Nov. 6, 1928. 1,690,859

G. H. GILMAN

DRILLING MACHINE

Filed Aug. 10, 1921 3 Sheets-Sheet 1

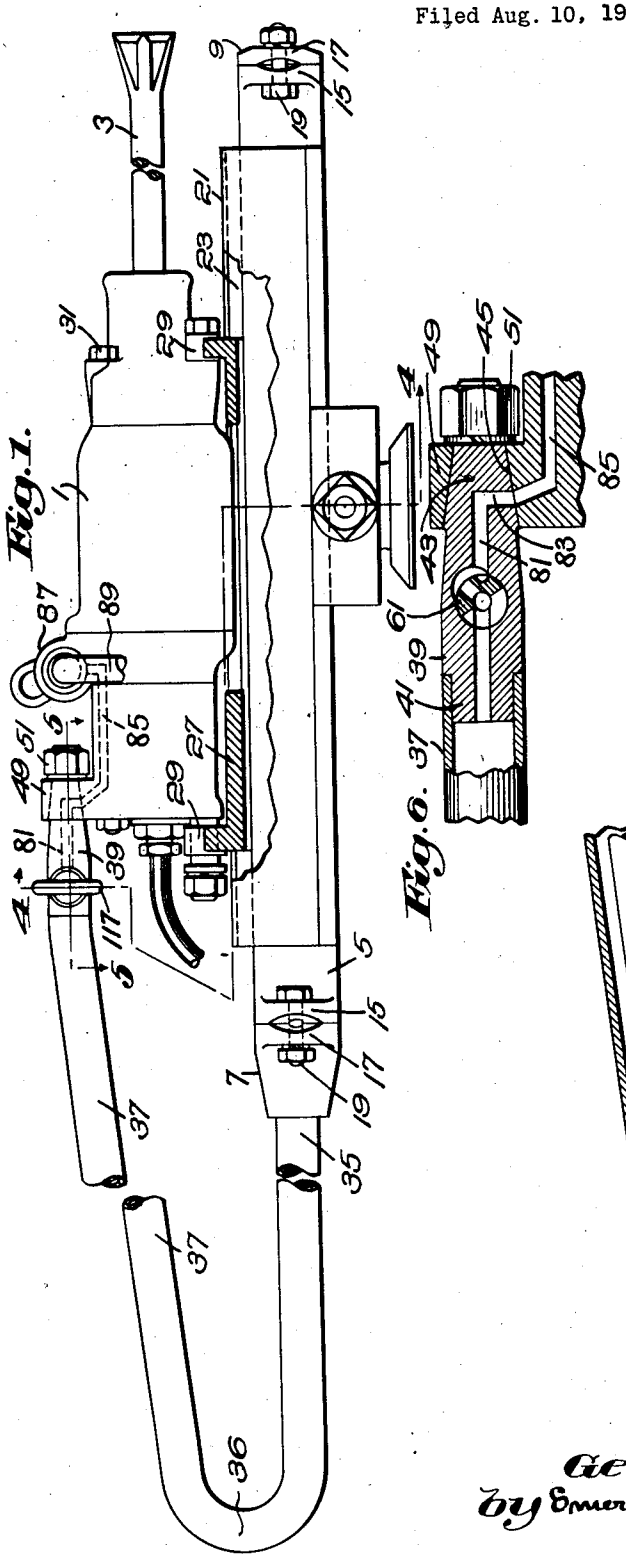


Fig. 1.

Fig. 6.

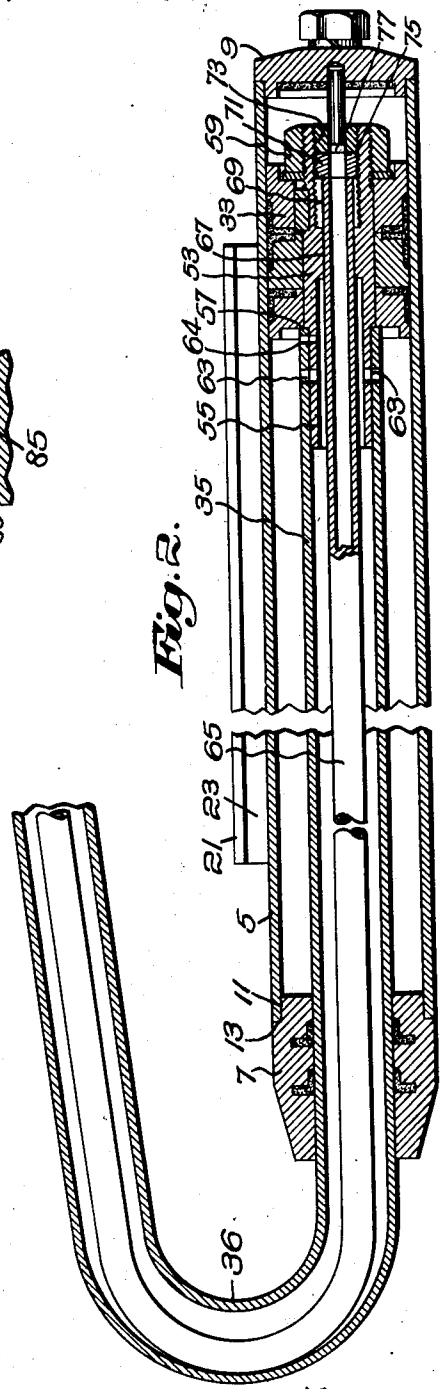


Fig. 2.

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Fig. 3.

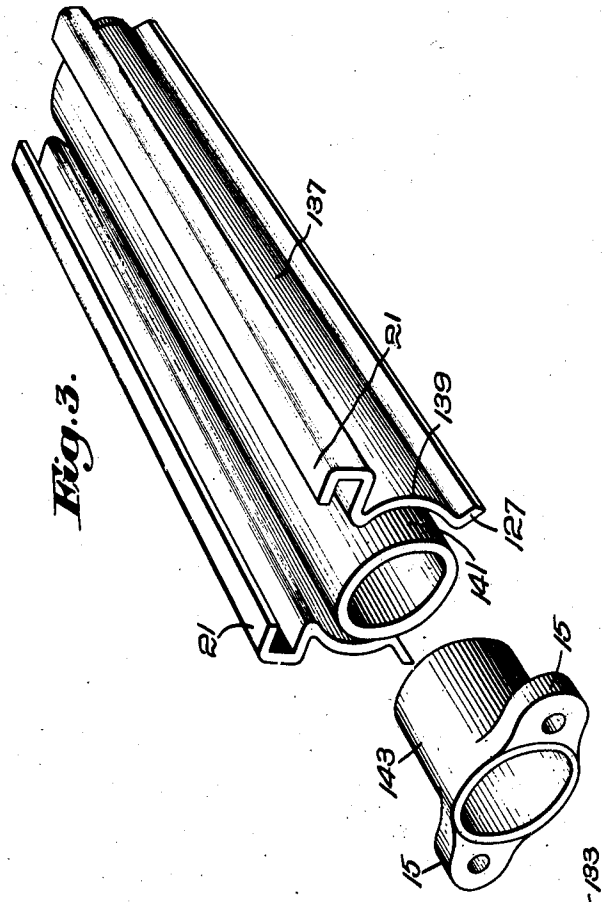
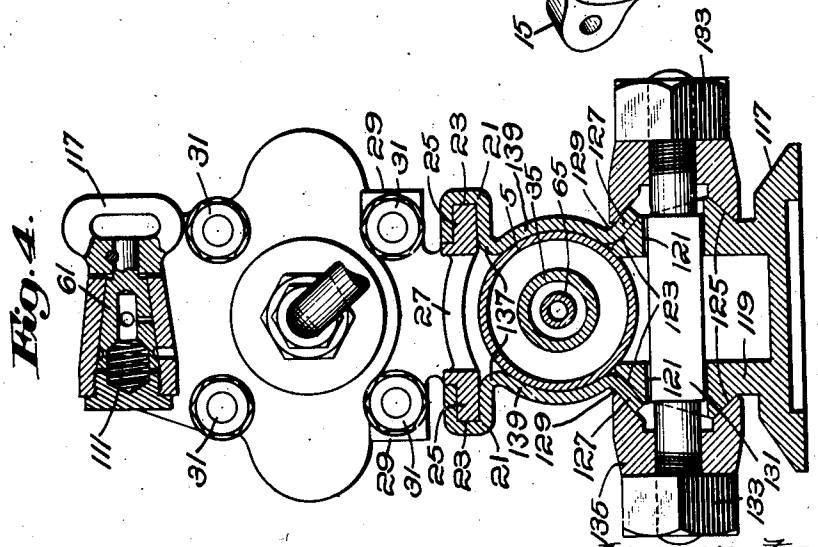


Fig. 4.



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DRILLING MACHINE

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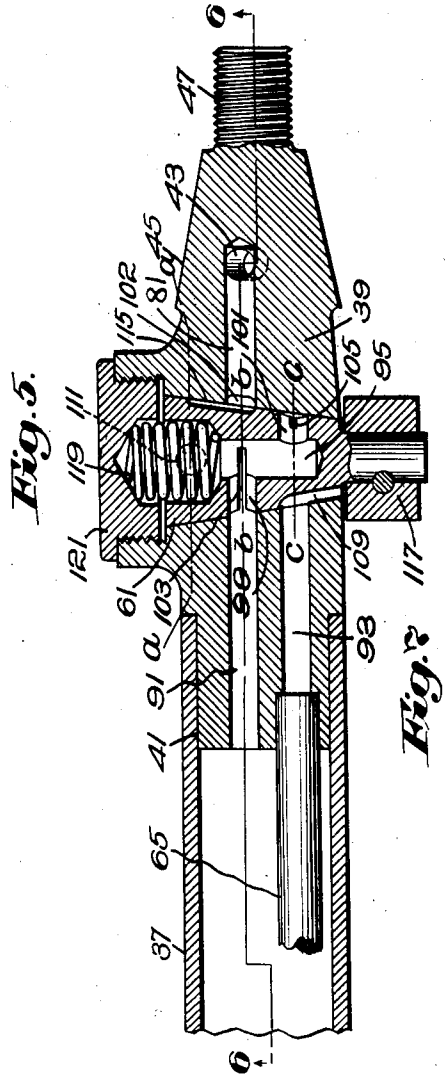


Fig. 5.

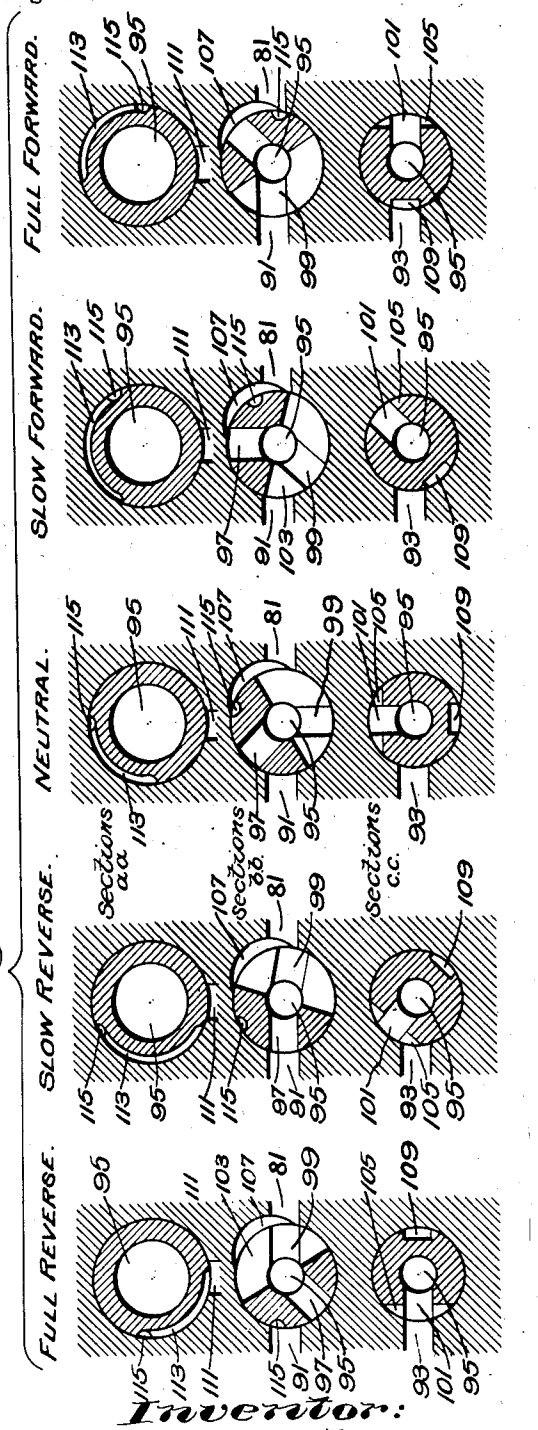


Fig. 2.

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George H. Gilman,
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Patented Nov. 6, 1928. 1,690,859

UNITED STATES PATENT OFFICE.

GEORGE H. GILMAN, OF BELMONT, MASSACHUSETTS.

DRILLING MACHINE.

Application filed August 10, 1921. Serial No. 491,136.

My invention relates to drilling machines and particularly but not exclusively to one in which the drilling engine is supported by a mounting having means for feeding the drill bit relatively to the work.

My invention will be best understood from the following description when read in light of the accompanying drawings of a specific embodiment of my invention selected for illustrative purposes, while the scope of my invention will be particularly pointed out in the appended claims.

In the drawings:—

Fig. 1 shows in elevation a breast stoper with a pneumatic feed and constructed according to my invention;

Fig. 2 is a longitudinal section of the feed cylinder and associated parts;

Fig. 3 is a perspective showing a detail of the machine;

Figs. 4 and 5 respectively are sections on the lines 4—4 and 5—5 of Fig. 1;

Fig. 6 is a section on the line 6—6 of Fig. 5; and

Fig. 7 represents the valve in its various positions, the sections corresponding to those on lines *a*—*a*, *b*—*b* and *c*—*c* of Fig. 5.

Referring to the drawings, I have shown an actuator 1 for a tool 3. The actuator and tool may be of any suitable type and as shown I have indicated the actuator as a fluid pressure operated impact engine and the tool as a rock drill bit.

The drill actuator is provided with a mounting which may be of any suitable type and as shown comprises a cylinder and piston, the latter being attached to the actuator for moving it along guide-ways supported by the cylinder.

As shown, the cylinder comprises the tubular structure 5 with front and rear heads 7 and 9, the latter being provided with reduced diameter portions 11 which enter the ends of the tubular structure and provide shoulders 13 abutting the ends thereof. At each end the tubular structure is provided with oppositely extending perforated ears 15 and each cylinder head with similarly constructed and arranged ears 17. Through the perforations of the adjacent ears I pass the bolts 19 for holding the cylinder heads and tubular structure in assembled relation.

For supporting the actuator, I provide the guide-ways 21 each providing a longitudinally extending slot 23 receiving the guide members 25 of the actuator. Although the guide members 25 may be formed integrally with the casing of the actuator I have shown them as comprising part of the cradle 27, the cradle having at opposite ends pairs of upstanding perforated ears 29 through the perforations of which I pass two of the four side bolts 31 of the actuator for securing the parts together.

Sliding in the cylinder I mount the feed piston which comprises the piston head 33 and the piston rod 35, the latter being in the form of a tube which extends through the rear cylinder head and is provided with the return bend 36 and a portion 37 connected to the actuator.

For connecting the portion 37 of the rod 35 to the actuator I provide the member 39 having a reduced diameter portion 41 received by the end of the portion 37 and welded thereto. At its opposite end the member 39 is formed to provide a plug 43 having the tapered frusto-conical surface 45 and the screw-threaded extremity 47. The actuator I provide with the upstanding lug 49 in which is formed a tapered socket for receiving the plug. The nut 51 carried on the screw-threaded portion 47 of the member 39 serves to draw the plug into the socket and rigidly hold it there. At its opposite end the tube 35 is welded to a member 53, the exterior diameter of the intermediate portion of the latter being intermediate the exterior and interior diameters of the tube 35 so that when the reduced diameter portion 55 of the member 53 is inserted into the end of the tube a shoulder 57 results, against which the piston head is held by the nut 59 engaging the exterior screw-threads formed on the opposite end of the member 53.

For controlling movement of the feed piston I locate in the member 39 a controlling valve 61, by which I am able to supply motive fluid to the ends of the feed cylinder. For conducting the motive fluid used at the rearward end of the feed cylinder I utilize the passage afforded by the interior of the tube 35, which interior is placed in communication with the rear end of the cylinder by means of the passages 63 and 64 formed through the piston. For conducting the motive fluid for the forward end of the cylinder I employ a tube 65 mounted interiorly of the tube 35. At its upper end

the tube 65 is connected to the member 39 and at its lower end fits in a fluid tight manner the reduced interior diameter portion 67 of the member 53. The front end of the member 53 is provided with a screw-threaded socket 69 in which is placed the nut 71 adapted to be forced against the tube. Rearwardly of the nut 71 is a lock-nut 73 carried by the socket and adapted to be forced against the nut 71. The tube 65 is somewhat flexible and is bent with the tube 35. At its intermediate portion the tube 65 rests against the wall of the return-bend 36 of the rod being forced into this position by the nut 71. By this construction the tube is supported against vibration. Motive fluid admitted to the tube 65 discharges into the forward end of the feed cylinder through the perforations 75 and 77 of the nuts, the rear end of the passage afforded by the tube and perforations being restricted when the piston approaches the forward end of its stroke by the cushion plug 79 carried by the front cylinder head, which plug is arranged to enter said passage and is of diameter slightly less than the passage.

The valve 67 for controlling the feed cylinder is of the frusto-conical turning plug type and is located in a similarly shaped valve seat in the member 39. Opening through one side of the valve seat is a passage 81 arranged longitudinally of the member 39 and placed in communication by means of a radial passage 83 with a passage 85 formed in the casing of the actuator and leading to the end of the valve casing 87 for the controlling valve of the actuator. The end of the passage 85 terminates in the valve casing 87 in such manner that it is in permanent communication with the air hose connection 89 supplying the actuator with motive fluid. Opening into the side of the valve seat opposite the passage 81 is a passage 91 formed in the member 39 and in communication with the tube 35 and spaced therefrom is a passage 93 opening through the valve seat and in communication with the interior of the tube 65. The valve is provided with an axial passage 95 which in the plane of the passages 81 and 91 is placed in communication with the exterior of the valve by means of angularly spaced radial passages 97 and 99, while in the plane of the passage 93 it is placed in communication with the exterior of the valve by means of the radial passage 101. Intersecting the passages 99 and 101 are narrow slots 103 and 105 forming restricted passages and in the valve seat is formed a groove 107 of limited angular extent in communication with the passage 81. On the side of the valve opposite the passage 101 is provided a longitudinal groove 109 terminating in the same plane as the passage 101 and opening through the end of the valve to the atmosphere. At the end of the valve opposite the groove 109 I provide the passage 111 formed in the valve casing and placing the valve seat in permanent communication with the atmosphere. In the same plane as the passage 111 I provide the valve with an arcuate groove 113 and in communication therewith the longitudinal groove 115 which extends toward the center of the valve and terminates in the plane of the passage 81. For operating the valve I provide a valve handle 117 and for holding the valve to its seat the compression spring 119 which abuts at one end the valve casing bonnet 121 and at its other end the valve.

The operation of the valve is best illustrated by Fig. 7 which shows five positions of the valve represented by sections *a*—*a*, *b*—*b*, and *c*—*c* of Fig. 5. The operation is as follows:

In the neutral position it will be noted that neither the supply passage 81 is connected to either the passage 91 or 93 nor are the latter connected to the atmosphere. If it is desired to move the drill bit toward the work the valve is turned clockwise to the position of the valve indicated as "Slow forward". In this position the passage 81 supplies motive fluid to the passage 91, and therefore to the rearward end of the feed cylinder, by way of the groove 107, radial passages 97 and 99 and the slot 103. In this position, the forward end of the feed cylinder may be exhausted by means of the groove 109 which may be placed more or less in communication with the passage 93 depending on the exact position in which the operator places the valve. Under these conditions, the feed piston is fed slowly forward due to the restricted admission of fluid to the rear end of the cylinder afforded by the slot 103 and the more or less restricted exhaust through the groove 109. When it is desired to feed the bit forward with the maximum force, the valve is moved from the "Slow forward" position to the "Full forward" position as illustrated by Fig. 7. Under these conditions the passage 99 is in full communication with the passage 91 and the groove 109 in communication with the passage 93 which permits a full supply of motive fluid to the rear end of the cylinder and a free exhaust from the front end of the cylinder.

When the drill bit is to be retracted from the work the valve is moved counterclockwise from the neutral position. Two of the retracting positions are illustrated in Fig. 7 by the positions indicated "Slow reverse" and "Full reverse". In the "Slow reverse" position both the passages 91 and 93 and therefore the rear and front ends of the feed cylinder are in communication with the pas-

sage 81, which causes the feed piston to be moved rearwardly owing to the fact that the forward effective area of the piston is greater than the rearward effective area of the piston. In the "Slow reverse" position the passage 81 supplies the axial passage of the valve with motive fluid by way of the radial passage 99 and from the axial passage the motive fluid is supplied to the passage 91 by way of the radial passage 97 and to the passage 93 by way of the radial passage 101 and the restricted passage afforded by the slot 105. It will be noted that in the "Slow reverse" position the front end of the cylinder is in restricted communication with the source of motive fluid supply and that this in addition to the differential action causes a slow movement of the feed piston. If the bit is to be retracted with the maximum of force the valve is moved to the position indicated in Fig. 7 as "Full reverse". In moving to this position from the "Slow reverse" position the slot 105 has been moved away from the passage 93 and the passage 101 moved into full communication with the passage 103 to supply a full amount of motive fluid to the forward end of the feed cylinder. Also in such position the groove 115 is moved into communication with the passage 91 and thus the rear end of the feed cylinder is connected to the atmosphere by way of said groove, the groove 113 and the passage 111. It will be understood that in each of the positions illustrated by Fig. 7, the supply of motive fluid and the exhaust thereof may be more or less varied by slightly moving the valve away from said positions.

For purposes of support, the machine is attached in swivelled relation to a suitable standard as for example a tripod or mine-column. For this purpose I provide a member having the frusto-conical trunnion 117 and a body 119 transversely perforated at 121 and provided at each side with a projection having oppositely inclined surfaces 123 and 125 The feed cylinder I provide with longitudinally extending guideways 127 having each a surface fitting the surface 123 and parallel thereto an opposite surface 129. Extending through the perforations 121 I provide a stud bolt 131 having screw-threaded end portions carrying the nuts 133. On the ends of the stud bolt in position to be engaged by the nuts I provide clips 135 each provided with oppositely inclined surfaces, one of which engages the surface 129 of one of the guide ways 123 and the other one of the surfaces 125. By means of this construction the trunnion may be positioned at any desired point longitudinally of the feed cylinder and may be clamped in such position by means of the nuts 133 and the bolt 131 which, when tightened, act to draw the clips toward each other to clamp the contacting surfaces of the latter and of the clips and guide-ways firmly together. I have shown the two guideways 21 and the two guide-ways 127 formed separately from the feed cylinder and secured thereto as for example by welding. More than one of the four guide ways may be formed of the same piece of metal as, for example, pairs of guide-ways may be formed of the same piece, and, as shown, I have provided metal strips 137 each of which forms one of the guide ways 21 and one of the guide ways 127 and is provided with a connecting portion 139 shaped to conform to the outer surface of the cylinder. These strips may be of any suitable material and formed in any suitable way for example I have found it practical to use for this purpose sheet metal which may be formed or shaped in any suitable manner as for example by pressing, drawing, rolling, extrusion or the like.

The body of the feed cylinder I have indicated as formed of a length 141 of tubular stock, which stock may be formed in any usual or suitable manner as for example may be drawn to form an integral tubular sheet of metal. For convenience of manufacture the end portions 143 of the cylinder are formed separately in order that the ears 15 and other portions of the end may be easily machined. The end portions 143 of the feed cylinder and body portion 141 I have secured by butt-welding. For example, the four pieces indicated in Fig. 3 may be placed together with the tube 141 projecting slightly beyond the ends of the strips 137 and by means of an electric weld the ends of the portions 141 and 143 of the strips 139 may be all secured together.

Although I have described for purposes of illustration one specific embodiment of my invention, it is to be understood that I am not limited thereby to its particular details and that within the scope of my invention wide deviations may be made from this embodiment without departing from the spirit of my invention.

Claims:

1. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a relatively thin walled tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said percussive tool for moving the latter relative to said cylinder, means slidably supporting said percussive tool on said cylinder and slidably supporting said cylinder on said fixture comprising four spaced ways extending longitudinally of said cylinder parallel to the axial line thereof, said ways formed of relatively thin sheet metal parts having portions conforming to the surface of said tube and welded thereto and portions extending away from the sur-

face of said tube for connecting the percussive tool to said cylinder and said cylinder to said fixture.

2. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a relatively thin walled tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said percussive tool for moving the latter relative to said cylinder, means slidably supporting said percussive tool on said cylinder and slidably supporting said cylinder on said fixture comprising four spaced ways extending longitudinally of said cylinder parallel to the axial line thereof, said ways in pairs formed integrally of relatively thin sheet metal parts having portions respectively disposed at opposite portions of said tube conforming to the surface thereof and welded thereto and having portions extending away from the surface of said tube for connecting the percussive tool to said cylinder and said cylinder to said fixture.

3. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a relatively thin walled tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said percussive tool for moving the latter relative to said cylinder, means slidably supporting said percussive tool on said cylinder and slidably supporting said cylinder on said fixture comprising four spaced ways extending longitudinally of said cylinder parallel to the axial line thereof, one pair of said ways being at the top of said cylinder for connecting said percussive tool thereto and the other pair being at the bottom of said cylinder for connecting said fixture thereto, the two ways at each of opposite sides of said cylinder being formed integrally of relatively thin sheet metal parts having portions conforming to the surface of said tube and welded thereto.

4. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a relatively thin walled tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said percussive tool for moving the latter relative to said cylinder, means slidably supporting said percussive tool on said cylinder and slidably supporting said cylinder on said fixture comprising four spaced ways extending longitudinally of said cylinder parallel to the axial line thereof, one pair of said ways being at the top of said cylinder for connecting said percussive tool thereto and another pair being at the bottom of said cylinder for connecting said fixture thereto, said ways being formed of relatively thin sheet metal parts having portions conforming to the surface of said tube and welded thereto and other portions extending away from said tube, and the ways of one of said pairs of ways being formed integrally with each other.

5. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a relatively thin walled tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said percussive tool for moving the latter relative to said cylinder, means slidably supporting said percussive tool on said cylinder and slidably supporting said cylinder on said fixture comprising a plurality of ways formed integrally of relatively thin sheet metal parts having portions conforming to the surface of said tube and welded thereto and portions extending away from said tube for connecting said percussive tool to said cylinder and said cylinder to said fixture, said ways being disposed parallel to the axial line of said cylinder.

6. A hammer rock drill having, in combination, a percussive tool carrying a drill steel, feeding means for said steel comprising a relatively thin walled tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said percussive tool for moving the latter relative to said cylinder, means slidably supporting said percussive tool on said cylinder comprising a pair of ways extending longitudinally of said cylinder parallel to the axial line thereof, said ways formed integrally with each other of relatively thin sheet metal parts having portions conforming to the surface of said tube and welded thereto and portions extending away from said tube for connecting said percussive tool to said cylinder.

7. A hammer rock drill having, in combination, a percussive tool carrying a drill steel, feeding means for said steel comprising a relatively thin walled tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said percussive tool for moving the latter relative to said cylinder, means slidably supporting said percussive tool on said cylinder comprising a pair of ways extending longitudinally of said cylinder parallel to the axial line thereof, said ways formed of relatively thin sheet metal parts having portions conforming to the surface of said tube and welded thereto and portions extending away from said tube for connecting said percussive tool to said cylinder.

8. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said drill steel slidably supporting said percussive tool and being slidably supported by

said fixture, said feeding means comprising four spaced ways arranged parallel to the axial line of said percussive tool, a pair of said ways being connected to said percussive tool and a pair to said fixture, and said ways in pairs being formed integrally with each other of relatively thin sheet metal parts, and means holding the ways of the two integrally formed pairs of ways in assembled relation with said tube as a unit.

9. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said drill steel slidably supporting said percussive tool and being slidably supported by said fixture, said feeding means comprising a plurality of spaced ways formed integrally as a whole of relatively thin sheet metal having guide portions for connection to said percussive tool and fixture respectively and portions connecting said guide portions, said ways and tube as a unit being secured in assembled relation.

10. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said tool for moving it relative to said cylinder, means slidably supporting said tool on said cylinder and slidably supporting said cylinder on said fixture comprising four spaced ways extending longitudinally of said cylinder parallel to the axial line thereof, said ways having portions conforming to the surface of said tube welded thereto and portions extending away from the surface of said tube for connecting said tool to said cylinder and the latter to said fixture.

11. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said tool for moving it relative to said cylinder, means slidably supporting said tool on said cylinder and slidably supporting said cylinder on said fixture comprising four spaced ways extending longitudinally of said cylinder parallel to the axial line thereof, said ways in pairs formed integrally with each other and having portions respectively disposed at opposite portions of said tube conforming to the surface thereof and welded thereto, said ways having other portions extending away from the surface of said tube for connecting said tool to said cylinder and the latter to said fixture.

12. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said tool for moving it relative to said cylinder, means slidably supporting said tool on said cylinder and slidably supporting said cylinder on said fixture comprising a plurality of ways formed integrally with each other and having portions conforming to the surface of said tube and welded thereto.

13. A hammer rock drill having, in combination, a percussive tool carrying a drill steel, a feed cylinder and feed piston, means operatively connecting said piston and tool for moving the latter relative to said cylinder, said cylinder slidably carrying said tool independently of said means and also carrying means for attachment to a support, said cylinder comprising a tube constituting the barrel thereof and a pair of spaced ways formed integrally with a part connecting said ways, said part extending lengthwise of said tube and conforming to the surface thereof substantially throughout the length of the tube and being welded thereto.

14. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said tool for moving it relative to said cylinder, means slidably supporting said tool on said cylinder and slidably supporting said cylinder on said fixture comprising four spaced ways extending longitudinally of said cylinder parallel to the axial line thereof, said ways and tube as a unit secured in assembled relation with the ways distributed around said tube.

15. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said tool for moving it relative to said cylinder, means slidably supporting said tool on said cylinder and slidably supporting said cylinder on said fixture comprising four spaced ways extending longitudinally of said cylinder parallel to the axial line thereof, said ways in pairs formed integrally with each other and said ways and tube as a unit secured in assembled relation.

16. A hammer rock drill having, in combination, a supporting fixture, a percussive tool carrying a drill steel, feeding means for said steel comprising a tube constituting the barrel of a feed cylinder, a piston in said cylinder operatively connected to said tool for moving it relative to said cylinder, means slidably supporting said tool on said cylinder and slidably supporting said cylinder on said fixture comprising a plurality

of ways formed integrally with each other, and said ways and tube as a unit secured in assembled relation.

17. In a drilling machine, a feeding device comprising a cylinder element and piston element one of which is movable, a drill actuator, means connecting said actuator with said movable element comprising a part movable with said actuator and providing a tapered socket, a tapered plug secured to the movable element of said feeding device, said plug fitting said socket and secured thereto, a valve carried by said plug and controlling fluid for both ends of said cylinder, and a single passage opening through the contacting surfaces of said plug and socket for connecting said valve to a source of fluid supply.

18. A rock drill having in combination, a drill steel, a hammering engine for actuating said steel, a tubular feed cylinder having a relatively thin cylindrical wall, sheet metal members at opposite sides of said cylinder having portions conforming to the walls of said cylinder and welded thereto, said sheet metal members being bent at their upper edges to form open sided channels extending longitudinally of said cylinder, a cradle sliding in said channels, means for securing said hammering engine to said cradle, a piston in said feed cylinder, and means for causing said piston to move said cradle along said channels comprising a substantially U-shaped rod having one leg secured to said piston and projecting from the rear end of said cylinder.

19. A rock drill having in combination, a drill steel, a hammering engine for actuating said steel, a tubular feed cylinder having a relatively thin cylindrical wall, sheet metal members at opposite sides of said cylinder having portions conforming to the walls of said cylinder and welded thereto, said sheet metal members being bent at their upper edges to form open sided channels extending longitudinally of said cylinder, a cradle sliding in said channels, means for securing said hammering engine to said cradle, a piston in said feed cylinder, means for causing said piston to move said cradle along said channels comprising a substantially U-shaped rod having one leg secured to said piston and projecting from the rear end of said cylinder, said sheet metal members having portions at their lower edges bent to form ways, and a fixture for securing said machine to a support slidably secured to said ways.

In testimony whereof, I have signed my name to this specification.

GEO. H. GILMAN.