969,319.

D. S. WAUGH.

DRILL FEEDING MECHANISM.

APPLICATION FILED FEB. 29, 1908.

Patented Sept. 6, 1910.

3 SHEETS—SHEET 1.

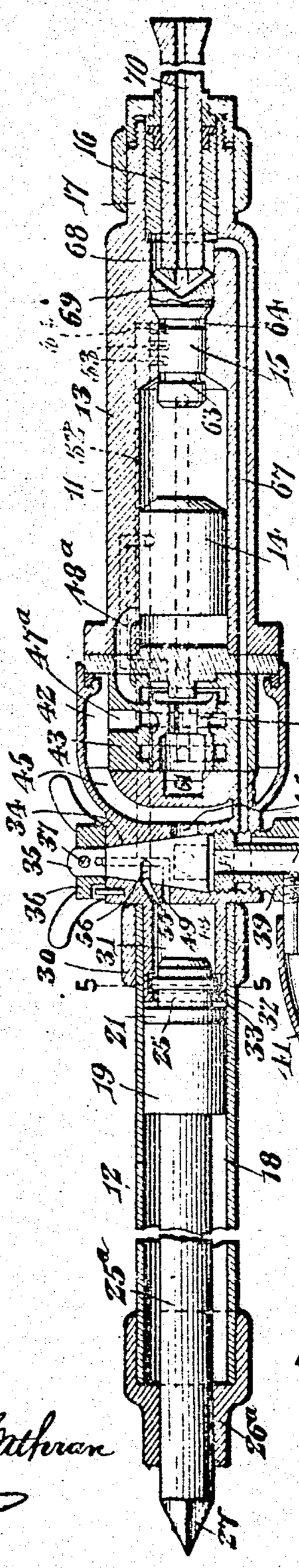

Fig. 1.

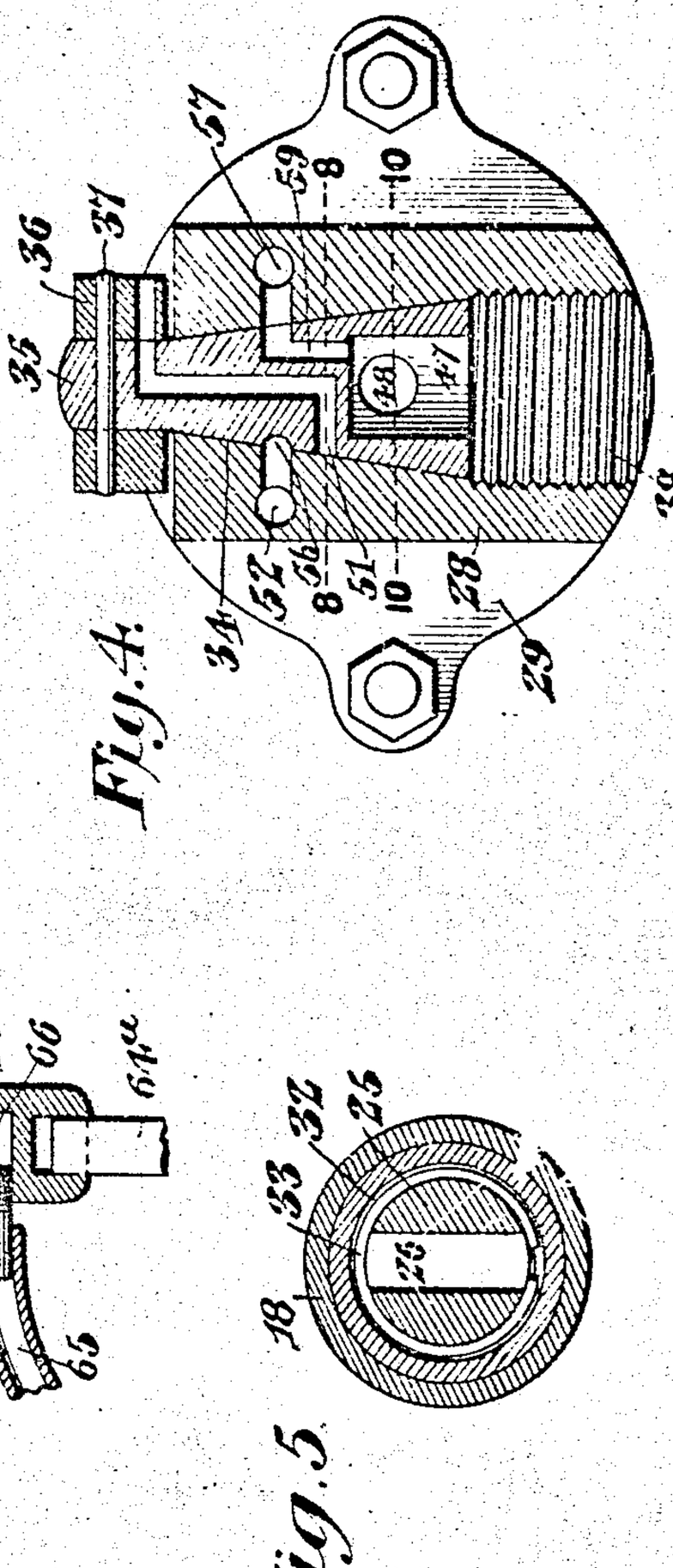

Fig. 4.

Fig. 5.

Witnesses

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3 SHEETS—SHEET 2.

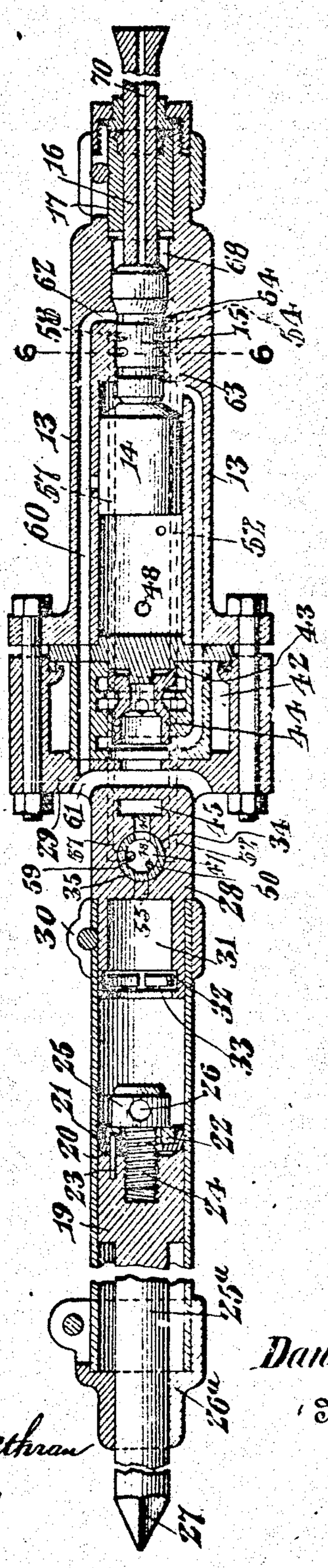

Fig. 2.

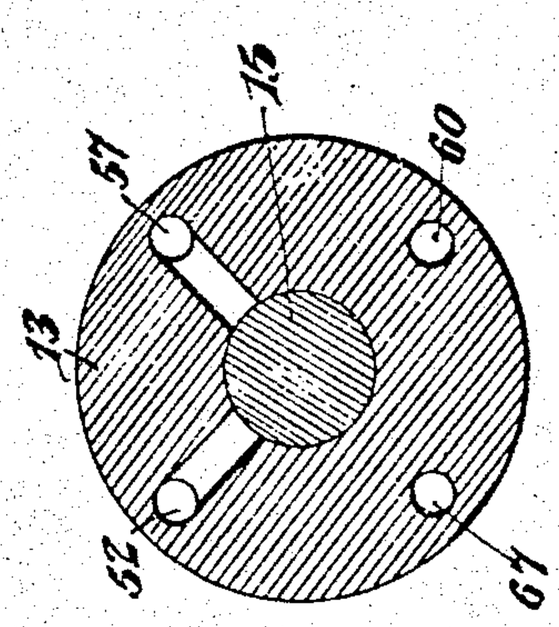

Fig. 6.

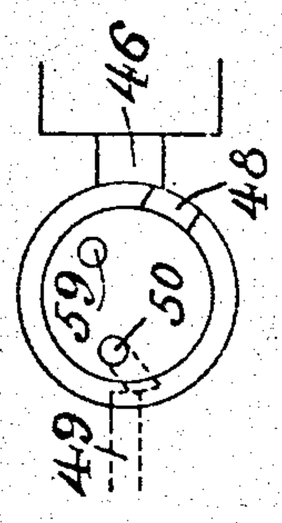

Fig. 11.

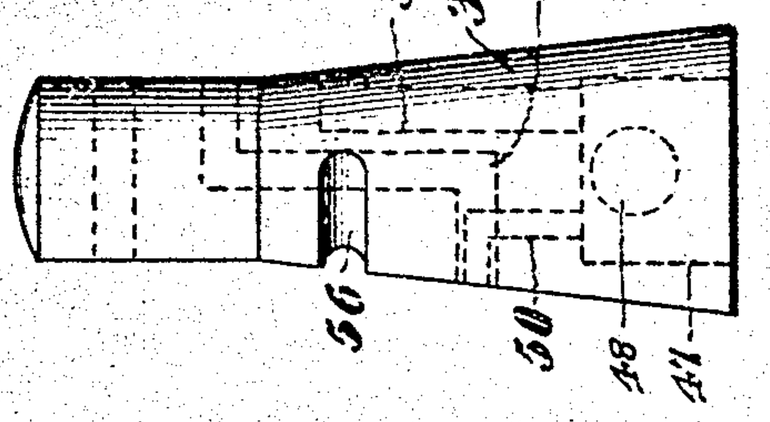

Fig. 7.

Witnesses

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APPLICATION FILED FEB. 29, 1908.

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3 SHEETS—SHEET 3.

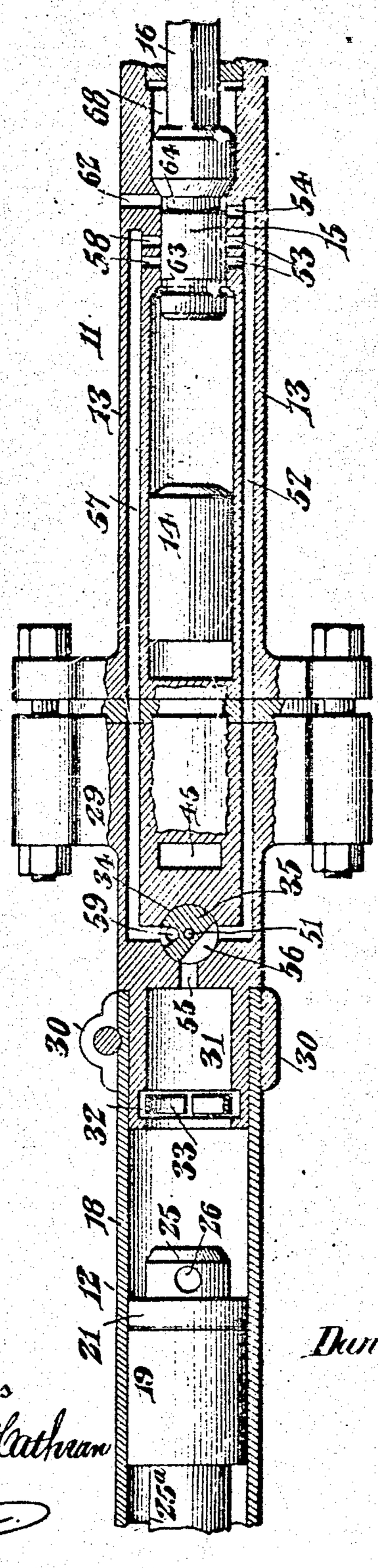

Fig. 3.

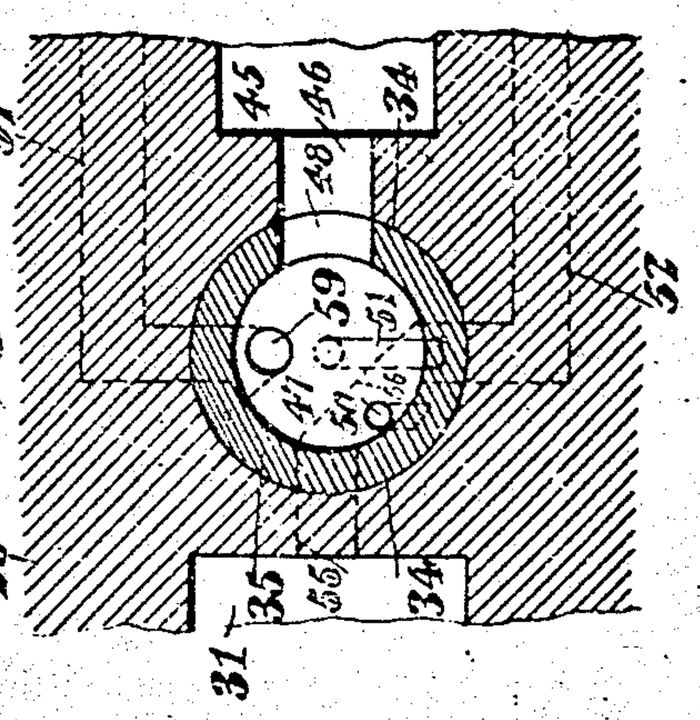

Fig. 10.

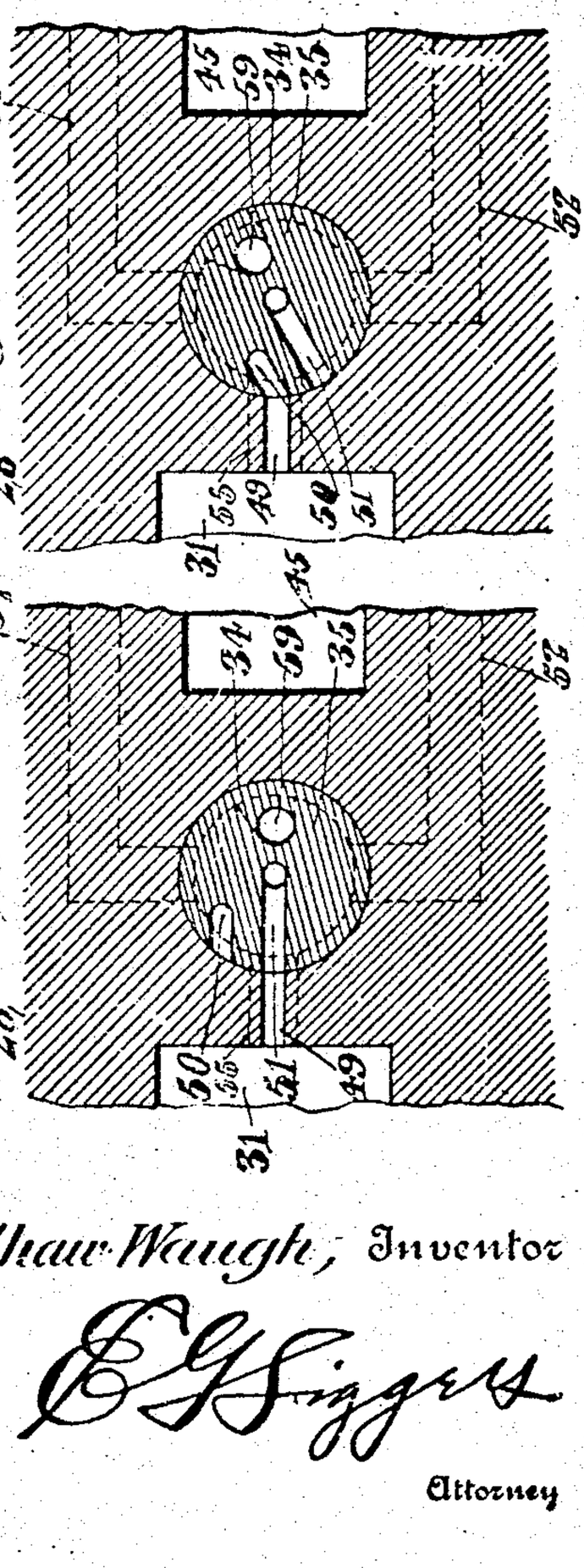

Fig. 9.

Fig. 8.

Witnesses

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UNITED STATES PATENT OFFICE.

DANIEL SHAW WAUGH, OF DENVER, COLORADO, ASSIGNOR TO THE DENVER ROCK DRILL & MACHINERY COMPANY, OF DENVER, COLORADO, A CORPORATION OF COLORADO.

DRILL-FEEDING MECHANISM.

969,319. Specification of Letters Patent. Patented Sept. 6, 1910.

Application filed February 29, 1908. Serial No. 418,520.

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 a new and useful Drill-Feeding Mechanism, of which the following is a specification.

This invention relates more particularly to means for feeding and holding to their work rock drills, hammers or other devices of an analogous nature, and more particularly pneumatic or fluid operated instruments.

One of the principal objects is to provide novel fluid operated means of a very simple character for holding the drill or other device to its work, regardless of the position of the motor or hammer, and to provide means for maintaining the ports of the feeding and holding means against relative movement when the same are inactive.

In the use of these mechanisms, when the drill or other instrument is being operated downwardly, the pressure of the fluid operated feeding means and the weight of the mechanism may be so great that considerable difficulty is experienced in effecting the necessary turning movements, and one of the important objects of the present invention is to provide means for producing a variable pressure upon the motor, said means being so arranged that when the working blow is delivered, the desired holding pressure is secured, and this pressure is relieved sufficiently during the return stroke to permit the drill or other device to be turned.

Another object is to provide an arrangement in which certain of the elements perform a plurality of functions, and the various operations are controlled by a single valve, thus greatly simplifying the mechanism and also producing an apparatus that can be successfully operated by an unskilled workman.

An embodiment of the invention that is at present considered the preferable one is illustrated in the accompanying drawings, and is described in the following specification, but it will be evident by reference to the appended claims that the invention is by no means limited to the structure disclosed and that the same may be materially modified and changed without departing from the spirit or scope of said invention.

In the drawings:—Figure 1 is a longitudinal sectional view through the structure, showing the feeding means in inoperative position. Fig. 2 is a longitudinal sectional view at right angles to Fig. 1. Fig. 3 is a longitudinal sectional view that is diagrammatic in its character illustrating more particularly the pressure controlling mechanism. Fig. 4 is a cross sectional view on an enlarged scale through the controlling valve. Fig. 5 is a cross sectional view on an enlarged scale and on the line 5—5 of Fig. 1. Fig. 6 is a cross sectional view on an enlarged scale and on the line 6—6 of Fig. 2. Fig. 7 is a side elevation on an enlarged scale of the controlling valve. Figs. 8 and 9 are sectional views on the line 8—8 of Fig. 4, but showing the controlling valve in different positions. Fig. 10 is a sectional view on the line 10—10 of Fig. 4. Fig. 11 is a diagrammatic view illustrating the arrangement of ports.

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

In the embodiment illustrated, the motor for the drill or other instrument, is designated generally by the reference numeral 11, and the motive fluid operated feeding means is in like manner designated by the reference numeral 12. The motor comprises a cylinder 13 within which operates a reciprocatory piston 14, this piston operating against a tappet device 15 located in one end of the cylinder and operating against a drill 16 or other instrument that is fitted in a suitable chuck carried by the free end of the cylinder.

The motive fluid feeding means consists of a cylinder 18 located in alinement with the cylinder 13 and having a reciprocatory piston arranged therein. This piston, as shown, more particularly in Fig. 2 consists of a head 19 having one end recessed, as shown at 20 to receive a packing disk or washer 21 formed of leather or other suitable material. A holding washer 22 is located against the packing washer 21, and a pin 23, carried by the head 19, passes through the washer 21, and is engaged with the washer 22. A holding screw 24 passing through the washer, is threaded into the head 19, and has a head 25 provided with a socket 26 to receive a turning device. A piston rod or stem 25^a, projecting from the head 19, passes through a suitable guide 26^a secured to the outer end of the cylinder 18

and terminates in a spur or point 27. The cylinders 13 and 18 are connected by a body or connection 28 integral with the head 29 of the motor cylinder 13, the body or connection 28 being fitted within the cylinder 18 and suitably clamped thereto by a split collar 30. The portion of said body or connection within the cylinder, has a recess 31 into which the head 25 is movable when the piston moves to its innermost position, and an annular internal groove or seat 32 arranged within the socket 31, has therein a split holding washer 33 that frictionally engages the head 25 to hold the piston and piston rod or stem in their innermost positions, when the parts are inactive and the drill is being transported from place to place.

The body or connection 28, which constitutes the connection between the two cylinders, is provided with a transversely disposed tapered valve seat 34 in which is rotatably mounted a master controlling valve 35, the smaller end of said valve projecting from one side of the body or connection and having a suitable operating device 36 secured thereto by a pin 37 or by any suitable means. It will be noted by reference to Figs. 1 and 4 that the larger end of the valve terminates short of the larger end of the seat, which is internally threaded, as illustrated at 38. A nipple 39, screwed into said threaded end of the seat, has a supply channel 40 that communicates with said end, and a pipe 41, leading from any suitable source of supply of motive fluid under pressure communicates with the channel 40. By this arrangement, the pressure of the air is directed against the larger end of the valve and serves to keep it firmly seated.

The means for effecting the operation of the piston 14 by the motive fluid supply through the pipe 41, need not be set forth in detail partially because said means constitutes the subject-matter of a separate application, filed March 24, 1908, Serial No. 422,895 and partially because, in so far as the present invention is concerned, any suitable means may be employed. Suffice it to state that an annular reservoir or chamber 42 is provided, which surrounds a valve casing 43, in which is located a reciprocatory valve 44. A channel 45, leading to the chamber 42, is in communication with a supply port 46 that communicates with the valve seat. The larger end of the valve is provided with a recess 47 that is thus in communication with the channel 40, and a lateral port 48, communicating with said recess, is movable into and out of register with the port 46. Another port 47ª, leading from the chamber 42, has communication with a supply channel 48ª leading to a point behind the piston 14, communication between the port 47ª and channel 48ª being controlled by the reciprocatory valve 44, and said valve also constitutes means for controlling the exhaust. With this structure when the port 48 is registered with the port 46, motive fluid supply, preferably air under pressure supplied through the pipe 41, will effect the reciprocation of the piston 14, and said piston striking the tappet 15, will effect a relative reciprocation between said tappet and the cylinder 13. The drill or other instrument, as 16 therefor located in the chuck 17, will therefore receive the force of the blows delivered by the piston 14.

A port 49 leads from the valve seat 44 to the interior of the cylinder 18 through the recess or seat 31, and a port 50, leading from the recess 47 in the end of the valve 35, has its end movable into and out of register with said port 49 so that the motive fluid can be supplied to the cylinder 18, and against the inner end of the piston. The valve 35 also has an exhaust channel 51, that is movable into register with the port 49 and extends through the projecting end of said valve. It will thus be evident that by turning the valve 35, either the supply port 50 or the exhaust port 51 may be brought into communication with the cylinder 18, in order to force the piston outwardly or to relieve the pressure against the same. This will be evident by reference to Figs. 8 and 9. Furthermore when the supply port 50 is in communication with the port 49, the supply port 48 may or may not be brought into communication with the supply port 46. For instance therefore, if the ports 49 and 50 are brought into communication without opening communication between the ports 48 and 46, then the piston rod 25ª will be moved outwardly before the motor is set in operation. On the other hand, if the ports 49 and 50 and the ports 48 and 46 are simultaneously registered, then the motor will be operated, and a constant pressure maintained against the piston of the feeding means.

As already suggested in the preliminary portion of the specification, when the motor is in certain positions, or if the pressure of the motive fluid is great enough, difficulty may be experienced in turning a drill. To avoid this, means are provided for varying the pressure, in the present embodiment, the pressure being relieved during the return stroke of the piston. To this end, it will be noted particularly by reference to Figs. 3 and 4 that the cylinder 13 is provided with a motive fluid conducting channel 52, which leads to the valve seat 34, and has a plurality of ports 53 and 54 communicating with a portion of the bore of the cylinder 13, in which the tappet 15 operates. The connection 28 between the cylinders 13 and 18 is provided with another port 55 that communicates with the valve seat and the cylin-

ber 18, and the valve 35 has a channel 56, which constitutes the means of communication between the channel 52 and port 55 when said valve 35 is in a predetermined position. A motive fluid supply channel 57 is also formed in the cylinder 13 and the connection 18, said channel 57, as shown in Fig. 3, leading from the valve seat and having ports 58 arranged in substantially the same planes with the ports 53. A supply port 59, formed in the valve 35, communicates at one end with the recess 47 in the end of said valve, and has its other end movable into register with the channel 57 when the channel 56 of the valve connects the channel 52 and the port 55. This arrangement is secured when the supply port 48 of the valve registers with the port 46, through which motive fluid is supplied to the motor. An exhaust channel 60 is furthermore formed in the cylinder 13, and as shown in Fig. 2, communicates with the exhaust port 61 for the motor. This channel has its inlet end in the form of a port 62 that is in line with the port 54 of the channel 52, as shown in Fig. 3. As already stated, Fig. 3 is somewhat diagrammatic in its character, in order to illustrate the association of the different ports. As a matter of fact, the channels 52 and 57 are not diametrically opposite, and the exhaust port 62 does not open directly through the side of the cylinder, but the operation of the structure can be made more plain by reference to said figure. It is to be observed that the tappet 15 is provided with annular grooves 63 and 64, the groove 63 registering with the ports 53 and 58 when the tappet moves outwardly with respect to the cylinder, under the action of the piston 14, and the groove 64 bringing the ports 54 and 62 into communication when the tappet is in its innermost position.

The operation of the mechanism may be briefly described as follows. When the apparatus is not in use, the piston in the feed cylinder 18 is preferably placed in its innermost position in which case, the head 25 will be grasped by the holding washer 33, and consequently the parts maintained in relatively immovable relation. In drilling upwardly extending holes with this machine the point or spur 27 of the piston steel 25 is placed against a plank or other support at the proper distance from the rock overhead, and the valve 35 is rotated slightly to bring the supply port 50 into communication with the port 49, whereupon the air admitted to the cylinder 18, will force the piston outwardly and bring the drill 16 up to the rock. A further rotation of the valve will bring the port 48 into communication with the port 46 and thus admit the air to the motor so that the piston 14 will be reciprocated, striking the tappet 15, the blow being thus communicated to the drill steel 16. The operator rotates the machine by means of suitable handles, one of which is shown at 64ª, thus turning the drill while the motive fluid feeding means always holds said drill to its work. In drilling a downwardly extending hole with the machine, there is often so much pressure against the rock due to combined weight of the machine and the pressure of the feeding means, that said machine cannot be readily rotated by hand. Whenever such a condition occurs, the valve 35 is given a further rotation, which will bring the ports 48 and 46 into full register, at the same time, bringing the port 59 and channel 57 into register and connecting the channel 52 and port 55 by means of the channel 56 at the same time carrying the ports 49 and 50 out of communication. When the parts are in this position, both the ports 51 and 50 are out of register with the port 49. When so arranged and the tappet 15 is in its innermost position, as illustrated in Fig. 3, it will be evident that the air in the cylinder 18 can exhaust through the port 55, the channel 56, the channel 52, the port 54, the groove 64, port 62 and channel 60. When, however, the piston delivers its working blow against the tappet 15, a relative movement between the cylinder 13 and the tappet 15 is effected. In other words, either the tappet 15 is moved outwardly, or the cylinder is moved rearwardly. This therefore carries the groove 64 out of register with the ports 54 and 62, cutting off the exhaust from the cylinder 18, but the same movement brings the groove 63 into alinement with one of the sets of ports 53 and 58. The result is that motive fluid flowing through the channel 57, will pass through the ports 58, the groove 63, and ports 53, through the channel 52, the channel 56 and the port 55, into the cylinder 18. The result is that a pressure in the feed mechanism is obtained at the time the blow is delivered to the drill, and as soon as the piston 14 starts back, the tappet 15 returns, again opening the exhaust and relieving the pressure so that the operator can turn the drill. It will thus be evident that the pressure in the feeding mechanism is automatically regulated by the movement of the tappet, which in turn is moved by the piston and by the vibration of the machine caused by said piston. In this machine, means are preferably provided for permitting the flow of water or air into the drill hole to clean the cuttings therefrom. To this end, a supply pipe 65 is employed, which is connected to the nipple 39, and communicates with the channel 66 in said nipple. This channel communicates with another channel 67 in the cylinder 13 that leads to a chamber 68 in the chuck 17. The outer end of the tap-

pet 15 is provided with ports 69 communicating with the chamber 68 and with a bore 70 formed in the drill steel 16.

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 sacrificing any of the advantages of the invention.

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

1. In a structure of the character set forth, the combination with a motor, of motive fluid operated feeding means for the motor, means for supplying motive fluid to the feeding means to move the motor to its work, and means associated with the supplying means and automatically operated by the motor for governing said supply.

2. In a structure of the character set forth, the combination with a motor, of motive fluid operated feeding means for said motor, means for directing motive fluid to the feeding means and means controlled by the operation of the motor and associated with the directing means for controlling the supply of motive fluid to the feeding means.

3. In a structure of the character set forth, the combination with a motor, of motive fluid operated feeding means for said motor, means for supplying motive fluid to the feeding means to move the motor to its work and exhausting said motive fluid from the feeding means and means controlled by the operation of the motor for controlling the exhaust of said motive fluid from the feeding means.

4. In a structure of the character set forth, the combination with a motor including a reciprocatory piston, of fluid operated feeding means connected to the motor and comprising a cylinder and a piston operating in the cylinder, of means for supplying motive fluid to the cylinder for moving the piston to its work, and means controlled by the motor piston and associated with the supplying means for controlling said supply of motive fluid.

5. In a structure of the character set forth, the combination with a motor including a reciprocatory piston and a tool-engaging tappet operated by the piston, of fluid operated feeding means connected to the motor and comprising a cylinder and a piston operating in the cylinder, and means for controlling the operation of the feeding piston, including a motive fluid conducting channel controlled by the tappet.

6. In a structure of the character set forth, the combination with a motor, of fluid operated feeding means for the motor, and means for supplying motive fluid to the feeding means including a motive fluid port, said motor including a device movable across the port for controlling the same.

7. In a structure of the character set forth, the combination with a motor, of fluid operated feeding means therefor, and means for supplying motive fluid to the feeding means including a motive fluid conducting channel, said motor including an automatically operated device having means for controlling the supply and exhaust of motive fluid through the channel.

8. In a structure of the character set forth, the combination with a motor including a cylinder and a device movably mounted in the cylinder, of feeding means connected to the motor and comprising a cylinder and a piston operating in the cylinder, said motor cylinder having a motive fluid conducting channel that communicates with the interior of the feeding cylinder, and an automatic movable device controlling the passage of motive fluid through said channel.

9. In a structure of the character set forth, the combination with a motor including a cylinder and an automatic device movably mounted in the cylinder, of feeding means connected to the motor and comprising a cylinder and a piston operating in the cylinder, said motor cylinder having a motive fluid conducting channel that communicates with the interior of the feeding cylinder, a supply channel and an exhaust channel, the movable device of the motor having means for bringing the supply channel and the exhaust channel into communication with said motive fluid conducting channel.

10. In a structure of the character set forth, the combination with a motor, including a cylinder, a piston, and a tappet device operated by the piston, of feeding means connected to the motor and comprising a cylinder, and a piston operating in the cylinder, said motor cylinder having a motive fluid conducting channel that communicates with the interior of the feeding cylinder, being also provided with a supply channel, and an exhaust channel, the tappet of the motor having means for bringing the supply channel and the exhaust channel alternately into communication with the conducting channel.

11. In a structure of the character set forth, the combination with a motor including a cylinder, a reciprocatory tappet operating in the cylinder and a reciprocatory piston operating against the tappet, of a feeding cylinder connected to the motor cylinder, and a piston operating in the feeding cylinder, said motor cylinder having a motive fluid conducting channel that communicates with the interior of the feeding cylinder and also having a supply channel and

an exhaust channel, the tappet being provided with ports that respectively bring the supply channel and the exhaust channel into communication with the motive fluid conducting channel upon the reciprocation of said tappet.

12. In a structure of the character set forth, the combination with a motor including a cylinder and a device movably mounted in the cylinder, of feeding means connected to the motor and comprising a cylinder and a piston operating in the cylinder, said motor cylinder having a motive fluid conducting channel that communicates with the interior of the feeding means, a supply channel and an exhaust channel, the movable device of the motor having means for bringing the supply channel and the exhaust channel into communication with said motive fluid conducting channel, and a common valve for controlling the supply of motive fluid to the motor and to the supply channel.

13. In a structure of the character set forth, the combination with a motor cylinder and a feeding cylinder, of a connection between the cylinders, said connection having a valve seat and a port leading from the valve seat to the feeding cylinder, the motor cylinder being provided with a supply channel and a motive fluid conducting channel that also communicates with the valve seat, the connection furthermore having a supply port for delivering motive fluid to the motor cylinder, means for supplying motive fluid to the valve seat, a rotary valve located in the seat and controlling the various ports and channels, the motor cylinder furthermore having an exhaust channel, a piston operating in the feeding cylinder, a piston operating in the motor cylinder, and a tappet movably mounted in the motor cylinder and operated by the piston, said tappet being provided with annular grooves for bringing the motive fluid supply channel and exhaust channel into communication with the motive fluid conducting channel alternately upon the reciprocation of the tappet.

14. In a structure of the character set forth, the combination with a reciprocatory motor, of fluid operated feeding means therefor, means for supplying motive fluid to the feeding means to hold the motor to its work, and means for automatically relieving the pressure of such motive fluid at each stroke of the motor.

15. In a structure of the character set forth, the combination with a reciprocatory motor, of fluid operated feeding means therefor, means for supplying motive fluid to the feeding means to hold the motor to its work, means for securing a holding pressure of motive fluid at the completion of the working stroke of the motor, and means for automatically relieving such pressure during the return stroke of the motor.

16. In a structure of the character set forth, the combination with a motor comprising a cylinder and a reciprocatory piston operating therein, of feeding means for the motor comprising a cylinder and a piston operating therein, means for conducting motive fluid to the cylinder of the feeding means to move the motor to its work, and automatic means for controlling said supply of motive fluid and maintaining the pressure thereof in the cylinder when the motor piston completes its operative stroke and relieving such pressure during the return stroke of said piston.

17. In a structure of the character set forth, the combination with a motor comprising a cylinder and a reciprocatory piston operating therein, of feeding means for the motor comprising a cylinder and a piston operating therein, means for conducting motive fluid to the cylinder of the feeding means to move the motor to its work, and automatic means operated by the motor piston for controlling said supply of motive fluid and maintaining the pressure thereof in the cylinder when the motor piston completes its operative stroke and relieving such pressure during the return stroke of said piston.

18. In a structure of the character set forth, the combination with a motor including a reciprocatory piston, of fluid operated feeding means for the motor, a conduit for supplying motive fluid to the feeding means to hold the motor to its work, and controlling means for the motive fluid supply operating across the conduit and automatically operated by the motor.

19. In a structure of the character set forth, the combination with a motor including a reciprocatory piston, of fluid operated feeding means for the motor, means for supplying motive fluid to the feeding means to hold the motor to its work and exhausting the same from the feeding means, and controlling means for the motive fluid supply and exhaust operated by the motor piston.

20. In a structure of the character set forth, the combination with a motor, of fluid operated feeding means for the motor, and automatic means for alternately admitting motive fluid to and exhausting it from the feeding means while the motor is in operation.

21. In a structure of the character set forth, the combination with a motor, of fluid operated feeding means for the motor, and automatic means operated by the motor for alternately admitting motive fluid to and exhausting it from the feeding means while the motor is in operation.

22. In a structure of the character set forth, the combination with a motor, of fluid operated feeding means for the motor, and means for automatically and periodically varying the motive fluid pressure in the feeding means while the motor is in operation.

23. In a structure of the character set forth, the combination with a motor, of fluid operated feeding means for the motor, and a tool-operating tappet operated by the motor and constituting means for governing the supply of motive fluid to the feeding means.

24. In a structure of the character set forth, the combination with a motor including a cylinder and a piston operating in the cylinder, of fluid operated feeding means for the motor, a motive fluid conduit having sections located in different walls of the cylinder and communicating with the feeding means, and a tool operating tappet operated by the motor piston and controlling the communication between the sections of the conduit.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

DANIEL SHAW WAUGH.

Witnesses:
W. H. LEONARD,
H. E. HARRIS.