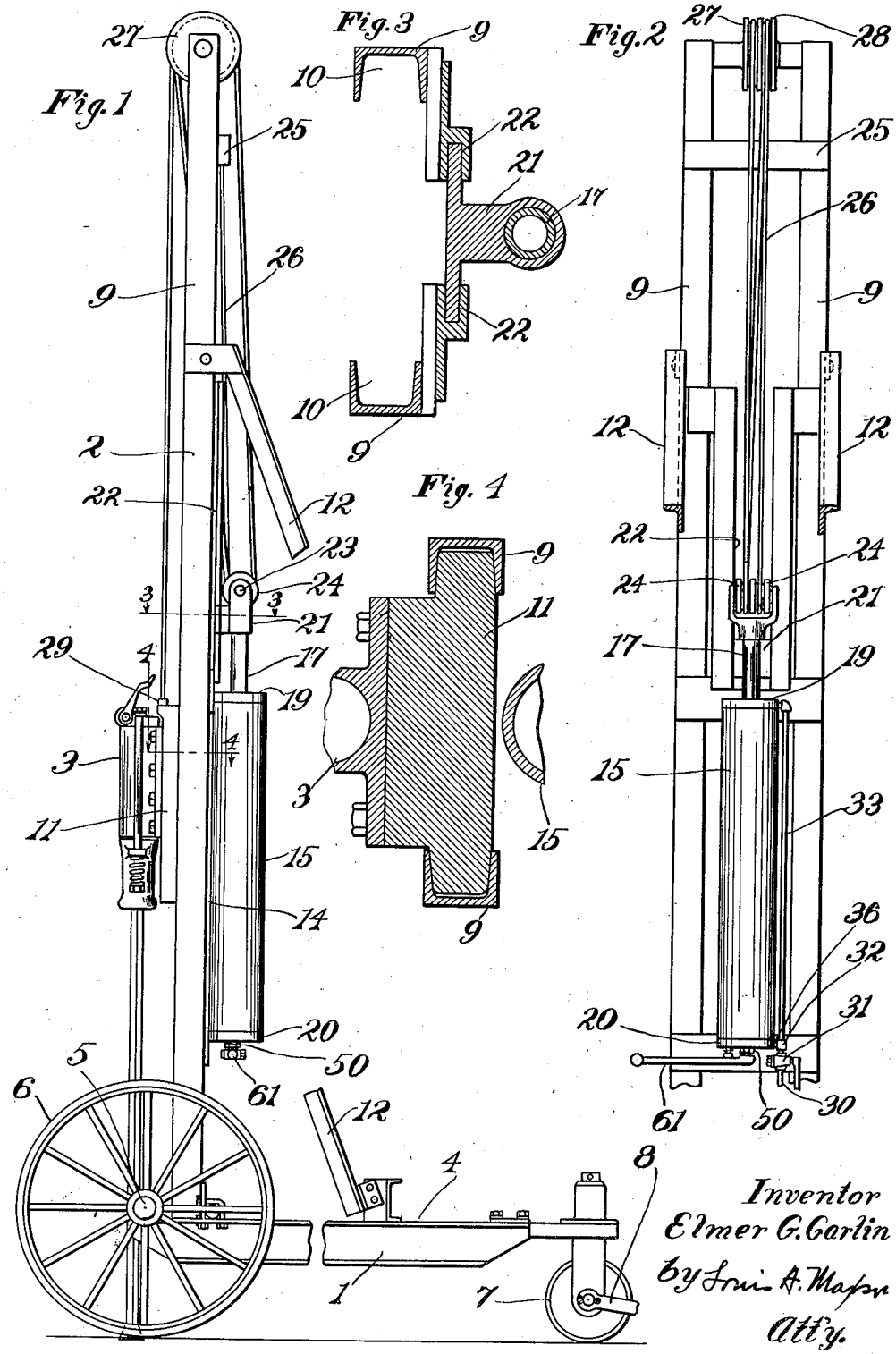
June 1, 1937. E. G. GARTIN 2,081,921

ROCK DRILL FEEDING MECHANISM

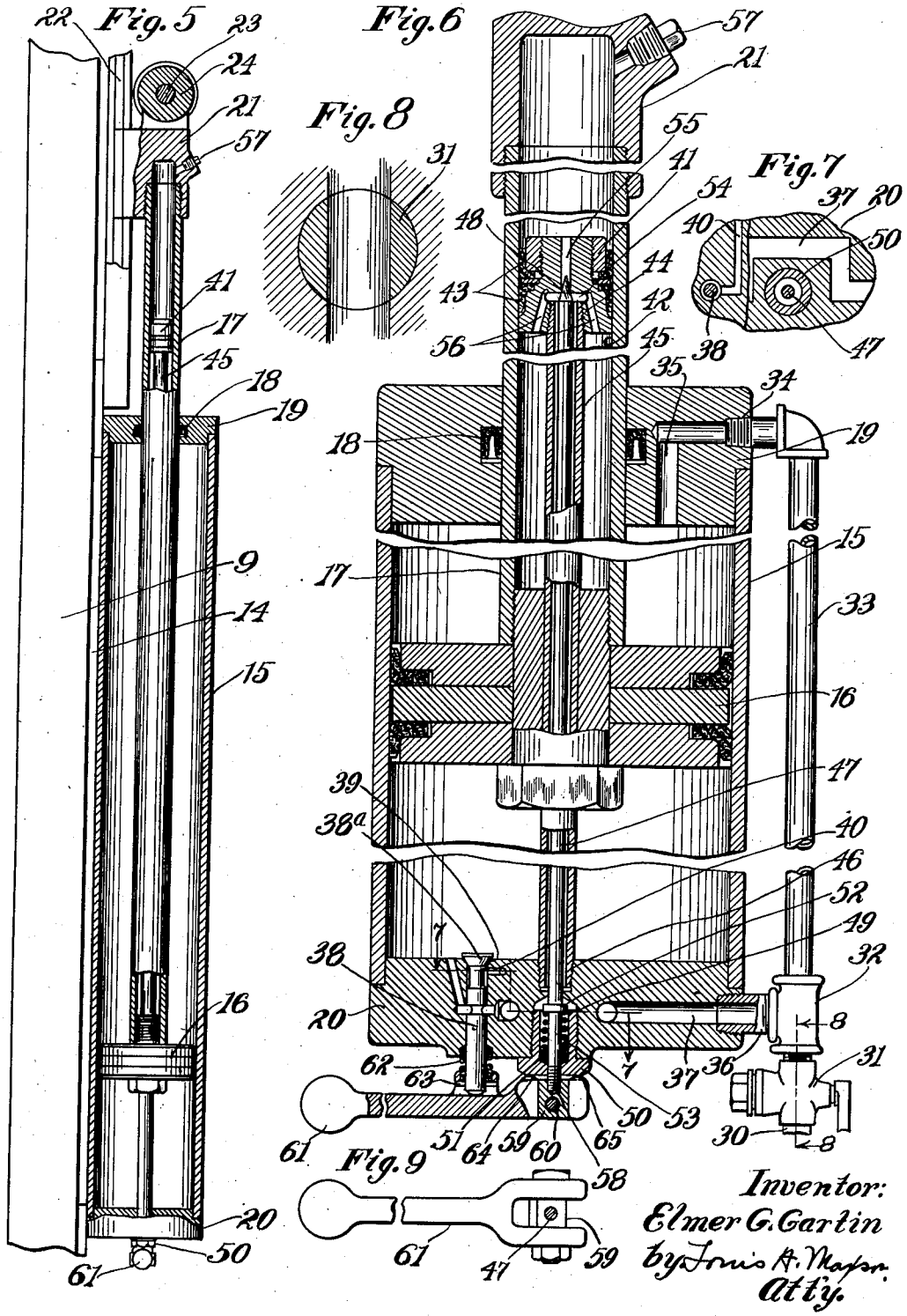
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ROCK DRILL FEEDING MECHANISM

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ROCK DRILL FEEDING MECHANISM

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Fig. 10

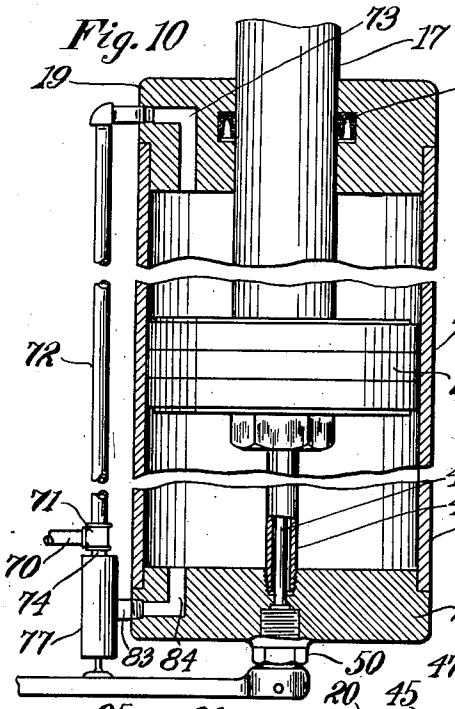


Fig. 11

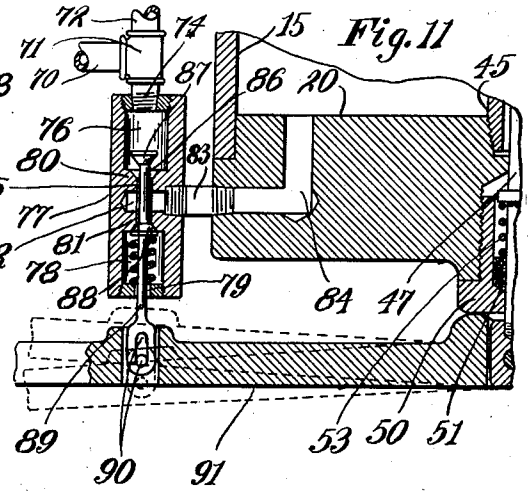


Fig. 12

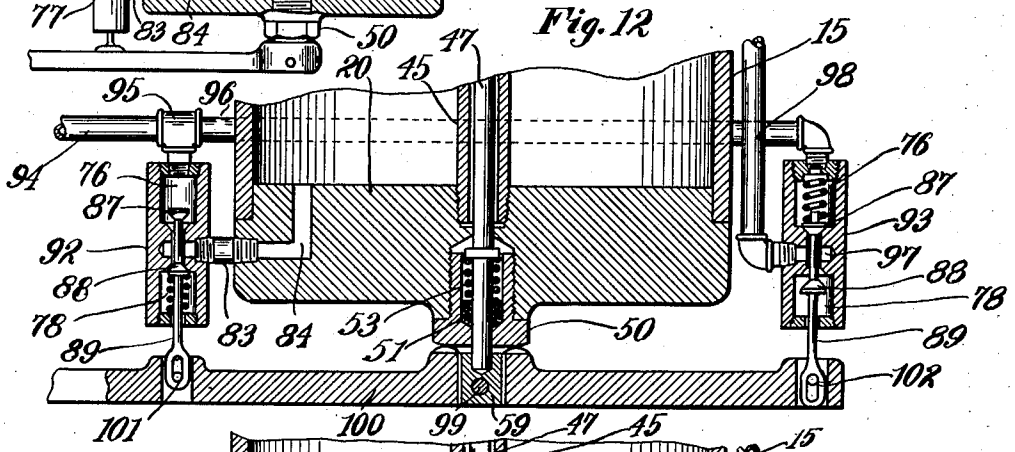


Fig. 13

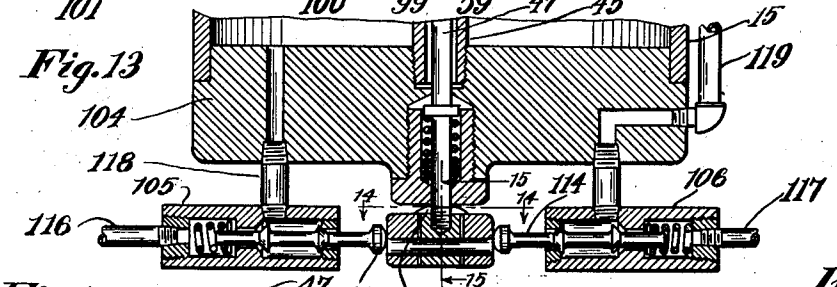


Fig. 15

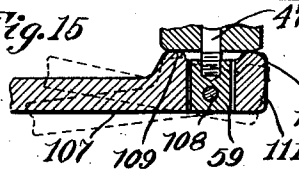
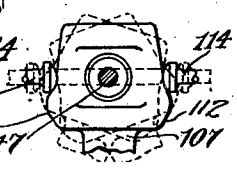


Fig. 14



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UNITED STATES PATENT OFFICE

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ROCK DRILL FEEDING MECHANISM

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Application August 22, 1934, Serial No. 740,976

10 Claims. (Cl. 121—9)

This invention relates to rock drills, and more particularly to improvements in the feeding mechanism of such drills.

An object of this invention is to provide an improved rock drill feeding mechanism. Another object is to provide an improved feeding mechanism for a rock drill of the mounted type, supported and guided for feeding movement along a guideway. Still another object is to provide an improved feeding mechanism for a rock drill of the mounted "tower" type for feeding the rock drill vertically along the guide tower. A further object is to provide an improved pneumatic feeding mechanism for a rock drill and having associated therewith improved liquid displacement means for controlling the action of the pneumatic feeding mechanism. A still further object is to provide an improved liquid-dashpot control means for a pneumatic feeding mechanism and having associated therewith improved valve controlling means for controlling the pneumatic pressure and the flow of liquid. These and other objects will, however, hereinafter more fully appear.

In the accompanying drawings there are shown for purposes of illustration several forms which the invention may assume in practice.

In these drawings,—

Fig. 1 is a side elevational view of a tower mounted drill with which one illustrative form of the improved feeding mechanism is associated.

Fig. 2 is a front elevational view of the guide tower and drill shown in Fig. 1.

Fig. 3 is a cross sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is a cross sectional view taken on line 4—4 of Fig. 1.

Fig. 5 is a fragmentary side elevational view, with parts in longitudinal vertical section, showing details of construction of the improved feeding mechanism.

Fig. 6 is an enlarged vertical sectional view taken through the feeding mechanism shown in Fig. 5.

Fig. 7 is a detail sectional view taken on line 7—7 of Fig. 6.

Fig. 8 is a cross sectional view through the main throttle valve.

Fig. 9 is a detail view showing the control lever for the pressure fluid and liquid displacement means.

Fig. 10 is a view similar to Fig. 5 showing a modified form of construction.

Fig. 11 is an enlarged fragmentary vertical sectional view through the mechanism shown in Fig. 10.

Fig. 12 is a view similar to Fig. 11 showing a further modified form of construction.

Fig. 13 is a view similar to Figs. 11 and 12 showing still another modified form of construction.

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

Fig. 15 is a detail sectional view taken on line 15—15 of Fig. 13.

As shown in the drawings, the several forms of the improved feeding mechanism are shown embodied in a rock drilling mechanism of the tower mounted, self-feeding type particularly designed for use in quarry work, although it will be evident that the improved structure constituting the features of this invention may be incorporated in drills of various other types. The drilling mechanism disclosed herein with which the feeding mechanism of all forms of the invention is associated comprises a wheeled carriage 1 having a tower support and guide herein in the form of a standard 2 mounted thereon and on which a hammer rock drill 3 of a standard design is supported and guided for feeding movement in a longitudinal direction therealong. The wheeled carriage 1 comprises a frame 4 herein generally triangular in shape supported on an axle 5 for the carriage wheels 6 and having at the point of its triangle a caster wheel 7 and a suitable draft connection 8 whereby the entire drilling unit may be towed from place to place. The standard 2 comprises parallel vertical channel irons 9, 9 forming parallel vertical guideways 10, 10 in which is slidably guided a carriage member 11, herein in the form of a weight, to which the rock drill support is secured. The channel irons 9, 9 of the guide tower 2 are braced with respect to the carriage frame 4 by means of diagonal brace rods 12.

Now referring to the illustrative form of the improved feeding mechanism and its associated liquid displacement means shown in Figs. 1 to 9, inclusive, it will be noted that secured to a plate 14 in turn secured to the vertical channel irons 9, 9 of the guide tower at the side of the latter opposite from the drill 3 is a vertically arranged feed cylinder 15 containing, as shown in Figs. 5 and 6, a reciprocable feed piston 16. Suitably secured to this feed piston is an upwardly extending tubular feed piston rod 17 passing through a stuffing box 18 carried within the top head 19 of the cylinder. The lower end of the cylinder is closed by a bottom head 20 and the heads 19 and 20 are secured to the ends of the cylinder

in any suitable manner. The upper end of the tubular piston rod 17 is threadedly connected to a sliding crosshead 21 guided, as shown in Fig. 3, in vertically extending parallel guideways 22, 22 suitably secured to the channel irons 9, 9. This sliding crosshead 21 has mounted thereon a horizontal shaft 23 on which is journaled a pair of guide sheaves 24. Secured at 25 to one of the channel irons is a cable 26 which extends around one of the pulleys 24 carried by the sliding crosshead and then passes upwardly around a guide sheave 27 journaled on the upper end of the guide tower. This cable passes from the guide sheave 27 down in the manner of a double loop around the second sheave 24 carried by the sliding crosshead and then passes upwardly around a parallel pulley 28 carried by the guide tower, the free end of this cable extending from the pulley 28 downwardly into connection at 29 with the sliding drill carriage 11. It will thus be seen that the pulleys and cable form a double loop speed multiplying connection between the feed piston and drill carriage so that when the feed piston moves within its cylinder a certain distance the drill carriage moves along the guide tower a distance four times greater. In other words, every inch the feed piston moves within its cylinder the drill carriage moves along the guide tower a distance of four inches. Pressure fluid, herein air under pressure, is supplied through a pipe connection 30 leading to any suitable source of pressure fluid supply under the control of a main throttle valve 31 to a T 32. Pressure fluid is supplied through the T 32 to a pipe connection 33 connected at 34 within the top cylinder head 19 and communicating through a passage 35 with the upper end of the cylinder bore at the upper side of the feed piston. The T 32 is also connected through a pipe connection 36 to a passage 37 formed in the lower head 20 and communicating under the control of a slide or plunger valve 38, with the lower end of the cylinder bore at the lower side of the feed piston. Formed on the plunger valve 38 is an end seating valve 38a engageable with a seat 39 for controlling the flow of pressure fluid from the lower end of the cylinder bore through an exhaust passage 40 leading to atmosphere. When the main throttle valve 31 is open as shown in Fig. 8, pressure fluid flows continuously through the pipe connection 33 and passage 35 to the upper end of the cylinder bore and through pipe connection 36 and passage 37 to the lower end of the cylinder bore. When the valve 38a is slid upwardly the supply of pressure fluid to the lower end of the cylinder is cut off and this latter end of the cylinder is vented to atmosphere past the valve 38a and exhaust passage 40.

The improved liquid displacement means for controlling the pneumatic feeding motor to regulate the rate of feed comprises a piston 41 contained in a displacement cylinder 42 formed in the tubular feed piston rod 17 and this piston carries oppositely arranged cup packings 43 to prevent leakage past the piston. Secured as by threading at 44 within the feed piston is a tubular piston rod 45 extending centrally through the tubular feed piston rod into threaded engagement at 46 at its lower end within the lower cylinder head 20. Arranged centrally within the tubular piston rod 45 is an axially movable plunger rod 47 having formed at its upper end a needle valve 48. Threaded at 49 within the lower cylinder head 20 is a bushing 50 carrying packing 51 sealing the lower end of the rod 47 and interposed between this packing and a collar 52 on the rod and arranged in the bushing 50 is a coiled spring 53. Formed in the piston 41 is a chamber 54 which is communicable through an axial passage 55 with the cylinder bore 42 at the upper side of the displacement piston 41 and through passages 56 with the bore 42 beneath the displacement piston 41. Carried by the sliding crosshead 21 is a filler plug 57 which may be removed to permit filling of the bore 42 with a suitable liquid such as oil.

Now referring to the operating means for the fluid and liquid control valves it will be noted that the lower end of the rod 47 is threaded at 58 within a member 59 in the form of a block on which is pivotally connected as by a pin 60 an operating lever 61. The outer end of the plunger valve 39 is engageable with the lever 61, and this valve and the valve 38 are constantly urged toward their outermost position by a coiled spring 62 interposed between the cylinder head 20 and a pin 63 carried by the plunger valve stem. The hub of the lever 61 is provided with projections 64 and 65 having curved surfaces engageable with the lower plane surface of the bushing 50. When the lever 61 is swung downwardly from the position shown in Fig. 6, it rocks about the projection 65 thereby to move the needle valve rod 47 downwardly while the valve 38a is maintained closed by the spring 62 with the passage 37 open. When the lever 61 is rocked upwardly about the projection 64, the needle valve rod 47 is likewise moved downwardly while at the same time the plunger valve 38 is moved upwardly to unseat the valve 38a and close the passage 37. When the lever 61 is in the position shown in Fig. 6 and the throttle valve 31 is open, pressure fluid is supplied to the opposite ends of the feed cylinder 15 at the opposite sides of the feed piston in the manner above described. Due to the differential areas at the opposite side of the piston, the upper area being the smaller, the pressure fluid acts on the lower piston area with an upward feeding tendency. When the needle valve of the liquid displacement means is in the position shown in Fig. 6, no liquid can flow from the upper side of the displacement piston to the opposite side of the latter, so the pressure fluid acting on the lower side of the feed piston 16 is prevented from moving this piston upwardly. When the lever 61 is rocked relative to the bushing 50 the rod 47 is moved downwardly thereby to unseat the needle valve 48 to allow displacement of liquid from the upper side of the displacement piston to the lower side of the latter. The feed may be checked at will simply by closing the needle valve 48 to prevent the by-passing of liquid from one side of the piston 41 to the other. If it is desired to effect downward movement of the feed piston 16 thereby to raise the drill carriage 11 upwardly along the guide tower, this may be accomplished simply by rocking the lever 61 upwardly to close the passage 37 and unseat the valve 38a thereby to cut out the flow of pressure fluid to the lower end of the feed cylinder bore and to vent the latter to atmosphere through exhaust passage 40. The pressure fluid at this time acts on the upper pressure area of the feed piston 16 to move the latter downwardly under the control of the needle valve 48 of the liquid displacement means. It will thus be seen that the liquid displacement means acts as a liquid dashpot and may be manually controllable

at will to regulate the feeding speed of the pneumatic feeding means or to interrupt feed.

In Figs. 10 and 11 there is shown a modified form of control valve means for the fluid supply and vent means for the pneumatic feeding cylinder. In this form of the invention pressure fluid, herein air under pressure, is supplied through a pipe connection 70 leading to any suitable source of supply, to a T 71. Fluid is supplied through this T through a pipe connection 72 connected to the upper cylinder head 19 and communicating through a passage 73 formed in the head with the cylinder bore at the upper side of the feed piston 16. The T 71 is also connected through a pipe connection 74 with a chamber 76 formed in a valve casing 77. Also formed in the valve casing is a chamber 78 connected through a vent passage 79 to atmosphere. Formed between the inner walls 80 and 81 of these chambers is a chamber 82 connected by a pipe connection 83 and a passage 84, formed in the lower head 20, to the lower end of the feed cylinder bore at the lower side of the feed piston 16. Slidably arranged within bores 85 formed in the walls between the walls 80, 81 is a plunger 86 having formed on its opposite ends end seating valves 87 and 88. The plunger is connected through a rod 89 and a pin and slot connection 90 to an operating lever 91 similar to the lever 61 heretofore described. When the valve 88 is seated and the valve 87 is in its open position, pressure fluid may flow through the pipe connection 83 and passage 84 to the lower end of the feed cylinder while pressure fluid is supplied continuously to the upper end of the feed cylinder at the upper side of the feed piston through pipe connection 72 and passage 73. When the lever 91 is swung downwardly, the valve 88 is unseated while the valve 87 is seated, and as a result the supply of pressure fluid to the lower end of the feed cylinder is cut off and the latter end of the cylinder vented to atmosphere through passage 84, pipe connection 83, chamber 78, and vent passage 79. Otherwise this form of the invention is similar to that above described.

In the modified form of construction shown in Fig. 12, two valve mechanisms 92 and 93 identical in design to the valve mechanism shown in Fig. 11 are provided for variably controlling the flow of pressure fluid to the opposite ends of the feed cylinder bore at the opposite sides of the feed piston. Pressure fluid is supplied through a pipe connection 94 and T 95 to the valve mechanism 92 and through a pipe connection 96 connected to the T 95 to the valve mechanism 93. The valve mechanism 93 is similar to that shown in Fig. 11 except in this instance the central chamber 97 between the valves is connected through a pipe connection 98 to the cylinder bore at the upper side of the feed piston 16. Pivoted on the needle valve operating block 59 at 99 is a double ended operating lever 100 to which the valve mechanism 92 is connected at 101 and the valve mechanism 93 at 102. When the lever 100 is in the position shown in Fig. 12, flow of pressure fluid to the upper end of the feed cylinder bore is cut off and this end of the cylinder bore is vented to atmosphere, while pressure fluid is supplied to the lower end of the feed cylinder bore. When the lever 100 is swung downwardly, the valve 92 is moved to cylinder bore venting position while the valve mechanism 93 is moved to pressure fluid supplying position, and as a result pressure fluid is supplied to the upper end of the cylinder bore while the lower end of the cylinder bore is vented to atmosphere. It will thus be seen that a regulated control of pressure fluid for opposite ends of the feed cylinder at the opposite sides of the feed piston is provided. Otherwise this form of the invention is the same as the forms above described.

Now referring to the further modified form of construction shown in Figs. 13, 14, and 15, it will be noted that an improved controlling arrangement is provided for the valve mechanisms shown in Fig. 12. In this instance, the valve mechanisms of Fig. 12 are shown in horizontal alined position beneath the lower cylinder head 104 and are indicated at 105, 106, respectively, the valve 105 corresponding to the valve 92 shown in Fig. 12 while the valve 106 corresponds to the valve 93 shown in that figure. As in the other forms of the invention, the lever 107 is pivotally connected at 108 to the block 59 of the needle valve operating rod 47 and this lever has projections 109 and 110 which correspond to the projections 64 and 65 of the other forms of the invention. It is therefore evident that when the lever 107 is swung upwardly or downwardly the needle valve operating rod 47 is moved axially downwardly to effect unseating of the needle valve of the liquid displacement means. In this instance, however, the lever 107 is movable horizontally about an axis coincident with the needle valve rod axis to effect control of the valve mechanisms 105 and 106. The hub 111 of this lever is provided with cam projections 112 and 113, and engageable with the projections 112 is a plunger 114 connected to the valve stem of the valve mechanism 106, while engageable with the cam projections 113 is a plunger 115 connected to the valve stem of the valve mechanism 105. When the hub 111 of the lever 107 is in its neutral position shown in Fig. 13, the plungers 114, 115 are in their innermost position with the pressure fluid supply valve of both valve mechanisms in open position and the vent valves of both valve mechanisms in their closed position. At this time there is a differential pressure acting on the feed piston to effect upward feeding movement of the latter as in the form of the invention shown in Fig. 6. When the lever 107 is moved horizontally in one direction or the other, one or the other of the cam projections 112, 113, operates to effect unseating of the vent valve of one of the valve mechanisms 105, 106 and seating of the supply control valve of the other valve mechanism, thereby to effect venting of one side or the other of the feed piston 16. Pressure fluid is supplied to the valve mechanism 105 through a supply pipe 116 and to the valve mechanism 106 through a supply pipe 117, these supply pipes being connected to the fluid supply connection 94 of the form of the invention shown in Fig. 12. The valve mechanism 105 is connected through a pipe connection 118 to the lower end of the cylinder bore and through a pipe connection 119 to the upper end of the cylinder bore. Otherwise this form of the invention is similar to that described above in the other forms.

In all forms of the invention, when pressure fluid is supplied to the opposite ends of the feed cylinder bore at the opposite sides of the feed piston 16 and the needle valve 48 of the fluid displacement means is in open position, the feed piston 16 travels upwardly within the bore of the feed piston 15 thereby moving the sliding crosshead 21 upwardly within its guides and through the cable and pulley connections 24, 26,

27, 28, the drill carriage 11 is fed downwardly in a feeding direction along the guide tower. The feed may be varied or interrupted at will by controlling the position of the needle valve 48 of the fluid displacement means, it being possible quickly to interrupt feeding movement by seating the needle valve 48 to interrupt bypassing of fluid from the upper side of the displacement piston 41 to the lower side of the latter. When the feed cylinder at the lower side of the feed piston 16 is vented to atmosphere, the pressure acting on the upper pressure area of the feed piston effects downward movement of the latter and, through the cable and pulley connections, moving the drill carriage upwardly along the guide tower, it being possible to regulate the rate of upward feeding movement by adjusting the position of the liquid by-pass controlling displacement valve 48.

As a result of this invention, it will be noted that an improved rock drill feeding mechanism is provided wherein the drill may be fed by pressure fluid in an improved manner and under the control of liquid displacement means. It will further be noted that by the provision of the particular control means disclosed, it is possible for the drill operator to regulate the feeding speed or wholly to interrupt feed as desired by the manipulation of a single control lever. These and other uses and advantages of the improved drill feeding mechanism will be clearly apparent to those skilled in the art.

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

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

1. In a rock drill feeding mechanism, in combination, a feeding motor, fluid displacement means associated with said feeding motor for regulating the rate of feed, means for controlling said feeding motor including valve means for regulating the flow of pressure fluid to said motor and for venting the feeding pressure when the flow of pressure fluid to said motor is interrupted, means for controlling said displacement means to vary the rate of feed and to interrupt operation of said feeding motor at will, and common control means for said feeding motor and displacement means controlling means.

2. In a rock drill feeding mechanism, in combination, a feeding motor including a feed cylinder and a feed piston reciprocable therein, liquid displacement means associated with said feeding motor for regulating the rate of feed and including a displacement cylinder movable with said feed piston and a liquid displacement piston contained in said displacement cylinder and secured to said feed cylinder, means for controlling said feeding motor including valve means for regulating the flow of pressure fluid to said feed cylinder and for venting said feed cylinder when the flow of pressure fluid thereto is interrupted, means for controlling said displacement means for varying the rate of feed and to interrupt movement of said feed piston at will including means for by-passing liquid from one side of said displacement piston to the other and valve means for controlling said by-passing means, and common control means for said feeding motor and displacement means controlling means.

3. In a rock drill feeding mechanism, in combination, a feeding motor including a feed cylinder and a feed piston reciprocable therein, fluid displacement means associated with said feeding motor for regulating the rate of feed, means for supplying pressure fluid to said feed cylinder to act constantly on one pressure area of said feed piston, means for variably controlling the supply of pressure fluid to the opposite end of said feed cylinder to act on the opposite pressure area of said feed piston and for venting said last mentioned end of said feed cylinder when the supply of pressure fluid thereto is interrupted, said feed piston having differential pressure areas and the pressure fluid acting constantly on the smaller area of said piston, means for controlling said fluid displacement means for controlling the rate of feed and to interrupt movement of said feed piston at will, and common control means for controlling said pressure fluid supply and venting means and said displacement means controlling means.

4. In a rock drill feeding mechanism, in combination, a feeding motor including a feed cylinder and a feed piston reciprocable therein, fluid displacement means associated with said feeding motor for regulating the rate of feed, controlling means for said feeding motor, controlling means for said fluid displacement means, and a common control handle for said controlling means, said handle movable in one direction to operate said controlling means for said feeding means and in a right angle direction to operate said fluid displacement means controlling means.

5. In a rock drill feeding mechanism, in combination, a feeding motor including a feed cylinder containing a reciprocable feed piston, liquid displacement means associated with said feeding motor for regulating the rate of feed, controlling means for said feeding motor including valve means for regulating the flow of pressure fluid to the opposite ends of said feed cylinder and for venting said cylinder ends when the flow of pressure fluid thereto is interrupted, controlling means for said liquid displacement means for varying the rate of movement of said feed piston and to interrupt said piston movement at will, and common control means for said feeding motor and displacement means controlling means.

6. In a rock drill feeding mechanism, in combination, a feeding motor including a feed cylinder containing a reciprocable feed piston, liquid displacement means associated with said feeding motor for regulating the rate of feed, controlling means for said feeding motor including valve means for regulating the flow of pressure fluid to the opposite ends of said feed cylinder and for venting said cylinder when the flow of pressure fluid thereto is interrupted, controlling means for said liquid displacement means for varying the rate of movement of said feed piston and to interrupt said piston movement at will, and a common control handle for operating said flow controlling and venting means and said displacement means controlling means.

7. In a rock drill feeding mechanism, in combination, a feeding motor including a feed cylinder containing a reciprocable feed piston, liquid displacement means associated with said feeding motor for regulating the rate of feed, controlling means for said feeding motor including valve means for regulating the flow of pressure fluid to the opposite ends of said feed cylinder and for

venting said cylinder when the flow of pressure fluid thereto is interrupted, controlling means for said liquid displacement means for varying the rate of movement of said feed piston and to interrupt said piston movement at will, and a common control handle for operating said flow controlling and venting means and said displacement means controlling means, said control handle movable in one direction to operate said fluid controlling and venting means and in a right angle direction to operate said displacement means controlling means.

8. In a rock drilling mechanism, in combination, a guide frame having longitudinal guideways, a rock drill guided on said frame guideways, a feed cylinder mounted in a stationary position on said guiding frame and arranged parallel with said drill guideways, a feed piston reciprocable in said feed cylinder and having a projecting piston rod, speed multiplying connections between said feed piston rod and said rock drill, fluid displacement means for regulating the rate of feed and for interrupting movement of the feed piston at will including a liquid displacement cylinder formed in said feed piston rod and containing a stationary liquid displacement piston, means for controlling the flow of pressure fluid to said feed cylinder to effect movement of said feed piston and to vent said feed cylinder when the flow of fluid thereto is interrupted, and means for controlling said displacement means including means for by-passing fluid from one side of said displacement piston to the other and valve means for controlling said by-passing means.

9. In a rock drilling mechanism, in combination, a guide frame having longitudinal guideways, a rock drill guided on said frame guideways, a feed cylinder mounted in a stationary position on said guide frame and arranged parallel with said drill guideways, a feed piston reciprocable in said feed cylinder and having a projecting piston rod, speed multiplying connections between said feed piston and said rock drill, fluid displacement means for regulating the rate of feed and for interrupting movement of the feed piston at will including a liquid displacement cylinder formed in said feed piston rod and containing a stationary liquid displacement piston, means for controlling the flow of pressure fluid to said feed cylinder to effect movement of said feed piston and to vent said feed cylinder when the flow of fluid thereto is interrupted, means for controlling said displacement means including means for by-passing fluid from one side of said displacement piston to the other and valve means for controlling said by-passing means, and a common control handle for operating said fluid flow and vent controlling means and said liquid displacement controlling means.

10. In a rock drilling mechanism, in combination, a guide frame having longitudinal guideways, a rock drill guided on said frame guideways, a feeding motor mounted on said guide frame including relative reciprocable feed cylinder and piston elements arranged with their longitudinal axes parallel with the drill guideways, speed multiplying connections between said feed piston and said rock drill, fluid displacement means associated with said feeding motor for regulating the rate of feed and for interrupting movement of said piston at will, means for supplying pressure fluid to said feed cylinder to effect movement of said feed piston in a direction rearwardly with respect to said guide frame to effect, through said speed multiplying connections, forward feeding movement of the rock drill along the frame guideways, means for controlling the flow of pressure fluid to said feed cylinder, and means for controlling said displacement means.

ELMER G. GARTIN.