

Jan. 15, 1935.

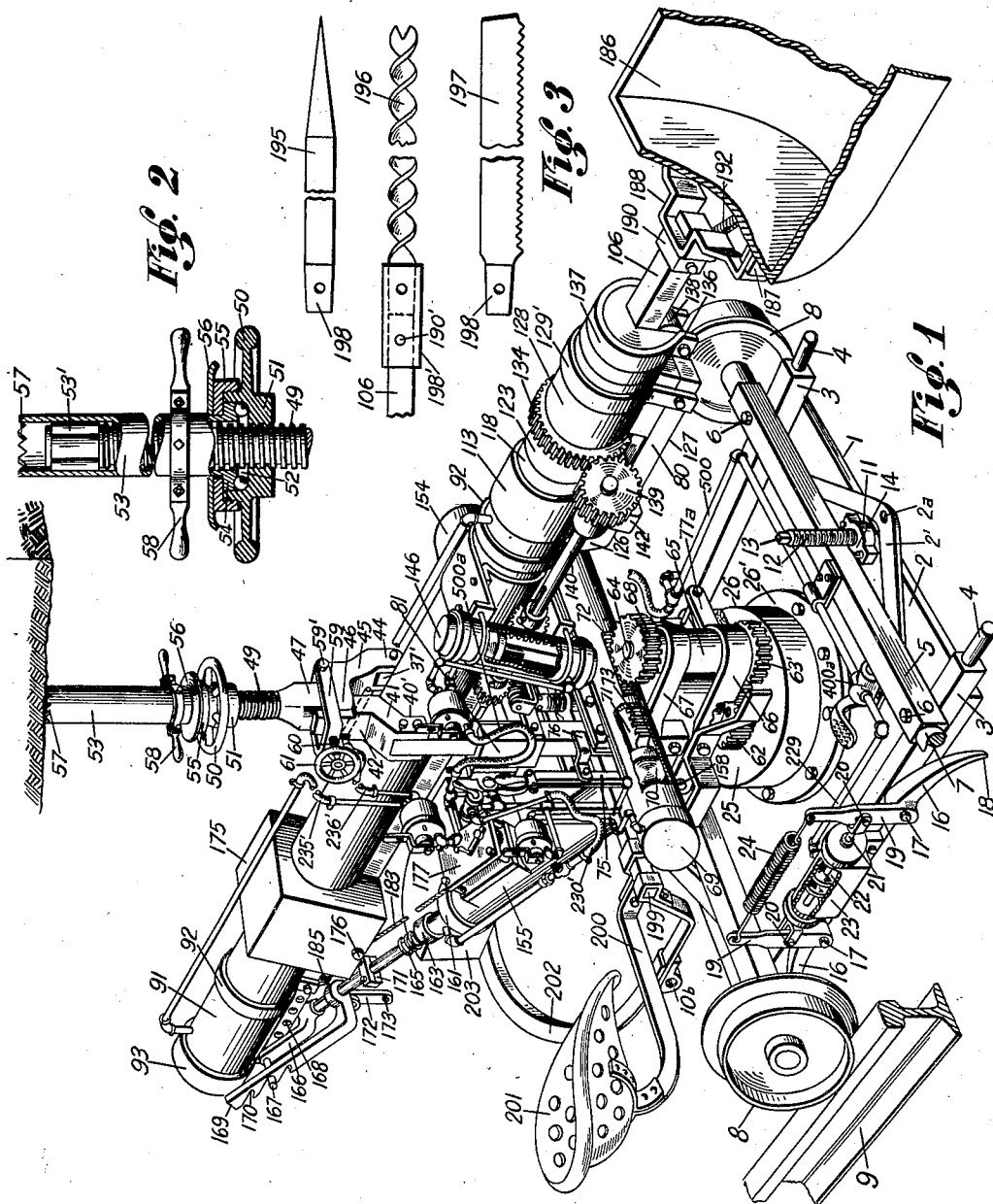
E. L. WHEELER

1,987,982

SHOVELING, DIGGING, AND BORING MACHINE

Filed Sept. 13, 1932

4 Sheets-Sheet 1



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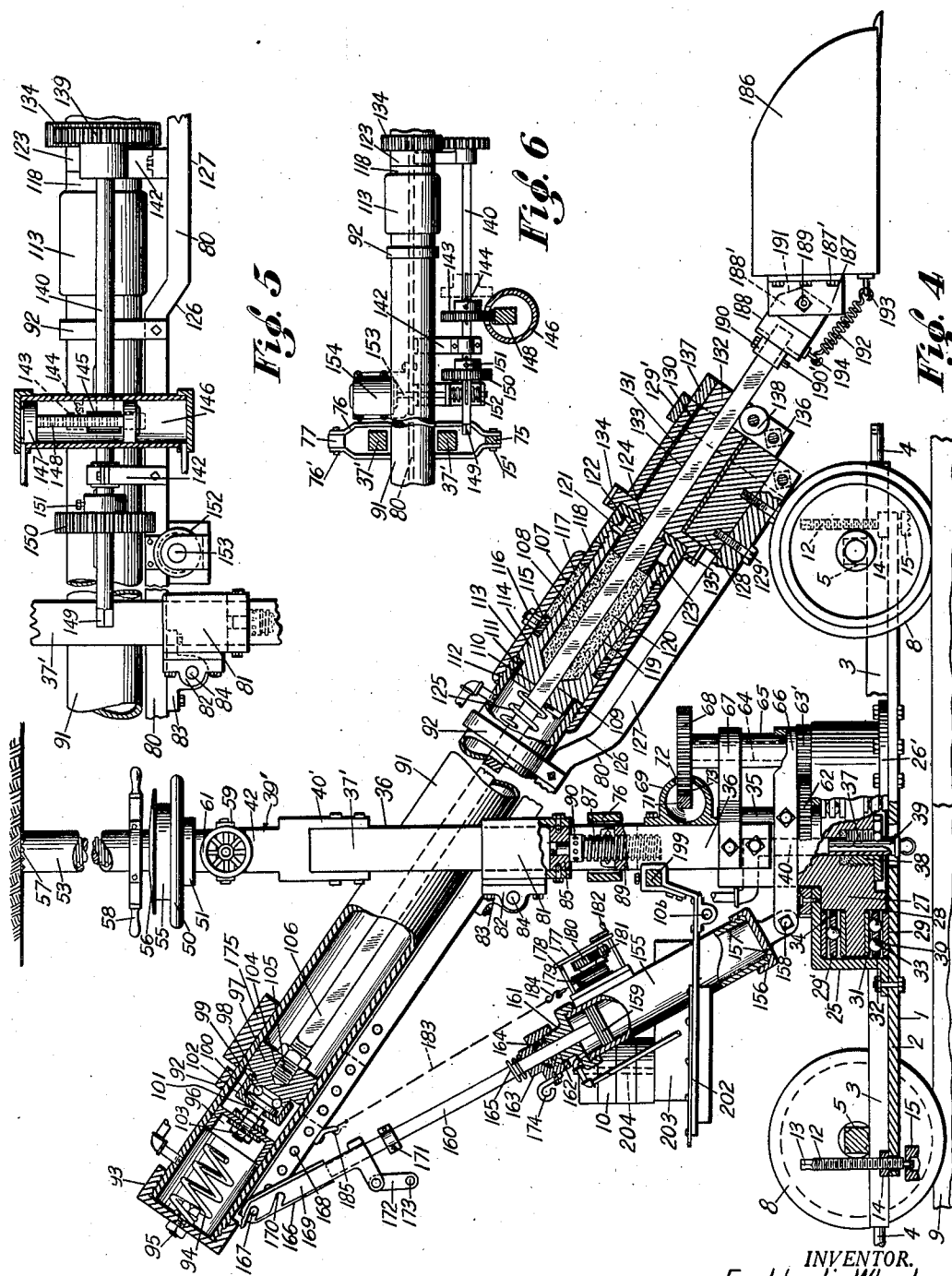
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SHOVELING, DIGGING, AND BORING MACHINE

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4 Sheets-Sheet 2



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SHOVELING, DIGGING, AND BORING MACHINE

Filed Sept. 13, 1932

4 Sheets-Sheet 3

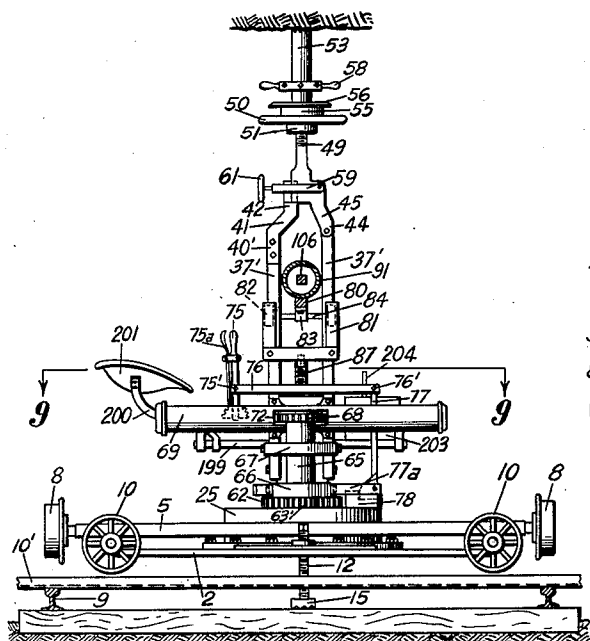


Fig. 7

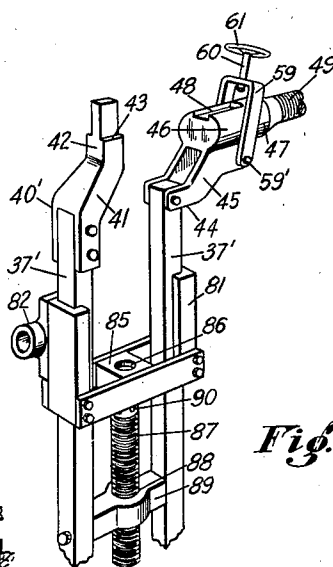


Fig. 8

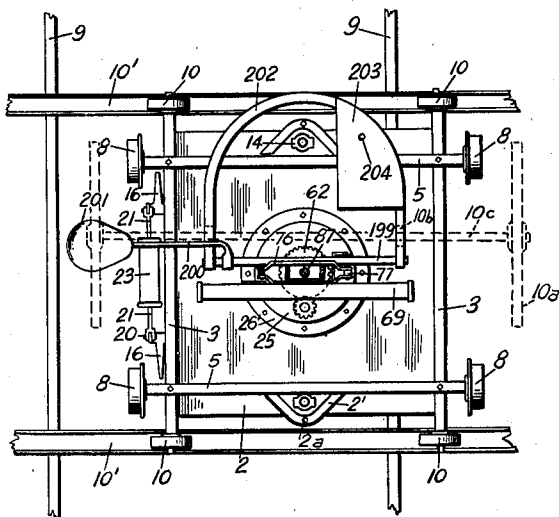


Fig. 9

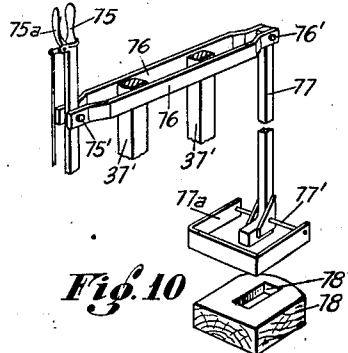


Fig. 10

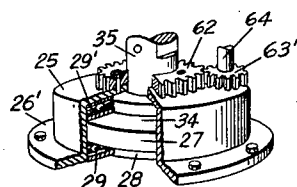


Fig. 11

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SHOVELING, DIGGING, AND BORING MACHINE

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4 Sheets-Sheet 4

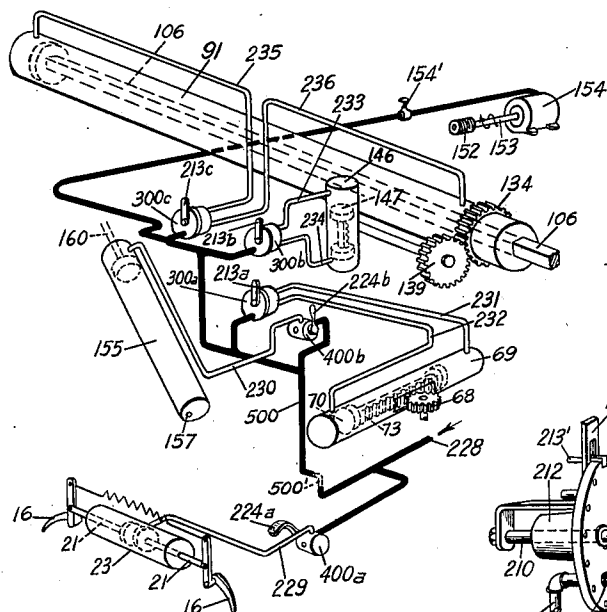


Fig. 12

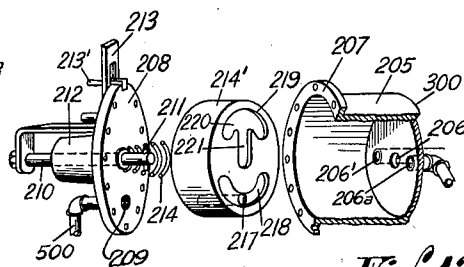


Fig. 13

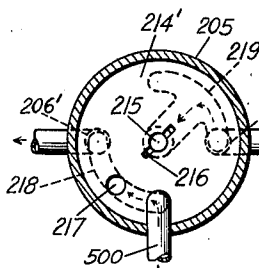


Fig. 14

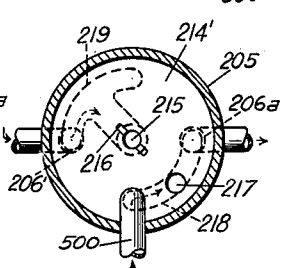


Fig. 15

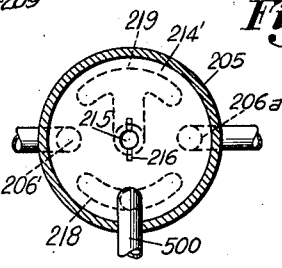


Fig. 16

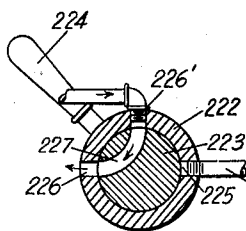


Fig. 17

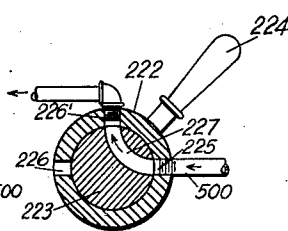


Fig. 18

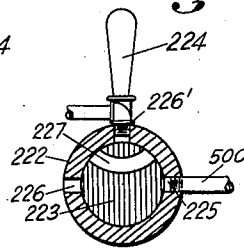


Fig. 19

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UNITED STATES PATENT OFFICE

1,987,982

SHOVELING, DIGGING, AND BORING
MACHINEEarl Leslie Wheeler, Cambridge, Ohio, assignor
of one-half to Porter H. Forsythe, Cambridge,
Ohio

Application September 13, 1932, Serial No. 632,936

46 Claims. (Cl. 262—8)

My invention relates to a shoveling, digging and boring machine. It has to do, more particularly, with a machine which is especially applicable to shoveling material, digging material and boring into material, although it is not limited to these operations but is capable of performing other operations. This machine is so designed and built that it is readily adaptable for use in a mine or other place where the space is limited, although it will be understood that it is not limited thereto.

In the past, there have been many prior art machines, of the type indicated, devised but all of them have been possessed of certain undesirable features. Most of them have been extremely complicated in structure and expensive to manufacture, and have contained a large number of parts subject to excessive wear. Furthermore, besides having a comparatively small capacity, these machines have been extremely cumbersome in structure and very heavy, so that they require a great amount of space in which to work. Such machines are, therefore, not suitable for working in the relatively restricted areas available in underground mining operations, or in other places where the space is restricted. Then too, most of the prior art machines are only capable of performing one operation and are possessed of many other undesirable features.

One of the objects of my invention is to provide a machine which is extremely simple and inexpensive to construct and which is capable of shoveling material, digging material, boring into material and performing various other operations in an efficient manner.

Another object of my invention is to provide a machine of the type indicated which is extremely compact in structure and which is therefore capable of operating in relatively restricted areas.

Another object of my invention is to provide a machine of the type indicated which is very light in structure and which is portable and can be moved from place to place by one man.

Another object of my invention is to provide a machine of the type indicated which will successfully perform its functions in an efficient, accurate and positive manner and which is of such a type that it may be readily controlled by a single man.

Another object of my invention is to provide a fluid operated machine of the type indicated which has a greatly increased capacity over prior art machines.

Other objects will appear as this description progresses.

In its preferred form, my invention contem-

plates the provision of a fluid operated machine which is mounted on a suitable chassis and this chassis is preferably provided with flanged wheels so that it may operate on the tracks in a mine or other such place. This chassis is also provided with an auxiliary set of wheels which may be mounted thereon so that the machine may be moved laterally of its normal path of travel, for example, into the rooms of a mine which are arranged at the sides of the entries. Means is provided for raising one end of the chassis off of the ground, at a time, so that the auxiliary wheels can be applied thereto. These wheels are adapted to operate in channel members and are so disposed that when they are mounted on the machine, the main wheels will occupy a position where they will not interfere with the ground or the auxiliary tracks on which the machine operates.

My invention further contemplates the provision of a turntable which is mounted on the chassis. This turntable has a jack-post suitably mounted thereon and the jack-post has an arm pivotally mounted thereon which is adapted to support the main cylinder of the machine. The arm is so mounted that it may be swung in a vertical plane. Furthermore, since the arm is mounted on the jack-post and the jack-post is mounted on the turntable, the arm may be swung laterally to any desired position. The rotation of the turntable is controlled by fluid actuated means.

The rear end of the arm is connected to the piston rod of a second cylinder in a suitable manner. This cylinder is also suitably connected to the chassis of the machine. Fluid may be admitted to and exhausted from the said second cylinder and this cylinder is adapted to control the up and down swinging movement of the arm and the main cylinder which is mounted thereon. Means is also provided on the jack-post for bodily adjusting the main cylinder and the arm on which it is mounted to various heights.

The main cylinder has a shaft suitably mounted therein in such a manner that it may be reciprocated longitudinally. This shaft is connected to a piston mechanism which operates in the main cylinder and reciprocation of the shaft is controlled by fluid pressure acting on the piston mechanism in the main cylinder. The shaft may have a shovel hingedly mounted on the outer end thereof or have other suitable tools mounted thereon. Fluid controlled means is also provided for continuously rotating said shaft so that the machine may be used for boring. Furthermore, means is provided for rendering said

last named means ineffective, or when a shovel is mounted on the outer end thereof, for merely rotating said shaft enough to dump the material from the shovel and to then return the shaft to its normal position.

My invention also further contemplates the provision of a jack which is arranged on the upper end of the jack-post and which is adapted to contact with the roof of the mine or other such place and to brace the machine in position. This jack may be adjusted to an inoperative position. Furthermore, fluid operated means is provided on the chassis for causing a plurality of teeth mounted thereon to dig into the ground to hold the machine in place.

This application is a continuation in part of my copending application, filed September 25, 1931, Serial No. 565,166, Shoveling, digging, and boring machine.

The preferred embodiment of my invention is shown in the accompanying drawings wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a perspective view of a machine constructed in accordance with my invention.

Figure 2 is a detail, partly in section, of the upper end of the jack-post.

Figure 3 is a view showing several tools which may be mounted on my machine so that it may perform various operations.

Figure 4 is a side elevation, partly broken away, of the structure shown in Figure 1.

Figure 5 is a detail partly in section of a portion of the forward end of the main cylinder and of the arm on which it is mounted and showing the mechanism which is mounted thereon.

Figure 6 is a reduced plan view, partly in section, of the structure shown in Figure 5.

Figure 7 is an end elevation, partly in section, of the entire machine.

Figure 8 is a perspective view of the upper portion of the jack-post of my machine, showing the jack in inoperative position.

Figure 9 is a plan view taken substantially on line 9—9 of Figure 7.

Figure 10 is a detail in perspective of the braking mechanism which is mounted on my machine and which is adapted to control rotation of the jack-post.

Figure 11 is a detail in perspective of a portion of the turntable mechanism of my machine.

Figure 12 is a diagram of the fluid system of my machine showing the various cylinders used for controlling various parts of my machine and showing the means for conducting fluid to said cylinders and the valves for controlling the application of fluid to and the exhaust of fluid from such cylinders.

Figure 13 is a perspective view, partly broken away, showing the type of valve used for controlling those cylinders of the fluid system of my machine wherein it is desirable to alternately exhaust fluid from one end of the cylinder and apply it to the other end, the parts of this valve being shown in spaced cooperative relation.

Figures 14 and 15 are horizontal sections of the valve shown in Figure 13, showing the various parts of the valve in the positions they occupy when the valve is actuated to cause fluid to be alternately exhausted from and applied to opposite ends of the cylinder, which is controlled by the valve.

Figure 16 is a view similar to Figures 14 and 15 and showing the valve in neutral position so

that no fluid is applied to or exhausted from the cylinder, which is controlled by this valve.

Figure 17 is a horizontal section of a valve which is used in the fluid system of my machine for controlling those cylinders wherein it is desirable to supply fluid to and exhaust fluid from one side of the pistons only, the various parts of this valve being shown in the positions they occupy when fluid is exhausted from the cylinder which the valve controls.

Figure 18 is a view similar to Figure 17, showing the parts of the valve in the positions they occupy when fluid is supplied to the cylinder.

Figure 19 is a view similar to Figures 17 and 18, showing the valve in neutral position, so that no fluid is supplied to or exhausted from the cylinder which it controls.

A chassis 1 is shown in the drawings, particularly in Figures 1 and 4, and is adapted to support the various members of my machine. This chassis comprises a base plate 2 which is of a comparatively great area. This base plate 2 is bolted, or otherwise secured, to a pair of longitudinally extending beams 3. These beams 3 are preferably square in cross section and are comparatively heavy and have spindles 4 formed at each end thereof. These spindles are provided for a purpose which will be later explained.

A pair of transverse beams 5 are also provided and these beams have each end thereof bolted to the longitudinal beams 3 by means of bolts 6. These beams 5 are also preferably square in cross section and have the spindles 7 formed on the outer ends thereof. These spindles 7 are adapted to receive flanged wheels 8 which are rotatably mounted thereon in a suitable manner. The flanged wheels 8 are adapted to support the machine on tracks 9.

I also provide a set of auxiliary wheels 10 (Figure 7) which are adapted to be mounted on the spindles 4. It will be understood that these auxiliary wheels are normally not mounted on the spindles 4 and that the machine is normally supported by wheels 8 on the tracks 9. However, if it is desired to move the machine laterally away from the tracks 9, the auxiliary wheels 10 are mounted on the spindles 4 and channel members 10' (Figures 7 and 8) are so disposed that the wheels 10 may travel therein.

The forward end of the base plate 2 is provided with a forwardly extending bent strap 2' which has both ends welded or otherwise secured to the base plate. The forward portion of this strap is provided with an opening 2a by which a suitable pulling means may be secured to the machine.

Means for raising either end of the chassis 1 is provided for facilitating the mounting of the wheels 10 on the spindles 4. This means comprises a jack member 11 disposed at each end of the machine. Each jack member comprises a threaded member 12 having a squared upper end 13 adapted to receive a wrench or other such tool. This shaft passes through a bearing member 14 which is disposed midway between the side edges of the base plate 2 and which is preferably bolted thereto. The threaded member 12 is provided on its lower end with a swiveled head 15 (Figure 4). This head 15 has a knurled lower surface so that it will grip the ground. The threaded members 12 normally occupy the positions shown in Figure 4 out of contact with the ground.

When it is desired to mount the auxiliary wheels 10 on the spindles 4, one of the members 12 is rotated until the head 15 contacts with the

ground. Continued rotation of this member causes one end of the machine to be raised and the wheels 8 at that end will be raised off of the tracks 9. The end of the machine will be raised sufficiently so that a pair of auxiliary wheels 10 may be mounted on the spindles 4. These wheels may be removably secured thereon in any suitable manner. A channel member 10' may then be placed under the pair of wheels 10, at the raised end of the machine, and then the jack 11 may be operated to lower the machine until the wheels 10 rest on such channel member.

In order to place the auxiliary wheels 10 on the opposite end of the machine the jack on that end of the machine is operated, in a similar manner, to raise the machine. Then a second channel member 10' is placed under the pair of wheels 10 at that end of the machine and the wheels are lowered into position thereon. Thus, it will be obvious that if it is desirable to move the machine laterally of the tracks 9 the wheels 10 are placed thereon and channel members 10' are suitably arranged so that the machine can be moved therealong. Furthermore, it is apparent that the wheels 10 can be readily applied to and removed from the machine.

Gripping means for holding the machine in position is provided on the chassis 1 and this means is adapted to grip the ground to hold the machine in any desired position, to which it has been moved along the tracks 9. As shown in Figure 1, this means comprises a pair of spaced teeth 16 which are pivotally mounted on the side of the chassis as at 17. The teeth are arcuate in shape and are provided with points 18 which are adapted to be forced into the ground.

Each of the teeth 16 is provided with an upwardly projecting lever 19 which is formed integrally therewith. These levers 19 are pivotally connected as at 20 to piston rods 21. The piston rods 21 are connected to pistons 22 which are disposed in a cylinder 23 mounted on the chassis. As shown in Figure 1, the pistons 22 in the cylinder 23 are not connected together. Fluid is adapted to be applied to the cylinder 23 at a point between the opposing ends of the two pistons 22, in a manner to be hereinafter explained. The upper ends of the levers 19 are connected to a spring member 24 which is disposed therebetween and which tends to hold the teeth 16 in inoperative position.

When the machine is in its proper location, and if it is desired to retain it in such location, fluid is introduced into the cylinder 23. This causes the pistons 22 to move apart and to move each piston rod 21 outwardly. Movement of the piston rods 21 outwardly causes the points 18 of the teeth to be forced into the ground. Since the pistons 22 are not connected together, one of the teeth may be forced into the ground farther than the other, depending upon the conditions of the ground. When pressure in the cylinder 23 is released, the spring 24 will pull the upper ends of the levers 19 towards each other and withdraw the points of the teeth from the ground. Thus, means is provided for retaining the machine in any desired position. This means may be quickly operated by fluid to grip the ground and when the fluid pressure is released, the teeth will be quickly withdrawn from the ground. It will be obvious that only one of these mechanisms is necessary but, if desired, one may be disposed at each side of the machine.

A turntable, which may be indicated generally by the numeral 26, is mounted on the upper sur-

face of the base plate 2 of the chassis. This turntable comprises a housing 25 which is mainly of cylindrical form but which has a flange 26' bolted to the base plate 2. A supporting table 27 is rotatably mounted within the housing 25 (Figure 4). This supporting table 27 is of the same diameter as the inside of the housing 25 and is also of the same height as the inside of this housing.

The lower surface of the table 27 is cut away as at 28 to form a chamber extending entirely therearound, on the underneath surface thereof, and adjacent the outer periphery thereof. This cutaway portion 28 is adapted to receive a thrust bearing indicated generally by the numeral 29. This thrust bearing comprises raceway members 30 and 31. A ball retaining member 32 is mounted between the raceway members 30 and 31. This member 32 is adapted to have a pair of rows of ball bearing members 33 mounted therein. Thus, the lower surface of the supporting table 27 is rotatably mounted on an anti-friction bearing.

The upper surface of the supporting table 27 is also cut away as at 34 to form a chamber extending entirely therearound. This chamber 34 is adapted to receive a thrust bearing 29' which is identical with the bearing 29 with the exception that this bearing is only provided with a single row of ball bearings 33.

It will be obvious that even though the supporting table 27 supports a great amount of weight there will be little friction generated when this member is rotated because it is mounted on the anti-friction bearing 29. Furthermore, if there is any tendency for the table 27 to tilt this will not produce friction on the upper end of the housing 25 inasmuch as the anti-friction bearing 29' is mounted between the outer edge of the table 27 and the inner surface of the upper end of the housing 25. Thus, the table 27 may be rotated with a minimum amount of power.

The upper surface of the table 27 is provided with a projecting hub 35 (Figure 11) which projects through an opening in the upper end of the housing 25. This member 35 is adapted to support the jack-post 36 of my machine, as will be later explained.

The table 27 is provided in its lower face with a chamber 37 which is cylindrical in form. This chamber 37 is adapted to receive a packing gland 38 which is suitably mounted therein. A short section of pipe 39 is adapted to pass up through this packing gland 38. The lower end of the pipe 39 passes through the base plate 2 and is rigidly connected to a second pipe which is disposed therebeneath. It will be obvious that the table 27 may rotate without rotating the pipe 39, and therefore, without affecting the rigid connection of this pipe to the pipe disposed beneath the base plate 2.

The upper end of the pipe 39 communicates with a passageway 40 which is formed in the extension 35 of table 27. This passageway 40 leads to a point adjacent the upper end of the member 35. The passageway 40 and the pipe 39, as well as the structure for mounting this pipe in the lower portion of the table 27 in such a manner that it will not rotate therewith, are provided for a purpose which will be set out more in detail hereinafter.

The jack-post 36 of my machine comprises a pair of vertically extending bars 37' (Figure 7) which are spaced apart a considerable degree so that they form a yoke member. These bars are

bolted at their lower ends to the extension 35 which is formed on the table 27. The bars 37' are secured to flattened portions formed on each side of the extension 35, by means of bolts 38' (Figures 1 and 4).

A jack member 39' is mounted on the upper end of the bars 37'. This jack member is of such a type that it may be disposed in operative position where it is adapted to be adjusted so that it will contact with the roof of the mine to brace the machine in place, or it may be swung to an inoperative position when not in use, as shown in Figure 8.

The upper end of one of the bars 37' is provided with a member 40' bolted to the upper end thereof. This member 40' is bifurcated at its lower end and fits over the upper end of the bar 37'. The member 40' is inclined inwardly as at 41 and is provided with a vertical extension 42. This vertical extension 42 has a shoulder 43 formed thereon, for a purpose which will be later explained.

The other bar 37' has a bifurcated member 44 pivotally mounted on the upper end thereof. This member 44 is inclined inwardly as at 45 and is provided with a horizontal portion 46 and an upwardly extending vertical portion 47. The inner side of the upwardly extending portion 47 is provided with a cutaway portion 48. The portion 47 has a threaded shaft 49 formed on the upper end thereof.

This threaded shaft 49 has a hand wheel 50 provided with a hub 51 which is threaded for co-operation with the shaft 49, mounted thereon (Figure 2). The upper portion of the hub 51 is cut away, as at 52, to form a raceway for a plurality of ball bearings which are adapted to be placed therein. A pipe 53 is adapted to be slipped on the upper end of the threaded shaft 49. This pipe 53 has a flange 54 formed on the lower end thereof. This flange is adapted to fit into the cutaway portion 52 of the hub 51. The lower surface of this flange is provided with a groove which is adapted to form the other raceway for the ball bearings. The upper end of the hub 51 is threaded on its outer surface and is adapted to receive a nut 55. This nut 55 overlaps the flange 54 and is adapted to retain the pipe 53 on the ball bearings. A collar 56 is mounted above the nut 55 and this collar is adapted to prevent entrance of any dirt or foreign matter, which may fall from the roof of the mine, into the operating mechanism of the jack.

The upper end of the pipe 53 is serrated as at 57 so that when it is forced against the roof of the mine it will be rigidly held in place. Roller bearings 53' are provided around the upper end of the shaft 49 and these bearings contact with the inner surface of the pipe 53. Thus, there will be no danger of the upper end of the shaft 49 binding with the pipe 53. The pipe 53 is also provided at its lower ends with a handle member 58 which is suitably secured thereto.

As shown in Figure 8, the jack 39' may be swung down to one side where it will be inoperative. If it is desired to use the jack it is swung upwardly to the position shown in Figures 1 or 4. When the portion 44 of the jack is swung upwardly, part of the horizontal portion 46 of the member 44 will rest on the shoulder 43 formed on the member 40'. The cutaway portion 48 will fit around the upper end of the vertical portion 42 of the member 40'. The upper end of this cutaway portion will rest on the extreme upper end of the portion 42. Thus, the jack member

will be rigidly supported on the upper ends of the bars 37'.

When the jack member has been swung into vertical position the hand wheel 50 may be rotated to cause the serrated upper edge of the pipe 53 to contact with the roof of the mine. Continued rotation of the hand wheel 50 causes the teeth on the upper end of the pipe to be forced into the roof surface. In case the roof is composed of hard material, when the upper end of the pipe contacts with the roof, the handle 58 may be used for rotating the pipe back and forth and at the same time the hand wheel 50 may be rotated so that the upper end of the pipe will be forced firmly into the roof surface. Thus, the jack member may be used as an additional means, to the teeth disposed on the chassis, for holding the machine in its proper position. When the jack is not in use it may be swung downwardly as shown in Figure 8.

The jack member 39' is further provided with a yoke member 59 which is adapted to fit over the portion 42 of the member 40' when the jack is in vertical position. This yoke member 59 is pivotally mounted on the jack member, as at 59', and is provided with a screw 60 which is threaded in an opening formed in the outer portion thereof. A hand wheel 61 is keyed on the outer end of this screw. It will be understood that when the jack is in vertical position the hand wheel 61 may be rotated to cause the inner end of the screw to contact with the portion 42 of the member 40' and to therefore rigidly hold the jack in position on the upper ends of the bars 37'.

The jack-post 36 of my machine is adapted to be rotated in a manner to be hereinafter described. Since an anti-friction bearing is provided between the lower end of pipe 53 and the hand wheel 50 which is disposed on threaded shaft 49, the body portion of the jack-post will be permitted to rotate without rotating the pipe 53, when the roof jack is in operative position.

The means for rotating the body portion of the jack-post 36 will now be described in detail. This means comprises a gear 62 (Figure 4) which is bolted to the upper surface of housing 25 and which is provided with an opening through which the upwardly projecting portion 35 of table 27 passes. The portion 35 may rotate in the opening in the gear 62 and this gear will be held immovable on the upper end of housing 25.

The gear 62 meshes with a pinion 63' which is keyed on the lower end of a shaft 64. This shaft 64 is rotatably mounted in a vertically disposed sleeve member 65. The lower end of the sleeve member 65 is supported by a yoke member 66 which passes around the portion 35 and which is bolted or otherwise secured thereto. The upper end of the sleeve 65 is supported by a yoke member 67 which is bolted or otherwise secured to the vertical bars 37'. The upper end of the shaft 64 is provided with a pinion 68 which is keyed thereto.

A cylinder 69 is suitably mounted on the vertical bars 37' adjacent the pinion 68. As shown in Figures 1 and 4 of the drawings, this cylinder is disposed in a horizontal position. Both ends of this cylinder are closed. A pair of pistons 70 are disposed in the cylinder and are adapted to reciprocate therein. The inner ends of these pistons are connected together by a piston rod 71. The cylinder 69 is provided with a slot 72 formed in the wall thereof between the pistons 70, this slot being disposed substantially midway between the ends of such cylinder. The pinion 68

is adapted to project through said slot into said cylinder and to mesh with a rack surface 73 which is formed on the piston rod 71. Fluid is adapted to be supplied alternately to each end of the cylinder 69 and to be exhausted from the opposite end to move the piston rod back and forth. The manner in which this fluid is applied will be set out later. As will be obvious from the drawings, the piston rod 71 is of such a length that the slot 72 will always lie between the pistons 70, so that no fluid will escape from the cylinder therethrough.

When the piston rod 71 is moved in either direction the rack surface thereon engages pinion 68 and causes rotation thereof. This, in turn, causes rotation of shaft 64 and the pinion 63'. The gear 62 is immovable on the housing 25 and therefore serves as a circular rack around the circumference of which the pinion 63' will bodily move. Movement of the pinion 63' around the gear 62 will cause bodily rotation of the main portion of the jack-post 36 and rotation of the table 27 on which the jack-post is mounted. Since the piston rod 71 is connected to both of the pistons 70, it will be extremely resistant to lateral thrust and will be very rigid so that distortion thereof will be prevented.

A braking mechanism for controlling rotation of the jack-post is shown in detail in Figure 10. This mechanism comprises a brake lever 75 which is mounted on a suitable supporting structure adjacent the cylinder 69. A locking mechanism 75a may be disposed at the lower end of the lever 75 for locking this lever in various positions. The lever 75 is pivoted midway between its ends as at 75' to a pair of strap members 76 which straddle the bars 37' and pass to the other side thereof. These bars 76 are pivoted as at 76' to the upper end of the bell-crank lever 77. The lower end of this bell-crank lever is pivotally mounted on a pin 77' which is in turn mounted on a support 77a. This support 77a is rigidly bolted to the machine as shown in Figure 7.

The support 77a is disposed directly above the upper surface of the housing 25 of the turntable mechanism. A block 78 is loosely mounted within the supporting member 77a and this block is adapted to contact with the upper surface of the housing 25. This block is preferably made of wood and is provided with a socket 78' on the upper surface thereof. This socket is adapted to receive the lower arm of the lever 77.

Movement of the lever 75 will cause the lever 77 to swing around the pin 77'. This will cause the short lower arm of the lever to exert a downward force on the block and to cause it to act as a friction brake upon the upper surface of the housing 25. It will be understood that in this manner rotation of the jack-posts may be retarded or stopped by the brake mechanism. Obviously, the block 78 may be replaced when necessary.

The mechanism for carrying the main cylinder of my machine so that it may be adjusted to various positions may be described as follows:

An arm 80 (Figures 1 and 4) is mounted on the upper portion of the jack-post 36 in such a manner that it may be tilted to any desired angle. This arm is adapted to carry the main cylinder of my machine as will be later described. The means for mounting this arm on the jack-post 36 comprises a slide member 81 which is mounted on the bars 37' in such a manner that it may be moved vertically along these bars. As will be obvious from the drawings, the arm passes

between the bars 37'. The slide member 81 is provided with bearing members 82 disposed at each edge thereof. The bearing members 82 are provided with openings which are adapted to receive a shaft 84. This shaft extends across the space between the bars 37'. The arm 80 is provided with a bearing member 83 which is bolted to the lower surface thereof (Figure 7). The shaft 84 is adapted to pass through an opening formed in this bearing member. Thus, it will be obvious that the arm 80 may be tilted to any desired angle.

The slide member 81 has a block 85 bolted to the lower end thereof. This block 85 is provided with an opening 86 which is adapted to receive the upper reduced end of a screw 87. The lower portion of this screw 87 is mounted in a threaded opening 88 formed in a block member 89 which is rigidly bolted or otherwise secured to the bars 37'. The screw 87 is provided adjacent its upper end with a plurality of openings 90 spaced around its periphery. These openings are adapted to receive a suitable tool by which the screw 87 may be rotated.

It will be understood that by rotating the screw 87 it is moved up or down in the block 89. This will cause vertical movement of the slide member 81. By this mechanism, the arm 80 and main cylinder may be bodily adjusted to any desired elevation on the jack-post 36. It will be understood hereinafter that by this adjustment the uppermost point to which the outer end of the arm and main cylinder may be swung may be varied. This is particularly advantageous as will be hereinafter explained.

The main cylinder 91 is mounted on the arm 80. This cylinder extends substantially the entire length of the arm 80 and is secured thereon by a plurality of clamp members 92. These clamp members pass around the cylinder and have their lower ends bolted to the arm 80.

The rear end of the main cylinder 91 is closed by a head 93 which is threaded thereon. This head has a buffer spring 94 bolted to the inner surface thereof by means of bolts 95.

The cylinder 91 has two pistons 96 and 97 which are adapted to operate therein. These pistons are swiveled together (Figure 4). The piston 96 is cup-shaped and has its open end disposed opposite the buffer spring 94 which is adapted to limit and to cushion its movement. The piston 97 is of the usual construction and is provided with a centrally projecting exteriorly threaded boss 98 directed toward the piston 96. The boss 98 has its outer face depressed to afford a raceway for anti-friction bearing balls 99. The second element of the raceway is provided by the conical end 100 of a headed bolt 101. A cap nut 102 is screwed on the boss 98. As shown in Figure 4, when the cap nut is positioned on the boss 98, the head 100 of the bolt 101 will be disposed therein. This bolt passes out through an opening in the cap nut 102.

The bolt 101 also passes through inner and outer washers and through a central opening formed in the piston 96. Nuts 103 are provided on the bolt 101 and these nuts contact with the respective inner and outer metal washers. Thus, it will be apparent that the piston 96 is swiveled to the piston 97. Furthermore, there is an anti-friction bearing which forms a part of this connection so that one of the pistons may revolve relative to the other without generating any appreciable amount of friction.

One face of the piston 97 is provided with a

threaded opening 104 which is formed centrally therein. The threaded end 105 of the shaft 106 is adapted to be threaded into the opening 104. Thus, the shaft 106 may be rigidly secured to the piston 97, and obviously, it is also removably secured thereto.

The shaft 106 is preferably square in cross section or of other angular shape. Since the shaft is square in cross section, or of other angular shape, the mechanism for rotating said shaft may be connected thereto in a very efficient manner. The shaft 106 is adapted to extend from the rear end of the cylinder 91 entirely therethrough and to project outwardly from the forward end thereof.

A packing gland of special form is disposed in surrounding relation to the shaft 106 adjacent the outer end of cylinder 91. Since the shaft 106 is square or angular in cross section it is necessary to provide this special form of packing gland. This novel form of packing gland 107 comprises a substantially cylindrical casting 108 which is provided with a closed rear end 109 having a square opening 110 therein through which the shaft 106 is adapted to pass. The rear portion 111 of this casting 108 is adapted to fit within the outer end of the cylinder 91.

The outer end of the cylinder 91 is threaded as at 112 and this threaded portion of the cylinder is adapted to receive the threaded inner end of a sleeve member 113 which is adapted to be screwed thereon. The casting 108 is also provided with a projecting collar 114 which is adapted to contact with the inner surface of the sleeve 113 when it is in place on the cylinder 91 and with the outer end of cylinder 91. Adjacent the outer edge of the collar 114 and disposed on the inner surface of the sleeve 113, is a collar 115. Bolts 116 have their inner ends threaded into this collar 115, and these bolts are adjustably secured in longitudinal slots formed in the sleeve 113.

Within the space between the outer surface of the casting 108 and the inner surface of the sleeve 113, packing 117 of any suitable material is disposed. A follower 118 is arranged in surrounding relation to the outer end of the casting 108 and this follower 118 is adapted to be forced inwardly to tightly pack the packing material between this follower and the collar 115. It will be apparent that the collar 115 may be adjusted longitudinally within the sleeve 113, at any time, to solidly pack the material 117 in case it becomes loose, due to wear.

The cylindrical casting 108 is provided with a longitudinal chamber 119 formed therein in surrounding relation to the shaft 106. This chamber 119 is adapted to receive suitable packing material 120 which is packed around the shaft 106. A follower 121 having a square opening 122, through which the shaft 106 is adapted to pass, has its inner end inserted in the outer open end of the cylindrical casting 108. This follower contacts with the packing material 120 and force is applied thereto to force the packing material in the chamber 119, as will be later described. A cap member 123 is threaded on the threaded outer end of the cylindrical casting 108. This cap member 123 is provided with a round opening 124 through which the shaft 106 is adapted to pass. The cap member 123 when it is threaded on the outer end of the cylindrical casting 108 may be rotated thereon and its inner end will contact with the follower 118 and will cause the packing 117 to be tightly packed between the sleeve 113

and the outer surface of the cylindrical casting 108. Furthermore, the inner surface of the end of the cap 123 will contact with the outer end of the follower 121 and will force it inwardly causing the packing 120 to be tightly packed in the chamber 119 around the shaft 106.

As will be apparent hereinafter, the shaft 106 is adapted to be reciprocated longitudinally and to also be rotated. The shaft 106 may reciprocate through the cylindrical casting 108 and the packing material disposed therein. When the shaft 106 is rotated, however, it will cause rotation of the cylindrical member 108 and the follower member 121. The cylindrical member 108 will rotate within the sleeve 113 which will remain stationary on the cylinder 91. Since the packing material 117 is disposed between the sleeve 113 and the outer surface of the cylindrical casting 108, there will be no danger of leakage of fluid at this point. It will be understood that even though I have provided a square shaft, this shaft may be reciprocated longitudinally and rotated either at different times or simultaneously, without loss of fluid from the cylinder 91. This is facilitated by the novel type of packing gland which I have provided.

As will be explained hereinafter, fluid is supplied to one end of the cylinder 91 at one side of the piston 96 and is exhausted from the other end of the cylinder 91 in front of the piston 97 and vice versa. The means for controlling the application of fluid to and exhaust of fluid from the cylinder 91 will be described hereinafter. The application of fluid to and exhaust of fluid from the cylinder 91 causes reciprocation of the shaft 106 as will be readily apparent. The inner end of casting 108 is provided with a buffer spring 125 which is fastened thereto. This buffer spring is adapted to serve as a cushion for the piston 97 when it nears the outer end of the cylinder 91.

The structure permitting rotation of shaft 106 is as follows:

The arm 80 is provided with a curved portion 126 so that the forward portion of the arm 127 is disposed at a lower level than the main portion of the arm. The extreme forward end of the arm 80 is provided with a bearing member 128 which is bolted thereto by bolts 129. The outer end of the arm 80 is further secured to the bearing member 128 by a clamp 129'. This bearing member is provided with a cylindrical opening 130 having Babbitt metal 131 disposed therein. A cylindrical member 132 is disposed within the bearing member 128 and is rotatably mounted therein.

This cylindrical member 132 has a square opening 133 extending therethrough and the shaft 106 is adapted to pass therethrough. The inner end of the cylindrical member is provided with a gear 134 which is integrally formed therewith. This gear 134 is provided with a socket 135 which is adapted to fit over the outer end of the cap 123. The gear 134 is adapted to project outwardly between the outer end of cap member 123 and the inner end of the bearing member 128. The bearing member will keep the gear and the cylindrical member 132 in the position shown in Figure 4.

The cylindrical member 132 is further provided with a slot 136 (Figure 1) formed underneath the shaft 106 and disposed at the forward end of the cylindrical member 132. A clamp member 137 is mounted in surrounding relation to the outer end of the member 132 and is securely fastened thereon. This clamp member has a

roller 138 mounted thereon and this roller projects upwardly into the slot 136 and contacts with the shaft 106. This roller serves as a roller bearing for the shaft 106 which is adapted to be reciprocated in the member 132.

It will be understood that when the member 132 is rotated through the medium of gear 134, in a manner to be hereinafter explained, this will cause rotation of shaft 106. The member 132 will rotate within the bearing member 128. When the member 132 rotates the clamp member 137 will also rotate therewith. Thus, the roller bearing 138 will always be in the proper position so that when the shaft 106 is reciprocated it will operate thereon.

The means for oscillating the shaft 106 for dumping will now be described in detail. This means comprises a gear 139 (Figures 1, 5 and 6) which meshes with a gear 134. This gear 139 is keyed to the outer end of the shaft 140 which is rotatably mounted adjacent the cylinder 91 in suitable bearing members, such as 142. This shaft has a pinion 143 splined thereon and the pinion is adjustable along this shaft. The hub of the pinion 143 is provided with a set screw 144 so that it may be held in any adjusted position on the shaft. This pinion is adapted to project through a slot 145 which is formed in the wall of a cylinder 146 midway between the ends thereof.

The cylinder 146 is identical with the cylinder 69 with the exception that it is considerably smaller. This cylinder has a pair of pistons 147 operating therein. These pistons are connected together by a piston rod 148 disposed therebetween. This piston rod is provided with a rack surface which is adapted to mesh with the pinion 143. However, the pinion may be adjusted along the shaft out of meshing relation with the rack on the piston rod 148.

Fluid is adapted to be supplied to one side of the cylinder 146 and exhausted from the other side alternately in a manner to be hereinafter described. When fluid is supplied to one side of the cylinder and exhausted from the other, it will cause movement of the pistons 147 therein. This will cause movement of the piston rod and the rack surface of this piston rod will mesh with the pinion 143 and will cause rotation thereof. This will in turn cause rotation of the shaft 140 and gear 139. Rotation of gear 139 causes rotation of gear 134 which will in turn cause rotation of the cylindrical member 132 and the shaft 106.

Movement of the piston rod 148 in one direction is adapted to preferably cause rotation of the shaft 106 through one-half a revolution so that when a shovel is mounted on the outer end thereof, the material may be dumped therefrom. Furthermore, movement of the piston rod in the opposite direction will return the shovel to its original upright position.

It will be understood that the pinion 143 could be moved out of mesh with the piston rod 148. Then the piston rod and the pistons thereon could be moved to one end of the cylinder as shown in Figure 5. The pinion can then be adjusted until it meshes with the rack on the piston rod. Thereafter, downward movement of the pistons and piston rod would cause rotation of the shaft 106 in a certain direction and upward movement of the piston rod would cause rotation of the shaft 106 in a reverse direction.

It will be understood that the piston rod 148 is of such a length that no matter what position the piston rods and the pistons occupy in the cylinder,

the slot 144 will always be between said pistons. Thus, no fluid will be permitted to escape through such slot.

The extreme inner end of the shaft 140 is provided with a portion 149 which is adapted to receive a crank. It will be understood that the pinion 143 could be adjusted out of meshing relation with the rack surface on the piston rod 148 and that the crank could then be used for manually rotating the shaft 106 to dump the material from the shovel mounted thereon.

The means for rotating the shaft 106 for drilling may be described as follows:

The shaft 140 is further provided adjacent its inner end with a gear 150 which is splined thereon. This gear is adjustable along the shaft and may be held in any adjusted position by a set screw 151. This gear is adapted to be moved along the shaft into and out of meshing relation with a worm 152 which is rotatably mounted underneath the arm 80. As shown in Figure 6, this worm is rigidly mounted on the rotor of a motor 154. This motor 154 may be of any type, preferably an air motor, and is controlled by a valve 154' (Figure 12). This motor receives fluid from the main pressure line which conducts fluid to the other operating mechanism of my machine.

The cylinder 146 and the associated mechanism are used for rotating the shaft 106 for dumping purposes. The motor 154 and associated mechanism are used for continuously rotating the shaft 106 so that it may be used for drilling or other such work. It will be understood that when the dumping mechanism is used the drill operating mechanism is not used, and vice versa. In order to render the dumping mechanism inoperative, the pinion 143 is moved out of mesh with the rack surface on the piston rod 144. To render the drilling mechanism inoperative, it is merely necessary to move the gear 150 out of meshing relation with the worm 152.

The means for tilting the arm 80 and the cylinder 91 carried thereby, to any desired position comprises a cylinder 155 (Figures 1 and 4) which is provided with a head 156 at its lower end and this head has an opening 157 therein. The head 156 of the cylinder is pivotally connected to the yoke member 66 as at 158, and as previously stated, this yoke member is mounted on the extension 35 of the table 27.

A piston 159 is adapted to operate in the cylinder 155. This piston 159 is connected to a piston rod 160. The piston rod 160 passes through an opening formed in a head 161 which is mounted on the upper end of the cylinder 155. The head 161 is provided with a boss 162 which is threaded and which is adapted to receive a cap member 163. Packing material 164 is adapted to be mounted between the upper end of the boss 162 and the cap 163. A spring 165 is loosely mounted on the upper end of cap member 163 in surrounding relation to the piston rod 160.

As shown best in Figure 1, the upper end of the piston rod 160 has a fork member 166 suitably mounted thereon. This fork member is adapted to straddle the rear end of the arm 80 and may be connected to such arm by a pin 167 adapted to pass through an opening 168 formed in such arm. This arm is provided with a plurality of openings 168 spaced therealong so that the connection of the piston rod to the arm may be varied in order to change the uppermost and lowermost limits to which the forward end of the arm may be adjusted. The piston rod 160 is further provided with a second fork member 169 adjustably

mounted on the upper end thereof. The arms of this fork member are provided with notches 170 which are adapted to engage the pin 167 which extends outwardly from the arm 80. This second fork member takes part of the thrust which would otherwise be placed on the fork member 166.

Fluid is adapted to be introduced into the upper end of the cylinder 155 above the piston 159 in a manner to be hereinafter described. It will be understood that when fluid is supplied above the piston 159 it will cause such piston to move downwardly in the cylinder 155 thereby pulling down on the rear end of the arm 80 and raising its forward end. Since the lower end of the cylinder is provided with the opening 157 there will be no pressure in the cylinder below the piston, which will tend to retard downward movement of the piston. It will be understood that when fluid is exhausted from the upper end of the cylinder the weight of the forward portion of the arm 80 and the cylinder 91 and the operating mechanism carried on the forward end thereof, will cause this forward end of the arm and cylinder to drop so as to raise the rear end of the arm and cylinder and to raise the piston 159.

The piston rod 160 is further provided with a collar 171 which is adjustable therealong. It will be understood that this collar may be adjusted to limit the downward stroke of the piston 159. It will be seen that the spring 155 and collar 171 will contact with each other and the spring serves as a cushion for the downward movement of the piston.

The fork member 169 is provided with a link 172 pivotally mounted thereon. This link 172 is provided with an opening 173 formed in the lower end thereof. The cap 163 of the cylinder 155 is provided with a laterally turned hook member 174 mounted thereon. When the machine is inoperative, the rear end of the arm may be moved downwardly to a substantially horizontal position and the hook 174 may be engaged by the opening 173 in the link 172. Thus, the arm will be held in horizontal position.

As shown in Figure 1, the rear end of the arm 80 is provided with a counterweight 175 which embraces the cylinder 91. The counterweight is longitudinally adjustable along the arm 80 and a removable bolt 176 is provided for securing it in any adjusted position. This bolt 176 is adapted to pass through any one of the openings 168 formed in the arm. Thus, the counterweight 175 may be adjusted to vary the effective weight of the rear end of the arm 80.

Manually controlled means for holding the arm 80 in any desired position is provided on the machine. This means is independent of the air-controlled mechanism which is used for tilting the arm and comprises a winch member 177 which is mounted on the cylinder 155. This winch member 177 comprises a supporting member 178 which is suitably secured to the cylinder. This support 178 has a drum 179 rotatably mounted therein. A gear 180 is formed integrally with the said drum. This gear 180 meshes with a pinion 181 which is mounted on the inner end of a crank 182. A cable 183 is adapted to be wound on the drum and the free end of this cable is provided with a hook 184 which may be engaged with a loop 185 secured to the under-surface of the arm 80.

When the cable is connected to the arm, the rear end of the arm may be pulled downwardly to any desired position by merely rotating the crank 182 and winding the cable on the drum 179.

Means is provided for locking the crank in position to prevent rotation of the drum. It will be obvious that by use of this winch member the arm 80 may be adjusted to any position and held in such adjusted position. It will be understood that this winch member is normally not used but in some cases it is highly desirable to use it.

The forward end of the shaft 106 may have any desired form of tool mounted thereon. As shown in Figures 1 and 4, the shaft 106 is provided with a shovel 186 hingedly mounted thereon. This shovel has two pairs of lugs 187 bolted to the rear surface thereof as at 187'. Each pair of these lugs is adapted to receive one arm 188' of a bail member 188 which is pivotally secured thereto as at 189. The bail member 188 is provided with a socket member 190 which is adapted to receive the outer end of the shaft 106. The socket member 190 is removably mounted on the outer end of the shaft and is held thereon by a pin 190' passing through openings in the walls of the socket and an opening in the outer end of shaft 106.

When the shovel 186 is in alignment with the shaft 106, the rear face of the shovel, or a plate disposed thereon, will contact with the outer ends of the arms 188' of the bail member 188. Thus, further downward movement of the shovel relative to the shaft 106 is prevented. However, the upper corners of the outer end of the arms 188' are cut away as at 191 so that the shovel may swing upwardly relative to the shaft 106. A spring 192 is connected to the rear surface of the shovel as at 193 and to the socket member 190 of the bail structure as at 194. This spring is normally adapted to keep the shovel 186 in alignment with the shaft 106.

It will be obvious that if pressure is applied to the forward edge of the shovel 186 it will cause it to swing upwardly around the pivot point 189 against the action of the spring 182. Thus, the shovel may occupy a horizontal position while the arm 80 and shaft 106 are tilted relative to the horizontal. As soon as pressure on the shovel is released, the spring 192 will return the shovel 186 to its normal position in alignment with the shaft 106. It will be obvious that this shovel may be readily removed from the outer end of the shaft 106 and other tools placed thereon. To remove the shovel, it is merely necessary to remove pin 190' and to slip the socket member 190 off of the end of shaft 106.

In Figure 3, I have shown a digging tool 195, a boring tool 196 and a saw 197, either one of which might be mounted on the outer end of the shaft 106. Each of these tools is provided with a portion 198, which is adapted to fit into one end of a socket member 198', shown in Figure 3. Openings are provided in the outer end of this socket member and these openings are adapted to receive a pin which passes through a corresponding opening in the portion 198 of the tools, so that any of the tools may be secured in the socket. This socket member is also provided with openings on its inner end. The inner end of this socket is adapted to fit over the outer end of shaft 106. The socket may be secured on the shaft by means of pin 190' which passes through the openings in the inner end of the socket member and the corresponding opening in the outer end of shaft 106. Thus, any of the tools may be mounted in the outer end of shaft 106. It will be obvious, however, that various other tools may be mounted on the outer end of shaft 106 so that the machine may perform various kinds of work.

As shown in Figure 1, my machine is further provided with a seat-supporting bar 199 which is mounted on the rear surface of the bars 37' a considerable distance above the chassis. The bar has an arm 200 extending laterally therefrom and a seat 201 is mounted on the outer end of this arm. This seat is provided for the operator of the machine. A semi-circular bar 202 has each of its inner ends connected to the bar 199 and extends rearwardly therefrom. This semi-circular bar 202 serves as an additional counterbalance for the forward portions of the machine. As shown in Figures 4 and 9, container 203 is mounted on the semi-circular bar 202 on the side opposite the seat 201 and adjacent the rear portion of the bar. This container 203 is adapted to receive counterbalance weight for counterbalancing the weight of the operator. A post 204 may be disposed on the upper surface of the container 203 and this post is adapted to receive the auxiliary wheels 10 when they are not being used. These wheels also serve as a counterbalance.

In some cases it may be desirable to support the machine on a transporting means other than the flanged wheels which are adapted to operate on tracks, so that the machine may be transported from place to place even though there are no tracks. In Figure 9, I have shown, by dotted lines, a pair of large transporting wheels 10a which are rotatably mounted on the outer ends of an axle 10c. This axle 10c is secured in members 10b which are mounted on each side of the rearwardly extending bar 202 (Figures 1 and 9).

It will be understood that when the transporting wheels 10a are used, the flanged wheels 8 and the auxiliary wheels 10 are removed and the entire machine is supported on the ground by means of wheels 10a. The machine may then be transported on these wheels to any desired position. When the machine is properly located, the wheels may be removed and the machine will then rest on the base plate 2 which will be disposed on the ground. Since this base plate is of comparatively great area there will be no danger of the machine tipping. Furthermore, if the machine is working in a suitable place, the roof jack may be used for holding it in place.

In Figure 12 I have shown diagrammatically, the various cylinders which control the operation of the various parts of my machine and the means for connecting these cylinders to the source of fluid supply. The fluid which I preferably use is compressed air but it will be understood that other fluids may be used if desired. The air under pressure is preferably supplied from a suitable compressor which may be disposed adjacent the machine. However, if desired, the compressor could be mounted directly on the machine.

With reference to Figures 13 to 16, inclusive, I have shown one type of valve which I may use for controlling application of fluid to, and exhaust of fluid from, several of the cylinders. This valve 300 comprises a casing 205 which is provided with a pair of apertures 206' and 206a and an aperture 206 formed in the rear end thereof. The front end of the casing 205 is provided with a flange 207 which is adapted to be bolted to a front plate 208. This front plate 208 is provided with an aperture 209. The front plate 208 is further provided with a shaft 210 projecting therefrom and this shaft has a pin 211 disposed transversely through an opening formed in the inner end thereof. The shaft 210 projects through the plate 208 and its outer end is mounted in a support 212. A lever 213 is provided for

rotating the shaft 210 and this lever is keyed to such shaft. Latching means 213' may be provided for locking the lever in any adjusted position. A spring 214 is adapted to be mounted in surrounding relation to the inner end of the shaft 210.

A valve core 214' is adapted to be rotatably mounted within the casing 205. This valve core is provided with a socket 215 formed on its front surface and this socket 215 is adapted to receive the end of the shaft 210. This socket 215 is provided with a slot 216 formed therein and this slot is adapted to receive the transverse pins 211. Thus, the core member 214' will rotate with the shaft 210 when such shaft is turned. Furthermore, the spring 214 will bear against the front surface of the core when the valve is assembled to keep the rear surface of such core tightly in contact with the rear surface of the casing 205, and to form a chamber in the casing between the core and the plate 208.

The core 214' has an opening 217 extending entirely therethrough and the rear end of this opening communicates with an arcuate groove 218 formed in the rear end of the valve core. The rear surface of the valve core is further provided with a groove 219 which is cut therein. This groove comprises an arcuate portion 220 and a straight portion 221 which extends from said arcuate portion.

The valve just described is to be used in the fluid supply system of my machine for controlling the application of fluid to those cylinders wherein it is necessary to alternately supply fluid to one end of the cylinder and to exhaust it from the other end of the cylinder.

The aperture 209 in the plate 208 of the valve 300 is adapted to communicate with the main air pressure line 500. The central aperture 206 formed in the rear end of the casing 205 is adapted to serve as an exhaust opening. The other two apertures 206' and 206a in the rear end of the casing are adapted to communicate with a pair of pipes, each of which is connected to one end of the cylinder which is to be controlled by this valve.

In Figure 14 I have shown the valve core 214' of this valve rotated to such a position that the groove 218 is so disposed as to cause communication between the opening 217 formed in the core and the apertures 206' formed in the rear end of the valve casing 205. As previously stated, this opening 206' communicates with one of the pipes which is connected to one end of the cylinder to be controlled by this valve. Thus, air will pass from the main pressure line 500 between the valve core 214', the base plate 208, and will then pass upwardly through the opening 217. It will then pass through groove 218 and out through the aperture 206' and through a pipe to one end of the cylinder. The arcuate portion 220 of the groove 219 will be so disposed that it will communicate with the other aperture 206a which communicates with a pipe connected to the opposite end of the cylinder. The straight portion 221 of this groove will communicate with the exhaust aperture 206. Thus, fluid will exhaust from one end of the cylinder through the pipe which is connected to the aperture 206a, will then pass through the straight portion 221 of the groove 219, and will then pass into the arcuate portion 220 of the groove and out through the exhaust opening 206.

In Figure 15 I have shown the valve core 214' rotated to such a position that it will cause ap-

plication of air to the end of the cylinder, opposite to that when it occupied the position shown in Figure 14, and which will also exhaust fluid from the end of the cylinder opposite to that which was exhausted when the valve core occupied the position shown in Figure 14.

In Figure 16 I have shown the valve in its neutral position. In this position both of the openings 206' and 206a which communicate with pipes that are connected to the cylinder, are closed by the upper end of the valve core. The groove 218 will not communicate with either of these apertures 206' or 206a. The groove 219 will only communicate with the exhaust aperture 206. Thus, no fluid will be applied to the cylinder or exhausted therefrom when the valve is adjusted as shown in Figure 16.

In Figures 17, 18 and 19, I have shown a valve 400 which may be used for controlling the application of fluid to those cylinders, mounted on my machine, where it is only necessary to supply fluid to the cylinder at one side of the piston and to exhaust fluid from such side of the piston. This valve 400 comprises a casing 222 having a valve core 223 rotatably mounted therein. Rotation of the valve core 223 is controlled by a lever 224. The valve casing 222 is provided with an inlet opening 225 which is adapted to communicate with the main pressure line 500. It is also provided with an opening 226' which communicates with a pipe connected to the cylinder which is to be controlled by this valve. The casing 222 is also provided with an exhaust opening 226. The valve core is provided with an arcuate passageway 227.

In Figure 17 I have shown the valve core 223 rotated to such a position that the passageway 227 establishes communication between the exhaust port 226 and the opening 226' which communicates with the pipe connected to the cylinder to be controlled by this valve. Thus, any air in the cylinder will be exhausted through the opening 226.

In Figure 18 I have shown the valve core rotated to such a position that the passageway 227 establishes communication between the opening 225 which communicates with the main pressure line 500 and the opening 226' which communicates with the pipe which is connected to the cylinder. Thus, pressure from the main air line will be supplied to the cylinder.

In Figure 19 I have shown the valve core 223 rotated to such a position that the passageway 227 will not communicate with any of the openings in the valve casing. This is the neutral position of the valve and when the valve is in this position, no pressure will be exhausted from the cylinder and no additional pressure will be supplied thereto.

The entire fluid system of my machine is shown diagrammatically in Figure 12. The shaded pipe indicates the main air line 500 and the end 228 of this main air pressure line may be connected to a suitable compressor. A portion of this pipe 500 is mounted beneath the base plate 2 of the chassis. This pipe is connected to pipe 39 which passes up into member 35. A section of the pipe 500 is also connected to the upper end of passageway 40 in the member 35. Thus, the section of the main pressure pipe which is disposed underneath the base plate and the section of pipe mounted on the machine proper are connected together in such a manner that rotation of the jack-post will not interfere with such connection. The dotted portion 500' (Figure 12)

of the pipe 500, indicates the point where this connection occurs.

A branch pipe 229 branches off of the main air pressure line 500 and a valve 400a is interposed therebetween. This valve 400a is identical to the valve 400 previously described. The pipe 229 communicates with the cylinder 23 midway between its ends and between the pistons 22. It will be understood that the lever 224a may be actuated to cause air to flow into the cylinder 23 and that this will cause the pistons 22 to move outwardly and to force the teeth 16 into the ground. The lever 224a may also be actuated to exhaust fluid from such cylinder so that the teeth will be withdrawn from the ground.

The main air pressure line is also provided with a branch pipe 230. This branch pipe 230 communicates with the upper end of the cylinder 155. As shown in Figure 1, this pipe is provided with a flexible portion 230' so that the cylinder 91 may swing without disturbing the connections of this pipe. A valve 400b is interposed between the end of the branch pipe 230 and the main pressure pipe 500. This valve 400b is also identical with the valve 400 previously described. It will be understood that the valve 400b may be actuated by the lever 224b to cause fluid to be supplied to the cylinder 155 above the piston 159 or to cause fluid to be exhausted therefrom. Thus, the cylinder 91 may be tilted to any desired position. Furthermore, it may be held in any position by adjusting the valve to neutral position.

Branch pipes 231 and 232 are provided and these pipes communicate with different ends of the cylinder 69. A valve 300a is disposed between the inner ends of these branch pipes and the main pressure pipe 500. This valve 300a is identical with the valve 300 previously described. It will be understood that by operating the valve lever 213a the valve may be adjusted so that it will alternately supply air to one end of the cylinder 69 and exhaust it from the other end thereof. Thus, movement of the piston rod 71 will be caused and this will cause rotation of the jack-post. The valve may also be adjusted to neutral position to hold the jack-post in any position to which it is rotated.

Branch pipes 233 and 234 are further provided and these branch pipes communicate with different ends of the cylinder 146. A valve 300b is interposed between the ends of these branch pipes and the main pressure pipe 500. The pipe 500 adjacent its connection to valve 300b is provided with a flexible section 500a (Figure 1). Thus, the cylinder 91 can be tilted without affecting the connection of pipe 500 to valve 300b. This valve 300b is also identical with the valve 300. It will be understood that by operating the lever 213b air may be supplied alternately to one end of the cylinder 146 and exhausted from the opposite end. This will cause movement of the piston rod 143 and will oscillate the shovel on the outer end of shaft 106 between normal position and dumping position.

Branch pipes 235 and 236 are also provided and a valve 300c is interposed between the ends of these branch pipes and the main pressure pipe 500. These pipes 235 and 236 are provided with flexible sections 235' and 236' (Figure 1). The opposite ends of these pipes communicate with opposite ends of the main cylinder 91. It will be obvious that by operating the lever 213c fluid may be alternately supplied to one end of the cylinder 91 and exhausted from the other end

of the cylinder 91. This will cause the longitudinal reciprocation of the shaft 106 in the cylinder 91. Furthermore, the valve may be adjusted to neutral position so that the shaft may be caused to remain in any position to which it is moved.

The operation of my machine will now be described, first, as it is used for shoveling and loading material. It will be understood that the shovel 186 will be mounted on the outer end of the shaft 106. The valve 300a will be first operated to swing the outer end of the cylinder 91 and the shovel 186 over the material to be shoveled. The rear end of the cylinder 91 may then be raised by operating the valves 400b to exhaust air from the upper end of the cylinder 155. When the forward end of the cylinder 91 has been lowered to such an extent that the shovel 186 will contact with the ground or the material to be shoveled, continued lowering of the arm will cause the shovel to assume a horizontal position. Then in order to force the shovel into the material, the valve 300c is operated to cause the shaft 106 to move forwardly.

The valve 400b is then actuated to cause fluid to be forced into the upper end of the cylinder 155 and this will cause raising of the forward end of the cylinder 91 and shaft 106 and will cause the shovel to pick up the material. The valve 300a may then be actuated to cause the shovel 186 to be swung over the point where it is desired to dump the material. The valve 300b may then be actuated to cause the shaft 106 to be oscillated so that the material will be dumped from the shovel. These operations may be repeated. It will be understood that the valve 300a and the valve 400b may be operated simultaneously to cause a vertical motion of the outer end of the cylinder 91 and also a lateral motion at the same time so that such arm may be swung in an arc between dumping position and loading position.

It will also be understood that the lowermost and uppermost limit of the outer end of the cylinder 91 may be adjusted by adjusting the connection of the piston rod 160 to such cylinder. Furthermore, the highest point to which the machine may dump the material may be varied by operating the screw member 87 which causes bodily adjustment of the cylinder 91 along the height of the jack-post 36. The lowermost point to which the rear end of the cylinder 91 may be moved may be adjusted by adjustment of the collar 171 on the piston rod 160.

When my machine is used for drilling, the shovel is removed from the outer end of the shaft 106 and the boring tool 196 is mounted thereon. The cylinder 91 is then adjusted to the proper position with the outer end of the bore in contact with the surface to be bored. The cylinder 91 may be held in the desired position by connecting the cable 183 thereto and adjusting the snubber 177 to hold it in such position. The pinion 143 on the shaft 140 is adjusted out of meshing relation with the rack formed on rod 148. The gear 150 is adjusted on the shaft 140 until it meshes with the worm 152. Then the motor 154 is started in operation and this will cause rotation of the shaft 106 and the boring tool 196. In order to move the shaft 106 forwardly, as the boring operation progresses, so that the boring tool will be crowded into the material, the valve 300c may be "cracked" in a well known manner to cause the shaft 106 to be crowded forwardly. When the bore has been made the valve 300c may be oper-

ated to cause the shaft 106 to move rearwardly and to withdraw the boring tool from the bore.

The machine may also be used for digging and in this case the digging tool 195 is mounted on the outer end of the shaft 106. When the digging operation is begun, the forward end of the cylinder is lowered to the desired position and is held in such position by the snubber 177. The valve 300c is then operated to cause reciprocation of the shaft 106 and this will cause the tool to reciprocate and to dig up the material.

The digging tool may be removed and a saw 197 placed on the outer end of the shaft 106. This sawing operation is conducted in much the same manner that the digging operation is conducted. The saw will be reciprocated back and forth and will saw into the material. During the sawing operation and drilling operation, the snubber 177 may be adjusted to prevent too much weight being applied to these tools.

It will be obvious that other forms of tools may be mounted on the outer end of the shaft 106 and that my machine may perform numerous other operations.

It will be understood from the above description that I have provided a machine having many desirable features. For example, my machine is extremely simple in structure and therefore, inexpensive to construct. Furthermore, it is compact and very light and can be moved from place to place readily by one man. It is also capable of operation in relatively restricted areas. Furthermore, it may be efficiently operated to perform all of its various functions by a single man. Then too, this machine has a greatly increased capacity over prior art machines and can perform numerous operations which was not possible with prior art machines.

It will be apparent that there are many other advantages possessed by my machine. These advantages will be readily apparent from the description and drawings and the claims appended hereto.

Having thus described my invention, what I claim is:

1. A machine of the class described comprising a tool carrying member, means for reciprocating said tool carrying member, means for continuously rotating said tool carrying member, and means for oscillating said tool carrying member about its own axis.

2. A machine of the class described comprising a tool carrying member, means for continuously rotating said tool carrying member, and independent means for oscillating said tool carrying member about its own axis.

3. A machine of the class described comprising a turntable, a jack-post mounted on said turntable, an arm pivotally mounted on said jack-post in such a manner that it may be tilted in a vertical plane, means for tilting said arm in a vertical plane and means for bodily adjusting said arm vertically along said jack-post.

4. A machine of the class described comprising a chassis, a turntable mounted on said chassis, an arm mounted on said turntable in such a manner that it may be tilted to any desired angle, means for tilting said arm, a shaft mounted on said arm, cylinder and piston mechanism for moving said shaft longitudinally, cylinder and piston mechanism for rotating said shaft, and means for bodily adjusting said arm to various heights.

5. A machine of the class described comprising a turntable, fluid controlled means for rotating said turntable, an arm mounted on said turntable

in such a manner that it may be tilted to any desired angle, fluid controlled means for tilting said arm, a shaft mounted on said arm, fluid controlled means for moving said shaft longitudinally, fluid controlled means for oscillating said shaft about its own axis between normal position and dumping position when a shovel is mounted on the outer end of said shaft without disturbing said arm, and separate fluid controlled means for continuously rotating said shaft.

6. A machine of the type described comprising a chassis, a turntable mounted on said chassis, a jack-post mounted on said turntable, an arm pivotally mounted on said jack-post in such a manner that it may be tilted to any angle, means for adjusting said arm bodily to various heights along said jack-post, a shaft mounted on said arm, means for reciprocating said shaft longitudinally, means for oscillating said shaft between normal position and dumping position when a shovel is mounted on the outer end of said shaft, means for rendering said last named means inoperative, and means for continuously rotating said shaft.

7. A machine of the class described comprising a turntable, means for rotating said turntable, an arm mounted on said turntable in such a manner that it may be tilted to any desired angle, a shaft mounted on said arm, means for reciprocating said shaft longitudinally, means for oscillating said shaft about its own axis between normal position and dumping position when a shovel is mounted on the outer end of said shaft without disturbing said arm, means for rendering said last named means inoperative, and means for continuously rotating said shaft.

8. A machine of the class described comprising a chassis, a turntable mounted on said chassis, fluid controlled means for rotating said turntable, an arm mounted on said turntable in such a manner that it may be tilted to any desired angle, fluid controlled means for tilting said arm, means for bodily adjusting said arm to various heights, a shaft mounted on said arm, fluid controlled means for moving said shaft longitudinally, and fluid controlled means for rotating said shaft.

9. A machine of the class described comprising a turntable, an arm mounted on said turntable, a shaft mounted on said arm, means for rotating said shaft about its own axis, said means comprising cylinder and piston mechanism, said cylinder and piston mechanism comprising a pair of pistons mounted in a single cylinder and being connected together by a piston rod, a rack surface formed on said piston rod, means for operatively connecting said gear to said shaft, means for rendering said means for rotating said shaft ineffective, and independent fluid controlled means for continuously rotating said shaft.

10. In a machine of the class described, a main cylinder, said cylinder being mounted in such a manner that it may be tilted to any angle, a shaft mounted in said cylinder and adapted to rotate and reciprocate therein, and a scoop member hingedly mounted on the outer end of said shaft.

11. In a machine of the class described, a main cylinder, said cylinder being mounted in such a manner that it may be tilted to any angle, a shaft mounted in said cylinder and adapted to rotate and reciprocate therein, a scoop member hingedly mounted on the outer end of said shaft, said scoop member being normally in alignment with said shaft and being movable out of alignment with said shaft when pressure is applied to the outer edge of said scoop, and means for returning said

scoop to its normal position when said pressure is released.

12. In a machine for the purpose set forth, a cylinder, a plunger therein and a rod connected to the plunger, means for introducing air under pressure into the cylinder to act upon the plunger to reciprocate the same, means for regulating the admission of air and likewise for regulating the reciprocatory movement of the plunger and air controlled means for imparting a rotary movement to the rod, independent of the air means for reciprocating the rod, and air operating means for swinging the cylinder to different vertical angles and means for turning the rod when the cylinder and rod are elevated and air operated means for rotating the cylinder and rod and brake means for stopping or limiting the vertical rotation of the rod and cylinder.

13. In an air operated machine for the purpose set forth, cylinders having plungers therein, a jack-post comprising an intermediate and end sections, and upon which intermediate section the cylinders are supported, means for longitudinally adjusting the intermediate section between the end sections of the jack-post, means actuated by the introduction of air under pressure into one of the cylinders for turning the intermediate jack section on the end sections, brake means for regulating such turning of the intermediate section, one of said cylinders being pivotally connected to the intermediate jack section adjacent one end of said cylinder, said cylinder having two plungers therein, one of which is rotatably mounted on the other, means for introducing air into said cylinder to reciprocate the plungers, lever operated valve means for controlling such admission of air, latching means for the lever means, a plunger rod on the rotatable plunger, guide means carried by the cylinder for preventing the rod from turning, a socket on the outer end of the rod for implements, valve controlled air operated means for imparting a rotary motion to the rod, independent of the reciprocatory motion imparted thereto, and one of said cylinders having its plunger pivotally connected to the last named cylinder and valve controlled means for introducing air under pressure to influence the last named plunger or rod to impart a vertical swinging to the cylinder having the reciprocatory and rotatable plunger rod.

14. In an air operated machine for the purpose set forth, cylinders having plungers therein, a jack-post comprising an intermediate and end sections, and upon which intermediate sections the cylinders are supported, means for longitudinally adjusting the intermediate section between the end sections of the jack-post, means actuated by the introduction of air under pressure into one of the cylinders for turning the intermediate jack section on the end sections, brake means for regulating such turning of the intermediate section, one of said cylinders being pivotally connected to the intermediate jack section adjacent one end of said cylinder, said cylinder having two plungers therein, one of which is rotatably mounted on the other, means for introducing air into said cylinder to reciprocate the plungers, lever operated valve means for controlling such admission of air, latching means for the lever means, a plunger rod on the rotatable plunger, guide means carried by the cylinder for preventing the rod from turning, a socket on the outer end of the rod for implements, valve controlled air operated means for imparting a rotary motion to the rod, independent of the reciprocatory motion imparted thereto, and one of said

cylinders having its plunger pivotally connected to the last named cylinder and valve controlled means for introducing air under pressure to influence the last named plunger or rod to impart a vertical swinging to the cylinder having the reciprocatory and rotatable plunger rod, and ground wheels on which the intermediate section of the jack-post is journaled.

15. In an air operated machine for the purpose set forth, cylinders having plungers therefor, a jack-post comprising an intermediate and end sections, and on which intermediate section the cylinders are supported, means for longitudinally adjusting the intermediate section between the end sections of the jack-post, means actuated by the introduction of air under pressure into one of the cylinders for turning the intermediate jack section on the end sections, brake means for regulating such turning of the intermediate section, one of said cylinders being pivotally connected to the intermediate jack section adjacent one end of the said cylinder, said cylinder having two plungers therein, one of which is rotatably mounted on the other, means for introducing air into said cylinder to reciprocate the plungers, lever operated valve means for controlling such admission of air, latching means for the lever means, a plunger rod on the rotatable plunger, guide means carried by the cylinder for preventing the rod from turning, a socket on the outer end of the rod for implements, valve controlled air operated means for imparting a rotary motion to the rod, independent of the reciprocatory motion imparted thereto, and one of said cylinders having its plunger pivotally connected to the last named cylinder and valve controlled means for introducing air under pressure to influence the last named plunger or rod to impart a vertical swinging to the cylinder having the reciprocatory and rotatable plunger rod, ground wheels on which the intermediate section of the jack-post is journaled and an operator's seat which is swingably supported from the jack-post.

16. In a compressed air shoveling, digging and boring machine, a cylinder having two plunger heads which are swivelly connected, valve controlled means for introducing air against either of the plungers and means for exhausting such air, a plunger rod secured to one of the plunger heads, such rod extending through the cylinder, means between the cylinder and the plunger rod for holding the same from turning, means for revolving said holding means, means for rotating the cylinder, means for imparting a vertical movement to the cylinder, a shovel pivotally supported on the outer end of the cylinder, means for holding the shovel from swinging in one direction, and spring means for influencing the shovel to swing the same.

17. A machine of the class described comprising a base member, a turntable on said base member, a tool carrying member mounted on said turntable in such a manner that it may be tilted in a vertical plane to any desired angle, means for tilting said tool carrying member, means for reciprocating said tool carrying member longitudinally, means for bodily adjusting said tool carrying member vertically to various heights relative to the turntable, means for continuously rotating said tool carrying member about its own axis, and means different from said last-named means for oscillating said tool carrying member about its own axis.

18. A machine of the class described comprising a base member, a turntable on said base mem-

ber, a tool carrying member mounted on said turntable in such a manner that it may be tilted in a vertical plane to any desired angle, means for tilting said tool carrying member, means for reciprocating said tool carrying member longitudinally, means for continuously rotating said tool carrying member about its own axis, and means different from said last-named means for oscillating said tool carrying member about its own axis.

19. A machine of the class described comprising a base member, a turntable on said base member, means for rotating said turntable, a tool carrying member mounted on said turntable in such a manner that it may be tilted in a vertical plane to any desired angle, means for tilting said tool carrying member, means for reciprocating said tool carrying member longitudinally, means for continuously rotating said tool carrying member about its own axis, and means different from said last named means for oscillating said tool carrying member about its own axis.

20. A machine of the class described comprising a base member, a turntable on said base member, a tool carrying member mounted on said turntable in such a manner that it may be tilted in a vertical plane to any desired angle, said tool carrying member being longitudinally reciprocable, means for continuously rotating said tool carrying member about its own axis, and means different from said last named means for oscillating said tool carrying member about its own axis.

21. A machine of the class described comprising a base member, a turntable on said base member, a tool carrying member mounted on said turntable in such a manner that it may be tilted in a vertical plane to any desired angle, fluid pressure means for tilting said tool carrying member to any desired angle, fluid pressure means for reciprocating said tool carrying member longitudinally, means for continuously rotating said tool carrying member, and fluid pressure means different from said last named means for oscillating said tool carrying member about its own axis.

22. A machine of the class described comprising a base member, a turntable on said base member, a tool carrying member mounted on said turntable in such a manner that it may be tilted in a vertical plane to any desired angle, fluid pressure means for tilting said tool carrying member, fluid pressure means for reciprocating said tool carrying member longitudinally, means for continuously rotating said tool carrying member about its own axis, and fluid pressure means different from said last named means for oscillating said tool carrying member about its own axis.

23. A machine of the class described comprising a base member, a turntable on said base member, fluid pressure means for rotating said turntable, a tool carrying member mounted on said turntable in such a manner that it may be tilted in a vertical plane to any desired angle, fluid pressure means for tilting said tool carrying member, fluid pressure means for reciprocating said tool carrying member longitudinally, means for continuously rotating said tool carrying member about its own axis and fluid pressure means different from said last named means for oscillating said tool carrying member about its own axis.

24. A machine of the class described comprising a tool carrying member, means for continuously rotating said tool carrying member, and means for oscillating said tool carrying member about its own axis.

25. A machine of the class described comprising

a tool carrying member, means for continuously rotating said tool carrying member, means for oscillating said tool carrying member about its own axis, said means being independent of each other, and means for rendering inoperative either the continuously rotating means or the oscillating means for said tool carrying member.

26. In a machine of the class described a jack-post, a tool carrying arm mounted on said jack-post, the lower end of said jack-post being mounted on a supporting table, said supporting table being rotatably mounted in a housing, anti-friction bearings disposed between said table and the bottom of said housing, and anti-friction bearings disposed between the table and the upper surface of said housing, a jack member mounted on the upper end of said jack-post, said jack member being adjustable, and an anti-friction bearing between said jack member and the upper end of said jack-post to permit rotation of said jack-post without rotating said jack member.

27. In a machine of the class described a jack-post, a tool carrying arm mounted on said jack-post, the lower end of said jack-post being mounted on a supporting table, said supporting table being rotatably mounted in a housing, anti-friction bearings disposed between said table and the bottom of said housing, and anti-friction bearings disposed between the table and the upper surface of said housing, a jack member mounted on the upper end of said jack-post, said jack member being adjustable, and an anti-friction bearing between said jack member and the upper end of said jack-post to permit rotation of said jack-post without rotating said jack member, said jack member being swingable between a vertical operative position and a substantially horizontal inoperative position.

28. In a machine of the class described a jack-post, a tool carrying arm mounted on said jack-post, the lower end of said jack-post being mounted on a turntable, a jack member mounted on the upper end of said jack-post, said jack member being adjustable into contact with a roof or other surface, an anti-friction bearing between said jack member and the upper end of said jack-post to permit rotation of said jack-post without rotating said jack member, said jack member being swingable between a vertical operative position and a substantially horizontal inoperative position.

29. In a machine of the class described, a vertical supporting member, a tool carrying arm mounted on said supporting member, the lower end of said supporting member being so mounted as to permit rotation thereof, fluid pressure means for rotating said supporting member in either direction, said fluid pressure means comprising a single cylinder mounted on said supporting member and having a pair of pistons therein, said pistons being connected together by a piston rod, a rack surface on said rod, a gear projecting through a slot in said cylinder and meshing with said rack, rotation of said gear being adapted to cause rotation of said supporting member, means for controlling supply of fluid in said cylinder and consequently controlling rotation of said supporting member, and a brake member independent of the means for rotating said supporting member for retarding or stopping rotation thereof.

30. In a machine of the class described, a vertical supporting member, a tool carrying arm mounted on said supporting member, the lower end of said supporting member being so mounted as to permit rotation thereof, means for rotating

said supporting member in either direction, and brake mechanism independent of said rotating means for retarding or stopping rotation of said supporting member.

31. In a machine of the class described, a supporting member, a main cylinder mounted on said supporting member and adjustable in a vertical plane relative thereto, a tool carrying shaft extending from said cylinder, said tool carrying shaft being of angular cross section and having its inner end connected to a piston structure in said cylinder, said piston structure comprising a piston to which the inner end of said shaft is connected, a second piston swiveled to said first piston, a buffer spring in the rear end of said cylinder and a buffer spring in the forward end of said cylinder, said shaft passing through a packing gland at the forward end of said cylinder, said packing gland being of such a type as to permit reciprocation of said shaft therethrough or rotation of said shaft, means for rotating said shaft and means for controlling supply of fluid to said cylinder to cause reciprocation of said shaft.

32. In a machine of the class described, a supporting member, a main cylinder mounted on said supporting member and adjustable in a vertical plane relative thereto, a tool carrying shaft extending from said cylinder, said tool carrying shaft being of angular cross section and having its inner end connected to a piston structure in said cylinder, said piston structure comprising a piston to which the inner end of said shaft is connected, a second piston swiveled to said first piston, said shaft passing through a packing gland at the forward end of said cylinder, said packing gland being of such a type as to permit reciprocation of said shaft therethrough or rotation of said shaft, means for rotating said shaft and means for controlling supply of fluid to said cylinder to cause reciprocation of said shaft.

33. In a machine of the class described, a supporting member, a main cylinder mounted on said supporting member and adjustable in a vertical plane relative thereto, a tool carrying shaft extending from said cylinder, said tool carrying shaft being of angular cross section and having its inner end connected to a piston structure, said piston structure comprising a piston to which the inner end of said shaft is connected, a second piston swiveled to said first piston, means for rotating said shaft and means for controlling supply of fluid to said cylinder to cause reciprocation of said shaft.

34. In a machine of the class described, a supporting member, a main cylinder mounted on said supporting member and adjustable in a vertical plane relative thereto, a tool carrying shaft extending from said cylinder, said tool carrying shaft having its inner end connected to a piston structure, said piston structure comprising a piston to which the inner end of said shaft is connected, a second piston swiveled to said first piston, means for rotating said shaft and means for controlling supply of fluid to said cylinder to cause reciprocation of said shaft.

35. In a machine of the class described, a supporting member, a shaft mounted on said supporting member, a scoop mounted on the outer end of said shaft, fluid pressure means for rotating said shaft to cause rotation of said scoop between dumping and filling positions, said fluid pressure means comprising a single cylinder, a pair of pistons in said cylinder, a piston rod connecting said pistons together, a rack surface on

said piston rod, a gear projecting through a slot in said cylinder and meshing with said rack surface, said gear being operatively connected to said shaft, and means for controlling supply of fluid to said cylinder to control rotation of said shaft.

36. In a machine of the class described, a supporting structure, a tool carrying arm mounted on said supporting structure in such a manner that it may be tilted in a vertical plane, fluid pressure operated means for tilting said arm to any desired angle, said fluid pressure operated means comprising a cylinder having its lower end pivotally connected to a supporting structure, a piston operating in said cylinder, a piston rod projecting from the upper end of said cylinder, the upper end of said piston rod being pivotally connected to said arm, means for varying the point of connection of said piston rod and said arm, means for supplying fluid into said cylinder to cause the piston and piston rod to move downwardly therein, a stop member for limiting downward movement of said piston rod, said piston being adapted to be moved upwardly by the weight of the forward portion of said arm when fluid is exhausted from said cylinder above said piston.

37. In a machine of the class described, a supporting structure, a tool carrying arm mounted on said supporting structure in such a manner that it may be tilted in a vertical plane, fluid pressure operated means for tilting said arm to any desired angle, said fluid pressure operated means comprising a cylinder having its lower end pivotally connected to a supporting structure, a piston operating in said cylinder, a piston rod projecting from the upper end of said cylinder, said piston rod being pivotally connected to said arm, and means for varying the point of connection of said piston rod and arm.

38. In a machine of the class described, a supporting structure, a tool carrying arm mounted on said supporting structure in such a manner that it may be tilted in a vertical plane, fluid pressure operated means for tilting said arm to any desired angle, said fluid pressure operated means comprising a cylinder having its lower end pivotally connected to a supporting structure, a piston operating in said cylinder, a piston rod projecting from the upper end of said cylinder, said piston rod being pivotally connected to said arm, and an adjustable stop member for limiting the stroke of said piston rod.

39. In a machine of the class described, a supporting structure, a tool carrying arm mounted on said supporting structure in such a manner that it may be tilted in a vertical plane, fluid pressure operated means for tilting said arm to any desired angle, said fluid pressure operated means comprising a cylinder having its lower end pivotally connected to a supporting structure, a piston operating in said cylinder, a piston rod projecting from the upper end of said cylinder, said piston rod being pivotally connected to said arm, and means independent of said fluid pressure means for holding said arm in a position to which it is tilted.

40. In a machine of the class described, a supporting structure, a scoop carrying shaft mounted on said supporting structure in such a manner that it may be tilted in a vertical plane, means for tilting said shaft in a vertical plane, means for reciprocating said shaft longitudinally, means for rotating said shaft, a scoop member hingedly mounted on the outer end of said shaft, said

scoop member being normally in alignment with said shaft but being movable out of alignment with said shaft when pressure is applied to the outer edge of said scoop, said scoop being adapted to automatically return to its normal position when said pressure is released.

41. In a machine of the class described, a supporting structure, a scoop carrying shaft mounted on said supporting structure in such a manner that it may be tilted in a vertical plane, means for tilting said shaft in a vertical plane, means for reciprocating said shaft longitudinally, a scoop member hingedly mounted on the outer end of said shaft, said scoop member being normally in alignment with said shaft but being movable out of alignment with said shaft when pressure is applied to the outer edge of said scoop, said scoop being adapted to automatically return to its normal position when said pressure is released.

42. In a machine of the class described, a supporting structure, a scoop carrying shaft mounted on said supporting structure in such a manner that it may be tilted in a vertical plane, fluid pressure means for tilting said shaft in a vertical plane, fluid pressure means for reciprocating said shaft longitudinally, a scoop member hingedly mounted on the outer end of said shaft, said scoop member being normally in alignment with said shaft but being movable out of alignment with said shaft when pressure is applied to the outer edge of said scoop, said scoop being adapted to automatically return to its normal position when said pressure is released.

43. In a machine of the class described, a supporting structure, a scoop carrying shaft mounted on said supporting structure in such a manner that it may be tilted in a vertical plane, fluid pressure means for tilting said shaft in a vertical plane, fluid pressure means for reciprocating said shaft longitudinally, and fluid pressure means for rotating said shaft, a scoop member hingedly mounted on the outer end of said shaft, said scoop member being normally in alignment with said shaft but being movable out of alignment with said shaft when pressure is applied to the outer edge of said scoop, said scoop being adapted to automatically return to its normal position when said pressure is released.

44. A machine of the class described comprising a chassis, means for holding said chassis in any position to which it is moved, a turntable mounted on said chassis, a vertically extending supporting member mounted on said turntable and adapted to rotate therewith, cylinder and piston mechanism for causing rotation of said turntable, an arm mounted directly on said supporting member at a point a considerable distance above the chassis, said arm being pivotally mounted on the supporting member in such a manner that it may be tilted in a vertical plane, cylinder and piston mechanism for tilting said arm and holding it in any tilted position, a main cylinder mounted on said arm, a tool carrying shaft extending from said cylinder and having its inner end connected to a piston which operates in said cylinder, reciprocation of said piston in said main cylinder being adapted to cause longitudinal movement of said shaft, and cylinder and piston mechanism for rotating said shaft about its own axis.

45. A machine of the class described comprising a vertically extending supporting member, a turntable upon which the lower end of said supporting member is mounted, fluid pressure

operated means for rotating said turntable, an arm mounted directly on said supporting member at a point spaced a considerable distance above the lower end of said supporting member, said arm being pivotally mounted on the supporting member in such a manner that it may be tilted in a vertical plane, fluid pressure operated means for tilting said arm and holding it in any tilted position, fluid pressure operated means for reciprocating said arm longitudinally, and fluid pressure operated means for rotating said arm about its own axis.

46. A machine of the class described comprising a base member, a turntable on said base member, a supporting member on said turntable and adapted to rotate therewith, a tool carrying member mounted on said supporting member in such a manner that it may be tilted in a vertical plane to any desired angle, means for tilting said tool carrying member, means for moving said tool carrying member longitudinally, and means for bodily adjusting said tool carrying member vertically to various heights on said supporting member without disturbing said supporting member.

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