Dec. 16, 1941. L. O. McLEAN 2,266,651

AUTOMOBILE CRANE SHOVEL AND THE LIKE

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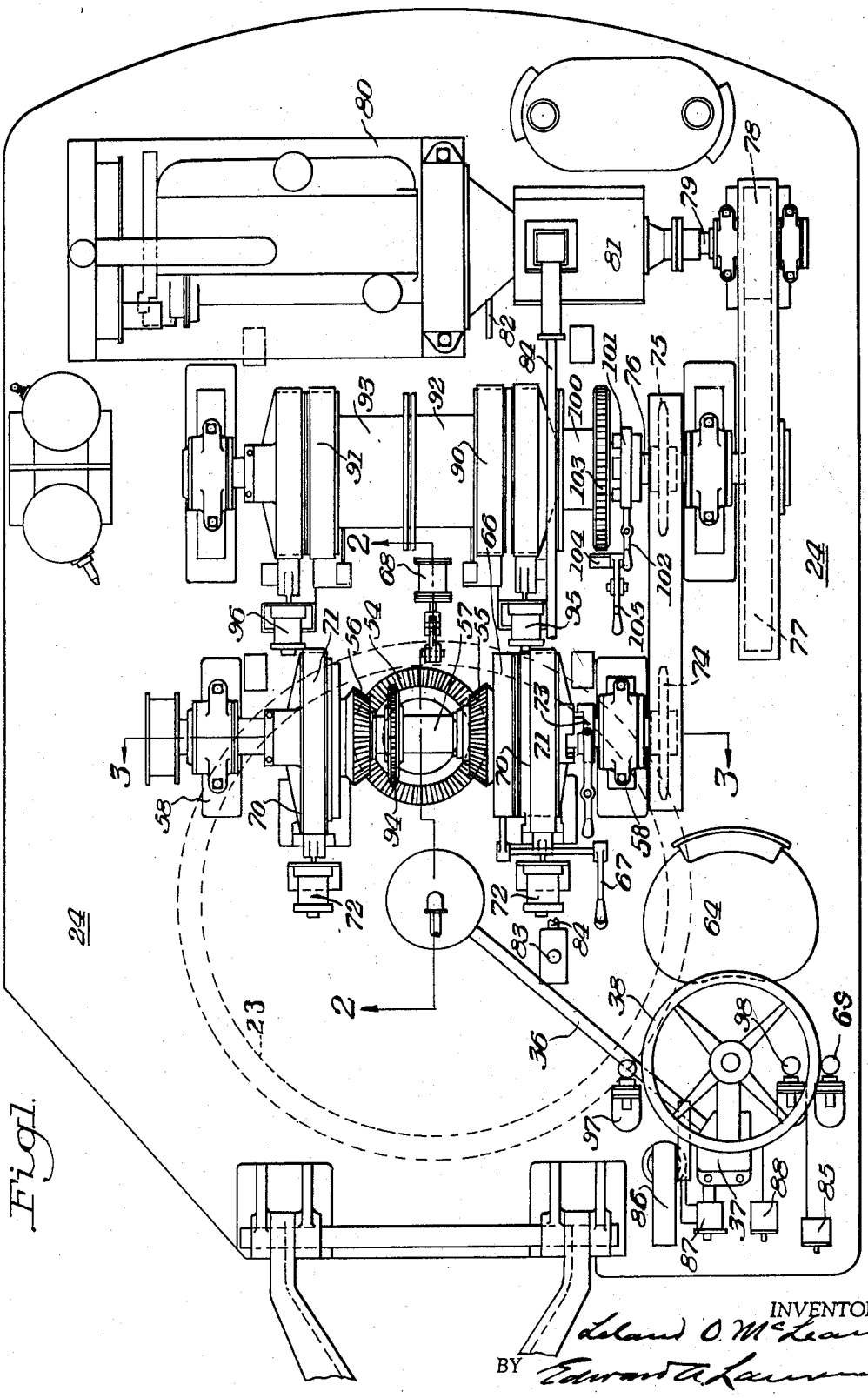


Fig1.

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Fig. 3.

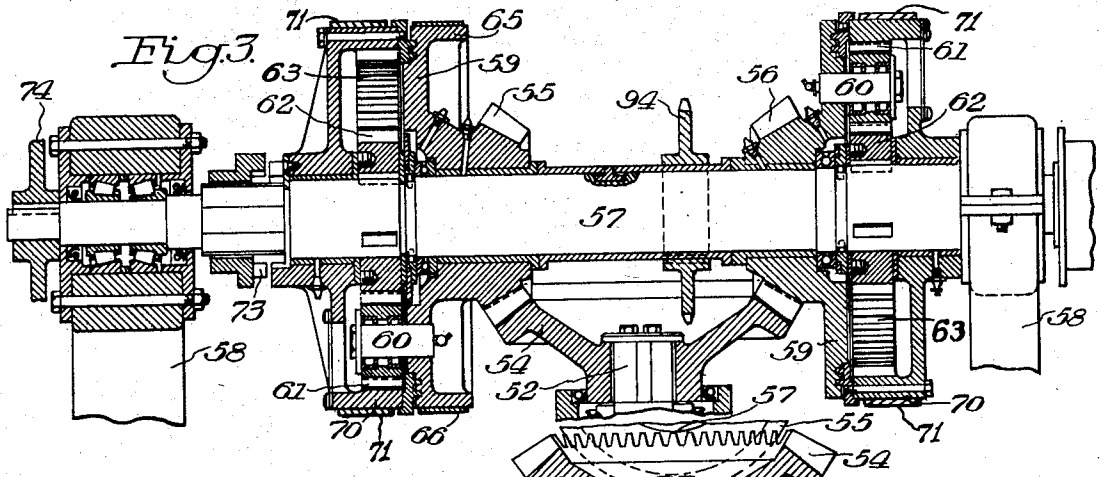
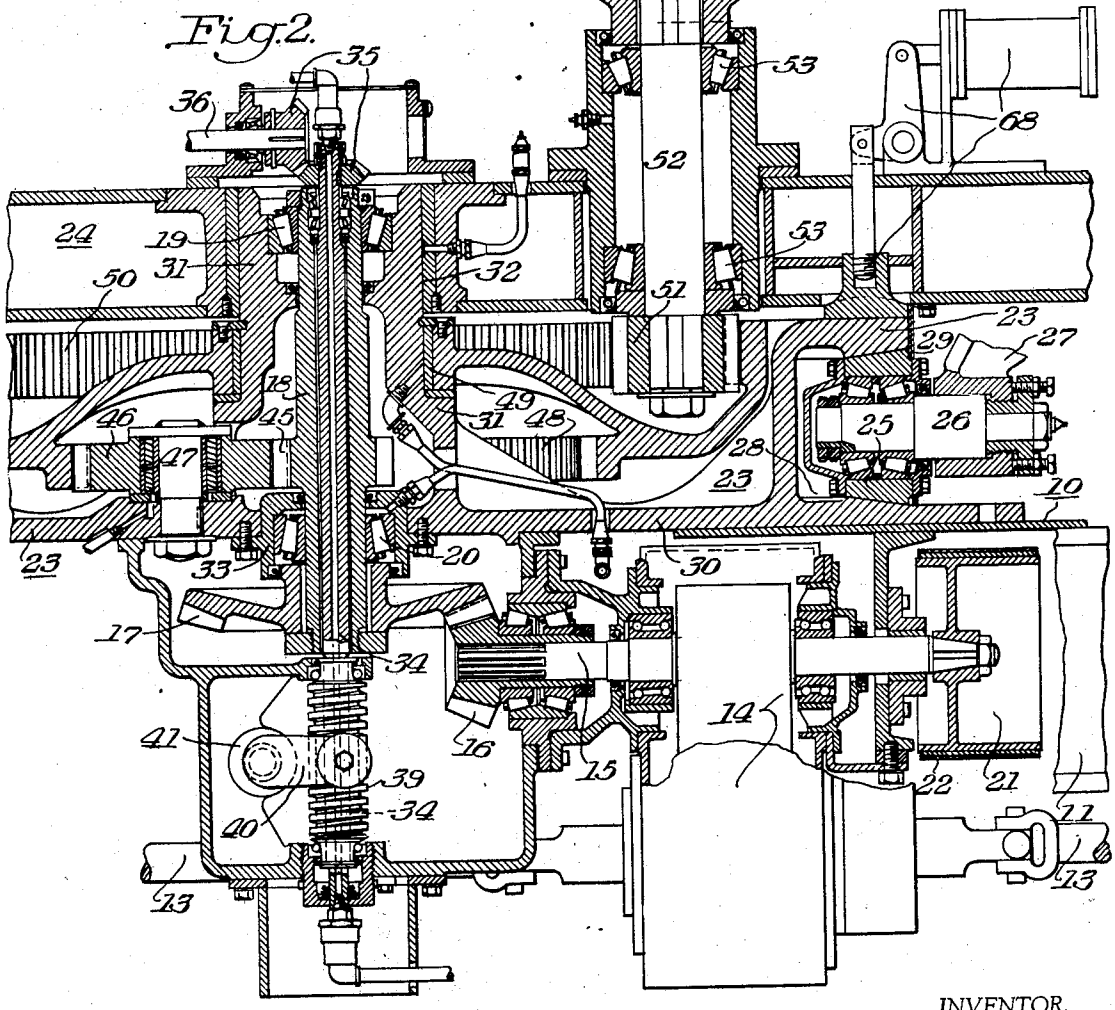


Fig. 2.



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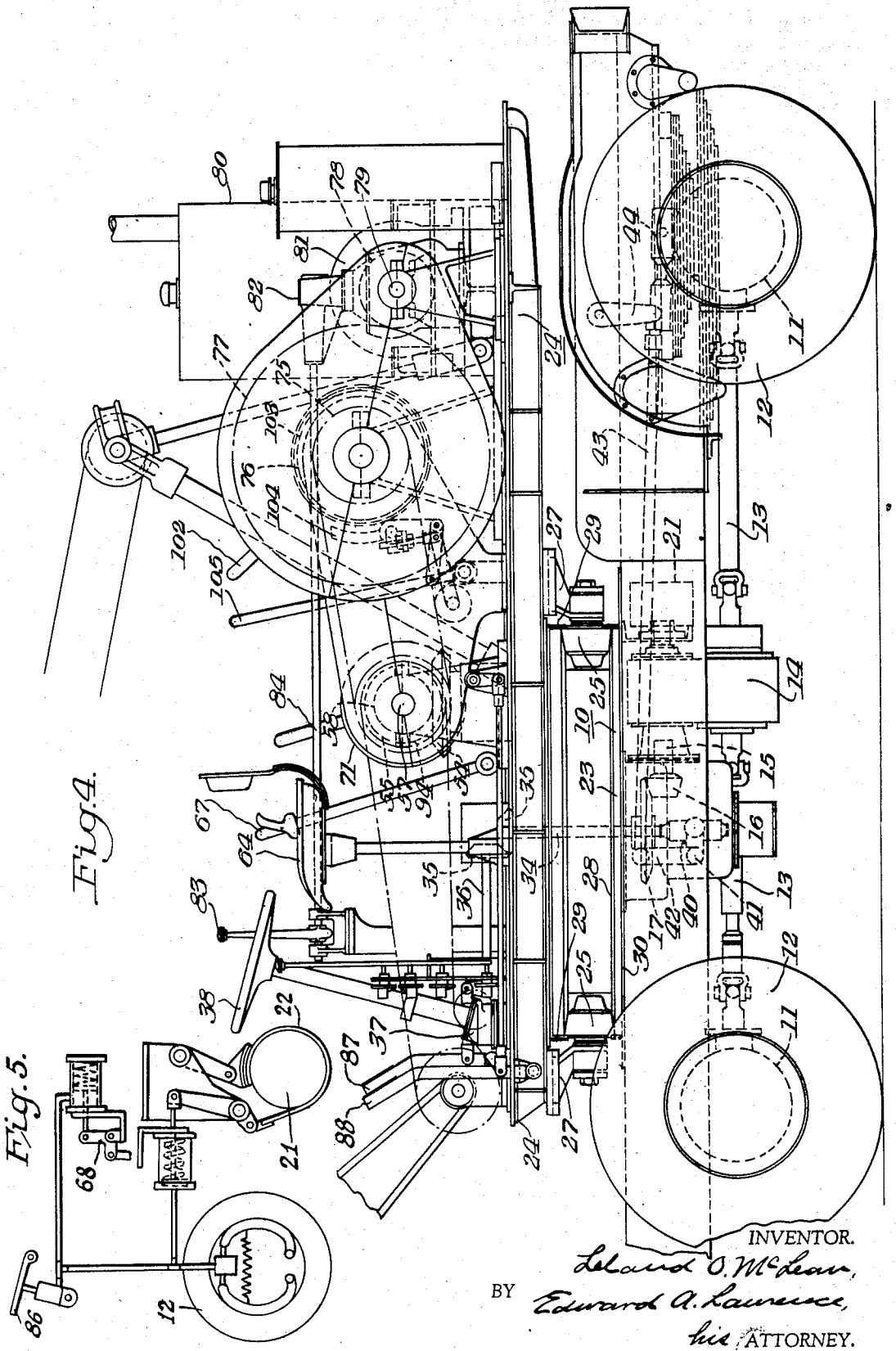


Fig. 4.

Fig. 5.

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2,266,651

AUTOMOBILE CRANE SHOVEL AND THE LIKE

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Application February 7, 1939, Serial No. 255,071

11 Claims. (Cl. 212—38)

This invention relates generally to vehicles having rotary tables such as power cranes, power shovels, dump trucks and the like, and more particularly to the manner of rotating the table and propelling the vehicle.

The principal object of this invention is the provision of a permanently engaged direct drive for revolving a rotary table on a vehicle and/or propelling the vehicle from a source of power on the table. The rotary movement of the table is generally known as the swing. An important advantage of this improved common drive is that it simplifies the mechanical structure on the table and provides a single control for manipulating the swing or the propulsion independently or simultaneously. Such a control is advantageous for power cranes, shovels, dump trucks and the like.

In cranes and shovels the operation of lifting and loading may be synchronized with a back and forward movement of the vehicle to a great advantage. Again if the operator sees any approaching danger such as the falling of material or the sliding of the bank at which he is digging, he is enabled to move the machine and himself back out of danger in less time than it would take to leave the machine. In many instances this is impossible with the present machine which frequently results in serious damage to both life and property.

As applied specifically to cranes this improvement permits the operator to swing the boom and travel simultaneously. Thus crane operations may be conducted in close quarters as between columns or closely stacked material.

This improvement provides many additional advantages in these and in other machines of like character.

Another object is the provision of a mobile substructure having a full revolving superstructure mounted thereon and provided with a source of power for revolving the superstructure and for propelling the substructure by means of a single drive through the superstructure and spaced from the revolving center thereof.

Another object is the provision of a gear concentrically mounted with a revolving table on a vehicle and arranged when locked to operate with a permanently engaged drive for swinging the revolving table and when unlocked to propel the vehicle from a source of power on the table.

Other objects and advantages appear in the following description and claims.

In the accompanying drawings a practical embodiment illustrating the principles of this invention is shown wherein:

Fig. 1 is a top plan view illustrating a revolving table of an automobile crane comprising this invention.

Fig. 2 is a vertical section taken through the line 2—2 of Fig. 1, with parts broken away, showing the drive connection comprising this invention.

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 1, with parts broken away, showing the horizontal drive shaft mounted on top of the table.

Fig. 4 is a side elevation of the automobile crane.

Fig. 5 is a diagrammatic view showing the pneumatic control connections for operating the chassis brakes and the turntable brake.

Referring to the drawings, the vehicle or mobile substructure 10 is made up of a chassis frame having front and rear axle driving assemblies 11 supported by the wheels 12 which are preferably provided with pneumatic tires for highway travel. The front and rear axle driving assemblies are connected by the drive shafts 13 to the intermediate differential 14 located approximately in the center of the vehicle. This differential in turn is driven by a chain from the jack shaft 15 supported in suitable bearings mounted on the chassis. A beveled pinion 16 is secured to one end of the jack shaft and is permanently meshed with the beveled gear 17 mounted on the lower end of the vertical tubular shaft 18 supported by upper and lower anti-frictional bearings 19 and 20 as illustrated in Fig. 2. The other end of the jack shaft is provided with a brake drum 21 arranged to be engaged by a friction band 22 which is preferably operated pneumatically. Each wheel of the chassis is also provided with a pneumatic brake preferably operated simultaneously with the friction band 22.

A circular casting 23 is secured on the frame of the chassis and supports the whole of the revolvable superstructure or turntable 24. The weight of the turntable is preferably carried by four conically shaped hook rollers 25 rotatably supported on the inwardly extending stub shafts 26 which are mounted in the brackets 27 depending from the under side of the table 24. The brackets 27 are spaced relative to principal loading points of the machine so that they will transmit the load to the chassis in such a manner as to minimize the bending strains. The inwardly projecting stub shafts 26 and the brackets

27 produce hook-like structures and permit the frusto-conically shaped rollers 25 to engage one or the other upper and lower mating surfaces of the annular track 28 in the perimetral surface of the circular casting 23, depending upon the position of the load on the table.

29 represents a depending annular shield secured to the under side of the table and arranged to enclose the track 28 except where the hook rollers extend therethrough. This shield prevents dirt and other foreign material from interfering with the operation of the rollers.

The circular casting 23 is provided with a base 30 having an upwardly extending hub 31 in the center thereof which projects above the rest of the casting and the perimetral surface thereof forms the central bearing 32 for the turntable 24. The upper bore of the hub is arranged to carry the antifrictional bearing 19 which supports the vertical tubular shaft 18. The antifrictional bearing 20 which supports the lower end of the shaft 18 is carried by the insert 33 secured in the center of the base 30.

The bore of the vertical drive shaft 18 is arranged to carry the tubular steering shaft 34 which extends above and below the drive shaft as shown in Fig. 2 and is connected at its upper end through the beveled gears 35 and the horizontal shaft 36 to the base of the steering column 37 where it is connected through another set of beveled gears to the steering wheel 38. The lower end of the shaft 34 is reduced in diameter to receive the worm 39, the threaded portion of which is arranged to be engaged by an inwardly projecting roller on the free end of the crank 40. The crank 40 is secured to the short shaft 41 having the crank 42 fixed at its other end and arranged to operate the steering rod 43 and the steering gear 44 for guiding the front wheels of the vehicle as shown in Fig. 4.

The tubular steering shaft 34 is provided with connections at its upper and lower ends for conveying fluid under pressure to operate the brake system of the chassis.

Intermediate of its ends the vertical drive shaft 18 is provided with the pinion 45 arranged in constant engagement with two or three gears 46 rotatably supported on the vertical stub shafts 47 which are secured to the base 30 of the circular casting 23. The gears 46 in turn are in mesh with the large internal gear 48 rotatably supported on the hub 31 as indicated at 49 in Fig. 2. It will be noted that the wall of the hub 31 is provided with openings for receiving the gears 46.

50 represents another internal gear formed integrally with the internal gear 48 and is larger in diameter. The gear 50 takes the place of the present circle or bull gear, which usually forms a part of the circle gear casting. This gear provides the means through which the vehicle is propelled. The dual function of this gear is one of the novel improvements comprising this invention.

The gear 50 is constantly in mesh with the pinion 51 secured to the lower end of the vertical shaft 52 extending through the table 24 and rotatably supported thereby as indicated at 53. A beveled gear 54 is secured to the upper end of the shaft 52. This beveled gear is above the floor of the table and is in constant mesh with the beveled gears 55 and 56 rotatably supported on the horizontal shaft 57 carried by the bearings 58 mounted on the table 24 as shown in Fig. 3. Each of the beveled gears 55 and 56 has a radially extending disk 59 formed integral therewith and arranged to carry a plurality of stub shafts 60, each of which rotatably support a planet gear 61 in constant mesh with their respective sun gears 62, secured to the shaft 57 and the internal gears 63.

The disk 59 of the gear 55, which is nearer to the operator's seat 64 than the gear 56, is provided with a cylindrical brake drum 65 engaged by the brake band 66. This brake band is operated mechanically by means of the brake lever 67 shown in Figs. 1 and 4. Since the brake drum 65 is tied with the vertical shaft 52 it provides a brake for the swing when the table is free to rotate and the pneumatic braking system, controlling the brake 22 and the wheels 12, is set, or it may be used for a parking brake when the machine is not in use and the table 24 is mechanically locked to the circular casting of the substructure or through the mechanically operated friction brake means 68 shown in Fig. 2.

The table brake 68 is fully engaged to lock the table to the chassis and the chassis brake system is released when the operator desires to travel along the highway, thus requiring the pinion 51 to drive the gear 50 instead of walking therearound, which latter action causes the table to swing. However by proportioning the frictional engagement of the brake 68 with the circular casting, the table may be made to swing as the vehicle travels or the brake may be made to operate in varying degrees from one function to the other. The operating cylinder of the brake 68 is a spring set pneumatic release and its air chamber is directly connected with the pneumatic brake system of the chassis.

Referring again to Fig. 3 the internal gears 63 are free to rotate on the shaft 57 and are provided with the cylindrical drum surfaces 70 arranged to be engaged by a friction band 71 operated by the air-set spring release cylinders 72 which are controlled by the back and forward movement of the control lever 69 at the left of the steering wheel. When these frictions are not set the sun gears 62 rotate planet gears 61 which in turn freely revolve the internal gears 63. If on the other hand either friction is set its respective sun gears will operate the planet gears and they walk around the internal gear 63, which is held stationary, and thus drive the disks 59 and the beveled gears causing the shaft 52 to rotate. The direction of rotation of the shaft 52 depends upon which of the beveled gears 55 or 56 is driving, and in turn whether the vehicle goes forward or backward, or whether the swing of the table is to the left or to the right. However the gear 55 normally produces a forward travel and a left swing and the gear 56 a backward travel and a right swing. A shovel generally digs off the back of the vehicle, as illustrated in Fig. 4, at which time the left swing would effect a backward movement of the vehicle in relation to the operator's position.

The sun and planet gear arrangement produces a reduction of 3 to 1 in the drive which is better suited for swinging the table and traveling near the working location. However when the table is locked and the vehicle is being transported the dent clutch 73 which is splined to the shaft 57 may be engaged with the casting of the internal gear 63, thereby locking the pinion 55 on the shaft 57 and eliminating the 3 to 1 reduction created by the sun and planet gears,

in which case the air-set of the swing control may also be used as a brake.

The shaft 57 is provided with a sprocket 74 driven by means of a chain connected to the sprocket 75 on the intermediate horizontal driving shaft 76. A large herringbone gear 77 is secured to the end of the shaft 76 and is arranged to mesh with the pinion 78 secured to the shaft 79 aligned with the internal combustion engine 80 and connected thereto through the transmission 81 and the clutch 82. The gears of the transmission are controlled in the ordinary manner by the gear shift lever 83 at the operator's station through the gear shift rod 84.

The motor clutch 82 is operated by the left hand pedal 85 at the operator's station. The pedal 86 at the extreme right when depressed sets the pneumatic brakes of the wheels 12 and the brake 22 on the jack shaft 15 and releases the spring set pneumatic release table brake 68. This pedal may be set and locked by depressing and tilting the tread of the pedal. The two intermediate pedals 87 and 88 mechanically operate the hoist brake 90 and the crowd brake or second drum brake 91, respectively, depending on whether the machine is rigged as a shovel or a crane. These brakes retard or lock the movements of the first or hoist drum 92 and the second drum or crowd 93 on the shaft 76. When rigged as a shovel the second drum 93 is replaced by a sprocket which provides the out crowd, the in crowd being provided by the sprocket 94 on the shaft 57 which may be operated by means of a clutch.

The first and second drums on the shaft 76 are operated by the air-set spring release frictions 95 and 96, which are similar to the frictions employed for swinging the table and are controlled by the levers 97 and 98 respectively. The frictions 95 and 96 having a sun and planet gear arrangement produce a 3 to 1 reduction in the operation of the drums 92 and 93. Thus if the second drum 93 is provided with a sprocket to furnish a crowd out for a shovel, the crowd in, operated by the sprocket 94, is three times faster, which is an important advantage since the crowd in merely lifts the empty dipper up as it swings back into position for digging. This promotes faster operation of the machine.

A boom hoist drum 100 is mounted on the shaft 76 between the first drum and the driving sprocket 75 and is provided with a dent clutch 101 which is operated mechanically by means of the lever 102.

This drum may be set by the ratchet gear 103 and pawl 104 operated by the lever 105. These levers are within the grasp of the operator. To lower the boom the hoist or crowd friction and brake are set, thereby locking the shaft. By slipping the friction the boom is eased down.

The combination drive and swing disclosed herein eliminates a set of beveled gears, a vertical drive shaft, and an air-set spring release friction. This reduces the mechanism on the table to a minimum and permits it to be positioned to the rear of the center of rotation of the table, thereby aiding in counterbalancing the load on the boom. The simplified table mechanism eliminates many dangers to the individuals working with the machine and also reduces the cost of the machine.

I claim:

1. In a vehicle of the character described, the combination of a mobile base, a turntable mounted on said base, a consecution of permanently meshed gears providing a solid drive between the turntable and the base for revolving the former and for propelling the latter a lever arranged to control the operation and the rotation of said gears in either direction, and a second lever arranged to control the application of the operation of said gears for revolving the turntable or propelling the base selectively or to progressively proportion the operation between these two functions.

2. In a vehicle of the character described, the combination of a mobile base, a turntable mounted on said base, a consecution of permanently meshed gears providing a solid drive between the turntable and the base for revolving the former and for propelling the latter, and single means for proportioning the operation of said gears to swing the turntable and propel the base, said means being arranged for progressively changing from one operation to the other.

3. In a vehicle of the character described, the combination of a mobile base, a turntable mounted on said base, a consecution of permanently meshed gears providing a solid drive between the turntable and the base for revolving the former and for propelling the latter, and single means for proportioning the operation of said gears to swing the turntable and propel the base, said means being arranged for progressively changing from either one of said operations to the other.

4. In a vehicle of the character described, the combination of a mobile base, a turntable mounted on said base, a consecution of permanently meshed gears providing a solid drive between the turntable and the base for revolving the former and for propelling the latter, inversely applied brake means to impede the swing of the turntable and the travel of the base respectively, and unitary means for actuating said brake means.

5. In a vehicle of the character described, the combination of a mobile base, a turntable mounted on said base, a consecution of permanently meshed gears providing a solid drive between the turntable and the base for revolving the former and for propelling the latter, inversely applied brake means to impede the swing of the turntable and the travel of the base respectively, and unitary means for progressively applying one of said brake means while relieving the other.

6. In a vehicle of the character described, the combination of a mobile base, a turntable mounted on said base, a source of power carried by the turntable, a vertical shaft carried by the turntable and eccentric to the axis of the latter and having a pinion secured to the lower end thereof, said shaft being arranged to be driven by said source of power, a gear rotatably mounted on the base concentrically of the rotary axis of the turntable and in constant engagement with said pinion, and a second pinion engaging said gear and arranged when rotated to propel the base and when held to permit the first pinion to walk around said base to revolve the turntable.

7. In a vehicle of the character described, the combination of a mobile base, a turntable mounted on said base, a source of power carried by the turntable, a vertical shaft carried by the turntable and eccentric to the axis of the latter, said shaft being arranged to be driven by said source of power, a ring gear rotatably supported on the base concentrically of the turntable, a pinion on the shaft meshing with the ring gear, means ac-

tuated by the rotating ring gear for causing the base to travel, and alternatively operating brake means for impeding the rotation of the table or the rotation of the ring gear.

8. In apparatus of the character described, the combination of a mobile vehicular chassis, a turntable rotatably mounted on said chassis, means for retarding and stopping relative movement between the turntable and the chassis, a gear rotatably mounted on said chassis below the turntable and concentric with the rotary axis thereof, a vertical shaft mounted on the turntable eccentrically of the axis thereof and having a pinion engaging said gear, a second pinion carried by the chassis and engaging said gear without interfering with the first pinion, said second pinion arranged when rotated to propel the chassis, and means for retarding and stopping the chassis, thereby retarding and stopping the rotation of said second pinion and said gear to permit the first pinion to walk around said gear and revolve the turntable.

9. In apparatus of the character described, the combination of a mobile vehicular chassis, a turntable rotatably mounted on said chassis, means for retarding and stopping relative movement between the turntable and the chassis, a gear rotatably mounted on said chassis below the turntable and concentric with the rotary axis thereof, a vertical shaft mounted on the turntable eccentrically of the axis thereof and having a pinion engaging said gear, a second pinion carried by the chassis and engaging said gear without interfering with the first pinion, said second pinion arranged when rotated to propel the chassis, and means for retarding and stopping the chassis, thereby retarding and stopping the rotation of said second pinion and said gear to permit the first pinion to walk around said gear and revolve the turntable, inversely applied means for controlling both of said first mentioned means to impede the rotation of the turntable or the travel of the chassis, and unitary means for actuating said brake means.

10. In apparatus of the character described, the combination of a mobile vehicular chassis, a turntable rotatably mounted on said chassis, means for retarding and stopping relative movement between the turntable and the chassis, a gear rotatably mounted on said chassis below the turntable and concentric with the rotary axis thereof, a vertical shaft mounted on the turntable eccentrically of the axis thereof and having a pinion engaging said gear, a second pinion carried by the chassis and engaging said gear without interfering with the first pinion, said second pinion arranged when rotated to propel the chassis, and means for retarding and stopping the chassis, thereby retarding and stopping the rotation of said second pinion and said gear to permit the first pinion to walk around said gear and revolve the turntable, inversely applied means for controlling both of said first mentioned means to impede the rotation of the turntable or the travel of the chassis, and unitary means for progressively applying one or the other of said brake means while relieving the other.

11. In apparatus of the character described, the combination of a mobile vehicular chassis, a turntable rotatably mounted on said chassis, an engine mounted on the turntable, a gear rotatably mounted concentrically of the axis of the turntable and arranged when rotated to propel the chassis, a shaft mounted on the turntable eccentrically of the axis thereof and arranged to be driven by the engine, a pinion on said shaft meshing with said gear, means for holding the turntable stationary relative to the chassis to permit the pinion to drive the gear, means for holding the chassis and thereby holding the gear to permit the pinion to walk around the gear and revolve the table, and a lever arranged to control the application of the operation of both of said means selectively or to progressively proportion the operation between these two means.

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