

Oct. 23, 1934.

N. D. LEVIN

1,978,368

DRILLING MACHINE

Original Filed Nov. 18, 1927

3 Sheets-Sheet 1

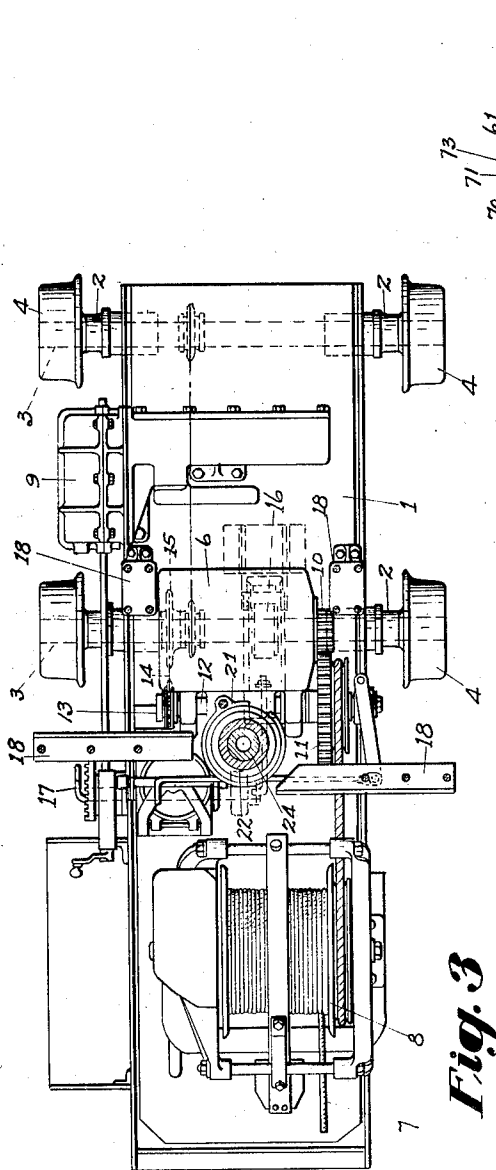


Fig. 3

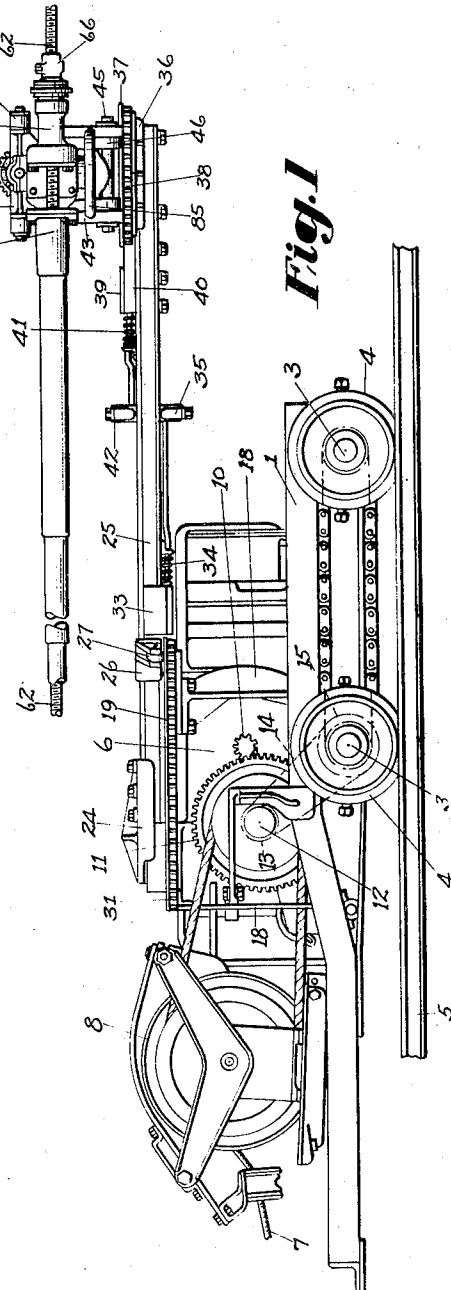


Fig. 1

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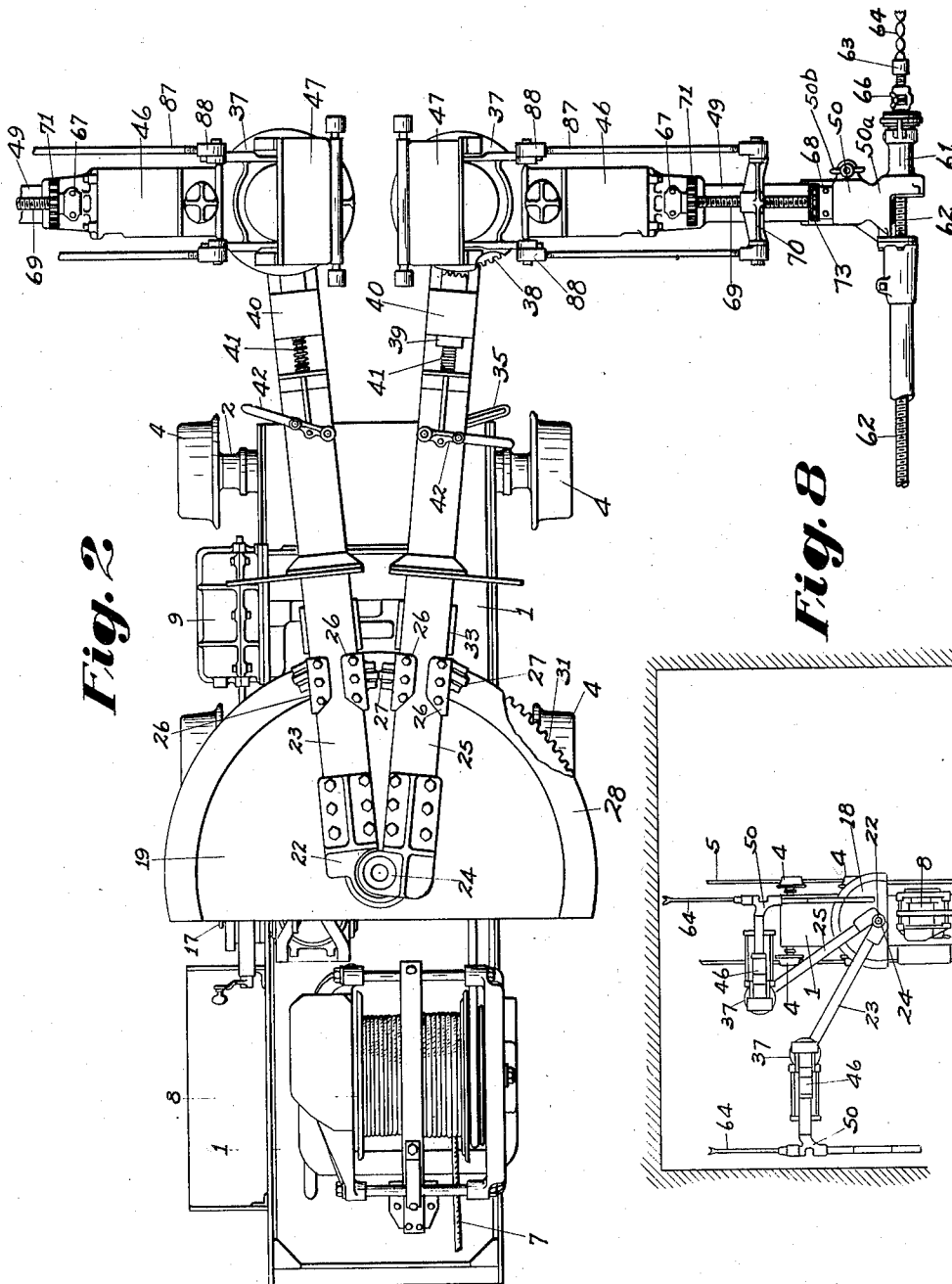


Fig. 2

Fig. 8

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1,978,368

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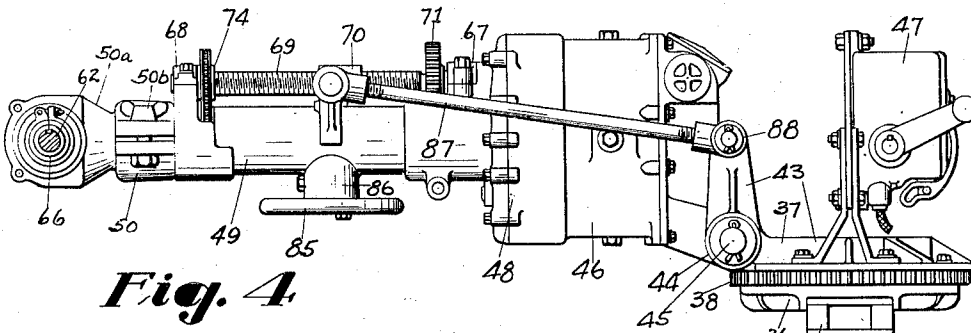


Fig. 4.

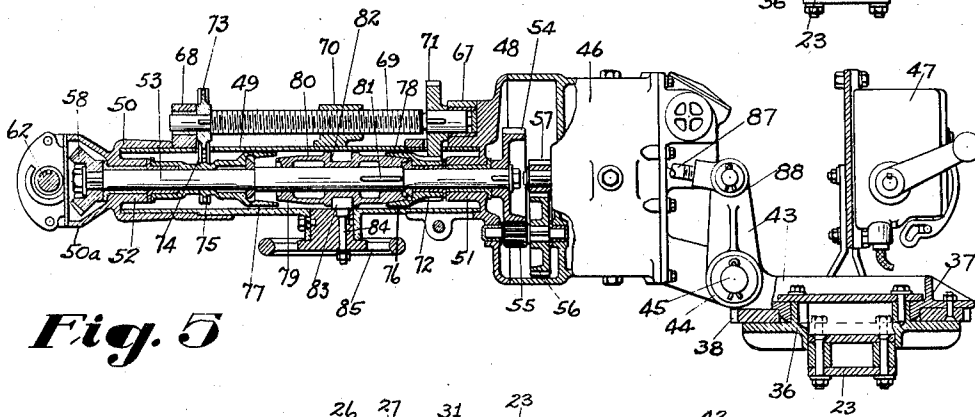


Fig. 5

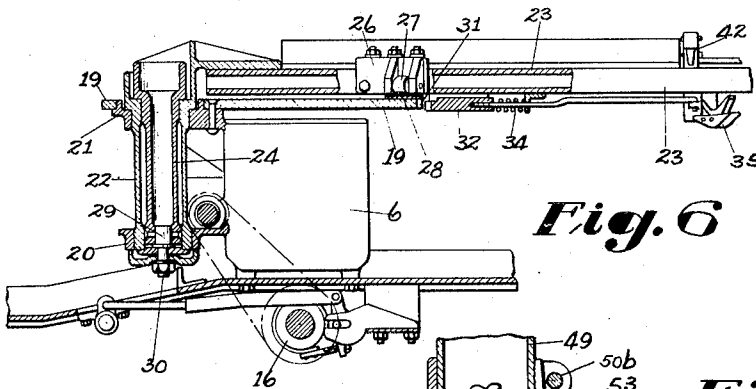


Fig. 6

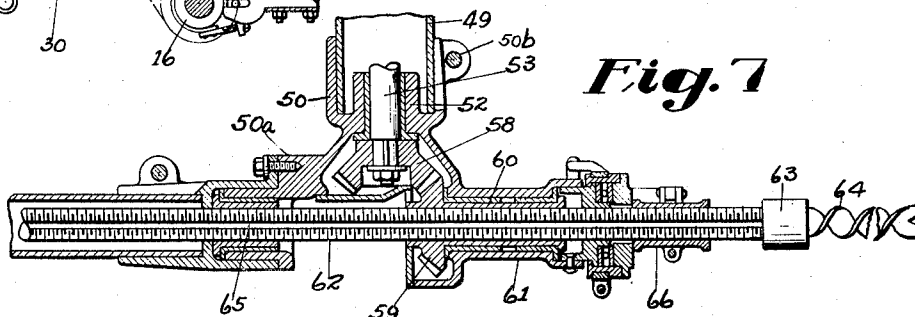


Fig. 7

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2006

UNITED STATES PATENT OFFICE

1,978,368

DRILLING MACHINE

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Jeffrey Manufacturing Company, Columbus,
Ohio, a corporation of Ohio

Application November 18, 1927, Serial No. 234,184
Renewed March 16, 1932

34 Claims. (Cl. 255—51)

The present invention relates to certain new and useful improvements in drilling machines, and particularly to drilling machines adapted to bore holes in the coal body to receive the blasting charges by which the coal is broken and dis-

lodged preparatory to its removal from the mine. It is the especial object of this invention to provide a wheel mounted self propelling machine of the class described, adapted to travel along the rails of a mine track from one working place to another and to rest upon and be braced by said rails during the drilling operation.

A further object is to provide, in a machine such as above described, improved drill supporting devices associated with power actuated mechanism, whereby the drilling devices may be expeditiously, conveniently and accurately adjusted to suitably position the blasting holes in relation to the material which is to be dislodged.

The means whereby I attain these objects are fully set forth in the following specification and illustrated in the accompanying drawings of which

Fig. 1 is a side elevation of what is now thought to be the preferred embodiment of my invention.

Fig. 2 is a plan view of the mechanism disclosed in Fig. 1.

Fig. 3 is a plan view of the supporting truck element of the machine illustrated in Figs. 1 and 2, the upper parts being broken away to reveal the truck driving mechanism.

Fig. 4 is a side elevation of the drill supporting and actuating mechanism.

Fig. 5 is a sectional view taken along the central longitudinal vertical plane of the devices shown in Fig. 4.

Fig. 6 is a fragmentary view, partly in section, of the pivotal supports of the drill supporting mechanism.

Fig. 7 is a detail of the drill actuating mechanism.

Fig. 8 is a plan view of a portion of a mine room with the machine according to the present invention in working position.

Like numerals refer to similar parts in the several figures.

The embodiment of my invention illustrated in the drawings comprises a truck having a main supporting frame 1 to which are attached the journal boxes 2. In the journal boxes 2 are journaled the axles 3 having flanged track wheels 4 adapted to rest upon and travel along the rails 5 of the mine track. Mounted upon the truck frame 1 is a motor 6 which may be of any

preferred type suitable to the conditions under which the machine operates. For purposes of illustration I have here shown an electric motor connected and arranged to receive its actuating current through the flexible conductor cable 7 from any suitable and convenient source of current supply. The conductor cable 7 is adapted to be wound upon the automatic cable reel 8 in the manner which is well understood in the coal mining art. Suitable means is provided for the control of the motor 6 in the controlling mechanism 9 which may be of the common and well known type. The motor is provided with an armature pinion 10 which engages a spur gear 11 fixed to the countershaft 12. A sprocket wheel 13 fixed to the countershaft 12 is connected by an endless chain 14 with the sprocket wheel 15 mounted upon the axle 3 to thereby cause the actuation of the traction wheels 4 from the motor 6 to propel the truck along the rails 5 of the mine track from one working place to another. Fixed to the axle 3 is a brake drum 16 having a suitable brake band adapted to be controlled by the brake lever 17 to lock the traction wheels 4 against rotation and thereby anchor the truck in the preferred position relative to the coal face.

Rigidly attached to the truck frame 1 is a supporting frame 18 having a top plate 19 the forward part of which is of circular outline concentric with the pivot members to be hereinafter described. The pivot members comprise the vertically disposed bearings 20 and 21 which are formed in the supporting frame work 18, and in these bearings is journaled a sleeve 22 which is rigidly attached to the horizontally extending arm 23 and constitutes the pivotal support about which said arm swings in a horizontal plane. Within the sleeve 22 is journaled a second sleeve 24 which is rigidly attached to a second horizontally extending arm 25 and constitutes the pivot about which said second arm swings in the same horizontal planes as the arm 23. The arms 23 and 25 are each provided with laterally projecting brackets 26 wherein are mounted the rollers 27 which bear upon the arcuate rail 28 attached to the top plate 19 concentric with the pivot bearings 20 and 21. The rollers 27 constitute fulcrum supports for the loads upon the overhanging ends of the arms 23 and 25. The upward thrust of the inner ends of the arms 23 and 25 is taken by the pivot bolt 29 which is attached to the inner sleeve 24 by a suitable rivet and which projects through the outer sleeve 22 and through the bottom of the lower bearing 20 against which the nut 30 abuts.

The arms 23 and 25 are substantially alike and a description of one applies to both. Formed in the periphery of the plate 19 are notches 31 adapted to be engaged by the corresponding teeth 5 of the latch member 32 to lock the arm 23 in the preferred position of angular adjustment about its pivotal support. The latch 32 is slidable in guideways 33 of the arm 23 and is engaged by a compression spring 34 whereby it is moved 10 into and retained in locking position. The latch 32 is also connected with an operating lever 35 positioned convenient to the hand of the operator, by the manipulation of which the latch 32 may be released to permit adjustment of the arm 23.

Fixed to the outer end of the arm 23 is a casting 36 which constitutes the supporting base upon which the turntable 37 is pivotally mounted. Formed in the periphery of the turntable 37 are 20 notches 38 adapted to engage the corresponding teeth of the latch member 39 to lock the turntable 37 in the preferred position of angular adjustment about its axis. The latch 39 is slidable in guideways 40 of the arm 23 and is engaged by a compression spring 41 whereby it is moved into and retained in locking position. 25 The latch 39 is also connected with an operating lever 42 positioned convenient to the hand of the operator by the manipulation of which the latch may be released to permit rotation of the turntable about its axis.

Formed on the turntable 37 are two parallel transversely extending ribs 43 upon which are formed journal bearings 44, and in these bearings is rotatably mounted the pivot pin 45. Supported upon the pivot pin 45 is a motor 46 which may be of any preferred type suitable to the conditions under which the machine operates. For purposes of illustration I have here shown 40 an electric motor adapted to receive its actuating current through suitable flexible conductors not shown in the drawings but which are connected with the automatic cable reel 8 and the flexible conductor cable wound thereon. The motor 46 is adapted to be controlled by a suitable 45 controller switch 47 which is preferably of a type well known in the mining art, and which it is not thought necessary to further describe at this time.

Projecting from the outer end of the frame of the motor 46 is a gear casing 48 to which is attached a steel tube 49. The outer end of the tube 49 extends into a socket 50, formed integral with the casting 50a which constitutes the main frame of the drilling mechanism. A clamping screw 50b 55 affords means to vary the frictional engagement of the surfaces of the socket 50 and the tube 49 to permit rotary adjustment of the drilling mechanism about the longitudinal axis of the tube 49, or to clamp said drilling mechanism in the preferred position of angular adjustment relative to said axis. Mounted in journal bearings 51 and 52 concentric with the tube 49 is a shaft 53 to the inner end of which is fixed a spur gear 54. 60 The spur gear 54 is connected through a pinion 55 and spur gear 56 with the armature pinion 57 of the motor 46 to rotate the shaft 53. At the outer end of the shaft 53 is fixed a mitre gear 58 which is engaged by a similar mitre gear 59 65 formed integral with the sleeve 60 journaled in a bearing 61 of the casting 50. Extending through the sleeve 60 concentric therewith is a feed shaft 62 having at its forward end a socket 63 adapted to receive the drilling tool 64. The shaft 62 is 70 provided with a longitudinally extending keyway

65 which engages a suitable key of the sleeve 60 to rotatively connect the shaft 62 with the sleeve 60 while permitting its longitudinal movement relative thereto. Extending from end to end of the shaft 62 is a screw thread adapted to be engaged 30 by a feed nut 66 which is of the type commonly used with drilling mechanism, and which is adapted to be optionally adjusted to engage the screw thread of the feed shaft 62. The feed nut 66 is attached to the casting 50 in a manner 35 which is well understood in the mining art, and serves, when in engagement with the screw thread to force the shaft 62 longitudinally forward to feed the drill tool to its work. When the feed nut is so adjusted as to be out of engagement 40 with the screw thread, the shaft 62 will be free to slide longitudinally of the sleeve to position the drill tool 64 relative to the material which is to be operated upon.

Journaled in suitable bearings 67 and 68 is a screw shaft 69 extending parallel with the shaft 53, and engaged by a crosshead 70 in such manner that rotation of the shaft 69 in one direction will cause movement of the crosshead 70 toward the motor 46, while rotation of the shaft 69 in the 95 opposite direction will cause said crosshead to move away from said motor. Fixed to the screw shaft 69 is a spur gear 71 which extends through an aperture in the steel tube 49 and engages a spur pinion 72 mounted upon the shaft 53 for free rotation relative thereto. Fixed to the screw 100 shaft 69 remote from the spur gear 71 is a sprocket wheel 73 engaged by an endless chain 74 which extends through an aperture in the tube 49 and engages a sprocket wheel 75 mounted upon the shaft 53 for free rotation relative thereto. Formed 105 integral with the pinion 72 and the sprocket wheel 75 are the sockets 76 and 77 respectively, which are adapted to be engaged by the cones 78 and 79 formed upon the sliding member 80 which is slidable upon the shaft 53 and rotatably connected thereto by a suitable key 81. Formed 110 in the sliding member 80 is a circumferential groove 82 which is engaged by a lug 83 attached to the ends of the cylindrical hub 84 of the handwheel 85 and eccentric thereto. The hub 84 is rotatably 115 mounted in a journal bearing 86 attached to the tube 49 in such manner that rotation of the handwheel 85 will cause longitudinal movement of the sliding member 80 relative to the shaft 53. 120 By the manipulation of the handwheel 85 the cone 78 may be forced into engagement with the socket 76 to drive the spur pinion 72 and through it to cause rotation of the screw shaft 69 in a direction to propel the crosshead 70 in one direction, or to force the cone 79 into engagement with 125 the socket 77 to drive the sprocket wheel 75 and through it to rotate the screw shaft 69 in the opposite direction to thereby propel the crosshead 70 in the opposite direction. Pivottally connected 130 to the crosshead 70 are connecting rods 87 which are anchored to upstanding projections 88 of the ribs 43 of the turntable 37. When the crosshead 70 is moved outwardly along the screw shaft 69 the pull upon the connecting rods 87 produces upward rotation of the drilling mechanism about the pivot pin 45 to elevate the drilling mechanism, 135 and when said crosshead 70 is moved inwardly along the screw shaft 69 the drilling mechanism will be rotated downwardly about the pivot pin 45. When the handwheel 85 is so manipulated that the slide member 80 is held in its central position, engaging neither of the sockets 76 nor 77 the screw shaft 69 will remain stationary, locking the crosshead 70 against longitudinal movement, and se- 140 145 150

curely holding the drilling mechanism in the preferred position of vertical adjustment.

In the operation of my improved drilling mechanism actuation of the motor 6 will cause rotation of the track wheels 4 to propel the machine from one working place to another, the direction of travel being controlled by manipulation of the controller 9. Current for the actuation of the motor 6 will be secured through the conductor cable 7 the free end of which is adapted to be connected to the convenient source of electric supply, such as the trolley wire arranged in the mine entries. When the machine has entered the mine room, or other working place, and has advanced to the desired position upon the mine track adjacent the working face, manipulation of the brake lever 17 will cause the brake mechanism 16 to anchor the truck to the mine track and prevent its movement relative to the working face. The hand lever 35 on each of the arms 23 and 25 may then be manipulated to permit rotation of the arms 23 and 25 about their pivotal support to the desired positions of angular adjustment, after which the latch members 32 may be allowed to engage the notches 31 upon the plate 18 to automatically secure said arms in place. The levers 42 may then be manipulated to unlock the turntables 37 and permit their rotation to the desired position of angular adjustment bringing the drilling mechanism into the desired relation with the material which is to be operated upon. After the motor 46 has been started the handwheel 85 may be manipulated to elevate or depress the drilling mechanism, after which the feed nut 66 may be adjusted into contact with the feed shaft 62 to force the drill forwardly to the desired depth. After the completion of the hole, or holes, reversal of the operations above described will again place the apparatus in convenient condition for transportation to the next working place.

It should be particularly noted that each drill is adjustable and operable individually and independently of the other and either drill may be operated from either side of the portable base 1. For instance, the horizontal boom 23 may be moved rearwardly as viewed in Fig. 8 entirely off the arcuate rail 28 thereby allowing free play for the other horizontal boom 25 to be swung horizontally on the vertical axis 24 relatively to the portable base 1 through a range of approximately 180 degrees so as to occupy positions wherein the outer extremity of the boom overhangs either side of the base.

As shown in Figs. 2 and 4 the arm 46, 49 is pivotally connected at 45 to the outer end of the boom 25 to swing in a vertical plane relatively to the boom into relatively inclined positions. Fig. 4 shows means between the boom and the arm for swinging the latter up and down on the pivot 45 relatively to the boom and for holding the arm in its different adjusted positions.

The drilling implement is swivelly mounted on the tube 49 and on the axis of the shaft 53 as shown at 50 in Fig. 5, for rotation through a complete circle, and may be held in adjusted position by means of the clamp 50b shown in Figs. 2 and 4. The swiveling axis of the drilling implement is at right angles to the vertical axis of the turntable 37. By means of the adjustments on these angularly related axes the drilling tool may, irrespective of the angular position of the horizontal boom 25, be adjusted to positions to drill holes at various elevations in the upright coal face in advance of the mine track at right

angles to such face and parallel to the ribs of the mine entry and parallel to the mine track and at various distances from the latter. Either supporting structure comprising the boom and the arm may be used to locate the drill for the drilling of holes in parallel relation to each other over a wide area of the coal face extending between the floor and the roof and between the ribs of the mine entry.

When only one supporting structure comprising a boom and an arm is to be employed the arm 46, 49 may be adjusted into parallelism with the coal face to extend toward one rib or the other from the turntable 37 and the drill operated at right angles to the coal face in advance of the mine track. For instance, if the supporting structure 23, 46 is swung rearwardly to an inoperative position, the arm 46, 49 at the outer end of the boom 25 may be swung 180 degrees from its position shown in Fig. 8 after removing the drill 64 from its holder, and then after swiveling the tool support 50 180 degrees on its axis the drill may be reinserted into its holder. It will thus be seen that the arm 46, 49 on the boom 25 may be swung upwardly or downwardly above a horizontal plane through the boom 25 or below such horizontal plane and along either side of the base at the rear of the forward end of the latter. Consequently, the supporting structure comprising the boom 25 and the arm 46, 49 is adjustable to position the drilling implement in relatively low planes along either side of the base and below the top of the base and in relatively high planes above the top of the base to drill parallel holes at right angles to the coal face and parallel to the ribs and in relatively low planes and in relatively high planes over a wide area of the coal face extending transversely of the forward end of the mine track.

The adjustments are made on the vertical pivotal axis 24 of the boom, on the horizontal pivotal axis 45 of the arm and on the angularly related axes including the vertical axis of the turntable 37 and the swivel axis of the tool support 50. The angular position of the boom 25 determines the distance of the drilling implement from the mine track; the angular position of the arm determines the elevation of the drilling implement; and the adjustments on the rectangularly related axes enables the positioning of the drilling tool parallel to the mine track and parallel to the ribs irrespective of the elevation of the drilling tool or its distance from the mine track.

It should also be observed that the overall height of the track-mounted drilling machine shown in Fig. 1 is relatively low to adapt the machine for operation in a low roof mine chamber. As shown in Figs. 2 and 8 the horizontal booms 23 and 25 are pivoted on a vertical axis 24 approximately midway between the ends of the drilling machine. The booms 23 and 25 are confined to move in a horizontal plane fixed in elevation and located adjacent to the top of the supporting framework. When the boom 23 is in the position shown in Fig. 8 and the boom 25 is similarly located on the opposite side of the machine the front end of the latter may be stationed near the working face which extends across the space in advance of the mine track.

It is desirable to drill holes at right angles to the working face and parallel to the ribs and closely adjacent thereto, and also closely adjacent to the mine bottom and closely adjacent to the mine roof. Notwithstanding the fact that the roofs may be of various heights and the ribs may

be at various distances from the mine track, such drill holes may be made by swinging the booms in the horizontal plane and locking the same in adjusted positions and swinging the arms 46 up or
 5 down on the horizontal axes 45 and holding the same at adjusted inclinations. To position the drill at right angles to the working face and parallel to the ribs mechanism is provided to afford adjustments of the drill on angularly related axes
 10 one of which is vertical at the center of the turntable 37 and the other of which is permanently at right angles to the axis of the drill, being located at 53 as shown in Fig. 4. It will thus be seen that by swinging the boom 23 in a horizontal
 15 plane at fixed elevation, by swinging the arm 46 in a vertical plane, and by adjusting the drill on the angularly related axes 23, 53, the drill may be located closely adjacent to the rib at various elevations including one position closely adjacent
 20 to the mine bottom and another position closely adjacent to the mine roof, for the drilling of holes at right angles to the working face and parallel to the rib. Holes may be drilled in any direction
 25 either in the ribs or in the working face in any horizontal plane between the floor and the roof and likewise holes may be drilled in any direction in any vertical plane between the ribs but it should be particularly noted that the drilling of
 30 holes in horizontal planes closely adjacent to the mine bottom and closely adjacent to the mine roof and in vertical planes closely adjacent to the ribs, and the drilling of holes in the corners of the working face at right angles thereto, greatly reduces the manual labor necessary after blasting
 35 in trimming the floor, roof and ribs to secure the desired continuations thereof.

What I claim is:

1. In a coal drilling machine, the combination with a wheel supported carriage adapted to rest
 40 upon and be braced by the rails of a mine track during the drilling operation, of power devices upon the carriage adapted to propel it along said rails, means to prevent movement of said carriage relative to said rails, an arm pivotally attached
 45 to said carriage for movement in horizontal planes, means to lock said arm against said pivotal movement, a drill supporting arm pivotally attached to said first mentioned arm and adapted to movement in vertical planes, drilling mechanism carried by said drill supporting arm, said
 50 mechanism including a drill extending at right angles to said drill supporting arm and a portion fixable to the latter in varied positions of relative angular adjustment, a motor arranged to actuate
 55 said drilling mechanism, and devices actuated by said motor connected and arranged to effect and control the vertical movement of said drill supporting arm as and for the purpose set forth.

2. In a coal drilling machine, the combination with a wheel supported carriage adapted to rest
 60 upon and be braced by the rails of a mine track during the drilling operation, of power devices upon the carriage adapted to propel it along said rails, means to prevent movement of said carriage relative to said rails, an arm pivotally attached to
 65 said carriage for movement in horizontal planes, means to lock said arm against said pivotal movement, a drill supporting arm pivotally attached to said first mentioned arm adapted to movement in both vertical and horizontal planes, means to lock
 70 the second mentioned arm against horizontal movement, drilling mechanism carried by said drill supporting arm, a motor upon said arm arranged to actuate said drilling mechanism, and
 75 devices actuated by said motor connected and

arranged to effect and control the vertical movement of said drill supporting arm as and for the purpose set forth.

3. In a coal drilling machine, the combination with a wheel supported carriage adapted to rest
 80 upon and be braced by the rails of a mine track during the drilling operation, of power devices upon the carriage adapted to propel it along said rails, means to prevent movement of said carriage relative to said rails, an arm pivotally attached
 85 to said carriage for movement in horizontal planes, means to lock said arm against said pivotal movement, a turntable mounted at the outer end of said arm for rotation in a horizontal plane, means to lock said turntable in the preferred position of angular adjustment, a drill supporting arm pivotally attached to said turntable
 90 adapted to movement in vertical planes, drilling mechanism carried by said drill supporting arm, and power devices connected and arranged to effect and control the vertical movement of said drill supporting arm as and for the purpose set forth.

4. In a coal drilling machine, the combination with a supporting frame, of an arm pivotally
 100 attached thereto for movement in horizontal planes, means to lock said arm in the preferred position of angular adjustment, a turntable mounted at the outer end of said arm for rotation in horizontal planes, means to lock said turntable in the preferred position of angular adjustment,
 105 a drill supporting arm pivotally attached to said turntable for movement in vertical planes, drilling mechanism carried by the second mentioned arm, and means to effect and control vertical movement of the second mentioned arm including a
 110 motor mounted on the latter.

5. In a coal drilling machine, the combination with a main frame, of an arm pivotally attached
 115 thereto, drilling mechanism carried by said arm, a screw shaft extending longitudinally of said arm, a nut operatively engaging said screw shaft, connections between said nut and the main frame, and means to rotate said screw shaft to effect angular movement of said arm about its
 120 pivotal support as and for the purpose set forth.

6. In a coal drilling machine, the combination with a main frame, of an arm pivotally attached
 125 thereto, drilling mechanism carried by said arm, a screw shaft extending longitudinally of said arm, a nut operatively engaging said screw shaft, connections between said nut and the main frame, and a motor mounted upon said arm and operatively connected with said drilling mechanism,
 130 and means actuated by said motor to rotate said screw to effect angular movement of said arm about its pivotal support as and for the purpose set forth.

7. In a coal drilling machine, a support, an arm
 135 pivotally mounted at one end on said support, drill mechanism on the free end of said arm, a power shaft extending longitudinally of said arm in operative connection with said drill mechanism, means for swinging said arm about its pivot point, and selective forward and reverse
 140 drive connections between said shaft and said swinging means, said drive connections including a clutch element slidable on said shaft.

8. In a coal drilling machine, a support, an arm
 145 pivotally mounted at one end on said support, drill mechanism on the free end of said arm, a power shaft extending longitudinally of said arm in operative connection with said drill mechanism, a screw spindle rotatably mounted on said arm, a nut engaging said spindle, a link connecting
 150 said nut and said support, and selective for-

ward and reverse drive connections between said shaft and said spindle, for the purpose described.

one direction, and a driving connection between the other of said sleeves and the shaft to drive the latter in the other direction.

9. In a coal drilling machine, a support, an arm pivotally mounted at one end on said support, drill mechanism mounted on the free end of said arm, a power shaft extending longitudinally of said arm in operative connection with said drill mechanism, a screw spindle rotatably mounted on said arm in substantially parallel relation to said power shaft, a pair of sleeves on said shaft, a sprocket on one of said sleeves, a gear on the other of said sleeves, a sprocket wheel and a gear on said spindle, a chain connecting said sprockets, said gears being in mesh with each other, a nut on said spindle, a link connecting said nut and said support, and means to engage said shaft with either of said sleeves whereby said spindle is rotatable in either direction.

10. In a coal drilling machine, a support, an arm pivotally mounted at one end on said support, a motor adjacent the pivotally mounted end of said arm and having a casing forming a section of said arm, a drill mechanism on the free end of said arm, and transmission means between said motor and said drill mechanism.

11. In a coal drilling machine, a support, a pair of arms pivoted to said support at a common point to swing in horizontal planes, a drill mechanism in connection with the free end of each of said arms, a locking plate having a toothed edge concentric with the pivot point of said arms, and a latch on each of said arms adapted to engage said toothed edge for the purpose described.

12. In a coal drilling machine, the combination with a support, of an arm in pivotal connection with said support, a motor at the pivoted end of the arm, the motor having a casing forming a section of the arm, a shaft extending longitudinally of the arm and driven by the motor, drill mechanism supported by the free end of said arm for relative rotary adjustment in a plane at right angles to said shaft, and a driving connection between said shaft and said drill mechanism.

13. In a coal drilling machine, the combination with a support, of an arm in pivotal connection with said support, a motor at the pivoted end of the arm, a shaft extending longitudinally of the arm and driven by the motor, drill mechanism supported by the free end of the arm, a driving connection between the shaft and drill mechanism, and means driven by the motor for swinging the arm about its pivot.

14. In a coal drilling machine, the combination with a support, of an arm in pivotal connection with said support, a motor at the pivoted end of the arm, a shaft extending longitudinally of the arm and driven by the motor, drill mechanism supported by the free end of the arm, a driving connection between the shaft and drill mechanism, and means driven from the shaft for swinging the arm about its pivot.

15. In a coal drilling machine, the combination with a support, of an arm in pivotal connection with said support, drill mechanism on the free end of the arm, a power shaft extending longitudinally of said arm in operative connection with said drill mechanism, a screw spindle rotatably mounted on said arm in parallel relation to said shaft, a nut engaging said spindle, a link connecting said nut and said support, a pair of sleeves rotatable on said shaft, clutch means to selectively connect said sleeves to said shaft, a driving connection between one of said sleeves and said spindle for rotating the latter in

16. In a coal drilling machine, the combination with a support, of an arm in pivotal connection with said support for relative swinging movement about a horizontal and a vertical axis, a motor at the pivoted end of the arm, a shaft extending longitudinally of the arm and driven by the motor, drill mechanism supported by the free end of the arm, a driving connection between the shaft and drill mechanism, and means driven by the motor for swinging the arm about its horizontal axis.

17. In a coal drilling machine, the combination with a support, of an arm in pivotal connection with said support for relative swinging movement about a horizontal and a vertical axis, a motor at the pivoted end of the arm, a shaft extending longitudinally of the arm and driven by the motor, drill mechanism supported by the free end of the arm, a driving connection between the shaft and drill mechanism, and means driven from the shaft for swinging the arm about its horizontal axis.

18. In a drilling mechanism, the combination with a carriage movable relative to a coal face, a member pivotally mounted upon said carriage for rotary movement in one plane, a second member pivotally mounted upon the first mentioned member for rotary movement in a plane at right angles to the plane of movement of the second member, drilling mechanism carried by the third member, a motor mounted on said second member, a driving connection between the motor and drilling mechanism, and means driven by said motor to effect relative angular adjustment of the second member to the first.

19. In a coal drilling machine, a supporting element, an arm element in pivotal connection at one end with said supporting element, a motor, a shaft extending longitudinally of the arm element, a drive connection between the motor and said shaft, drill mechanism supported by the arm element at the free end of the latter, a drive connection between said shaft and drill mechanism, a link extending between the arm element adjacent its pivoted end and the supporting element, said link being pivoted at one end directly to one of said elements, a member on the other of said elements reciprocable substantially in the swinging plane of the link, the other end of the link having a pivotal connection with said member, and means driven by said motor for reciprocating said member to swing the arm.

20. In a coal drilling machine, a supporting element, an arm element in pivotal connection at one end with said supporting element, a motor, a shaft extending longitudinally of the arm element, a drive connection between the motor and said shaft, drill mechanism supported by the arm element at the free end of the latter, a drive connection between said shaft and drill mechanism, a link extending between the arm element adjacent its pivoted end and the supporting element, said link being pivoted at one end directly to one of said elements, a member on the other of said elements rectilinearly reciprocable substantially in the swinging plane of the link, the other end of the link having a pivotal connection with said member, and means driven from said shaft for reciprocating said member to swing the arm.

21. In a coal drilling machine, a supporting element, an arm element in pivotal connection

at one end with said supporting element, a motor, a shaft extending longitudinally of the arm element, a drive connection between the motor and said shaft, drill mechanism supported by the arm element at the free end of the latter, a drive connection between said shaft and drill mechanism, a link extending between the arm element adjacent its pivoted end and the supporting element, said link being pivoted at one end directly to one of said elements, a screw spindle journaled on the other of said elements substantially in the swinging plane of the link, means driven by said motor for rotating the spindle in either direction, a nut on the spindle and reciprocable thereby, and a pivotal connection between the other end of said link and said nut.

22. In a coal drilling machine, a supporting element, an arm element in pivotal connection at one end with said supporting element, a motor, a shaft extending longitudinally of the arm element, a drive connection between the motor and said shaft, drill mechanism supported by the arm element at the free end of the latter, a drive connection between said shaft and drill mechanism, a link extending between the arm element adjacent its pivoted end and the supporting element, said link being pivoted at one end directly to one of said elements, a screw spindle journaled on the other of said elements substantially in the swinging plane of the link, reversible drive connections between said motor and spindle for rotating the latter in either direction, manually operable control means for said reversible drive connections, a nut on the spindle and reciprocable thereby, and a pivotal connection between the other end of said link and said nut.

23. In a coal drilling machine, a support, an arm in pivotal connection at one end with the support, a motor, a shaft extending longitudinally of the arm element, a drive connection between the motor and said shaft, drill mechanism supported by the arm at the free end of the latter, a member reciprocable in parallel relation to the arm and in connection with the latter, motor operated means for reciprocating said member, and a link pivoted at one end to said support and at the other to said member whereby the arm is adapted to be swung upon reciprocation of said member.

24. In a coal drilling machine, a support, an arm in pivotal connection at one end with the support, a motor, a shaft extending longitudinally of the arm element, a drive connection between the motor and said shaft, drill mechanism supported by the arm at the free end of the latter, a screw spindle journaled on the arm in substantially parallel relation thereto, motor driven means for driving said spindle in either direction, a nut on said spindle and reciprocable thereby, and a link pivoted at one end to said support and at the other end to said nut whereby the arm is adapted to be swung upon reciprocation of said nut.

25. In a drilling apparatus, the combination with a portable support, of a forwardly extending boom pivotally mounted at its rear end on said support for swinging movement about vertical and horizontal axes, a drilling tool, a support therefor adjustably carried at the outer end of said boom, a motor, mechanism driven by said motor for driving said drilling tool, and mechanism driven by said motor for swinging said boom about its horizontal axis.

26. In a drilling apparatus, the combination

with a portable support of an elongated supporting arm pivotally mounted at its rear end on said support for swinging movement about vertical and horizontal axes, said arm being swingable horizontally and vertically about said axes, a drilling tool, a support therefor adjustably mounted on the outer extremity of said arm, a motor for driving said drilling tool, and mechanism driven by said motor for swinging said arm on said horizontal axis.

27. In a drilling machine, the combination with a truck adapted to travel on a mine track, of a turntable support mounted on said truck for rotation relatively thereto on an upright axis, an elongated boom pivotally mounted on said turntable support for swinging movements relatively thereto on a horizontal axis, a drilling tool supported on the outer end of said boom and adjustable on an axis extending longitudinally of the boom, a motor for driving said drilling tool, and mechanism driven by said motor for swinging said boom on said horizontal axis.

28. In drilling apparatus, the combination with an elongated boom, of a supporting frame, means for adjustably mounting said boom on said frame for movement to laterally and vertically inclined positions, a drill, mechanism mounting said drill on said boom for adjustment to horizontal positions at right angles to a working face in advance of said frame and at any point on said face, a motor for operating the drill in any of its adjusted positions, and means driven by said motor for swinging said boom to its vertically inclined positions and locking the same against up and down movements while said drill is in operation.

29. In drilling apparatus, the combination with a portable support, of a pair of independently adjustable elongated booms each mounted on said support for free swinging movement relatively thereto on an upright axis, releasable locking means for holding said booms in adjusted positions relative to said portable support, two drilling tools one mounted at the outer extremity of each of said supporting structures for adjustment relative thereto on the longitudinal axes of the booms, motor operated self-locking mechanism for independently adjusting the elevations of the outer ends of said booms to adjust the positions of said drilling tools into different relatively high parallel positions in planes above the top of said support and into different relatively low parallel positions in planes below said top to enable said drilling tools to drill holes in parallel positions at various elevations at opposite sides of said support and in horizontal planes above and below the top of said portable support, and motor operated mechanism for driving said drilling tools while occupying their adjusted positions in parallelism to each other.

30. In drilling apparatus, the combination with a wheeled support movable over a mine track and operable while positioned thereon, an arm pivoted on said support and swingable from side to side of said support across the front thereof to position the free end of said arm at either side or in front of the support, a second arm pivoted on the free end of the first for swinging movement relative thereto on vertical and horizontal axes, a drill carried at the free end of said second arm, a drill driving motor, and means driven by said motor for swinging said second arm about its horizontal axis, said last named means being operative to hold said second arm in adjusted position.

31. In a machine of the class described, a wheel mounted frame adapted to travel on a mine track;

a pair of rotary drilling tools, means for rotating said tools and reciprocating them on their own axes; means supporting said tools on said frame for positioning at opposite sides of the longitudinal axis thereof, for adjustment toward and away from said axis with the axes of said tools parallel to the longitudinal axis of the frame, for vertical adjustment relative to the frame and for adjustment in the longitudinal direction of the said longitudinal axis relative to the frame; and means for advancing the frame whereby said tools may be engaged in a face in advance of the frame and at variously spaced points on the face determined by the adjustment of said tools to drill holes in said face parallel to the line of advance of said frame.

32. In a machine of the class described, a wheel mounted frame adapted to travel on a mine track, a pair of arms pivotally mounted on said frame and swingable horizontally to position their free ends in various spaced relations laterally of the frame at opposite sides thereof, rotary drilling tools pivotally supported on the free ends of said arms respectively so as to be positionable in parallel relation to the longitudinal axis of the frame in various angular relations of said arms to said axis and at equal distances at the sides of said axis, means for adjusting the elevation of said tools, means for holding said arms in adjusted position, means for rotating said drilling tools, and means for advancing the frame whereby said tools may be engaged in a face in advance of the frame and at variously spaced points on said face determined by the position of said arms to drill holes in said face parallel to the line of advance of said frame.

33. In a machine of the class described, a wheel mounted frame adapted to travel on a mine track, a pair of arms pivotally mounted on said frame and swingable between positions wherein they extend forwardly relative to the frame and wherein they extend oppositely laterally thereof, other arms pivoted to the free ends of the first arms on vertical axes, rotary and reciprocable drilling tools carried by said other arms at their free ends on axes perpendicular to the axes of said other arms respectively, means for adjusting the elevation of said tools, said other arms being adjustable about said vertical axes to maintain the drilling tools perpendicular to a face in advance of the machine irrespective of the adjustment of the first arms, means for locking all of said arms in their adjusted positions, and means for advancing the frame whereby said tools may be engaged in a face in advance of the frame and at variously spaced points on said face determined by the position of said arms to drill holes in said face parallel to the line of advance of said frame.

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34. In a machine of the class described, a wheel mounted frame adapted to travel on a mine track, a pair of arms pivotally mounted on said frame and swingable between positions wherein they extend forwardly relative to the frame and wherein they extend oppositely laterally thereof, other arms pivoted to the free ends of the first arms on vertical axes, rotary and reciprocable drilling tools carried by said other arms at their free ends on axes perpendicular to the axes of said other arms respectively, means for adjusting the elevation of said tools, said other arms being adjustable about said vertical axes to maintain the drilling tools perpendicular to a face in advance of the machine irrespective of the adjustment of the first arms, means for locking all of said arms in their adjusted positions, and means for advancing the frame whereby said tools may be engaged in a face in advance of the frame and at variously spaced points on said face determined by the position of said arms to drill holes in said face parallel to the line of advance of said frame.

NILS D. LEVIN.

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