

Feb. 18, 1930.

C. E. DAVIS

1,747,162

POWER SHOVEL

Filed Aug. 5, 1926

7 Sheets-Sheet 1

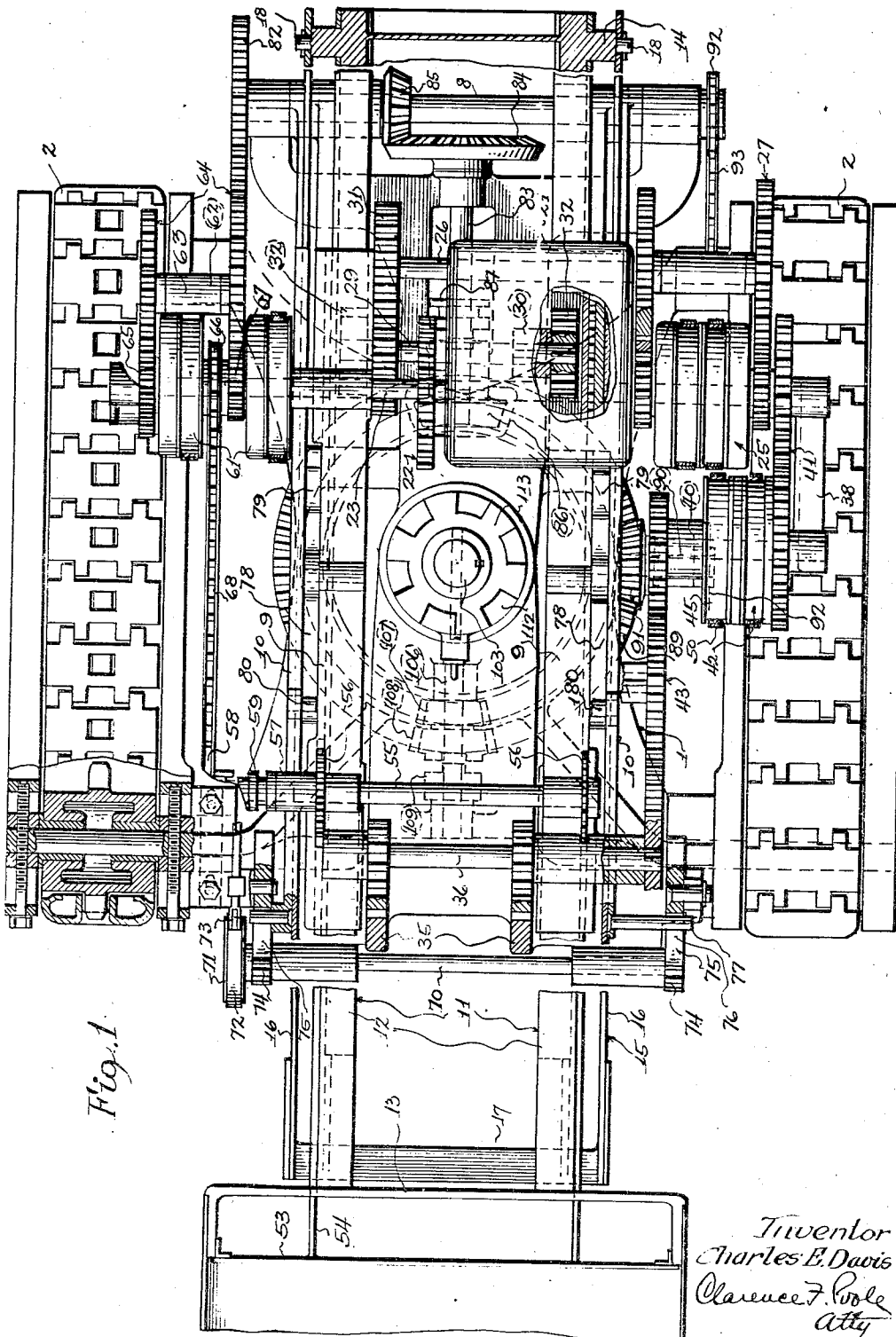


Fig. 1

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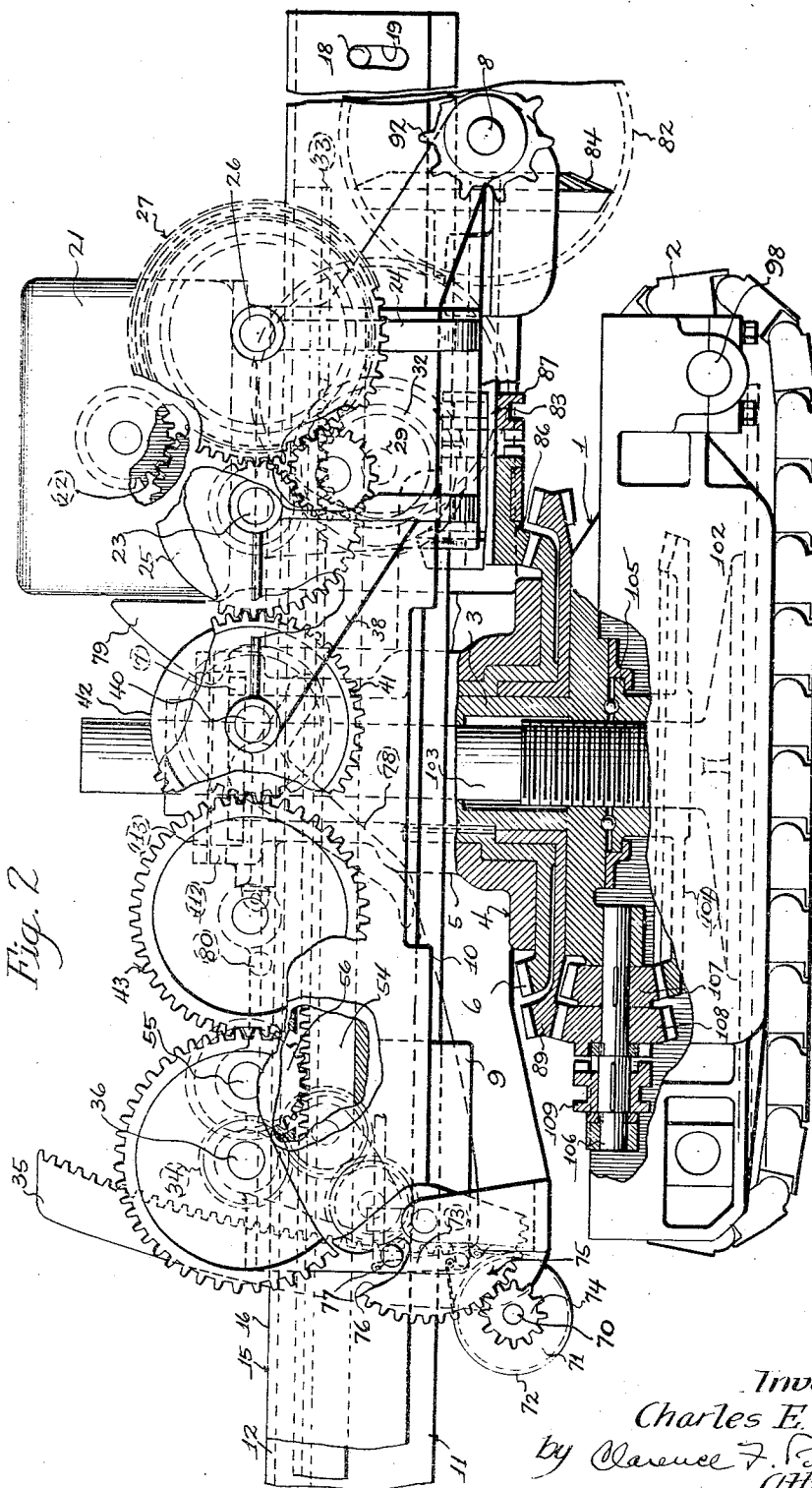
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7 Sheets-Sheet 2



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7 Sheets-Sheet 3



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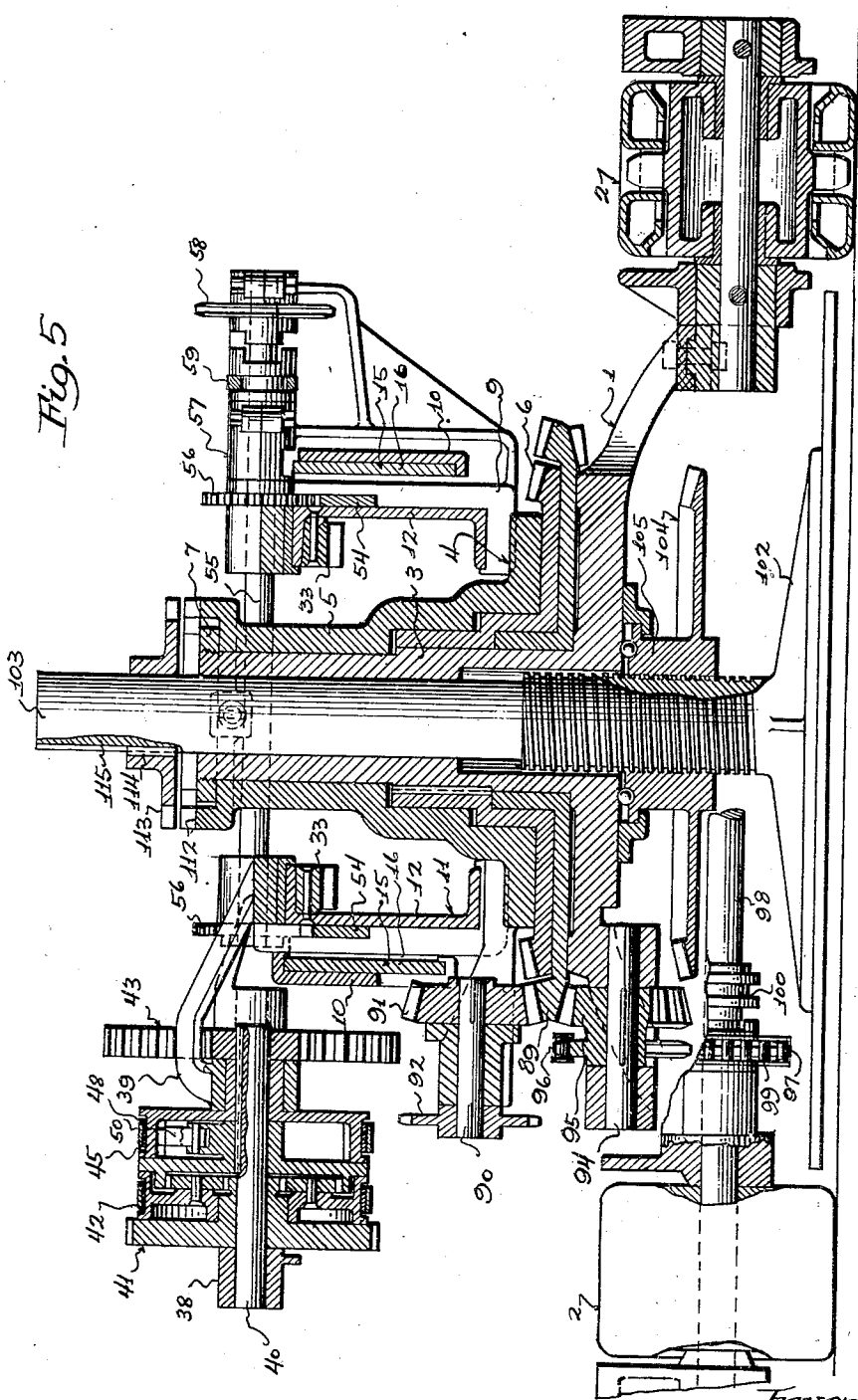
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POWER SHOVEL

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7 Sheets-Sheet 5

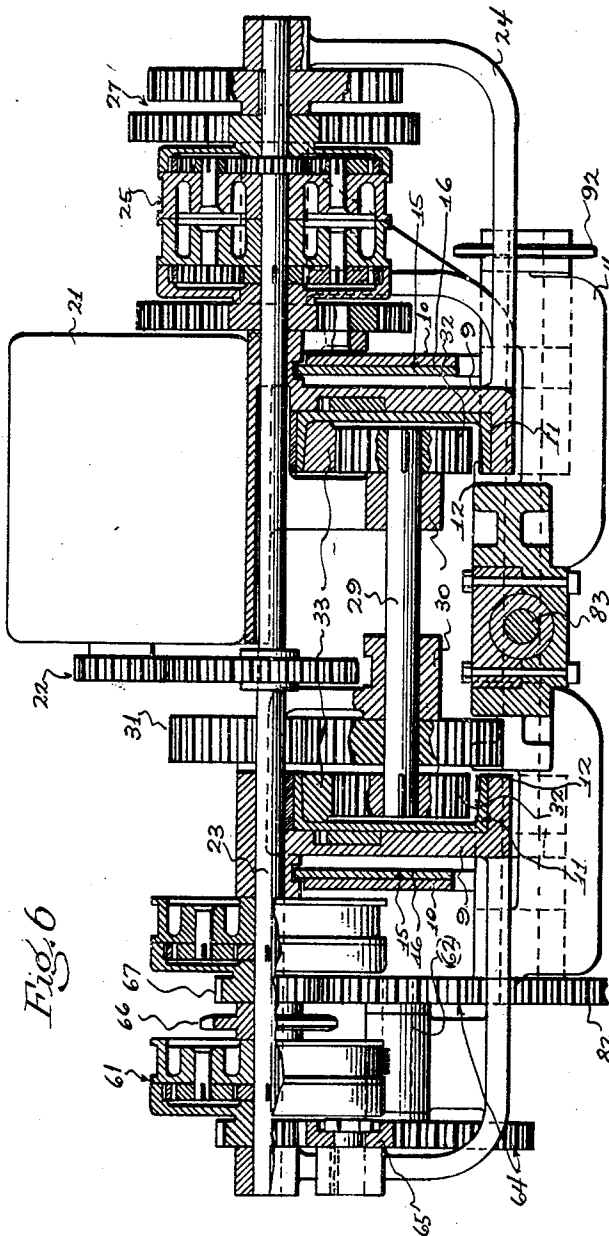


Fig. 6

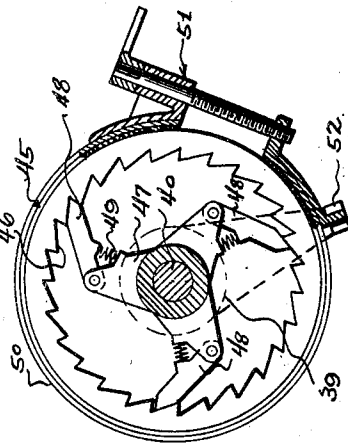


Fig. 7

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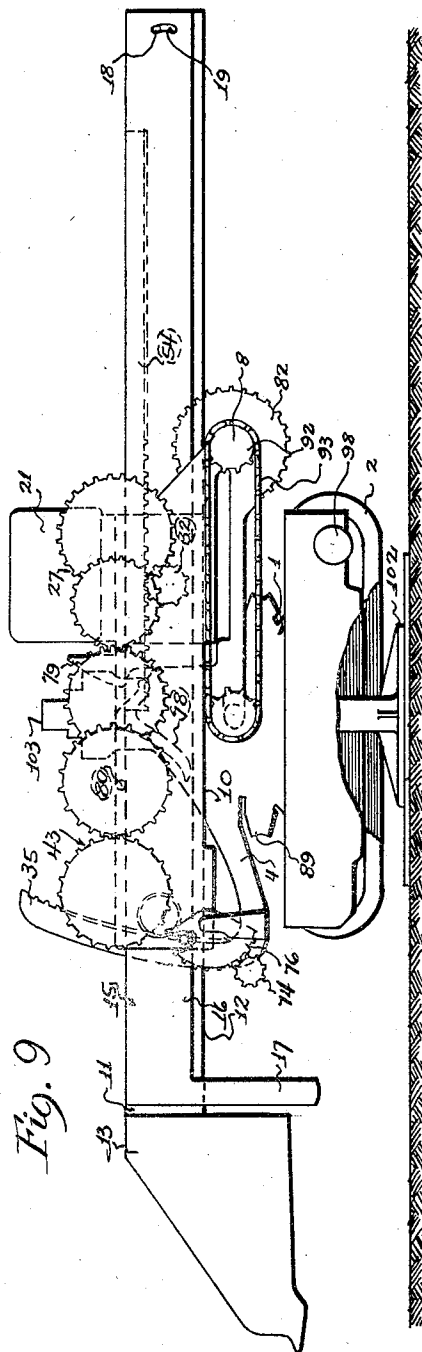
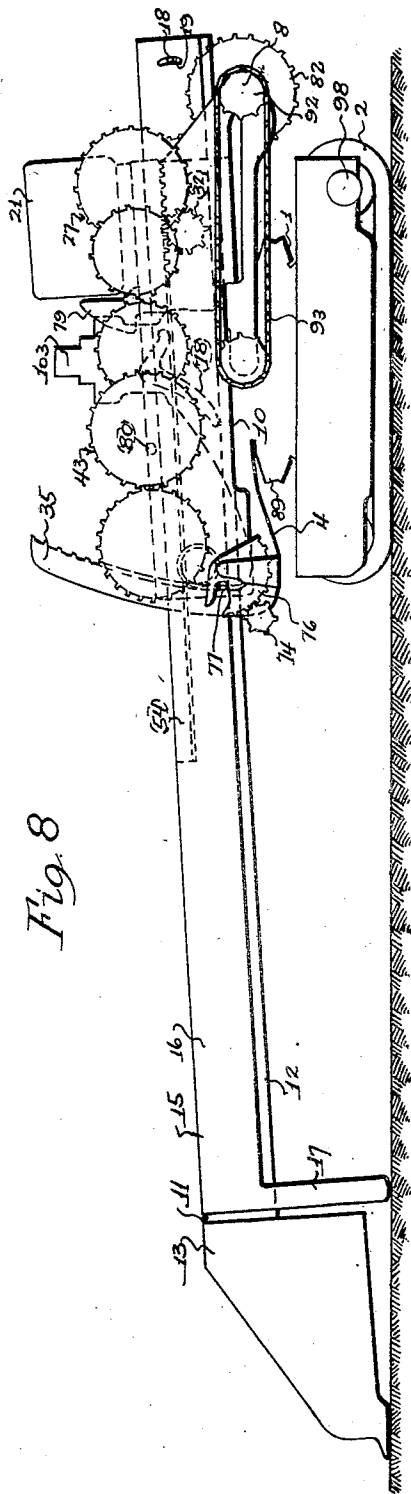
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7 Sheets-Sheet 6



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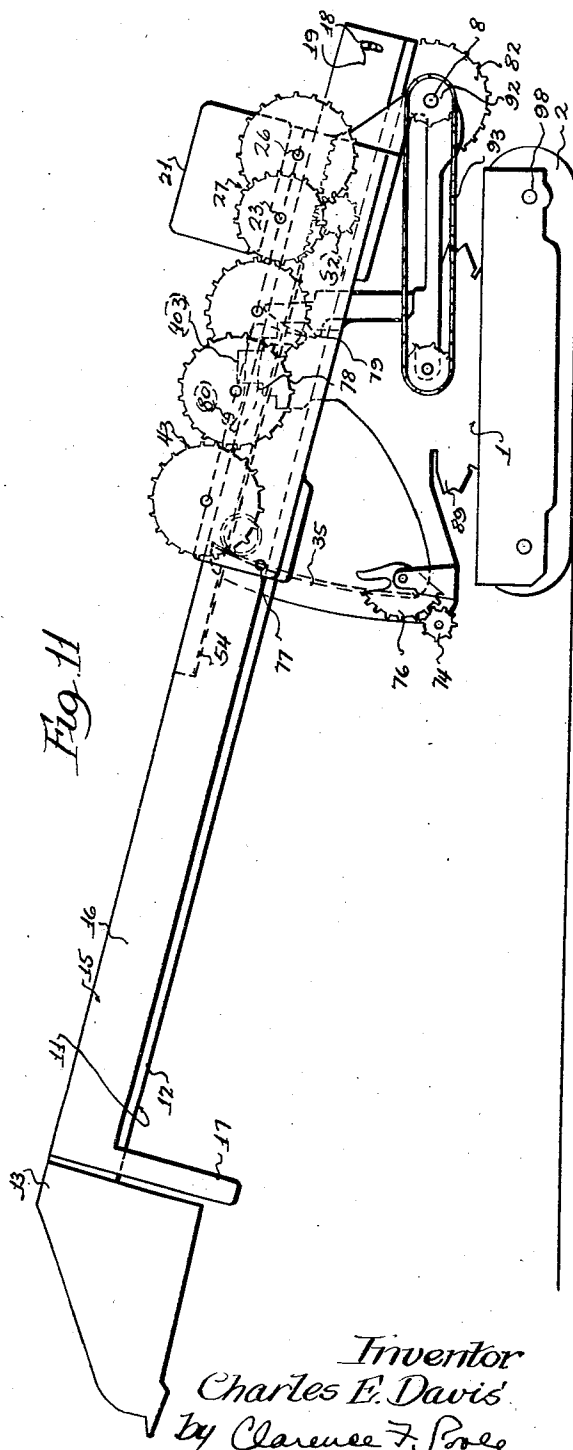
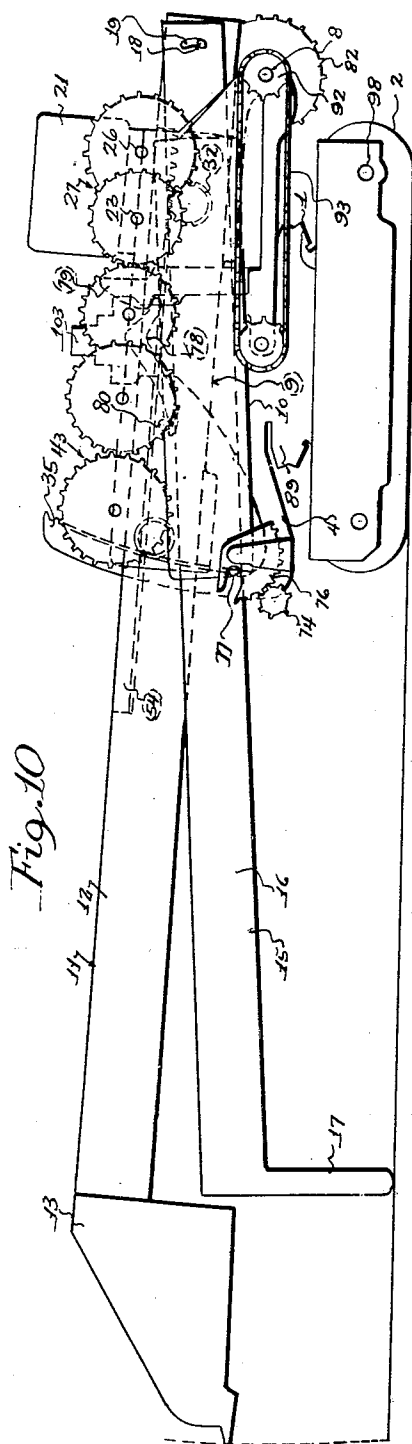
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POWER SHOVEL

Filed Aug. 5, 1926

7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

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POWER SHOVEL

Application filed August 5, 1926. Serial No. 127,301.

This invention relates particularly to power shovels for use in confined spaces, such as in mines, although not limited to this use alone.

One of the objects of the invention resides in providing for the reactance of the scooping mechanism of a power shovel, particularly during the movement of the scoop of the shovel vertically through a pile or deposit of material after loading therefrom, in an effective manner and without necessitating the employment of weight for this purpose.

Other objects reside in the provision of a power shovel which is particularly adapted for use in confined spaces, such as in mines, with a view toward compactness, effective operation and proper control.

Referring to the drawings:

Figure 1 is a top plan view of a power shovel embodying one form of my invention with parts broken away and in section and intermediately broken and longitudinally condensed;

Figure 2 is a side elevation of the machine illustrated in Figure 1 with parts broken away and in section;

Figure 3 is a side elevation of the machine illustrated in Figure 1 showing the side of the machine opposite that which is shown in Figure 2 and with parts broken away and in section;

Figure 4 is an enlarged section on the line 4—4 of Figure 3;

Figure 5 is a transverse vertical sectional view of the main portion of the machine on the line 5—5 of Figure 1 and with one of the continuous tread mechanisms in elevation and partially broken away and with the other continuous tread mechanism in transverse section;

Figure 6 is a partial section on the line 6—6 of Figure 1;

Figure 7 is a partial section on the line 7—7 of Figure 5; and

Figures 8, 9, 10 and 11 are diagrammatic views of the machine showing parts thereof in different positions of their various movements.

Like numerals refer to like parts throughout the several figures.

In the drawings 1 designates a base frame

which is carried on laterally spaced continuous tread devices 2 of usual construction which are adapted for the propulsion of the shovel.

The base frame 1 is provided with a centrally disposed concentrically bored vertical hub 3 extending upwardly therefrom. A turntable or rotatable frame 4 is carried on the base frame and is journaled on said hub 3 for angular movement in a horizontal plane with respect to the base by means of a bored hub 5 formed integrally with the turntable and extending upwardly therefrom and journaled on the hub 3 of the base and a stepped hub of a gear 6 secured on an intermediate portion of the hub 3, the web of this gear forming a downward thrust bearing for the turntable and a ring 7 screwthreaded on the upper end of the hub 3 forming an upward thrust bearing for the turntable. See particularly Figure 5.

A transversely disposed horizontal transmission shaft 8 is rotatably mounted on the rear end of the turntable 4, and journaled on this shaft and extending forwardly therefrom are two elevating frames 9 and 10 comprising pairs of arms. The arms of each of these frames are disposed on respective sides of the hubs 3 and 4 of the base frame 1 and the turntable 4 respectively, and a scoop beam 11 comprising laterally spaced parallel inwardly facing channel members 12 has these channel members mounted for longitudinal movement on respective arms of the inner elevating frame 9. A forwardly facing scoop 13 is carried on the front end of the beam 11 and the rear transverse structure of this scoop serves to secure the channel members 12 in spaced relation at their front ends, see particularly Figures 1 and 5, and a transverse structure 14 at the rear end of this beam secures the rear ends of these channel members in spaced relation. See Figure 4. A reaction beam 15 comprising laterally spaced parallel members 16 has these members mounted for longitudinal movement on respective arms of the outer elevating frame 10. The front end of the reaction beam is provided with a downwardly extending portion or foot 17 which is engageable downwardly on a floor and which

serves to secure the front ends of the members 16 of the reaction beam 15 in spaced relation. See particularly Figures 1, 5 and 8.

The beams 11 and 15 are similarly disposed as are the elevating arms 9 and 10, and by reason of the journaling of the rear ends of the elevating arms on the transverse shaft 8, the beams 11 and 15 are carried for similar vertical movement as well as for similar longitudinal movement by reason of their similar disposition and mounting on respective pairs of elevating arms 9 and 10 for longitudinal movement with respect thereto.

The transverse structure 14 at the rear end of the scoop beam 11 extends outwardly from respective channel members 12 with stud formations 18 which are engaged in vertical slots 19 through the rear ends of respective members 16 of the reaction beam 15. By means of this pin and slot connection between the beams 11 and 15 longitudinal movement of the reaction beam 15 is effected with this movement of the beam 11 so that the foot 17 of the reaction beam 15 is maintained adjacent the scoop 13 while independent vertical movement of these beams is permitted for purposes hereinafter described.

Mounted on the elevating frame 9 adjacent its rear end and above the beam 11 is an electric motor 21, and this motor drives, by means of a reducing gear train 22, a horizontal transversely disposed shaft 23 journaled on the top of the elevating frame 9 adjacent the motor and on lateral extensions 24 of the frame 9 extending outwardly below the respective arms of the elevating frame 10 and upwardly for journaling respective ends of the shaft 23. See Figures 1, 2, 3 and 6. Mounted on the left hand portion of the shaft 23 between the elevating frame 9 and the left hand extension 24 thereof, is a pair of manually controlled releasable frictional driving devices 25 of the planetary type, which are connected to drive another horizontal transversely disposed shaft 26, journaled on the top of the elevating frame 9 adjacent the motor, by means of respective of two reducing gear trains 27, one of which gear trains includes an additional idler gear 28 whereby the shaft 26 is driven in respective directions by the driving devices 25. Another horizontal transverse shaft 29 is disposed between the channel members 12 of the beam 11 and is journaled on brackets 30 of respective arms of the elevating frame 9, and this shaft is driven from the shaft 26 by a gear train 31. Gears 32 are secured on respective ends of the shaft 29 within the enclosures of respective channel members 12 and mesh with respective downwardly facing racks 33 secured to and extending longitudinally of the channel members 12. Thus it will be observed that the scoop beam 11 is reciprocated longitudinally by alternate engagement of the frictional driving device 25.

The elevating frame 9 is operated on its pivotal axis on the shaft 8 for vertically operating the scoop beam 11 in the following manner: The turntable 4 is provided at its forward end with a pair of laterally spaced rearwardly facing racks 35, curved on the axis of the shaft 8, and extending upwardly from the turntable in substantially vertical disposition adjacent and on the inside of respective arms of the elevating frame 9. See Figures 1, 2 and 3. Journaled on and extending across between the arms of the elevating frame 9 is a horizontal transversely disposed shaft 36 on which are secured a pair of gears 37 which drive on respective racks 35 by means of gear trains 34 carried with the elevating frame 9, so that rotation of the shaft 36 effects vertical movement of the elevating frame 9 and with it the scoop beam 11.

Rotation of the shaft 36 is effected in the following manner: Carried for rotation on the forward extension 38 of the left hand extension 24 of the elevating frame 9 and another extension 39 of this elevating frame and disposed forwardly of the shaft 23 is another horizontal transversely disposed shaft 40. See Figures 1, 2 and 5. This shaft 40 is driven from the shaft 23 by means of a gear train 41 and a manually controlled releasable frictional driving device 42 of the planetary type carried on the shaft 40, whereby the shaft 40 may be selectively operated from the motor 21. The shaft 36 is driven from the shaft 40 through a gear train 43, and in a direction to operate the gears 37 upwardly on the racks 35, thus lifting the elevating arm 9 and scoop beam 11 when the driving device 42 is engaged to drive from the motor 21.

Thus is upward movement of the scoop beam 11 and with it the scoop 13 effected, and downward movement of the elevating frame 9, the scoop beam 11 and the scoop 13 under the influence of gravity is controlled as follows: Journaled on the extension 39 and on the shaft 40 is a brake drum 45 provided with internal ratchet teeth 46. See Figures 1, 5 and 7. Pivotaly mounted on a spider formation 47 of the driven member of the driving device 42, which is secured with the shaft 40, is a plurality of pawls 48 which are yieldably urged into engagement with the ratchet teeth 46 of the drum 45 by springs 49 whereby to form an automatic one way driving connection between the shaft 40 and the brake drum 45. The outer surface of the brake drum 45 is a friction surface, and a friction brake band 50, adjustable by means of a usual adjustment device 51 and fixed against rotation by engagement with an arm 52 of the extension 39, engages said outer surface of the brake drum 45 to form a friction brake therewith. The arrangement of the said automatic one way driving connection is such that it rotates the brake drum 45 with downward movement of the elevating frame 9, the scoop

beam 11 and scoop 13 whereby this brake controls said downward movement, whereas the upward movement of the elevating frame 9 and related parts is effected free of this brake by reason of the pawls 48 ratcheting over the ratchet teeth 46 of the brake drum. Thus is provided an effective control of the vertical movement of the scoop 13.

The scoop 13 is provided with an ejector 53 operable longitudinally thereof and accordingly longitudinally of the beam for ejecting material from the scoop. This ejector is operated from the motor 21 in the following manner. See Figures 1, 5 and 6. A pair of rack bars 54 are secured at their front ends to the ejector 53 and extend rearwardly therefrom in parallelism with and on the outside of respective channel members 12 of the scoop beam 11 and are carried for longitudinal movement with respect to this beam in suitable slide bearings on respective arms of the elevating frame 9. A horizontal transversely disposed shaft 55 is journaled on the elevating frame 9 adjacent the forward end thereof, and a pair of gears 56 are secured on this shaft and mesh with respective rack bars 54. Control of the shaft 55 effects longitudinal movement of the rack bars 54 with respect to the beam 9 and corresponding movement of the ejector 53 with respect to the scoop 13, whereas the shaft 55 when permitted to rotate in correspondence with longitudinal movement of the beam 9 does not effect operation of the ejector, thus permitting longitudinal operation of this beam.

The shaft 55 is controlled to effect actuation of the ejector in the following manner. The shaft 55 is extended to the right and this portion thereof is journaled on an extension 57 of the elevating frame 9. On this extended portion of the shaft 55 is journaled a sprocket 58, and this sprocket may be fixed on this shaft to drive the same by a manually controlled releasable positive clutch 59 of usual construction. Mounted on the right hand portion of the shaft 23 between the elevating frame 9 and the right hand extension 24 thereof is a pair of manually controlled releasable frictional drive devices 61 of the planetary type, which are connected to drive a horizontal transversely disposed shaft 62, journaled in an extension 63 of the elevating frame 9 adjacent its rear end, by means of respective of two reducing gear trains 64, one of which gear trains includes an additional idler gear 65 whereby the shaft 62 is driven in respective directions by the driving devices 61. See Figures 1, 3, 5 and 6. Journaled on the last mentioned portion of the shaft 23 is a sprocket 66 which is secured to a gear 67 of one of the gear trains 64 which is also journaled on the shaft 23. As a result the sprocket 66 may be driven in either direction from the shaft 23 by manipulation of the aforementioned driving devices 61, this

sprocket being driven directly in one direction by the inner driving device 61 which drives the gear 67 directly and in the opposite direction by the outer driving device 61 driving the outer gear train 64 which in turn drives the inner gear train 64 including the gear 67 to which this sprocket is secured. A chain 68 is trained over the sprockets 58 and 66 so that when the aforementioned clutch 59 is engaged the ejector 53 may be operated in either direction from the motor 21 by manipulation of the driving devices 61. Except when it is desired to operate the ejector the clutch 59 is disengaged so that the longitudinal operation of the scoop beam 11 is not interfered with and so that the driving devices 61 may be used for other purposes hereinafter described.

As hereinbefore described the reaction beam 15 is operated longitudinal with the scoop beam 11, and the purpose of this is to maintain the foot 17 at the front end of the reaction beam adjacent the scoop 13 for advantageously reacting lifting of the scoop by engagement with a supporting floor adjacent the scoop. The beams 11 and 15 are independently movable vertically, and means is provided whereby lifting of the scoop 13 is reacted on the reaction beam 15 with the foot 17 thereof engaged on a supporting floor, as shown in Figures 8 and 10. This means, as shown, releasably secures the reaction beam with the turntable 4 against upward movement of the reaction beam with the foot 17 of the reaction beam engaged with the supporting floor during the first part of the lifting movement of the scoop 13 during which movement the scoop is lifted vertically through a pile or deposit of material after loading therefrom, it being obvious that after the scoop is free from the pile or deposit of material resistance to lifting of the scoop is materially decreased so that thereafter the reaction beam may be lifted from engagement with the supporting floor to permit and provide clearance for horizontal angular movement of the scoop 13 as by operation of the turntable 4, as shown in Figures 9 and 11.

Accordingly, a horizontal transversely disposed shaft 70 is journaled on the turntable 4 at the front end thereof, and secured to the left hand end of this shaft is a brake drum 71 which is frictionally engaged by a brake band 72 which is manually releasable by means of a usual adjustment mechanism 73, thus forming a releasable friction brake for resisting rotation of the shaft 70. See Figures 1, 2 and 3. Secured on the shaft 70 adjacent respective ends thereof are two gears 74, and journaled on the turntable adjacent the shaft 70 and on the outsides of respective arms of the elevating frame 10 and disposed on a common horizontal transversely disposed axis are two segment gears 75 which mesh with respective gears 74 for rotation of the shaft 70

and the brake drum 71 with angular movement of these segment gears. The segment gears 75 are radially slotted, as designated at 76, and studs 77 are mounted on the front ends of respective arms of the elevating frame 10 and are adapted to engage the slots 76 of respective segment gears 75 in the following manner. When the elevating arm 10 is positioned in the upper part of its vertical movement, as shown in Figure 11, the studs 77 are disposed above the segment gears which are positioned with the outer open ends of the slots 76 facing upwardly. As the elevating arm 10 is moved downwardly the studs 77 enter the slots 76, as shown in Figure 9, and on continued downward movement of this elevating arm these studs by their engagement with the slots 76 turn the segment gears 75 so that the slots 76 are disposed substantially horizontal, as shown in Figures 8 and 10. When the segment gears 75 are positioned with the slots thereof horizontal the reaction beam 15, which is carried by the elevating frame 10, is in a lower position with the foot 17 thereof engaged downwardly on the supporting floor, as shown in Figures 8 and 10. When the segment gears 75 are positioned with the slots 75 disposed horizontally and the studs 77 engaged therein the segment gears must be turned in order to permit upward movement of the elevating frame 10 and the reaction beam 15, and the aforementioned brake on the shaft 70, acting on the segment gears 75 through the gears 74 meshed therewith, operates to secure the elevating frame 10 and the reaction beam 15 with the turntable and with the foot 17 of the beam 15 engaged downwardly on the supporting floor, as shown in Figures 8 and 10. Consequently lifting of the scoop 13 is reacted on the reaction beam 15 which is supported thereagainst outwardly of the base frame 1 and turntable 4 in the direction of the scoop with obvious advantage and preferably, as shown, adjacent the scoop.

As will be observed the means, provided for securing the elevating frame 10 with the turntable against upward movement of the elevating frame 10 and the reaction beam 15, is releasable to permit upward movement of this elevating frame and beam, the brake on the shaft 70 being released sufficiently to permit the studs 77 to operate the segment gears 75 to dispose the slots 76 thereof vertically for the disengagement of the studs therefrom with upward movement of the elevating frame 10.

Means is provided for vertically operating the elevating frame 10 and the reaction beam 15 in correspondence with the elevating frame 9 and scoop beam 11 during the upper part only of the vertical movement of the elevating frame 9, and consists of the following. See particularly 1 and 3. Pivotal mounted on respective arms of the elevating frame

9 intermediate the ends thereof and disposed on a horizontal transversely disposed axis is a pair of bell crank levers 78, and formed on transversely spaced standards on and extending upwardly from the turntable 4 is a pair of cams 79 which are adapted to be engaged by arms of respective bell crank levers 78 for operating these arms. The arrangement of the levers 78 and cams 79 is such that while the elevating frame 9 is in the lower part of its vertical movement the cam engaging arms of the levers 78 lie below the cams 79 and are not engaged thereby, as shown in Figures 2, 3, 8 and 9. When, however, the elevating frame 9 is operated above this lower part of its movement the cam engaging arms of the levers 78 are engaged by the cams 79 to operate the other or forwardly extending arms of the levers 78 upwardly with respect to the elevating frame 9 to engage respective studs 80 on the elevating frame 10 and lift the same with the elevating frame 9 on further upward movement thereof, as shown in Figure 11, the cam 79 being formed to initially accelerate the upward movement of the elevating frame 10 until the reaction beam 15 is parallel with the scoop beam 11 and then to carry the reaction beam with the scoop beam in this parallel relation therewith. It is obvious that as the elevating frame 9 moves downwardly the levers 78 and cams 79 act in a reverse manner and carry the elevating frame 10 downwardly with the elevating frame 9 with the scoop and reaction beams in parallel relation until at an intermediate point in the downward movement thereof the downward movement of the elevating frame 10 is accelerated until the foot 17 of the reaction beam engages the supporting floor preparatory to another lifting movement of the elevating frame 9 and with it the scoop beam 11 and scoop 13.

Thus, in the construction and arrangement shown, the reaction beam 15 is secured with the turntable 4 against upward movement of the beam with the foot 17 of the beam engaged downwardly on the supporting floor. When the first part of the upward movement of the scoop 13 is completed, the reaction beam is released from the turntable and is then operated upwardly with the scoop. As the scoop 13 is moved downwardly from an upper position the reaction beam is carried downwardly therewith until at an intermediate point in the downward movement of the scoop the downward movement of the reaction beam is accelerated until the foot 17 engages the supporting floor when the reaction beam is again secured with the turntable preparatory to another lifting movement of the scoop.

As hereinbefore described, the elevating frames 9 and 10 are journaled for pivotal movement in a vertical plane on the transmis-

sion shaft 8 which is journaled on the turntable 4. Secured on the shaft 8 is a gear 82 which meshes with the gear of one of the gear trains 64 secured to the shaft 62. See Figures 1 and 3. Thus the shaft 8 may be driven in either direction from the motor 21 by means of the driving devices 61 and the gear trains 64 in a manner that permits pivotal movement of the elevating frame 9 with respect to the turntable.

The turntable 4 is operated angularly about its vertical axis by the motor 21 and through the shaft 8 in the following manner. See Figures 1 and 2. A shaft 83 is journaled on the rear portion of the turntable and is disposed radially with respect thereto. Secured on the rear end of the shaft 83 is a bevel gear 84 which meshes with a bevel gear 85 secured on the shaft 8, whereby the shaft 83 is driven from the shaft 8. The hereinbefore mentioned gear 6 is an upwardly facing bevel gear, and journaled on the turntable and on the front end of the shaft 83 is a bevel gear 86 which meshes with the gear 6. The gear 86 is driven from the shaft 83 by means of a manually controlled releasable positive clutch 87 of usual construction. Thus, assuming the clutch 87 is engaged, the turntable may be operated in either direction from the motor 21 by manipulation of the driving devices 61.

The continuous tread devices 2 are operated for the propulsion of the machine by the motor 21 and through the shaft 8 in the following manner. See Figures 1, 5 and 8. Journaled for rotation on the hub 3 of the base frame 1 between the main portion of the base frame and the hereinbefore mentioned gear 6 is a large bevel gear 89 having both upwardly and downwardly facing gear teeth. A horizontal transversely disposed shaft 90 is journaled on one side of the turntable 4 on an axis intersecting the axis of the turntable, and a bevel gear 91 is secured on this shaft and meshes with the upwardly facing gear teeth of the gear 89. Two aligned sprockets 92 are secured respectively on the shafts 90 and 8, and a chain 93, see Figures 1 and 8, is trained over these sprockets for driving the shaft 90 from the shaft 8 and through the gear 91 driving the gear 89. A horizontal transversely disposed shaft 94, disposed radially of the gear 89, is journaled on the base frame 1 at one side thereof, and a bevel gear 95 is secured on this shaft and meshes with the downwardly facing gear teeth of the gear 89. A sprocket 96 is secured on the shaft 94, and a second sprocket 97 is rotatably mounted in alinement with the sprocket 96 on a driving shaft 98 of the continuous tread devices 2. A chain 99 is trained over the sprockets 96 and 97 for driving the sprocket 97 from the gear 89, and a manually controlled releasable positive clutch 100 of the usual construction fixes the sprocket 97 with

the shaft 98 for driving the continuous tread devices 2 from the motor 21. Thus, assuming the clutch 100 is engaged, the continuous tread devices 2 may be operated in either direction from the motor 21 by manipulation of the driving devices 61.

A means is provided whereby the machine may be turned abruptly or have its direction of propulsion changed within a relatively small space and consists of the following. See Figures 2, 5 and 9. A centrally disposed support member 102 is disposed underneath the base frame 1 between the continuous tread devices 2 and is engageable with the supporting floor for carrying the machine. This support member is provided with a centrally disposed vertical shaft 103 extending upwardly therefrom through and journaled in the bore of the hereinbefore described hub 3 of the base frame 1. A bevel gear 104, disposed underneath of the base frame 1 and rotatably mounted thereon by means of a suitable bearing 105, is screwthreaded upon the lower portion of the shaft 103 so that rotation of this gear with respect to this shaft effects relative vertical adjustment between the support member 102 and the base frame 1 carrying the continuous tread devices 2.

When it is desired to turn the machine the support member 102 is operated downwardly by rotation of the gear 104 in the proper direction until the support member engages with the supporting floor and lifts the base frame 1 to a position in which the continuous tread devices 2 are disengaged with the supporting floor, as shown in Figure 9, in which position the base frame 1 may be moved angularly about the support member and shaft to any desired angular position. After the base frame 1 is positioned the bevel gear 104 is operated in the opposite direction to again engage the continuous tread devices 2 with the supporting floor and to disengage the support member 102 from the supporting floor and to return it to its normal position elevated from the supporting floor as shown in Figure 5.

The bevel gear 104 is operated and the base frame 1 is operated angularly with respect to the support member 102 from the motor 21 in the following manner:

The gear 89 is driven from the shaft 8 in the manner hereinbefore described, the shaft 8 being driven in either direction from the motor 21 through the driving devices 61 and gear trains 64. A horizontal shaft 106 is journaled on the base frame 1 at the front thereof on an axis intersecting the axis of the turntable 4 and shaft 103. Secured on this shaft 106 is a bevel gear 107 which meshes with the bevel gear 104 for driving the same. Journaled on the shaft 106 is another bevel gear 108 which meshes with the downwardly facing teeth of the hereinbefore mentioned gear 89, and a manually controlled releasable positive clutch 109 of usual construction fixes the

gear 108 with the shaft 106 for driving the gear 104 for vertically adjusting the support member 102. Thus, assuming the clutch 109 is engaged the bevel gear 104 may be operated in either direction from the motor 21 by manipulation of the driving devices 61.

In order to prevent angular movement of the turntable 4 by reason of reaction caused in the driving of the continuous tread mechanisms 2 a removable stud 111 is engaged in registering radial bores in the hubs 3 and 5 respectively of the base frame 1 and turntable 4, it being obvious that this stud is removed when it is desired to operate the turntable on the base frame or vice versa as when shoveling and when turning the base on the support member 102. See particularly Figure 3.

The upper end of the hub 5 of the turntable has clutch teeth 112 formed thereon, and a clutch member 113 is mounted for sliding movement on the shaft 103 above the hub 3 of the base frame 1. See Figures 1, 3 and 5. A key 114 is secured in a keyway of this clutch member and is slidably engaged in a keyway 115 on the shaft 103 to rotatably fix this clutch member and shaft. The lower end of this keyway engaging the key 114 limits downward movement of the clutch member 113 with respect to the shaft 103 so that when the support member 102 is in its normal upper position, as shown in Figure 5, the clutch member 113 is disengaged from the turntable thereby permitting the turntable to turn independently of the support member 102 and shaft 103. The hub of the clutch member 113 is provided with a radial bore 116 for the insertion of a removable bar, indicated by dotted line at 117 in Figure 3, for preventing rotation of the shaft 103 when the gear 104 is operated while the clutch member 113 is disengaged from the clutch teeth 112.

The clutch member 113 is engaged with the clutch teeth 112 when the support member 102 is in a lower position with respect to the turntable and carrying the machine for the turntable of the base frame 1, as shown in Figure 9. When the machine is so carried by the support member the base frame 1 and with it the continuous tread devices 2 may be turned about the support member by engagement of the clutch 87 and manipulation of the driving devices 61. The clutch member 113 engaged with the clutch teeth 112 provides for the reaction on the turntable caused by the turning of the base frame 1 by fixing the turntable with the support member 102 engaged on the supporting floor. The clutch member 113 engaged with the clutch teeth 112 also provides for the reaction of the operation of the gear 104.

It will be observed that the driving devices 61 and gear trains 64 are utilized for a number of purposes selected by selective engage-

ment of the clutches 59, 87, 100 and 109, the clutch 87 being engaged for angularly moving the turntable during shoveling operations and for turning the base frame 1 and the continuous tread devices 2 with respect to the support member 102.

While I have herein shown and described one form of my invention, I do not wish to be limited to the precise details of construction or arrangement of parts herein shown and described except as specifically limited in the appended claims.

I claim as my invention:

1. In a power shovel, the combination of a frame, a scoop, means carried by said frame for operating said scoop, and a member engageable downwardly on a support outwardly of said frame in the direction of said scoop for reacting lifting of said scoop and movable horizontally with respect to said frame in said direction.

2. In a power shovel, the combination of a frame, a scoop, means carried by said frame for operating said scoop vertically and horizontally, a member engageable downwardly on a support outwardly of said frame and adjacent said scoop for reacting lifting of said scoop and movable horizontally with respect to said frame in correspondence with horizontal movement of said scoop, and means for horizontally operating said reaction member in correspondence with horizontal movement of said scoop.

3. In a power shovel, the combination of a frame, a scoop, means carried by said frame for operating said scoop, a reaction member engageable downwardly on a supporting floor outwardly of said frame in the direction of said scoop and movable vertically with respect to said frame, releasable means for reacting lifting of said scoop on said reaction member, and means for vertically operating said reaction member.

4. In a power shovel, the combination of a frame, a scoop, means carried by said frame for operating said scoop, a reaction member engageable downwardly on a supporting floor outwardly of said frame in the direction of said scoop and movable vertically with respect to said frame, releasable means for fixing said reaction member with said frame with respect to upward movement of said reaction member, and automatic means for effecting vertical movement of said reaction member with said scoop during the upper part of the vertical movement of the scoop and permitting a reactioning position of the reaction member during the first part of the lifting movement of the scoop.

5. In a power shovel, the combination of a frame, a scoop, means carried by said frame for operating said scoop horizontally and vertically, a reaction member engageable with a supporting floor outwardly of said frame in the direction of said scoop and mov-

able with respect to said frame vertically and horizontally in correspondence with horizontal movement of said scoop, releasable means for reacting lifting of said scoop on said reaction member, means for vertically operating said reaction member with respect to said frame, and means for horizontally operating said reaction member in said direction.

6. In a power shovel, the combination of a frame, a pair of similarly disposed elevating arms pivotally mounted on said frame for similar vertical movement, a pair of similarly disposed beams mounted on respective of said arms for vertical movement therewith and for longitudinal movement with respect thereto, a pin and slot connection between said beams for effecting longitudinal movement thereof together and permitting independent vertical movement thereof, a radially slotted member pivotally mounted on said frame for angular movement in an upright plane, a releasable friction device for opposing angular movement of said radially slotted member, a pin on one of said elevating arms and engageable in the slot of said radially slotted member in lower positions of this elevating arm, a cam mounted on said frame, a lever pivotally mounted on the other of said elevating arms, and engageable with said cam for vertically operating said first mentioned elevating arm in correspondence with said second mentioned elevating arm during the upper part only of the vertical movement of said second mentioned elevating arm.

7. In a power shovel, the combination of a base, a turntable mounted on said base for movement in a horizontal plane with respect thereto, scooping mechanism carried by said turntable, and means carried with said turntable and engageable downwardly on a support outwardly of said base for reacting lifting of said scooping mechanism.

8. In a power shovel, the combination of a frame, a turntable mounted on said base for angular movement in a horizontal plane with respect thereto, a scoop, means carried with said turntable for operating said scoop, a reaction member carried with said turntable for horizontal angular movement therewith and movable vertically with respect thereto and engageable downwardly on a support outwardly from said base in the direction of said scoop, releasable means for fixing said reaction member with said turntable against upward movement of the reaction member, and means associated with said turntable for vertically operating said reaction member.

9. In a power shovel, the combination of a base, a turntable mounted on said base for angular movement in a horizontal plane with respect thereto, a scoop, means carried with said turntable for operating said scoop hori-

zontally and vertically, a reaction member carried with said turntable and movable vertically and horizontally with respect thereto corresponding with said movement of said scoop and engageable with a supporting floor outwardly from said base in the direction of the scoop, means for operating said reaction member horizontally with said scoop for engagement of the reaction member with the floor adjacent the scoop, releasable means for fixing said reaction member with said turntable against upward movement of the reaction member, and means for effecting vertical movement of said reaction member with respect to said turntable.

10. In a power shovel, the combination of a base, a turntable mounted on said base for movement in a horizontal plane with respect thereto, a pair of similarly disposed elevating arms pivotally mounted on said turntable for similar vertical movement, a pair of beams disposed similarly with respect to said arms and mounted on respective thereof for vertical movement therewith and longitudinal movement with respect thereto, a scoop on the front end of one of said beams, the front end of the other beam being engageable downwardly on a supporting floor for reaction thereon, means for operating said reaction beam longitudinally with said scoop beam for engagement of the front end of the reaction beam with the floor adjacent said scoop, releasable means for securing the elevating arm of the reaction beam with said turntable with the reaction beam in a downward floor engaging position, and automatic means for vertically operating the elevating arm of the reaction beam in correspondance with the elevating arm of the scoop beam during the upper part only of the vertical movement of the elevating arm of said scoop beam.

11. In a power shovel, the combination of a base, propulsion means on said base, a turntable mounted on said base for angular movement in a horizontal plane with respect thereto, an elevating frame pivotally mounted on said turntable for movement in a vertical plane with respect thereto, a prime mover on said elevating frame, and means operated by said prime mover for operating said propulsion means therefrom and adapted to permit said pivotal movement of said elevating frame and said angular movement of said turntable.

12. In a power shovel, the combination of a base frame, continuous tread propulsion means carrying said base frame for propulsion, a turntable mounted on said base frame for angular movement in a horizontal plane with respect thereto, an elevating frame pivotally mounted on said turntable for movement in a vertical plane, a motor on said elevating frame, a revoluble transmission member carried with the turntable and disposed on the pivotal axis of said elevating frame,

manually releasable means for driving said transmission member from the motor, a revoluble gear disposed coaxially with said turntable, a second gear rotatably mounted on said turntable and meshing with said first mentioned gear for driving said first mentioned gear from said transmission member, and a third gear rotatably mounted on said base frame and meshing with said first mentioned gear for driving said propulsion means.

13. In a power shovel, the combination of a turntable frame, an elevating frame pivotally mounted on said turntable frame for movement in a vertical plane, a prime mover on said elevating frame, a vertical rack on said turntable, a revoluble gear on said elevating frame and meshing with said rack, and manually controlled releasable means for driving said gear from said prime mover.

14. In a power shovel, the combination of a turntable frame, an elevating frame pivotally mounted on said turntable frame for movement in a vertical plane with respect thereto, a motor on said elevating frame, manually controlled means operated by said motor for lifting said elevating frame, and means for controlling downward movement of said elevating arm under the influence of gravity.

15. In a power shovel, the combination of a turntable frame, an elevating frame pivotally mounted on said first mentioned frame for movement in a vertical plane, a motor on said elevating frame, manually controlled releasable friction means operated by said motor for lifting said elevating frame, a rotatory friction device, and an automatic one way driving device for controlling downward movement of said elevating frame under the influence of gravity by said friction device.

16. In a power shovel, the combination of a turntable frame, an elevating frame pivotally mounted on said turntable frame for movement in a vertical plane, a motor on said elevating frame, a vertical rack on said turntable frame, a revoluble gear on said elevating frame and meshing with said rack, a manually controlled releasable friction driving device on said elevating frame for driving said gear from the motor to lift said elevating frame, an adjustable rotatory friction brake device on said elevating frame, and an automatic one way driving device for connecting said brake device with said gear for controlling downward movement of said elevating frame under the influence of gravity.

17. In a power shovel, the combination of a base, propulsion means on said base, a turntable mounted on said base for angular movement in a horizontal plane with respect thereto, an elevating frame pivotally mounted on said turntable for movement in a vertical plane with respect thereto, a prime mover on said elevating frame, a revoluble transmis-

sion member carried with said turntable, means for driving said transmission member from said prime mover and adapted to permit said movement of said elevating frame, releasable means for operating said turntable on said base from said transmission member, and releasable means for operating said propulsion means from said transmission member and adapted to permit said movement of said turntable on said base.

18. In a power shovel, the combination of a base frame, propulsion means carrying said base frame, a turntable mounted on said base frame for angular movement in a horizontal plane with respect thereto, an elevating frame pivotally mounted on said turntable for movement in a vertical plane, a motor on said elevating frame, a revoluble transmission member disposed on the pivotal axis of said elevating frame and carried with said turntable, manually controlled releasable means for driving said transmission member from said motor in either direction, manually controlled releasable means for operating said turntable from said transmission member, and manually controlled releasable means for operating said propulsion means from said transmission member including a second revoluble transmission member disposed coaxially with said turntable.

19. In a power shovel, the combination of a base frame, continuous tread means carrying said base frame for propulsion, a turntable mounted on said base frame for angular movement in a horizontal plane, an elevating frame pivotally mounted on said turntable for movement in a vertical plane, a motor on said elevating frame, a revoluble transmission member disposed on the pivotal axis of said elevating frame, a pair of oppositely acting manually controlled releasable frictional driving devices for driving said transmission member from said motor in either direction, a gear disposed coaxially with said turntable and secured with said base frame, a second gear mounted for rotation on said turntable and meshing with said first mentioned gear, means including a releasable positive clutch for driving said second gear from said transmission member, a third gear revolubly mounted and disposed coaxially with said turntable, and means cooperating with said third gear for driving said propulsion means from said transmission member including a releasable positive clutch, a fourth gear rotatably mounted on said turntable and meshing with said third gear, and a fifth gear rotatably mounted on said base frame and meshing with said third gear.

Signed at Chicago, in the county of Cook and State of Illinois, this 26th day of July, A. D. 1926.

CHARLES E. DAVIS.