D. S. WAUGH.

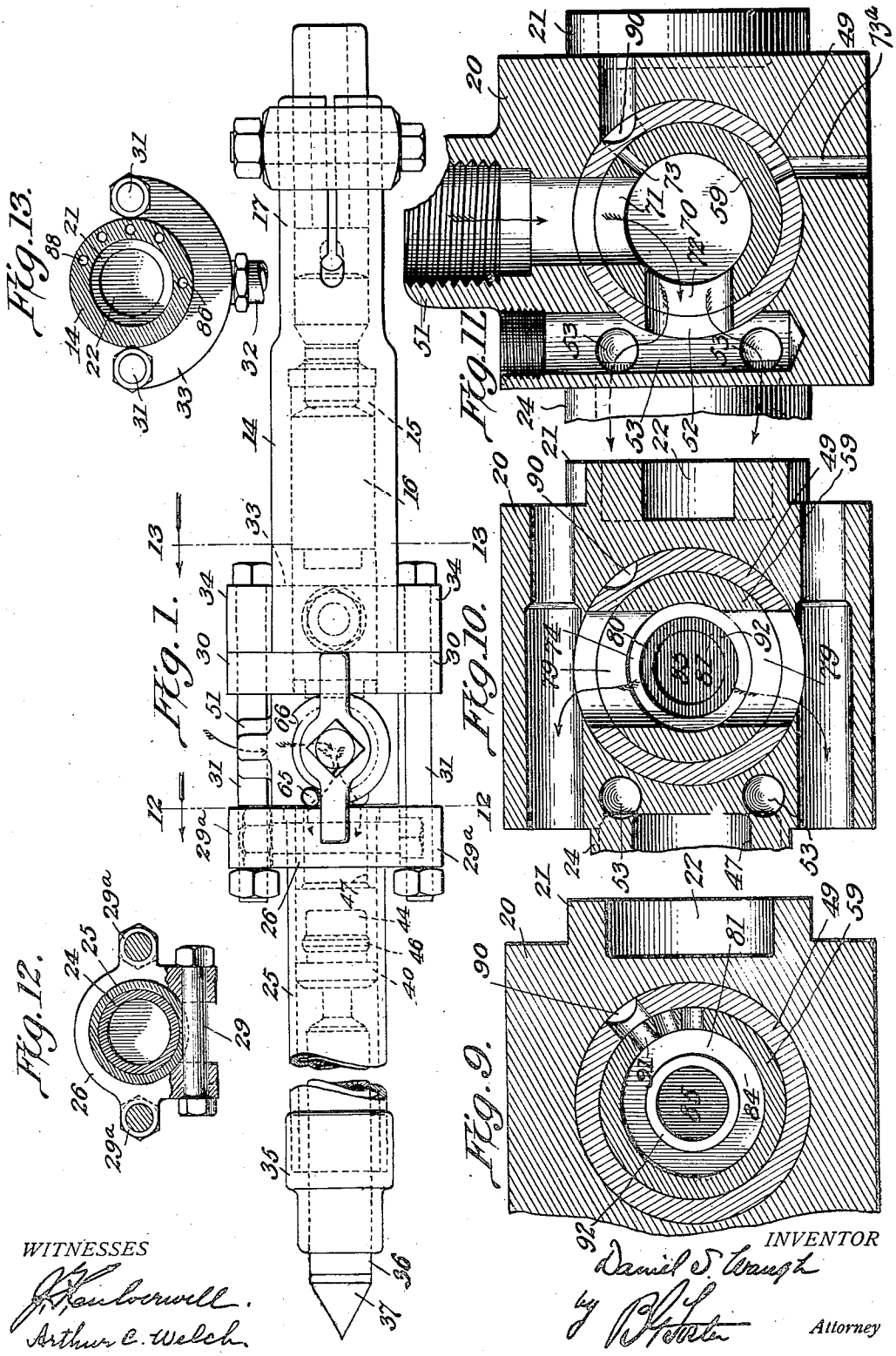
ROCK DRILLING MACHINE.

APPLICATION FILED SEPT. 12, 1911.

1,067,388.

Patented July 15, 1913.

5 SHEETS—SHEET 1.



WITNESSES

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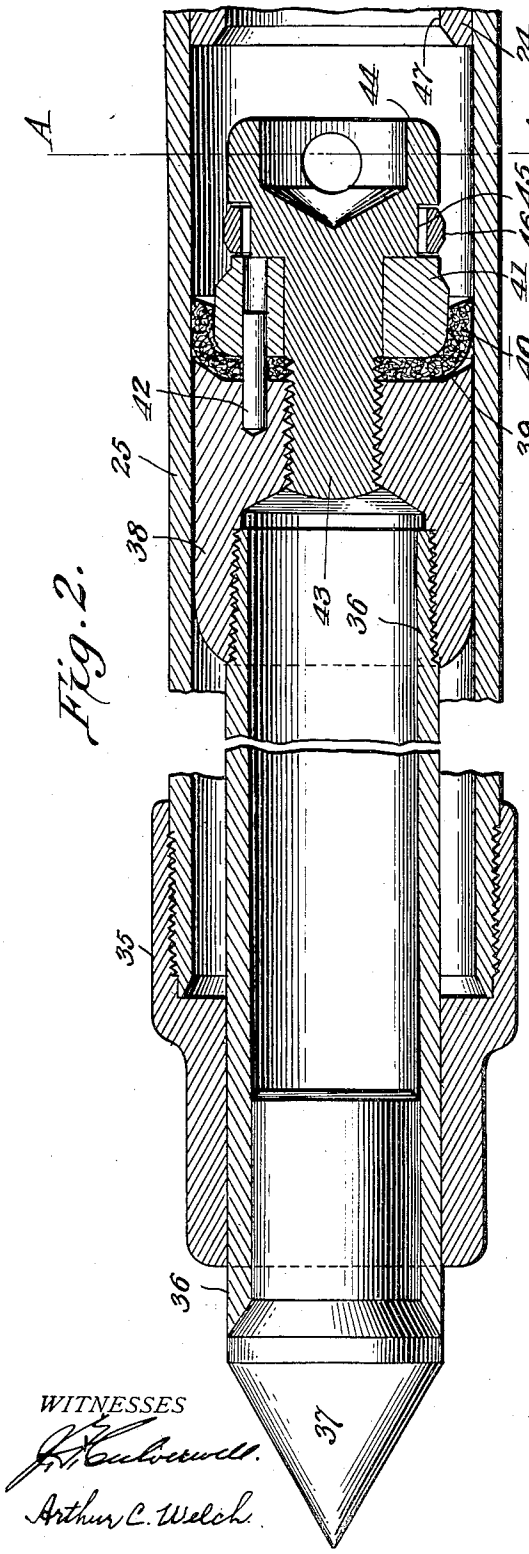


Fig. 2.

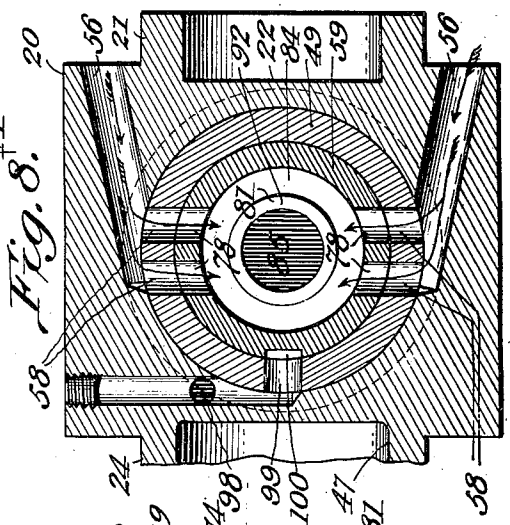


Fig. 8.

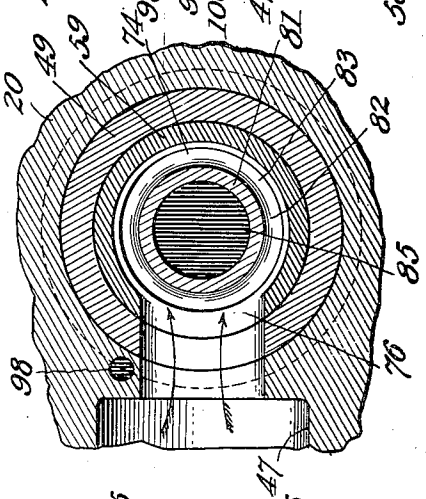


Fig. 7.

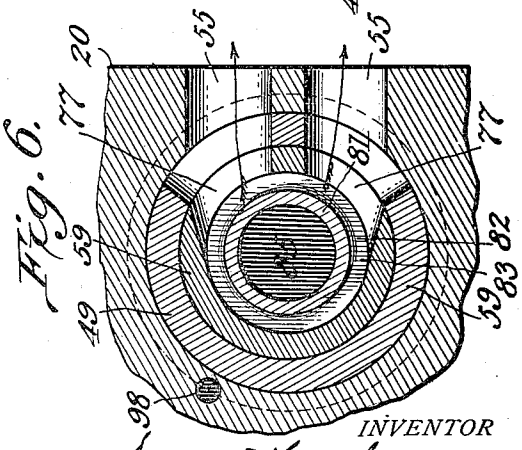


Fig. 6.

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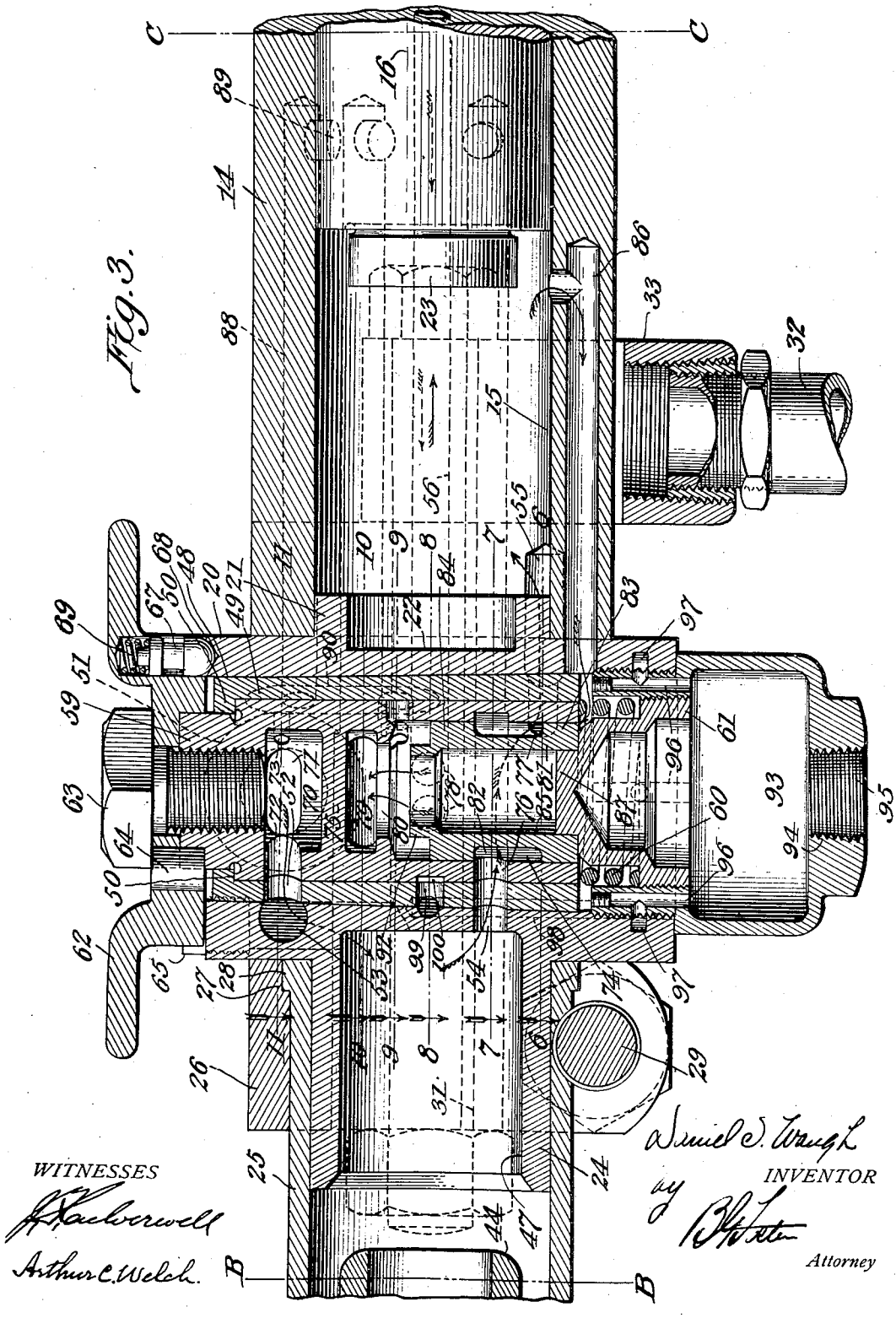
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5 SHEETS—SHEET 3.

Fig. 3.



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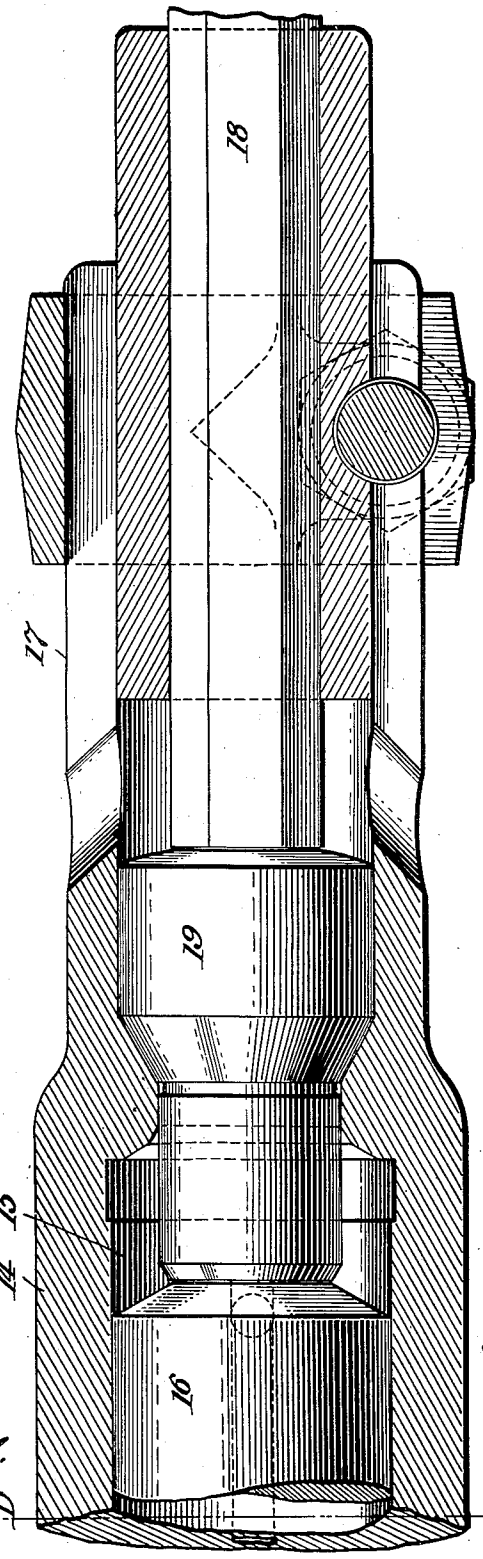


Fig. 4.

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5 SHEETS—SHEET 5.

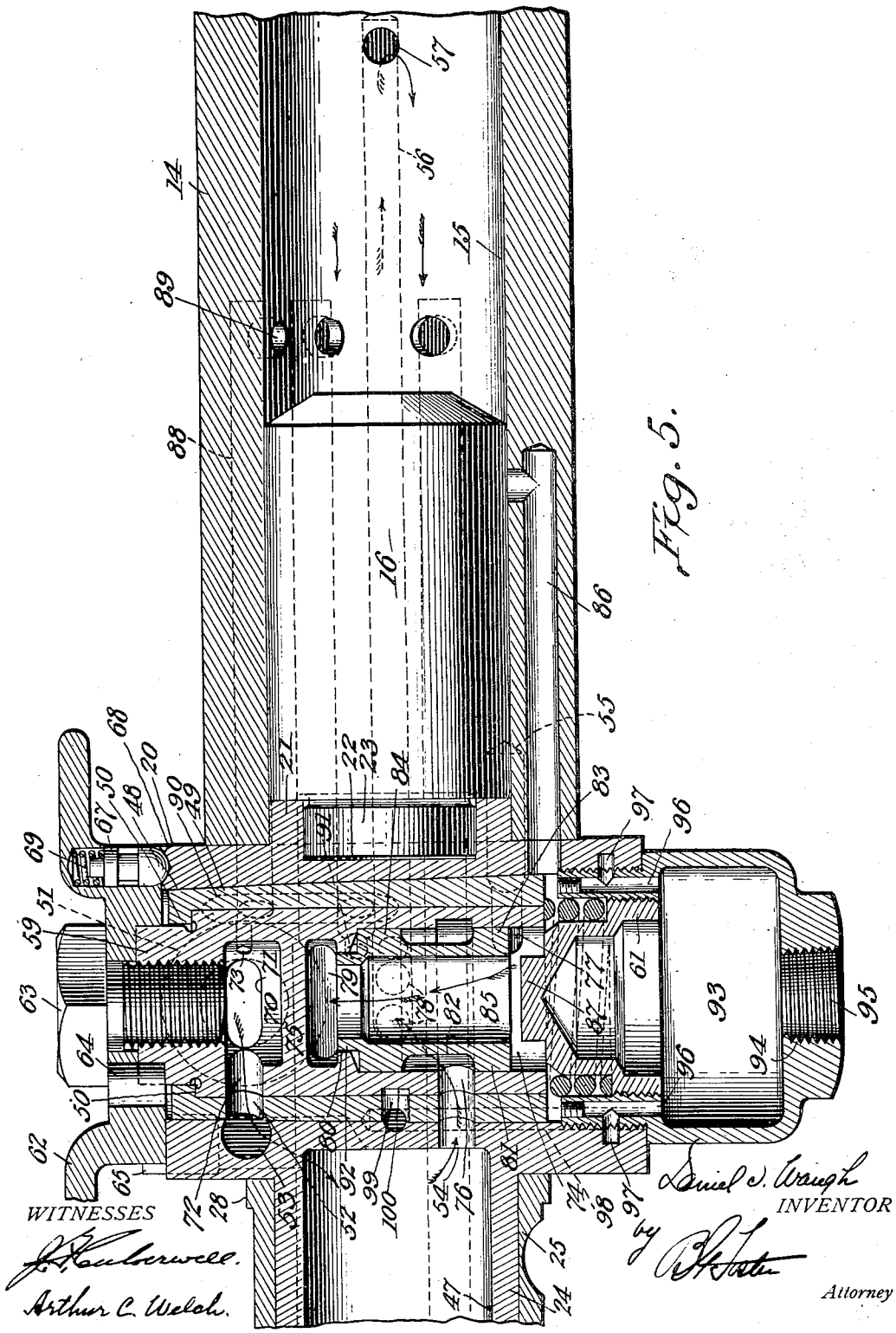


Fig. 5.

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UNITED STATES PATENT OFFICE.

DANIEL SHAW WAUGH, OF DENVER, COLORADO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE DENVER ROCK DRILL MANUFACTURING COMPANY, OF DENVER, COLORADO, A CORPORATION OF COLORADO.

ROCK-DRILLING MACHINE.

1,067,388. Specification of Letters Patent. Patented July 15, 1913.

Application filed September 12, 1911. Serial No. 648,960.

To all whom it may concern:

Be it known that I, DANIEL SHAW WAUGH, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented new and useful Improvements in Rock-Drilling Machines, of which the following is a specification.

The present invention relates to rock drills, and the primary object is to provide a structure of the type operated by motive fluid, preferably air, said structure being very compact and the parts thereof accessible, while retaining the advantages that are secured in modern drills of this type.

In the drawings:—Figure 1 is a view in elevation of the drill. Figs. 2, 3 and 4 are enlarged sectional views through the same, Figs. 2 and 3 joining on the lines A—A and B—B, and Figs. 3 and 4 joining on the lines C—C and D—D. Fig. 5 is a sectional view corresponding to Fig. 3, but showing the automatic valve in a different position. Fig. 6 is a sectional view on the line 6—6 of Fig. 3. Fig. 7 is a sectional view on the line 7—7 of Fig. 3. Fig. 8 is a sectional view on the line 8—8 of Fig. 3. Fig. 9 is a sectional view on the line 9—9 of Fig. 3. Fig. 10 is a sectional view on the line 10—10 of Fig. 3. Fig. 11 is a sectional view on the line 11—11 of Fig. 3. Fig. 12 is a sectional view on the line 12—12 of Fig. 1. Fig. 13 is a sectional view on the line 13—13 of Fig. 1.

Similar reference numerals designate corresponding parts in all the figures of the drawings.

In the embodiment disclosed, the motor, as is usual in this type of structures, comprises a cylinder member 14, having a piston chamber 15 therein, in which reciprocates a piston 16. A chuck 17 is carried by one end of the cylinder member for receiving the usual drill tool or steel 18, and a tappet 19 is interposed between the drill tool or steel, and the piston for transmitting the force of the blow from the latter to the former. The cylinder member 14 is mounted at its rear end on a head block 20, having a boss 21 that fits within the cylinder member, which boss is provided with a pocket 22 that receives a projection 23 on the rear end of the piston, thereby providing an air cushion for said piston on its return stroke, as hereinafter more fully described.

The head block 20 has a rearwardly extending sleeve 24, on which is mounted the cylinder 25 of the motive fluid-actuated means for holding the tool to its work. This cylinder 25 is secured in place upon the sleeve 24 by a split collar 26 surrounding the end of the cylinder and the sleeve, and having at its inner end an internal groove 27 that receives the rib 28 formed upon the cylinder 25. A bolt 29 serves to maintain the collar 26 in its clamping position. The said collar 26 is provided on diametrically opposite sides with ears 29^a. The rear end of the cylinder member 14 has corresponding ears 30. Through the alined ears are passed clamping bolts 31 that thus serve to maintain the two cylinders in operative positions upon the head block 20.

In addition, the bolts 31 constitute means for securing in place the handle for turning the drill. This handle is illustrated at 32, and is secured to a yoke 33 that partially surrounds the cylinder member 14, being provided with terminal ears 34, through which said bolts pass.

The cylinder 25 is provided at its outer end with a cap 35, through which passes a piston rod 36, terminating at its outer end in a spur 37, and having its inner end secured to a piston that operates in the cylinder 25. This piston consists of a head 38 threaded to the rod 36, and having its opposite end cup-shaped, as illustrated at 39 to receive a packing cup 40 borne against by a washer 41. The said cup 40 and washer 41 are held against rotation with respect to the head 38 by a pin 42 engaging these three elements and the parts are maintained in coöperative relation by a bolt 43 that passes through the washer 41 and the cup 40, and is threaded into the head 38. This bolt 43 is provided with a recessed head 44 having an annular groove 45 in which is placed a split yielding friction ring 46 having its opposite corners beveled off and arranged to frictionally engage in the bore 47 of the sleeve 24, so as to hold the piston in its innermost position.

The head block 20 constitutes a casing, both for the initial and the automatic valve. It is therefore bored out transversely, as shown at 48, the bore being slightly tapered, and snugly receiving a valve cage 49 that is

also open ended and tapered slightly, the end having the bore of smaller diameter being provided with an internal flange 50. The said head block or valve casing is provided at one side with a motive fluid inlet nipple 51 that opens through the cage. An air port 52 opens through one side of the cage into a passage 53 leading into the bore 47 of the sleeve 24, and consequently into the cylinder 25 of the feeding mechanism. From this bore 47, and consequently from the air feed cylinder 25, an outlet port 54 extends through the head block and cage into the interior of said cage. A series of ports 55 lead from the opposite side of the cage to the rear end of the piston chamber 15, and one or more passageways 56 lead from the front end of the piston chamber 15 through the port 57 to the valve cage, opening therethrough through one or more ports 58, as shown in Fig. 8.

A rotary initial or throttle valve 59 is mounted in the cage 49, being held abutted against the flange 50 by a spring 60 that bears against its larger end, said spring being borne against by a plug 61, located in the opposite end of the head block. The end of the valve 59, opposite the spring 60, projects through the cage and through the head block, said projecting end having fitted thereon, a handle 62 that is held in place by a bolt 63, and is prevented from turning on the valve by a key 64. The amount of rotation of the handle, and consequently of the valve, is controlled by a stop 65 that operates in the cut-away portion 66 of said handle, and the different desired positions of the handle are determined by a plunger 67 carried by the handle, and engaging in sockets 68 formed in the end of the head block. The plunger has a rounded end that can be forced out of the sockets by the movement of the handle, and is urged into said sockets by a spring 69 bearing against its rear end.

The valve 59 is provided in one end with a motive fluid-receiving chamber 70 having an inlet port 71 that is movable into and out of register with the inlet nipple 51 of the head block. It furthermore has in one side an outlet port 72 that is movable into and out of communication with the port 52 leading to the feed cylinder. In addition, an initial port 73, shown in Fig. 11, is provided, which when the valve moves from closed position, communicates with the nipple 51, before the port 71 comes into communication with said nipple, thus admitting a small amount of air into the feed cylinder prior to the opening of any of the other ports, so as to move the drill to its work before it is started in operation as hereinafter described. Furthermore by reference to Fig. 11, it will be seen that the valve cage 49 and head block 20 are provided with an exhaust passageway 73^a, so arranged that when the initial valve 59 is in closed position, the port 71 will be in communication with the passage 53 and the port 72 will be in communication with the passage 73^a, thus providing an exhaust vent from the feed cylinder which will permit the piston to be moved to its innermost position. The initial valve 59 is furthermore provided with an internal automatic valve chamber 74 separated from the chamber 70 by a partition 75. A port 76 is formed through the initial valve, and is movable into and out of communication with the port 54 leading from the feed cylinder, the arrangement being such that the port 76 will register with the port 54 when the port 71 is in register with the inlet nipple 51, and the port 72 is in register with the port 52. The port 73, however, moves into communication with the nipple 51, before the port 76 communicates with the port 54, and consequently, as above explained, the motive fluid will be admitted to the feed cylinder before the air or motive fluid enters the automatic valve chamber. The rotary valve 59, in addition, is provided with a pair of ports 77, as shown in Fig. 6, which move into register with the ports 55, leading to the rear end of the piston chamber 15, and said valve 59 also has other ports 78, which move into register with the passageways 56, leading from the front end of the piston chamber 15. These ports will of course be in communication when the port 76 is in communication with the port 54.

Leading from the end of the automatic valve chamber 74, which is opposite the plug 61, are opposite exhaust passages 79, which, as shown in Fig. 10, open through the valve cage, and through the head block into the open air. Communication between the said automatic valve chamber 74 and the exhaust passages 79 is secured through a reduced part 80 of the said chamber.

A reciprocatory automatic valve 81 is mounted in the automatic valve chamber 74, and has an annular groove 82 formed between two portions of different diameters, designated respectively 83 and 84, the portion 83 being of greater diameter than the portion 84. This groove 82 is always in communication with the port 76, and consequently with the motive fluid supply, when the initial valve is open. The movement of the valve is sufficient to alternately expose the ports 77 to the groove 82, and also the ports 78 to said groove 82, so as to thus alternately supply the motive fluid to opposite ends of the piston chamber 15, and thereby effect the reciprocation of the piston. The said valve is also provided with an internal exhaust passageway 85 extending therethrough, and when the said valve is in the position shown in Fig. 5, this exhaust pas-

sageway is not only in communication with the passageways 79, but also with the ports 77, so that air in rear of the piston 16 can exhaust through the channel thus produced, while air is being admitted to the front end of the piston chamber 15 through the passage 56 and port 57. On the other hand, when the valve is in the opposite position or in that shown in Fig. 3, then the motive fluid admitted through the port 76 to the groove 82, will pass through the ports 77 and passageways 55 into the rear end of the piston chamber 15, driving the piston forward, while the motive fluid in advance of said piston will exhaust through the port 57 and passageway 56, thence past the end of the valve, inasmuch as the ports 78 are uncovered, and out through the exhaust passageways 79.

The automatic valve 81 is positively moved in opposite directions by live motive fluid delivered from the cylinder member. To this end, a passageway 86 leads from an intermediate portion of the piston chamber 15 to the end of the automatic valve chamber 74 into which the plug 61 projects and the said plug 61 has a central inwardly extending pilot 87 that snugly fits in the exhaust passage 85 of the automatic valve when the valve is in the position shown in Fig. 3. Another passageway 88 communicates with the piston chamber 15 in advance of the passageway 86 through a port 89, and this passageway 88 leads to the valve cage, where it communicates with a concave slot 90 in the exterior of said valve cage this slot being shown in Figs. 9 and 10. The initial valve is provided with ports 91 that communicate with the said passage and open into the automatic valve chamber 74 directly adjacent to the contracted portion 80. The automatic valve 85 has a pilot 92 on this end that enters into the reduced portion 80 leaving a small space, however, that is in communication with the ports 91 illustrated in Fig. 9.

The operation of the machine is substantially as follows: Assuming an air hose or other supply of motive fluid connected to the nipple 51 and the initial valve 59 in its closed position, with the feed piston in its innermost position, if the handle 62 is moved initially, to bring the port 73 into communication with the inlet nipple 51, the motive fluid will enter said port 73, pass through the chamber 70 and through the port 71 (which is now in communication with the port 52), thence passing through the passageway 53, will enter the feed cylinder. The piston will thus be moved outwardly, or rather, the cylinder with the mechanism carried thereby, will be moved with respect to the piston, the spur of said piston being placed against a suitable abutment, and as a result, the machine will be moved to its work, but inasmuch as the port 76 is still out of communication with the port 54, the motor will be at rest. If now, the initial valve is moved still farther, the various ports above described, will all be brought into communication, and as a result, the motive fluid will be in the groove 82. Assuming the automatic valve in the position shown in Fig. 3, the motive fluid will pass through the ports 55, behind the piston, driving said piston forwardly until it strikes the tappet. The air in advance of said piston will exhaust through the port 57, the passageway 56 thence through the ports 58 and 78, past the end of the automatic valve, and out through the exhaust passages 79. As soon as the piston 16 in its forward movement uncovers the passageway 86, the motive fluid will enter said passage, and acting against the end of the automatic valve will move it to the opposite end of its valve chamber. When this occurs the motive fluid entering through the ports 76 and around the automatic valve, will be transferred into the passageway 56, and enter the front end of the piston chamber through the port 57, driving the piston rearwardly, while the exhaust will take place through the passage 86, until covered, and also through the ports 55, the exhaust passage 85 in the automatic valve, and thence into the exhaust passages 79, where it will escape to the outer air. In this return movement, the automatic valve will be held in a position to permit this exhaust by the pressure of the exhaust itself, and it will therefore drop to an intermediate position, as fully explained in my Patent, No. 915,813, dated Mar. 23, 1909. As soon as the piston approaches the limit of its rearward movement, the port 89 is uncovered, thus admitting live motive fluid to the passage 88, whence it passes through the groove 90, and port 91 against the opposite end of the automatic valve, moving said valve again to the position shown in Fig. 3, the pilot 87 entering the exhaust passage 85 of said automatic valve before the pilot 92 of the automatic valve leaves the contracted portion 80. As this change takes place, the piston 16 will reach its limit of movement, and the projection or boss 23 thereof entering the pocket 22 will produce an air cushion that will start the piston on its return stroke.

In order that the parts may properly operate, it is desirable that they should be effectively lubricated, and to this end, a lubricant reservoir 93 is employed that is screwed into the end of the head block, opposite to the valve handle 62. This reservoir has a filling opening 94, closed by a plug 95, and its inner end is partially formed by the plug 61 already described, which is threaded thereinto. Ports 96 are formed in this reservoir and lead from the

lubricant holding chamber to an annular groove 97. A passageway 98 leads from this groove to a port 99 formed in the valve cage 49, and a pocket 100 formed in the initial valve, moves into alinement with the port 99 and the port 78. When the initial valve is open, the oil or lubricant will fill the pocket 100, and when the valve is closed, it will flow from said pocket into the ports 78, and thence be carried by the air to all parts of the mechanism.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art, without further description, and it will be understood that various changes in the size, shape, proportion and minor details of construction, may be resorted to without departing from the spirit or scope of the invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. In apparatus of the character described, the combination with a motor, of means for delivering motive fluid thereto, and means for controlling the supply of motive fluid, including a throttle valve, an automatic valve, one valve being mounted on the other, and means for operating the automatic valve directly by the motive fluid.

2. In apparatus of the character described, the combination with a motor, of means for delivering motive fluid thereto, and means for controlling the supply of motive fluid, including a throttle valve, an automatic valve, one valve being located within the other, and means for operating the automatic valve directly by the motive fluid.

3. In apparatus of the character described, the combination with a motor, of means for delivering motive fluid thereto, and means for controlling the supply of motive fluid, including a manually operated valve and an automatic fluid operated valve, one valve being mounted on the other.

4. In apparatus of the character described, the combination with a motor, of means for delivering motive fluid thereto, and means for controlling the supply of motive fluid, including a rotary valve and a reciprocatory valve, one valve being mounted on the other and being automatically operated directly with the motive fluid.

5. In apparatus of the character described, the combination with a motor, of means for delivering motive fluid thereto, and means for controlling the supply of motive fluid, including a rotary throttle valve and a reciprocatory distributing valve, one valve being mounted on the other.

6. In apparatus of the character described, the combination with a motor, of means for delivering motive fluid thereto, and means for controlling the supply of motive fluid, including a throttle valve and an automatic fluid operated valve operating in the throttle valve.

7. In an apparatus of the character described, the combination with a motor, of means for delivering motive fluid thereto, and means for controlling the supply of motive fluid, including a rotary valve and a reciprocatory valve operating in the rotary valve, one of said valves being automatically operated directly by the motive fluid.

8. In apparatus of the character described, the combination with a motor, of a valve casing having ports in communication with the motor, a manual valve in the casing controlling the supply of motive fluid, and an automatic fluid operated valve in said casing that governs the passage of the motive fluid through the ports to the motor.

9. In apparatus of the character described, the combination with a motor, of a valve casing connected thereto, an automatic fluid operated valve in the casing, and a throttle valve constituting a cage for the automatic valve.

10. In apparatus of the character described, the combination with a motor, of a throttle valve having an internal valve chamber, an automatic valve operating in said chamber, and means for supplying motive fluid to the automatic valve for operating it.

11. In apparatus of the character described, the combination with a motor, of a throttle valve having an internal valve chamber, and ports communicating therewith and with the motor, an automatic valve operating in said chamber and controlling the ports, and means for directing motive fluid against the automatic valve for operating it.

12. In apparatus of the character described, the combination with a motor, of a throttle valve having an internal valve chamber, said valve having a supply port leading to the chamber, the supply of motive fluid to the port being controlled by the movement of the valve, and said valve also having ports leading from the chamber to the motor, and an automatic valve operating in the chamber and controlling the passage of motive fluid through the latter ports, said motor having ports leading to the internal valve chamber for operating the automatic valve by the motive fluid.

13. In apparatus of the character described, the combination with a motor, of a throttle valve having an internal valve chamber, said valve having a supply port leading to the chamber and an exhaust passage leading therefrom, the supply of mo-

tive fluid to the supply port being controlled by the movement of the valve, and said valve also having ports leading from the chamber to the motor, and an automatic valve operating in the chamber and controlling the passage of motive fluid through the latter ports from the supply port and also from said latter ports to the exhaust passage, said motor having passages leading therefrom to the internal chamber to conduct motive fluid to the latter for operating the automatic valve.

14. In apparatus of the character set forth, the combination with a motor, of a throttle valve having an internal valve chamber, said valve having a supply port leading to the chamber, which port is controlled by the movement of the valve, and said valve also having ports leading from the chamber to the motor, and an exhaust passage that leads from said chamber to the outer air, and a reciprocatory automatic valve having a groove that is constantly in communication with the supply port and alternately communicates with the ports leading from the chamber to the motor, said valve also alternately affording communication between the latter ports and the exhaust passage, said motor having passages leading from the motor to the internal chamber to conduct motive fluid thereto for operating the automatic valve.

15. In apparatus of the character set forth, the combination with a cylinder member, of a reciprocatory piston therein, a head block mounted on one end of the cylinder member, means connected to the head block for supplying motive fluid to the motor, a rotary throttle valve in the head block controlling such supply and having an internal chamber with a supply port leading thereto, and delivery ports leading to the cylinder member on opposite sides of the piston, and a reciprocatory automatic valve actuated directly by the motive fluid and operating in the chamber and governing the supply of motive fluid from the supply port to the delivery ports.

16. In apparatus of the character set forth, the combination with a motor, of an automatic valve chamber having an exhaust passage leading from one end to the external atmosphere, and supply and exhaust ports connecting the chamber with the motor, an automatic valve operating in the chamber and controlling the ports, one end of the valve entering the exhaust port, and means for delivering motive fluid against the end portion of the valve adjacent said entering end to move the valve to a position to carry the said end out of the exhaust passage.

17. In apparatus of the character described, the combination with a motor, of an automatic valve chamber having an exhaust passage opening through one end, and supply and exhaust ports connecting the chamber with the motor, an automatic valve operating in the chamber and controlling the ports, a pilot carried by one end of the valve and entering the exhaust port, said valve also having an exhaust passageway therethrough, and means for delivering motive fluid from the motor against the end portion of the valve adjacent to the pilot to move the valve to a position to carry the said pilot out of the exhaust passage.

18. In apparatus of the character described, the combination with a motor, of an automatic valve chamber having an exhaust passage opening through one end, and supply and exhaust ports connecting the chamber with the motor, an automatic valve operating in the chamber and controlling the ports, a pilot carried by one end of the valve and moving into and out of the exhaust port, said valve having an exhaust passage extending entirely therethrough and through the pilot, a stationary pilot located in the end of the chamber opposite the exhaust port, said valve moving into and out of coaction with the pilot, and said latter pilot entering the exhaust passageway of the valve, and means for conveying motive fluid from the motor to opposite ends of the valve alternately when the pilot of said valve is in the exhaust passage of the chamber, and when the pilot of the chamber is in the exhaust passage of the valve.

19. In apparatus of the character set forth, the combination with a motive fluid operated motor, of motive fluid operated feeding means therefor, a throttle valve for controlling the supply of motive fluid, and an automatic valve for directing the supply of motive fluid to the motor, one of said valves being mounted on the other.

20. In apparatus of the character set forth, the combination with a motive fluid operated motor, of motive fluid operated feeding means therefor, a throttle valve for controlling the supply of motive fluid, and an automatic valve for directing the supply of motive fluid to the motor mounted in the throttle valve.

21. In apparatus of the character set forth, the combination with a motive fluid operated motor, of motive fluid operated feeding means therefor, a chambered rotatable throttle valve for controlling the supply of motive fluid to both the feeding means and motor, and an automatic valve operating in the chamber for directing the supply of motive fluid to the motor.

22. In apparatus of the character described, the combination with a motor, of motive fluid actuated feeding means therefor, a head block interposed between the motor and feeding means, and a throttle valve and an automatic valve, both located

in the head block, one valve being arranged within the other, the throttle valve controlling the supply of motive fluid to both the motor and feeding means, the automatic valve directing the supply to the motor.

23. In apparatus of the character described, the combination with a motor, of motive fluid actuated feeding means therefor, a head block interposed between the motor and feeding means, a rotary throttle valve in the head block, and a reciprocatory automatic valve in the throttle valve, the throttle valve controlling the supply of motive fluid to both the motor and feeding means, the automatic valve directing the supply to the motor.

24. In apparatus of the character described, the combination with a motor, of feeding means therefor, means for supplying motive fluid to the feeding means and the motor, a throttle valve controlling said supply, and an automatic valve governing the passage of motive fluid to the motor, said automatic valve being located in the throttle valve.

25. In apparatus of the character described, the combination with a motor, of feeding means therefor, means for supplying motive fluid to the feeding means and thence delivering it to the motor, a throttle valve controlling the supply to the feeding means, and an automatic valve carried by the throttle valve and governing the passage of the motive fluid from the feeding means to the motor.

26. In apparatus of the character described, the combination with a motor, of feeding means therefor, a head block interposed between the motor and feeding means, a throttle valve in the head block controlling the supply of motive fluid to the feeding means, said head block having a passage leading from the feeding means to the motor, and an automatic valve in the throttle valve governing said passage.

27. In apparatus of the character described, the combination with a motor, of feeding means therefor, a head block interposed between the motor and feeding means and having a motive fluid supply passage leading to the feeding means, and a delivery passage leading from the feeding means to the motor, a throttle valve controlling said passages, and an automatic valve in the throttle valve governing the passage of fluid to the motor from the feeding means.

28. In apparatus of the character described, the combination with a motor, of feeding means therefor, a head block interposed between the motor and feeding means and having a motive fluid supply passage leading to the feeding means, and a delivery passage leading from the feeding means to the motor, a rotary throttle valve controlling said passages, and an automatic reciprocatory valve in the throttle valve for governing the passage of motive fluid to the motor from the feeding means.

29. In apparatus of the character described, the combination with a motor, of feeding means therefor, a head block interposed between the motor and feeding means and having a motive fluid supply passage leading to the feeding means, and a delivery passage leading from the feeding means to the motor, a rotary throttle valve controlling said passages, and an automatic reciprocatory valve in the head block governing the passage of motive fluid to the motor from the feeding means, the reciprocatory valve being located in the throttle valve.

30. In apparatus of the character described, the combination with a motor having a reciprocatory piston, of feeding means therefor including a cylinder and a piston, a head block interposed between the motor and feeding means, and having a motive fluid supply connection, and a passage leading therefrom to the feeding means, a rotary throttle valve located in the head block and controlling said passage, said throttle valve having an internal chamber, the head block and throttle valve also having a passage leading from the feeding means to the chamber, and other passages leading from the chamber to the motor on opposite sides of the piston, and a reciprocatory automatic valve located in the chamber of the throttle valve and controlling the supply of motive fluid from the feeding means through the head block and throttle valve to the motor.

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

DANIEL SHAW WAUGH.

Witnesses:
W. H. LEONARD,
JESSIE TURNER.