

May 26, 1953

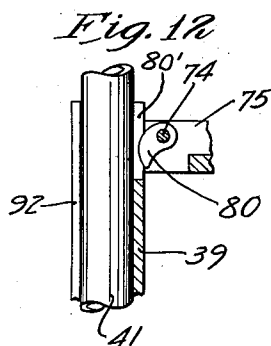
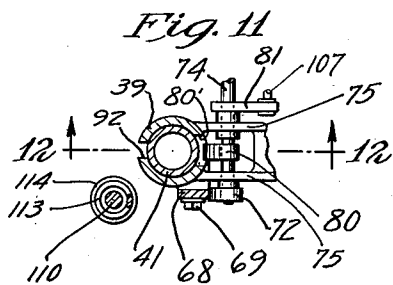
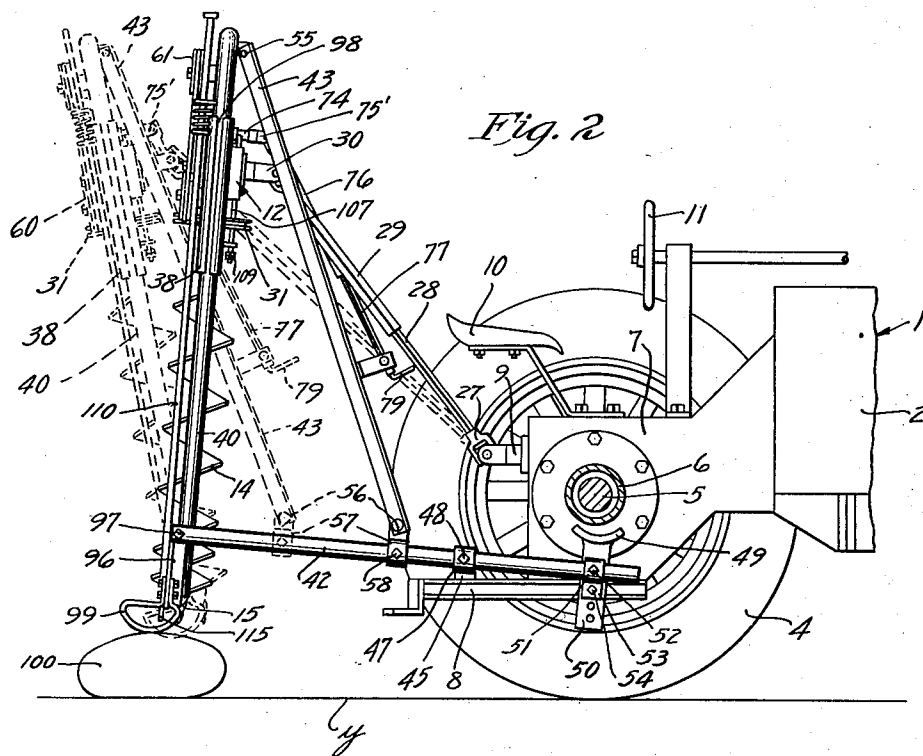
G. H. JONES

2,639,892

EARTH-BORING MACHINE

Filed June 5, 1946

4 Sheets-Sheet 2



Inventor
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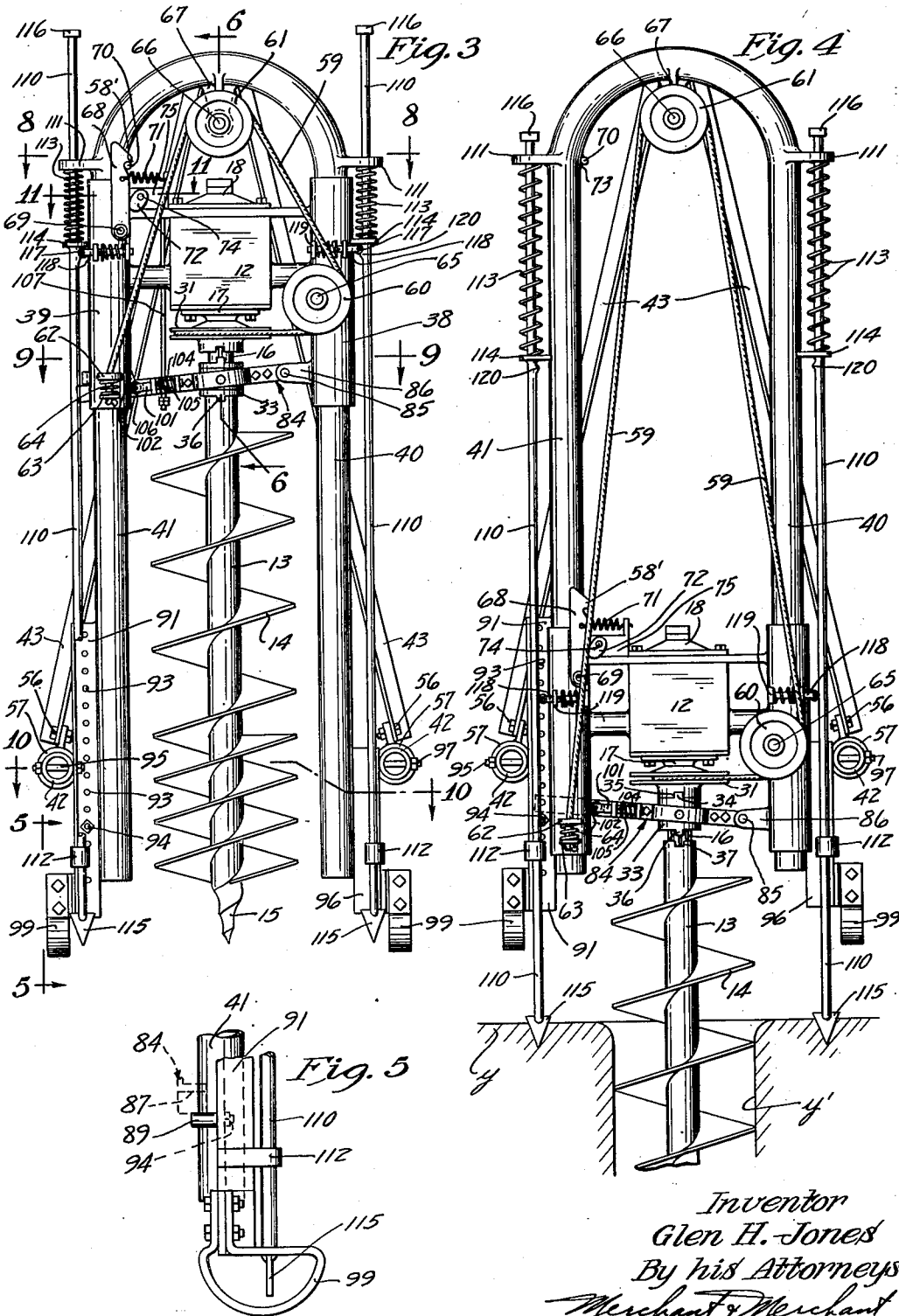
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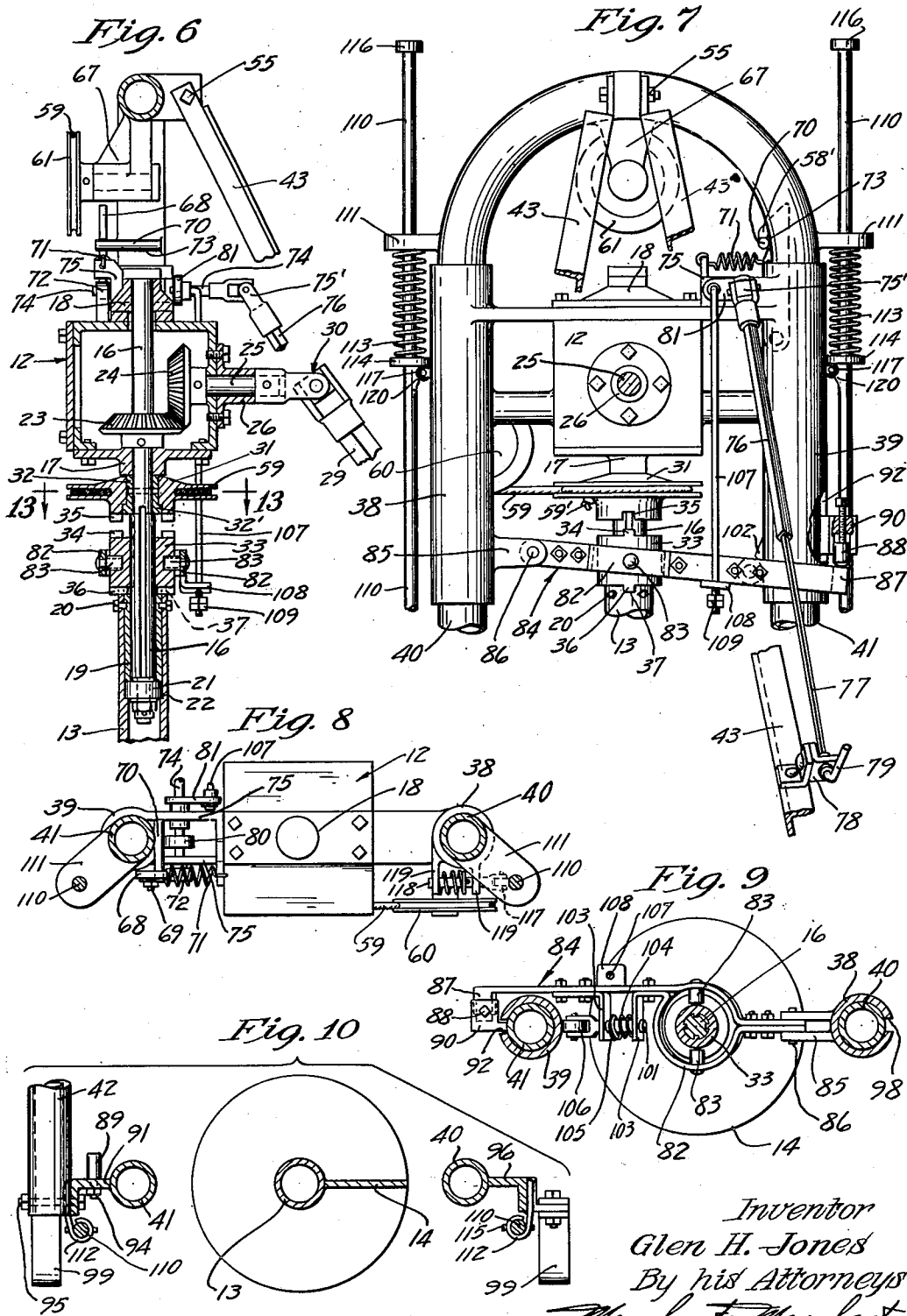
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UNITED STATES PATENT OFFICE

2,639,892

EARTH-BORING MACHINE

Glen H. Jones, Minneapolis, Minn.

Application June 5, 1946, Serial No. 674,514

24 Claims. (Cl. 255—19)

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My present invention relates to improvements in earth-boring machines, and more particularly to portable power-driven machines of this character that are adapted for drilling holes for receiving posts, poles, and the like; an important object of the invention being the provision of an improved boring mechanism that is adapted to be mounted on and carried by a suitable vehicle, such as a farm tractor, truck or trailer, and driven, preferably, by the power plant of the traction vehicle through a suitable take-off shaft.

Another important object of the invention is the provision of an improved means for mounting the boring mechanism on and driving the same from the tractor or analogous vehicle in such a manner that the boring mechanism will pass freely over obstructions without injury thereto.

Another important object of the invention is the provision of improved means for leveling the boring mechanism whereby when the tractor is standing on a slope or on uneven ground the auger of the boring mechanism may be adjusted to assume a plumb position or, when required, the auger may be adjusted to bore a hole at an angle to the vertical.

Another important object of the invention is the provision of an improved earth-boring mechanism wherein the power-driven auger, upon reaching a predetermined depth, will be automatically power-retracted from the hole bored thereby and reset in starting position for the next drilling operation. In the preferred embodiment of the invention herein illustrated, the depth of the bore is variable and is controlled by pre-adjusted stops, and mechanism is also provided under manual control of the operator whereby the boring operation may be interrupted and the auger retracted at any time during the drilling operation, whereby to minimize damage to the auger in case it engages a serious obstruction, such as a rock or the like.

Still another object of the invention is the provision of improved means under manual control of the operator whereby downward movements of the auger may be interrupted or retarded at any time during the boring operation independently of rotary movements of the auger.

Still another object of the invention is the provision of manually releasable means for automatically locking the auger in its retracted inoperative position independently of the lifting or retracting mechanism.

A still further object of the invention is the provision of means for stabilizing the boring mechanism against lateral wobbling movements during the drilling operation.

The above and other highly important objects and advantages of the invention will be made apparent from the following specification, claims, and appended drawings.

In the drawings, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a view in side elevation, with some

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parts broken away and some parts shown in section, showing a preferred embodiment of earth-boring mechanism built in accordance with the instant invention mounted on a conventional farm tractor;

Fig. 2 is a fragmentary view corresponding to Fig. 1, but showing somewhat different positions of the parts of the drilling or boring mechanism;

Fig. 3 is a view in rear elevation on an enlarged scale of the boring mechanism of Fig. 1, and showing the parts thereof in their fully retracted upper positions;

Fig. 4 is a view similar to Fig. 3, but showing the auger and certain associated parts in their extreme lower positions;

Fig. 5 is an enlarged fragmentary detail view taken on the line 5—5 of Fig. 3;

Fig. 6 is an enlarged sectional view taken on the line 6—6 of Fig. 3;

Fig. 7 is an enlarged fragmentary view in front elevation taken on the vertical line 7—7 of Fig. 1;

Fig. 8 is an enlarged transverse sectional view taken on the horizontal line 8—8 of Fig. 3;

Fig. 9 is an enlarged transverse sectional view taken on the horizontal line 9—9 of Fig. 3;

Fig. 10 is an enlarged transverse sectional view taken on the horizontal line 10—10 of Fig. 3;

Fig. 11 is an enlarged fragmentary detail view taken on the horizontal line 11—11 of Fig. 3;

Fig. 12 is a fragmentary detail view taken on the line 12—12 of Fig. 11;

Fig. 13 is an enlarged detail sectional view taken on the line 13—13 of Fig. 6;

Fig. 14 is an enlarged fragmentary detail view taken on the horizontal line 14—14 of Fig. 1; and

Fig. 15 is an enlarged detail sectional view, with some parts broken away and some parts shown in section, taken on the vertical line 15—15 of Fig. 1.

The tractor illustrated in the drawings hereof, and which is indicated as an entirety by 1, is of a well-known commercially available make, and comprises mainly a power plant in the nature of an internal combustion engine 2, pneumatic tire-equipped front steering wheels 3, pneumatic tire-equipped rear driving wheels 4, rear axle shafts 5, rear axle housing sections 6 extending in opposite directions from a gear case 7, a platform 8 mounted on and extending rearwardly from the gear case 7, a power take-off shaft 9 extending from the gear case 7, an operator's seat 10, and a steering wheel 11. In this particular type of tractor, the engine structure serves as the intermediate portion of the frame, and the gear case 7 is made rigid with the power plant or engine 2 and contains the differential mechanism between the axle shafts 5, a suitable variable speed transmission mechanism, and gearing operatively connecting the power take-off shaft 9 to the engine.

The boring head of my improved machine comprises a rectangular gear case or box 12 and a depending auger shaft 13 equipped with a spiral auger 14. The lower end of the auger shaft 13 is tapered to a point and spirally threaded to

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provide a pilot 15 extending beyond the auger 14. The auger shaft 13 is journaled on a power shaft 16 that depends from and is, in turn, journaled in bearing bosses 17 and 18 on the lower and upper portions respectively of the gear case or box 12. The shaft 16 is journaled in the tubular auger shaft 13 through the medium of an interposed bearing sleeve 19 anchored to the tubular auger shaft 13 by cap screws or the like 20. The lower end of the power shaft 16 is equipped with a thrust bearing 21 that is clamped between the lower end of the bearing sleeve 19 and an auger shaft shoulder 22 to retain the auger shaft against axial movements on the power shaft 16.

The gear case or box 12 of the boring head contains an intermeshing pair of bevelled gears 23 and 24 respectively, the former of which is mounted on the power shaft 16 and the latter of which is mounted fast on a stub shaft 25 journaled in and projecting through a bearing boss 26 of the gear case 12. The shaft 16 of the boring head is driven from the power take-off shaft 9 of the tractor through power transmission connections comprising a universal joint 27, a longitudinally extensible and contractible drive shaft made up of telescopically engaged cross sectionally rectangular sections 28 and 29, a universal joint 30, and said stub shaft 25 and bevelled gears 24 and 23 respectively.

Mounted fast on shaft 16 immediately below the hub 17 (see Fig. 6) is a thrust bearing sleeve 32 having a shoulder 32' spaced from the hub 17. This sleeve 32 cooperates with the gear case hub 17 and the hub of gear 23 to lock shaft 16 against axial movements. Journaled on the sleeve 32 between shoulder 32' and hub 17 is a cable winding drum 31 forming part of the boring head retracting or elevating mechanism hereinafter to be more fully described.

For selectively driving either the auger shaft 13 or the winding drum 31 from the power shaft 16, I provide a dog clutch comprising a clutch element 33 slidably mounted on the shaft 16 intermediate the tubular auger shaft 13 and the hub of winding drum 31. This sliding clutch element 33 is spline keyed to the shaft 16 as shown best in Figs. 6 and 9, and the upper end of said clutch element 33 is provided with circumferentially spaced clutch dogs or teeth 34 for intermeshing driving engagement with circumferentially spaced clutch teeth or dogs 35 formed on the lower end of the hub of winding drum 31, and the lower end of the sliding clutch element 33 is provided with circumferentially spaced clutch dogs or teeth 36 for intermeshing driving engagement with a similar series of teeth or dogs 37 (see Figs. 3, 4 and 6) on the upper end of the tubular auger shaft 13. With this arrangement, it will be clear that when the sliding clutch element 33 is moved to its upper position as shown in Fig. 4, the winding drum 31 will be in driving engagement with the power shaft 16 and the auger shaft 13 will be free on the shaft 16; and it will also be clear that when the sliding clutch element 33 is shifted to its lower position as shown in Figs. 3, 6 and 7, the winding drum 31 will be free of the shaft 16 while the auger shaft 13 will be operatively coupled to the shaft 16. The mechanism for shifting the sliding clutch element 33 will later be described.

The gear case 12 of the boring head is rigidly mounted between a laterally spaced pair of guide sleeves 38 and 39, which form part of the boring head and are, in turn, telescopically applied to and slidable on opposite parallel guide legs 40 and 41 respectively of an inverted U-shaped

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frame element. This inverted U-shaped frame element is mounted on and supported from the tractor by a supporting structure comprising laterally spaced rearwardly extended cantilever bars 42 and diagonal braces 43. The cantilever bars 42 are rigidly connected one to leg 40 and the other to leg 41 of the inverted U-shaped frame near the bottoms thereof, and said cantilever bars 42 are intermediately pivoted to the tractor platform 8 at 44, as best shown in Fig. 14. By reference particularly to Fig. 14, it will be noted that the pivotal connections between the cantilever bars 42 and platform structure 8 are accomplished by cantilever bar-carried stud bolts working through opposite end flanges of an anchoring bracket 45 that is anchored to the platform 8 by bolts or the like 46. Also by reference to Fig. 14, it will be seen that the said pivot stud bolts project from and are carried directly by mounting sleeves 47 that are adjustably slidably mounted on opposite cantilever bars 42 and are locked in desired positions on said bars 42 by set screws or the like 48. The inner end portions of the cantilever bars 42 are equipped with segmental saddles 49 that engage the under surfaces of opposite rear axle housing sections 6 and thereby retain the cantilever bars 42 against counterclockwise pivotal movements in respect to Figs. 1 and 2, but which permit free clockwise pivotal movements of said cantilever bars 42 in respect to said Figs. 1 and 2. Mounting of the saddles 49 on the inner end portions of cantilever bars 42 is accomplished through the medium of depending anchoring flanges 50 on the saddles 49, mounting sleeves 51 adjustably slidably mounted on the cantilever bars 42 and held in adjusted position by set screws 52, depending anchoring flanges 53 on said mounting sleeves 51, and nut-equipped bolts 54 passing through the flanges 53 and 50. By reference to Figs. 1 and 2, it will be seen that the flanges 50 are provided with a spaced series of holes for optional reception of the anchoring bolts 54 to permit adjustment of the cantilever bars to accommodate the mounting structure to different tractors. The upper ends of the diagonal braces 43 are rigidly connected to the upper intermediate portion of the inverted U-shaped frame at 55, and the lower ends of said diagonal braces 43 are each pivotally connected at 56 to an opposite cantilever bar 42 through the medium of flange-equipped anchoring sleeves 57 that are slidably adjustably mounted on opposite cantilever bars 42, and which are normally locked in position by suitable set screws 58.

The mechanism for automatically lifting or elevating the boring head comprises the power shaft 16 of the boring head, the slidable clutch element 33, the winding drum 31, and a flexible cable 59 running over a pulley wheel 60 and a pulley wheel 61. The opposite flanges of the winding drum 31 are spaced to snugly receive the cable 59, one end of which is anchored to the radially inner portion of the winding drum by being projected downwardly through a hole in the lower flange of the drum and knotted therebelow, as shown at 59' in Fig. 7. The cable 59 thus winds spirally upon itself. The other end of the cable 59 extends through an anchoring flange 62 on the guide sleeve 39 of the boring head, and is provided below said anchoring flange 62 with a yielding anchor comprising a washer 63 and a coil compression spring 64. The pulley wheel or sheave 60 is pivotally mounted on the guide sleeve 38 of the boring head at 65, and the pulley wheel of the sheave 61 is pivotally anchored to the intermediate upper portion of the

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inverted U-shaped guide frame at 66 through the medium of a bracket 67, see particularly Figs. 3 and 4.

The mechanism, herein illustrated, for automatically but manually releasably locking the boring head in its extreme upper or retracted inoperative position independently of the lifting or elevating mechanism comprises a latch bar 68 having a detent 58' and being pivoted to the guide sleeve 39 at 69, a cooperating latch dog in the nature of a pin 70, a coil tension spring 71 yieldingly biasing the latch bar 68 in the direction of the pin 70, and a latch-tripping cam 72. The latch pin 70 is welded or otherwise rigidly secured to the guide leg 41, as shown best at 73 in Figs. 4 and 7. The free upper end of the latch bar 68 is bevelled to provide a cam surface which, under upward movements of the latch bar 68 with the boring head, will engage the pin 70 with a camming action that will deflect the upper end of the latch bar 68 against the yielding action of spring 71 and guide the latch detent 58' into operative engagement with the pin 70. The cam 72 serves both as a trip for the latch bar 68 and as a stop therefor, and is mounted fast on one end of a rock shaft 74 that projects through and is journaled in bearing brackets 75 of guide sleeve 39, see particularly Figs. 7 and 8. The rock shaft 74 is adapted to be operated manually to turn the cam 72 and trip the latch by operating connections comprising a universal joint 75' and a longitudinally extensible and contractible operating shaft made up of telescoping rectangular sections 76 and 77 respectively. The telescoping shaft section 77 is journaled in a bearing bracket 78 on one of the diagonal braces 43 and is outwardly turned below said bearing bracket to provide an operating handle 79 located within convenient reach of an operator positioned on the tractor seat 10.

Also mounted on the rock shaft 74 is a brake cam 80 (see particularly Figs. 8, 11, and 12) and a bell crank 81, shown best in Figs. 6, 7, 8, and 11. Braking cam 80 is located adjacent the leg 41 of the guide frame and works through a slot or notch 80' (see Fig. 12) in the guide sleeve 39 of the boring head. The brake cam 80 is normally spaced from the guide post or leg 41, as shown best in Figs. 11 and 12, and is adapted to be brought into frictional engagement with the guide post or leg 41 by rotation of the rock shaft 74 in a counterclockwise direction with respect to Fig. 7 and in a clockwise direction with respect to Fig. 12, but is so orientated on the rock shaft 74 that it will not come into frictional braking contact with the guide leg 41 until the latch bar 68 has been tripped and released from the pin 70 by the cam 72 as a result of rock shaft movement in the same direction as is required to apply the brake.

The mechanism for operating the sliding clutch element 33, whereby to alternately couple the auger shaft 13 and winding drum 31 to the power shaft 16, comprises a shifter collar 82 having diametrically opposed shifter pins 83 working in a peripheral channel in the sliding clutch element 33, and which shifter collar 82 is formed by the intermediate portion of a shifter lever 84. One end of the shifter lever 84 is pivoted to a bearing bracket 85 on the guide sleeve 39 at 86, and the other or free end of the shifter lever 84 extends beyond the guide sleeve 39 and is provided therebeyond with a laterally offset end 87 for cooperation with upper and lower stops 88 and 89 respectively, see particularly Figs. 3, 5, 7 and 10. The stop 88 is vertically adjustably

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mounted in a stop bracket 90 rigid on and projecting from the upper intermediate portion of the guide leg 41, and the stop 89 is rigidly carried by an elongated angle bracket 91 fast on and projecting from the lower portion of the guide post or leg 41 in vertical alignment with the guide leg 39. By reference to the drawings, it will be seen that the guide sleeve 39 is longitudinally slotted at 92 to receive the brackets 90 and 91, which brackets may be assumed to be welded to the guide post or leg 41, and by particular reference to Figs. 3 and 4, it will be seen that the elongated bracket 91 is provided with a longitudinally spaced series of holes 93 for optional reception of the threaded nut-equipped end 94 of stop 89, see particularly Figs. 3, 4 and 10 of lower stop 89. Also, by reference to the drawings, it will be seen that the outer end of one of the cantilevers 42 is anchored to the lower end portion of guide leg 41 through the medium of the elongated bracket 91 and bolt 95, and that the outer end of the other cantilever bar 42 is anchored to the lower end portion of guide leg or post 40 through the medium of an elongated bracket 96, similar to bracket 91, by a bolt 97. By still further reference to the drawings, and particularly to Fig. 9 thereof, it will be seen that the guide sleeve 39 is longitudinally slotted at 98 to receive the bracket 96.

The elongated brackets 91 and 96, each of which is welded fast on its respective leg 40 or 41, project below the bottom of their respective legs, and are each equipped with a shoe 99, and which shoe 99 is normally spaced above the ground but is adapted to engage irregularities in the ground or obstructions, whereby to tilt the cantilever bars 42 and parts carried thereby on the axes of pivot bolts 44 to thereby clear the obstruction or irregularity, see particularly full lines in Figs. 2 and 14. In this respect, it will be noted that the cantilever bars normally extend in a substantially horizontal plane, as shown in Fig. 1, but that when either of the shoes 99 engage an irregularity or obstruction, such as the rock 100 of Fig. 2, the cantilever bars 42 and the entire mechanism carried thereby will be tilted on the axes of pivots 44 in the manner illustrated by full lines in Fig. 2, wherein it will be noted that the saddles 49 are retracted out of engagement with axle housing sections 5.

The stop 88 is positioned to be engaged by the end 87 of the shifter arm 84 when the power head and elements movable therewith closely approach their fully retracted upper inoperative positions, and when so engaged cause the shiftable clutch element 33 to be shifted out of operative driving engagement with the winding drum 31 and into operative driving engagement with the auger shaft 13. In other words, the stop 88 is so arranged and positioned that the elevating mechanism for the boring head will be rendered inoperative and the auger rendered operative coincidental with engagement of the latch detent 58' of latch bar 68 with the latch pin 70. The stop pins 89, on the other hand, determines the depth of the hole to be bored or drilled by the auger, and is adjustably positioned by selection of the proper hole 93 to engage the end portion 87 of the shifter lever 84 when the auger has bored to the desired depth, and at this time interrupts downward movement of the shifter lever 84 and causes the sliding clutch element 33 to be shifted out of driving engagement with the auger and into driving engagement with the winding drum 31, to thereby ren-

der the elevating mechanism operative to retract the auger from the bore.

For the purpose of maintaining the shifter lever 84 against accidental displacement from either of its operative positions, I provide yielding retaining mechanism (see particularly Figs. 3, 4, and 9) comprising a spring pressed plunger 101 and a cooperating double-faced cam 102. The plunger 101 is slidably mounted in brackets 103 on the shifter arm 84 and is subject to the yielding pressure of a compression spring 104 compressed between one of the said brackets 103 and a pin-retained washer 105 on the plunger 101. The projected end of the plunger 101 is equipped with a roller 106 (see particularly Figs. 3, 4, 8, and 9) for cooperation with the cam 102, which cam 102 is anchored fast to bearing sleeve 39 of the boring head. The two-faced cam 102 is so orientated that its apex or toe portion, from which it tapers in opposite directions toward the bearing sleeve 39, will be engaged by the roller 106 when the sliding clutch element 33 is in its intermediate position and so that its lower face will be engaged by the spring pressed roller 106 when the shifter arm 84 is in its lower position, and the upper tapered face thereof will be engaged by the spring pressed roller 106 when the shifter arm 84 is in its upper position. Obviously, with this arrangement the shifter lever will always be maintained under yielding pressure to remain in its last set operative position.

Now, because it is sometimes desirable to cause the auger to be retracted before it reaches the predetermined depth, I provide, in addition to the above described automatic control of the sliding clutch element 33, for manual operation of said sliding clutch element in the following manner: The bell crank 81 on the rock shaft 74 has pivotally connected to its outer end a depending rigid link 107 (see particularly Figs. 6, 7, and 8), the lower end portion of which works slidably through a flange 108 on the shifter lever 84 and is provided below said flange with an adjustable head in the nature of a pair of screw-threaded nuts 109. With this arrangement, when it be desired to stop rotation of the auger and start retraction thereof at any time during its downward travel but before the lower stop 89 becomes effective, the operator may accomplish this result by merely rotating the handle 79, rock shaft 74, and bell crank 81 in a direction opposite that required to trip the latch bar 68 and operate the brake cam 80. This will lift the link 107 to bring the adjustable head 109 thereof into operative engagement with flange 108, and thereafter move the shifter lever 84 and clutch element 33 sufficiently to release said clutch element 33 from driving engagement with the auger shaft and bring the same into driving engagement with drum 31 of the retracting mechanism.

Although the boring mechanism, including the mounting elements therefor, is inherently quite rigid, there is, nevertheless, a tendency to produce a lateral wobbling action of the entire mechanism during the boring operation and particularly during the initial portion of this operation, and which is particularly noticeable when the boring mechanism is applied to a pneumatic tire-equipped tractor such as is shown in the accompanying drawings. In accordance with the present invention, however, this objectionable tendency to wobble and thereby produce unnecessary strains and stresses on the boring mechanism is controlled, and resultant wobble elimi-

nated, by a stabilizing mechanism heretofore briefly mentioned and which, in its preferred embodiment illustrated, comprises spring pressed stabilizer rods 110. These stabilizer rods 110 extend one in laterally spaced parallel relation to the guide post or leg 40 and the other in laterally spaced parallel relation to the guide post or leg 41 and have their upper portions longitudinally slidably mounted in bearing flanges 111 and their lower portions slidably mounted in bearing brackets 112. The stabilizer rods 110 are yieldingly biased in a downward direction by coil compression springs 113 compressed between the bearing flanges 111 of the guide frame legs and flanges 114 on the stabilizer rods 110. The lower ends of the stabilizer rods 110 are preferably, but not essentially, provided with pointed arrow-like heads 115 that are adapted to be pressed into the ground Y on opposite sides of the auger and the hole or bore Y' drilled thereby. When the stabilizer rods 110 are released, they will be spring pressed into the ground Y substantially as shown in Fig. 4 or to a maximum depth determined by engagement of heads 116 on the upper ends of the stabilizer rods 110 with the flanges 111. However, during the final upward retracting movements of the boring head, the stabilizer rods 110 will be automatically retracted against the yielding action of the springs 113 by engagement of the roller-equipped ends 117 of spring pressed plungers 118 with the under sides of stabilizer arm-carried flanges 114 to the fully retracted positions of Fig. 3. The said plungers 118 are each slidably mounted in a pair of flanges 119 carried by and projecting from a guide sleeve 38 or 39. The plungers 118 are spring pressed in the directions of their respective cooperating guide rods 110, so that the rollers 117 thereof are maintained, or at all times tightly pressed against their respective rods 110, and underlie the flanges 114. By reference to Figs. 3, 4, and 7, it will be seen that the guide rods 110 are provided below, but in closely spaced relation to, the flanges 114 with detents 120 which provide roller-receiving notches therebetween and the flanges 114 and which, detents 120, function in cooperation with the spring pressed roller-equipped plungers 118 to apply definite predetermined downward pressures to their respective stabilizer rods 110 when said stabilizer rods come into engagement with the ground during downward movements of the boring head. In this respect, it will be seen that the stabilizer rods 110 will follow the spring pressed plungers downwardly with the boring head through the combined yielding action of gravity and the springs 113 until the ends 115 of the stabilizer rods meet the resistance of the ground, after which the roller-equipped ends of the plungers 118 will tend to move away from the flanges 114, but will meet the resistance of the detents 120, which will be sufficient to sink the ends 115 of the stabilizer rods somewhat deeper into the ground than was accomplished by the springs and gravity. Of course, when the resistance to downward movements of the stabilizer rods builds up to a predetermined value, the roller-equipped ends of the plungers 118 will ride over the detents 120 and follow down the stabilizer rods with the boring head without subjecting the stabilizer rods to any further appreciable downward force.

Résumé of operation

For the purposes of transporting and spotting the auger, the parts will be positioned as shown

in Figs. 1, 3, 6, and 7, wherein it will be noted that the boring head and upper stabilizer rod are in their fully retracted positions and the sliding clutch element 33 is in driving engagement with the auger shaft 13 and is uncoupled from the winding drum 31; the boring head being locked in this upper position by engagement of detent 58' of latch bar 69' with latch pin 70'. For the purpose of this case, it may be assumed that the power take-off shaft 9 is of the continuously operating variety, so that the auger will be operatively coupled to the tractor engine whenever the auger shaft 13 is engaged by the clutch element 33. With the parts positioned for transportation as in the figures last noted, it will be seen that the shoes 99 are spaced from the ground, but, nevertheless, project below the lower ends 115 of the retracted stabilizer rods 110 and below the pilot end 15 of the auger shaft 13. If, as heretofore pointed out, during transportation of the mechanism, the shoes 99 engage a serious irregularity or obstruction, the said shoes 99 will ride freely thereover, raising the free end of the auger frame and causing the cantilever bars 42 to partake of pivotal movements on the pivots 44, and as soon as the obstruction is passed the parts will return to their normal positions of Fig. 1, all as best shown in Fig. 2. As soon as the auger is properly spotted, the tractor operator will usually occupy the seat 10 of the tractor and may set the mechanism in operation by imparting a slight counterclockwise movement (in respect to Fig. 7) to the operating shaft 77 through the medium of its handle 79 sufficient to release the latch detent 58' from latch pin 70' through action of cam 72. Upon releasing of the latch, the boring head will drop under the action of gravity to bring the auger pilot 15 into engagement with the ground, thereby starting the boring operation. During this initial dropping of the boring head from its fully retracted position to a point of initial engagement of the auger with the ground, the ends 115 of the stabilizer rods 110 will be forced into the ground in the manner heretofore described and will anchor the mechanism against lateral wobbling movements during the entire boring operation and during the major part of the initial auger retracting cycle. Of course, if the operator wishes to retard the rate of fall of the auger from its fully retracted position to the ground, or if he wishes to retard the rate of boring speed, he may do so by imparting a slight additional counterclockwise movement to operating shaft 77 to bring the brake cam 80 into frictional braking action with the guide leg 41. This braking action is particularly important in certain types of soil, such as heavy clay, where the auger may tend to screw itself into the earth without lifting the same. Ordinarily, the boring operation will be permitted to continue until the predetermined depth of bore is obtained, and at which time the free end 87 of the shifter arm 84 comes into contact with stop pin 89, causing the sliding clutch element 33 to be moved out of driving engagement with the auger shaft 13 and into driving engagement with the winding drum 31 of the lifting mechanism, thereby stopping the auger and starting the retracting operation. At this point, the parts will be positioned as shown best in Fig. 4, in which the cable 59 is largely wound off of the drum 34. With the drum now operating in a winding direction, the cable 59 will be wound spirally thereon, thereby retracting the auger back to its fully retracted position

of Figs. 1 and 3, where it will be automatically retained by engagement of latch detent 58' with latch pin 70' in the manner heretofore described. Approximately coincidentally with the engagement of latch detent 58' with latch pin 70', the free end portion 87 of the shifter lever 84 will engage the upper stop 88 and cause the sliding clutch element 33 to be moved out of operative engagement with the winding drum 31 and back into operative engagement with the auger shaft 13. Of course, during the above noted retraction of the auger, the stabilizer rods 110 will have been automatically retracted in the manner heretofore described and the several parts of the machine will now have been automatically reset for the next subsequent boring operation. As also heretofore pointed out, it may sometimes be desirable to stop the boring operation and start retraction of the auger before the auger has reached the predetermined depth, and this may readily be accomplished by merely turning the operating shaft 77 in a clockwise direction with respect to Fig. 7 sufficient to move the shiftable clutch element 33 out of operative engagement with the auger shaft and into operative engagement with the winding drum; this being accomplished through linkage comprising the bell crank 81, link 107, link head 109, and shifter arm flange 108.

Of course, the depth of bore is adjustably variable by shifting the stop pin 89 into different holes 93 of bracket 91.

What I claim is:

1. In an earth boring machine, a supporting structure, a unitary boring head comprising a downwardly extending auger and power operated means for rotating the auger, means mounting and guiding the unitary boring head on the supporting structure for upward and downward movements on the supporting structure axially of the auger, normally inoperative power operated boring head retracting mechanism operatively connected with the boring head and supporting structure, said boring head retracting mechanism comprising means connectible with said power operated means for operating said retracting mechanism and disconnectible from said power operated means to render said retracting mechanism inoperative, means on said supporting structure engageable with the retracting mechanism when the boring head reaches its lowered position to operatively connect said retracting mechanism with the power operated means for operating the retracting mechanism to move the boring head to its retracted position, means on the supporting structure for disconnecting the retracting mechanism from the power operated means when the boring head reaches its retracted position and manually releasable latch mechanism comprising cooperating latch elements on the supporting structure and boring head automatically engageable when the boring head reaches its retracted position for retaining the boring head in its retracted position independent of the boring head mechanism.

2. The structure defined in claim 1, in which the said manually operable latch tripping means comprises a cam element mounted adjacent the relatively movable latch element and operative thereon to move the same against action of its yielding means to trip the latch element, and manually operable means for rotating said cam.

3. The structure defined in claim 1, in which the said relatively movable latch element is mounted on and for travelling movements with

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the boring head, and in further combination with manually operable latch releasing mechanism comprising a manually operable cam also mounted on and for travelling movements with the boring head and positioned to engage the movable latch element and trip the same.

4. In an earth boring machine, a supporting structure, a unitary boring head comprising a downwardly extending auger and power means for rotating the auger, means on the supporting structure for guiding the boring head for upward and downward movements axially of the auger, power operated means for retracting the boring head from a lowered boring position to an elevated retracted position, and automatically engageable manually releasable latch mechanism for engaging and retaining the boring head when in its retracted position, said latch mechanism comprising cooperating latch elements on the supporting structure and the boring head.

5. In an earth boring machine, a supporting structure, a unitary boring head comprising a downwardly extending auger and power operated means for rotating the auger, means mounting and guiding the unitary boring head on the supporting structure for upward and downward movements on the supporting structure axially of the auger, normally inoperative power operated boring head retracting mechanism operatively connected with the boring head and supporting structure, said boring head retracting mechanism comprising means connectible with said power operated means for operating said retracting mechanism and disconnectible from said power operated means to render said retracting mechanism inoperative, means on said supporting structure engageable with the retracting mechanism when the boring head reaches its lowered position to operatively connect said retracting mechanism with the power operated means for operating the retracting mechanism to move the boring head to its retracted position, means on the supporting structure for disconnecting the retracting mechanism from the power operated means when the boring head reaches its retracted position, and automatically engageable manually releasable latch mechanism retaining the boring head in its retracted position independent of the boring head retracting mechanism, the said latch mechanism comprising cooperating relatively fixed and relatively movable latch elements mounted one on the supporting structure and the other for travelling movements with the boring head, yielding means biasing the said relatively movable latch element in a direction of operative engagement with its cooperating relatively fixed latch element, and manually operable means for tripping the movable latch element.

6. The structure defined in claim 5 in further combination with automatically engageable manually releasable latch means retaining the boring head in its elevated position independently of the elevating mechanism, said latch mechanism comprising cooperating latch elements on the supporting structure and boring head.

7. In an earth-boring machine, a supporting structure having upwardly and downwardly directed guide means, a unitary boring head mounted for sliding movements on the upwardly and downwardly directed guide means of the supporting structure and comprising a downwardly extended auger and power operated means for rotating the auger, normally inoperative power operated mechanism operatively as-

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sociated with the supporting structure and boring head for retracting the auger, means operatively associated with the retracting mechanism for rendering same operative when the boring head reaches a predetermined lowered position to move the boring head from said lowered position to its retracted position, means operatively associated with the retracting mechanism for rendering same inoperative when the boring head has reached its retracted position, a fixed latch element carried by the supporting structure, a cooperating retractable latch element movably mounted on the boring head, yielding means biasing the said retractable latch element in a direction of operative engagement with the cooperating relatively fixed latch element, a manually operable rock shaft mounted on the boring head, a cam element fast on the rock shaft and operative on the movable latch element to move and trip the same, and a brake element also mounted fast on the rock shaft and engageable under rotation of the rock shaft with the guide means of the supporting structure to retard downward movements of the boring head, the said elements being so relatively orientated upon the rock shaft that same will move successively into operative positions by a continued unidirectional movement of the rock shaft and the said elements being angularly disposed relative to the axis of the rock shaft whereby the first noted element will trip the latch before the second noted element is brought into braking engagement with the guide means.

8. The structure defined in claim 7 in further combination with an operating element on the supporting structure and operating connections therefrom to said rock shaft.

9. In an earth-boring machine, a supporting structure having upwardly and downwardly directed guide means, a boring head mounted for sliding movements on said guide means; said boring head being a unitary structure and including a power-driven shaft, a depending power operated auger supported by said shaft, a winding drum journaled for rotation about said shaft, and clutch means rotatable with said shaft and slidable thereon for selectively coupling the winding drum to the power operated shaft; an elevating mechanism for the boring head which includes the said winding drum of the boring head, and cooperating engageable devices carried by the boring head and supporting structure respectively for automatically shifting said clutch means into winding drum driving position when the boring head reaches a predetermined lower position and automatically shifting said clutch means out of winding drum driving position when the boring head reaches a predetermined elevated position.

10. The structure defined in claim 9 in further combination with automatically engageable manually releasable latch mechanism retaining said boring head in its elevated position independently of the boring head elevating mechanism, said latch mechanism comprising cooperating latch elements mounted one on the supporting structure and the other on the boring head.

11. In an earth-boring machine, a supporting structure having upwardly and downwardly directed guide means, a boring head mounted for up and down sliding movements on said guide means; said boring head comprising a power rotated shaft, a depending power-driven auger freely journaled on said shaft, a winding drum

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coaxial of and journaled on said shaft for rotation independently thereof, and cooperating shiftable and non-shiftable clutch elements carried one by the winding drum and the other by said power operated shaft for selectively coupling said winding drum to said shaft for rotation therewith; power operated boring head retracting mechanism comprising said winding drum and cable means anchored thereto for winding thereon and reacting on the supporting structure; automatic shifting mechanism for said shiftable clutch element comprising a boring head-carried shifter element and cooperating lower and upper stops on the supporting structure, said lower stop being positioned and arranged to be engaged by the boring head-carried shifter element to move said shifter element into operative engagement with its cooperating non-shiftable clutch element to render the retracting mechanism operative when the boring head reaches a predetermined lowered position, said upper stop being positioned and arranged to be engaged by said boring head-carried shifter element to move the shiftable clutch element out of operative engagement with its cooperating non-shiftable clutch element when the boring head reaches a predetermined elevated position; and cooperating means on the supporting structure and boring head for retaining said boring head in its elevated position independently of the retracting mechanism.

12. In an earth boring machine, a supporting structure having upwardly and downwardly directed guide means, a unitary boring head structure mounted for up and down sliding movements on said guide means; said unitary boring head structure comprising a power rotated shaft; a depending power driven auger rotatably journaled on said shaft, a cable winding drum disposed coaxially of and rotatably journaled on said power driven shaft, cooperating shiftable and non-shiftable clutch elements, carried one by the cable winding drum and the other by said power operated shaft for selectively coupling said drum to and uncoupling same from said shaft; power operated boring head retracting mechanism including said winding drum and a cable having one end thereof secured to said drum for winding thereon, idler means on the supporting structure engaging said cable; the other end of said cable being secured to said boring head structure, automatic shifting mechanism for said shiftable clutch element comprising a shifter lever pivoted on the boring head structure and operatively engaged with the shiftable clutch element, and upper and lower stop means on the supporting structure successively engageable by said shifter lever for engagement of the clutch elements when the boring head is in a predetermined lower position and for disengagement of the clutch elements when the boring head is in an upper retracted position.

13. In an earth boring machine, a supporting structure having upwardly and downwardly directed guide means, a unitary boring head mounted for up and down sliding movements on said guide means; said unitary boring head comprising a depending power rotated shaft; a depending auger co-axial with and rotatably journaled on said power rotated shaft, a cable winding drum co-axial of and journaled on said shaft for rotation relative thereto, clutch means for selectively and independently coupling the auger and drum to said power rotated shaft; said clutch means including a shiftable clutch

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element supported on said shaft for rotation therewith and for axial sliding movement thereon and co-operating clutch elements on the drum and auger, means for automatically shifting the shiftable clutch element into driving engagement with the clutch elements on the winding drum for rotation thereof with the shaft when the boring head reaches a predetermined lowered position and for automatically shifting the shiftable clutch element into driving engagement with the clutch elements on the auger for rotation thereof when the boring head reaches a predetermined elevated position, said last named means comprising a shifter element mounted for travel with and operatively coupled to the shiftable clutch element, cooperating upper and lower stops carried by the supporting structure and being in the path of movement of said shifter element and engaging same at the upper and lower positions of the boring head; and boring head retracting mechanism including said drum and a cable having one end thereof anchored to said drum for winding thereon upon rotation of the drum, the cable passing over idler means on the supporting structure and having its opposite end anchored to said boring head.

14. In an earth-boring machine, the combination with a supporting structure, a unitary boring head comprising a power-driven shaft and a depending rotary power-driven auger, and cooperating guide means on the supporting structure and boring head guiding the boring head for upward and downward movements axially of the auger, of an auger elevating mechanism comprising a cable winding drum carried by and journaled on said shaft, a cable anchored to and wound upon the winding drum and extending therefrom to the supporting structure at a point above the winding drum; and power transmission means adapted to operatively couple the winding drum to the said power-driven shaft of the boring head, said power transmission means being carried by the boring head and comprising cooperating drive elements mounted on the shaft one of which is mounted for shifting movements into and out of operative engagement with the other thereof; and means for automatically shifting the said shiftable drive element comprising an operating element for the shiftable drive element carried by the boring head and spaced stops on the supporting structure successively engageable with said operating element upon movement of said boring head to predetermined upper and lower positions to respectively disconnect and connect said drive elements.

15. In an earth-boring machine, a vehicle-carried supporting structure having upwardly and downwardly directed guide means, an auger-equipped boring head mounted for up and down travelling movements on the guide means of the supporting structure, power operated means for elevating the boring head, and automatically extensible and contractible means for stabilizing the boring head structure against lateral wobbling movements during boring operations, said stabilizing means comprising a downwardly biased stabilizing device mounted on the supporting structure for limited up and down movements with respect thereto and having a ground engaging lower end portion, cooperating elements mounted for movements one with the boring head and the other with the stabilizing device, the one in the path of travel of the other and positioned to come into engagement during

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final retracting movements of the boring head and cause retraction of the stabilizing device with the boring head during such final retracting movements of the boring head and to become disengaged and permit extension of the downwardly biased stabilizing device into operative engagement with the ground during initial downward movements of the boring head.

16. The structure defined in claim 15, in which the ground engaged lower end of the stabilizing device is pointed to permit insertion into the ground.

17. The structure defined in claim 15, in which the said stabilizing means is duplicated at opposite sides of the auger-equipped boring head.

18. In an earth-boring machine, a vehicle-carried supporting structure having upwardly and downwardly directed guide means, an auger-equipped boring head mounted for up and down travelling movements on said guide means, power operated means for elevating the boring head, and means for automatically stabilizing the boring head supporting structure against lateral wobbling movements, said stabilizing means comprising a stabilizing device having a ground engaging lower end and mounted on the supporting structure for limited up and down movements with respect thereto, yielding means biasing the stabilizing device in a downward ground engaging direction, and cooperating elements mounted for movements one with the boring head and the other with the stabilizing device and constructed and arranged to automatically come into engagement and retract the downwardly biased stabilizing device during upward movements of the boring head and to become disengaged and permit extension of the stabilizing device into operative engagement with the ground under the action of its biasing means during downward movements of the boring head.

19. The structure defined in claim 18, in which the ground engaging lower end of the stabilizing device is pointed to permit insertion into the ground.

20. In an earth-boring machine, a vehicle-carried supporting structure having upwardly and downwardly directed guide means, an auger-equipped boring head mounted for up and down travelling movements on said guide means, power operated means for elevating the boring head, a stabilizing device carried by the boring head and mounted for limited up and down reciprocating movements with respect thereto and having a ground engaging lower end portion, and means automatically extending said stabilizing device in a ground engaging direction during downward movements of the boring head and automatically retracting the same to inoperative position during retracting movements of the boring head, said last named means comprising a cam detent element and a cooperating yieldingly biased element, one of said elements being carried by the boring head and the other by the stabilizing device, said yieldingly biased element being mounted for movements into and out of the path of travel of the cam-acting element and being biased in the direction of the path of travel of the last said element.

21. In an earth-boring machine, a vehicle-carried supporting structure having upwardly and downwardly directed guide means, an auger-equipped boring head mounted for up and down travelling movements on said guide means, power operated means for elevating the boring head, a stabilizing device carried by the boring head

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and mounted for limited up and down reciprocating movements with respect thereto and having a ground engaging lower end portion, means automatically extending said stabilizing device in a ground engaging direction during downward movements of the boring head and automatically retracting the same to inoperative position during retracting movements of the boring head, said last named means comprising a cam detent element and a cooperating yieldingly biased element, one of said elements being carried by the boring head and the other by the stabilizing device, said yieldingly biased element being mounted for movements into and out of the path of travel of the cam element and being biased in the direction of the path of travel of the last said element, the biasing means for the stabilizing device exerting sufficient resistance to retracting movements of the stabilizing device to overcome the resistance of the cam element on its cooperating yieldingly biased element during retracting movements of the boring head, and means positioned to engage the yieldingly biased element during final retracting movements of the boring head and after said yieldingly biased element has passed over its cooperating cam element to impart positive retracting movements to the stabilizing device.

22. The structure defined in claim 21, in which the said cam element is rigidly carried by the stabilizing device and its cooperating yieldingly biased element is mounted for common movements with the boring head.

23. In a portable earth boring machine, a wheel-equipped vehicle having a rear axle housing, a rigid substantially horizontal supporting member pivoted intermediate its ends to the rear end portion of the vehicle for upward and downward movements of its rear end portion and extending both forwardly and rearwardly of its pivotal connection, a saddle carried by the forwardly-projecting end portion of said rigid supporting member and engaging an under-surface of the vehicle rear axle housing structure to limit downward movements of the rearwardly-extending end portion of the rigid supporting member to a generally horizontal position but allowing upward movements of said rearwardly-extending end portion, an auger-equipped boring head mounted on the rearwardly-extending portion of said supporting member, the boring head being supported out of contact with level ground by said rigid supporting member for transportation purposes.

24. The structure defined in claim 23 in further combination with ground-engaging shoes carried by the rearwardly-projected end portion of the pivoted supporting member, said shoes extending below the plane of the bottom of the auger but being spaced above the plane of level of the ground supporting the vehicle.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,073,821	Roberts	Sept. 23, 1913
1,243,580	Besancon	Oct. 16, 1917
1,271,904	Jones	July 9, 1918
1,464,231	Yezek	Aug. 7, 1923
1,540,682	Dreher et al.	June 2, 1925
2,416,036	Zimmerlein et al.	Feb. 18, 1947
2,418,601	Richards	Apr. 8, 1947