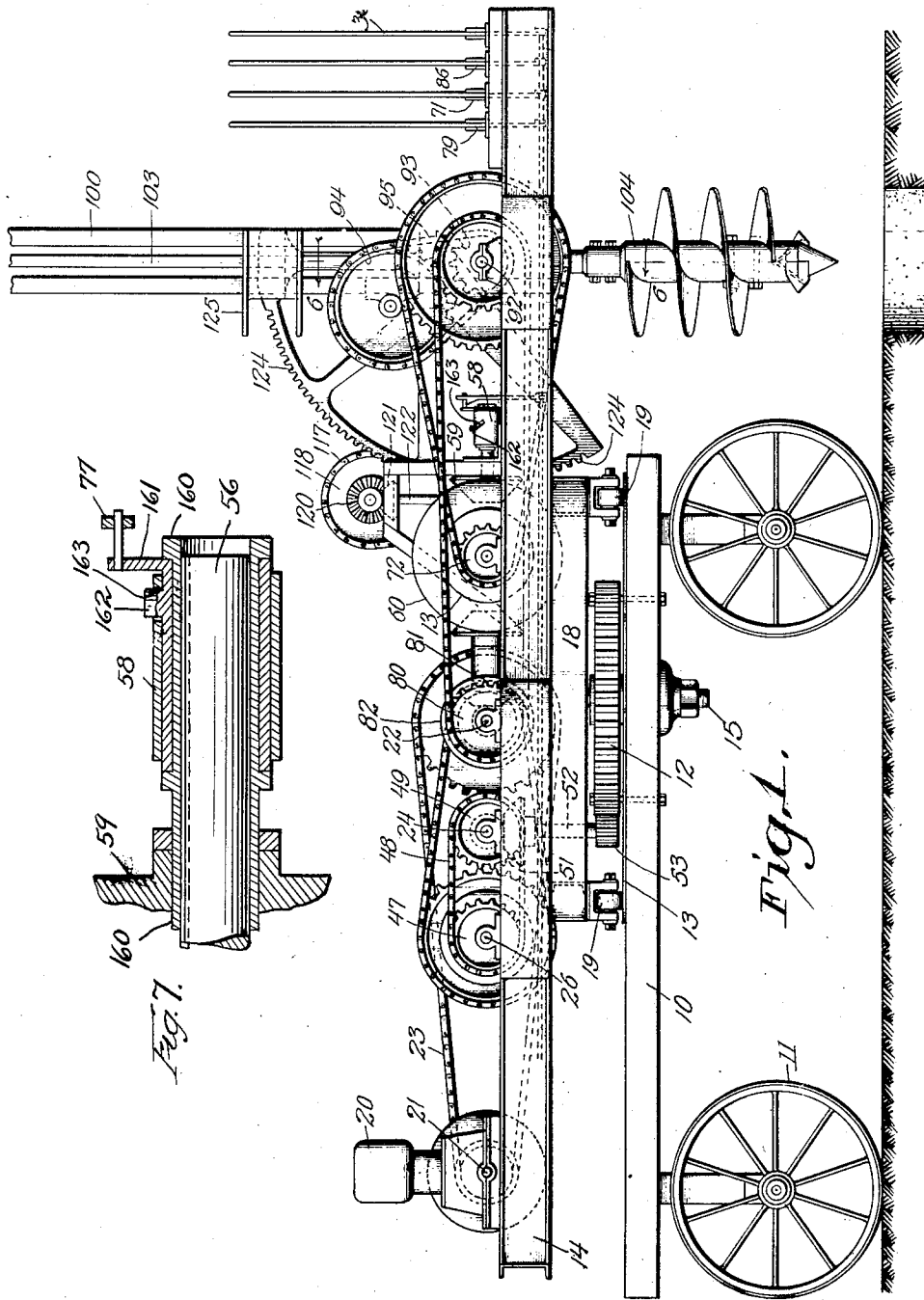


W. E. MOORE.
EARTH BORING MACHINE.
APPLICATION FILED SEPT. 7, 1918.

1,375,640.

Patented Apr. 19, 1921.

4 SHEETS—SHEET 1.



Witnesses:
Arthur W. Carlson
Robert F. Weir

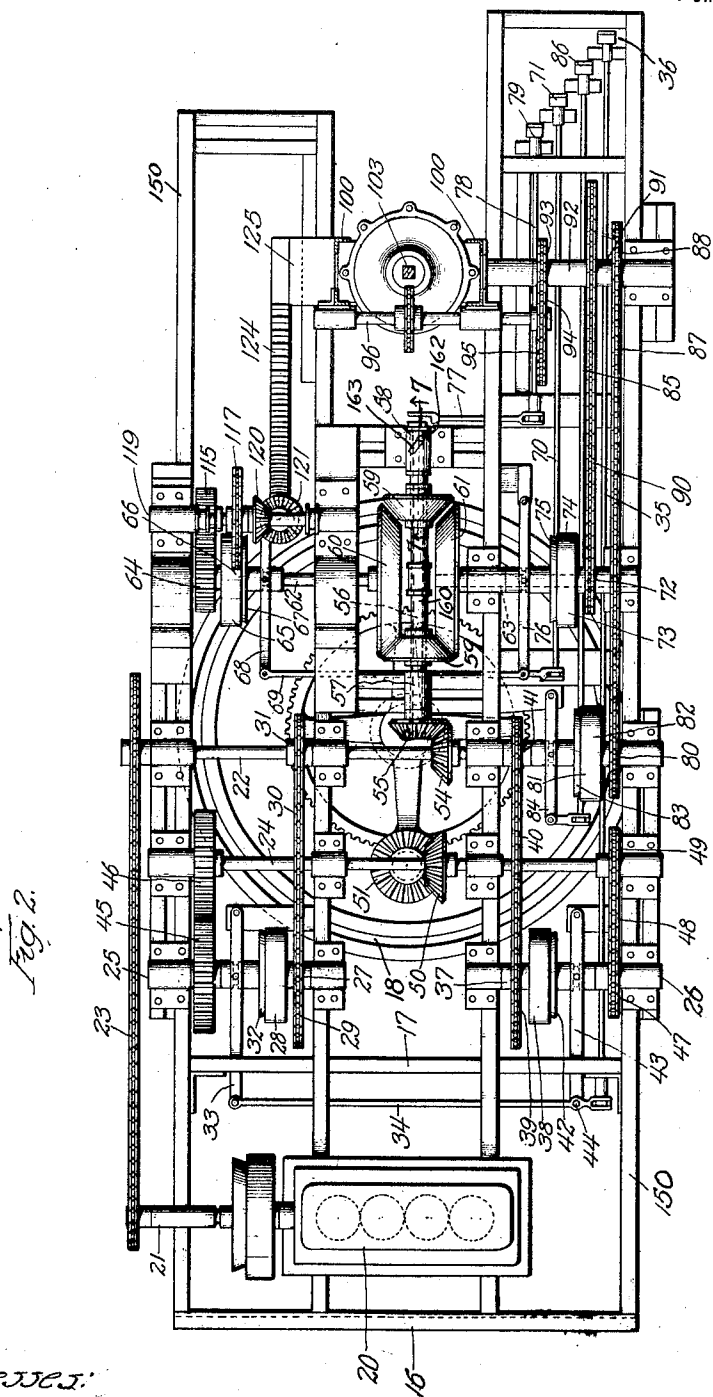
Inventor
William E. Moore.
Forie Bain & Co.
Attys.

W. E. MOORE.
EARTH BORING MACHINE.
APPLICATION FILED SEPT. 7, 1918.

1,375,640.

Patented Apr. 19, 1921.

4 SHEETS—SHEET 2.



Witnesses:
Arthur M. Carlson
Robert F. Weir

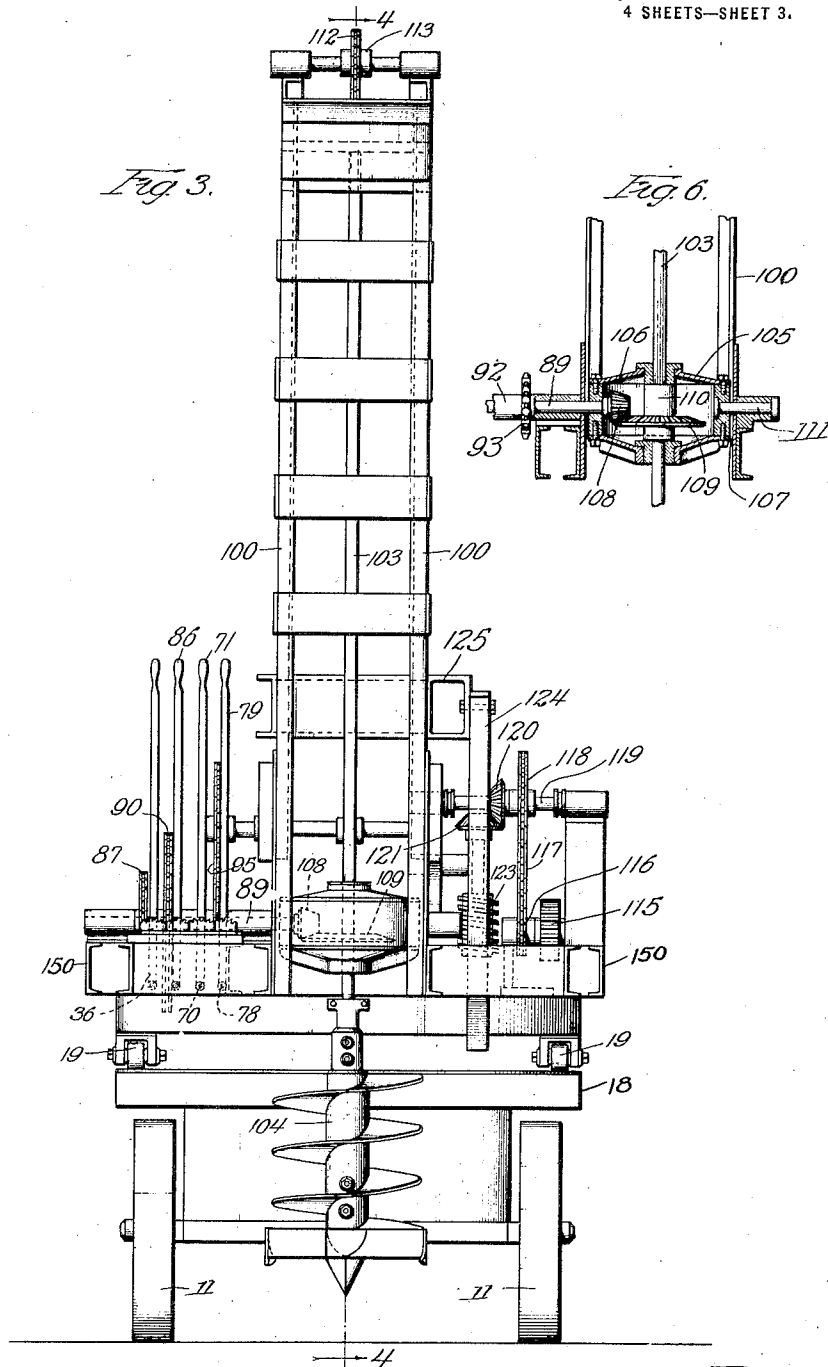
Inventor
William E. Moore.
Frie Bain & Bean.
Attys.

W. E. MOORE.
EARTH BORING MACHINE.
APPLICATION FILED SEPT. 7, 1918.

1,375,640.

Patented Apr. 19, 1921.

4 SHEETS—SHEET 3.



Witnesses:
Arthur M. Carlson
Robert H. Weir

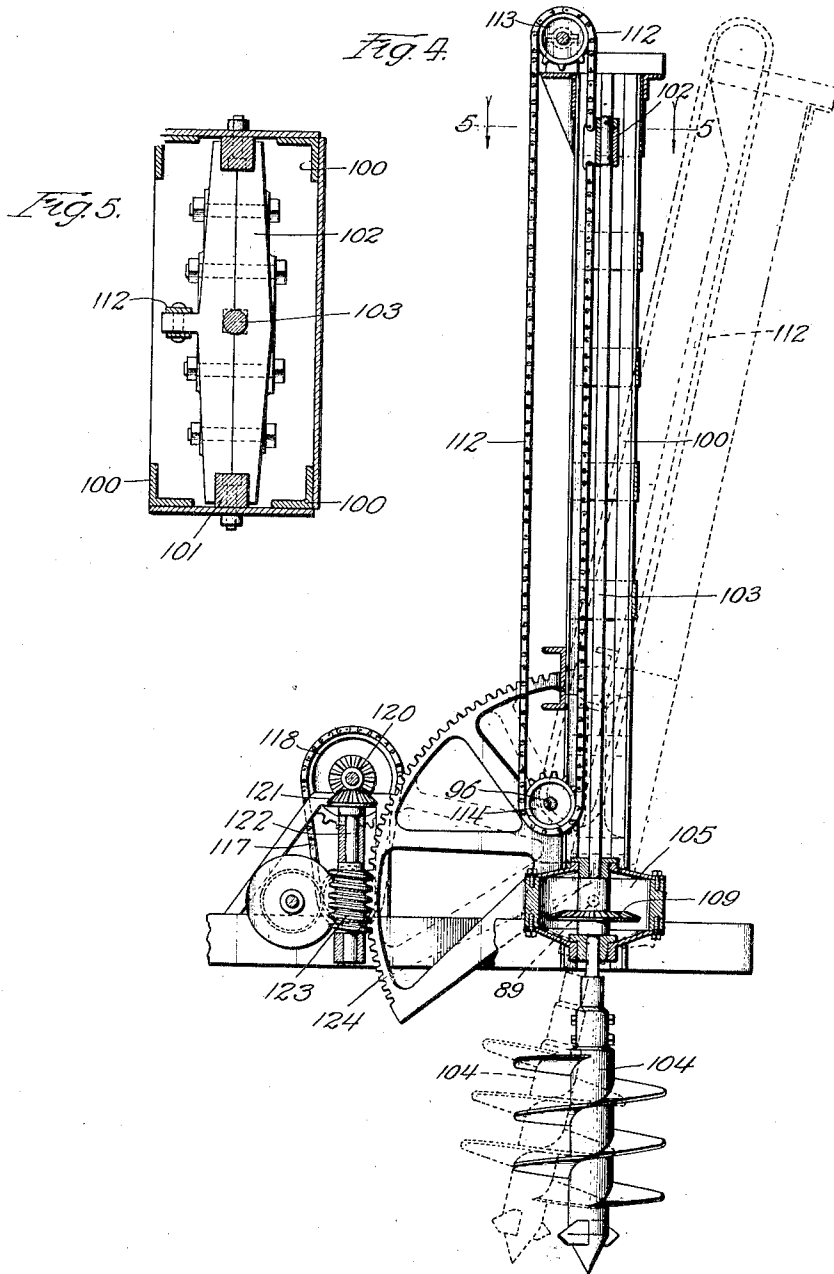
Inventor
William E. Moore.
Forie Bain & Bean
Atty's.

W. E. MOORE.
EARTH BORING MACHINE.
APPLICATION FILED SEPT. 7, 1918.

1,375,640.

Patented Apr. 19, 1921.

4 SHEETS—SHEET 4.



Witnesses
Arthur H. H. H.
Robert H. H.

Inventor
William E. Moore.
Forie Bain & Bean.
Att'ys

UNITED STATES PATENT OFFICE.

WILLIAM E. MOORE, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
INTERNATIONAL EARTH BORING MACHINE CORPORATION, A CORPORATION OF
DELAWARE.

EARTH-BORING MACHINE.

1,375,640.

Specification of Letters Patent.

Patented Apr. 19, 1921.

Application filed September 7, 1918. Serial No. 252,994.

To all whom it may concern:

Be it known that I, WILLIAM E. MOORE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Earth-Boring Machines, of which the following is a specification.

This invention relates to earth boring machines.

The invention is particularly applicable to power operated earth boring machines of the mobile type.

One of the objects of the invention is to provide an improved earth boring machine.

Another object is to provide an earth boring machine which may be readily controlled.

Another object is to provide an earth boring machine wherein the boring tool is rotated, raised and lowered, positioned relative to the work, and inclined by a common source of power and without danger of interference.

Another object is to provide an earth boring machine having improved operating and controlling mechanism.

Another object is to provide a mobile earth boring machine wherein the boring auger may be readily positioned above the work.

Another object is to provide an earth boring machine wherein the auger is rotated and driven to the work by a common source of power and wherein the operations are independently controlled.

Another object is to provide an earth boring machine which is efficient and reliable.

Other objects and advantages of the invention will appear from the specification and claims.

An embodiment of the invention is illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of an earth boring machine.

Fig. 2 is a top plan thereof.

Fig. 3 is a rear elevation.

Fig. 4 is a section on the line 4—4 of Fig. 3.

Fig. 5 is a section on the line 5—5 of Fig. 4.

Fig. 6 is a section through the auger tower mounting, and

Fig. 7 is a section on the line 7—7 of Fig. 2.

The earth boring machine has a frame 10 and wheels 11 forming the chassis of a vehicle. Chassis frame 10 supports a turntable 14. Upon turntable 14 is mounted the operating motor, auger tower and transmission and control mechanism whereby the motor supplies the power for producing the desired operations of the boring auger and the operations thereof are controlled.

Rigidly secured to chassis frame 10 is a gear wheel 12, through which the turntable is rotated, and a circular track 13, upon which the turntable is mounted.

The turntable is pivoted to chassis frame 10 by a stud or shaft 15 which is rigidly secured to the frame and passes axially through gear wheel 12. The frame of the turntable is composed of two side bars 15, end member 16 and transverse stays 17. These members may be made from channel iron. Secured to the bottom of the frame is an annular turntable support or track 18. Support 18 is formed of parallel facing channel bars to which are secured a number of journaled rollers 19. Rollers 19 rest upon track 13 and convey thereto the weight of the turntable and the apparatus carried thereby and upon these rollers the turntable may be rotated.

Mounted on one end of turntable 14 is a motor 20, such as a gasoline engine. Engine 20 has a shaft 21 which is connected to a main shaft 22 of the transmission mechanism by a sprocket wheel and chain connection 23. Main shaft 22 is located longitudinally intermediate the ends of turntable 14 and extends entirely across the same.

From main shaft 22 power is taken for rotating the turntable to position the auger relative to the work, for rotating the auger to effect the boring operation, for raising and lowering the auger and for tilting the auger to produce inclined holes or move the auger to carrying and operating positions, etc.

Rotating turntable.

The turntable is rotated in either direction through a train of power transmitting mechanism acting upon gear wheel 12. In front of main shaft 22 is a turntable rotating shaft 24 which is turned in one direction through an intermediate shaft 25 and in the

reverse direction through an intermediate shaft 26. Rotatably mounted upon shaft 25 is a sleeve 27 to which is rigidly connected the cup of a clutch 28 and a sprocket wheel 29. An endless chain 30 interconnects sprocket wheel 29 and a sprocket wheel 31 keyed to shaft 22. The cone 32 of clutch 28 is mounted to slide upon and rotate shaft 25. Cone 32 is moved along shaft 25 into and out of driving position by a lever 33, which is operated through a link 34 and a rod 35 by an operator's lever 36.

Shaft 26 is provided with a sleeve 37 rotatably mounted thereon. Sleeve 37 has rigidly secured thereto the cup of a clutch 38 and a sprocket wheel 39. Sprocket wheel 39 is interconnected by an endless chain 40 with a sprocket wheel 41. Sprocket wheel 41 is keyed to main shaft 22. The cone 42 of clutch 38 is adapted to slide upon and rotate shaft 26. Cone 42 is moved into and out of driving position by a lever 43 which is secured to link 34 by a pivot 44. Clutches 28 and 38 are therefore simultaneously operated by operator's lever 36. The relation of the clutches is such that both may be in non-driving position at the same time, when the turntable is to be held relatively stationary and one or the other, but never both simultaneously may be in driving position to rotate the turntable in the desired direction.

Shaft 25 drives shaft 24 through meshing gear wheels 45 and 46, keyed to the respective shafts. Shaft 26 drives shaft 24 through sprocket wheels 47 and 49, keyed to the respective shafts and interconnected by an endless chain 48. Shaft 24 is thus driven in one direction by shaft 26 and in the opposite direction by shaft 25.

A beveled gear wheel 50 is keyed to shaft 24. Gear wheel 50 meshes with a beveled gear wheel 51 keyed to a shaft 52 which also carries a pinion 53 meshing with gear wheel 12. Consequently when shaft 24 is driven in either direction pinion 53 rotates upon and about the stationary gear wheel 12 and the turntable is accordingly rotated.

If, for example, the turntable is to be turned to the right, operator's lever 36 is moved to throw in clutch 28. The turntable is then rotated by the engine through chain 23, shaft 22, chain 30, clutch 28, gear wheels 45 and 46, shaft 24, gear wheels 50 and 51, pinion 53 and gear wheel 12.

When the turntable is to be stopped lever 36 is moved to mid-position wherein both clutches 28 and 38 are thrown out of driving position.

To reverse the direction of movement of the turntable, operator's lever 36 is moved to the opposite position. Thereupon clutch 38 is thrown in and the engine rotates the turntable through chain 23, shaft 22, chain

40, clutch 38, chain 48, shaft 24, gear wheels 50 and 51, pinion 53 and gear wheel 12.

The turntable may therefore be rotated in either direction upon the manipulation of a single lever readily accessible to the operator. The relation of the clutches provides a positive safety arrangement for preventing both clutches from being thrown in simultaneously which might result in broken gears, sprocket wheels, chains, shafts, or other parts of the structure. The proper operation of the turntable is thus insured and the auger may be readily and quickly positioned above the work.

Rotating auger.

The auger is rotated always in the same direction by the engine and the operation may be started and stopped by the manipulation of a single lever.

Shaft 22 has rotatably mounted thereon a sprocket wheel 80. Sprocket wheel 80 is rigidly secured to the cup 81 of a clutch 82. Cup 81 cooperates with a clutch cone 83 which is adapted to slide longitudinally upon and be rotated by shaft 22. A lever 84 is secured to cone 83 and acts to force the cone into and out of engagement with cup 81. Lever 84 is actuated through a rod 85 by an operator's lever 86.

An endless chain 87 interconnects sprocket wheel 80 and a sprocket wheel 88, which is keyed to a shaft 89. (See particularly Figs. 3 and 6.)

Shaft 89 has secured thereto a bevel pinion 108 which meshes with a bevel gear wheel 109. Gear wheels 108 and 109 are located in a gear box 105 carried by the lower end of the auger tower.

An auger or boring tool 104 is carried on the end of an auger shaft 103. Shaft 103, which has a square cross section throughout the greater portion of its length, passes through a square opening in a sleeve or bushing 110 of gear wheel 109. Shaft 103 is adapted to slide through the opening in sleeve 110 and gear wheel 109, but is rotated when gear wheel 109 revolves.

When the auger is to be driven, operator's lever 86 is moved to cause the engagement of cup 81 and cone 83 of clutch 82. Thereupon the auger is rotated by the engine through sprocket chain 23, shaft 22, clutch 82, sprocket wheel 80, shaft 89 and gear wheels 108 and 109. On account of the auger shaft slidably passing through sleeve 110 and gear wheel 109, the auger may be rotated in any longitudinal position of the auger shaft.

Raising and lowering auger.

The auger is lowered and raised or driven to and from the work by the engine and its up and down movement is independent of

the rotation so that these operations may be independently varied to best suit the conditions of the work.

Keyed to shaft 22 is a bevel gear wheel 54. Gear wheel 54 meshes with a bevel gear wheel 55 keyed to the end of a shaft 56 journaled in a bearing 57. Surrounding shaft 56 is a sleeve 160. Sleeve 160 is feathered to shaft 56 so as to be adapted to slide upon but be rotated thereby. Sleeve 160 is journaled in a collar 161 movably carried in a thrust bearing 58 and thus supports one end of shaft 56. Rigidly mounted upon sleeve 160 are a pair of facing bevel gear wheels 59. Gear wheels 59 are adapted to engage either of two facing bevel gear wheels 60 and 61. Collar 161 has a pin 162 extending through a spiraled slot 163 in bearing 58 and carries a lever 164. When lever 164 is rotated collar 161 is turned and the cooperating pin and slot move sleeve 160 and gear wheel 59 to the right or left, as viewed from Figs. 1 and 2, depending upon the direction of rotation.

The position of gear wheels 59 relative to gear wheels 60 and 61 is controlled by a lever 77 which moves lever 164 and is interconnected by a rod 78 with an operator's lever 79.

Gear wheel 61 is keyed to the end of a shaft 63. A sprocket wheel 72 is rotatably journaled on shaft 63 and carries a cup 73 of a clutch 74. Clutch 74 has a cone 75 keyed to slide upon and rotate with shaft 63. Clutch 74 is thrown into and out of driving connection by a lever 76 interconnected by a rod 70 with an operator's lever 71.

Sprocket wheel 72 is interconnected by an endless chain 90 with a sprocket wheel 91 carried by a sleeve 92 which is journaled upon shaft 89. Sleeve 92 has a sprocket wheel 93 rigidly secured thereto. Sprocket wheel 93 is interconnected with a sprocket wheel 94 by an endless chain 95. Sprocket wheel 94 is keyed to a shaft 96 journaled in bearings carried by the auger tower.

The auger tower comprises four posts of angle iron, rigidly secured at their bottoms to a gear box 105. Gear box 105 is journaled on opposite sides upon the turntable by shaft 89 and a trunnion 111, which have suitable bearings supported by the turntable framework as shown in Fig. 6. Posts 100 carry a pair of longitudinally extending guides 101 which provide ways for the opposite sides of a sliding cross-head 102. Head 102 has journaled therein a circular cross sectioned portion of auger shaft 103, whereby, when the head is moved up and down in the tower, the auger shaft and auger are raised and lowered. The head and its guides brace the upper end of the auger shaft so that the same is securely retained in proper position within the tower

and is protected against objectionable deflection.

Head 102 has a lug or clamp to which is secured an endless chain 112. Chain 112 passes over a sprocket wheel 113 journaled at or near the top of the tower and a sprocket wheel 114 keyed to shaft 96. Thus as shaft 96 is rotated in one or the other direction, chain 112 raises or lowers the auger.

When the auger is to be moved longitudinally in one direction, operator's lever 79 is thrown so that the left hand gear wheel 59 engages gear wheel 61. (See Fig. 2.) Operator's lever 71 is also thrown to place clutch 74 in driving position.

The auger is now moved by the engine through chain 23, shaft 22, gear wheels 54 and 55, the left hand gear wheel 59 and gear wheel 61, shaft 63, clutch 74, sprocket wheel 72, chain 90, sprocket wheel 91, sleeve 92, sprocket wheel 93, chain 95, sprocket wheel 94, shaft 96 and sprocket wheel 114 and chain 112.

To move the auger in the reverse direction, operator's lever 79 is thrown to the reverse position, whereupon the right hand gear wheel 59 engages gear wheel 61 (see Fig. 2). The direction of rotation of shaft 63 is thus reversed and consequently the movement of the auger shaft and auger is reversed.

Tilting auger tower.

The auger is tilted or inclined by the engine and the tilting movement may be controlled by a single lever.

Gear wheel 60 is keyed to a shaft 62 which has journaled thereon a sleeve carrying a gear wheel 64 and a cup 65 of a clutch 66. Clutch 66 has a cone 67 adapted to slide upon but rotate with shaft 62. Cone 67 is provided with a lever 68 which is connected to rod 70 by a link 69. Consequently when operator's lever 71 is actuated, it moves cone 67 into an out of driving connection with cup 65. The relation of clutches 74 and 66 and their operating connections are such that when one clutch is moved to driving position the other clutch is simultaneously moved out of driving position. Thus it is impossible to raise or lower the auger while it is being tilted and vice versa.

Gear wheel 64 meshes with a pinion 115 to which is secured a sprocket wheel 116. An endless chain 117 interconnects sprocket wheel 116 and a sprocket wheel 118. Sprocket wheel 118 is keyed to a shaft 119 which also has keyed thereto a bevel pinion 120. Pinion 120 meshes with a bevel pinion 121, keyed to the end of a short vertical shaft 122. Shaft 122 carries a worm 123 adapted to engage a segmental rack 124. Through rack 124 the tower is tilted about a horizontal axis provided by shaft 89 and

trunnion 111 on gear box 105. Rack 124 is rigidly secured to a frame 125 which fits around three sides of the auger tower so that when the rack is turned to tilt the tower the strain will be applied across the entire width of the tower. Bending or unequal strain, such as might be imparted to the tower if the tilting forces were applied only on one side, are thereby lessened.

When the tower is to be tilted to a position to bore an inclined hole or for ready transportation, lever 79 if not already in position to cause the engagement of gear wheel 60 and the required gear wheel 59, is moved and then clutch 66 is actuated by operator's lever 71. Lever 71 insures that clutch 74, controlling the up and down movement of the auger, is thrown out of driving position before clutch 66 is thrown into driving position.

Thus if lever 79 is in one position and clutch 66 is thrown into driving position, the auger tower and auger is rocked or tilted by the engine through sprocket chain 23, shaft 22, gear wheels 54 and 55, left hand gear wheel 59, gear wheel 60, shaft 62, clutch 66, gear wheels 64 and 115, sprocket wheel 116, sprocket chain 117, sprocket wheel 118, shaft 119, gear wheels 120 and 121, shaft 122, worm 123 and rack 124.

Throwing operator's lever 79 to the reverse position will move gear wheels 59 so that the right hand gear wheel will engage gear wheel 60. The direction of rotation of shaft 62 will be reversed and the tower will be tilted in the opposite direction.

Having described my invention, what I claim is:—

1. An earth boring machine including in combination a main frame, a supporting frame rotatably mounted thereon, an auger tower mounted near one end of said supporting frame, means for rotating said supporting frame relative to said main frame, said auger tower being pivotally mounted with reference to said supporting frame, the pivotal mounting including a trunnion on one side and a driving shaft on the other side, means for actuating said driving shaft, an auger mounted in said auger tower and having operative connection with said driving shaft, and means for tilting said auger tower.

2. An earth boring machine including in combination a main frame, a supporting frame rotatably mounted thereon, an auger tower mounted near one end of said supporting frame, means for rotating said supporting frame relative to said main frame, said auger tower being pivotally mounted with reference to said supporting frame, the pivotal mounting including a trunnion on one side and a driving shaft on the other side, means for actuating said driving shaft, an auger mounted in said auger tower and having operative connection with said driv-

ing shaft, and means for tilting said auger tower, said means including a segment gear connected to said auger tower, gearing for operating said segment gear and means for operating said gearing.

3. An earth boring machine including in combination a main frame, a supporting frame rotatably mounted thereon, an auger tower mounted near one end of said supporting frame, means for rotating said supporting frame relative to said main frame, said auger tower being pivotally mounted with reference to said supporting frame, the pivotal mounting including a trunnion on one side and a driving shaft on the other side, means for actuating said driving shaft, an auger mounted in said auger tower and having operative connection with said driving shaft, and means for tilting said auger tower, said means including a segment gear connected to said auger tower, gearing for operating said segment gear and means for operating said gearing, said gearing and said driving shaft being cooperatively controlled so that only one of them may be in operation at the same time.

4. An earth boring machine including in combination, a main frame, a supporting frame mounted for rotary movement thereon, an auger tower pivotally mounted in one end of said supporting frame, said pivotal mounting including a trunnion on one side and a driving shaft on the other side, an auger mounted in said auger tower and connections between said driving shaft and said auger for driving the auger in any position, a driven shaft on said supporting frame, connections between said driven shaft and said driving shaft for actuating the same, connections between said driven shaft and said auger tower for tilting the same relative to said supporting frame, both of said connections including reversing mechanism whereby the auger tower may be tilted in either direction relative to said supporting frame.

5. An earth boring machine including in combination, a main frame, a supporting frame mounted for rotary movement thereon, an auger tower pivotally mounted in one end of said supporting frame, said pivotal mounting including a trunnion on one side and a driving shaft on the other side, an auger mounted in said auger tower and connections between said driving shaft and said auger for driving the auger, in any position, a driven shaft on said supporting frame connections between said driven shaft and said driving shaft for actuating the same, connections between said driven shaft and said auger tower for tilting the same relative to said supporting frame, both of said connections including reversing mechanism whereby the auger tower may be tilted in either direction relative to said supporting

frame, said connections also including clutches connected together for coöperation whereby only one of said connections is operative at a time, the other being inoperative.

6. An earth boring machine including in combination a main frame, a supporting frame mounted to be turned thereon, an auger tower pivotally mounted near one end of said supporting frame, a driven shaft, means connected to said driven shaft for turning said supporting frame relative to said main frame, an auger mounted in said auger tower and means for raising and lowering said auger in said auger tower, means for tilting said auger tower relative to said supporting frame, a friction drive mechanism operatively connected to said driven shaft having one side connected to said means for tilting said auger tower and having the other side connected to the means for raising and lowering said auger in said auger tower.

7. An earth boring machine including in combination a main frame, a supporting frame mounted to be turned thereon, an auger tower pivotally mounted near one end of said supporting frame, a driven shaft, means connected to said driven shaft for turning said supporting frame relative to said main frame, an auger mounted in said auger tower and means for raising and lowering said auger in said auger tower, means for tilting said auger tower relative to said supporting frame, a friction drive mechanism operatively connected to said driven shaft having one side connected to said means for tilting said auger tower and having the other side connected to the means for raising and lowering said auger in said auger tower, said connections between the friction drive and the tilting mechanism and the raising and lowering mechanism for the auger tower and auger being so arranged that only one of said mechanisms is operative at a time.

8. An earth boring machine including in combination a main frame, a supporting frame rotatably mounted thereon, an auger tower pivotally mounted at one end of said supporting frame, an auger movable in said auger tower, a motor mounted on said supporting frame, a driven shaft operatively connected to said motor, means for rotating said supporting frame relative to said main frame operated from said driven shaft and including a pair of clutch members coöperatively associated together so that only one of said clutch members may be engaged at one time, the means for rotating said supporting frame including means for rotating it in both directions and the clutches controlling both of said means, clutch con-

trolled means operated from said driven shaft for driving said auger in said auger tower, a friction drive operatively connected to said driven shaft and connections from one side of said friction drive for tilting said auger tower relative to said supporting frame and connections from the other side of said friction drive for raising and lowering said auger in said auger tower and clutches controlling said two last mentioned connections, said clutches being comparatively associated so that only one of said clutches may be thrown into operation at one time, the other then remaining out of operation.

9. A portable boring machine comprising a vehicle, a turntable rotatably mounted upon the vehicle, an auger tower tiltably mounted upon one side of the turntable, a rotatable auger shaft extending and movable longitudinally of the tower and braced near its upper end by the tower, and a common source of power for rotating the turntable and the auger shaft and driving the auger shaft in both directions longitudinally of the tower.

10. A portable boring machine comprising a vehicle, a turntable rotatably mounted upon the vehicle, an auger tower mounted upon one side of the turntable, a rotatable auger shaft extending and movable longitudinally of the tower and braced near its upper end by the tower, a common source of power for rotating the turntable and the auger shaft and driving the auger shaft in both directions longitudinally of the tower, and control mechanism for independently controlling the rotation of the turntable, the rotation of the auger shaft and the longitudinal drive of the auger shaft.

11. An earth boring machine comprising a turntable rotatably mounted upon a vehicle, an auger tower mounted upon the turntable, a rotatable and longitudinally movable auger shaft supported adjacent the tower, a source of power, and independently controlled means for causing the source of power to rotate the auger and drive the same to and from the work.

12. An earth boring machine having a turntable rotatably mounted upon a vehicle, a source of power, an auger tower mounted upon the turntable, a rotatable and longitudinally movable auger shaft adjacent the auger tower and braced thereby, power transmitting mechanism coöperating with the source of power, the turntable and the auger shaft whereby the source of power may rotate both the turntable and the auger shaft and drive the auger shaft to and from the work, and control mechanism for independently controlling the rotation of the turntable, the rotation of the auger shaft and the longitudinal drive of the auger shaft.

13. An earth boring machine comprising a turntable rotatably mounted upon a vehicle, a tilttable auger tower mounted upon the turntable, a rotatable and longitudinally movable auger shaft supported adjacent the tower and braced thereby, a source of power, independent power connections between the source of power and the turntable, the tower and the auger shaft so that the source of power may rotate the turntable, tilt the tower and rotate and longitudinally drive the auger shaft in both directions, and manually operable clutches for independently and noninterferingly causing the source of power to perform its functions.

14. An earth boring machine comprising a vehicle, a turntable mounted thereon, an auger tower mounted upon the turntable, a rotatable auger shaft supported adjacent the tower and longitudinally movable thereof to drive an auger to and from the work, a motor carried by the vehicle, connections for causing the motor to rotate the turntable and the auger shaft and to drive the shaft

to and from the work, and manually actuated control mechanism for independently disconnecting the motor from the turntable and from the auger shaft.

15. An earth boring machine comprising a vehicle, a turntable thereon, an auger tower mounted upon the turntable and comprising parallel upright supports, an auger shaft within the tower and longitudinally movable thereof, a cross-head slidingly supported within the tower and carrying the auger shaft and bracing the upper end thereof, a common source of power for rotating the turntable, rotating the auger shaft and positively driving the same in both directions longitudinally of the tower, and control means for stopping and starting the rotation of the turntable and the auger shaft and stopping, starting and reversing the longitudinal movement of the auger shaft.

In testimony whereof I hereunto subscribe my name.

WILLIAM E. MOORE.