L. WEST.

ROCK DRILLING MACHINE.

APPLICATION FILED APR. 1, 1909.

953,651.

Patented Mar. 29, 1910

2 SHEETS—SHEET 1.

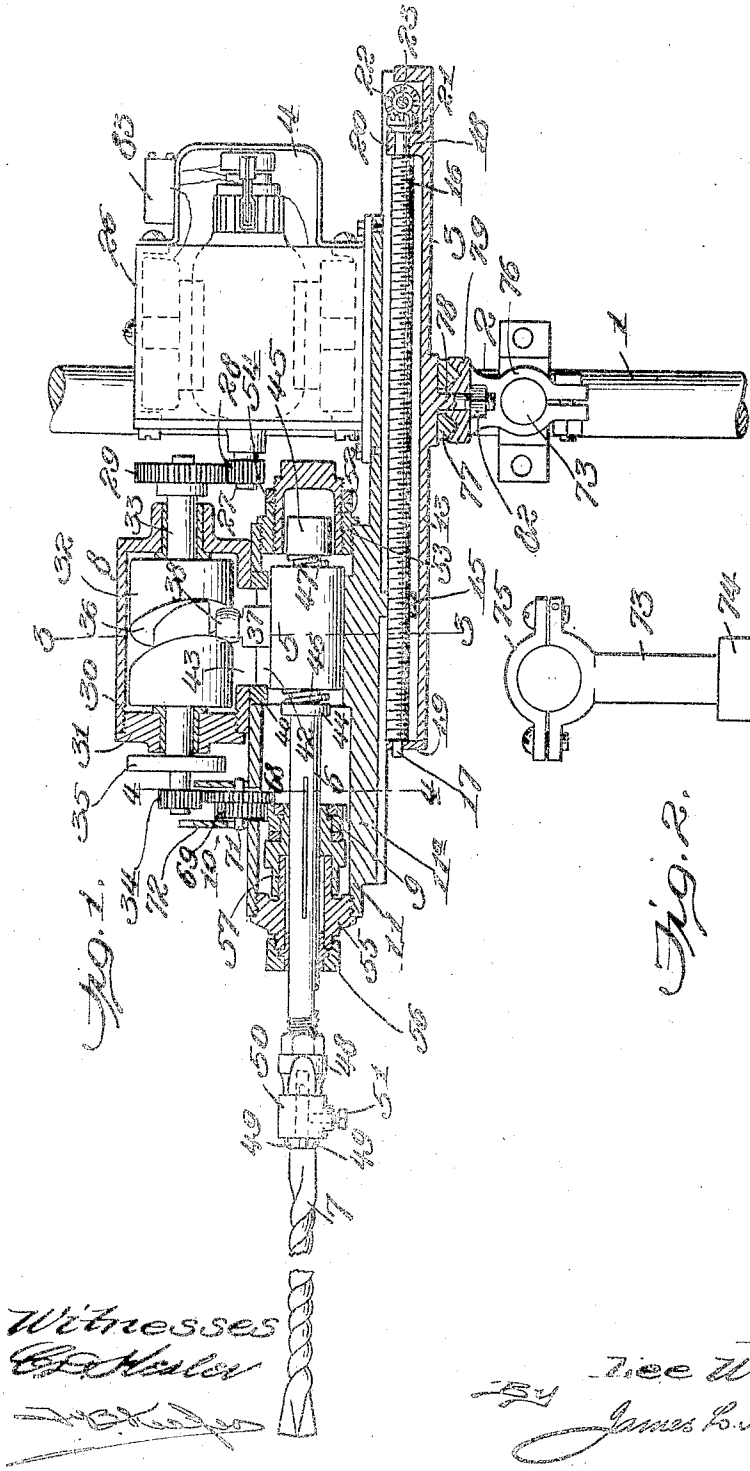

Fig. 1.

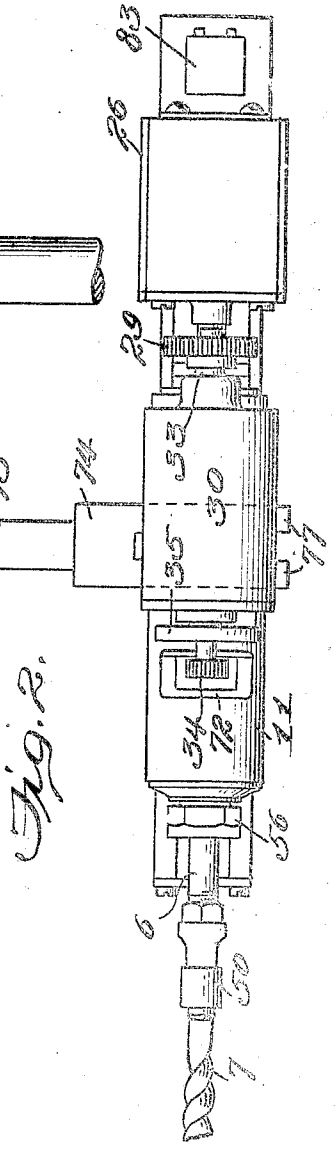

Fig. 2.

Witnesses

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By James L. Norris

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2 SHEETS—SHEET 2.

Fig. 3.

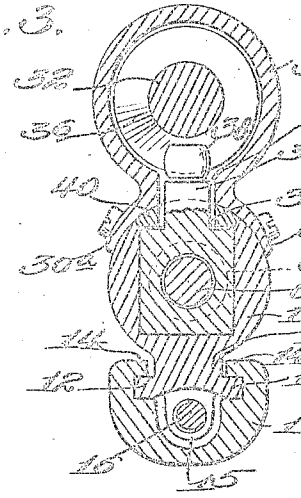

Fig. 4.

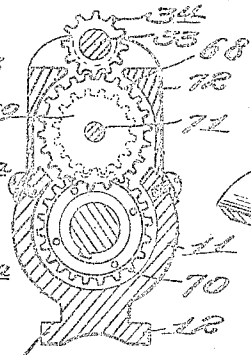

Fig. 7.

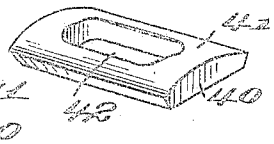

Fig. 5.

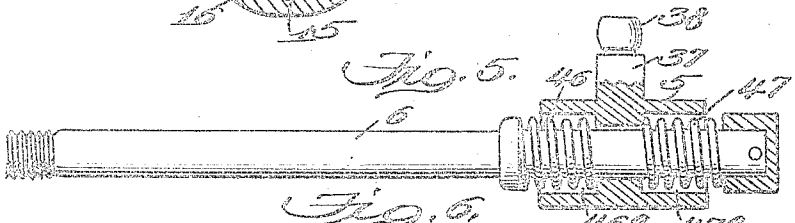

Fig. 6.

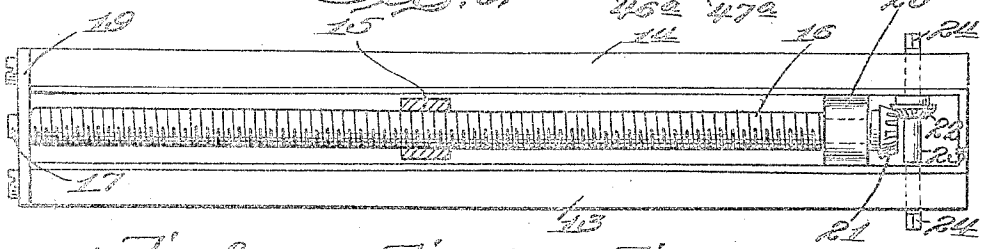

Fig. 8.

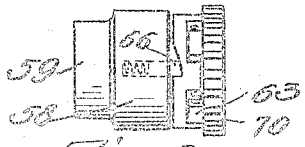

Fig. 10.

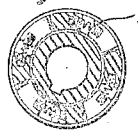

Fig. 11.

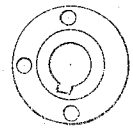

Fig. 12.

Fig. 9.

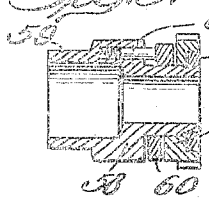

Fig. 13.

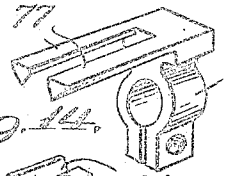

Fig. 14.

Witnesses:

Inventor

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UNITED STATES PATENT OFFICE.

LEE WEST, OF IRONTON, OHIO.

ROCK-DRILLING MACHINE.

953,651. Specification of Letters Patent. Patented Mar. 29, 1910.

Application filed April 1, 1909. Serial No. 487,218.

To all whom it may concern:

Be it known that I, LEE WEST, a citizen of the United States, residing at Ironton, in the county of Lawrence and State of Ohio, have invented new and useful Improvements in Rock-Drilling Machines, of which the following is a specification.

This invention relates to new and useful improvements in rock drilling machines and has more particular reference to a structure of that general type in which is embodied a reciprocating piston and mechanical operating means therefor which in turn receives its motion from a suitable prime mover.

The primary object of the invention is to provide novel means for reciprocating and for simultaneously rotating the drill steel and the novelty of the present arrangement resides more particularly in the provision of positive specifically novel means for accomplishing each of the aforesaid movements, which means are simultaneously driven from the prime mover. As an incidental novel feature of this arrangement, the embodiment of the invention herein disclosed proposes the use of a single element which shall be common to the organization of both the drill rod reciprocating means and the drill rod rotating means and such element is driven directly from the prime mover which is preferably an electric motor.

The invention aims as a further object to provide drill rotating means which shall embody novel structural details comprehended more particularly in a driving ratchet constructed of yieldably connected sections in order to allow of a certain play, sufficient to take up shocks in accordance with variations in the degree of hardness of the rock or stone which is being drilled.

The invention aims as a further object to provide a novel pneumatic cushioning device which is employed in conjunction with spring cushions on the operating piston and which retards the impact of said piston on its rearward stroke and at the same time gives an initial acceleration thereto on its forward stroke.

In the accompanying drawings I have illustrated a preferred embodiment of the invention, the structural details of which are set forth at length in the following description while the novel features by which the invention is distinguished from the prior art are recited in the claims appended at the end of the description.

In the said drawings: Figure 1 is a central longitudinal section of a drilling machine constructed in accordance with the present invention, parts being shown in elevation. Fig. 2 is a top plan view thereof. Fig. 3 is a transverse section on the line 3—3 of Fig. 1. Fig. 4 is a transverse section on the line 4—4 of Fig. 1. Fig. 5 is a side elevation with parts shown in section, of the reciprocatory piston. Fig. 6 is a plan view of the feed mechanism detached from the rest of the machine. Fig. 7 is a detail perspective view of a block which forms a bearing for the reciprocatory plunger or piston head and also a guide for the connecting pin which is carried on said head. Fig. 8 is a side elevation of the piston rotating mechanism. Fig. 9 is a central longitudinal sectional view thereof. Fig. 10 is a transverse sectional view with parts shown in elevation, showing the relation between the yieldable parts of the ratchet. Fig. 11 is an end elevation of a retaining nut or collar which is embodied in the piston rotating mechanism. Fig. 12 is a detail perspective view of the ratchet ring which forms a part of the piston rotating mechanism. Fig. 13 is a detail perspective view of a supporting bracket for the drilling machine, and Fig. 14 is a detail perspective view of a clamping block, having coöperation with the bracket illustrated in Fig. 13.

Similar characters of reference refer to corresponding parts through the several views.

In its general organization, the machine which forms the subject matter of the present invention embodies a supporting post, as 1, an adjustable bracket mechanism, as 2, a feed mechanism, as 3, which is connected directly to the bracket mechanism 2, a prime mover, as 4, which is preferably an electric motor and in the present embodiment is so shown, a reciprocating plunger or head, as 5, a piston, as 6, which is driven by the plunger, a drill bar, as 7, a plunger reciprocating mechanism, as 8, a piston rotating mechanism, as 9, and transmission gearing, as 10, for operating the piston rotating mechanism 9.

The plunger 5 is mounted for reciprocation in a casing 11 which is provided with a

depending web 11ª extending the whole length thereof and projecting some distance in the rear, the said web having side flanges 12. The feed mechanism 3 comprises a shell, as 13, which is constructed at its sides with overhanging flanges 14, the latter fitting over the flanges 12. The web 11ª is also provided with a depending threaded lug, as 15, which fits into the channel of the shell 13 and through which is threaded the feed screw 16. The latter has at its ends trunnions, as 17 and 18, the trunnion 17 being journaled in the removable forward end wall 19 of the shell 13 and the trunnion 18 being journaled in a transverse web, as 20, which is located in the rearward portion of the shell. The trunnion 18 projects beyond the web 20 and carries a crown or bevel gear, as 21, which is in mesh with a bevel gear 22. The latter is carried upon a transverse shaft 23, the end portions of which project beyond the shell 13 and are squared, as at 24, to receive a suitable crank handle (not shown) by means of which the feed screw 16 may be turned and the machine moved axially in a forward or rearward direction.

The rearwardly projecting portion of the web 11ª serves as the support for the prime mover, 4, which may be of any suitable type but is preferably an electric motor, the details of which are not relevant to the subject matter of the present invention. The motor 4 is inclosed in a housing 26 and its shaft, as 27, projects forwardly beyond the housing and carries a spur wheel pinion, as 28. The pinion 28 forms an element of a train for driving the plunger reciprocating mechanism, the other element of the train comprising a spur wheel pinion 29, which is in mesh with and driven by the pinion 28. The ratio between the pinions 28 and 29 is preferably 1:3.

The plunger reciprocating mechanism is mounted in a casing, as 30, having a removable forward head, as 31, and mounted upon the upper side of the casing 11. Within the casing 30 is a rotatable cylindrical member, as 32, which is carried upon a longitudinal shaft, as 33. The shaft 33 takes its bearings in the end heads of the casing 30 and projects at each end beyond said end heads, the pinion 29 being mounted upon the rearwardly projecting end portion of the shaft 33, while upon the forwardly projecting end portion of said shaft is mounted a pinion, as 34, which forms an element of the transmission train 10. A hand wheel, as 35, is also mounted upon the forwardly projecting portion of the shaft 33 and is provided in order that the parts may be operated manually under certain conditions. The cylindrical member 32 is constructed with a spiral cam groove, as 36, in which is received the end of a pin, as 37, which projects from the upper side of the plunger 5. The pin 37 has a reduced end portion upon which is rotatably mounted a hardened steel collar, as 38, which serves as an anti-friction device and has contact with the side faces of the cam groove 36.

The plunger 5 is preferably of square or rectangular cross section, as shown more particularly in Fig. 3 and the casing 11 has its central bore constructed for a portion of its length also of square or rectangular cross section in order that the plunger 5 may have a conformable bearing therein. The casing 11 is constructed in its upper side with an opening, as 39, into which is set a removable bearing block 40 which is illustrated more particularly in Fig. 7 and is of general wedge shape, having a curved upper face, as 41, which is flush with the curved upper side of the casing 11 and which fits conformably against the side lips or flanges 30ª by means of which the casing 30 is attached to the casing 11, as shown in Fig. 3.

The block 40 bears against the upper side of the plunger 5 and is provided with a longitudinal slot, as 42, through which the pin 37 projects, the said pin also projecting through a longitudinal slot, as 43, which is formed in the under side of the casing 30.

The piston 6, as above stated, is driven by the plunger 5 but is yieldably related thereto, the piston thus having a certain degree of axial play. The plunger 5 is provided with a central opening through which the piston 6 extends and is slidable. Forwardly of said plunger, the piston is provided with a collar, as 44, and rearwardly of said plunger with a removable cap, as 45. Between the collar 44 and the forward face of the plunger an expansive coil spring 46 is interposed and a similar spring, as 47, is placed between the cap 45 and the rear face of the plunger, the springs 46 and 47 serving to absorb the shocks incident to the forward and rearward impact of the piston due to the sudden termination and reversal of the forward and rearward movements of the plunger and to provide an efficient resilient connection for transmitting the movement of the plunger in either direction to the piston. The springs 46 and 47 are preferably seated in recesses, as 46ª and 47ª respectively, which are formed in the end faces of the plunger, as shown more particularly in Fig. 5. A portion of the piston 6 projects forwardly beyond the end of the casing 11 and carries a removably assembled chuck, as 48, in which the drill steel is held. The chuck 48 is constructed with a pair of opposed spring jaws, as 49, which are held in clamping engagement with the shank of the drill steel by a collar, as 50, which slidably surrounds the jaws and which in turn is held against displacement by a set screw, as 51, the latter being threaded through the collar and engaging one of the jaws 49.

The spring 46 effectually absorbs the impact of the plunger on its forward stroke and means are also provided for absorbing the impact of the plunger on its rearward stroke. The means which absorbs the impact of the plunger on its rearward stroke is of pneumatic nature and preferably comprises an axially adjustable cylinder, as 52. The cylinder 52 has its rear end closed and of square formation for engagement by an adjusting wrench but has its forward end open. The cap 45 works in the cylinder 52 and in such relation constitutes in effect a plunger which compresses the air in said cylinder. The cylinder 52 forms also a component part of a removable rear end head for the casing 11 and accordingly has threaded engagement in a collar, as 53, the latter being threaded directly into the end of the casing 11. For the purpose of holding the cylinder 52 at any selected position to which it may be adjusted, a jam-nut, as 54, is provided, the nut 54 being threaded upon the cylinder 52 and engaging the end face of the collar 53, as shown more particularly in Fig. 1. The casing 11 is provided also with a removable forward head, as 55, which is threaded into the forward end of said casing and which carries a bearing gland, as 56. The head 55 constitutes also a bearing for the piston rotating mechanism and accordingly is provided with an inward axially extending hollow bearing trunnion, as 57. The relation of the piston rotating mechanism in the organized machine, is shown more particularly in Fig. 1, and the structural details of such mechanism are shown in Figs. 8 to 11. Such mechanism preferably comprises a cylindrical member, as 58, having a forwardly extended journal portion, as 59, which surrounds the bearing trunnion 57. The member 58 is keyed to the piston 6 and it will be understood that means are provided for positively rotating the member in one direction in order that the piston 6 may be correspondingly rotated. Such means comprises preferably a segmental positively driven ratchet device including a ratchet ring or segment, as 60, and a pinion ring or segment, as 61, the rings 60 and 61 rotatably surrounding the rearwardly projecting portion of the member 58. The ring 60 has its rear face formed with recesses, as 62, which receive projections, as 63, on the forward side face of the ring 61. The projections 63 are of less length than the recesses 62 and consequently a certain degree of play is provided for in the operative direction of rotation of the ratchet device. Between the projections 63 and the corresponding side faces of the recesses 62 expansive coil transmission springs, as 64, are disposed, such springs being shown in Figs. 8 and 10 and serving to yieldably connect the ring 60 for rotation with the ring 61 and to take up shocks therebetween during the operative rotation of the ratchet device. The ring 60 is formed on its forward face with ratchet teeth, as 65, for engagement with spring pressed pawls, as 66, which are set into the enlarged central portion of the member 58 and move axially thereof. The ring 61 has its rear face dished to provide for the assemblage of a locking collar or nut, as 67, which is shown more particularly in Figs. 9 and 11 and which is assembled or removed by a spanner-wrench, the collar 67 being threaded upon the end of the member 58.

The piston rotating mechanism 9 is driven by the gear train 10 which includes, in addition to the pinion 34, pinions 68 and 69, the former being in mesh with the pinion 34 and the latter being in mesh with the spur teeth 70 of the ring 61. The pinions 68 and 69 project through an opening in the upper side of the casing 11 and are mounted upon a common shaft, as 71, which is journaled in the side walls of a suitable casing, as 72, the latter being removably mounted upon the casing 11, as shown more particularly in Fig. 1. The drilling machine supporting mechanism 2 comprises a horizontal bar, as 73, and a bracket, as 74, the latter directly carrying the drilling machine. The bar 73 is mounted for sliding and pivotal adjustment upon the post 1 which is preferably of round cross section and is held upon said post by a clamping yoke of well known form and which is designated generally as 75. The bracket 74 is formed with a depending yoke, as 76, which is clamped upon the bar 73, the latter being also of round cross section in order that said bracket may have a tilting or pivotal adjustment to vary the angle at which the drill steel is presented to the rock. The bracket 74 is also formed with two spaced parallel tongues, as 77, which straddle a bolt, as 78, the latter depending from the casing 13. In order that the casing 13 may be firmly held upon said bracket, a clamping block, as 79, is provided. This block is illustrated in detail in Fig. 14 and has an opening, as 80 through which the bolt 78 loosely passes and recesses, as 81, into which the tongues 77 conformably fit. The assembled relation of these parts is shown in Fig. 1. A nut, as 82, is threaded upon the lower end of the bolt 78 for the purpose of binding the block 79 against the tongues 77 and thereby firmly securing the drilling machine to the bracket.

It will thus be seen that the adjustability of the drilling machine as an entirety to any position is universal. A straight vertical adjustment of the machine is had by properly positioning the bar 73 upon the post 1. A pivotal adjustment of the machine in a vertical plane is had by properly positioning the yoke 76 upon the bar 73. A pivotal adjustment of the machine in a horizontal

plane is had by setting the bar 73 at the desired angle with relation to the post 1. A lateral adjustment of the machine is had by properly positioning the block 79 with relation to the tongues 77 and also by moving the yoke 76 axially to any desired position upon the bar 73, and finally a forward and rearward axial adjustment of the position of the machine is had by manipulating the screw 16.

The manner of operation will be readily apparent from the foregoing description. A suitable device, as 83, is provided for starting the motor 4 and the latter through the medium of the wheels 28 and 29 rotates the cylindrical member 32. The member 32 forms an element of the plunger reciprocating mechanism, the other element of such mechanism comprising the pin 37 which is engaged in the cam groove 36 and which, by virtue of such engagement, is reciprocated when the member is rotated. The member 32 also forms an element of the means for rotating the piston, the other elements of which comprise the transmission gearing 10 and the piston rotating mechanism 9. Consequently, it will be seen that the member 32 immediately and positively produces two simultaneous movements of the piston 6, the one being a reciprocatory movement and the other being a rotating movement. The reciprocating movement of the plunger 5 is transmitted to the piston by resilient connections which comprise the springs 46 and 47 and the rotating movement of the mechanism 9 is transmitted to the piston 6 also by resilient connections, which comprise the springs 64. The spring 46 takes up the impact or shock due to any relative movement of the piston and the plunger 5 on the forward stroke thereof and the pneumatic cushioning mechanism comprising the cap 45 and the chamber 52 takes up the shock incident to the impact of the sudden rearward movement of the piston. The piston 6 is thus effectually cushioned at every stage of its operation and, by virtue of this cushioning effect, not only is the running of the machine improved, the parts operating as noiselessly and with as little friction as possible, but the life of the drill rod is materially prolonged, since the shock incident to the jamming of the drill rod in a hard seam of the rock is not transmitted suddenly or directly to the connected operating parts but indirectly and through the agency of the resilient cushioning connections aforesaid. At the same time the advantage of a positive drive and from a common driving element of both the rotating and reciprocating mechanisms is had. In case it should be necessary, the motor 25 may be stopped and the movement of the piston in either direction may be effected by hand, by reason of the provision of the wheel 35. The drill rod may also be turned by hand when necessary in the normal direction of its rotation, as in the operation of changing drill rods, in which it is desirable to position the chuck so that ready access may be had to the screw 51. This continued movement of the drill rod does not effect any movement of the other parts of the machine. The structure also presents the advantageous incidents of compendiousness, and durability and the parts thereof may be readily set up or dismantled and old or worn parts may be removed and replaced by new parts. This advantage is had by reason of the removable relation of the casings 13 and 11, 26 and 11, 30 and 11, and 72 and 11, and of the cylinder 52 and 11. It will be seen that the several casings mentioned may be stripped from the casing 11 and that, therefore, the various mechanisms are practically self-contained units.

Words of position, as "horizontal," "vertical," "upper" and "under" wherever used in the specification are to be understood as used in their relative sense and are not absolute in their meanings, such words being simply used to correspond to the arrangement as disclosed in the drawings.

The structure disclosed is to be regarded merely as exemplary of a preferred and advantageous embodiment of the invention, which, in so far as I am aware, is quite broad in its scope and admits of numerous modifications, such as fall within the terms of the appended claims.

Having fully described my invention, I claim:

1. In a rock drilling machine, in combination, a casing, a reciprocatory piston therein and carrying a drill bar, means for reciprocating the piston and an axially adjustable air cylinder mounted at the rear end of the casing and receiving and cushioning the rear end of the piston.

2. In a rock drilling machine, in combination, a casing, a piston disposed in the casing, projecting therebeyond and carrying a drill bar, piston rotating means in the casing and mounted on the piston, the casing having an opening adjacent the rotating means, piston reciprocating means in the casing and also mounted on the piston, the casing also having an opening adjacent the reciprocating means, an exteriorly disposed longitudinal shaft parallel to the piston, means for rotating the shaft, means on the shaft for operating the piston reciprocating means, the latter including an element which projects through the second opening, and gearing for operating the piston rotating means from the shaft, the gearing including elements which project through the first opening.

3. In a rock drilling machine, in combination, an elongated casing, a plunger movable

axially therein, a piston also movable axially in the casing and projecting beyond the forward end thereof, a drill bar carried by the piston, connections between the plunger and the piston whereby the former produces the movement of the latter, a gear wheel on the piston, the casing having an opening adjacent the plunger and having also an opening adjacent the gear wheel, the plunger having a stem which projects through the first opening, a second casing mounted on the first casing, a cylindrical member revolubly mounted in the second casing, and extending parallel to the piston, the cylindrical member having a peripheral cam groove, the stem of the plunger engaging in the groove, and a gear train operated by the cylindrical member and including a gear wheel which projects through the opening adjacent to the gear wheel on the piston and meshes with said gear wheel.

4. In a rock drilling machine, in combination, an elongated casing, a plunger movable axially therein, a piston also movable axially in the casing and projecting beyond the forward end thereof, a drill bar carried by the piston, connections between the plunger and the piston whereby the former produces the movement of the latter, a gear wheel on the piston, the casing having an opening adjacent the plunger and having also an opening adjacent the gear wheel, the plunger having a stem which projects through the opening, a self-contained plunger reciprocating mechanism including a casing which is removably secured on the first casing, a cylindrical member revolubly mounted in the second casing and having a peripheral cam groove in which the stem of the plunger engages and trunnions for the cylindrical member which project through the end heads of the second casing, each of the trunnions carrying a gear wheel, a motor driven gear wheel meshing with the gear wheel on one of the trunnions, a third casing mounted on the first casing, and gears in the third casing, driven by the gear wheel on the other trunnion and in turn driving the gear wheel on the piston.

5. In a rock drilling machine, in combination, a casing, a reciprocatory piston therein and carrying a drill bar, means for reciprocating the piston, a collar removably fitted in the rear end of the casing, a cup shaped piston cushioning member threaded in the collar for adjustment axially thereof, and jam nuts provided on the cup shaped member to engage the face of the collar and lock the cup shaped member against rotation.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LEE WEST.

Witnesses:
JAMES R. PAUL,
JOHN F. FEARON.