Dec. 14, 1948. L. J. FELLAY ET AL 2,456,056

MINE DRILL SUPPORT AND DRIVING MECHANISM

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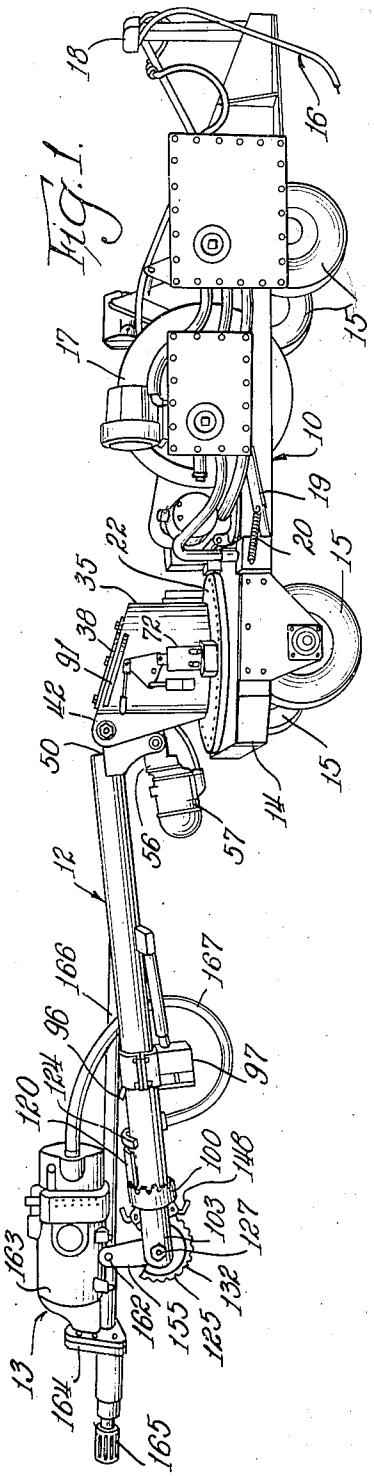


Fig. 1.

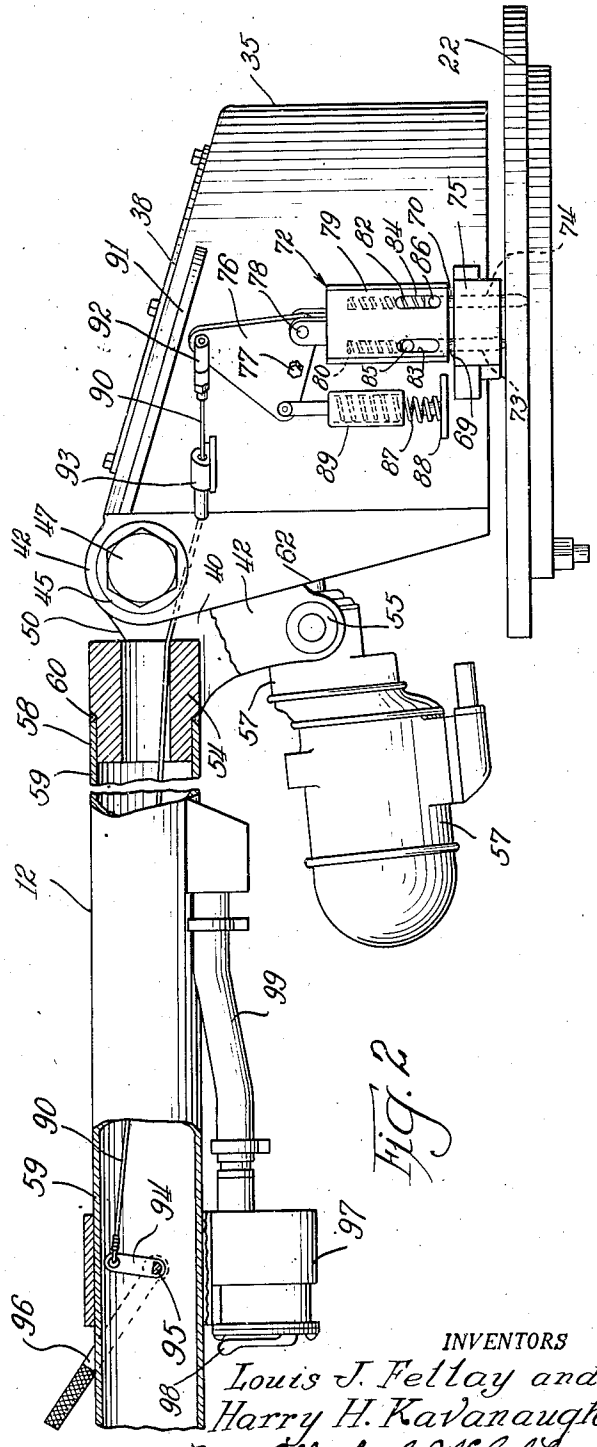


Fig. 2.

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Fig. 3.

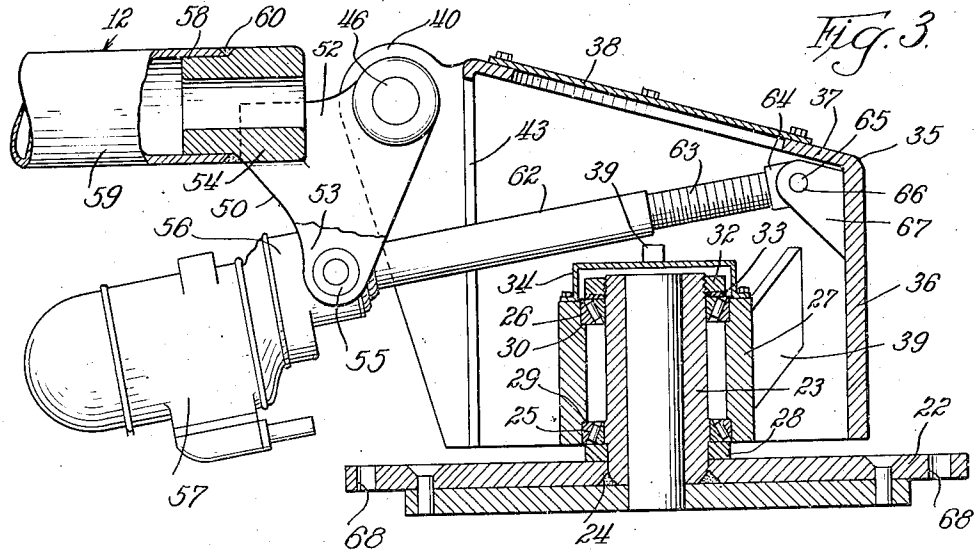
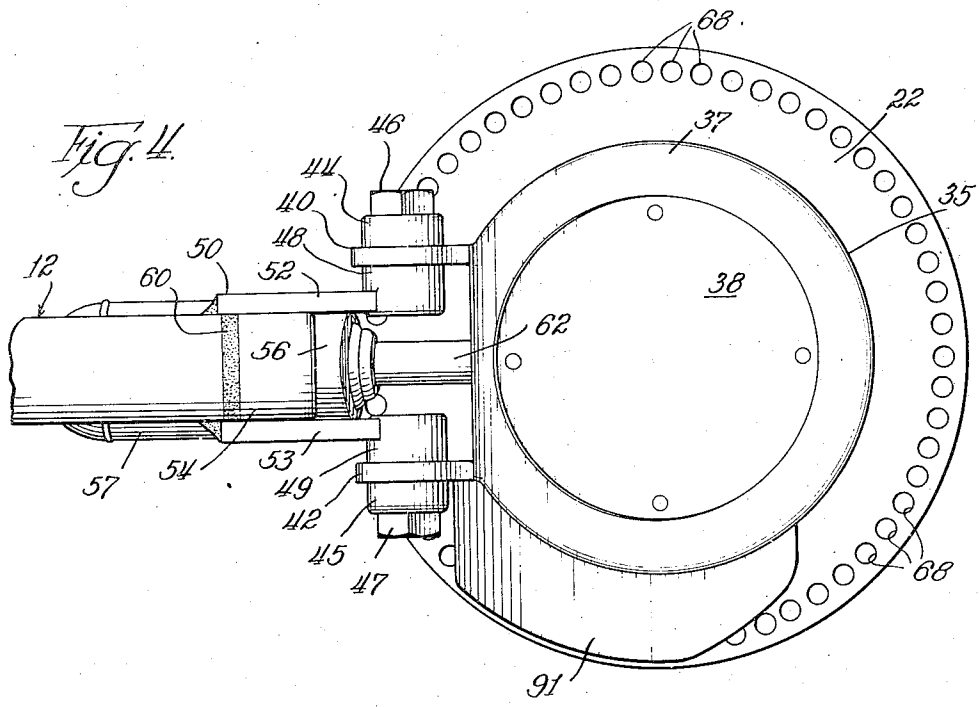


Fig. 4.



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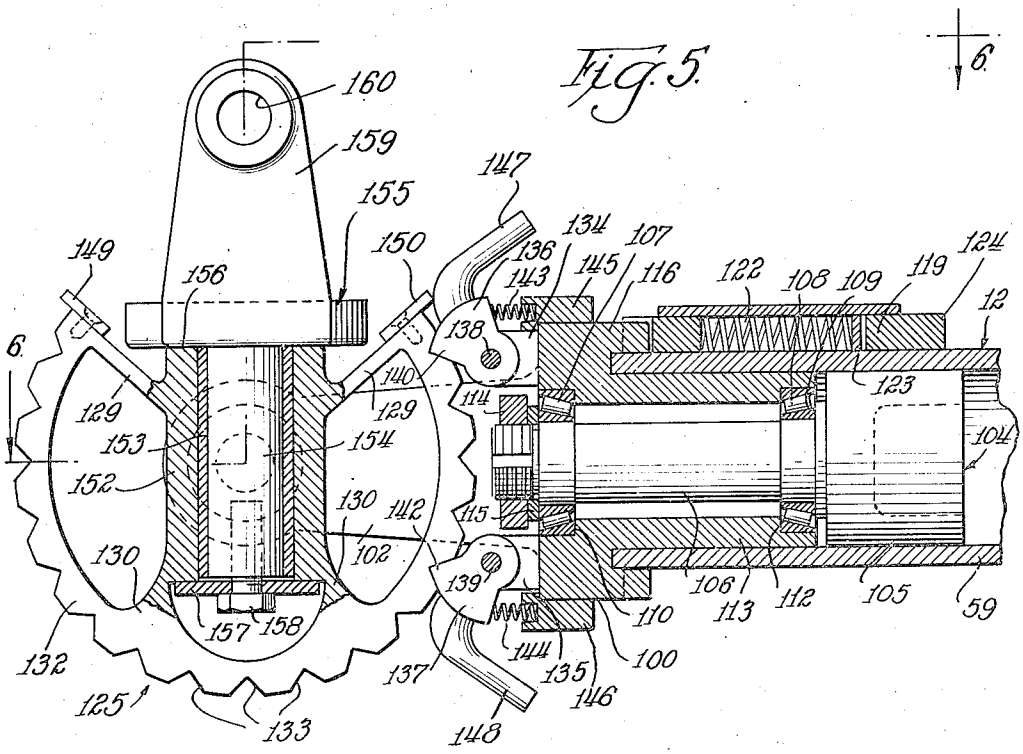
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MINE DRILL SUPPORT AND DRIVING MECHANISM

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Fig. 5.



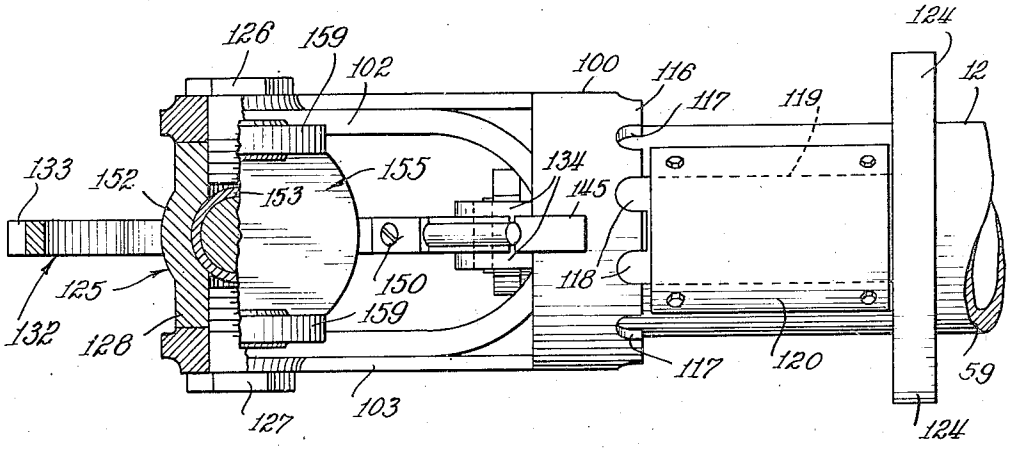


Fig. 6.

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2,456,056

MINE DRILL SUPPORT AND DRIVING MECHANISM

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Application September 10, 1947, Serial No. 773,270

11 Claims. (Cl. 255—51)

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Our present invention relates to mine drill support and driving mechanisms, and more particularly to such a mechanism which is readily placeable and capable of a wide range of adjustment for drilling in coal mine shafts and the like preparatory to the placement of explosive charges.

One of the objects of our invention is to provide a mine drill support and driving mechanism embodying a supporting tram which is readily maneuverable into a desired position and is self-sustaining at that position and has mounted thereon a drill carrying and driving arm adjustable for directing a drill to a multiplicity of positions and directions.

As another object, our invention comprehends the provision of a mine drill support and driving mechanism incorporating a drill carrying arm selectively swingable to adjusted positions in transverse planes and having at its free end a drill driving mechanism which is further adjustable in a plurality of directions and planes.

This invention further has within its purview the provision of a mine drill support and driving mechanism having a plurality of selective adjustments covering a wide range of drill angles and positions, and all of which adjustments are subject to control from a convenient operating position.

For another object, our invention includes the provision of a mine drill support embodying a turret rotatable in one plane relative to a support and a drill carrying arm swingable relative to the turret in planes transverse to the plane of movement of the turret, and at the free end of which drill carrying arm a drill driving mechanism is mounted for substantially universal movement relative to the arm to adjusted positions.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings of which there are three sheets:

Fig. 1 is a general side elevational view of a mine drill support and driving mechanism incorporating a preferred embodiment of our invention;

Fig. 2 is a fragmentary side elevational view of a portion of the structure shown in Fig. 1 drawn to a larger scale and having portions cut away to show certain details;

Fig. 3 is a fragmentary side sectional view of a portion of the structure shown in Figs. 1 and 2;

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Fig. 4 is a top plan view of the portion of the structure shown in Fig. 3;

Fig. 5 is a fragmentary side sectional view, drawn to an enlarged scale, of a different portion of the mine drill support structure shown in Fig. 1; and

Fig. 6 is a fragmentary top view, partially in section, and viewed substantially as indicated by the lines 6—6 and accompanying arrows in Fig. 5.

Considered generally, the exemplary form of our mine drill support and driving structure which is shown in the accompanying drawings for illustrative purposes includes a tram 10 adapted to be power driven in a mine to shaft positions at which drilling is to be done for the setting of explosive charges. At such positions the tram provides a stable and stationary support for a drill supporting arm 12, which arm is swingable in transverse planes and carries at its free end a drill driving and feeding mechanism 13. The drill driving and feeding mechanism is practically universally adjustable with respect to the free end of the arm for finally determining the position and direction at which the hole is to extend into the vein. The movable parts of the arm supporting structure and those which carry the drill driving and feeding mechanism at the end of the arm are so equipped with locks and controls that they may all be readily manipulated by an operator standing near the free end of the arm and in such a way that when the auger has been started for the drilling of a hole, it will continue to drill and feed without being additionally guided by the operator.

As far as the details of the tram are pertinent to the instant invention, it includes a relatively heavy and rugged base plate structure 14 supported for movement on wheels 15 and electrically driven by power supplied through a main power cable 16. In operation, the main power cable 16 is normally wound upon a reel 17 and extends therefrom through a rear guide 18. Thus, as the tram moves away from the power connection to the main cable, the cable unwinds from the reel 17 behind the tram and extends to the position of use in the mine.

When the tram has been moved to a position for drilling operations, side braces, such as 19, which are carried for swinging movement relative to the sides of the base plate structure 14 are swung downwardly to engage and dig into the shaft floor so as to prevent the rearward movement of the tram. In the disclosed embodiment of the tram structure, tension springs such as 20 provide resilient toggle connections which

hold the side braces 19 in either their floor-engaging or retracted positions. Having the required stability and rigidity in the supporting structure for the drill carrying arm which, in the present instance, is provided by the tram, and having that supporting structure movable when desired, facilitates the placement of the supporting structure and avoids the necessity for the use of posts or the like which are manually moved and set into position.

As shown in Figs. 1 to 4 inclusive, an index plate 22 is desirably circular in shape and is secured to the upper surface of the tram base plate structure 14, desirably at the forward end thereof. Centrally of the index plate 22 and extending upwardly therefrom in substantially perpendicular relationship to the surface of the plate, is a hollow stud shaft 23 which, as shown in Fig. 3, is preferably secured to the index plate by welding, as at 24. Bearings 25 and 26, desirably of the roller thrust bearing type, are disposed near opposite ends of the stud shaft 23 and within a sleeve 27. The lower of the bearings 25 is supported by a spacing collar 28 on the stud shaft 23 adjacent the surface of the index plate 22; while shoulders 29 and 30 serve to space the bearings within the sleeve and provide support for the upper bearing 26. In the disclosed embodiment of our invention, a nut 32 threaded onto the upper end of the stud shaft 23 and having a washer 33 between it and the bearing 26 holds the parts of the bearing and sleeve assembly in assembled relationship. A cap 34 secured to the upper end of the sleeve 27 and overlying the end of the stud shaft is desirable for preventing dirt from getting into the bearings.

A turret 35 having a substantially cylindrical side wall 36, a sloping top wall 37 and a detachable cover plate 38, is carried for rotational movement relative to the index plate and base plate structure by a plurality of webs or vanes 39 secured to and extending between the outer surface of the sleeve 27 and the inner surface of the turret side wall. Along the higher or forward portion of the turret side wall 36, bearing support plates 40 and 42 are secured thereto in substantially parallel relationship and at separated positions on the periphery of the turret. The general planes of the support plates 40 and 42 in addition to being substantially parallel to one another, are also substantially parallel to the axis of the stud shaft 23. Between the support plates 40 and 42, an open slot 43 is provided in the side wall of the turret.

On the outer surfaces and near the tops of the support plates 40 and 42 projecting bosses 44 and 45, respectively, carry stud bolts 46 and 47 which extend inwardly in opposed and coaxial relationship and have inner end portions which serve as stud shafts journaled in and supporting the bearings 48 and 49 which are integrally formed on and as a part of a support bracket 50. In the disclosed embodiment of our invention the support bracket 50 is of generally triangular shape as viewed from the sides and has substantially parallel and separated side wall portions 52 and 53 upon which the bearings 48 and 49 are integrally formed, and which side wall portions 52 are connected by an integral portion 54 intermediate the side wall portions and displaced from the bearings 48 and 49. At a position displaced from the axis of the bearings 48 and 49, as well as from the integral portion 54, bearings such as 55 provide supports for stud shafts

which carry a gear box 56 for rotational movement between the side wall portions 52 and 53. A driving motor 57 is secured to and supported by the gear box 56.

On the side of the integral portion 54 substantially opposite the bearings 48 and 49, that integral portion is cylindrical in shape and projects away from the bearings 48 and 49 with an axis extending between the side wall portions 52 and 53 to provide a seat 58 for receiving and supporting the end of a piece of relatively heavy cylindrical tubing 59 which comprises a substantially rigid part of the drill supporting arm 12. As indicated at 60 in Figs. 2 and 3, the tubing 59 is secured to the integral portion 54 of the bracket by an annular welded seam.

Extending from the end of the gear box 56 and into the interior of the turret 35 from the side of the gear box opposite the motor 57, is a cover sleeve 62 for a screw mechanism including a threaded shaft 63. One end of the threaded shaft 63 is provided with a headed portion 64 through which a cross pin 65 extends, and which cross pin is journaled in bearings 66 provided in bracket plates 67 secured to the internal side wall surface of the turret. Thus, one end of the threaded shaft is anchored for rotational movement to the interior of the turret at a position considerably displaced from the axis of the stud shafts 46 and 47 which carry the support bracket 50 upon which one end of the drill carrying arm 12 is supported. The threaded shaft 63 extends into the cover sleeve 62 and is threaded into that sleeve. The cover sleeve 62 is rotatably supported relative to the gear box 56 and is driven through suitable gears within that box by the motor 57. Hence, operation of the motor, which is reversible, in one direction or the other, effects extension or retraction of the screw mechanism.

Since the anchored end of the threaded shaft 63 is displaced from the axis of the bearings 48 and 49, and since the axis of the studs which connect the gear box 56 to the support bracket 50 is displaced from both the axis of the bearings 48 and 49 and the integral portion 54 of the support bracket, the triangular relationships are such that extension and retraction of the screw mechanism swings the support bracket about the axis of the bearings 48 and 49 and thus varies the angular position of the drill carrying arm in a plane transverse to the surface of the index plate 22.

From the foregoing description, it may be readily understood that the turret provides a rugged support for one end of the drill carrying arm, and also supports that arm for swinging movement in a horizontal plane. Also, in association with the electrically driven screw mechanism and the support bracket 50, the drill carrying arm is swingable relative to the turret in a vertical plane. The mechanical characteristics of the screw mechanism are such that when adjusted to any particular position by operation of the motor 57, the drill carrying arm is firmly supported and held in that vertical position when the motor is stopped.

Since the drill carrying arm provides a support for the drill driving and feeding mechanism which is to be adjustable to fixed positions held during the drilling operation, it is also necessary to provide a locking mechanism for holding the turret in any one of a multiplicity of positions to which it may be adjusted. For this purpose, we have provided in the index plate an annular

series of circumferentially and equally spaced openings in concentric relationship to the axis of the stud shaft 23. These openings 68, as shown in Fig. 4, are disposed at positions radially outward of the turret 35 and coact with locking pins 69 and 70 (Fig. 2) of a locking mechanism 72 carried on the exterior surface of the turret side wall.

Having particular reference to Fig. 2, the locking pins 69 and 70 are carried for linear sliding movement in bearing apertures 73 and 74 respectively in a block 75 which is secured to the outer surface of the turret side wall closely adjacent the surface of the index plate 22. The spacing of the pins 69 and 70, by preference, is different from that of the openings 68, so that only one of the pins is engaged in an opening at any one time. Such spacing of the pins provides smaller increments of variation between locked positions than is provided by the normal spacing between the holes 68.

In the disclosed embodiment of our invention, a triangular plate 76 is supported for swinging movement relative to the outer surface of the turret side wall by suitable means such as a cap screw 77. This plate serves somewhat the purpose of a bell crank. That is, connected to one corner thereof and supported therefrom through a cross pin 78, is a lift block 79. This lift block is drilled to receive the projecting ends of the pins 69 and 70 above the block 75 and has compression springs 80 and 82 disposed therein which normally bias the pins 69 and 70 respectively toward the surface of the index plate 22. On the outer surface, the lift block 79 has elongated slots 83 and 84 therein which adjoin lower end portions of the drilled apertures therein which receive the pins 69 and 70. Projecting cross pins 85 and 86 secured to each of the pins 69 and 70 extend into the slots 83 and 84 respectively and serve to lift the pins 69 and 70 when the lift block is moved upwardly. The positions of the cap screw 77 which carries the plate 76 and the cross pin 78 which connects the plate 76 to the lift block 79 are relatively disposed in such relation that movement of the plate 76 in one direction lifts the lift block to effect removal of the engaged pin from one of the holes in the index plate 22. While thus retracted, the turret is free to be rotated. Upon release, the pins are free to relock the turret in its set position.

By preference, the plate 76 is biased toward a position effecting locking engagement of the pins 69 and 70 by a compression spring 87; one end of the spring 87 being fixedly supported by plate 88 secured to the outer side wall surface of the turret while the other end is carried within a tubular housing 89, one end of which is connected to the plate 76 at a position opposed to that of the cross pin 78. For the protection of the locking mechanism 72 and its associated parts, it is our preference that a plate 91 is secured to the side wall of the turret above those parts. This plate projects outwardly from the turret side wall as shown in Figs. 2 and 4 to provide a cover over those parts.

For convenience in the operation of our drill supporting and driving mechanism, the controls for the various locks and motor driven parts are desirably located on the drill carrying arm at a position near the free end thereof and convenient to the drill operator. With this in mind, a flexible operating wire 90 has one end anchored to an attaching element 92 on the plate 76 at a position displaced from the cap screw 77 and cross pin 78. This operating wire 90 extends

through suitable guides such as 93 and into the interior of the tubular portion of the drill carrying arm 12. At the end opposite the fitting 92 and at a position convenient for operation, the operating wire is attached to a lever arm 94 carried internally of the tubing 59 by a shaft 95, which shaft is journaled in the tubing wall and carries an operating handle 96 adjacent the exterior of the drill carrying arm.

Closely adjacent the position of the handle 96 on the drill carrying arm 12, a conventional reversing switch 97 is secured to the drill carrying arm and has a switch actuating handle 98 conveniently exposed at one end thereof. Electrical connections from the switch 97 to the reversible driving motor 57 are made through suitable conduits 99, as indicated in Figs. 1 and 2.

It may now be readily understood that it is the purpose of the tram to transport, locate and support the parts of the drill supporting and driving mechanism to and at an approximate position of use from which holes may be drilled at various associated and related positions and at various elevations by adjustment of the position of the drill carrying arm. At such adjusted position, the drill carrying arm provides a support for the drill carrying and feeding mechanism 13 stably to hold the auger during a drilling operation. In order to provide additional flexibility for adjustment of the drill angle and position, as well as for obtaining access to more difficultly reached positions, additional variable and adjustable parts are interposed between the free end of the drill carrying arm and the drill carrying and feeding mechanism.

Having reference to Figs. 1, 5, and 6, a first swivel head 100 is mounted at the free end of the tubular arm 59, and has opposed side arms 102 and 103 formed integrally therewith and projecting outwardly therefrom in substantially parallel relationship and longitudinally beyond the end of the tubular arm. As shown in Fig. 5, an insert 104 has an enlarged cylindrical end portion 105 which is fed into and secured within the end portion of the tubular arm 59. As an integral part of the insert 104 and projecting axially from the enlarged end portion 105, is a spindle portion 106 of smaller diameter than the interior of the tubular arm 59. Bearings 107 and 108 which are desirably of the roller thrust bearing type support the first swivel head for rotational movement relative to and substantially coaxially with the longitudinal axis of the drill carrying arm. The bearing 108 is located by a shoulder 109 on the spindle portion 106 of the insert 104 adjacent the enlarged end portion 105. Shoulders 110 and 112 on the inner surface of a sleeve portion 113 of the first swivel head separate and locate the bearings. A nut 114 threaded onto the end of the spindle portion 106 and an associated washer 115 serve to hold the swivel head in assembled relationship with respect to the spindle portion of the insert.

In our disclosed structure an integral skirt portion 116 on the first swivel head overlies the outer and marginal portion of the tubular arm. The marginal edge of the skirt portion 116 which faces the tubular arm 59 has therein a series of circumferentially spaced radial notches 117 which are adapted to coact with similarly spaced projecting tongues 118 on the end of a linearly movable slide 119 to hold the first swivel head in predetermined rotational positions relative to the end of the tubular arm. The slide 119 preferably conforms substantially to the surface of the tubu-

lar arm 59 and is slidable within an overlying slide block 120 secured to the outer surface of the tubular arm. A compression spring 122 disposed within the slide block 120 and having one end abutting a stop 123 secured to the tubular arm, biasses the slide to a position in which the tongues 118 engage the notches 117. At the end of the slide 119 opposite the tongues 118, handle portions 124 are provided on the slide 119, which handle portions project outwardly from the sides of the slide block 120 and overlie the tubular arm 59 for convenient access in manually effecting release of the first swivel head.

A second swivel head is disposed between the opposed side arms 102 and 103 of the first swivel head and rotatable relative thereto about the axis of opposed and aligned inwardly projecting studs 126 and 127, which studs extend through the projecting ends of the opposed side arms 102 and 103. This second swivel head has one hub portion 128 about the axis of the studs 126 and 127 which hub portion is partially encircled by and has secured thereto, by integrally formed webs 129 and 130, an annular segment 132, which segment presents a generally arcuate outer surface having therein a series of circumferentially and equally spaced notches 133. The notches by preference are substantially V-shaped and symmetrically disposed with respect to radii of the segment.

The axis of the studs, as well as the segment 132, is substantially perpendicular to the longitudinal axis of the tubular arm 59. Also, the diameter and position of the segment 132 are desirably such that it extends between the opposed side arms 102 and 103 of the first swivel head 100, with the periphery of the segment closely adjacent the skirt portion of the first swivel head.

Pairs of lugs 134 and 135 in spaced relationship are integrally formed on the outer end portion of the first swivel head at diametrically opposed positions adjacent the periphery of the segment 132. Between the lugs of the pairs 134 and 135, respectively, pawls 136 and 137 are supported for rotational movement by pins 138 and 139 which extend through the lugs and the pawl. The pawls have projecting portions 140 and 142 aligned with and adapted to fit into the notches 133 in the periphery of the segment 132. Also, compression springs 143 and 144 disposed between the pawls and projections 145 and 146 on the first swivel head bias the pawls into engagement with notches 133 of the segment. The angular dispositions of the pawls are such that one of the pawls prevents rotation of the segment in one direction, while the other of the pawls prevents rotation thereof in the opposite direction. Handles 147 and 148 are provided on the pawls for effecting manual release thereof when desired. Plates 149 and 150 secured to opposite end surfaces of the segment 132 and projecting beyond the arcuate surface thereof are adapted to engage the respective pawls and provide stops preventing movement of the second swivel head beyond a position in which it is engaged by the pawls.

In addition to the hub portion 128, the second swivel head has a hub portion 152, the axis of which is perpendicular to the axis of the hub portion 128. This second hub portion desirably has therein a bronze bushing 153 which provides a bearing for a spindle portion 154 of a third swivel head 155. At one end of the spindle portion 154, the third swivel head 155 is provided with an outwardly projecting shoulder 156 which engages one end surface of the hub portion 152. At the other end of the hub portion 152, a retaining plate 157 is secured to the end of the spindle portion 154 by fastening means such as a cap screw 158; the retaining plate 157 overlying the end surface of the hub portion 152 opposite the shoulder 156 to hold the third swivel head in place with reference to the second swivel head.

At the end adjacent the shoulder 156, the third swivel head 155 includes a pair of spaced and substantially parallel arms 159 projecting away from the spindle portion 154 and providing bearings 160 in which a cross pin 161 (Fig. 1) is rotatably disposed to support the drill driving said feeding mechanism relative thereto. The disclosed drill driving and feeding mechanism includes a driving motor 163 at the forward end of which and mounted thereon is a gear box 164 enclosing suitable reduction gears through which an auger chuck and drive clutch mechanism 165 and a feed screw (not shown) are driven. Extending rearwardly from the gear box 164 in alignment with the auger chuck and clutch mechanism, an elongated tubular housing 166 encloses the drill feed screw and serves as a handle useable by the operator to direct the drill relative to the end of the drill carrying arm 12 while a hole is being started. After such a hole is started, the auger maintains the selected position of the drill driving and feeding mechanism and is automatically fed into the hole by the action of the feed screw. Power for the driving motor 163 is supplied through a flexible insulated cable 167.

For convenience in operation and the replacement of augers the chuck and clutch mechanism 165 includes a chuck for holding the drill and manually operable and releasable parts such that the feeding of the auger may be stopped while the drive motor 163 is in operation.

From the foregoing description and reference to the accompanying drawings, it may be readily understood that we have provided a rugged and stable drill support and driving mechanism for use in mines and which embodies parts and relationships thereof which additionally impart to the structure a wide range of flexibility in use, as well as facilities for speed in operation.

While we have illustrated and described a preferred embodiment of our invention, many modifications may be made without departing from the spirit of the invention, and we do not wish to be limited to the precise details set forth, but desire to avail ourselves of all changes within the scope of the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. A mine drill support and driving mechanism comprising, in combination, a base plate, a turret supported for rotational movement relative to the base plate, a latch mechanism for locking the turret in any one of a multiplicity of positions relative to the base plate, a drill carrying arm supported at one end by the turret for swinging movement in a plane transverse to the plane of said rotational movement, a motor driven screw mechanism for determining the position of the arm relative to the turret, a drill driving and feeding mechanism mounted for practically universal swinging movement at the other end of the drill carrying arm, and a manually operable control element for actuating said latch mechanism and a switch for controlling said motor driven screw mechanism both mounted on the drill

carrying arm near said drill driving and feeding mechanism.

2. A mine drill support and driving mechanism as set forth in claim 1 wherein the parts for mounting the drill driving and feeding mechanism relative to the drill carrying arm include a first swivel head supported for rotation in one plane relative to the arm, latch means for locking said first swivel head in selected positions, a second swivel head supported for rotation relative to the first swivel head in a plane transverse to the last mentioned plane, latch means for locking the second swivel head in selected positions relative to the first swivel head, and means connecting the drill driving and feeding mechanism to the second swivel head for swinging movement.

3. A mine drill support and driving mechanism as set forth in claim 1 wherein said latch mechanism for locking the turret in any one of a multiplicity of positions comprises a plate secured to said base plate and having therein an annular series of holes concentric with the axis of rotational movement of the turret and in circumferentially and equally spaced relationship, a block carried by said turret and supporting a pair of lock pins in diametrical alignment with said holes and for linear movement toward and from said holes, said lock pins being spaced a distance proportional to and different from the circumferential spacing of said holes, springs biasing the pins into engagement with the holes, and a pin lifting mechanism for retracing the pins from engagement in said holes.

4. In a mine drill support and driving mechanism, the combination comprising an index plate having a circular series of circumferentially spaced holes therein, a stud shaft secured to and projecting in normal relationship to the surface of the index plate and concentrically disposed with reference to said series of holes, a turret supported for rotation on said stud shaft, a latch mechanism for locking the turret in fixed positions relative to the index plate and including a pin carried by the turret for movement to and from engagement with the holes in said index plate, a drill carrying arm supported at one end by the turret and projecting therefrom, said drill carrying arm being supported relative to the turret for swinging movement in a plane transverse to the general plane of the index plate and having a side lever arm thereon projecting angularly from the drill carrying arm, a motor driven extensible and retractible screw mechanism having one end connected to the turret and the other end connected to the side lever arm at a distance from the drill carrying arm so that extension and retraction of the screw effects swinging movement of the drill carrying arm, and a drill driving and feeding mechanism mounted at the free end of the drill carrying arm, said latch mechanism for locking the turret in fixed positions relative to the index plate also including a spring for biasing said pin toward the index plate, and a flexible control element extending to an actuating lever on the drill carrying arm.

5. In a mine drill support and driving mechanism, the combination comprising an index plate having a circular series of circumferentially spaced holes therein, a stud shaft secured to and projecting in normal relationship to the surface of the index plate and concentrically disposed with reference to said series of holes, a turret including a side wall of generally cylindrical shape and a cover plate and supported for rotation on said stud shaft, a latch mechanism for locking the turret in fixed positions relative to the index plate and including a pin carried on the side wall of the turret for movement to and from engagement with the holes in said index plate, a drill carrying arm supported at one end by the turret and projecting therefrom, said drill carrying arm being supported relative to the turret for swinging movement in a plane transverse to the general plane of the index plate and having a side lever arm thereon projecting angularly below the drill carrying arm, and an extensible and retractible screw mechanism having an exposed threaded element at one end connected to the interior of the turret and protected thereby and an externally protected threaded element at the other end connected to the side lever arm at a distance from the drill carrying arm so that extension and retraction of the screw mechanism effects swinging movement of the drill carrying arm relative to the turret.

6. In a mine drill support and driving mechanism, the combination comprising an index plate having a circularly disposed series of equally spaced openings therein, a turret supported for rotational movement relative to the index plate, a locking pin support block secured to the turret and having openings therein spaced in relation to and differently than the holes of said series, turret holding pins mounted in said openings in the support block for sliding movement toward and from said openings in the index plate, a lift block mounted on said turret adjacent said support block for linear movement toward and from the support block, said lift block having pin receiving openings and adjoining slots of predetermined length therein and slidably receiving portions of said turret holding pins which project from the support block, side pins secured to turret holding pins and projecting therefrom for limited sliding movement in said slots, springs housed within the lift block and biasing the turret holding pins into engagement with the index plate, lever means for moving the lift block to effect disengagement of the holding pins from the turret plate when the side pins reach their limit of movement in said slots, spring means for biasing the lever means to move the lift block toward the support block, and means for actuating the lift block and turret holding pins against the biasing force of said spring means.

7. In a drill support and driving mechanism, the combination comprising a drill carrying arm providing a movable drill support, and a drill carrying and driving mechanism mounted on the drill carrying arm through a plural swivel connection having serially connected swivel heads rotatable in transverse planes, said drill carrying and driving mechanism being journalled for free swinging movement in one plane relative to one of the swivel heads, said one of the swivel heads being journalled for free rotational movement relative to a second swivel head in a plane transverse to the plane of swinging movement of said one swivel head, said one of the swivel heads and said second swivel head remaining free respectively for said swinging and rotational movements in transverse planes during operation of the drill carrying and driving mechanism, said second swivel head being supported for rotational movements in planes transverse to one another, and holding parts for securing said second swivel head in adjusted positions in each of the last mentioned transverse planes.

8. In a drill support and driving mechanism, the combination comprising a drill carrying arm

providing a movable drill support, and a drill carrying and driving mechanism mounted on the drill carrying arm through a plural swivel connection having serially connected swivel heads rotatable in transverse planes, said swivel heads including a first swivel head which is normally free to rotate in one plane and two additional swivel heads rotatable in planes and about axes transverse to one another and each in a plane transverse to the plane of rotation of the first swivel head, means for normally holding each of said two additional swivel heads in adjusted positions, said drill carrying and driving mechanism being carried by said first swivel head and normally free for swinging movement relative thereto about an axis whose plane of revolution is substantially parallel to the axis of rotation of one of said two swivel heads.

9. In a drill support and driving mechanism as defined in claim 8, the axes of rotation of said two swivel heads and the axis of rotation of said first swivel head having a point at which they intersect.

10. In a mine drill support and driving mechanism, the combination comprising a substantially rigid drill carrying arm, a support relative to which one end of the arm is swingable to adjusted positions, a drill driving and feeding mechanism, and a plurality of swivel heads through which the said drill driving and feeding mechanism is supported for swinging movement in transverse planes relative to the free end of the drill carrying arm, said plurality of swivel heads including a first swivel head supported at one end of the arm for rotation about an axis extending longitudinally of the arm, a second swivel head supported by the first swivel head for rotation about an axis transverse to the axis of rotation of the first swivel head, retaining mechanisms disposed at adjacent positions on the arm and first swivel head respectively for holding each of the first and second swivel heads in preselected positions, a third swivel head supported by the second swivel head for rotation about an axis transverse to the axes of rotation of the first and second swivel heads, the axes of rotational movement of the second and third swivel heads having a point of intersection which is substantially coincident with the axis of rotation movement of the first swivel head and a motor which comprises a part of the drill driving and feeding mechanism mounted for rotational swinging movement on the third swivel head at a position close to said axis of rotational movement of the first swivel head.

11. In a mine drill support and driving mechanism, the combination comprising a substantially rigid drill carrying arm, a support relative to which one end of the arm is swingable to adjusted positions, a drill driving and feeding mechanism, and a plurality of swivel heads through which the said drill driving and feeding mechanism is supported for swinging movement in transverse planes relative to the free end of the drill carrying arm, said swivel heads being supported for rotation about axes which are successively perpendicular to one another and including a first swivel head rotatable about the longitudinal axis of the drill carrying arm, a mechanism for determining the relative positions of the arm and said first swivel head, a second swivel head mounted for rotation in either direction relative to said first swivel head about an axis transverse to the longitudinal axis of the drill carrying arm, and a manually operable latching mechanism for determining the position of the second swivel head, said latching mechanism including dual pawls, one of which pawls is effective to arrest rotation of the second swivel head in one direction and the other pawl being effective to arrest rotation of the second swivel head in the other of the two opposed directions of rotation.

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