Nov. 17, 1959 J. D. PRITCHARD ET AL 2,913,226

ROCK-DRILLING MACHINE

Filed Sept. 29, 1952 4 Sheets-Sheet 1

FIG. 1.

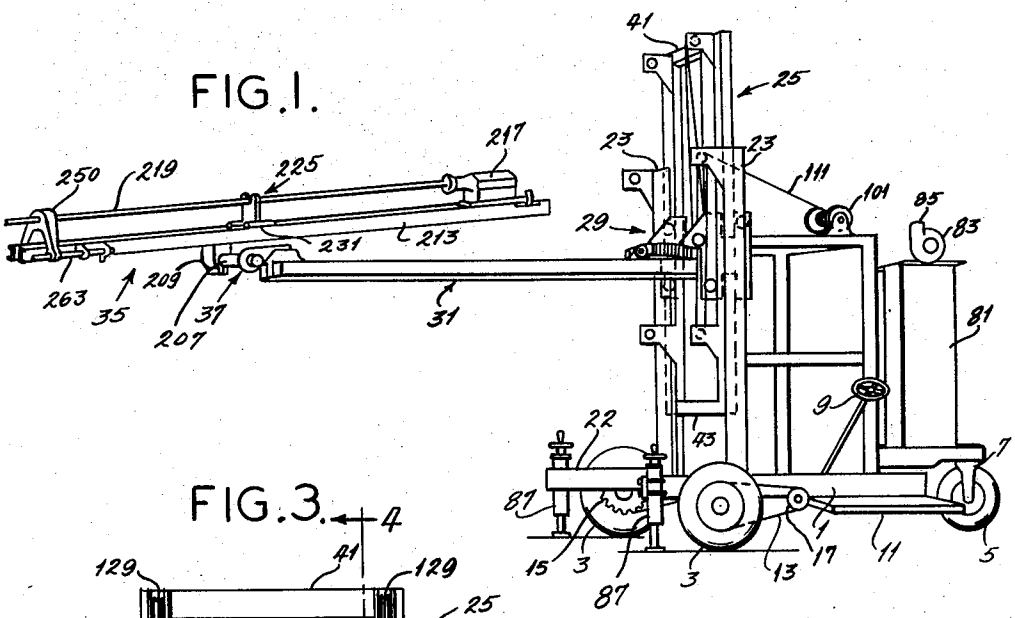


FIG. 3.

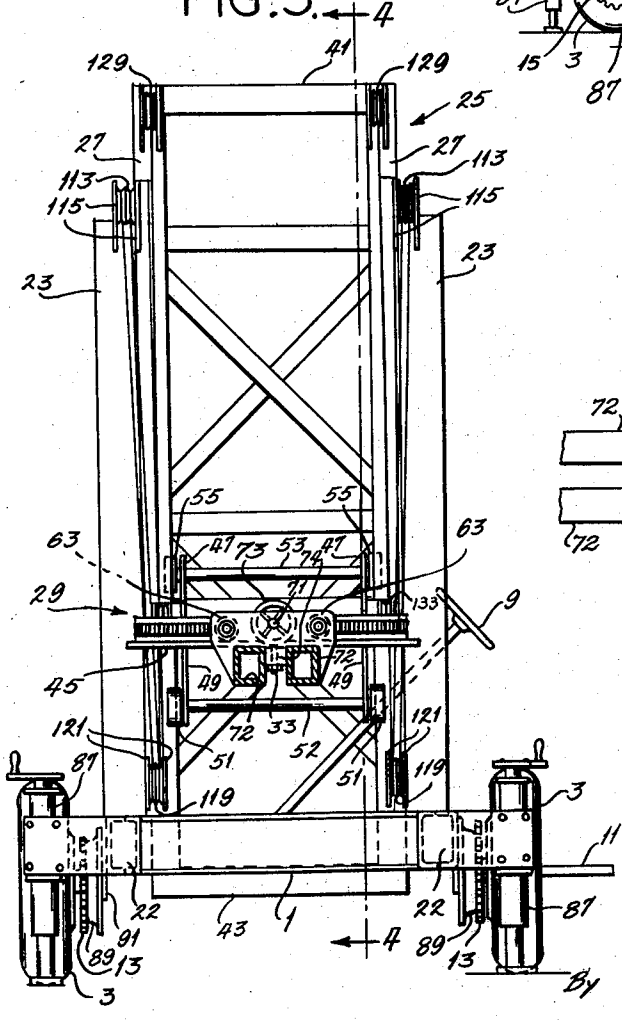
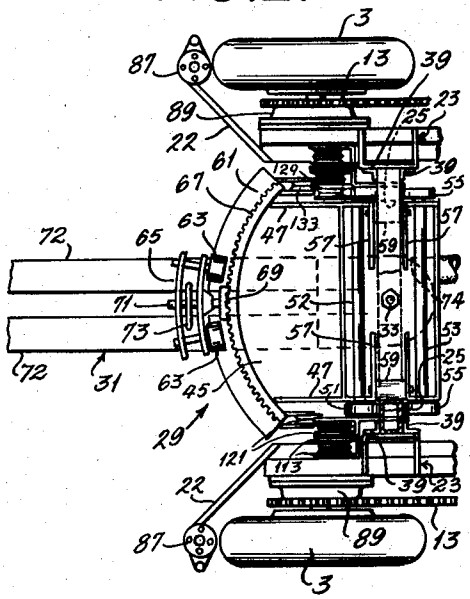


FIG. 2.



INVENTORS,
JACK DONALD PRITCHARD,
STEPHEN ROY BLACKWELL,
Bruninga and Sutherland,
ATTORNEYS.

Nov. 17, 1959 J. D. PRITCHARD ET AL 2,913,226

ROCK-DRILLING MACHINE

Filed Sept. 29, 1952 4 Sheets-Sheet 2

FIG.5.

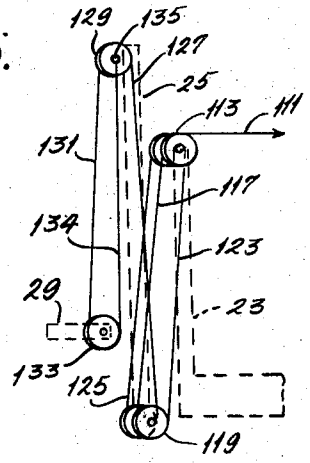


FIG.4.

INVENTORS.
JACK DONALD PRITCHARD,
STEPHEN ROY BLACKWELL,
Bruninga and Sutherland,
ATTORNEYS.

By

Nov. 17, 1959 J. D. PRITCHARD ET AL 2,913,226

ROCK-DRILLING MACHINE

Filed Sept. 29, 1952 4 Sheets-Sheet 3

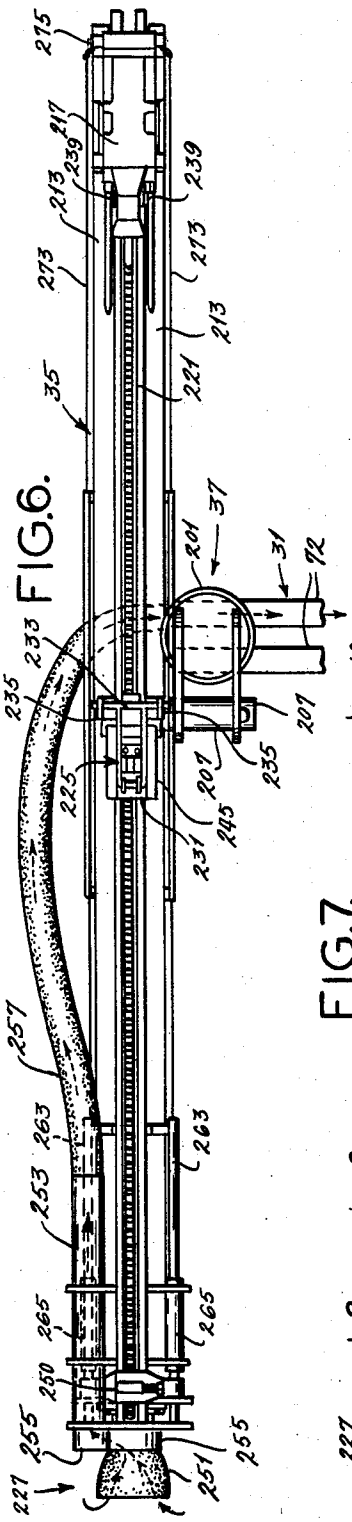


FIG. 6.

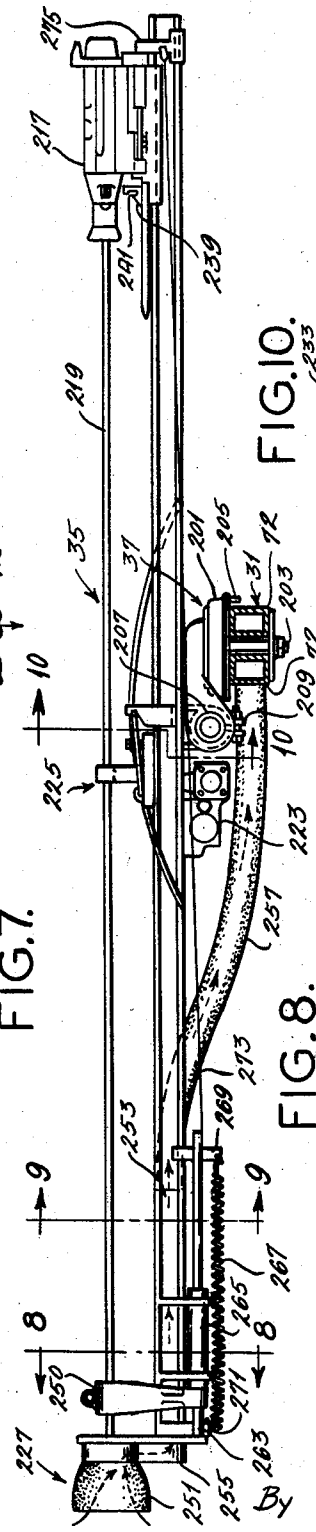


FIG. 7.

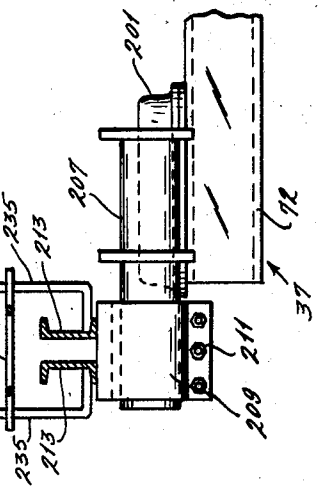


FIG. 10.

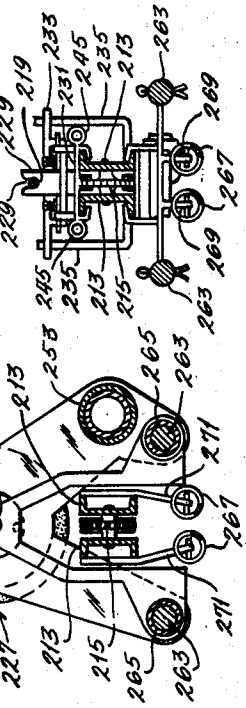


FIG. 9.

FIG. 8.

INVENTORS,
JACK DONALD PRITCHARD,
STEPHEN ROY BLACKWELL,
Bruninga and Sutherland,
ATTORNEYS.

Nov. 17, 1959 J. D. PRITCHARD ET AL 2,913,226

ROCK-DRILLING MACHINE

Filed Sept. 29, 1952 4 Sheets-Sheet 4

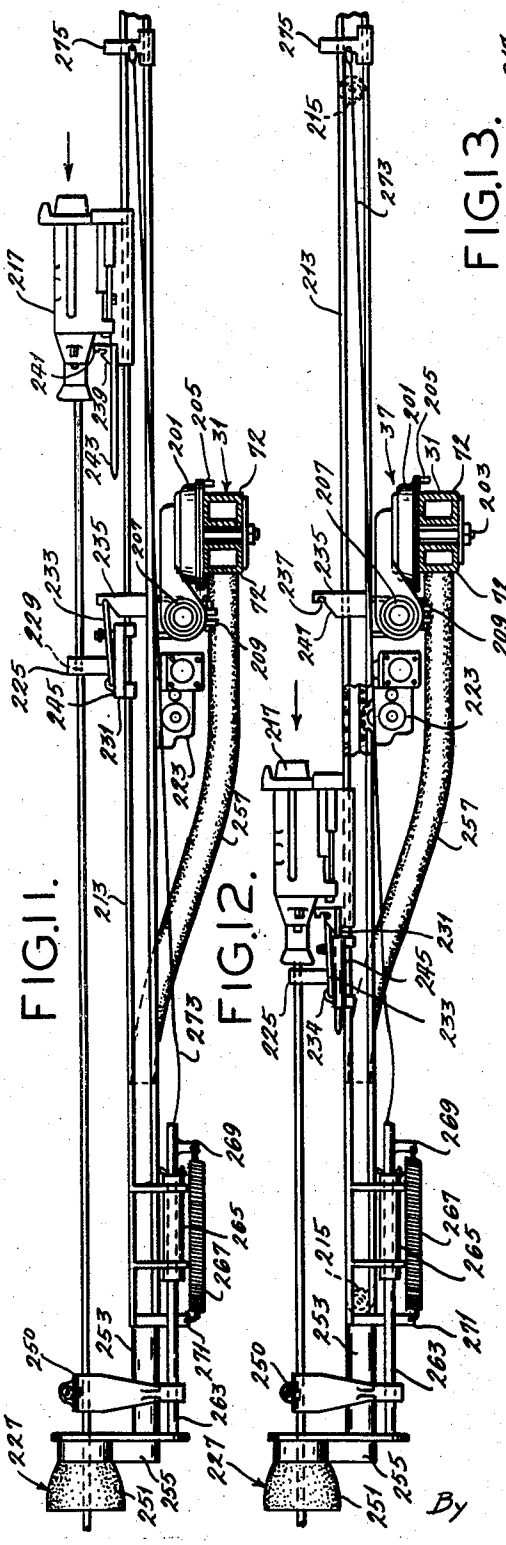


FIG. 11.

FIG. 12.

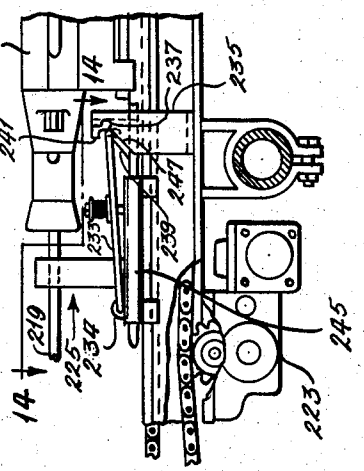


FIG. 13.

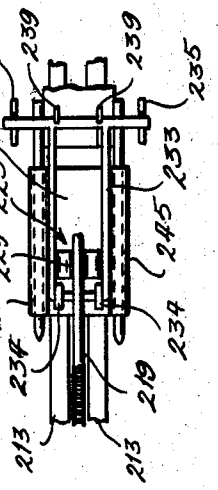


FIG. 14.

INVENTORS,
JACK DONALD PRITCHARD,
STEPHEN ROY BLACKWELL,
Brumings and Sutherland,
ATTORNEYS.

United States Patent Office 2,913,226
Patented Nov. 17, 1959

2,913,226

ROCK-DRILLING MACHINE

Jack D. Pritchard, Kirkwood, Mo., and Stephen Roy Blackwell, East St. Louis, Ill.

Application September 29, 1952, Serial No. 312,134

2 Claims. (Cl. 255—51)

This invention relates to rock-drilling machines for use in quarrying and mining operations, particularly subsurface operations.

It will be understood a common method of breaking up the rock front or face is by blasting, and modern techniques have led to the use of sequentially fired charges of explosives placed in the face according to a carefully selected pattern. For example, in one such pattern the blasting holes are arranged in horizontally-spaced inwardly-convergent vertical rows. The two innermost rows are fired first and the remaining rows are fired successively in the direction away from the middle, with the result being a spreading collapse of the face. Experience has shown the accuracy in the pattern of the blasting holes is important to the successful carrying out of such blasting.

Heretofore, such drilling has been carried out from portable scaffolding placed up against the face, but this has not been entirely satisfactory, because considerable time was wasted in moving the scaffolding, and because the holes were not always in the proper degree of alignment, depth, etc. It is accordingly an object of this invention to provide a rock-drilling machine adapted to drill a relatively wide width of the face in a relatively short time. Another object of this invention is the provision of a rock-drilling machine for facilitating the drilling of accurately placed blasting holes.

To the attainment of these objectives, we provide a wheeled vehicle constructed with a fixed superstructure of such height as to clear the ceiling of the quarry or mine and permit the vehicle to traverse the mine floor. A pair of upright rails are slidably mounted in the superstructure on opposite sides of the machine, and these rails are extendable out of the superstructure for engagement with the mine ceiling. A boom carriage rides upon the rails, and a boom is cantilevered from the carriage on a pivotal support, which permits the boom to be swung to different positions in a horizontal plane. At the outer end of the boom, there is a drilling unit including the usual elongate motor rail, drill motor movable therealong and elongate drill bit. The unit is preferably pivoted at its center with a double hinge to permit its adjustment both horizontally and vertically with respect to the boom.

In operation, the drilling unit and boom are adjusted and locked in position for drilling a lowermost blasting hole for one of the vertical rows of the pattern. The carriage-supporting rails and the carriage may then be elevated for drilling superimposed holes forming the remainder of the particular row. When the row is completed, the drill unit is lowered, and the boom and drilling unit adjusted for the next row of blasting holes, perhaps without necessitating movement of the vehicle. In this manner, an accurate pattern is quickly and conveniently drilled.

The invention also contemplates the provision of an elevating system wherein a winch-controlled hoisting cable is trained about the carriage-supporting rails so

that the rails are first elevated with the carriage resting at their bottom, until the frame engages the ceiling of the mine or quarry. Further elevation is then obtained by movement of the carriage and attached boom relative to the rails, the rails remaining in contact with the ceiling to provide a stabilizing action during elevated drilling operations. The particular cable system may vary, depending upon the relative weights of the frame and the carriage with its attached parts.

An additional feature of this invention is a provision of an intermediate support for the elongate drill bit of the drilling unit. With the rock-drilling machine of this invention, the drilling unit per se might be quite long (18 feet), hence an intermediate support for the drill bit, which is of corresponding length, is desirable to prevent breaking thereof. But as the drill motor should be advanceable the full length of the unit, the intermediate support must not interfere with the movement of the motor. In this invention, the intermediate support is automatically latched to the motor and carried forward, as the drill motor is advanced beyond mid position. When the motor is retracted, the bit support is detached from the motor and latched in mid position on the drilling unit to provide support for the bit.

Additionally, there is an automatically operated dust collector shield carried at the forward end of the drilling unit for cooperation with the rock face. The drill bit extends through the dust shield, and the dust shield is connected by duct and hose to a dust collector and filter mounted on the vehicle proper. The dust collector shield and forward support for the drill rod are spring biased outwardly, and are retractable by means of a catch movably mounted at the rear of the drilling unit for actuation by the drill motor. When the drill motor is advanced preparatory to drilling, the dust collector shield is spring biased into engagement with the rock face, and when the drill motor is fully retracted, the dust shield is retracted against its bias in order to permit repositioning of the drilling unit preparatory to drilling a new hole.

Other features of the invention will be in part apparent from and in part pointed out in the following detail description taken in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view of the rock-drilling machine herein described;

Fig. 2 is a partial top-plan view of the machine, parts being broken away;

Fig. 3 is a front view of the machine, the boom being broken away;

Fig. 4 is a side elevation of the machine, the boom being broken off and a front part of the machine being shown in section on the line 4—4 of Fig. 3;

Fig. 5 is a diagrammatic view illustrating the cable system for elevating the drilling unit;

Fig. 6 is a top-plan view of the drilling unit with the drill motor fully retracted;

Fig. 7 is a side elevation of Fig. 6;

Fig. 8 is an enlarged vertical section taken on the line 8—8 of Fig. 7;

Fig. 9 is an enlarged vertical section taken on the line 9—9 of Fig. 7;

Fig. 10 is an enlarged section taken on the line 10—10 of Fig. 7;

Fig. 11 is a side elevational view similar to that of Fig. 7 showing how the dust-collector sleeve is advanced when the drill motor is partially advanced;

Fig. 12 is a side elevation similar to that of Fig. 7 showing the drill motor advanced beyond mid point, with the intermediate support for the drill rod carried forward with the drill motor;

Fig. 13 is a partial side elevation of the drill unit il-

lustrating the manner is which the intermediate support for the drill rod cooperates with the drill motor as the latter moves past mid position; and

Fig. 14 is a plan view taken on the line 14—14 of Fig. 13.

Referring now to Fig. 1 of the drawings, there is shown a three-wheeled powered vehicle adapted to traverse the floor of a quarry or mine. In the form shown, the vehicle has a box-type chassis 1 with rubber-tired drive wheels 3 journaled thereon at one end, herein termed the front of the machine. At the other or rear end of the machine, there is a wheel 5 carried on a pivoted fork 7, which in turn is mechanically coupled to a conventional steering wheel 9 by a conventional steering linkage (Fig. 4). The steering wheel extends from one side of the vehicle and an operator's platform 11 projects from this side of the chassis beneath the steering wheel. It is contemplated various other operating controls would be located at this side of the machine for convenient access to an operator standing on the platform 11.

The drive for the vehicle is provided by means of chains 13 (Fig. 4) trained around sprockets 15 on the drive wheels 3 and sprockets 17 on a drive shaft 18. The drive shaft 18 traverses the box chassis 1 and is driven through a differential 19 by means of a chain drive 20 and an electric motor 21. It is contemplated electrical supply lines (not shown) will be provided to extend from the machine to a suitable electrical supply in the mine and that the drive motor 21 is primarily for positioning the machine adjacent the rock face. Should it become necessary to move the machine any considerable distance, a tractor may be employed. Bumpers 22 are shown as extending from the box chassis to protect the drive wheels.

Projecting upwardly from the chassis at its front are two fixed guide members 23, one on each side of the chassis. These guide members 23 support a movable frame 25 which may be elevated with respect to the chassis. The movable frame 25 includes a pair of vertical rails 27, which slidably cooperate with the vertical guide members 23 and also serve as supports for a vertically movable carriage 29. This carriage 29 in turn carries a boom 31 which is mounted for swinging movement in a horizontal plane at the front of the machine. The boom is pivoted to the carriage at one end upon a pin 33, and at its other end, an elongate drilling unit 35 is centrally supported by hinge apparatus generally designated 37.

Each of the fixed guide members 23 is shown in Fig. 2 to comprise an outwardly turned channel member with vertically-extending horizontally-spaced flanges 39 affixed thereto, one on each side of the associated rail 27. The frame 25 is thus slidably supported within slots defined by the flanges 39. The frame 25 also includes a top cross member 41 and a bottom cross member 43. The carriage 29, which extends across and through the frame 25, may thus be moved along the frame from the lower cross member 43 to the top member 41.

The carriage 29 comprises a horizontal plate or platen 45 arranged to project through the frame 25, and vertically disposed roller-supporting plates 47 secured along the side edges of the platen. Rollers 51 are supported from the plates 47 on a shaft 52 below the platen for rolling cooperation with the forward surface of the frame 25. Additional rollers 55 on a shaft 53 are supported from the upper back portions of the members 47 for rolling cooperation with the rear surface of the frame. The carriage also includes transverse members 57 extending inwardly from the side plates 47 on opposite sides of the frame. These members 57 support inner rollers 59, which are journaled for rolling cooperation with the inner surface of the rails 27 of the frame 25. It will thereby be apparent the carriage 29 is readily movable the full length of the frame 25, the uppermost and lowermost positions of the carriage relative to the frame being determined by engagement of upper and lower edges 48 and 49 of the roller-supporting plates 47 with the upper and lower frame members 41 and 43, respectively.

The horizontal platen 45 of the carriage projects forwardly beyond the side plates 47, and the margin 61 thereof is curved to provide a horizontal rail upon which rollers 63 may ride. These rollers are journaled upon bracket members 65 carried by the boom so that the boom is supported as a pivoted cantilever, which may be swung horizontally. To lock the boom in position, there is provided a boom brake including cooperating toothed segments 67 and 69 on the carriage 29 and boom 31, respectively. The segment 69 is carried by a screw 71 threaded through the bracket members 65, and the screw may be turned by a hand wheel 73 to move the boom segment 69 into and out of locking engagement with the carriage segment 67.

The boom 31 is constructed from two box-type beams 72 connected at the rear ends by a member 74. The pivot pin 33 extends through the carriage platen 45 and this connecting member 74 of the boom. A dust collecting hose 75 extends from the rear end of one of the box-type structural beams 72 upwardly to a support 77 and then downwardly for connecting at 79 to a dust collector or filter box 81. A suction fan 83 is mounted upon the top of the box 81 to exhaust through the box 81 and hose 75 into the atmosphere, as at 85. Such collector boxes are a conventional item known in the art. Dust is collected at the point of drilling in a manner to be explained and carried back by air suction to the box 83. The dust is then separated from the air by collector plates within the box, and the box is emptied from time to time through a bottom opening (not shown).

The machine may also include screw-jacks 87 mounted on the forward bumpers 22 for stabilizing the machine, although it will be understood the machine would include conventional wheel brakes 89 for locking the machine in position. The wheels 3, including their sprockets 15 and brakes 89, are supported from the chassis 1 at 91.

The pin and roller support of the boom 31 upon the carriage 29 permits manual movement of the boom with respect to the carriage upon release of the brake 67 and 69. The elevation of the boom is power controlled. A motor-driven hoisting winch 101 is provided upon the superstructure 103 of the machine. This winch is driven from an electric motor 105 (Fig. 4) by means of a belt drive 107, which may include a belt-tightening idler 109. Cables 111 extend from the winch 101 on opposite sides of the machine toward the front.

Each of these cables is first trained around a part of a double sheave 113 supported from forwardly projecting brackets 115 at the top of the vertical guide members 23. The cable then extends downwardly at 117 and is trained about a double sheave 119 journaled on a forwardly projecting bracket 121 at the bottom of the frame 25. From the sheave 119, the cable is continued upwardly at 123 around the other part of the double sheave 113 alnd back down at 125 to the other part of the sheave 119. From 119, the cable is then carried upwardly at 127 and over a single sheave 129 on a forwardly projecting bracket 151 at the top 41 of the frame. The cable is then extended downwardly at 131 and about a sheave 133. This sheave 133 is journaled in the carriage 29, and the cable is continued upwardly at 134 and its end is secured at 135 at the top of the frame 25. Fig. 5 diagrammatically illustrates this cable system.

With this arrangement, it will be apparent the lift upon the carriage is twice that of the tension in the cable and the lift upon the frame 25 is four times the tension in the cable. Hence upon operation of the winch 101, the carriage-supporting frame 25 initially moves upwardly with the carriage 29 resting on the bottom 43 thereof. The relative weights of the frame 25 and the carriage 29 (with its boom, etc.) are such as to insure this initial

movement of the frame. When the frame engages the ceiling (dashed lines of Fig. 4), the carriage then begins to move upwardly within the frame. To simplify the view of Fig. 4, the carriage is shown elevated with the frame in its lowermost position (solid lines), but it will be understood that in operation, the carriage does not leave the bottom of the frame unless the latter engages the ceiling or is locked relative to the guide members **23**.

With the carriage elevated in the frame, an upward thrust is continuously applied to the frame by reason of the weight or downward reaction of the carriage and the parts carried thereby. It has been found this upward force of the frame upon the ceiling is sufficient, in practice, to provide a proper stabilizing action for the machine while drilling operations are conducted at some elevation from the floor. Although the system described is satisfactory, other systems might be employed. For example, the double sheaves **113** and **119** might be converted to single sheaves, and the single sheave **133** on the carriage might be eliminated with the end of the cable being attached directly to the carriage.

Referring now to Figs. 6–14, the drilling unit **35** is supported upon the outer end of the boom **31** by the double hinge system generally designated **37**. This hinge system may comprise a conventional automotive wheel brake **201** secured over the end of the boom in order to provide for horizontal swinging movement. The brake **201** may be locked as by means of a threaded actuator **205**, which sets the brake in the conventional manner. A transverse pipe **207** is secured to the top of the brake **201** to project therefrom. The drilling unit **35** is then centrally balanced and supported for vertical swinging movement on this pipe **207** by a split clamp **209**. Bolts **211** on the clamp lock the drilling unit in position.

The drilling unit is an item known in the art with the exceptions to be noted. The unit comprises a pair of spaced channel rails **213** with chain sprockets **215** located between the respective ends of these channel members. An air-actuated impact drill motor **217** is carried upon the rails **215** so as to be movable approximately the full length thereof. An elongate drill bit **219** is operated by this motor. The motor **217** and drill bit are advanced and retracted by means of a chain **221** trained around the sprockets **215**. The chain is attached to the drill motor and is driven from an air-operated advancing motor **223** mounted below the central portion of the rails **213**. The advancing motor **223**, when operated, thereby applies drilling pressure to the bit.

The drilling unit of this invention is particularly distinguished by the provision of an intermediate support **225** for the drill bit and by the provision of automatically operated dust-collector shield apparatus **227**. As the motor is advanced beyond midposition (Fig. 12), the support is carried forward by the drill motor **217**, and when the motor is retracted again past midposition, the support is automatically detached and locked in an intermediate position (Figs. 6, 7 and 11) to provide support for the bit. With the machine of this invention, it is contemplated the drill bit may be as long as eighteen feet, hence the intermediate support is desirable. The dust-collector apparatus **227** is automatically advanced against the rock face when the drill motor is advanced preparatory to drilling and is automatically retracted, when the drill motor is fully retracted, to permit re-positioning of the unit.

The intermediate support **225** comprises a notched vertical member **229** in which the drill bit may rest. This notched member **229** is mounted upon a bit-supporting carriage **231**, which is movable over the rails **213**. The frame in turn is adapted to be locked in position by a U-shaped latching link **233**. The link is pivoted at **234** for cooperation with stops **235** fixed upon the rails. As best shown in Fig. 13, the link **233** seats in detent notches **237** formed in the stops **235**. The detent cooperation is sufficient to maintain the support in its intermediate position with the motor retracted, but permits the link to be carried out of the notch **237** when the motor is advanced beyond midposition.

The drill motor carries latch plates **239**, which are notched at **241** for cooperation with the link **233**. The motor also has forwardly projecting prongs **243** cooperable with tubular members **245** on the movable frame **231**. When the motor is advanced, the prongs **243** enter the tubular members **245**, and the latch plates **241** on the motor carry the link **233** out of the notches **237** on the stops **235**. The motor is thus permitted to move forwardly beyond mid position.

The link is gravity latched in the notches **241** in the latch plates so that the bit-supporting carriage **231** will also retract with the motor. As the motor is retracted, sloped cam surfaces **247** on the stops **235** engage the link **233** and unlatch the link by lifting it clear of the notches **241** in the latch plates. The bit support is thus detached from the motor and latched in mid position, thereby to provide support for the relatively long, otherwise unsupported, section of the drill bit extending between a forward support **250** and the drill motor.

The forward bit support **250** is carried upon the automatic dust-shield apparatus **227**. The latter comprises a short cylindrical shield **251** surrounding the drill bit. The shield is preferably formed of flexible material such as rubber to fit closely with the rock face. The shield **251** is supported upon, and connects with, a duct member **255**, which is connected through a telescoping pipe **253** to a hose **257**. The hose is then connected to that one of the box structural beams **72** of the boom **31** which is connected to the hose **75** in the vehicle. Dust generated at the point of drilling is thus carried back to the filter box **81**.

A flexible sealing member **259** in the rear of the duct **255** admits the end of the drill bit **219** and permits relative movement while sealing against air leakage at this point. Both the duct **255** and the forward bit support **250** are carried upon telescoping rods **263**, which slide within tubes **265**. The tubes **265** are fastened to the forward end of the rails **213**. Springs **267** are fastened at **269** to the rear ends of the rods **263** and at **271** to the forward ends of the rails **213**, in order to bias the dust shield forwardly into engagement with the rock face. The shield is retractable by means of cables **273** attached to the rods **265** and extended rearwardly to a sliding catch **275** supported at the rear end of the rails **213**. When it is desired to retract the dust shield **251** preparatory to repositioning the drill unit, the drill motor **217** is fully retracted to engage the catch **275** and move it rearwardly. It will be understood that the motor **217** is advanced and retracted by means of the advancing motor **223**, which is under control from the vehicle.

The air lines for the advancing motor **223** and the drill motor **217** are not shown, but they may be carried back to the vehicle through the other box structural beam **72**, which does not form a part of the dust collecting system. The machine may carry an air compressor or the air lines may be connected from the vehicle to an existing compressed-air supply in the quarry or mine.

From the foregoing description, it is apparent that those skilled in the art will understand the structure, function and mode of operation of the invention herein disclosed, and appreciate the advantages thereof. Although one embodiment has been disclosed in detail, it is to be understood that the invention is not limited thereto, but the drawings and description thereof are to be understood as being merely illustrative. It is realized that many modifications and variations will present themselves to those skilled in the art without departing from the spirit of this invention or the scope thereof as set forth in the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. A rock-drilling machine comprising a wheeled vehicle, vertical guide means mounted upon said vehicle, an elongate frame supported by said guide means for relative vertical telescoping movement, a carriage supported by said frame for vertical movement relative thereto, a drilling unit carried by said carriage, an elevating mechanism comprising a winch mounted on the vehicle, a sheave mounted at the top of the fixed vertical guide means, a second sheave mounted at the bottom of said frame, a third sheave mounted at the top of the fixed vertical guide, a fourth sheave mounted on the bottom of the frame, a fifth sheave mounted at the top of said frame, a sixth sheave mounted on said carriage, and cable means extending from the winch over the sheaves in the order named and then to the top of said frame.

2. A rock-drilling machine of the character set forth for use in underground mines having an overhead ceiling, said machine comprising a wheeled vehicle, vertical guide means fixed upon said vehicle, an elongate vertical frame supported on said guide means for vertical movement relative thereto, said frame having upper and lower ends, a carriage supported on said frame for vertical movement over said frame, a drilling unit carried by said carriage, and elevating mechanism having a power unit coupled to both the frame and carriage, said elevating

mechanism having means constructed and arranged to elevate the frame prior to upward movement of the carriage on the frame until the upper end of the frame engages the ceiling of the mine and for thereafter elevating the carriage relative to the frame while holding the frame in engagement against the ceiling, whereby initial upward movement of the drilling unit is effected by elevation of said frame and subsequent upward movement effected by elevation of the drilling unit over said frame, the drilling unit being braced by engagement of the frame with the ceiling of the mine during subsequent elevation.

References Cited in the file of this patent

UNITED STATES PATENTS

1,977,349	Nell	Oct. 16, 1934
1,991,576	Remde	Feb. 19, 1935
2,075,185	Eiler	Mar. 30, 1937
2,079,189	Simpson et al.	May 4, 1937
2,088,649	Hart	Aug. 3, 1937
2,149,348	Kelley	Mar. 7, 1939
2,362,161	Sellars	Nov. 7, 1944
2,389,558	Slater	Nov. 20, 1945
2,480,066	Weaver	Aug. 23, 1949
2,590,958	Goodrich	Apr. 1, 1952
2,670,931	Curtis	Mar. 2, 1954
2,718,118	Benjamin	Sept. 20, 1955
2,765,148	Prince	Oct. 2, 1956