Aug. 2, 1938. E. G. GARTIN 2,125,287

ROCK DRILL

Filed July 24, 1935 2 Sheets-Sheet 1

Fig. 1.

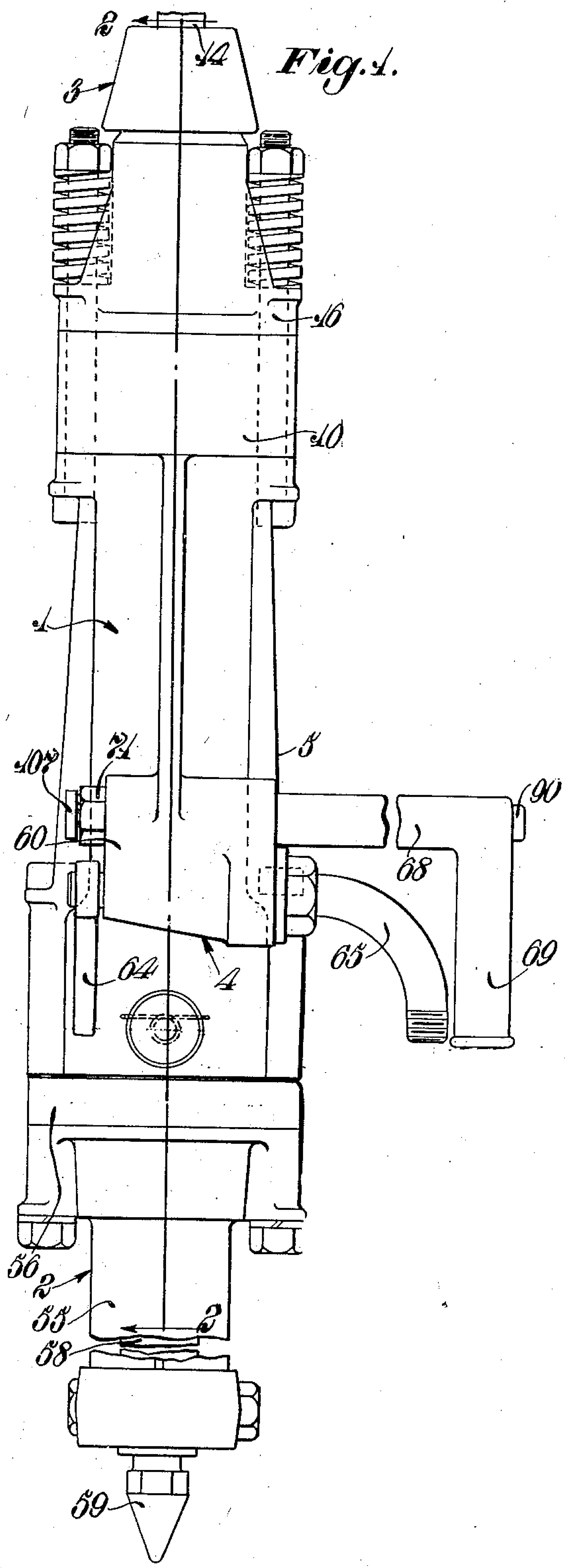
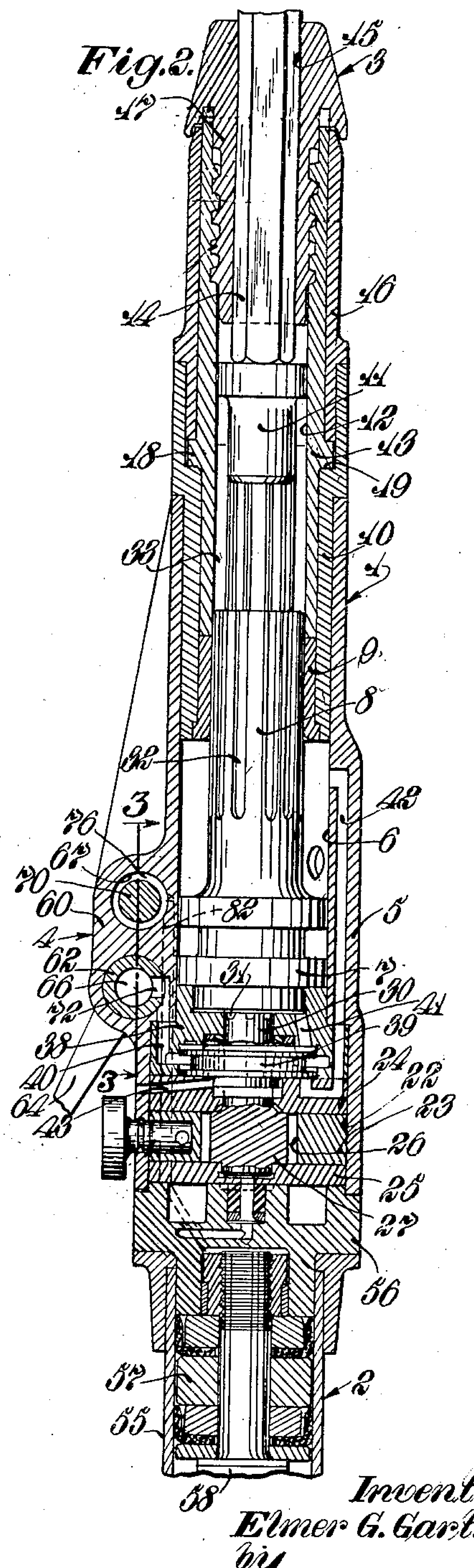


Fig. 2.



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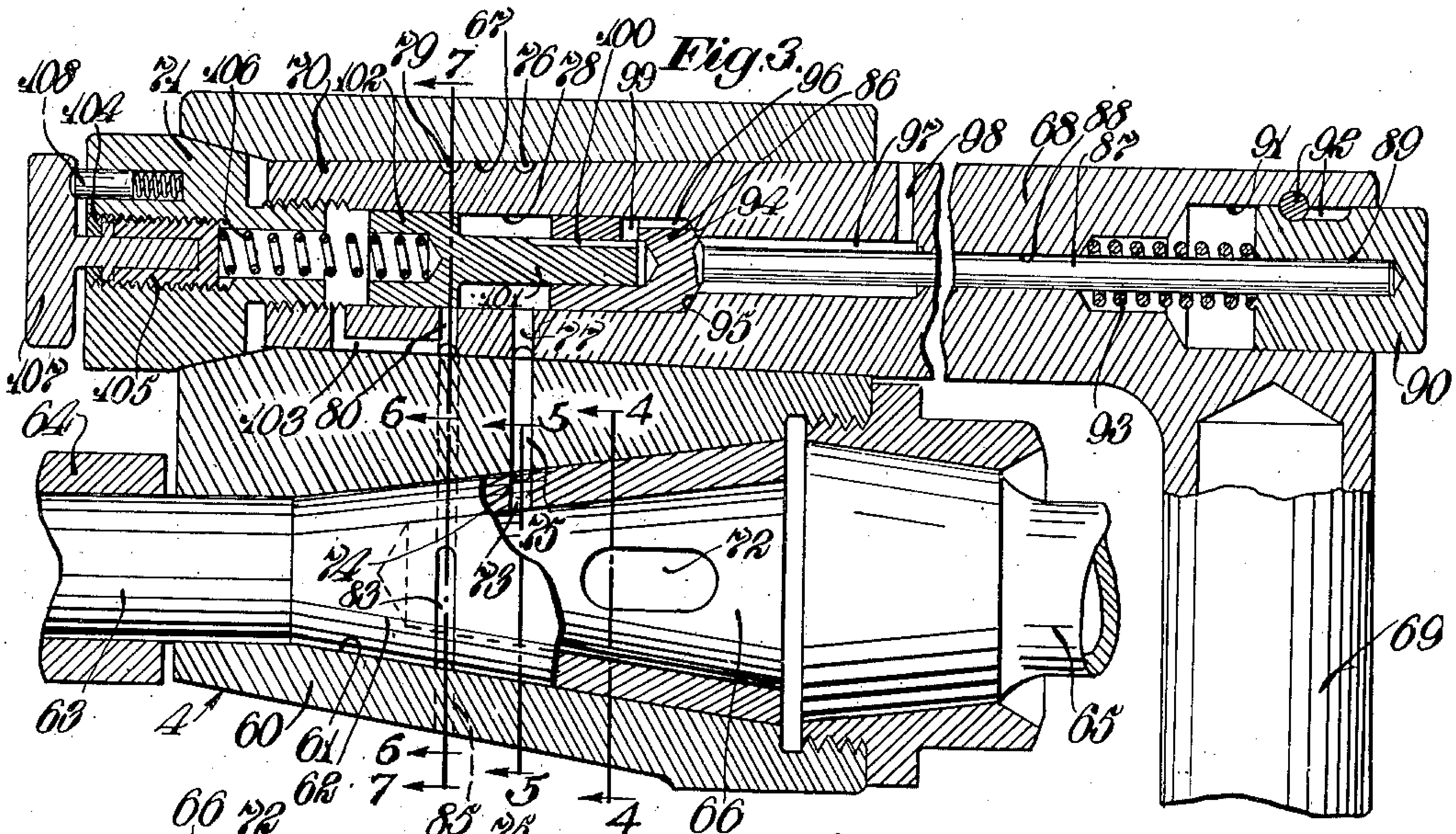

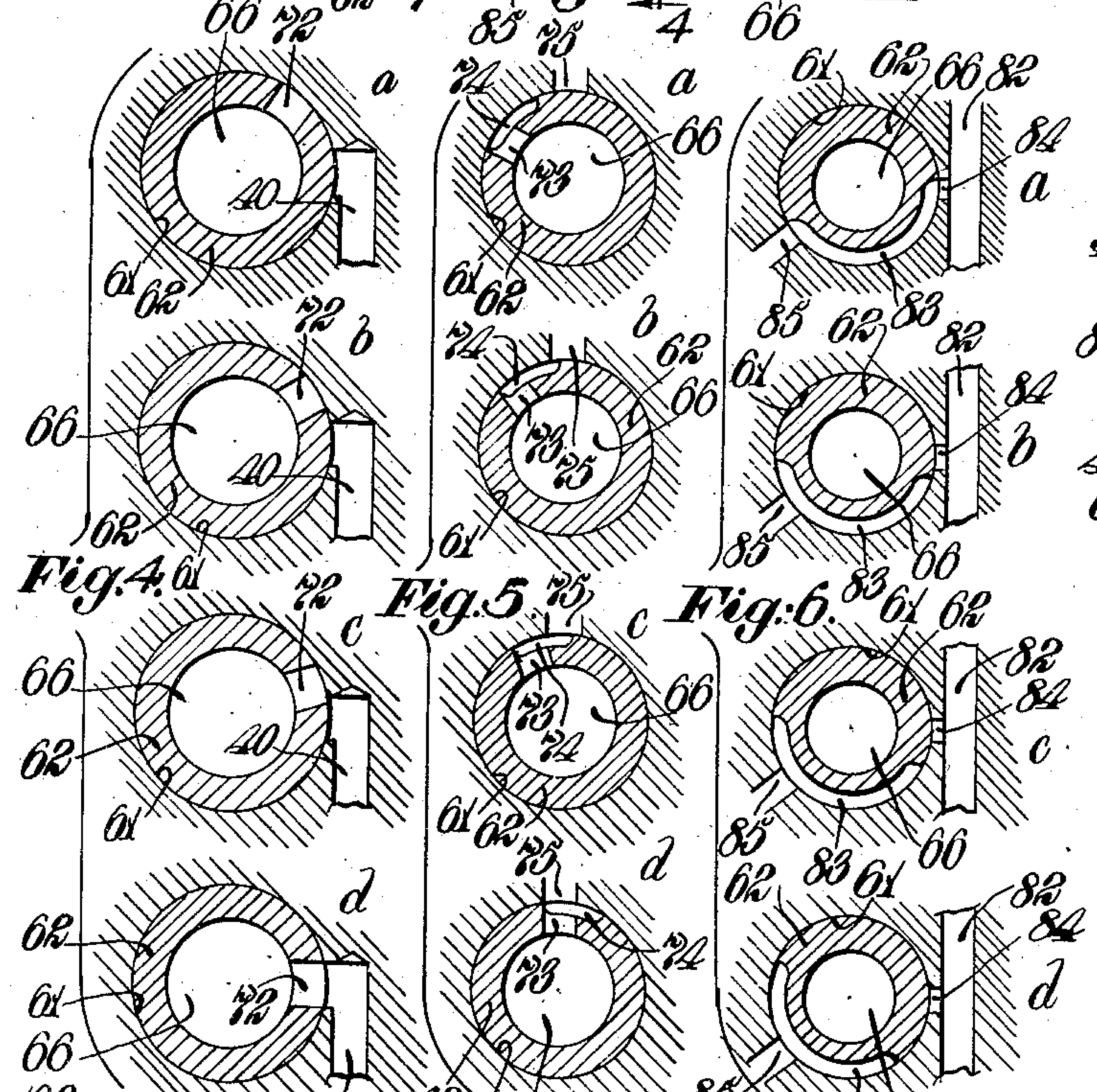

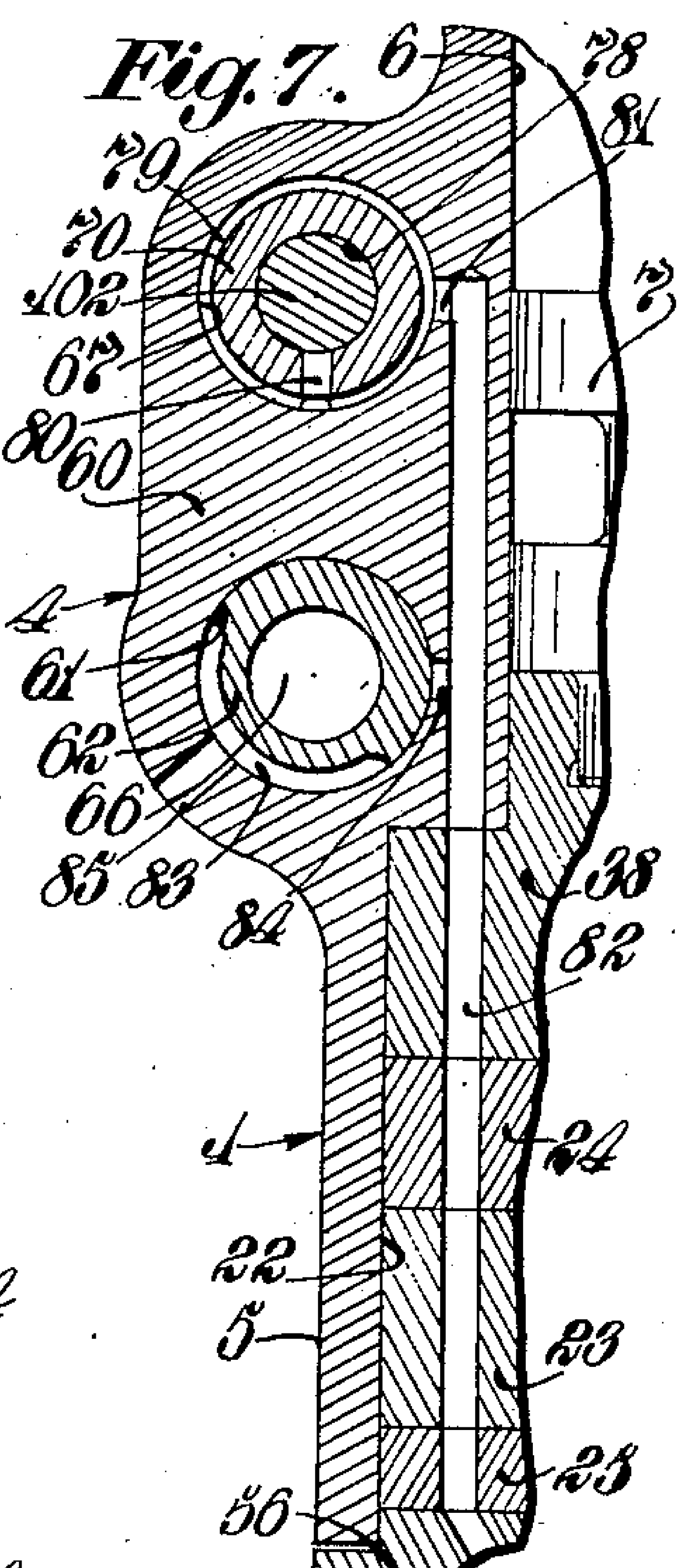

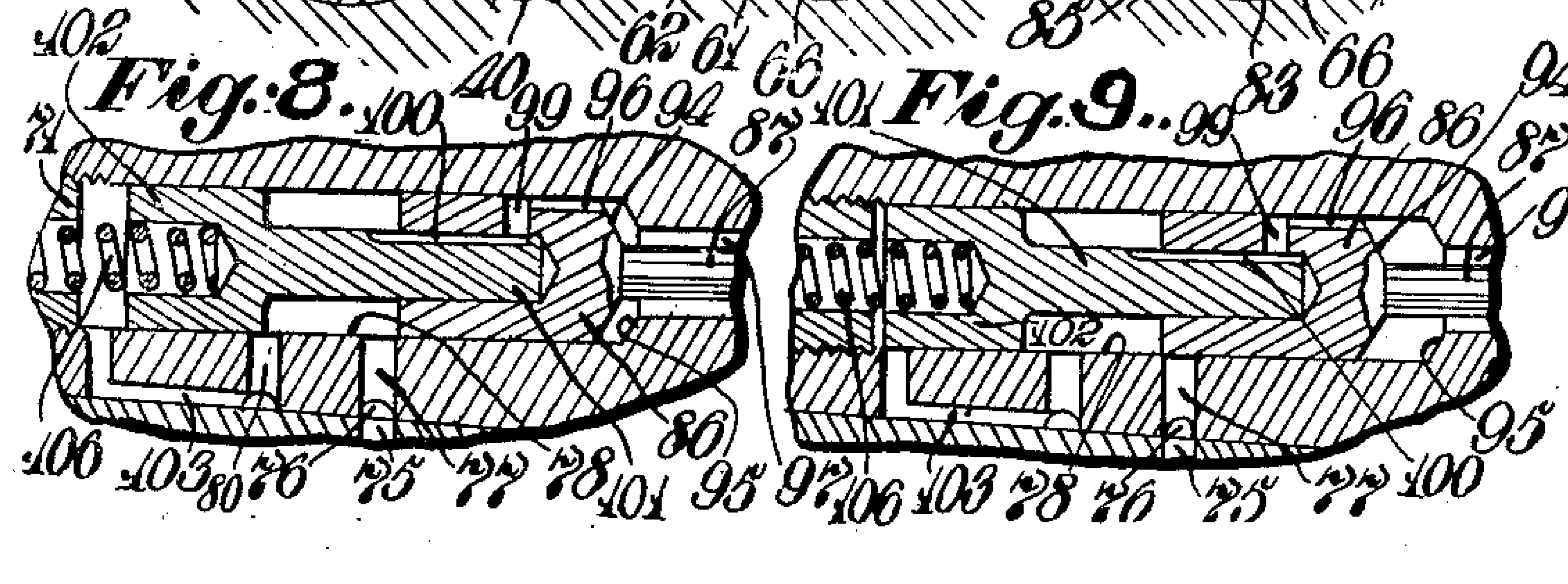

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UNITED STATES PATENT OFFICE

2,125,287

ROCK DRILL

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Application July 24, 1935, Serial No. 32,919

15 Claims. (Cl. 121—9)

This invention relates to rock drills, and more particularly, but not exclusively, to improvements in a pressure fluid actuated hammer rock drill of the stoper type.

An object of this invention is to provide an improved rock drill feeding means and improved control means for the feeding means. Another object is to provide an improved pressure fluid actuated feeding means having improved automatic means for regulating the feeding pressure, the automatic means having associated therewith improved means for manually regulating the feeding pressure. A further object of this invention is to provide an improved pressure reducing valve for a rock drill feeding means. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings,—

Fig. 1 is a side elevational view of a stoper rock drill, in which the illustrative form of the improved feeding means is embodied.

Fig. 2 is a view in longitudinal section taken substantially on line **2—2** of Fig. 1.

Fig. 3 is a vertical sectional view taken substantially on line **3—3** of Fig. 2.

Fig. 4 is a detail sectional view taken substantially on line **4—4** of Fig. 3, the different positions of the throttle valve being indicated at *a*, *b*, *c* and *d*, respectively.

Fig. 5 is a detail sectional view taken substantially on line **5—5** of Fig. 3, the different positions of the throttle valve being indicated at *a*, *b*, *c* and *d*, respectively.

Fig. 6 is a detail sectional view taken on line **6—6** of Fig. 3, the different positions of the throttle valve being indicated at *a*, *b*, *c* and *d*, respectively.

Fig. 7 is a detail view in longitudinal section taken on line **7—7** of Fig. 3.

Fig. 8 is a fragmentary sectional view taken in the plane of Fig. 3 showing the feed regulating valves in a different position.

Fig. 9 is a fragmentary sectional view taken in the plane of Fig. 3 showing the feed regulating valves in still another position.

In this illustrative embodiment of the invention there is shown a hammer rock drill of the stoper type generally comprising a hammer motor generally designated **1**, a feeding mechanism generally designated **2**, a chuck mechanism generally designated **3** and an improved control mechanism generally designated **4**.

The hammer motor **1** is herein of the pressure fluid actuated, reciprocating piston type comprising a cylinder **5** having a bore **6** containing a reciprocatory hammer piston **7**. The hammer piston has a forwardly projecting striking bar **8** guided in a bushing **9** supported within a sleeve **10** mounted within the forward portion of the cylinder **5**, and this striking bar is adapted to deliver impact blows to a tappet or striking block **11** reciprocably mounted in a bore **12** formed in a rotatable chuck sleeve **13**. The impact blows of the hammer piston are transmitted through the striking block **11** to the shank of a usual drill steel **14**, the drill steel herein being of hexagonal cross section and loosely mounted for reciprocatory movement within a correspondingly-shaped bore **15** formed in a chuck **17** secured within the rotatable chuck sleeve **13**. Secured to the sleeve **10** is a front chuck housing **16**, and the chuck sleeve **13** is rotatably mounted in the sleeve **10** and the chuck housing. Formed externally on the rotatable sleeve **13** is an annular collar **18** interposed between a shoulder **19** formed on the member **10** and the inner end of the chuck housing **16**, and this collar maintains the chuck sleeve against longitudinal displacement while permitting free rotation thereof with respect to the elements **10** and **16**. It will thus be seen that when pressure fluid is supplied to the motor cylinder, the hammer piston is rapidly reciprocated to deliver impact blows through the striking block **11** to the drill steel shank.

The means for rotating the drill steel as it is percussively actuated by the hammer piston may be of a design similar to that disposed in my copending application, Ser. No. 722,571, filed April 26, 1934, and on which Patent No. 2,100,324 issued Nov. 30, 1937. It will be observed that arranged in a bore **22** formed within the rearward portion of the cylinder **5** is a motor casing **23** having front and rear heads **24** and **25**, respectively. Formed in the motor casing, as shown most clearly in Fig. 2, is a motor chamber **26** containing intermeshing, toothed, motor rotors, the central one of which is shown at **27**, preferably of the spur gear tooth type. In this instance, the central rotor **27** is preferably formed integral with a rifle bar **30** suitably journaled within the motor heads and having spirally arranged grooves **31** interlocked with spiral lugs formed on a usual rifle nut secured within the hammer piston **7** in the manner clearly described in my copending application mentioned above. The piston striking bar 8 is provided with longitudinal grooves 32 slidingly interlocked with straight lugs 33 formed on the rotatable chuck sleeve 13.

The fluid distribution means for effecting reciprocation of the hammer piston 7 may be of a design similar to that disclosed in my copending application, Ser. No. 708,269, filed Jan. 25, 1934. Arranged in the bore 22 and forming a closure for the rear end of the cylinder bore is a rear head 38, and this head cooperates with the front head 24 of the rotation control motor to form a valve chest for a fluid distributing valve 39, this valve encircling the rearward portion of the rifle bar 30. This valve controls the flow of pressure fluid from a supply passage 40 to supply passages 41 and 42 leading to the opposite ends of the cylinder bore and the exhaust of pressure fluid from the cylinder in the manner clearly described in my copending application, Ser. No. 708,269 above referred to.

In this construction, the supply passage for the rotation control motor communicates with the passage 42 at a point adjacent the distributing valve 39 so that when pressure fluid is supplied to the front supply passage 42 for the forward end of the motor cylinder to effect retraction of the hammer piston, pressure fluid is at the same time supplied to the rotation control motor, and the motor rotors are at that time locked in stationary position by the pressure fluid within the motor inlets. As the hammer piston 7 moves rearwardly the lugs on the rifle nut secured therein engage with the spiral grooves on the then-stationary rifle bar 30, causing the hammer piston to be rotated, and this rotative movement of the hammer piston is transmitted through the grooves 32 on the striking bar and the lugs 33 on the chuck sleeve to the drill steel. When the distributing valve 39 is in a position to supply pressure fluid from the passage 40 to the supply passage 41, pressure fluid may flow to the rear end of the cylinder bore to effect the forward working stroke of the hammer piston, and the pressure fluid in the supply passage 42 and the motor inlets is conducted to exhaust through an exhaust passage 43, thereby permitting the motor rotors to revolve freely during the forward working stroke of the hammer piston so that the latter delivers an unimpeded impact blow to the drill steel shank.

The feeding mechanism 2 for feeding the drill steel toward the work as it is percussively actuated by the hammer motor is, in this instance, of the pressure fluid actuated "feed leg" type comprising a feed cylinder 55 secured to the rear head block 56 of the cylinder 5 and containing a feed piston 57. This feed piston has a piston rod 58 terminating at its lower end in an abutment engaging point 59. It will thus be seen that when pressure fluid is supplied to the forward end of the feed cylinder bore in advance of the feed piston, the feed cylinder 55 is moved forwardly with respect to the stationary feed piston 57.

Now referring to the improved control valve mechanism generally designated 4, it will be observed that formed within a projecting boss 60 integral with the side of the motor cylinder 5 is a transverse bore 61 containing a rotary throttle valve 62. The throttle valve is of frusto-conical form, and the bore 61 is of conical shape to receive the valve. The valve shank 63 has secured thereto a manual control handle 64. Pressure fluid is adapted to be supplied through a swivel pipe connection 65 to an internal chamber 66 within the valve 62. Formed in the boss 60 and arranged parallel with the bore 61 is a bore 67 within which is secured a drill supporting handle 68 of a usual design having a usual grasping portion 69. This handle has a conical shank 70 and the bore 67 is of conical form to receive the handle shank in the manner shown in Fig. 3, and a conical nut 71 threaded within the handle shank is provided for rigidly securing the supporting handle in position. The wall of the throttle valve 62 is traversed by a port 72 communicable with the supply passage 40 of the fluid distribution means, as shown in Fig. 4. As shown in Fig. 5, the wall of the valve 62 is traversed by a port 73 communicating with a circumferentially extending groove 74 formed on the exterior surface of the valve, and this groove is communicable through a passage 75 with an annular groove 76 formed on the handle 68, and this groove is communicable through a passage 77 with an axial bore 78 formed in the handle. An annular groove 79 formed on the handle is communicable through a passage 80 with the axial bore 78, and, as shown in Fig. 7, this groove 79 is connected through a port 81 to a feed supply passage 82 (see also Fig. 7) communicating with the forward end of the feed cylinder 55. As shown in Fig. 6, the valve 62 is provided with a circumferential groove 83 communicable through a port 84 with the feed supply passage 82 and with a vent passage 85. Reciprocably mounted in the bore 78 of the supporting handle is a valve 86 having an operating rod 87 guided within an axial bore 88 formed in the handle and secured at 89 at its outer extremity to an operating plunger 90. This plunger is guided in a bore 91 formed in the handle, and displacement of the plunger from the bore is limited by a pin and slot connection 92. A spring 93 normally urges the operating plunger toward its outermost position, as shown in Fig. 3. When the valve 86 is in the position shown in Fig. 3, a conical end seating surface 94 engages a conical seat 95 for cutting off communication of a groove 96 on the valve with an axial chamber 97. This chamber 97 is connected through a passage 98 to exhaust, while the groove 96 communicates through a passage 99 with a groove 100 formed on the stem 101 of a plunger valve 102, which, like the valve 86, is guided in the bore 78. A passage 103 connects the groove 79 with the axial bore 78 at the left hand end of the plunger valve 102 as viewed in Fig. 3. Threaded at 104 within the nut 71 is an adjustable follower 105 for adjusting the tension of a coil spring 106 acting on the plunger valve 102. Secured to the follower 105 is an operating handle 107 provided with a spring pressed detent lock 108. The plunger valve 102 is adapted to regulate automatically the feeding pressure within the feed cylinder, any desired feeding pressure being attainable simply by properly adjusting the tension of the spring 106 acting on the valve. The valve 86 is a feed control valve for manually regulating the feeding pressure.

When the throttle valve 62 is in the position *a* in Figs. 4, 5 and 6, the feed supply passage 82 is vented to atmosphere through port 84, groove 83 and vent passage 85, and the passages 40 and 75 are cut off by the valve. When the throttle valve is in the position *b* in Figs. 4, 5 and 6, the vent passage 85 is cut off from the feed supply passage 82, the motor supply passage 40 is still cut off from the passage 72, while the groove 74 has partial communication with the passage 75 so that a small amount of pressure fluid may flow from the chamber 66 in the valve through passage 73, groove 74, passage 75, groove 76, passage 77 to the axial bore 78 between the valves 86 and 102. When the throttle valve is in the position *c* in Figs. 4, 5 and 6, the groove 74 nearly completely communicates with the passage 75 while the passage 72 slightly communicates with the motor supply passage 40 and the vent 85 is still cut off from the feed supply passage 82. When the throttle valve 62 is in the position *d* in Figs. 4, 5 and 6, the vent passage 85 is still out of communication with the feed supply passage 82, the groove 74 is in full communication with the passage 75 and the passage 72 is in full communication with the motor supply passage 40. When the throttle valve is in this latter position, the hammer motor is operating to actuate percussively and rotate the rock drill steel. Pressure fluid flows from the valve chamber 66 through passage 73, groove 74 and passages 75 and 77 to the bore 78 between the inner adjacent ends of the valves 102 and 86, and acts on the right hand side of the valve 102 to move the latter to the left against the tension of the spring 106 from the position shown in Fig. 3 to the position shown in Fig. 8. Pressure fluid then flows through passage 80, groove 79 and passages 81 and 82 to the feed cylinder to effect feeding of the drill steel toward the work as drilling progresses. At the same time pressure fluid flows through passage 103 to the bore 78 at the left hand end of the valve 102. When the pressure in the feed cylinder builds up so that the pressure acting on the left hand end of the valve 102 plus the pressure exerted by the spring 106, is greater than the pressure acting on the right hand end of the valve, the latter is again shifted to its position shown in Fig. 3, and remains in such position until the pressure in the feed cylinder drops below the pressure at the right hand end of the valve 102. The valve 102 is then again moved to the left to open the passage 80 to effect a supply of fluid to the feed cylinder. For instance, if the pressure at the right hand end of the valve 102 were 100 lbs. and the spring pressure acting on the left hand end of the valve were 5 lbs., the pressure in the feed cylinder would be maintained at substantially 95 lbs., the pressure acting on the left hand end of the valve together with the pressure exerted by the spring automatically cutting off the feed supply when 95 lbs. is surpassed and again automatically opening the feed supply when the feeding pressure drops substantially below 95 lbs. By adjusting the tension of the spring 106, the feeding pressure within the feed cylinder may, of course, be regulated. When it is desired to reduce slightly the feeding pressure, the operator may press inwardly on the operating plunger 90 to move the valve 86 from the position shown in Fig. 3 to the position shown in Fig. 8, and at this time the pressure flowing to the axial bore 78 between the valves is vented to atmosphere through groove 100, passage 99, groove 96, chamber 97 and vent passage 98. When it is desired to reduce further or entirely release the feeding pressure, the valve 86 is moved into the position shown in Fig. 9, closing the passage 77, thereby cutting off the supply of pressure fluid to the feed cylinder, while the feed supply passage 82 is vented to atmosphere through the groove 100, passage 99, groove 96, chamber 97 and vent passage 98.

As a result of this invention, it will be noted that an improved rock drill is provided having improved automatic and manual means for regulating the feeding pressure. It will further be noted that by the provision of the improved automatic and manual regulating means for the feeding pressure it is possible to control the same automatically and to adjust it manually at will. These and other uses and advantages of the improved rock drill will be clearly apparent to those skilled in the art.

While I have in this application specifically described one form which my invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be 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, a drill steel actuating motor, pressure fluid actuated feeding means therefor, an automatic pressure reducing valve for regulating the feeding pressure, and a manually controllable valve engageable with said automatic regulating valve for manually regulating the feeding pressure.

2. In a rock drill, a drill steel actuating motor, pressure fluid actuated feeding means therefor, automatic means for regulating the feeding pressure including means providing a valve bore containing an automatic regulating valve, and a manually controllable valve means associated with said automatic valve and including a manual control valve arranged in said valve bore in alinement with said automatic regulating valve for manually regulating the feeding pressure.

3. In a rock drill, a drill steel actuating motor, a supporting handle for the drill, pressure fluid actuated feeding means for said motor, and automatic means for regulating the feeding pressure and including a valve bore arranged in said supporting handle and an automatic regulating valve contained in said valve bore and controllable automatically by the pressure in said feeding means.

4. In a rock drill, a drill steel actuating motor, a supporting handle for the drill, pressure fluid actuated feeding means for said motor, automatic means for regulating the feeding pressure and including a valve bore arranged in said supporting handle and an automatic regulating valve contained in said valve bore and controllable automatically by the pressure in said feeding means, and a manually controllable valve means associated with said automatic valve for manually regulating the feeding pressure.

5. In a rock drill, a drill steel actuating motor, a supporting handle for the drill, pressure fluid actuated feeding means for said motor, automatic means for regulating the feeding pressure and including a valve bore arranged in said supporting handle and an automatic regulating valve contained in said valve bore and controllable automatically by the pressure in said feeding means, and a manually controllable valve means associated with said automatic valve for manually regulating the feeding pressure and having a manual control element mounted on the outer extremity of said handle.

6. In a rock drill, a drill steel actuating motor, a supporting handle for the drill, pressure fluid

actuated feeding means for said motor, automatic means for regulating the feeding pressure and including a valve bore arranged in said supporting handle and an automatic regulating valve contained in said valve bore, and a manually controllable valve means associated with said automatic valve for manually regulating the feeding pressure and including a manually operable valve arranged in said valve bore in alinement with said automatic regulating valve.

7. In a rock drill, a drill steel actuating motor, a supporting handle for the drill, pressure fluid actuated feeding means for said motor, automatic means for regulating the feeding pressure and including a valve bore arranged in said supporting handle and an automatic regulating valve contained in said valve bore, and a manually controllable valve means associated with said automatic valve for manually regulating the feeding pressure and including a manually operable valve arranged in said valve bore in alinement with said automatic regulating valve and having a manual control element mounted on the outer extremity of said handle.

8. In a rock drill feeding mechanism, a pressure fluid actuated feeding motor, means for supplying pressure fluid to said feeding motor, an automatic valve for regulating the feeding pressure, and a manually controllable valve associated with said automatic regulating valve, said manual valve engageable with said automatic valve for effecting movement of the valves in unison, said manual valve operable to effect manual feed pressure regulation.

9. In a rock drill, pressure fluid actuated feeding means, an automatic pressure reducing valve for regulating the feeding pressure, and a manually controllable valve for regulating the feeding pressure, said manual control valve operative to effect movement of said automatic valve and to effect manual regulation of the feeding pressure.

10. In a rock drill, pressure fluid actuated feeding means, an automatic pressure reducing valve for regulating the feeding pressure, and a manually controllable valve for controlling the feeeding pressure independently of any control of said automatic valve.

11. In a rock drill, pressure fluid actuated feeding means, an automatic pressure reducing valve for regulating the feeding pressure, a manually controllable valve for regulating the feeding pressure independently of said automatic valve, and means for actuating said manual regulating valve including means for manually moving said automatic valve and to effect manual regulation of the feeding pressure.

12. In a rock drill, a drill steel actuating motor, pressure fluid actuated feeding means for said motor, a manually controllable valve for controlling the pressure fluid supply to said motor, an automatic pressure reducing valve for regulating the feeding pressure, and a manually controllable valve operable independently of said motor control valve and associated with said automatic pressure reducing valve for manually regulating the feeding pressure.

13. In a rock drill, a drill steel actuating motor, a supporting handle for the drill, pressure fluid actuated feeding means for said motor, automatic pressure reducing valve means for automatically regulating the pressure in said feeding means and including a valve bore formed in said supporting handle and an automatic regulating valve contained in said valve bore, and manually operable means for adjusting said automatic valve to obtain different feeding pressures.

14. In a rock drill, a drill steel actuating motor, a supporting handle for the drill, pressure fluid actuated feeding means for said motor, automatic pressure reducing valve means for automatically regulating the pressure in said feeding means and including a valve bore formed in said supporting handle and an automatic regulating valve contained in said valve bore, a manually controllable valve means associated with said automatic valve for manually regulating the feeding pressure, and manually controllable means for adjusting said automatic valve to obtain different feeding pressures independently of said manual control valve means.

15. In a rock drill, a drill steel actuating motor, a supporting handle for the drill, pressure fluid actuated feeding means for said motor, automatic pressure reducing valve means for automatically regulating the pressure in said feeding means and including a valve bore formed in said supporting handle and an automatic regulating valve contained in said valve bore, a manually controllable valve means associated with said automatic valve for manually regulating the feeding pressure and having a manual control element mounted on the outer extremity of said handle, and manually controllable means for adjusting said automatic valve to obtain different feeding pressures independently of said manual control valve means.

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