

March 29, 1932.

R. L. BROWN

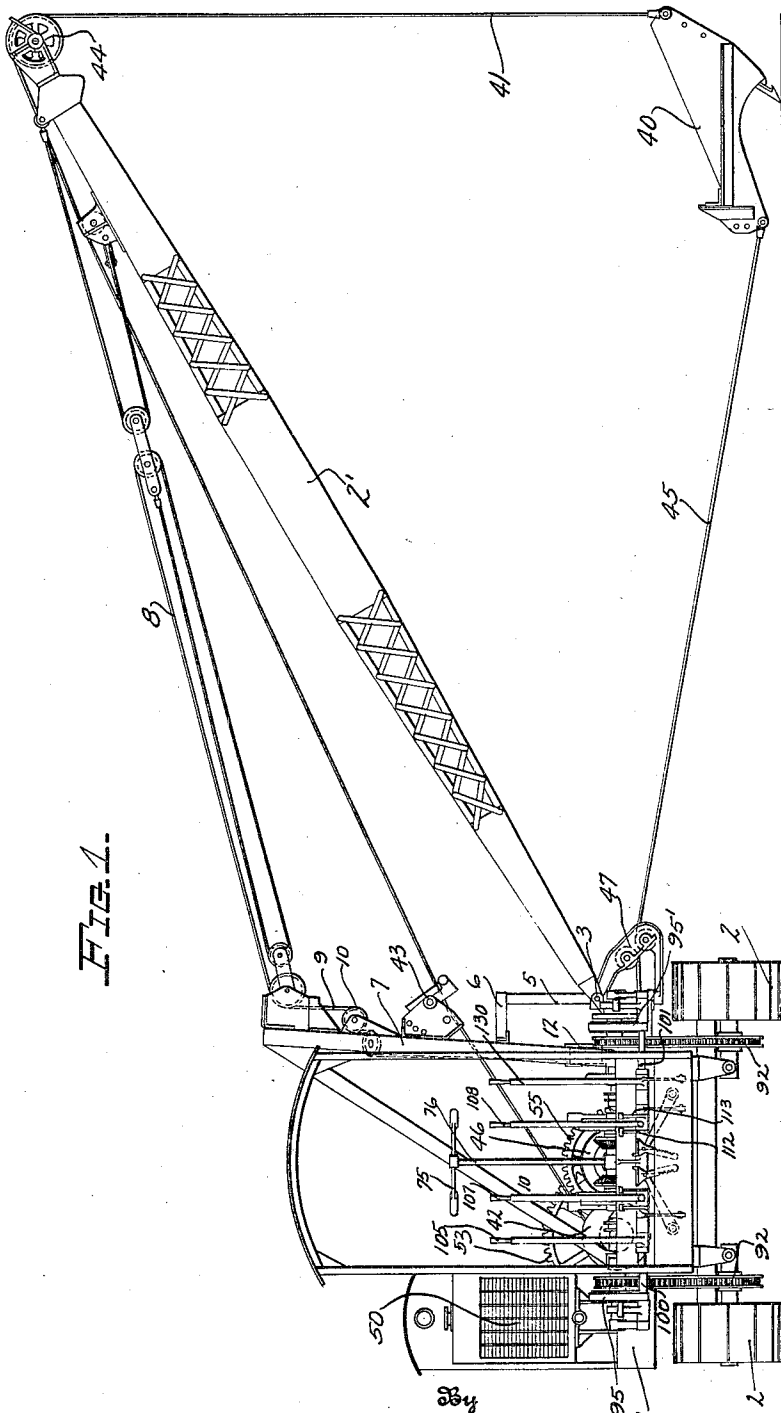
1,851,346

EXCAVATING MACHINERY

Filed March 1, 1929

5 Sheets-Sheet 1

FIG. 1.



Inventor
Robert L. Brown

Bottom, Hudson, Lecky, McKinnon & Michael
Attorney

March 29, 1932.

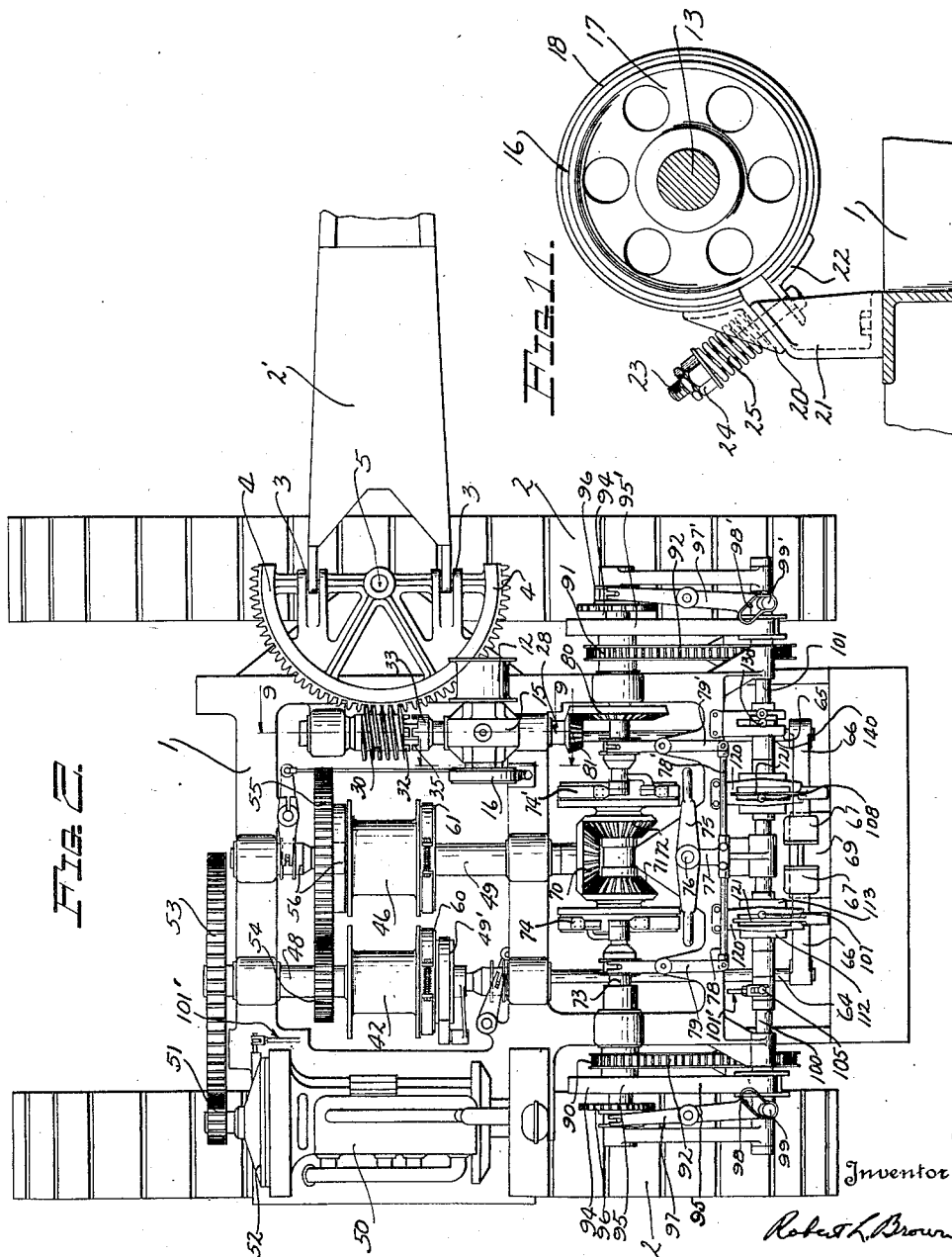
R. L. BROWN

1,851,346

EXCAVATING MACHINERY

Filed March 1, 1929

5 Sheets-Sheet 2



March 29, 1932.

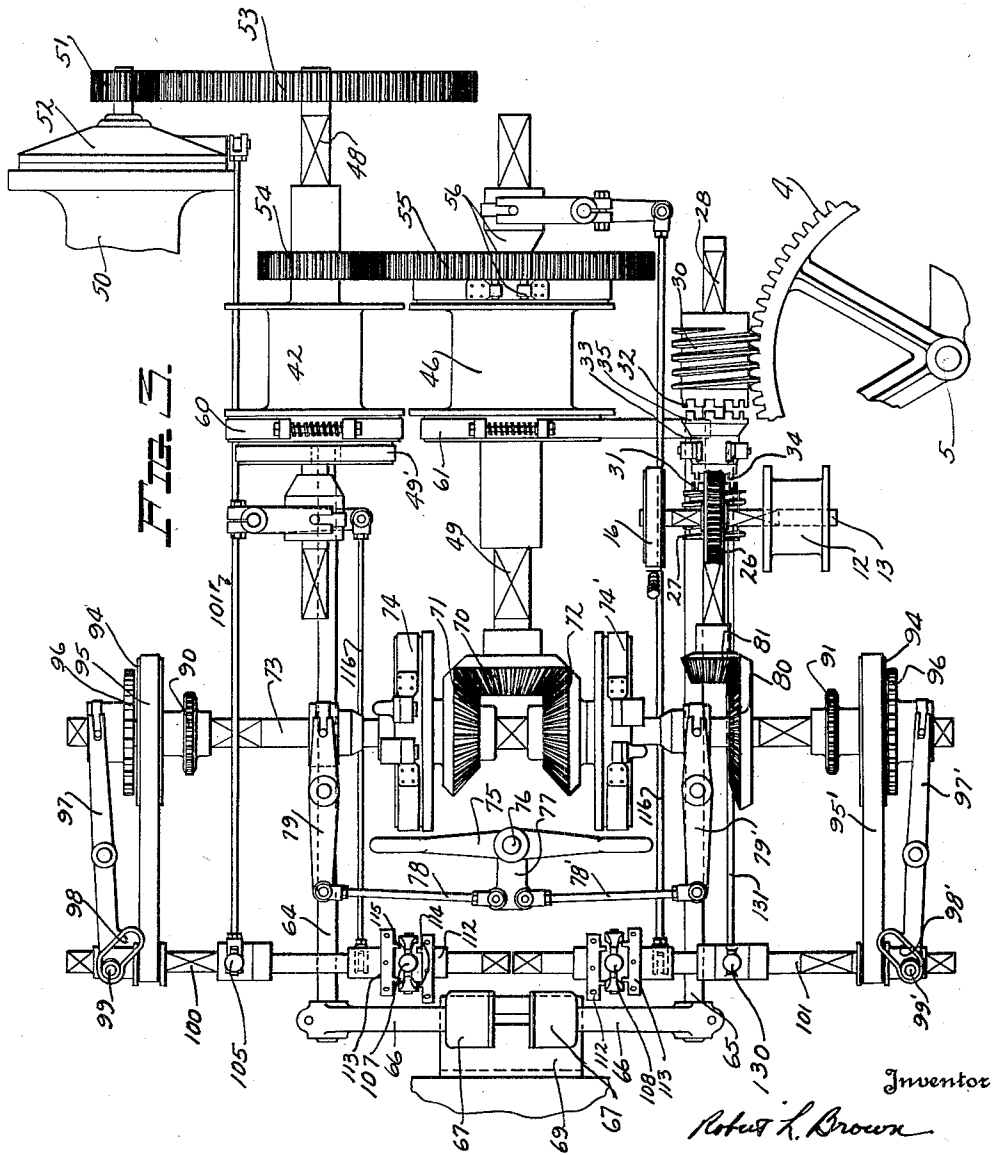
R. L. BROWN

1,851,346

EXCAVATING MACHINERY

Filed March 1, 1929

5 Sheets-Sheet 3



Inventor

Robert L. Brown

34
Rollins, Hendon, Leach, Mc Namara & Wheeler
Attorneys

March 29, 1932.

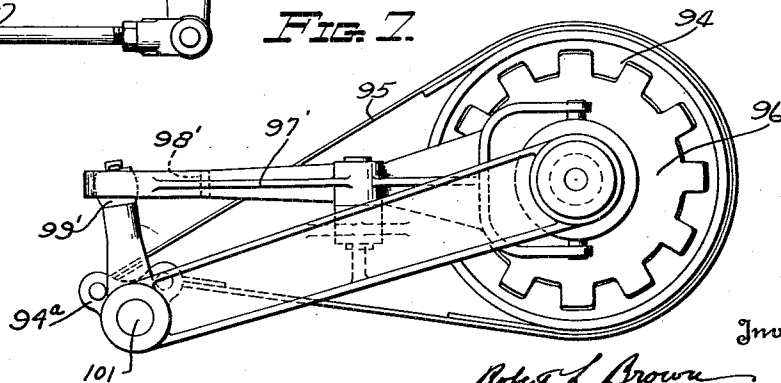
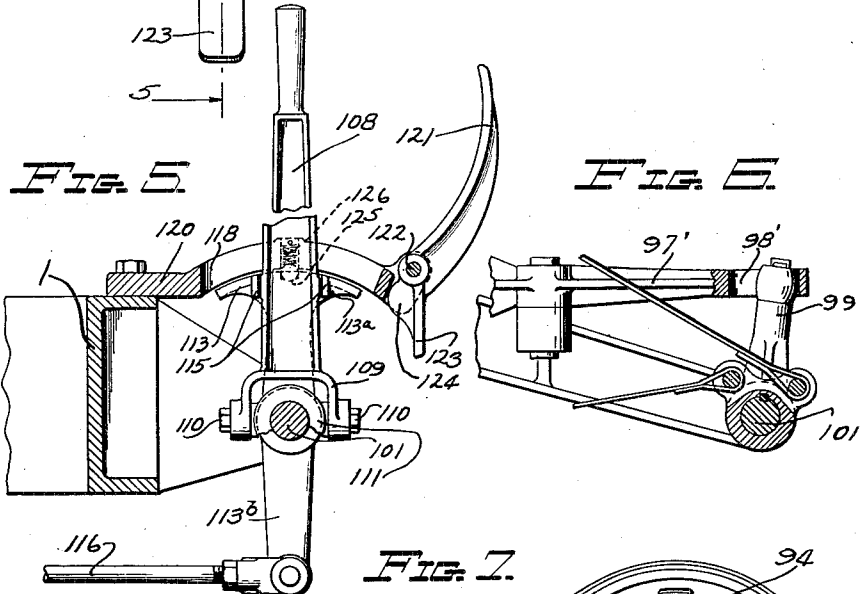
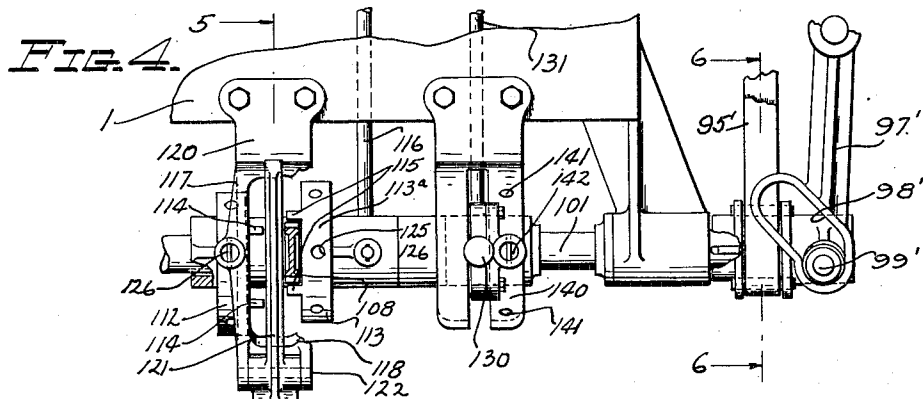
R. L. BROWN

1,851,346

EXCAVATING MACHINERY

Filed March 1, 1929

5 Sheets-Sheet 4



March 29, 1932.

R. L. BROWN
EXCAVATING MACHINERY
Filed March 1, 1929

1,851,346

5 Sheets-Sheet 5

FIG. 8.

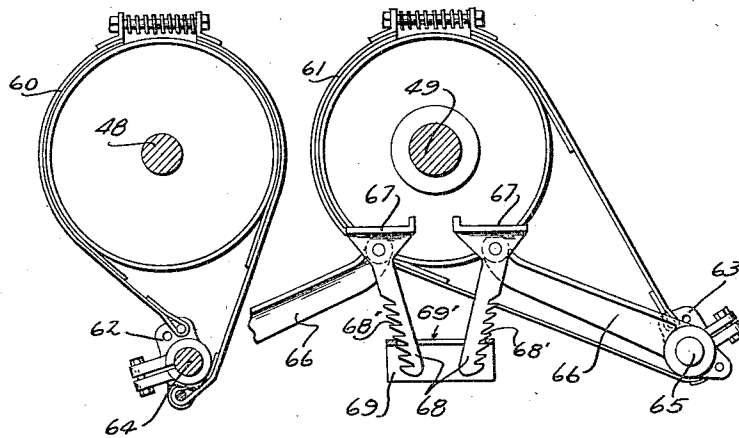


FIG. 9.

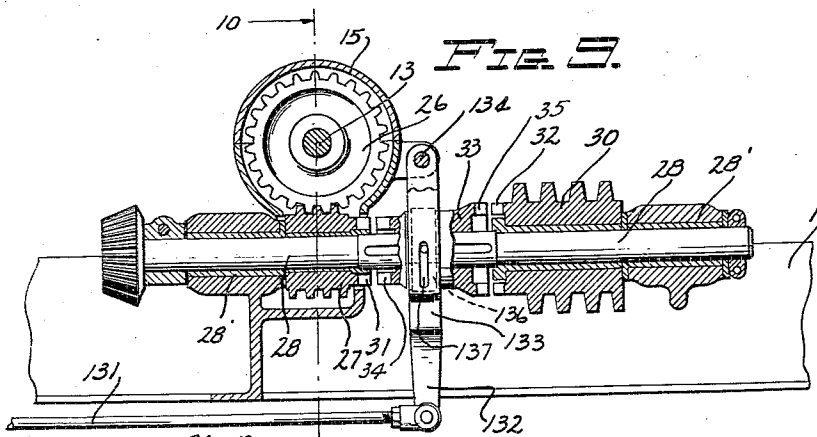
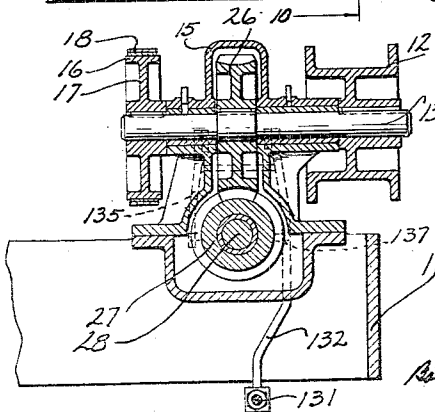


FIG. 10.



Inventor

Robert L. Brown

By *Reuben, Hudson, Leach, MacKinnon and Mitchell*
Attorney

UNITED STATES PATENT OFFICE

ROBERT L. BROWN, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO HARNISCHFEGGER CORPORATION, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN

EXCAVATING MACHINERY

Application filed March 1, 1929; Serial No. 343,612.

This invention relates to excavating machinery of the type primarily designed for use as a backfiller, although also capable of effective use in carrying out other excavating operations and further adapted for employment as a crane.

Machines of this character comprise a frame mounted on suitable traction devices, which are usually in the form of endless traction belts or self-laying tracks. A boom is mounted on the frame for up and down movement and also for horizontal swinging movement. Some means must be provided for hoisting, that is, raising and lowering the boom and holding it in adjusted position, and further, mechanism must be provided for swinging the boom horizontally. Where the machine is employed as an excavator, as, for instance, a backfiller, a hoist line is extended out over the boom and is connected to a scraper or scoop and the scraper also has a dragline connected thereto. These lines are controlled respectively from a hoist line drum and a dragline drum mounted on the frame and driven from a suitable power plant such as internal combustion engine. The drive of the drums, the drive for the traction devices, the drive for the boom hoisting and swinging mechanism and a control of the drives for these several instrumentalities presents a serious and difficult problem because all of these instrumentalities must be selectively driven and except for the drums must be reversely driven.

In carrying out these operations prior machines of this type have utilized complicated and loosely organized mechanisms lacking in the desirable features of durability and reliability and requiring for the control of the operations a multiplicity of hand control levers as well as foot levers or pedals, all of which had to be manipulated by the operator when the machine was in operation. Because of the difficulty in controlling such prior machines, they are slow in operation.

Further, they frequently break down and by reason of the complication of the mechanism and the inaccessibility of the parts thereof, are difficult to repair or recondition.

One of the principal objects of the present invention is to provide a simple and compact mechanism for selectively driving the drums and for selectively or simultaneously driving the traction devices either forwardly or reversely and for selectively and reversely driving the boom hoist and boom swinging mechanism. The means employed for this purpose is so organized and consolidated and the control mechanism associated therewith is so constituted that only four control levers are utilized ordinarily during the operation of the machine as a backfiller. In carrying out this feature, a single control lever selectively controls the drive of one of the drums and the drive of one of the traction devices. Further, a single control lever selectively regulates the action of the boom hoist mechanism and the boom swinging mechanism. The reversing of the drive for the traction devices and of the drive for the boom hoisting and boom swinging mechanism is effected by a single reversing mechanism under the control of a single lever. The only other hand lever employed controls the main clutch of the motor. The brakes organized with the drums are operated from foot pedals. The levers required to be manipulated to operate the machine are conveniently grouped in front of the operator within easy reach and have a straight forward and backward pull.

Another important feature of the invention resides in the provision of a machine of this character in which the shafting, gearing, clutches, brakes, etc., constituting the mechanism for driving the drums, the traction devices and the boom hoisting and swinging mechanism, are organized with a single piece cast steel frame and are located at practically the same horizontal level so as to be readily

accessible for all purposes and so as to insure permanent alinement and durability along with reliable operation throughout the life of the machine.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings, forming a part of this specification, and in which:

Figure 1 is a view in end elevation showing a backfiller embodying the present invention;

Figure 2 is a fragmentary view in top plan showing the main frame of the backfiller and the parts carried thereby, and also a portion of the boom, parts being omitted for the sake of illustration;

Figure 3 is a diagrammatic plan view similar to Figure 2 but omitting the frame and the bearings and other parts to illustrate how the control levers are connected up with the various instrumentalities;

Figure 4 is a fragmentary plan view of one side of the rear or control end of the backfiller with parts broken away and parts shown in section for the sake of illustration;

Figure 5 is a fragmentary view taken on line 5—5 of Figure 4;

Figure 6 is a similar view taken on line 6—6 of Figure 4;

Figure 7 is a fragmentary view in elevation looking toward the left in Figure 4 but illustrating one of the traction clutches and brakes;

Figure 8 is a fragmentary view partly in end elevation and partly in transverse vertical section showing how the foot pedals are connected up with the brakes for the hoist line and dragline drums;

Figure 9 is a view partly in elevation and partly in section taken in the plane of line 9—9 of Figure 2 and illustrating the drive for the boom swinging and boom hoisting mechanism;

Figure 10 is a view in section taken on line 10—10 of Figure 9; and

Figure 11 is a detail view in elevation showing the brake employed for holding the boom hoisting drum in adjusted position.

Referring to the drawings and more particularly to Figures 1 and 2, the numeral 1 designates generally the frame of the backfiller which is of single piece cast steel construction and which is supported in a conventional manner upon traction devices 2 which may be endless flexible belts or self-laying tracks. At one side of the frame 1 the boom 2' is mounted, the foot of the boom being connected by horizontal pivots 3 to a worm gear segment 4, the worm gear segment being supported on the frame 1 and being constrained to rotary movement by means

of a pivot shaft 5, the lower end of which is connected to the frame and the upper end of which is fixed to a bracket 6 secured to the A-frame 7 of the machine. The boom 2' may be raised and lowered vertically about the pivots 3 but these pivots 3 are so constituted that when the worm gear segment 4 is turned the boom 2' will be constrained to swing horizontally therewith.

Boom hoisting and swinging mechanism

The boom 2' is raised and lowered and is held in adjusted position by means of hoisting tackle 8 which may be of any appropriate form and which is interposed between the outer end of the boom and the upper end of the A-frame 7. The hoisting tackle 8 has a boom hoist line 9 reeved around guide pulleys 10 on the A-frame and extended down to a boom hoist drum 12 fixed to one end of a shaft 13 rotatably supported in bearings provided therefor in a casing 15 securely bolted down onto the main frame 1. The shaft 13 and consequently the drum 12 and the boom 2' are maintained in any adjustment by a constantly acting brake designated generally at 16 and which is shown in Figures 10 and 11. It comprises a drum 17 fixed to the end of the shaft 13 opposite the hoist drum 12 and engaged by a brake band 18. The brake band 18 has a lug 20 at one end fixed to a bracket 21 bolted to the main frame 1, and has a lug 22 at its other end engaged by a sliding bolt 23 which passes through an opening in the lug 20 and bracket 21 and which has a nut 24 mounted thereon and engaged with one end of a spring 25, the other end of the spring abutting against the lug 20. The spring 25 is under compression and contracts the band 18 around the drum 17. The shaft 13 is rotated in either direction by means of a worm wheel 26 fixed therein and meshing with a worm 27 loosely mounted on a shaft 28 mounted in suitable bearings 28' provided on the main frame 1 and reversely driven in a manner which will hereinafter more clearly appear.

On this same shaft 28 a second worm 30 is also loosely mounted and meshes with the worm gear segment 4 on which the boom is supported. While the worms 27 and 30 are freely rotatable relative to the shaft 28 they are held against axial displacement along this shaft as will appear from Figure 9. Moreover, the worms 27 and 30 are spaced along the shaft and their confronting ends are formed with clutch jaws designated at 31 and 32, respectively. In between the worms 27 and 30 a sliding clutch member 33 is splined to the shaft 28, that is, it is constrained to rotate with the shaft 28 although freely slidable along the shaft. The ends of this clutch member 33 are formed with clutch jaws 34 and 35 engageable respectively with

the clutch jaws 31 and 32 of the worms 27 and 30.

Mechanism for operating and controlling scraper

As illustrated in Figure 1, a scraper 40 is provided where the machine is used as a back-filler. The scraper 40 is connected to one end of a hoist line 41 which has its opposite end secured to and wrapped around a hoist line drum 42. After leaving the drum 42 the hoist line 41 extends through a hoist line fair lead 43 supported on the A-frame and which may be constructed in accordance with the disclosure of the application of Frank E. Brown for hoist line fair leads, filed January 21, 1928, Serial Number 248,288. Beyond the fair lead 43 the hoist line 41 extends along and over the boom and around a pulley 44 at the outer end of the boom and thence down to the scraper 40. A drag line 45 is also provided for the scraper 40 and has one end connected to the scraper and its opposite end secured to and wrapped around a dragline drum 46 mounted on the frame 1, the intermediate portion of the dragline passing through the fair lead 47 which may be constructed in accordance with the disclosure of Robert L. Brown for dragline fair leads, filed January 21, 1928, Serial Number 248,287.

Drums 42 and 46 are rotatably supported on drum shafts 48 and 49, respectively. The drum 42 may be clutched to its shaft by virtue of the provision of a friction band type clutch 49' of conventional construction carried by a spider fixed to rotate with the shaft 48 and engaging a flange of the drum 42. The shaft 48 is driven from the power plant, which may be an internal combustion engine 50 by means of a pinion 51 driven from the engine through a conventional clutch 52 and meshing with a large gear wheel 53 fixed to one end of the shaft 48. The shaft 49 is driven at a reduced speed from the shaft 48 by means of intermeshing gear wheels 54 and 55 fixed to the shafts 48 and 49, respectively. This arrangement is advantageous as it provides for the desirable difference in the speed and power ratio in the drives of the dragline drum and the hoist line drum. A conventional clutch 56 of the friction band type is carried by the gear wheel 55 and engages a flange of the drum 46 so that when desired the drum 46 may be driven with the gear wheel 55 and the shaft 49. The clutches 49 and 56 are of the type illustrated in detail in the patent to Lewis Wehner, 1,570,108, granted January 19, 1926, for excavator cranes.

For holding the drums 42 and 46 against movement, or for retarding their movement when desired, brake bands 60 and 61 are provided and encircle flanges formed on the ends of the drums 42 and 46, respectively. (compare Figures 2 and 8), the bands 60 and

61 being connected respectively to brake operators 62 and 63 fixed or clamped to brake shafts 64 and 65 extending lengthwise of the machine and back to the operator's platform where they have operating arms 66 secured thereto and carrying pivoted foot pedals 67. The arms 66 extend toward each other and the foot pedals 67 are located in close proximity. As shown in Fig. 8, each foot pedal has a depending latch arm 68, the latch arm 68 operating through a slot 69' in a keeper plate 69 fixed to the frame of the machine. Teeth 68' on the latch arms 68 are engageable with the shoulders or abutments presented by the ends of the slots. With this arrangement the operator may depress either pedal 67 to apply the brake controlled thereby and may then tilt the pedal on its arm 66 to engage the teeth of the latch arm carried by the pedal with the shoulder on the keeper plate, thereby releasably locking the brake applied. To release the brake the operator merely presses down on the foot pedal and reversely tilts the same to disengage the teeth of the latch arm from the shoulder of the keeper plate.

Reversing mechanism for traction drive and drive for boom hoist and swing mechanisms

One of the drum shafts, preferably the shaft 49, is extended rearwardly as shown in Figure 3 and at its free end has a beveled pinion 70 fixed thereto. The pinion 70 meshes with oppositely disposed pinions or gears 71 and 72 loosely mounted on a transverse shaft 73 but selectively clutched thereto by means of conventional friction clutches designated at 74 and 74'. Obviously, when the clutch 74 is thrown in to connect the pinion 71 to the shaft 73 then the shaft 73 will be driven in one direction whereas when the clutch 74 is thrown out and clutch 74' thrown in the shaft 73 will be oppositely or reversely rotated. For purpose of coordinately actuating the clutches, a double arm control lever 75 is provided and is fixed to the upper end of a vertical shaft 76. The lower end of this shaft 76 carries a crank arm 77 which connects through connecting rods 78 and 78' with clutch shifters 79 and 79', the latter being connected to the operating mechanism for the clutches 74 and 74', respectively. When the control lever 75 is swung in one direction, as for instance in a clockwise direction as viewed in Figure 3, it throws in the clutch 74 and throws out the clutch 74'. Reverse turning of the lever 75 reversely actuates the clutches 74 and 74'.

The shaft 28 which drives the boom hoist and swinging mechanisms is constantly driven from the transverse shaft 73 by means of a beveled gear wheel 80 fixed on the shaft 73 and meshing with a beveled pinion 81 fixed to the rear end of the shaft 28.

The traction drive

The traction drive includes sprocket wheels 90 and 91 loosely mounted on the opposite end portions of the shaft 73 and connected by sprocket chains 92 with the driving sprocket wheels of the endless traction belts. These driving sprocket wheels and their organization with the traction belts 2 are not shown as this is conventional and well known structure. The sprocket wheels 90 and 91 may be simultaneously or selectively clutched to the shaft 73 and either sprocket wheel may be braked to provide for steering movements. The construction which permits of this, forms the subject matter of the copending application of Robert L. Brown for traction steering clutch and brake arrangement, filed February 20, 1928, Serial Number 255,521, and reference is made to such application for a full disclosure of this feature of this machine. For the purposes of the present invention it is sufficient to understand that the sprocket wheels 90 and 91 have combined brake drums and clutch members 94 formed integral therewith or rigidly connected thereto. Brake bands 95 and 95' are engaged with and disengaged from the outer periphery of the members 94 under the control of operators 94^a fixed to and rocked by control shafts 100 and 101 supported for rocking movement in bearings provided on the rear end of the main frame 1. Slidable clutch members 96 coact with the clutch structure of the members 94 under the control of shifters 97 and 97' having cam grooves 98 and 98' receiving studs 99 and 99'. When either of the shafts 100 or 101 are rocked in a counter-clockwise direction, as viewed in Figure 7, they will release their associated clutches and apply their associated brakes and when oppositely moved will release the brakes and apply the clutches. The shafts 100 and 101 are, however, supported for independent movement so that on one side of the machine the clutch of the traction drive can be thrown out and the brake applied while on the other side the clutch is thrown in and the brake released whereby to effect steering. As far as this mode of operation is concerned, however, it does not per se constitute any part of this invention as is being claimed in the copending application of Robert L. Brown, Serial Number 255,521, above referred to. The present application in this respect is concerned only with the simplified control mechanism for effecting this and other operations.

Control lever mechanism

A simplified control lever mechanism is mounted on the shafts 100 and 101 and includes a hand lever 105 loosely mounted on the shaft 100 and connected by a rod 101' to the operating mechanism of the main clutch

52. In addition to the hand lever 105, a hand lever 107 is mounted on the shaft 100 and a similar hand lever 108 is mounted on the shaft 101. The hand lever 107 is adapted to operate the clutch 49' controlling connection of the drum 42 with its shaft 48 and this same control lever 107 may be utilized to impart rocking movement to the shaft 100 and thereby regulate the action of the traction steering clutch and brake arrangement on the left hand side of the machine. The control lever 108 is mounted on the shaft 101 and coacts with the clutch 56 of the dragline drum 46 and the traction steering clutch and brake arrangement on the right hand side of the machine. As the construction of the hand levers and the means which adapts them to perform their dual purpose is identical, a detail illustration of one of the hand levers will serve for both. Thus, as shown in Figure 5, the lower end of each of these hand levers is bifurcated as at 109 and is pivoted for transverse tilting by means of trunnions 110 projecting from diametrically opposite portions of a collar 111 rotatably supported on its control shaft. On the opposite sides of the hand lever 109, crank arms 112 and 113 are arranged (see Figures 1, 3 and 4). The crank arms 112 is a single arm which has its hub fixed to the shaft 101 and which has its face adjacent the lever 108 formed with spaced lugs 114 whereby when the lever is rocked to the left as viewed in Figure 4, it will fit in between the lugs 114 and thus be interconnected with the crank arm 112 and may be rocked forwardly or rearwardly to rotate the shaft 101 and operate the traction steering clutch and brake arrangement. The crank arm 113 is of double arm construction. It has an upwardly projecting arm 113^a formed with lugs 115 similar to the lugs 114 and serving to interconnect the hand lever 108 with the crank arm 113 when the hand lever is tilted to the right, as viewed in Figure 4. The other arm 113^b of the crank arm 113 projects downwardly below the shaft 110, as illustrated in Figure 5, and it is pivotally connected to the rearward end of a connecting rod 116 extending underneath the main frame of the machine and connected at its forward end to the operating mechanism for the clutch 56. The upper ends of the arms 112 and 113 are of arcuate form and travel beneath similarly shaped side members 117 and 118 of a quadrant or bracket designated generally at 120 and secured to and projecting beyond the rear end of the main frame 1. It is through the slot or opening between these side members 117 and 118 of the bracket 120 that the lever 108 extends. In order to prevent accidental disengagement of the lever from the lugs of the crank arm with which it is interconnected, a pivoted guide or retainer 121 is provided, the guide or retainer being pivoted intermediate

its ends as at 122 to ears provided therefor on the rearward end of the bracket 120 and extending longitudinally and centrally of the opening or slot of the bracket when in operative position whereby it prevents accidental transverse tilting of the hand lever. When the hand lever is to be shifted from one crank to the other the guide or retainer 121 is tilted to the position shown in Figure 5, and such tilting may be effected by stepping or pressing down on a pedal or extension 123 integrally formed with the guide or retainer 121 and projecting rearwardly therefrom. A stop lug 124 is also integral with the guide or retainer 121 and engages the rearward end of the bracket to prevent excessive movement of the guide or retainer when it is swung to inoperative position.

For the purpose of releasably holding the crank arms 112 and 113 in adjusted position they have their upper arcuate surfaces formed with spaced recesses 125 or depressions of rounded formation and the side members 117 and 118 of the bracket 120 carry spring projected balls or detents 126 which automatically snap into these recesses whenever they are brought into position therebeneath. The engagement between the spring projecting balls and their recesses is sufficient to hold the parts in any adjustment but does not interfere with the controlling movements.

To the right of the lever 108 a fourth hand lever, designated at 130, is provided, the hand lever 130 being loosely mounted on the shaft 108 and having a downwardly projecting arm pivoted to one end of a connecting rod 131. The forward end of this rod 131 is pivoted to the lower end of an operating arm 132 of a clutch shifter 133 (see Figures 9 and 10). The upper end of this shifter 133 is pivoted as at 134 to the casing 15. The shifter 133 includes not only the elongated arm 132 but also a shorter arm 135 and the arms 132 and 135 straddle a split collar 136 loosely mounted in an annular groove of the clutch member 33 and having laterally projecting pins 137 which extend into slots formed in the arms of the shifter.

The lever 130 operates in the slot of a bracket or quadrant 140 fixed to and projecting beyond the rearward end of the frame 1 and having spaced recesses 141 with which a spring projected ball or detent 142 mounted on one side of the lever 130 coacts whereby to releasably hold the lever 130 in any one of its three adjustments.

Operation

The control of the operation of the machine is facilitated by the convenient grouping of the control levers with an easy reach of the operator who occupies a seat (not shown) just in the rear of the lever assembly and by

the fact that the manipulation of the levers is effected by a straight backward pull or a straight forward push. Ease of operation is further enhanced by the feature of having only two levers, the levers 107 and 108 to control the hoist and dragline drums and also the traction drive.

If the boom is to be swung or raised and lowered, the operator need only properly manipulate the lever 130, as this lever can effect neutral positioning of the clutch 33 or engage the clutch with the worm 30 actuating the boom swinging gear or with the worm 27 actuating the boom hoisting drum. The direction in which the traction drive is actuated, in which the boom is swung horizontally or in which the boom is adjusted vertically is determined by manipulation of the double arm lever 75, as the single reversing mechanism controlled thereby not only effects the traction drive but also the boom swinging and hoisting mechanism.

What I claim is:

1. A machine of the character described comprising traction devices, a frame supported thereon, a boom mounted on the frame for vertical and horizontal swinging movement, mechanism for imparting horizontal swinging movement to the boom, hoist mechanism for the boom, a hoist line extending out over the boom, a scraper connected to the hoist line, a drag line also connected to the scraper, hoist and drag line drums mounted on the frame, shafts on which said drums are rotatably mounted, a power drive for one of said shafts, gearing for transmitting motion from one of the shafts to the other, clutches operable to constrain the drums to rotate with their shafts, a reversing mechanism driven from one of the drum shafts, a traction drive actuated from the reversing mechanism and a common drive for the boom swing mechanism and the boom hoist mechanism actuated from the reversing mechanism.

2. A machine of the character described comprising traction devices, a frame supported thereon, a boom mounted on the frame for vertical and horizontal swinging movement, mechanism for imparting horizontal swinging movement to the boom, hoist mechanism for the boom, a hoist line extending out over the boom, a scraper connected to the hoist line, a drag line also connected to the scraper, hoist and drag line drums mounted on the frame, power drive mechanism for the drums, reversing mechanism actuated from the drum drive mechanism, driving means for the traction devices actuated from said reversing mechanism, and means actuated from the reversing mechanism for selectively driving the boom swinging mechanism and the boom hoist mechanism.

3. A machine of the character described comprising a frame, traction devices at the sides of the frame, a pair of drums mounted

- on the frame, clutch controlled power means for selectively driving said drums, a reversing mechanism actuated from the drum drive, a drive for each of the traction devices including a traction steering clutch and brake arrangement, two control shafts, each control shaft operatively associated with one of the traction steering clutch and brake arrangements, two actuators on each control shaft, one actuator being fixed to its control shaft, the other actuator being loose on the control shaft and connected to one of the drum clutches and a single control lever for the actuators of each shaft, said control lever being selectively engageable with either actuator whereby each control lever is operable to control the clutch of one of the drums or the operation of one of the traction drives.
4. A machine of the character described comprising a frame, a worm gear segment rotatably mounted on the frame, a boom pivoted to the segment so as to be swung horizontally therewith while free to move up and down vertically, a worm meshing with the segment and operable when rotated to turn the segment, boom hoist mechanism including a drum, a worm and worm gear for rotating the drum, a drive shaft on which said worms are rotatably mounted and means for selectively clutching the worms to the drive shaft.
5. A machine of the character described comprising a frame, traction devices at the sides of the frame, a pair of drums mounted on the frame, clutch controlled power means for selectively driving said drums, a drive for each of the traction devices, two control shafts, each control shaft being operatively associated with one of the traction devices, two actuators on each control shaft, one actuator being fixed to its control shaft, the other actuator being loose on its control shaft and connected to one of the drum clutches, and a single control lever on each control shaft selectively engageable with either of the actuators whereby the lever is operable to control the clutch of one of the drums or the operation of one of the traction drives.
6. A machine of the character described comprising a frame, traction devices at the sides of the frame, a boom mounted on the frame for vertical and horizontal swinging movement, hoist mechanism for the boom, swing mechanism therefor, hoist and drag line drums mounted on the frame, clutch controlled power means for selectively driving said drums, a drive for each traction device, a single clutch controlled drive common to the hoist mechanism and swing mechanism, two control shafts, each control shaft being operatively associated with one of the traction drives, two actuators on each control shaft, one actuator being fixed to its control shaft, the other actuator being loose on its control shaft and connected to one of the drum clutches, a single control lever on each control shaft selectively engageable with the actuators of such shaft and operable to control the clutch of one of the drums and the operation of one of the traction drives, and another control lever mounted on one of the control shafts and connected with the clutch of the drive common to the hoist and swing mechanism.
- In witness whereof, I hereto affix my signature.
- ROBERT L. BROWN.