Jan. 24, 1939. M. P. HOLMES 2,144,627

DRILLING APPARATUS

Filed Nov. 16, 1931 3 Sheets-Sheet 1

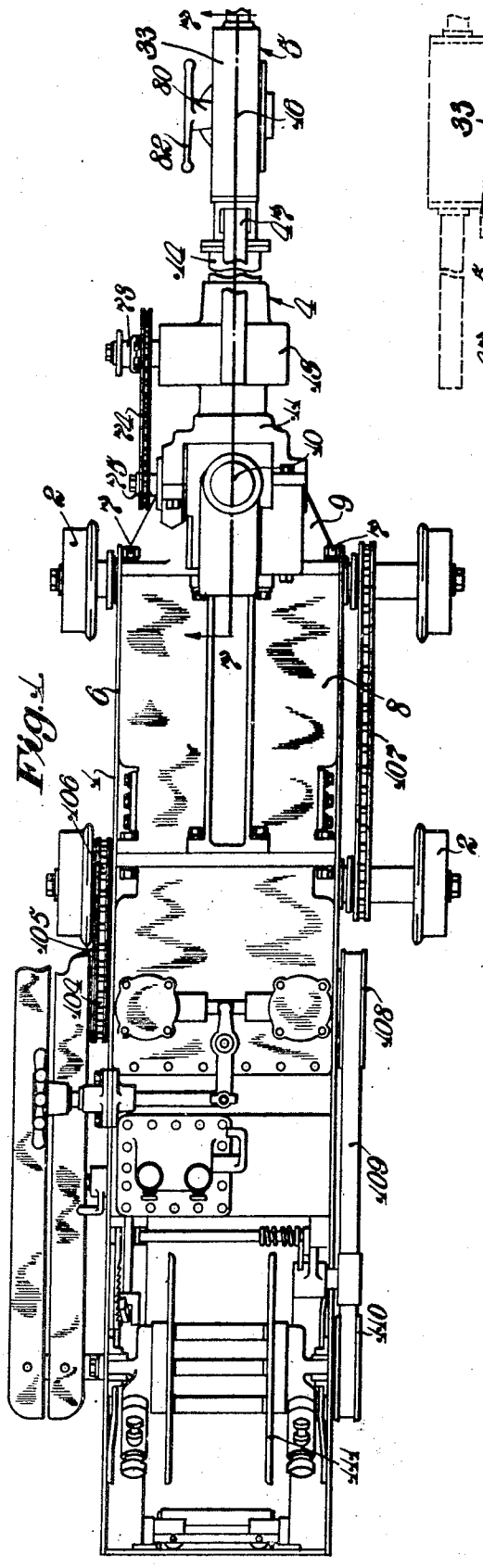


Fig. 1.

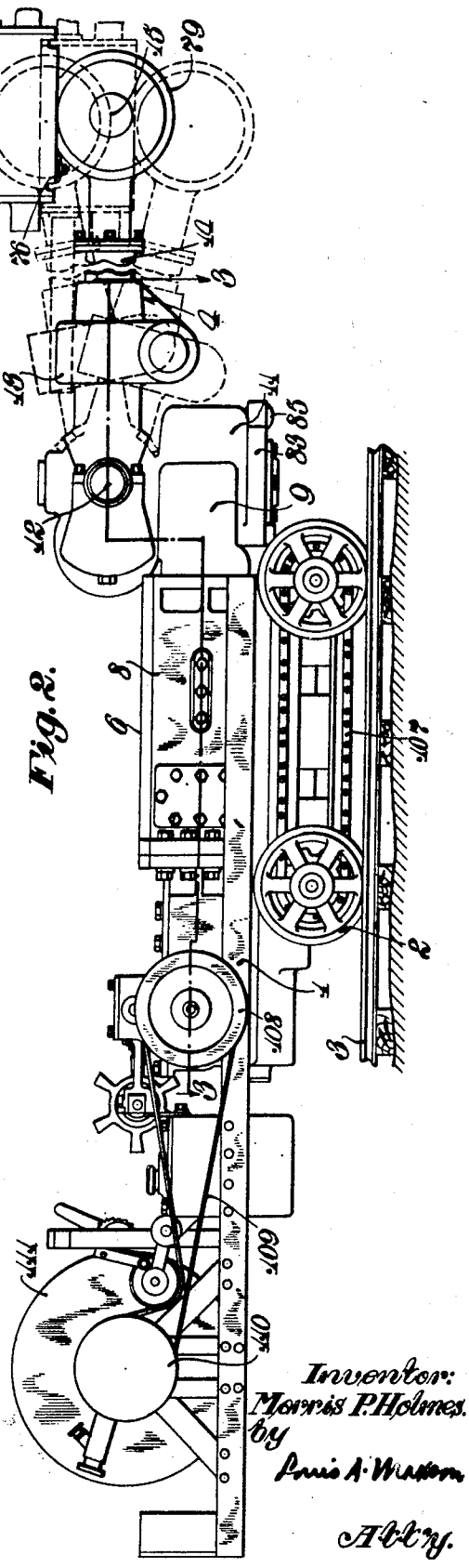


Fig. 2.

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DRILLING APPARATUS

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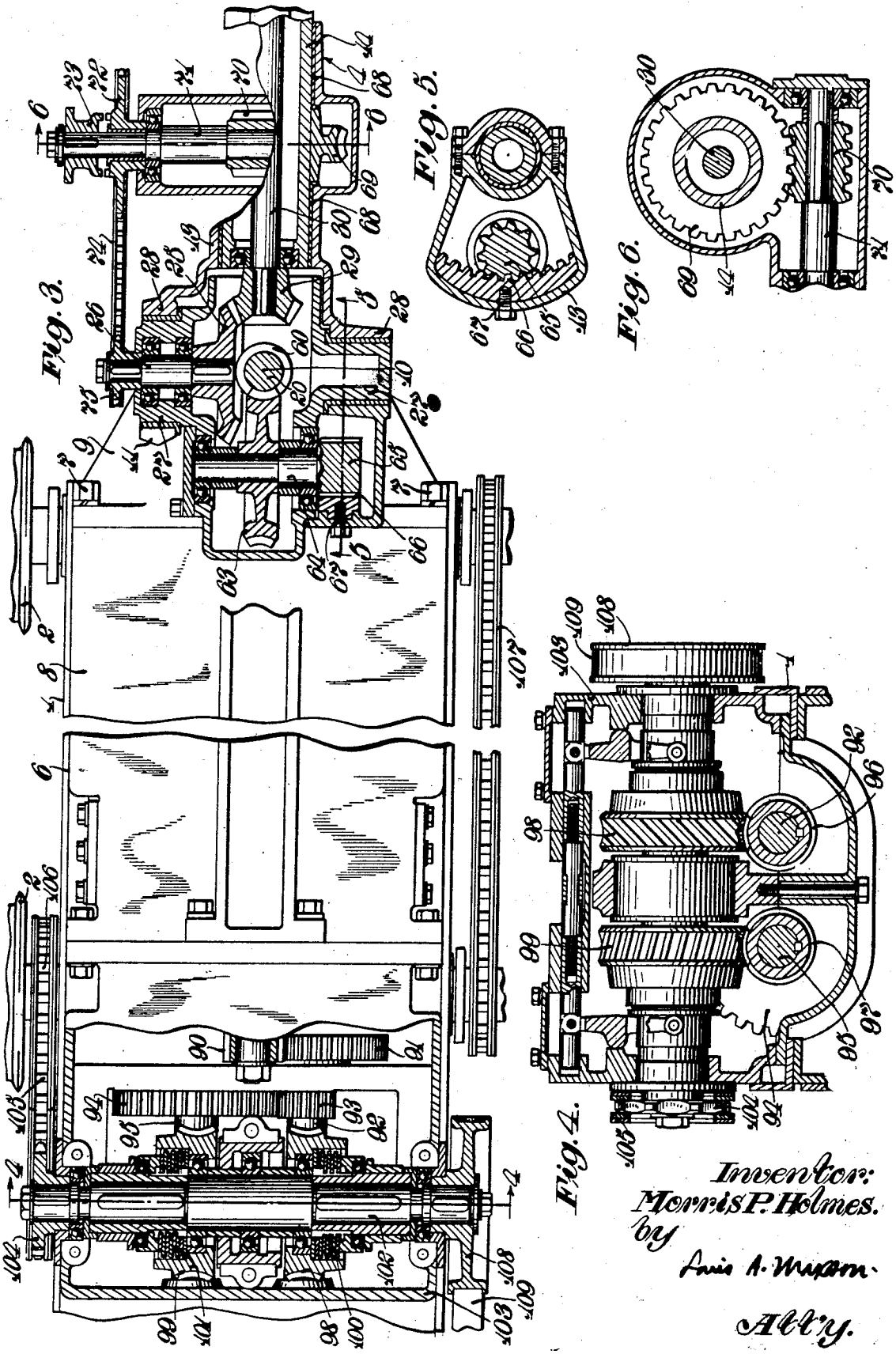


Fig. 3.

Fig. 5.

Fig. 6.

Fig. 4.

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DRILLING APPARATUS

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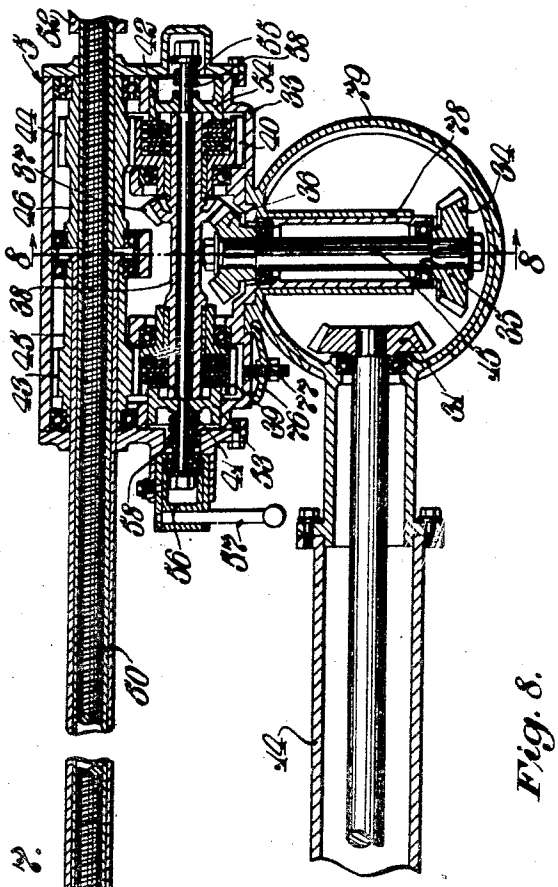


Fig. 7.

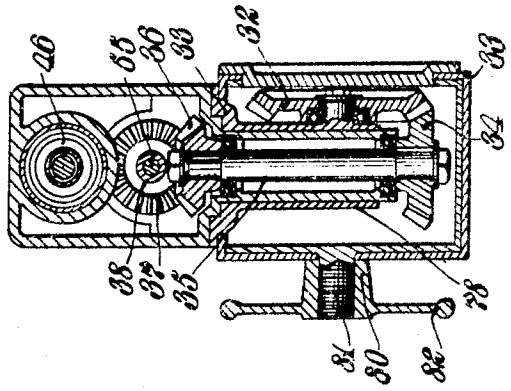
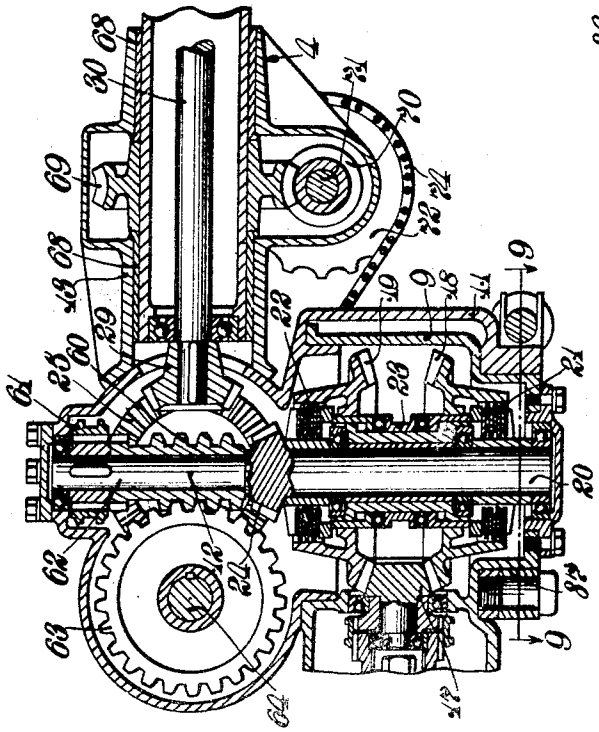


Fig. 8.



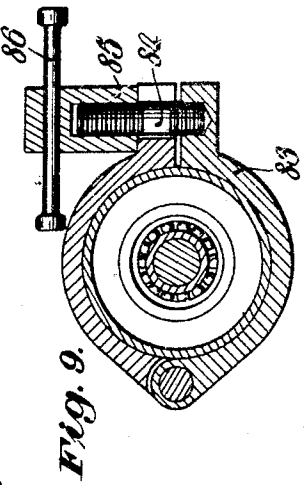


Fig. 9.

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UNITED STATES PATENT OFFICE

2,144,627

DRILLING APPARATUS

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Application November 16, 1931, Serial No. 575,273

9 Claims. (Cl. 255—47)

This invention relates to drilling apparatus and more particularly, but not exclusively, to drilling apparatus especially adapted to use in drilling shot or blast holes in mines.

An object of this invention is to provide an improved drilling apparatus. Another object is to provide an improved drilling apparatus especially adapted for drilling shot or blast holes in mines. A further object is to provide drilling apparatus having improved adjustable supporting means for the drilling implement. Yet another object is to provide improved adjustable supporting means for a drilling implement of a coal drilling apparatus whereby shot or blast holes may be drilled in the coal face at any desired location. A still further object is to provide improved adjustable supporting means for a drilling implement whereby the various adjustments thereof are effected by power. Yet another object of the invention is to provide improved propelling means for such an apparatus. These and other objects of this invention will, however, hereinafter more fully appear in the course of the following description and as more particularly pointed out in the appended claims.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings:

Fig. 1 is a plan view of the illustrative embodiment of the improved drilling apparatus.

Fig. 2 is a side elevational view of the drilling apparatus shown in Fig. 1, the adjustable supporting structure for the drilling implement being shown in a plurality of positions as indicated in the full and dotted lines.

Fig. 3 is a horizontal sectional view, partially shown in plan, taken substantially on line 3—3 of Fig. 2.

Fig. 4 is a transverse vertical sectional view taken substantially on line 4—4 of Fig. 3.

Fig. 5 is a detail sectional view taken substantially on line 5—5 of Fig. 3.

Fig. 6 is a transverse vertical sectional view taken substantially on line 6—6 of Fig. 3.

Fig. 7 is a longitudinally extending vertical sectional view taken substantially on line 7—7 of Fig. 1.

Fig. 8 is a transverse vertical sectional view taken substantially on line 8—8 of Fig. 7.

Fig. 9 is a detail sectional view taken substantially on line 9—9 of Fig. 7.

In this illustrative embodiment of the invention there is shown a coal drilling apparatus of the self propelled, track supported and guided type generally comprising a truck frame 1 mounted on wheels 2 adapted to run along a trackway 3. Adjustably mounted on the forward end of the truck frame is an elongated boom structure, generally designated 4, having adjustably mounted thereon at its outer extremity a drilling implement 5. Supported on the truck frame is a motor 6 which is operatively connected to the devices for adjusting the boom structure, for actuating the drilling implement and for driving the truck wheels to propel the apparatus as hereinafter described.

Now referring to the improved adjustable supporting structure for the drilling implement, it will be noted that secured as by bolts or screws 7 to the forward end of the motor housing 8 is a bracket 9 having pivotally mounted thereon for horizontal swinging movement relative thereto about a vertical axis 10 located in advance of the front truck wheels, a swivel frame 11. Pivotally mounted on the frame 11 on a horizontal axis 12 for swinging movement in a vertical direction relative thereto is a frame 13, in turn having rotatably mounted thereon for rotation about its longitudinal axis relative thereto an elongated boom 14. Adjustably mounted on the outer extremity of the boom for swinging movement relative thereto about the rectangularly related axes 15 and 16 is the drilling implement 5. The motor 6 is herein of the reversible electric type and is arranged with its power shaft horizontally disposed and extending longitudinally of the apparatus. Connectible to the forward end of this power shaft is a bevel pinion 17 meshing with reverse bevels 18, 19. These reverse bevels are suitably journaled on a vertical shaft 20 arranged with its axis coincident with the axis 10 of swinging movement of the swivel frame 11. These reverse bevels are alternately connectible to the shaft 20 to effect rotation of the latter in either of opposite directions by means of multiple disc clutches 21 and 22 respectively. These clutches are provided with any suitable form of operating means including a reciprocable shipper member 23 slidably mounted on the adjacent hubs of the bevel gears 18, 19 and controlled by a suitable hand lever. Formed integral with the shaft 20 is a bevel pinion 24 meshing with a bevel gear 25, (see Fig. 3) keyed to a horizontal shaft 26 arranged with its axis coincident with the axis 12 of vertical swinging movement of the boom supporting frame 13. As shown, the swivel frame 11 is provided with trunnions 27, 27 supporting bearing sleeves on which are rotatably mounted hub portions 28, 28 integral with the

swingable boom supporting frame 13, and the shaft 26 is journaled within bearings supported within one of these trunnions. Meshing with the bevel gear 25 is a bevel gear 29 fixed to a shaft 30 suitably journaled within and extending centrally through the boom 14 as shown in Fig. 7. Keyed to the forward end of this shaft is a bevel gear 31 meshing with bevel gear 32 arranged with its axis coincident with the swivel axis 15 and suitably journaled within the drill housing 33. The gear 32 meshes with a bevel gear 34 keyed to a shaft 35 arranged with its axis coincident with the swivel axis 16 of the drilling implement 5. This shaft is likewise suitably journaled within the drill housing and has keyed thereto and drives a bevel gear 36 meshing with bevel gear 37 formed integral with a hollow shaft 38. This hollow shaft is journaled within the hubs of spur gears 39 and 40 respectively, and these gears are selectively connectible to the shaft by means of multiple disc clutches 41 and 42 respectively.

Now referring more particularly to the specific structure of the drilling implement 5 per se, it will be observed that the gears 39, 40 respectively mesh with spur gears 43 and 44 formed on alined shafts 45 and 46 suitably journaled within the drill housing. The shaft 45 is fixed to and drives a tubular member 47 having fixed thereto at 48 and arranged centrally therein a feed screw 49. The shaft 46 is fixed to and drives a tubular member 50 telescopically arranged within the tubular member 47. The feed screw 49 is telescopically arranged within the tubular member 50 and is threadedly connected thereto at 51. The tubular member 50 carries at its forward end a usual chuck 52 which receives the usual drill steel, not shown. As shown in Fig. 7, the disc clutches 41, 42 are provided with suitable operating means including clutch applying members 53, 54 actuated through a rod 55 extending centrally through the hollow shaft 38 and have a suitable cam operating mechanism 56 controlled by a lever 57. Interposed between the rod 55 and each of the clutch applying members are coil springs 58 which normally maintain the clutches applied and are adapted to yield upon overloading of the clutches. It will thus be seen that when the lever 57 is swung in one direction or the other, the rod 55 is moved axially, thereby causing movement of one or the other or both of the clutch applying members 53 and 54 into their clutch applying positions. The sets of gears 39, 43 and 40, 44 are of different tooth ratio so that when the friction clutches 41, 42 are both applied, the tubular members 47 and 50 are rotated at different rates, thereby rotating the feed screw and feed nut at different rates to obtain a differential screw feed, and as a result the drill steel chuck 52 is fed forwardly at a relatively slow drilling speed. When the friction clutch 42 is released and the clutch 41 is applied, the feed nut remains stationary as regards rotation relative to the feed screw 49, and as a result the tubular member 50 and the drill steel chuck 52 are fed rapidly forwardly. When the clutch 41 is released and the clutch 42 applied, the feed nut 51 is rotated while the feed screw remains stationary as regards rotation relative to the feed nut, and as a result the drill steel chuck 52 is fed rapidly rearwardly. It will also be evident that due to the arrangement of the various driving gears and shafts relative to the axes of the swingable frames 11, 13 and the boom, and the rectangularly related axes of the drilling implement, the drill steel chuck may be driven irrespective of the adjusted positions of the various elements about their respective axes.

Power operated means are provided for vertically swinging the boom supporting frame 13 and for rolling the boom about its longitudinal axis relative to the frame 13. The swinging mechanism for the frame 13 comprises a worm 60 connectible by a sliding clutch 61 to the reduced extension 62 of the shaft 20. This worm meshes with worm wheel 63 keyed to a horizontal shaft 64 suitably journaled within the bracket 9. Formed integral with this shaft is a spur pinion 65 meshing with a segmental gear element 66 fixed as by a screw 67 to the frame 13. It will thus be seen that when the clutch 61 is connected and one or the other of the disc clutches 21 and 22 is applied, the boom 14 may be swung by power upwardly or downwardly about the axis 12 of the frame 13 as desired. The worm gears 60, 63 are of the self-locking type and maintain automatically the boom in its different vertically adjusted positions. The boom 14 is journaled at its rearward end for rotation about its longitudinal axis within bearing sleeves 68, 68, supported within the frame 13 as shown in Fig. 7, and interposed between these bearing sleeves and keyed to the boom is a worm wheel 69. Meshing with this worm wheel is a worm 70 fixed to a shaft 71 suitably journaled within the frame 13. As shown in Fig. 3, journaled on the shaft 71 is a chain sprocket 72 and this sprocket is connectible to the shaft by a sliding clutch 73. This sprocket is connected by an endless chain 74 to a chain sprocket 75 keyed to the shaft 26. It will thus be seen that when the clutch 73 is connected, the boom 14 may be rolled about its longitudinal axis to position the drill implement 5 in various positions about the boom axis through the connections 74, 72 and the worm gearing 69, 70. This worm gearing is also of a self-locking type and maintains automatically, when disconnected from its driving mechanism, the boom in its various positions of adjustment.

As previously mentioned, the drilling implement 5 is swingable about rectangularly related axes relative to the boom structure. When it is desired to swing the drilling implement about the axis 16, a clamp 76 operated by a set screw 77 is loosened and the drill housing 33 may then be swung within the tubular bearing mounting 78 formed on the swivel frame 79. Simply by tightening the clamp member 76, the drill housing is locked against swinging movement relative to the swivel frame 79. The drilling implement may be swung about the axis 15 by releasing a clamping element 80 threadedly connected at 81 to the swivel frame 79 and operated by a hand bar 82. When the hand bar is turned to tighten the clamping element 80, the drill housing and swivel frame 79 are held in frictional engagement but when the parts are released, the drilling implement may be freely swung about its axis 15. The drilling implement and the entire boom supporting structure therefor are swingable horizontally about the axis 10 of the swivel frame 11, and the means for locking the parts in their different positions of adjustment comprises, as shown in Fig. 9, a split clamp 83. This clamp may be tightened by means of a screw 84 and cooperating nut 85 operated by a hand bar 86. When this clamp is tightened in frictional engagement with the depending bearing portion 87 integral with the bracket 9, the parts are locked against swinging movement.

The mechanism for driving the truck wheels

to propel the apparatus along the trackway comprises a spur pinion 90 keyed to the rear end of the motor power shaft and meshing with a spur gear 91 fixed to a horizontal shaft 92. Also fixed to the shaft 92 is a spur gear 93 meshing with a spur gear 94 fixed to a shaft 95 arranged parallel with the shaft 92. Keyed to the shafts 92, 95 respectively, are worms 96, 97 respectively, meshing with fast and slow speed worm wheels 98 and 99. These worm wheels are alternatively connectible by multiple disc clutches 100 and 101, respectively, to a horizontal shaft 102. This shaft is suitably journaled within a gear casing 103 located at the rear end of the motor 6 and has fixed thereto at one end a chain sprocket 104 connected by an endless chain 105 to a sprocket 106 fixed to the rear truck wheel axle. The front and rear axles of the truck are connected in driving relation by a usual chain and sprocket connection 107. It will thus be seen that when one or the other of the disc clutches 100, 101 is applied, the truck wheels may be driven through the fast and slow speed worm gear trains at a relatively high speed or a relatively low speed. The direction of the truck wheel drive may be reversed simply by reversing the motor 6. Keyed to the opposite end of the shaft 102 is a pulley 108 connected by an endless belt 109 to a pulley 110 fixed to the driving shaft for the usual power conductor cable reel 111.

The general mode of operation of the improved drilling apparatus will be clearly apparent from the description given. The apparatus is propelled along the mine trackway through the fast and slow speed worm gear trains 96, 98 and 97, 99 under the control of the fast and slow speed disc clutches 100 and 101. When the working place is reached, the boom structure may be adjusted horizontally about the axis 10 of the swivel frame 11 simply by releasing the split clamp 83 and manually swinging the boom structure into the desired horizontal position, the split clamp thereafter being set to hold the parts in position. The boom structure may be swung upwardly and downwardly by power about the axis 12 of the frame 13 by connecting the sliding clutch 61, the boom structure being swung by power through the worm gearing 60, 63 under the control of the disc clutches 21, 22 to position the drilling implement in relatively high planes or relatively low planes. The boom 14 may be rotated about its longitudinal axis to move the drilling implement in different positions about the boom axis, simply by connecting the clutch 73, the boom being rotated by power through the connections 75, 74, 72 under the control of the disc clutches 21, 22. The drilling implement may be adjusted about the rectangularly related axes 15, 16 relative to the boom structure simply by releasing the clamping elements 76, 80, thereby enabling the drilling implement to be swung either vertically or horizontally relative to the boom.

As a result of this invention it will be noted that an improved drilling apparatus is provided especially adapted for drilling shot or blast holes in the coal face and having improved adjustable supporting means for the drilling implement whereby the drilling implement may be positioned at any desired location relative to the coal face. It will further be noted that by providing the power operated means for swinging and rolling the boom structure, the drilling implement may be quickly and expeditiously adjusted into different drilling positions. These and other uses and advantages of the improved drilling apparatus will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a drilling apparatus, the combination of a portable base, a motor on said base, an elongated boom structure mounted on said base for swinging movement relative to said base and said motor, a drilling implement swivelly mounted on the outer extremity of said boom structure to swing into different angularly related drilling positions relative thereto about rectangularly related axes, means driven by said motor for swinging said boom structure as aforesaid, and means driven by said motor for rotating and axially feeding said drilling implement relative to said boom structure irrespective of the adjusted positions of both the latter and said drilling implement.

2. In a drilling apparatus, the combination of a portable base, a motor on said base, an elongated boom structure mounted on said base for adjustment into different positions relative to said base and said motor, a drilling implement swivelly mounted on the outer extremity of said boom structure to swing into different angularly related drilling positions relative thereto about rectangularly related axes, means driven by said motor for adjusting said boom structure as aforesaid, and means driven by said motor for rotating and axially feeding said drilling implement relative to said boom structure irrespective of the adjusted positions of both the latter and said drilling implement.

3. In a drilling apparatus, the combination of a portable base, an elongated boom structure mounted on said base for swinging movement in a plurality of angularly related directions relative thereto, a drill support mounted on the outer extremity of said boom structure for rotation about the longitudinal axis of said boom structure, a drilling tool swivelly mounted on said drill support to swing into different angularly related drilling positions relative thereto, a motor, means driven by said motor for effecting swinging movement of said boom structure in one of aforesaid directions relative to said base, means driven by said motor for rotating said drill support about the longitudinal axis of said boom structure, and means driven by said motor for rotating and axially feeding said drilling tool relative to said boom structure while the latter remains stationary as regards swinging movement.

4. In a drilling apparatus, the combination of a portable base, a swivelled frame mounted on said base for rotation relative thereto about a vertical axis, an elongated supporting structure pivotally mounted on said swivelled frame for swinging movement relative thereto about a horizontal axis extending transversely of said swivelled frame, the longitudinal axis of said supporting structure as the latter is swung about said horizontal axis, moving into different angularly related supporting positions with respect to the horizontal while said vertical axis always

remains vertical, a drill support mounted on the outer extremity of said supporting structure for rotation about the longitudinal axis of said supporting structure in any of aforesaid angularly related positions of the latter, motor operated means for swinging said supporting structure in a vertical direction about said horizontal axis and for rotating said drill support about the longitudinal axis of said supporting structure, a frame swivelly mounted on said drill support to swing relative thereto about an axis at right angles to said axis of rotation of said drill support, a frame swivelly mounted on said last mentioned frame to swing relative thereto about an axis at right angles to the axis of swinging movement of said last mentioned swivelled frame, a drilling tool carried by said last mentioned swivelled frame and adjustable into different angularly related drilling positions relative to said supporting structure about said axes of swinging movement of said two last mentioned swivelled frames, motor operated means for rotating and axially feeding said drilling tool relative to said swivelled frames while the latter and said supporting structure remain stationary as regards swinging movement, and a motor common to both of said motor operated means for actuating the latter.

5. In a drilling apparatus, a portable base, a support mounted on said base for rotation relative thereto about a vertical axis, a second support mounted on said first support to swing relative thereto about a horizontal axis, an elongated boom extending a substantial distance in advance of said base and mounted at its rear extremity on said second support for rotation relative thereto about its longitudinal axis, a drill support mounted on the outer extremity of said boom to swing relative thereto about an axis at right angles to the boom axis, a drilling tool swivelly mounted on said drill support about an axis at right angles to the swivel axis of said drill support, and a motor on said base relative to which said boom, supports, and drilling tool are adjustable, for driving said drilling tool.

6. In a drilling apparatus, a portable base, a support mounted on said base for rotation relative thereto about a vertical axis, a second support mounted on said first support to swing relative thereto about a horizontal axis, an elongated boom extending a substantial distance in advance of said base and mounted at its rear extremity on said second support for rotation relative thereto about its longitudinal axis, a drill support mounted on the outer extremity of said boom to swing relative thereto about an axis at right angles to the boom axis, a drilling tool swivelly mounted on said drill support about an axis at right angles to the swivel axis of said drill support, and a motor on said base relative to which said boom, supports, and drilling tool are adjustable, for driving said drilling tool and for swinging said second support about its pivot.

7. In a drilling apparatus, a portable base, a support mounted on said base for rotation relative thereto about a vertical axis, a second support mounted on said first support to swing relative thereto about a horizontal axis, an elongated boom extending a substantial distance in advance of said base and mounted at its rear extremity on said second support for rotation relative thereto about its longitudinal axis, a drill support mounted on the outer extremity of said boom to swing relative thereto about an axis at right angles to the boom axis, a drilling tool swivelly mounted on said drill support about an axis at right angles to the swivel axis of said drill support, and a motor on said base relative to which said boom, supports, and drilling tool are adjustable, for driving said drilling tool, for swinging said second support about its pivot, and for rotating said boom about its longitudinal axis relative to said second support.

8. In a drilling apparatus, a portable base, a support mounted on said base for rotation relative thereto about a vertical axis, a second support mounted on said first support to swing relative thereto about a horizontal axis, an elongated boom extending a substantial distance in advance of said base and mounted at its rear extremity on said second support for rotation relative thereto about its longitudinal axis, a drill support mounted on the outer extremity of said boom to swing relative thereto about an axis at right angles to the boom axis, a drilling tool swivelly mounted on said drill support about an axis at right angles to the swivel axis of said drill support, a motor on said base relative to which said boom, supports, and drilling tool are adjustable, and means driven by said motor for driving said drilling tool and including driving elements arranged with their axes alined with the support and tool axes and cooperating transmission connections including a transmission element extending longitudinally of said boom.

9. In a drilling apparatus, a portable base, a support mounted on said base for rotation about a vertical axis, a second support mounted on said first support to swing relative thereto about a horizontal axis, an elongated boom mounted on said second support for rotation relative thereto about its longitudinal axis, a drilling tool carried at the outer extremity of said boom, a motor on said base relative to which said supports and boom are adjustable, means driven by said motor for swinging said second support relative to said first support including a driving element arranged with its axis coincident with the axis of said first support and swinging connections actuated by said driving element, and means driven by said driving element and including a rotating element secured to said boom, for rotating the latter relative to said second support.

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