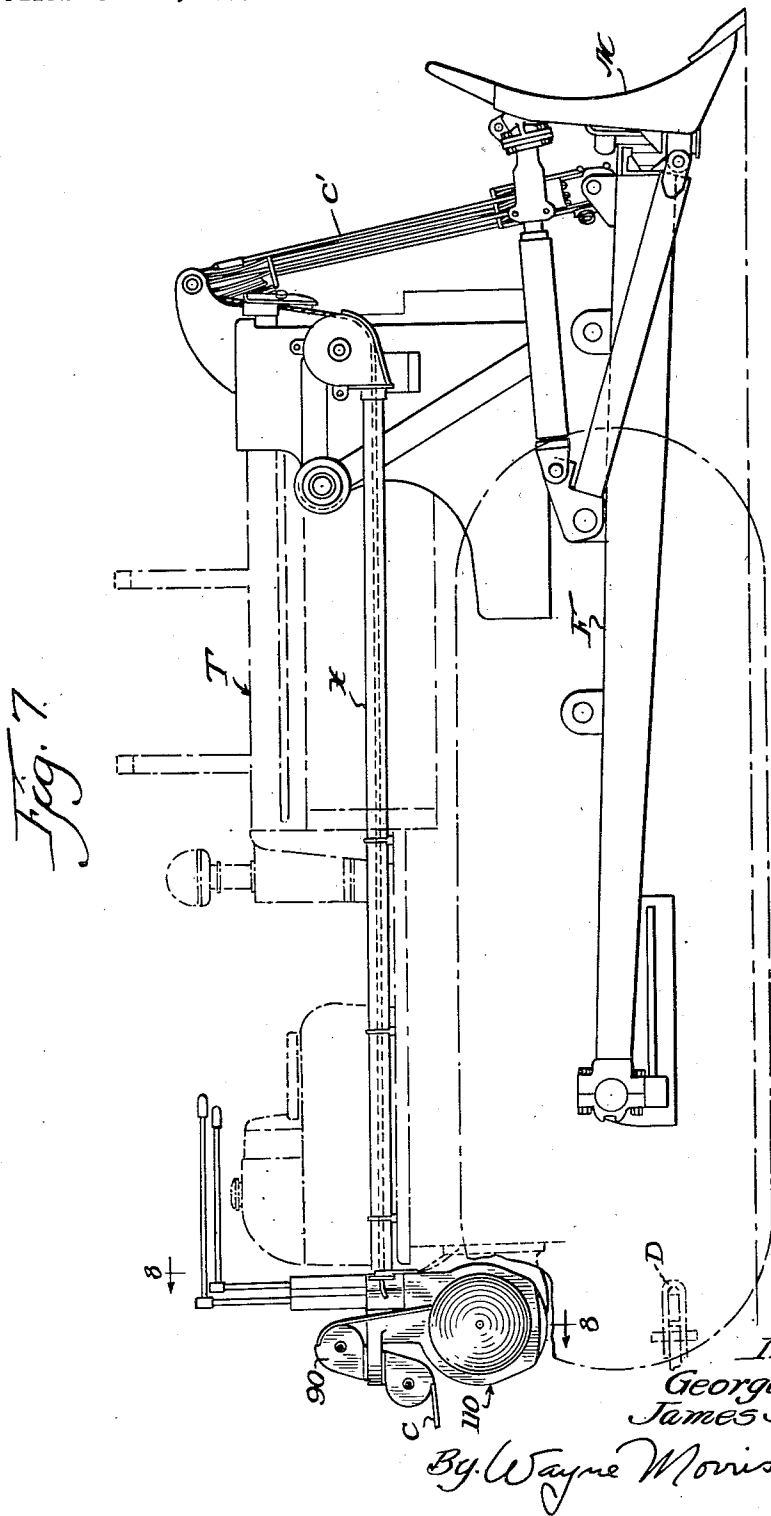
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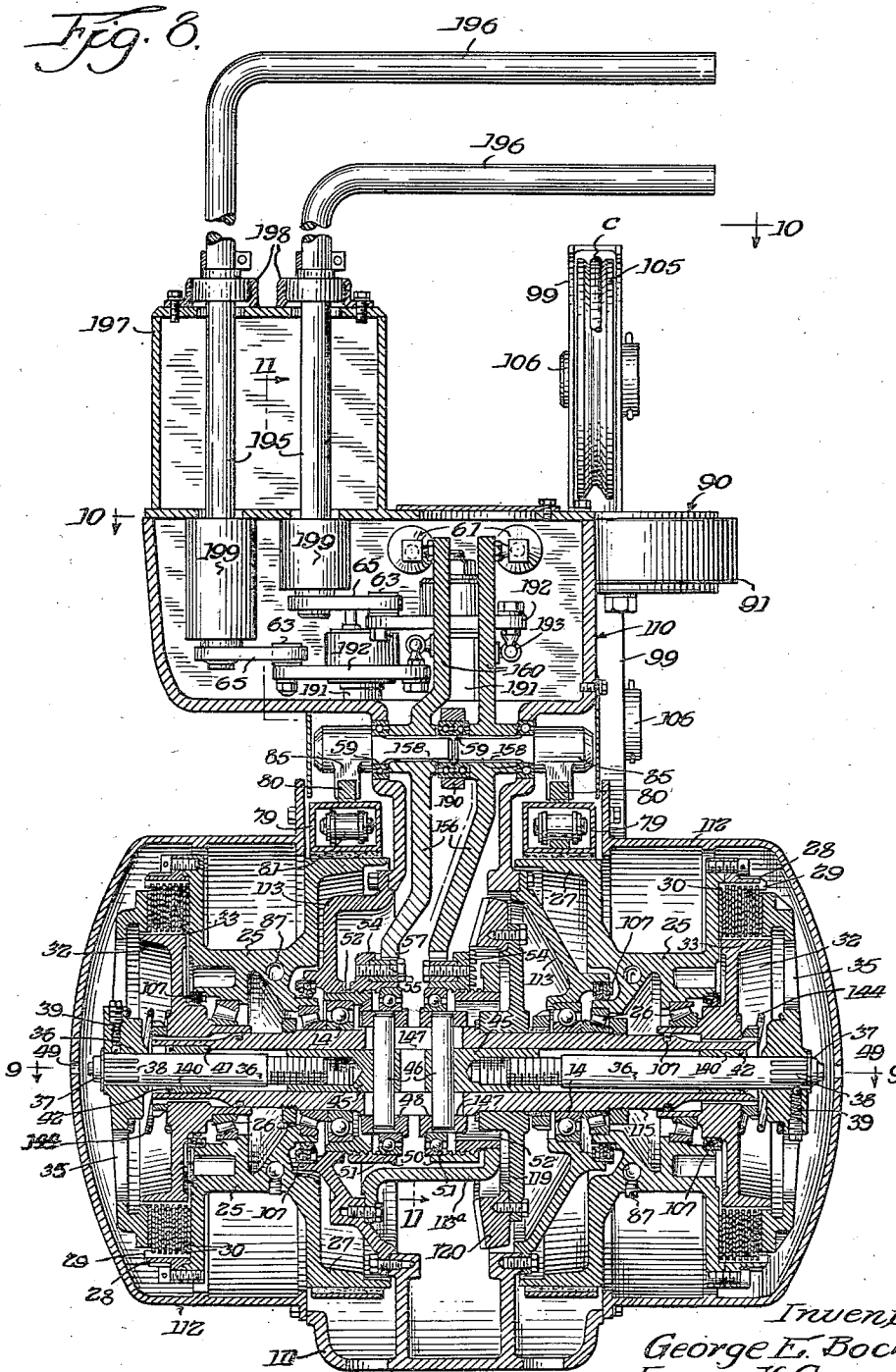
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WINCH STRUCTURE

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8 Sheets-Sheet 6



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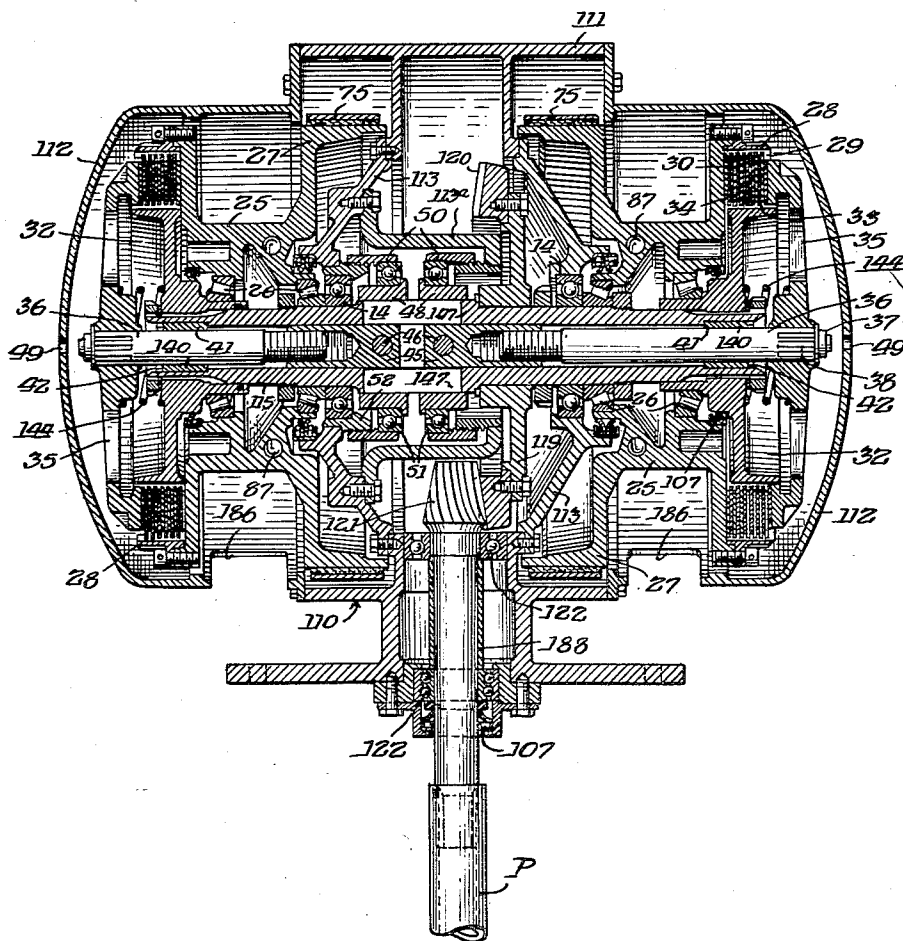
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Fig. 9.



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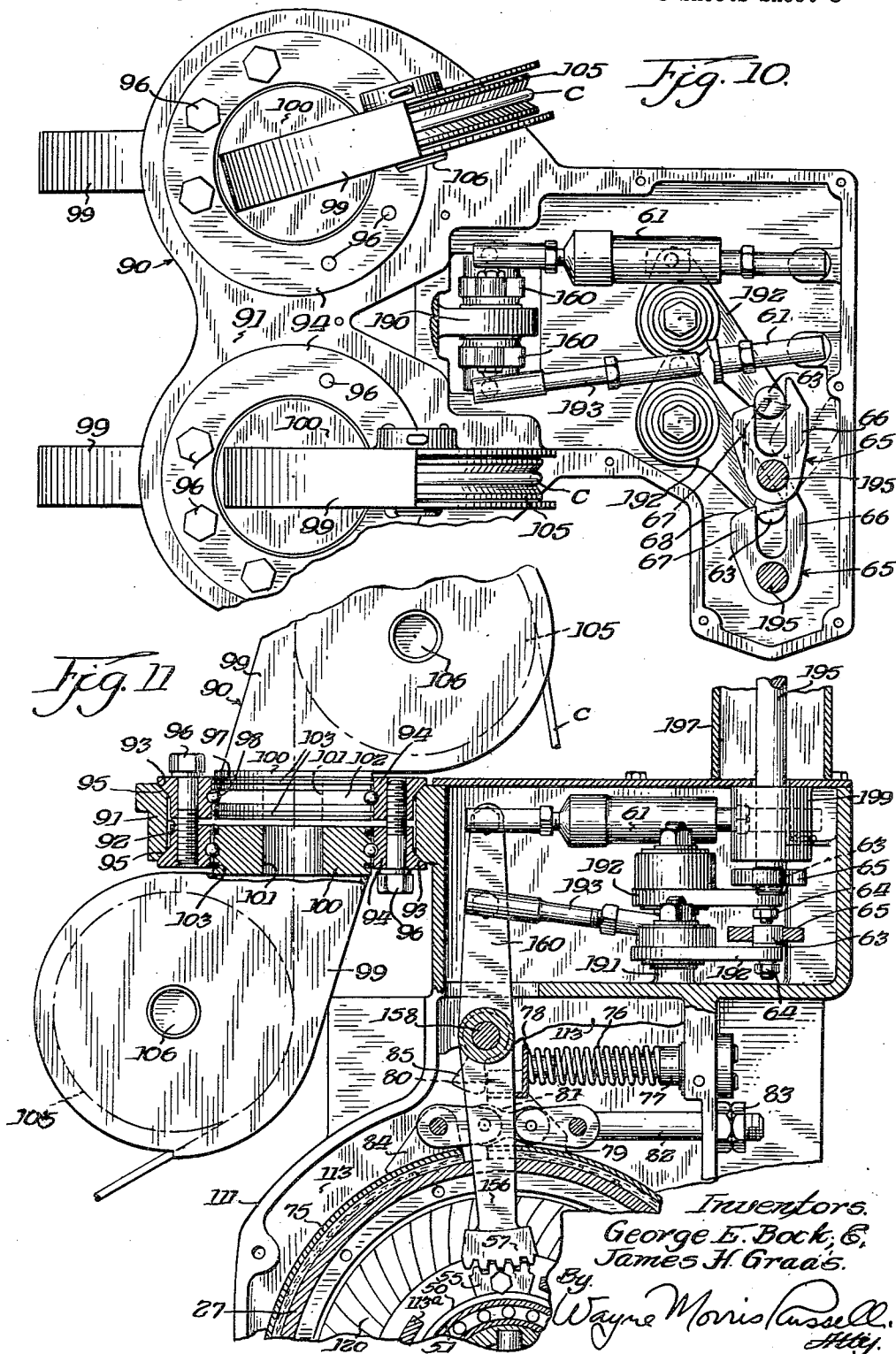
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WINCH STRUCTURE

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2,820,609

WINCH STRUCTURE

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Application November 20, 1953, Serial No. 393,298

26 Claims. (Cl. 254—185)

The present invention relates to a winch structure, and more particularly to a winch construction well adapted to use on a tractor and providing improved operation.

In one of the embodiments of the invention illustrated, a winch with a single cable drum and adapted for mounting on the front end of a tractor, as for operating a bulldozer moldboard or the like, is provided to be driven from a power take-off shaft of the tractor. In another embodiment, a winch having a pair of cable drums on a common shaft, adapted for mounting at the rear of a tractor as for controlling the operation of a scraper or other equipment drawn by the tractor, is provided and arranged for driving by a power take-off shaft. This embodiment includes a simple, compact fairlead structure for the cables windable on the drums which is of minimum height and disposed at a low level in closely spaced relation to the winch casing. This construction avoids obstruction of the tractor operator's view of the equipment drawn by the tractor and operated by the cables, and brings the point of application of the cable load to a low level or plane relatively close to the drawbar so as to minimize the overturning effect of the load on the tractor. In both forms of the winch, one-way brake means and clutch means for each drum are arranged on opposite sides of the drum so as to separate the two main sources of heat generated in operation and more readily dissipate the heat; and the arrangement is such that the brake means for each drum may be removed and replaced axially past the clutch means, the shaft being rotatably supported in cantilever fashion and the drum mounted adjacent an unsupported shaft end for this purpose. The clutch means are exposed for servicing at the same time that access is provided to the brake means for removal, upon removal of a cover portion of the winch casing. Control means convenient to the tractor operator's station operate linkage means for engaging and disengaging the clutch means and also for disengaging the brake means, the linkage means including a cam follower engaged by a cam for movement thereof in opposed directions from a neutral or normal position in which the clutch means are disengaged and the brake means engaged. Movement in one direction from the neutral position causes engagement of the clutch means while the brake means are engaged, to rotate the drum with the shaft, and movement in the other direction causes disengagement of the brake means while the clutch means are disengaged, to free the drum for rotation about the shaft. The cam and cam follower lock at a predetermined position of the linkage means upon movement in this second direction to hold the brake and clutch means positively in disengaged condition, but are readily unlocked merely by movement of the control means to return the linkage means to neutral position. For operating the clutch means, means shiftable axially of the shaft are employed, with rotatable threaded means for effecting the axial shifting when rotated. Meshing gear members on the threaded means and on a pivoted lever oscillated by the linkage means afford

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positive, non-slipping actuation of the threaded means for proper operation of the clutch means.

The invention provides several operational advantages, such as the minimization of heat generated in the winch, the servicing and/or removal and replacement of the brake and clutch means without disassembly of the winch, the positive shifting of the clutch operating means, the simple action of the linkage means for releasing the brake means and engaging the clutch means, and the simple, safe, positive, yet readily releasable locking of the brake and clutch means in drum-disengaging condition. In addition, the unobstructed visibility and the low plane of pull afforded by the winch construction having the fairlead integrated therewith are important practical advantages. Provision is also made for easy adjustment of the timing of the tractor motor. All of these combine to provide a greatly improved winch construction which is particularly adapted to use on and affords safer and more efficient operation of tractors, but is applicable equally well in many other fields of winch use to provide the same improved results and advantages as it does with tractors.

It is an object of the present invention to provide a winch construction in which the brake and clutch means for the drum, as the two main sources of heat in operation, are widely spaced apart to allow improved dissipation of heat.

Another object is the provision of a winch structure in which the brake and clutch means for the winch drum are so arranged that the clutch means are exposed for servicing and the brake means are removable and replaceable axially past the clutch means without disassembly of the winch upon removal of a cover on a casing enclosing the winch shaft and drum.

Another object is the provision of a winch structure in which the winch shaft is mounted cantilever fashion with a drum mounted on an unsupported portion thereof to allow removal or replacement of the drum brake means axially of the shaft without disassembly of the winch.

Another object is the provision of a winch structure including a fairlead and so constructed and arranged as to result in a compact unit particularly adapted for mounting at the rear of a tractor at a low level to afford maximum visibility and minimum spacing above the drawbar.

Another object is the provision of a winch structure including a fairlead of strong, compact, and simple construction mounted in closely spaced relation on a casing for the winch.

A further object is the provision of a fairlead construction for a tractor winch or the like which is strong, simple, compact, and adapted for disposition closely adjacent the winch.

It is another object of the invention to provide a winch structure providing improved dissipation of heat generated in operation by the brake and clutch means for a drum, providing for ready and positive locking of the brake and clutch means in drum-disengaging position for free drum rotation, and providing an efficient fairlead mounted closely adjacent the winch casing to afford a very compact construction.

Another object is the provision of a winch structure in which novel means are employed for selective operation of the brake and clutch means for the drum affording a ready and positive locking of such means in drum-disengaging position for free drum rotation.

Another object is the provision of a winch structure having novel means for selectively operating the brake and clutch means for the drum including toggle lock means to hold the brake and clutch means in drum-disengaging position for allowing free rotation of the drum.

Still another object is the provision of a winch structure

having means for selectively operating the brake and clutch means for the drum effecting a wedged toggle lock of such means in drum-disengaging position allowing free rotation of the drum when desired.

Another object is the provision of selectively actuatable means for operating the brake and clutch means for the drum of a winch also acting as toggle lock means for holding the brake and clutch means in drum-releasing position allowing free rotation of the drum.

A further object is the provision of means for locking the brake and clutch means for a drum of a winch in drum-releasing position to allow free drum rotation effecting a wedged toggle lock safely and positively maintaining the released condition of the drum yet permitting ready return to drum-engaging position of the brake and clutch means.

Another object is the provision of a positive, non-slipping means affording an operative connection between the clutch means and the control means therefor to assure proper operation of the clutch means.

Other and further objects, advantages, and features of the invention will be apparent to those skilled in the art from the following description, in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagrammatic side elevation of a tractor equipped with a cable-operated bulldozer moldboard, showing one embodiment of the winch structure of the invention mounted at the front of the tractor;

Fig. 2 is a horizontal sectional view through the winch structure of Fig. 1, taken substantially as indicated by the line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view taken substantially as indicated by the line 3—3 of Fig. 2;

Fig. 4 is a cross-sectional view taken substantially as indicated by the line 4—4 of Fig. 2;

Fig. 5 is a fragmentary vertical section view taken substantially as indicated by the line 5—5 of Fig. 4;

Fig. 6 is a fragmentary view showing certain of the parts of Fig. 4 in a locking position by full lines and in another position by broken lines;

Fig. 7 is a diagrammatic side elevation of a tractor equipped with a cable-operated bulldozer moldboard, showing another embodiment of the inventive winch structure mounted at the rear of the tractor;

Fig. 8 is a vertical sectional view through the winch structure of Fig. 7, taken substantially as indicated by the line 8—8 of Fig. 7;

Fig. 9 is a horizontal sectional view taken substantially as indicated by the line 9—9 of Fig. 8;

Fig. 10 is a horizontal sectional view taken substantially as indicated by the line 10—10 of Fig. 8; and

Fig. 11 is a cross-sectional view taken substantially as indicated by the line 11—11 of Fig. 8, with certain of the parts omitted or broken away for clearness.

Referring first to Figs. 1 to 6 of the drawings, showing one form taken by the winch structure of this invention, there is illustrated in Fig. 1 a more or less diagrammatic representation of the general arrangement and relation of a winch structure, generally designated 10, on the forward end of a tractor T having a bulldozer blade or moldboard M adjustably mounted on a frame F pivoted adjacent the rear of the tractor and arranged to be raised and lowered by a cable C reeved through suitable pulley blocks for winding on the winch structure. The operation of the winch is controlled by a suitable hand lever H convenient to the tractor operator's station having a shifting rod S extending to the forward end of the tractor and appropriately connected to the winch, as more fully explained hereinafter. The hand control lever H is adapted to move between a number of positions to operate the winch for raising and lowering the pivoted frame and moldboard, these positions being indicated in Fig. 1 at N, R, L, and TO. The lever is shown as in a neutral position N, in which the cable drum of the winch is undriven and held against rotation, from which position it may be moved

in one direction to the raising position R, in which the drum is driven to reel in the cable C and thus lift the moldboard M. The lever is also movable in the opposite direction to the lowering position L, in which the drum is undriven and is released for rotation by the cable load, so that the moldboard may descend by gravity. Movement of the lever H in the same direction and beyond position L brings it to a "toggle-out" position TO in which a toggle lock is effected maintaining the cable drum of the winch in its released or free-running condition, so that the cable may be freely unwound from or wound on the drum, as in manual respooling thereof.

As best shown in Figs. 2 to 4 inclusive, the winch 10 comprises a casing 11, which may be formed of several joined parts, adapted to be mounted between the radiator (not shown) of the tractor engine and an apertured radiator guard G at the front of the tractor. A removable cover 12 is provided for the forward end of the casing, in the form of a cover plate bolted to the casing, and having a large circular aperture from the periphery of which there extends forwardly a cylindrical cover portion closed at its outer or forward end. The cylindrical portion projects through a suitable opening provided therefor in the guard G. A web 13 generally parallel to the rear casing wall and having a circular dished or forwardly offset portion with a circular aperture therein is provided in the casing 11. The rear wall of the casing has an aperture coaxial with the aperture of the dished portion of web 13, and forward and rear bearings 14 in horizontal axial alignment are mounted in the apertures of the web 13 and rear wall, respectively. A horizontal main shaft 15 is rotatably supported by the bearings 14, the solid rear end of the shaft projecting through the rear casing wall. The shaft is hollow from its forward end to adjacent the rear end, and projects forwardly of the forward bearing 14 to a point adjacent the closed forward end of the cylindrical portion of the cover 12. Lock nuts 16 and 17, each with a lock washer, are provided respectively on the rear and forward ends of the shaft to prevent axial movement thereof, the rear nut 16 engaging against the outer surface of rear bearing 14 and with the projecting rear end of the shaft being enclosed in a suitable box 18 with a gasketed cover on the rear casing wall. Splined on the rear portion of the shaft 15 inwardly of the rear bearing 14 is the hub 19 of a main gear 20, in this instance formed separately and bolted together. A driving pinion 21 (Fig. 3) is suitably journaled at the lower portion of casing 11 by bearings 22 in the rear wall and adjacent the web 13 on an axis parallel to that of the main shaft 15, and meshes with the gear 20. The pinion shaft extends rearwardly out of the casing and is splined for connection with the power take-off shaft P of the tractor engine, as shown. It will be seen that the shaft 15 is driven whenever the shaft rotates. On the forward end of the pinion shaft, a hexagonal projection 23 is formed, for engagement by a suitable wrench so that the power take-off shaft P may be turned for adjusting the timing of the tractor motor or engine. Access to the projection 23 is afforded by a tubular portion of the casing 11 aligned with the shaft and normally closed by a threaded plug 24 at the forward end of the casing. This construction is advantageous in permitting timing adjustment of the motor in a very simple and facile manner, without disassembly or dismounting of the winch.

A cable reel or drum 25 is rotatably mounted on the main shaft 15 forwardly of the forward bearing 14 by means of suitable bearings 26, and at its rear face or side has a peripheral flange 27 encircling the dished portion of web 13 but spaced therefrom. The flange provides a cylindrical braking surface on the drum 25 adapted for engagement with a band brake. To the other or forward side of the drum is secured an annular clutch plate hub 28 having internal teeth 29. A

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plurality of externally toothed annular clutch plates 30 are mounted in the hub, the teeth engaging to prevent relative rotation of the hub and plates but allowing the plates to move axially on the hub. Splined or otherwise suitably secured on the forward end of main shaft 15, with its hub engaged by the lock nut 17, is a clutch plate drum 32 having external teeth 33 engaging with internal teeth of a plurality of annular clutch plates 34, which are thus held against rotation relative to the clutch plate drum 32 but left free for axial movement thereon, similarly to the clutch plates 30 mounted on the hub 29. The plates 30 and 34 are disposed in alternation with each other so that upon application of inward pressure they are brought into tight frictional contact to hold the cable drum 25 substantially fixed relative to the shaft 15 for rotation therewith.

A pressure spider or plate 35 with an axially inwardly offset marginal portion extending between the clutch plate hub 28 and clutch plate drum 32 is provided to apply the clutch-engaging pressure for drivingly connecting the main shaft and cable drum. The pressure plate is mounted on the forward reduced end of a transfer shaft 36 axially disposed within the hollow portion of the main shaft 15 and projecting outwardly therefrom. A lock nut 37 with a washer on the forward end of the transfer shaft secures the pressure plate. Inwardly of its forward end and within the hub of the pressure plate 35, the transfer shaft has a plurality of flutes 38 in which a spring-urged detent 39 in the pressure plate hub engages to hold the pressure plate against any slight tendency to turn on the transfer shaft, and also to give an audible indication of the amount of take-up when adjustment of the transfer shaft is made as explained herebelow. A plain annular bearing 40 for the transfer shaft 36 is disposed in the interior of the main shaft 15 engaged against a forwardly facing shoulder 41 formed therein, and a suitable oil seal 42 is provided at the forward side of the bearing. A washer 43 engages against the seal and serves as a seat for one end of a clutch release spring 44 the other end of which engages against the hub of the pressure plate to urge the transfer shaft and pressure plate axially outwardly, or forwardly, of the main shaft 15. The inner or rear end of the transfer shaft 36 is threadedly secured in an adjusting sleeve 45 slidable in the hollow portion of the main shaft and held against rotation relative thereto by a connecting pin 46 extending diametrically through and projecting through longitudinal slots 47 in shaft 15 into a shifter collar 48 slidably fitting on the exterior of the shaft. A slot, not shown, is formed in the forward end of the transfer shaft 36 for the reception of a screwdriver to screw the transfer shaft inwardly or outwardly of the sleeve 45, so that the location of the pressure plate 35 may be varied relative to the clutch plates or in other words so that the axial spacing between the forward side of the cable drum and the pressure plate may be adjusted. Thus, wear on the clutch plates is compensated for by screwing the transfer shaft somewhat into the sleeve 45. A hole 49 is provided in the casing cover 12 in axial alignment with the transfer shaft 36 to permit engagement of a screwdriver in the slotted end of the shaft without requiring removal of the cover. When the transfer shaft is turned, the clicks resulting from engagement of the spring-urged detent 39 in the flutes 38 successively moving past it provide an audible indication of the degree of axial adjustment of the transfer shaft 36 and pressure plate 35.

To draw the transfer shaft and pressure plate axially rearwardly or inwardly for applying the clutch-engaging pressure, an annular nut member 50 is journaled about the collar 48 by a suitable bearing 51, which has a tight press fit in a plain rear portion of the nut member and engages at its forward side against an internal shoulder of the member 50 and at its rear side against a flange on

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the collar. The forward internally threaded portion of the nut member extends within the dished portion of the web 13 and adjacent the forward bearing 14, threadedly engaging in easy screwing relation with the externally threaded rearwardly extending portion of an annular screw member 52 the forward portion of which is suitably secured in the aperture of the web 13. The forward bearing 14 fits within this forward portion of the screw member, and is held against axial movement by disposition between a radially inwardly extending flange or lip at the forward side of that member and a snap ring 53 engaged in a groove in the interior surface of the screw member. On the nut member 50 is formed an ear or lug 54 to which is bolted a sector gear 55. A lever 56 rockable in the plane of this gear has another sector gear 57 formed on its swinging end meshing with sector gear 55, so that when the lever rocks in one direction the nut member 50 is turned by the gears to move rearwardly on the screw member 52, shifting the bearing 51 and thereby the collar 48, pin 46, sleeve 45, and transfer shaft 36 rearwardly against the compression of the spring 44 to move the pressure plate 35 for pressing the clutch plates 30 and 34 together to provide a driving connection between the main shaft 15 and the cable drum 25. Swinging of the lever 56 in the opposite direction causes forward movement of the parts, aided by the action of the spring 44, to effect disengagement of the clutch plates and disconnect the drum from rotation with the shaft 15. The rocking lever 56 is fixed on a rock shaft 58 which is journaled by suitable horizontally aligned bearings 59 in apertures in the rear casing wall and web 13, as shown in Figs. 2 and 5, radially outward of the main gear 20 and the brake surface flange 27 of the cable drum, and projects through the web 13.

As best shown in Figs. 4 and 5, an arm 60 is splined or otherwise fixed on the rock shaft 58 adjacent the rear end thereof and extending upwardly therefrom, the hub of this arm and the hub of lever 56 together extending between the bearings 59. A spring cartridge 61 extends over the main gear 20 from the upper end of the arm 60, to which one of its ends is connected by a ball stud, its other end being anchored by the web 13 by another ball stud or like universal joint means. Spring means in the cartridge are arranged to hold the arm 60 in a normal or neutral position, shown in Fig. 4, and to return the arm to such position upon movement thereof in either direction. This neutral position of arm 60 corresponds to the neutral position of the hand control lever H, the lever 56 in fixed relation to the arm being in a position in which the nut member 50 and the parts movable thereby are located sufficiently forward relative to the main shaft 15 and cable drum 25 to leave the clutch plates disengaged. On one face of the arm 60 is a cam follower 63 in the form of a cylindrical boss or the like having a threaded stem passing through the arm to receive a securing nut 64. A cam 65 of general U shape defined by a pair of arms 66 and 67 spaced apart by a slot is disposed with its arms engaging about the cam follower 63. The cam arm 66 is longer than the arm 67, which shorter arm has an end surface 68 at an acute angle to the inner side or face thereof, that is, the arm face defining one side of the cam slot. Journaled in bearings 69 mounted in apertures in the rear casing wall and an upward extension of the web 13 is a control shaft 70, parallel to the rock shaft 58 and spaced thereabove, on which the cam 65 is fixed in any suitable manner with its slot extending radially. Adjacent the rear bearing 69, the shaft 70 has an enlarged portion providing a forwardly facing shoulder against which the cam is held by a spacer 71 extending on the shaft between the forward bearing 69 and the forward face of the cam. The cam 65 is thus disposed in a plane parallel to the arm 60 so as to engage with the follower 63. The rear portion of the control shaft 70 projects through the rear bearing 69 outwardly of the rear casing wall and has an actuating

lever 72 fixed thereon as by a hub member 73. The actuating lever is adapted for connection transversely of the tractor to the shifting rod S by any appropriate link means, not shown, so as to be rotated in one direction or the other by movement of the hand control lever H to turn the control shaft 70 correspondingly, and thus swing the cam 65 to move the cam follower 63 and arm 60. A stop 74 extends rearwardly from the web 13 to limit movement of the cam in one direction, while allowing the arm 60 to swing without obstruction, and movement of the arm and cam in the other direction may be limited by the shaft 70 serving as a stop for the arm 60, although such limitation is not necessary.

A band brake 75 is disposed about the cylindrical braking surface provided by the flange 27 of the cable drum 25. The brake is of a type permitting rotation of the drum with the main shaft 15 upon engagement of the clutch means already described, but preventing drum rotation in the opposite direction, as under a load applied to the cable when the clutch is disengaged. One end of the brake band is resiliently urged toward the other, so as to tighten the band about the flange 27, by a helical spring 76 supported vertically by a spring guide 77 extending from the casing 10. The spring bears at one end against the casing or a shoulder on the guide 77, and at the other end against a projection 78 of a hollow stirrup 79 secured on the end of the brake band. The stirrup is disposed adjacent the forward portion of the rock shaft 58, and has an abutment block 80 on the projection 78. Although not shown, suitable means are preferably provided for adjusting the compression of the spring 76. The other end of the brake band is anchored to the casing by a chain 81 or other suitable means passing through the opening of the stirrup 78 and having at one end an adjusting rod 82 projecting through the casing and threaded at its projecting end to receive adjusting nuts 83. At its other end, the chain 81 is attached to a lug 84 secured on the brake band. The compression of the spring 76 is insufficient to tighten the brake band about the flange 27 of the cable drum to the extent necessary to hold the drum against rotation. When the drum 25 is rotated with the main shaft 15 upon engagement of the clutch means, which rotation is in a counter-clockwise direction as viewed in Fig. 4, the brake 75 remains relatively loose on the flange 27 and allows the drum to rotate with the shaft. When the clutch means are disengaged, so that the cable drum might rotate clockwise on the shaft 15, any tendency of the drum to turn clockwise causes the brake band end anchored by the chain 81 to approach the spring-urged end, or in other words to draw or tighten the brake band about the drum flange 27. This clamping or tightening effect of clockwise rotation of the drum, added to or supplementing the tightening effect of the spring 76, results in a close, tight contact of the brake band on the drum flange to hold the drum securely against such rotation. A brake release lug or lever 85 is splined on the forward end of the rock shaft 58 to extend over the abutment block 80 of the stirrup 78, so as to engage with the block upon counter-clockwise turning of the rock shaft, as viewed in Fig. 4, and move it downwardly to relieve the brake band of the force of the spring 76. The cable drum is then released from the brake and the clutch means so that it may rotate freely on the main shaft 15, as for paying out of cable. The brake release lever 85, which of course is in fixed relation to the arm 60, is slightly spaced from the abutment block 80 in the normal or neutral position of the arm 60 and hand control lever H.

With the clutch means disengaged and the brake in its normal engaged relation with the cable drum, the clutch means may be engaged to cause rotation of the drum with the shaft 15, continuously rotated by the main gear 20 driven from the tractor motor, when the hand control lever H is moved from its neutral position N to the raising position R. This swings the actuating lever 72, through

its connection to the lever H, to turn the shaft 70 in a counter-clockwise direction as viewed in Fig. 4. As the cam 65 swings with the shaft 70, its longer arm 66, by engagement against the cam follower 63 of the arm 60, swings the arm 60 against the force of the spring cartridge 61 to turn the rock shaft 58 clockwise, the rocking lever 56 and the brake release lever 85 rotating clockwise with the rock shaft. In this direction of rotation of the rock shaft 58, the lever 85 merely moves away from the abutment block 80 and brake spring 76 and has no effect on the brake 75, but the lever 56 by the meshed engagement of its sector gear 57 with the corresponding gear 55 of the nut member 50 turns the nut member on the fixed screw member 52 so as to move axially rearwardly. The gears provide a positive, non-slipping operative connection for rotating the nut member. The bearing 51 is moved rearwardly by the nut member to shift the collar 48, pin 46, sleeve 45, transfer shaft 36, and pressure plate 35 in the same direction, against the resistance of the spring 44, so that the clutch means are engaged by application of pressure to the clutch plates 30 and 34 and the cable drum 25 is drivingly connected with the main shaft 15 to rotate therewith. The positions assumed by the cam, arm, and spring cartridge are shown in broken lines in Fig. 6. The cable C, which passes through an opening 36 in the casing 11 and may be fastened to the drum by insertion in suitable apertures or bores 87 in the drum hub, is wound on the cable drum to raise the frame F and with it the moldboard M. Release of the hand control lever H allows the spring cartridge 61 to draw the arm 60 back to its neutral position, turning the rock shaft 58 clockwise to restore the lever 56 and brake release lever 85 to their normal positions and causing the nut member 50 to screw forwardly on the screw member 52 to effect disengagement of the clutch means, the hand control lever H also being returned to its neutral position N by the spring action.

When it is desired to allow the cable drum 25 to rotate independently of the main shaft 15, so that the cable may be payed out, as in lowering of the moldboard from a raised position, the lever H is moved forwardly from its position N to the lowering position L, causing the control shaft 70 to turn clockwise as viewed in Fig. 4. The shorter arm 67 of cam 65 then swings the arm 60 from its neutral position, by engagement with the cam follower 63, to turn the rock shaft 58 counterclockwise with its rocking lever 56 and brake release lever 85, toward the full-line position of the parts as shown in Fig. 6. As the lever 56 rotates in this direction, the nut member 50 is moved forwardly on the screw member 52 so that the pressure plate 35 moves axially outwardly or forwardly away from the clutch plates in disengaging relation, but this has no operative effect on the clutch, since the clutch plates 30 and 34 and the pressure plate were already in disengaged condition at the beginning of the movement. The brake release lever 85, however, in turning counterclockwise, engages the abutment block 80 of the brake band stirrup 79 and through the projection 78 acts against and overcomes the force of the brake spring 76, causing further compression thereof, and thus relieves the brake band of the tightening effect of the spring. The brake 75 is then sufficiently loose on the cable drum flange 27 to allow the drum to rotate in either direction on the main shaft 15. In this released condition of the drum, the weight of the pivoted frame F and moldboard M acting on the cable C causes unreeling of the cable from the drum 25 so that the frame and moldboard are lowered by gravity. Similarly, of course, any unspooling load on the cable will cause it to be payed out. The rate at which the cable is unwound from the drum is controllable by the distance through which the brake release lever 85 is moved, or in other words by the degree of relief of the brake 75 from the force of the spring 76. Upon release of the control lever H, the parts are returned to their

normal or neutral positions by the action of the spring cartridge 61 and spring 76.

To allow safe manual handling of the cable as in re-spooling or the like, a positive, safe, yet readily releasable locking mechanism and arrangement is provided which effects a toggle lock of the parts in the clutch-disengaged and brake-disengaged condition of the cable drum, allowing free rotation of the drum on the shaft 15. The lock is effected by the end surface 68 of the shorter cam arm 67 and the cam follower 63 of the arm 60, upon movement of the control lever H from its neutral position N through the lowering position L to the "toggle out" position TO. By such movement of the lever H, the arm 60 is swung by the cam 65 to release the brake 75 while the clutch is disengaged, in the same manner as when releasing the drum from the brake while maintaining manual control of the rate of rotation of the drum. The movement is continued, however, until an extreme position of the cam 65 and arm 60 is reached, adjacent the stop 74. In this predetermined position, the cam arm 66 substantially engages against the stop, the cam and arm 60 coming into a predetermined angular relation, and the end surface 68 of the cam arm 67 moving into tangential relation with the cam follower 63 as the cam arm and cam follower swing along their respective and diverging arcs from the neutral position. The positions of the parts are substantially as shown in full lines in Fig. 6. The lever H is then released, and the spring cartridge 61 and brake spring 76 tend to return the arm 60 and cam 65 to neutral position, moving the parts slightly back from the extreme position. The angle of the end surface 68 of the cam relative to the inner face of the arm 67, or, since the slot between the cam arms extends radially of the shaft 70, relative to the radial line of the cam passing through the center of the cam follower, is such that in the tangential engagement of the surface with the follower return movement of the follower through its arc under the action of the spring means merely urges the cam toward the stop 74, as will be evident from Fig. 6. The cam and follower are thus wedged in a secure lock against return to neutral position, holding the brake 75 released from the cable drum flange 27 and the clutch means in disengaged condition so that the drum is free to rotate in either direction on the main shaft 15. The toggle relation of the cam and the arm 60 under the urging of the spring cartridge 61 and brake spring 76 is readily released or overcome to return the parts to normal position by manual movement of the hand control lever H toward its neutral position, causing the shorter arm 67 of the cam to swing a sufficient distance against the wedging force applied by the spring cartridge and brake spring to move its end surface 68 out of engagement with the cam follower 63, whereupon the parts can be returned to neutral position by the unaided spring means.

It will be evident that the brake 75 and the clutch comprised by the clutch plates 30 and 34 are widely spaced apart in the disclosed winch structure, being separated by the cable drum at the opposite sides of which they are mounted. In the operation of the winch, heat is generated by the friction involved in the engagement of the brake with the drum flange 27 and the repeated operation of the clutch, due to the constantly required changes in rotation of the drum. The clutch and brake are the two main sources of heat in the winch, and since in the past they have commonly been disposed close together for reasons of compactness, they have often caused excessive heating of the winch due to concentration of heat. The separation of these heat sources by the present construction avoids such heat concentration and results in a more widespread distribution of the lower heat about the winch, so that the generated heat is readily dissipated and overheating of the winch is avoided. The disclosed construction, by providing a cantilever shaft, permits ready access to the clutch and brake for servicing, repair or

replacement thereof without the necessity of disassembling the winch. The diameter of the cable drum flange 27 is at least equal to, or in any event not very much smaller than, that of the clutch plate hub 28. As will be evident from Fig. 2, the clutch at the forward end of the main shaft 15 is completely exposed upon removal of the cover 12 for any necessary operations thereon, and the brake is exposed for complete inspection and is only somewhat less accessible for removal. To remove the brake, it is only necessary to remove the adjusting nuts 83 exteriorly of the casing and then pass the brake axially forwardly past the drum 25 and the clutch, the absence of bearing mounts at the forward end of the main shaft permitting this simple operation. No disassembly of the winch is required. Replacement of the brake involves merely the reverse of the removal procedure.

Another winch structure 110 embodying the invention is illustrated in Figs. 7 to 11 inclusive. This winch structure is particularly adapted to mounting on the rear of a tractor for operating equipment drawn by the tractor, for example a scraper, and includes two cable drums as well as an integrated fairlead construction for the cables. The structure is shown in Fig. 7 mounted on the rear end of a tractor T substantially the same as that shown in Fig. 1, with a drawbar D for connection to equipment to be towed thereby and having a pivoted frame F carrying a moldboard M to be raised and lowered by a cable C', so that it may be employed as a bulldozer when not used for drawing or otherwise operating other equipment. A guide tube X is provided, however, for leading the cable C' to the winch structure at the rear of the tractor. A pair of cables C are provided for the drums. A casing 111 encloses the winch structure, having a generally cylindrical lower portion with its axis extending transversely of the tractor on each end of which is bolted a cover 112 similar to the cover 12 of the winch structure 10 already described. As best shown in Figs. 8 and 9, the casing is provided with a pair of axially spaced internal webs 113, which may be formed of several sections bolted or otherwise secured together, dished or offset outwardly from each other adjacent the axis of the cylindrical casing portion and having axially aligned apertures therein. From one of the webs 113, in this instance the left-hand web as viewed in Figs. 8 and 9, a generally cylindrical screw carrier 113a extends axially to adjacent the other web, and has an internally threaded aperture in alignment with the web apertures. Bearings 14 for a main shaft 115 are disposed in the apertures of the webs 113. The shaft 115 extends through the apertures in the webs 113 and screw carrier 113a and projects to adjacent the closed ends of the covers 112, being unsupported adjacent its ends and of hollow or tubular formation throughout its length. Splined on the shaft 115 somewhat to the right of its center, as viewed in Figs. 8 and 9, and inwardly of the right-hand web 113, is the hub 119 of a main hypoid gear 120 which meshes with a hypoid driving pinion 121 the shaft of which is journaled in bearings 122 in a mounting flange of the casing 111 and between internal ribs of the casing forming parts of the webs 113, a spacer 188 being sleeved on the pinion shaft between the bearings to maintain their proper location. The shaft of pinion 121 projects out of the casing through the mounting flange in axial alignment with a power take-off shaft P of the tractor motor, the axis of which is in perpendicular but non-intersecting relation to the axis of the main shaft 115, being at a somewhat lower level.

A cable drum 25 is rotatably mounted adjacent each end of the main shaft 115 by bearings 26 and has a flange 27 at its inner side providing a cylindrical surface for engagement by a band brake 75 and extending about the dished or offset portion of the adjacent web 113. An internally toothed clutch plate hub 28 at the outer side of each drum 25 carries externally toothed clutch plates 30 frictionally engageable by internally toothed clutch plates 34 carried by a clutch plate drum 32 fixed on the

end of the main shaft, upon application of inward pressure by a pressure plate 35, all substantially as described in connection with the winch structure 10. Each pressure plate 35 is secured by a lock nut 37 to the outer end of a transfer shaft 36 slidably supported within the shaft 115 by a bearing 140 adjacent which is an oil seal 42, and an adjusting sleeve 45 slidable in the shaft 115 and threadedly receiving the inner end of the transfer shaft. The outer end of each transfer shaft is slotted for reception of a screwdriver insertable through a hole 49 in the adjacent cover 112 so that the transfer shaft may be adjustably screwed inwardly or outwardly in its adjusting sleeve 45. The pressure plate 35 is urged axially outwardly by a spring 144 disposed between its hub and the hub of the clutch plate drum 32, about the end of the main shaft, which is held against axial shifting by a lock nut 17 screwed thereon to bear against the clutch plate drum hub. A spring-pressed detent 39 in the hub of the pressure plate 35 engages in flutes 38 formed in the end portion of the transfer shaft. Each of the adjusting sleeves 45 has a connecting pin 46 extending therethrough and through diametrically opposed slots 147 in the main shaft into shifter collars 48 slidable on the main shaft. The slots 147 are somewhat to the left of the longitudinal center of the shaft 115, as viewed in Figs. 8 and 9, and the right hand transfer shaft is somewhat longer than the left-hand one, to allow for clearance of the main gear 120. A nut member 50 is rotatably mounted about each collar 48 by a bearing 51, and is movable axially of the main shaft in either direction by its engagement with a fixed screw member 54, substantially as explained in connection with the winch structure 10. The right-hand screw member is secured in the aperture of the carrier 113a, while the left-hand screw member is secured in the aperture of the left-hand web 113 and has the left-hand bearing 14 internally mounted therein. An external lug 54 on each of the nut members 50 has a sector gear 55 secured thereto extending radially through an opening in the cylindrical carrier 113a, with which meshes a corresponding sector gear 57 formed on the free end of a rockable lever 156 fast on a rock shaft 158 journaled by sealed bearings 59 mounted in apertures in an upward extension of the adjacent web 113 and in a shaft support bracket 190 extending from an upper extension of the casing 111. The two rock shafts 158 are axially aligned and project outwardly through the webs 113, the bracket 190 being in substantially the central transverse plane of the main shaft, and the levers 156 are bent or offset in longitudinal section to allow for the location of the slots 147 offset from that central plane. About the brake flange 27 of each cable drum 25 is disposed a brake band 75, as best shown in Fig. 11, one end of which is urged toward the other so as to tighten about the flange by a spring 76 disposed about a guide 77 and bearing at one end against a shoulder thereon and at the other end against the projection 78 of a stirrup 79 secured on the end of the brake band, the guide being threaded in an adjacent portion of the casing so that the compression of the spring may be adjusted thereby. An abutment block 80 is provided on the stirrup projection. The other end of the brake band is anchored to the adjacent casing portion by a chain 81 or the like passing through the stirrup 79 and connected at one end to an adjusting rod 82 projecting through the casing and secured by adjusting nuts 83, the other end of the chain 81 being connected to an attaching lug 84 on the brake band. The abutment blocks 80 are engageable by brake release levers 85 fast on the respective outer ends of the rock shafts 158. The clutches and brakes of the two cable drums are engageable and disengageable individually by oscillation of the respective rock shafts to swing the respective levers 156 and brake release levers 85 in one direction or the other for engaging the clutch means or releasing the brake means.

It will be clear that as thus far described the construction

and operation of the winch structure 110 are in general similar to those of the winch structure 10, although with certain differences, and that each of the drums 25 is operable and controllable independently of the other. Somewhat different means are employed in winch structure 110 than in winch structure 10 to control the operation of the mechanism, however. At the upper portion of casing 111 is a control box communicating with the lower portion of the casing through an opening between the webs 113. Arms 160, corresponding generally to the arm 60 of winch structure 10, but preferably formed as extensions of the levers 156, project upwardly from the respective rock shafts into the control box, and each is held in a desired neutral position by a spring cartridge 61 connected between its upper end and a wall of the box. A pair of bearing studs 191 extend vertically from the bottom of the box, and each has mounted on its upper end an intermediate control lever 192 rotatable in a horizontal plane about the stud. At one end of each intermediate lever 192 is a cam follower 63. The other end of each lever 192 is connected to one of the arms 160 by a suitable link 193, so that swinging of the lever in a horizontal plane causes swinging in a vertical plane of the arm 160 linked thereto, to turn the rock shaft on which the arm is fast and swing the corresponding rockable lever 156 and brake release lever 85 for operation of the clutch means and brake of the cable drum associated therewith, in the manner already explained. A radially slotted cam 65, having a long arm 66 and a shorter arm 67 with an end surface 68 at an acute angle to the radial line of the slot, engages with each follower 63 and is secured on the lower end of each of a pair of control shafts 195 extending vertically upwardly out of the control box and having horizontal handle portions 196 at their upper ends to extend adjacent the tractor operator's station. A suitable housing 197 extends upwardly from the cover of the control box for a portion of the height of the control shafts, and at its top is mounted a suitable bearing 198 for each of the shafts 195, while cylindrical supports 199 depend from the control box cover about the shafts to mount bearings (not shown) for the lower ends of the shafts. For compactness, the intermediate levers 192 are mounted at different levels, and the lower ends of the shafts 195 are at correspondingly different levels. One of the links 193 is connected at the lower face of the upper lever 192, and the other link at the upper face of the lower intermediate lever. It may be noted that the handle portions 196 of the control shafts are shown in Fig. 8, for clearness, as extending at approximately 90° out the positions they actually occupy, shown generally in Fig. 7.

It will be evident from what has been explained heretofore that upon movement of the handle 196 of one of the control shafts 195 in either direction from a neutral position corresponding to the neutral position of the associated arm 160 and therefore of the rock shaft 158 and the levers 156 and 85 mounted thereon, and further corresponding to the clutch-disengaged, brake-engaged condition of the corresponding cable drum 25, the cam 65 carried by the shaft 195 will swing the intermediate control lever 192 with the cam follower 63 of which it is engaged. The arm 160 connected to the lever 192 is therefore swung from the neutral position to turn the rock shaft 158 in one direction or the other to cause engagement of the clutch means of the associated drum, while leaving the brake means engaged, so that the drum will rotate with the shaft 115, or to release the brake means of the drum while the clutch is also disengaged, so that the drum may rotate on the main shaft. When it is desired to free the drum entirely for rotation on the shaft 115 and maintain it in that condition, the control shaft 195 is turned sufficiently in the brake-releasing direction to cause the end surface 68 of the cam to engage tangentially against the cam follower 63, the action of the spring cartridge 61 and brake spring 76 then effecting a wedging

engagement between the follower and end surface tending to swing the cam further in the brake-releasing direction, against which further movement the cam is held by the forward wall of the control box serving as a stop, as indicated by dotted lines in Fig. 10. The toggle lock thus effected between the cam 65 and lever 192, under the action of the spring means, safely and surely holds the parts in the proper positions for free running of the cable drum on the main shaft 115, but is readily broken by application of manual force to turn the cam so as to disengage the end surface 68 of the shorter arm 67 from the cam follower against the force of the spring cartridge and brake spring, which may then act on the arm 160 to return the parts to neutral position. The operation and control of the independent cable drums of winch structure 110 and of the drum of the winch structure 10 previously described are generally similar, but effected in a somewhat different manner and by different means.

Integrated in the winch structure 110 is a fairlead generally designated 90, for the cables C, of a construction particularly advantageous in connection with tractors but also advantageous in many other applications. Formed integral with the casing 111 at the level of the top of the control box is a horizontal, relatively thick projection 91 extending rearwardly clear of the remainder of the casing, and conveniently of a generally figure 8 outline. A pair of circular apertures 92 extend vertically through the projection, with bevels 93 about the apertures at the upper and lower faces of the projection. A pair of identical annular retainers 94 each having a peripheral flange adjacent one face thereof with a beveled surface 95 corresponding to the bevels 93 is disposed in each aperture 93 of the fairlead projection 91. The retainers are arranged in opposed relation, one extending into the aperture from the top face of the projection and the other from the bottom face, the beveled surface 95 of each engaging the corresponding bevel 93 of the projection. The portions of the retainers within the aperture are of smaller diameter than the aperture, so that the surface of the aperture may be left unfinished. The retainers are secured in clamped relation against the bevels 93 of the projection 91 by a plurality of bolts or capscrews 96 each extending through one of the retainers and threaded into the other, the retainers preferably having an axial dimension such that they do not contact each other when so clamped in place. A groove 97 is formed in the inner surface of each retainer 94 as the outer race for ball bearings 98. Rotatably mounted in the projection aperture 93 by each retainer is a sheave bracket 99 which has a sheave guard or housing perpendicular to a circular base 100 having an axial aperture 101 there-through. The base 100 of each sheave bracket is of less diameter than the internal diameter of the retainer 94, and has a peripheral groove 102 forming an inner race for the ball bearings 98, by which it is interlocked with the retainer. The balls may be inserted between the retainer and bracket base in any suitable manner, as by means of a radial aperture in the retainer closed after assembly of the parts. Seals 103 are secured in grooves on opposite sides of the bearing groove 102 to retain lubricant in the bearing. A sheave 105 is rotatably carried by the sheave bracket housing portion, journaled on a pin 106 supported in the bracket. The axis of the sheave and the axis of the base extend in planes perpendicular to each other, as will be clear from Figs. 10 and 11, but the sheave axis is spaced from the base axis by a distance substantially equal to the pitch radius of the sheave, and is spaced above the top of the base by slightly more than this distance. Fig. 11 illustrates in broken lines the pitch of the sheaves and the pitch line of a cable C reeved thereabout, from which this relation will be clear, as also the disposition of the cable through the apertures 101 of the opposed sheave bracket bases in each of the projection apertures 92.

The bases 100 of the sheave brackets 99 in each pro-

jection aperture are thus arranged substantially back to back with their axes in alignment and substantially coincident with the pitch line of the cable portion extending between the two sheaves, and are rotatable to swivel the brackets and the sheaves carried thereby about the aligned base axes, which thus define a common swivel axis. The disposition of the bracket bases in substantially back-to-back relation in the aperture 92 by means of the retainers 94 with one sheave bracket extending upwardly and the other downwardly, and the close spacing of the sheaves vertically relative to their respective bases results in a compact fairlead construction of minimum height as an integral part of the winch structure. The mounting of the sheave brackets in the casing projection in the manner disclosed provides a very strong structure in which stresses due to loads imposed on the cables are minimized, and one which is assembled very easily and requires a minimum of different parts, all of the four sheave assemblies being identical. A cable C extends from each cable drum 25 through a suitable opening 186 in the casing 111, being secured to the drum as by means of bores 87 in the hub thereof, upwardly over the upper sheave 105 of the adjacent pair of sheaves and downwardly through the aligned apertures 101 of the sheave bracket bases 100, along the swivel axis of the brackets, and then about the lower sheave rearwardly to any desired point, as a control member of equipment drawn by the tractor. The upper sheave 105 of each pair need swivel only enough to allow proper laying of the cable on and spooling off its associated drum, and stop means may be provided to limit the rotation of the upper sheave bracket in both directions, if desired. The lower sheave, however, is desirably allowed to rotate horizontally about the swivel axis through as great an arc as possible. To this end, the capscrews 96 by which each pair of sheaves is clamped on the projection 91 are arranged in two groups diametrically opposite each other, one group being adjacent the control box. The capscrews of this group extend upwardly through the lower retainer 94 to engage threadedly in the upper retainer, their heads projecting below the lower retainer, while the capscrews 96 of the other group have their heads engaged on the upper retainer and extend therethrough into the lower retainer. This affords a strong securement of the sheave brackets and retainers without requiring great thickness of metal, and at the same time avoids obstruction to swiveling of the lower sheave bracket rearwardly of the control box, since the only projections at the lower face of the lower retainer are the capscrew heads adjacent the box. Ample swiveling of the lower sheaves is thus allowed, as will be evident from Figs. 10 and 11, the lower brackets 99 being swingable through arcs of more than 180° so that the lower sheaves may be directed somewhat forwardly when necessary or desirable.

The fairlead construction, because of its compact arrangement, avoids or at least greatly minimizes interference with or obstruction of the tractor operator's view of the object or equipment to which the cables C are connected, the upper sheave brackets being well below the line of sight from the operator's station, as will be evident from Fig. 7. At the same time, the compact winch structure and the relatively low level at which the fairlead is carried thereby results in a relatively close vertical spacing of the lower sheaves from the drawbar D by which the tongue of a scraper or like machine is connected to the tractor. This minimizes the effect or tendency which a load imposed on the cables has of turning the tractor in a vertical plane about the drawbar connection to lift the forward end of the tractor, since the distance or arm through which the cable load acts is reduced. The winch structure 110 is secured on the rear of the tractor by means of the mounting flange, which may be bolted or otherwise attached to a suitable portion of the tractor, with the shaft of the driving pinion 121 connected to the power take-off shaft P of the tractor motor as previously

explained. When it is desired to operate the tractor as a bulldozer, the cable C' at the forward end is passed through the guide tube X, about a sheave (not shown) suitably mounted adjacent the gear of the tube, and through the fairlead to one of the drums 25 of the winch structure. The other drum may be kept idle, since only one drum is required to operate the moldboard M. The operation of the drum for moving the moldboard is the same as in the case of the winch structure 10. The cable C of the drum would ordinarily be unreel from the drum, but if desired the cable C' might be omitted and the cable C employed instead, being reeved through the blocks at the forward end of the tractor.

The casings of the winch structures 10 and 110 are largely filled with oil for lubricating the various bearings, gears, and other parts, suitable oil seals 107 being provided at the hubs of the cable drums 25 and clutch plate drums 32 and serving with the seals 42 to prevent the oil from passing to the drums and the brake and clutch means. Such seals 107 are also provided for the driving pinions 21 and 121 to prevent leakage of oil from the casing. The oil is thus retained between the web 13 and the rear wall of the casing in the winch structure 10, and between the webs 113 and in the control box in the winch structure 110, except for lubrication about and within the main shaft in each case. The winch casing may communicate adjacent the driving pinion with an oil reservoir (not shown), and the driving pinion and main gear be employed as a pump efficient enough to circulate oil through the casing from the reservoir, so that ample oil capacity is provided and proper lubrication of the moving parts is assured, resulting in trouble-free operation and long life of the structures.

What is claimed:

1. A winch construction comprising a casing including a cover, a shaft mounted horizontally in cantilever fashion in the casing unsupported adjacent one end, a cable drum rotatable on the shaft with one side thereof inwardly of said unsupported shaft end having at said one side a cylindrical portion not substantially less in diameter than the drum providing a braking surface and at the other side a clutch mounting of a diameter not substantially greater than that of the cylindrical portion, brake means normally engageable with the cylindrical portion to prevent rotation of the drum in a direction opposite to that of the shaft while allowing rotation of the drum with the shaft, clutch means at said unsupported end of the shaft and said other side of the drum for drivingly connecting the shaft and drum, said cover being disposed adjacent the unsupported shaft end and removable to expose the clutch means and drum for servicing of the clutch means and removal and replacement of the brake means axially past the drum and clutch means, operating means movable to effect engagement and disengagement of the clutch means, release means operable to disengage the brake means, and means for effecting selective operation of said clutch operating means and brake release means to engage the clutch means during engagement of the brake means and to disengage the brake means during disengagement of the clutch means.

2. A winch construction comprising a casing including covers at opposite ends thereof, a shaft mounted horizontally in cantilever fashion in the casing with its ends adjacent said covers and supported adjacent its central portion but unsupported adjacent its ends, a pair of cable drums rotatably mounted on the opposite shaft portions axially outward of its center each with an inner side thereof adjacent said central shaft portion and an outer side adjacent an end of the shaft and having at said inner side a cylindrical portion not substantially less in diameter than the drum providing a braking surface and at said outer side a clutch mounting of a diameter not substantially greater than that of the cylindrical portion, brake means for each drum each normally engageable with the cylindrical portion of one of the drums to prevent drum

rotation in a direction opposite to that of the shaft while allowing rotation of the drum with the shaft, clutch means at the ends of the shaft and said outer side of each drum for selectively connecting the shaft in driving relation with each drum, each cover being removable to expose the clutch means of one of the drums for servicing of the clutch means and removal and replacement of the brake means of said one drum axially past the drum and clutch means, operating means selectively movable to effect engagement and disengagement of the clutch means of each drum, release means selectively operable to disengage the brake means of each drum, and means for effecting selective operation of the clutch operating means and brake release means of each drum to engage the clutch means during engagement of the brake means and to disengage the brake means during disengagement of the clutch means.

3. A tractor power winch unit comprising a casing, a hollow main shaft in the casing, a drum rotatable on the main shaft, brake means engageable with one side of the drum to prevent rotation of the drum opposite to that of the main shaft while allowing rotation thereof with the main shaft, clutch means at the other side of the drum engageable for rotating the drum with the main shaft, operating means movable for engaging and disengaging the clutch means, a transfer shaft fixed for rotation with the main shaft and axially shiftable therein for moving the clutch operating means, threaded means operatively connected to and rotatable for axially shifting the transfer shaft, a rock shaft, a lever fixed on the rock shaft, cooperable gear members on said threaded means and said lever for turning the threaded means upon rocking of the lever, release means fixed on the rock shaft operable to disengage the brake means from the drum, linkage means movable in opposed directions from a neutral position corresponding to clutch-disengaged brake-engaged condition of the drum for oscillating the rock shaft and including an arm fixed on the rock shaft, biasing means for returning the linkage means to the neutral position from a moved position, a cam follower on the linkage means, a cam engaging the cam follower, control means for moving the cam with the follower to move the linkage means in one direction from neutral position for turning the rock shaft to rock said lever and cause engagement of the clutch means while leaving the brake means engaged and to move the linkage means in the opposite direction from neutral position for turning the rock shaft to operate the release means for disengaging the brake means while leaving the clutch means disengaged and to effect a toggle lock of the cam with the follower upon linkage means movement to a predetermined position in said opposite direction for preventing return from brake-disengaging position, a fairlead in closely spaced relation to said casing including a projection on the casing, a pair of sheave brackets with axially apertured circular bases swiveled back to back in the projection on a common axis, a sheave journaled in each bracket on an axis spaced from the swivel axis by the pitch radius of the sheave, and a cable windable on the drum reeved about said sheaves, and means for operating the main shaft from a power unit of the tractor.

4. A tractor power winch unit comprising a casing, a main shaft in the casing, a drum rotatable on the main shaft, brake means engageable with one side of the drum to prevent rotation thereof in the direction opposite to that of the main shaft while allowing drum rotation with the main shaft, clutch means at the other side of the drum engagable to establish a drive connection of the main shaft and drum, operating means movable to effect engagement and disengagement of the clutch means, shiftable means for moving the clutch operating means, a pivoted lever, cooperable gear members on said shiftable means and said lever to shift the shiftable means for engaging and disengaging the clutch means upon rock-

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ing of the lever; release means fixed relative to the lever operable to disengage the brake means from the drum, linkage means for oscillating the lever selectively movable in one direction from a neutral position corresponding to clutch-disengaged brake-engaged condition of the drum to turn the lever for engaging the clutch means while leaving the brake means engaged and in the opposite direction from said neutral position to turn the lever for operating said release means to disengage the brake means while leaving the clutch means disengaged, said linkage means including an arm fixed relative to the lever, biasing means for returning the linkage means from a moved position to the neutral position, and a cam follower on the linkage means, a cam engaging the cam follower, control means for moving the cam with the follower to move the linkage means in either of said directions and effecting a lock of the cam with the follower upon predetermined linkage means movement in said opposite direction to prevent return of the linkage means from brake-disengaging position, a fairlead mounted in closely spaced relation on the casing including a pair of sheave brackets with axially apertured bases swiveled back to back on a common axis in a casing projection, a sheave journaled in each bracket on an axis spaced from the swivel axis by the pitch radius of the sheave, and a cable reeved about said sheaves and windable on the drum.

5. A tractor power winch unit comprising a casing, a main shaft in the casing, a drum rotatable on the main shaft, brake means engageable with one side of the drum to prevent rotation thereof opposite to that of the main shaft while allowing drum rotation with the main shaft, clutch means at the other side of the drum engageable to establish a drive connection of the main shaft and drum, actuating means movable to effect engagement and disengagement of the clutch means, a rocking lever operatively connected with the clutch actuating means for movement thereof, release means fixed relative to the lever operable to disengage the brake means from the drum, linkage means for oscillating the rock shaft movable in opposite directions from a neutral position corresponding to clutch-disengaged brake-engaged condition of the drum and including an arm fixed relative to the lever, biasing means for returning the linkage means from a moved position to the neutral position, and a cam follower on the linkage means, a cam engaging the cam follower, control means for moving the cam with the follower to move the linkage means in one direction from neutral position for rocking said lever for engagement of the clutch means while the brake means are engaged and to move the linkage means in the opposite direction from the neutral position for turning the lever to operate the release means for disengagement of the brake means while the clutch means are disengaged and upon linkage means movement in said opposite direction to a predetermined position to effect a locking of the cam with the follower for preventing return of the linkage means from brake-disengaging position, a fairlead in closely spaced relation to said casing including a projection on the casing, a pair of sheave brackets with apertured bases swiveled back to back in said projection on a common axis, a sheave journaled in each bracket on an axis spaced from the swivel axis by the pitch radius of the sheave, a cable windable on the drum reeved about said sheaves with the pitch line between the sheaves substantially coincident with said swivel axis, and means connecting the main shaft with a tractor power unit for rotation thereby.

6. A winch construction comprising a hollow main shaft, a cable drum rotatable on the main shaft, a braking surface at one side of the drum, brake means normally engageable with the braking surface to prevent drum rotation in the direction opposite to that of the main shaft while allowing rotation thereof with the main shaft, clutch means at the other side of the drum engageable to establish a drive connection of the main shaft and drum, oper-

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ating means movable for engagement and disengagement of the clutch means, a transfer shaft in the main shaft fixed for rotation therewith and axially shiftable therein to move said clutch operating means, rotatable threaded means operatively connected to the transfer shaft for axial shifting thereof, a rock shaft, a lever fixed on the rock shaft, cooperable gear members on said threaded means and said lever for turning the threaded means upon rocking of the lever, release means fixed on the rock shaft operable to disengage the brake means from said braking surface, linkage means for oscillating the rock shaft movable in opposed directions from a neutral position in which engagement of the brake means and disengagement of the clutch means are effected and including an arm fixed on the rock shaft, biasing means for returning the linkage means to said neutral position from a moved position, a cam follower on the linkage means, a cam engaging the cam follower, and control means for moving the cam with the follower to move the linkage means in one direction from said neutral position for turning the rock shaft to rock the lever for engaging the clutch means while leaving the brake means engaged and to move the linkage means in the opposite direction from the neutral position for turning the rock shaft to operate said release means for disengaging the brake means from said braking surface while leaving the clutch means disengaged, said cam having a surface portion engaging in toggle lock relation with said follower upon linkage means movements in said opposite direction to a predetermined position to prevent return of the linkage means from said brake-disengaging position.

7. A winch construction comprising a hollow main shaft, cable drum rotatable on the main shaft, brake means normally engageable with the drum to prevent rotation thereof in a direction opposite to that of the main shaft while allowing rotation thereof with the main shaft, clutch means at the other side of the drum operable to hold the drum for rotation with the main shaft, operating means movable for engagement and disengagement of the clutch means, a transfer shaft in the main shaft fixed for rotation therewith and axially movable to move said clutch operating means, shiftable means for moving the transfer shaft axially, a pivoted lever operatively connected to the shiftable means, release means fixed relative to the lever operable to disengage the brake means from the drum, linkage means for oscillating the lever and movable in opposed directions from a neutral position in which disengagement of the clutch means and engagement of the brake means are effected and including an arm fixed relative to the lever and release means, biasing means for returning the linkage means to the neutral position from a moved position, a cam follower on the linkage means, a cam engaging the cam follower, and control means for moving the cam with the follower to move the linkage means in one of said directions from neutral position for turning said lever for causing engagement of the clutch means while leaving the brake means engaged and to move the linkage means in the other of said directions from neutral position for turning said release means for causing disengagement of the brake means while leaving the clutch means disengaged, said cam having a surface portion locking with the follower upon movement of the linkage means in said other direction to a predetermined position to prevent return of the linkage means from brake-disengaging position.

8. A winch construction comprising a main shaft, a cable drum rotatable on the main shaft, brake means normally holding the drum against rotation in the direction opposite to that of the main shaft while permitting rotation thereof with the main shaft, clutch means operable to establish a driving connection of the main shaft and drum, clutch actuating means movable to effect engagement and disengagement of the clutch means, a rocking lever operatively connected with the clutch actuating means to cause movement thereof, release means

fixed relative to the lever operable to disengage the brake means from the drum, linkage means movable in opposite directions from a neutral position corresponding to clutch-disengaged brake-engaged condition of the drum for oscillating the lever and release means and including an arm fixed relative to the lever and release means, biasing means for returning the linkage means from a moved position to said neutral position, a cam follower, a pivoted cam engaging the cam follower, and control means for swinging the cam with the follower to move the linkage means in one direction from said neutral position for turning said lever for moving the clutch actuating means to engage the clutch means while leaving the brake means engaged and to move the linkage means in the opposite direction from the neutral position for turning the release means for disengaging the brake means while leaving the clutch means disengaged, said cam having a surface engaging said follower in locking relation upon movement of the linkage means in said opposite direction to a predetermined position to prevent movement of the linkage means from brake-disengaging position.

9. A winch construction comprising a shaft, a cable drum rotatable on the shaft, brake means normally holding the drum against rotation opposite to the direction of shaft rotation while allowing drum rotation with the shaft, clutch means operable to provide driving engagement of the shaft with the drum, clutch actuating means movable for effecting engagement and disengagement of the clutch means, a pivoted lever operatively connected with the clutch actuating means to cause movement thereof, release means in fixed relation to the lever operable to disengage the brake means from the drum, biasing means normally urging the lever and release means to a normal position corresponding to disengagement of the clutch means and engagement of the brake means, a cam follower on the lever, a cam engaging the cam follower, and control means for selectively moving the cam to swing the lever and release means in one direction from normal position for engagement of the clutch means while leaving the brake means engaged and in the other direction from normal position for disengagement of the brake means while leaving the clutch means disengaged, said cam having a surface portion engaging the follower in locking relation upon movement of the lever in said other direction into a predetermined angular relation with the cam to hold the lever against return from brake-disengaging position by the biasing means.

10. A winch construction comprising a shaft, a cable drum rotatable on the shaft, brake means normally holding the drum against rotation opposite to the direction of shaft rotation while allowing drum rotation with the shaft, clutch means operable to provide driving engagement of the shaft with the drum, clutch actuating means movable for effecting engagement and disengagement of the clutch means, a pivoted lever operatively connected with the clutch actuating means to cause movement thereof, release means in fixed relation to the lever operable to disengage the brake means from the drum, a pivoted member, link means connecting the pivoted member and lever, biasing means normally urging the pivoted member, lever, and release means to a normal position corresponding to disengagement of the clutch means and engagement of the brake means, a cam follower on the pivoted member, a cam engaging the cam follower, and control means for selectively moving the cam to swing the pivoted member in one direction from normal position for rocking the lever and release means for engagement of the clutch means while leaving the brake means engaged and in the other direction from normal position for rocking the lever and release means for disengagement of the brake means while leaving the clutch means disengaged, said cam having a surface portion engaging the follower in locking relation upon movement of the pivoted member in said other direction into a pre-

determined angular relation with the cam to prevent return of the pivoted member from brake-disengaging position by the biasing means.

11. A winch construction comprising a main shaft, a cable drum rotatable on the main shaft, brake means for the drum, clutch means engageable for drivingly connecting the main shaft and drum, clutch actuating means movable to effect engagement and disengagement of the clutch means, a lever operatively connected with the clutch actuating means for movement thereof and pivoted for swinging in one direction to effect engagement of the clutch means and in the opposite direction to effect disengagement thereof, linkage means for oscillating the lever having a neutral position corresponding to disengaged condition of the clutch means and including an arm fixed relative to the lever, biasing means for returning the linkage means to neutral position upon movement thereof, means for moving the linkage means in one direction from neutral position to swing the lever for causing clutch engagement and in the other direction from neutral position to bring the linkage means to a predetermined locking position for holding the clutch means disengaged, and lock means for locking the linkage means in said predetermined position against return by the biasing means including a cam movable by said moving means and a cam follower on the linkage means engageable in locking relation by the cam upon linkage means movement to said predetermined position.

12. A winch construction comprising a shaft, a cable drum rotatable on the shaft, clutch means operable for establishing and disestablishing a driving connection of the shaft and drum, brake means normally engageable with the drum to prevent drum rotation in the direction opposite to that of the shaft while allowing rotation thereof with the shaft, a rockable brake release lug swingable in one direction for contacting a portion of the brake means to move the brake means into disengagement from the drum, linkage means movable for oscillating the lug having a neutral position corresponding to engaged condition of the brake means and including an arm fixed relative to the lug, biasing means for returning the linkage means to neutral position upon movement thereof, means for moving the linkage means in a direction from neutral position to swing the lug for causing disengagement of the brake means and to a predetermined locking position for holding the brake means disengaged, and lock means for locking the linkage means in said predetermined position against return by the biasing means including a cam movable by said moving means and a cam follower on the linkage means engageable in locking relation by the cam upon linkage means movement to said predetermined position.

13. In a winch construction including a shaft, a cable drum rotatable on the shaft, clutch means operable to provide driving engagement of the shaft with the drum, clutch actuating means for effecting engagement and disengagement of the clutch means, brake means normally engageable with the drum to prevent rotation of the drum opposite to the direction of shaft rotation while allowing drum rotation with the shaft, release means for disengaging the brake means from the drum, means for selectively operating the clutch actuating means and brake release means movable to cause engagement of the clutch means while leaving the brake means engaged and to cause disengagement of the brake means while leaving the clutch means disengaged and including a pivoted member, and biasing means for return movement of the operating means upon an operating movement thereof, a lock for holding the operating means in brake-disengaging position comprising a cam follower on said pivoted member and a pivoted cam engaging the follower to effect movement of the operating means to brake-disengaging position, said cam having a surface portion extending generally radially of the pivotal axis thereof engaging the follower to rotate the pivoted member for brake-

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disengaging movement of the operating means upon swinging of the cam in one direction and also having an end surface portion defining an acute angle with the radial surface portion and engaging the follower upon swinging of the cam and pivoted member to a predetermined angular relation to cock the cam and member against return movement by a biasing means with the follower urged against said end surface portion in wedging relation by the biasing means.

14. In a winch construction including a shaft, a cable drum rotatable on the shaft, clutch means operable to provide driving engagement of the shaft with the drum, clutch actuating means for effecting engagement and disengagement of the clutch means, brake means normally engageable with the drum to prevent rotation of the drum opposite to the direction of shaft rotation while allowing drum rotation with the shaft, release means for disengaging the brake means from the drum, means for operating the clutch actuating means and brake release means selectively movable to cause engagement of the clutch means while leaving the brake means engaged and to cause disengagement of the brake means while leaving the clutch means disengaged and including a pivoted member, and biasing means for returning the operating means upon movement thereof, a toggle lock for holding said operating means in a brake-disengaging position comprising a cam follower on said pivoted member and a pivoted cam swingable by movement of the operating means to said brake-disengaging position in engagement with the follower, said cam having a surface portion extending generally radially of the pivotal axis thereof to engage the follower in swinging of the cam and an end surface portion defining an acute angle with the radial surface portion to engage the follower upon swinging of the cam and pivoted member to a predetermined angular relation in movement of the operating means to brake-disengaging position for cocking the cam and member to prevent return movement of the operating means by the biasing means, the biasing means urging the pivoted member toward return to press the follower against said end surface portion in wedging relation.

15. In a winch construction including a shaft, a cable drum rotatable on the shaft, clutch means operable to establish and disestablish a driving connection of the shaft and drum, clutch actuating means movable for effecting engagement and disengagement of the clutch means, brake means normally engageable with the drum to prevent rotation of the drum opposite to the direction of shaft rotation while allowing drum rotation with the shaft, release means movable to disengage the brake means from the drum, shift means for moving said clutch actuating means, linkage means operatively connected with said release means and shift means having a normal position corresponding to clutch-disengaged brake-engaged condition of the drum and movable in opposed directions from normal position for selective operation of the release means and shift means, biasing means for returning the linkage means to normal position upon movement thereof, and means for moving the linkage means in one direction from normal position to cause engagement of the clutch means while leaving the brake means engaged and in the other direction from normal position to cause disengagement of the brake means while leaving the clutch means disengaged, a cam movable by said moving means, and a cam follower on a pivoted member of the linkage means, said cam having a surface portion so related to the axis thereof as to engage lockingly with said follower upon movement of the linkage means in said other direction to a predetermined position bringing said pivoted member into a predetermined angular relation with said cam and said cam surface portion and follower effecting a toggle lock of the pivoted member and cam preventing return of

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the linkage means to normal position by said biasing means.

16. In a winch construction including a shaft, a cable drum rotatable on the shaft, clutch means operable to provide driving engagement of the shaft with the drum, clutch actuating means for effecting engagement and disengagement of the clutch means, brake means normally engageable with the drum to prevent rotation of the drum opposite to the direction of shaft rotation while allowing drum rotation with the shaft, release means for disengaging the brake means from the drum, and means for selectively operating said clutch actuating means and said release means to disengage the clutch means while leaving the brake means engaged and to disengage the brake means while leaving the clutch means disengaged and including a pivoted member, a toggle lock for holding said selective operating means in brake-disengaging position comprising a cam follower on said pivoted member, a cam movable upon movement of the operating means to said brake-disengaging position and engaging with said follower, and a surface portion on the cam so related to the axis thereof as to lock with the follower upon relative movement of the pivoted member and cam to a predetermined angular relation upon movement of the operating means to said brake-disengaging position, said cam and pivoted member in said relation effecting a toggle preventing return of said operating means from the brake-disengaging position.

17. In a power winch construction including a cable drum and operating means therefor enclosed in a casing mounted on the rear of a tractor adjacent the control station thereof, a low and compact fairlead structure for a cable to operate equipment drawn by the tractor and windable on said drum comprising a horizontal projection on the casing having an aperture extending between the opposite faces thereof with a beveled edge at each face, a pair of sheaves, a pair of brackets each journaling one of the sheaves and having a circular axially apertured base smaller than said projection aperture with its axis substantially tangent to the pitch line of the sheave, a pair of substantially identical circularly apertured bearing members each rotatably mounting one of the sheave bracket bases therein and spaced only slightly from the sheave, said bearing members being disposed bearing against the projection at opposite faces of said casing projection to locate the bracket bases in back-to-back relation within the projection aperture with the axes thereof in substantially vertical alignment, and a plurality of securing members fastening the bearing members together in clamping relation on said projection with one end of each securing member projecting outwardly of the bearing members, said securing members being arranged in two groups with the projecting ends of one group extending from the upper bearing member and those of the other group extending from the lower bearing member adjacent the junction of the projection and casing to allow maximum swinging of the lower sheave bracket about the swivel axis.

18. In a power winch construction including a cable drum and operating means therefor enclosed in a casing mounted on the rear of a tractor adjacent the control station thereof, a low and compact fairlead structure for a cable to operate equipment drawn by the tractor and windable on said drum comprising a horizontal projection on the casing having an aperture extending between the opposite faces thereof, a pair of sheaves, a pair of brackets each journaling one of the sheaves and having a circular apertured base smaller than said projection aperture with its axis substantially tangent to the pitch line of the sheave, said brackets being disposed with the bases in back-to-back relation in the projection aperture, and a pair of opposed substantially identical apertured members extending into the projection aperture and having flanges bearing on oppo-

site faces of the projection and spaced only slightly from the respective sheaves securing said bracket bases in the projection aperture to swivel about a common substantially vertical axis.

19. In a power winch construction including a cable drum and operating means therefor enclosed in a casing mounted on the rear of a tractor adjacent the control station thereof, a low and compact fairlead structure for a cable to operate equipment drawn by the tractor and windable on said drum comprising a horizontal projection on the casing having an aperture extending between the opposite faces thereof, a pair of sheaves, a pair of brackets each journaling one of the sheaves and having a circular apertured base smaller than said projection aperture with its axis substantially tangent to the pitch line of the sheave, a pair of substantially identical apertured bearing members rotatably mounting the bases of said sheave brackets and bearing on opposite faces of the projection to dispose said bases in back-to-back relation in said projection aperture with their axes substantially aligned vertically.

20. In a power winch construction for mounting on the rear of a tractor adjacent the control station including a casing secured on the tractor enclosing a cable drum and operating means therefor, a fairlead for a cable windable on the drum comprising a horizontal projection on the casing, and a pair of sheave brackets one extending upwardly and the other downwardly from the casing projection each journaling a sheave and having an apertured base swiveled in said projection about a substantially vertical axis common to both brackets, the axis of each sheave being offset from said swivel axis a distance substantially equal to its pitch radius to provide a pitch line between the sheaves substantially coincident with said swivel axis, and the vertical spacing of the sheave axes being only slightly more than the sum of the radii thereof and the combined thickness of the bases.

21. In a winch construction comprising a casing, a main shaft rotatably supported in the casing, a cable drum rotatable on the main shaft, brake means for holding the drum against rotation in a direction opposite to that of the main shaft, clutch means for connecting the drum to the main shaft for rotation therewith, a gear fast on the main shaft, a motor, and a driving pinion meshing with said gear, a shaft for said pinion having one end projecting from the casing in alignment with and connected to a drive shaft of the motor, a closeable aperture in the casing adjacent the other end of the pinion shaft and aligned therewith, and means on said other end of the pinion shaft accessible through said aperture for manually turning the pinion and drive shafts for timing adjustment of the motor.

22. In a winch structure comprising a rotatable shaft mounted in cantilever fashion unsupported adjacent one end, a cable drum rotatably mounted on said shaft at said one end having at the drum side facing axially inwardly relative to said shaft end a cylindrical portion not substantially less in diameter than the drum and also having at the other side a circular clutch mounting not substantially greater in diameter than the drum, said cylindrical portion having an external braking surface for engagement by a band-type brake and said circular clutch mounting providing for clutching of the drum to the shaft, whereby the drum brake and clutch means are spaced apart to facilitate dissipation of heat generated thereby and the brake is movable axially of the shaft past the drum and clutch means.

23. A winch structure comprising a rotatable shaft mounted in cantilever fashion providing a free end thereto, a cable drum rotatably mounted on said shaft, said drum having an annular recessed portion adapted to receive a wound cable therein and defined by spaced radially directed annular side walls, the outer peripheral edge portion of the drum wall spaced the farthest from the free end of said shaft having integrally formed therewith an

axially directed cylinder portion the outer surface of which receives thereabout a band-type brake operable to control rotation of said drum and which is of sufficient diameter to be movable in an axial direction past said drum toward the free end of said shaft, the drum wall nearest the free end of said shaft having mounted operatively thereto an annular clutch assembly received about the free end of said shaft and operable to rotate said drum with said shaft, and a removable housing member received about the free end of said shaft and the elements carried thereby.

24. A winch structure comprising a housing having a rotatable shaft mounted therein in cantilever fashion with the free end thereof extending through an opening in said housing, a cable drum rotatably mounted on said shaft at least substantially outwardly of said housing, said drum having an annular recessed portion adapted to receive a wound cable therein and defined by spaced radially directed annular side walls, the outer peripheral edge portion of the drum wall spaced the farthest from the free end of said shaft having integrally formed therewith an axially directed cylinder portion positioned within said housing, the outer surface of said cylinder portion receiving thereabout a band-type brake operable to control rotation of said drum and which is of sufficient diameter to be movable in an axial direction out of said housing and past said drum toward and beyond the free end of said shaft, the drum wall nearest the free end of said shaft having mounted operatively thereto an annular clutch assembly received about the free end of said shaft and operable to rotate said drum with said shaft, and a removable cover member received about the free end of said shaft and the elements carried thereby and attached to said housing to cover the opening therein.

25. A winch structure comprising a housing having a rotatable shaft mounted therein in cantilever fashion with the free end thereof extending through an opening in said housing, a cable drum rotatably mounted on said shaft at least substantially outwardly of said housing, said drum having an annular recessed portion adapted to receive a wound cable therein and defined by spaced radially directed annular side walls, the outer peripheral edge portion of the drum wall spaced the farthest from the free end of said shaft having integrally formed therewith an axially directed cylinder portion positioned within said housing, the outer surface of said cylinder portion receiving thereabout a band-type brake operable to control rotation of said drum and which is of sufficient diameter to be movable in an axial direction out of said housing and past said drum toward and beyond the free end of said shaft, the drum wall nearest the free end of said shaft having mounted operatively thereto an annular clutch assembly received about the free end of said shaft and operable to rotate said drum with said shaft, the greatest outer diameter of said clutch assembly being less than the greatest inner diameter of said band-type to allow the latter to be movable in an axial direction out of said housing past said clutch assembly and the free end of said shaft, and a removable cover member received about the free end of said shaft and the elements carried thereby and attached to said housing to cover the opening therein.

26. In a power winch construction for use with a tractor and including a cable drum and operating means therefor, a compact fairlead structure for mounting on an end of a tractor to control a cable windable on said drum and connect the same with equipment drawn by the tractor, said fairlead structure including a platform member having a vertically directed opening therethrough, separate bearing assemblies rotatably mounted in said opening one above the other and each having axially aligned cable-receiving central openings extending through, the uppermost bearing assembly having a shaft carrying housing attached to the top surface thereof and rotatable therewith, the top sheave receiving the cable from said drum and passing the same downwardly

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through the cable-receiving openings, the lowermost bearing assembly having a sheave-carrying housing attached to the bottom surface thereof and rotatable therewith, the bottom sheave receiving the cable from the cable-receiving openings and passing the same to said equipment, the cable-feeding portion of the top sheave and the cable-receiving portion of the bottom sheave lying in substantially the same vertical plane along which said cable moves through the cable-receiving openings.

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