

June 7, 1932.

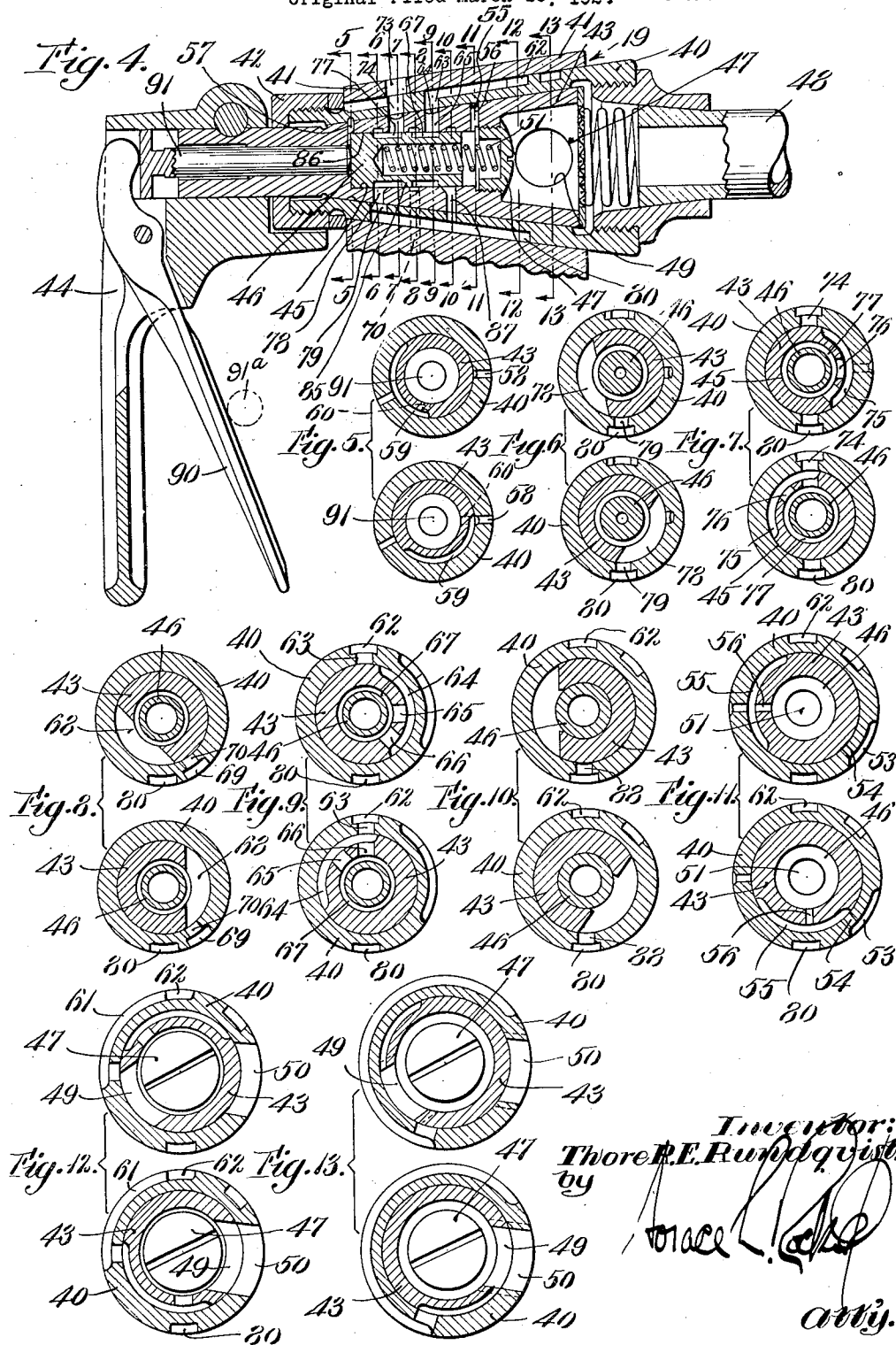
T. R. E. RUNDQVIST

1,862,497

DRILLING MECHANISM

Original Filed March 13, 1924

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Fig. 14.

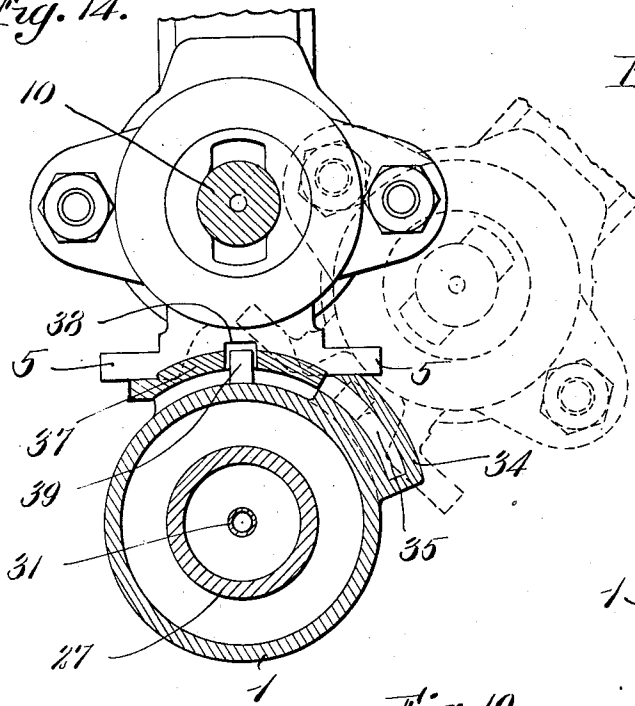


Fig. 15

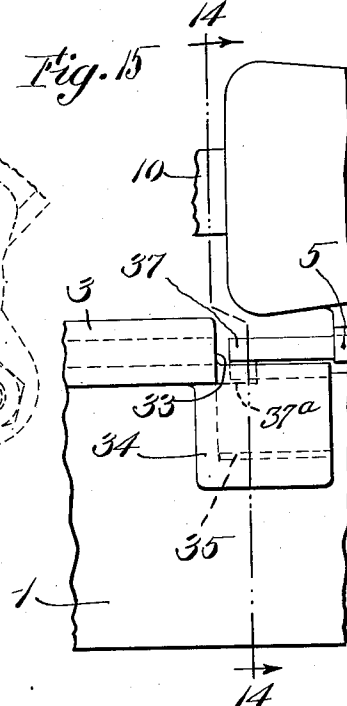


Fig. 19.

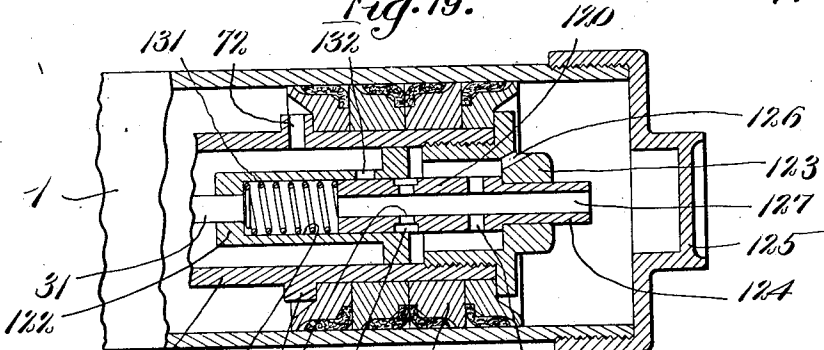
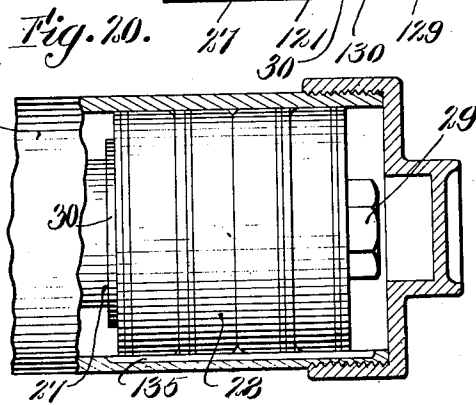


Fig. 20.



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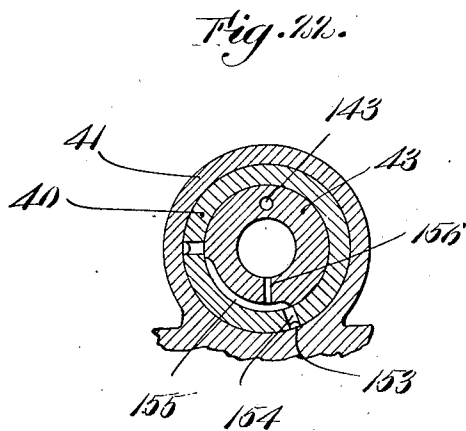
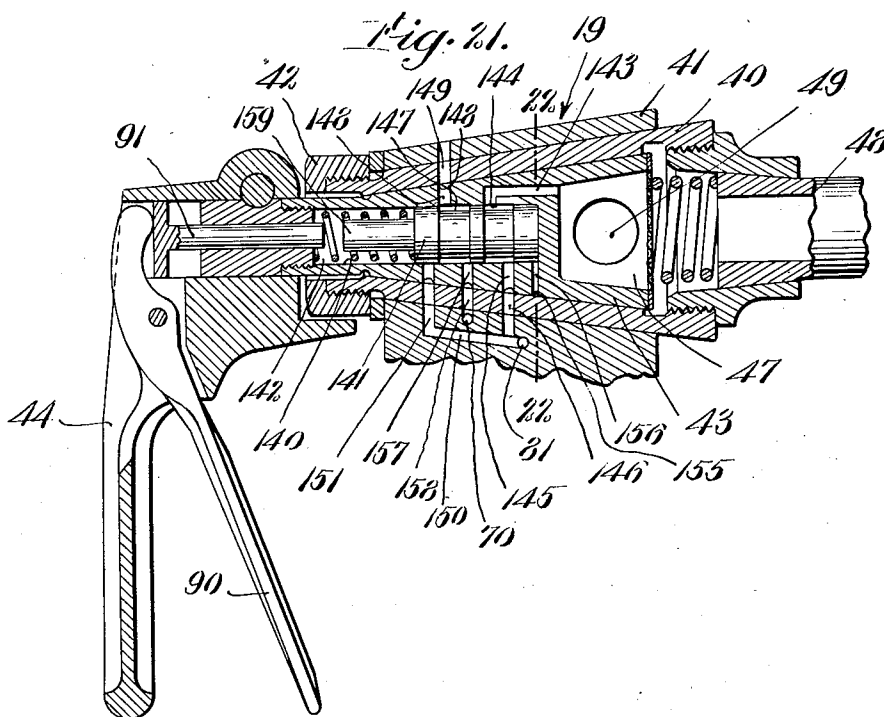
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UNITED STATES PATENT OFFICE

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DRILLING MECHANISM

Application filed March 13, 1924, Serial No. 699,109. Renewed September 15, 1930.

This invention relates to drilling mechanisms.

It has for its object to provide an improved drilling mechanism. Another object is to provide an improved automatic drilling mechanism. A further object is to provide a drilling mechanism of the drifter type having feeding mechanism therefor and provided with improved means for automatically reversing said feeding means when the operation of the drilling mechanism is not normal, one example of which is when resistance to rotation of the drill steel becomes too great. A further object is to provide improved means for automatically reversing the drill when the same has reached the end of its forward stroke. Still another object is to provide improved means which cooperates with a part of the automatic stop means to blow out the hole at the will of the operator. Another object is to provide improved means for blowing out the hole at the will of the operator without affecting the operation of the feeding mechanism. Another object is to provide improved automatic means which is responsive to the normal operation of the hammer piston to control a pneumatic feed therefor.

In the accompanying drawings I have shown for purposes of illustration several forms which my invention may assume in practice.

In these drawings,—

Fig. 1 is a developed longitudinal vertical section of my invention parts being shown in elevation.

Fig. 2 is a vertical transverse section on line 2—2 of Fig. 1.

Fig. 3 is a vertical transverse section on line 3—3 of Fig. 1, parts being shown in elevation.

Fig. 4 is a longitudinal section through the controlling valve which is transversely disposed to the machine and is taken on line 4—4 of Fig. 3.

Figs. 5 to 13 are transverse sections through the controlling valve taken on lines 5—5 to 13—13 of Fig. 4 respectively.

Fig. 14 is a vertical transverse section on line 14—14 of Fig. 1 with the drilling mechanism

in its rearmost position rather than in its forward position as shown in Fig. 1 and also on line 14—14 of Fig. 15.

Fig. 15 is a fragmentary side elevation of Fig. 14 corresponding to a view looked at from the opposite side of the machine shown in Fig. 1.

Fig. 16 is an enlarged detail of the valve mechanism for automatically stopping and reversing the drilling motor upon reaching its forward limit of movement.

Fig. 17 is an enlarged sectional view of the manually operable means for cleaning the hole by air pressure, the view being taken substantially on line 17—17 of Fig. 3.

Fig. 18 is a transverse section taken on line 18—18 of Fig. 1 of the pawl and ratchet mechanism for assisting in steel rotation.

Fig. 19 is an enlarged detail of a modified form of automatic forward stop for the drill.

Fig. 20 is a still further modification of the automatic stop.

Fig. 21 is a longitudinal section through a modified form of automatic feed controlling pilot valve.

Fig. 22 is a section on line 22—22 of Fig. 21.

In the illustrative form of my invention I have shown the same embodied within a drifter type of drill having a pneumatic feed cylinder 1 used as a supporting shell while projecting downwardly therefrom is a usual supporting member 2 which may be mounted on any suitable support and projecting upwardly from the cylinder 1 are longitudinal grooved guides 3 extending substantially the full length of the feed cylinder. As is customary the drilling mechanism, generally indicated at 4, is slidably mounted in the guideways 3 as by having gibs 5 disposed therein which, as clearly shown in Fig. 3, are disposed somewhat below the under side of the drilling mechanism 4. The drilling mechanism proper is of the usual type employing a motor including a cylinder 6 having a rotatable rifle bar 7 and ratchet mechanism 8 adapted to cause a cooperating piston 9 to be partially rotated on alternate strokes thereof, such partial rotation being transmitted to a hollow steel 10 carried in a chuck sleeve 11 rotated by a striking bar

12 having straight grooves on the periphery thereof to cooperate with a chuck nut 13. A usual type of fluid distribution valve 14 is employed which cooperates with forward and rearward passages 15 and 16 each of which forms an inlet and exhaust passage for the opposite ends of the motor cylinder. There are also employed usual piston controlled throw ports 17 leading from opposite ends of the motor cylinder 6 to the valve 14 for controlling actuation of the valve 14. Carried in the rear head 18 of the motor cylinder is a usual main valve 19 adapted to control fluid flow to the motor 4 and to the feeding cylinder 1 by means hereafter described. The head 18 also carries hole cleansing fluid conducting tubes 20 one of which terminates within the striking bar 12 and the other within a hollow portion of the steel 10, while fluid is supplied thereto as by a suitable connection 21.

The particular structure employed for feeding the drilling mechanism, which includes valve mechanism and passages for automatically controlling the feed, comprises a rearwardly extending U-shaped arm 22 clearly shown in Figs. 1 to 3 formed on the head 18 and terminating at its rearward end in a downwardly projecting member 23 which has a conical shaped bore 24 in axial alignment with the cylinder 1. Disposed within and projecting forwardly from the bore 24 is a plug member 25 held therein by a nut 26 while threadedly connected thereto at its forward end is a hollow piston rod 27 carrying a piston 28 at its forward end which is held thereto by any suitable construction such as a flanged plug 29 threaded into the forward hollow portion of the rod 27 to cause the several elements of said piston 28, which includes suitable packing, to be thrust into tight engagement against a flange 30. Also carried in the plug 25 is a forwardly extending fluid conducting tube 31 coaxially disposed with respect to the cylinder and rod 27 and terminating in a head 32 fixed within the forward portion of the bore of the rod 27, the same being made leak proof. From the construction thus far described it will be seen that the drilling mechanism when moved back and forth in the guideways 3 will also cause movement of the piston 28 as by the arm 22 and depending connection 23.

One feature of my invention is to provide improved means for swinging the drilling mechanism to one side of its normal operative position in order that a steel might be removed or one of a greater length than has just been removed inserted. For example, in drilling a hole, the drilling mechanism will be moved to its rearmost position, a relatively short steel inserted, and the drilling mechanism then fed forward to its forward limit. If it is now desired to drill a deeper

hole, obviously it would require a steel of greater length, and the machine is then again brought to its rearmost position and the short steel moved forward into the hole. The drilling mechanism is then swung laterally in order to remove the short steel. The longer steel then inserted into the hole to a depth so that the shank will clear the forward end of the chuck housing, after which the drilling mechanism is swung to its normal position. The steel may then be pulled back into the chuck which will then be rotated to be fed forward a distance substantially equal to the feeding length of the cylinder 1. Such an operation may be repeated as often as desired to deepen the hole. To permit this lateral movement, the guideways 3 terminate as at 33 slightly in advance of the rearmost portion of the cylinder 1 while positioned adjacent the end of one of these guideways, is a member 34 having an arcuate groove 35 formed therein, the center of transverse curvature of this groove coinciding with the axis of the feeding cylinder. The distance between the end of the guideways 33 and the rear head 36 through which the piston rod 27 projects is slightly greater than the length of the piston 28. Hence when said piston is in its rearmost position the gibs 5 are of such length that they will be freed from their guideways and the drilling mechanism may then be swung to its lateral position, being guided during such movement by an arcuate lug 37 mounted on the forward end of the drilling mechanism substantially adjacent the end of the chuck housing and adapted to have slidable engagement with the groove 35. The mechanism is prevented from having lateral movement in the other direction by a suitable extension 37^a of the lower portion of one of the guideways 3 against which said lug 37 will abut. It will be noted that during the lateral swinging of the mechanism to the dotted line position shown in Fig. 14 the piston rod 27 will act as a supporting pivot.

An opening 38 is formed in the lug 37 to allow passage therethrough of a suitable lug or stop member 39 formed on the upper side of the cylinder 1, the function of which will appear later.

In order to accomplish the automatic feature of cutting off the forward feed and causing actuation of the reverse feed when the operation of the drilling mechanism is not normal, such for instance as when the steel thereto becomes stuck or when resistance to rotation thereto becomes too great, I have provided suitable valves and passage means for controlling the flow of fluid to opposite sides of the piston 28. This means includes the main control valve 19 comprising a conical sleeve 40 non-rotatably seated within the conical bore of the valve housing 41 and held therein by any suitable means such as a nut 42. Rotatably mounted within the sleeve 40 is a

main conical shaped valve 43 adapted to seat within a conical bore in the sleeve 40 and rotated by a suitable lever 44. Reciprocally mounted within a bore 45 formed in the valve member 43 is a spring pressed pilot valve 46. Communicating with a chamber 47 formed in the member 43 is a usual inlet conduit 48 from which fluid will flow to chamber 47 and out through ports 49, 50 in the valve member 43 and sleeve 40, respectively, to a suitable passage leading to inlet of the distributing valve 14. These ports are further shown in Figs. 12 and 13, the upper views of which are in closed position and the lower in open position.

The pilot valve 46 has suitable annular grooves which connect certain passages leading from a source of live pressure fluid and to the forward and rear sides of the piston 28. The valve 46 when in the position shown in Fig. 4 is in normal forward feeding position, the same being held in that position by a spring 51. Said valve is also subjected to the pressure fluctuations within the opposite ends of the motor cylinder 4 as by a passage 52 leading from the passage 16 (see Fig. 1) to the groove 53 formed on the outer periphery of the sleeve 40 through a port 54 to recess 55 (see Fig. 11), and through port 56 to the inner end of the valve 46, while communicating with the passage 15 is a passage 57 adapted to conduct fluid to the rear of the valve 46 as by a port 58 (Fig. 5) formed in the sleeve 40, groove 59 formed in the periphery of the valve member 43, and port 60 leading therefrom to the end of said valve. Thus upon reciprocation of the piston, the pressure fluctuations within the motor cylinder will pass through the passages 52 and 57 to both ends of said valve but as these fluctuations occur very rapidly there is maintained a substantially constant pressure at both ends of the valve 46 which will not cause a fluttering movement of the valve 46. The steadiness of said valve is assisted by the spring 51. Suitable passages are provided for conducting fluid from a source of live fluid supply to the rear side of the piston 28 which comprises grooves 61, 62 in the periphery of the sleeve 40 (Fig. 12) port 63, groove 64 formed in the periphery of the valve mechanism 43, and ports 65 or 66 to an annular groove 67 formed in the periphery of the pilot valve 46. The groove 67 communicates with a chamber 68 (see Fig. 8) formed by cutting a vertical slot in the outer portion of the valve member 43 and with a port 69 leading to a passage 70, port 71 formed in the member 25, (Fig. 1), hollow portion of the piston rod 27 and port 72 formed in the forward portion of the piston rod to the rear side of the piston 28 which will cause said piston to move forwardly and feed the drilling mechanism therewith.

During the flow of fluid through the passages just mentioned the cylinder in front

of the piston 28 is vented to the atmosphere as by having a port 73 formed in the valve housing 41 and which communicates with a port 74 formed in the sleeve 40 (Fig. 7), groove 75 formed in the periphery of the valve member 43, port 76, annular groove 77 formed in the periphery of the pilot valve 46, ports 78 and 79 (see Fig. 6), longitudinal groove 80 and passage 81 (Fig. 1) which leads to a chamber 82 formed in the rear portion of the member 25 from which the conducting tube 31 communicates to allow a flow of fluid from or to the front side of the piston 28 as by a bore 83 formed in the piston retaining nut 29.

If now, for any reason, the mode of operation of the drilling mechanism should become incomplete for instance if the resistance to steel rotation should become too great the piston 9 would be prevented from completing its rearward stroke, which is the direction of movement upon which the steel is rotated, and the pressure on the rear side of said piston will be exhausted to atmosphere as through the valve 14. The valve 14 will also relieve the pressure in the passage 52 and the ports and passages connected therewith which lead to the front side of the pilot valve 46. Live pressure fluid will, however, still be admitted to the front side of the piston 9 and as a result normal working or live pressure might be maintained in the passage 57 and the passages and ports communicating therewith which lead to the rear side of the pilot valve 46 so that the pressure on the rear end of the valve 46 will force the same in a right hand direction against the tension of the spring 51, the result being that port 68 is cut off by the annular ring 85, thereby preventing further flow to the rear side of the piston 28 through the passage 70, and upon movement of the ring 85 to the right hand side of the port 68, passage 70 will be vented to atmosphere as by the annular groove 77 which will communicate with port 73. At this instant, the vent for the forward side of the piston 28 will be closed as by a shoulder 86 riding over the port 79. Live fluid pressure at the same time is admitted to the reverse passage 81 and consequently to the forward side of the piston 28 to drive the same rearwardly. This latter function is accomplished due to the fact that annular grooves 67 will now allow communication between the live air port 63 and a port 87 formed in the valve member 43 which communicates with the port 88 and a passage 80 through passage 81 to the front side of the piston 28. As soon as the steel is sufficiently released or becomes free, the piston 9 will assume normal operation and thereby allow normal pressure to be built up at both ends thereof to transmit equal pressures to the ends of valve 46, whereby the spring 51

will again force the valve over to its normal forward feeding position.

Upon first turning the valve 43 to open position, it will be seen that the device, due to the normal position of the valve 46, would feed forwardly until the steel engaged the material to be drilled. It is oftentimes desired to "spot" a hole before allowing a full forward feed and to do this, I have provided a trigger lever 90 pivotally mounted upon the lever 44 and adapted to actuate a stem 91 coaxially disposed within the stem of the valve member 43 to push the valve 46 forwardly so that it might vent the forward feed and throw on the reverse feed. In the operation of this part of the device it is seen that should the levers 90 and 44 be squeezed together, the device would reverse and when the lever 90 was released, it would immediately feed forward. Thus by alternately compressing and releasing the lever 90, the drilling mechanism can be first fed forward and then rearward within a relatively short distance so as to hold it in substantially one position adapted for spotting. I also find that a satisfactory operation can be had if the operator will merely place his finger at some predetermined position as designated by a dotted circle 91^a in Fig. 4 and hold the same there throughout the spotting operation so that when the main valve is turned on and the machine fed forward, lever 90 will engage the operator's finger and thus reverse the mechanism until sufficient reverse movement has been attained to allow the pilot valve 46 to again throw in the forward feed which will thereby cause the lever 90 to again be fed forward against the operator's finger. It is found in actual practice that the total reverse and forward movement of the mechanism is very minute so as to present practically a stationary drill for spotting. I have also found that a mechanical finger longitudinally movably supported on some stationary part of the mechanism can be used so that by placing said finger at any longitudinal position, the same operating effect can be had as just described.

It is often desirable to clean out the hole being drilled by supplementing the usual hole cleansing fluid with live actuating pressure from the motor cylinder, and to accomplish such a function, I hold by suitable means, the piston 9 in its rearward position so that live fluid in front of the piston can then flow down through the flutes formed in the periphery of the striking bar 12 to the steel. It is to be noted, however, that in the ordinary operation of the piston 9, if the same becomes held on its rearward stroke, the normal operating pressure on the rear side of the piston will exhaust to relieve pressure on the front end of the pilot valve 46 while pressure on the front side of the piston will be maintained at normal and throw

the pilot valve 46 to the right, thus causing reverse feeding movement. It will thus be seen that to hold the piston 9 in order to blow out the hole and still maintain the steel within the hole some means must be provided for preventing reverse feeding of the drilling motor. To hold, at the will of the operator, the piston 9 in its rearward position to affect the blowing feature, it is necessary to hold the valve 14 at one end of its travel. To accomplish this, I provide means adapted to cut off flow from the reverse throw port 17 leading to the front end of the cylinder 6.

This means comprises a manually operable spring pressed valve 92 reciprocally mounted within a bore 93 formed in the rear head 18 and traversing the passage 57 leading from the passage 15 to the rear side of the pilot valve 46. However, to allow the normal flow of fluid through said passage, an annular groove 94 is formed in the valve 92. A spring pressed fluid pressure actuated plunger 95 is reciprocally mounted within reduced and enlarged bores 96 and 97 as shown in Fig. 17. Upon forward movement of the plunger 95, the throw port 17 will be cut off from communication with the forward part of the cylinder 6 and thereby prevent live pressure fluid from flowing to one end of the valve 14, thus causing the latter to be held which prevents live pressure fluid to be distributed to the rear side of the piston 9 to force the same forward. To actuate the plunger 95 the bore 97 communicates with the bore 93 below the lower end of the valve 92, when in the position shown in Fig. 17, as by a passage 98. It is to be noted that the passages 57 and 98 which lead into the bore 93 are disposed close together so that upon downward movement of the valve 92 the annular groove 94 will allow communication between said passages and at the same time shut off communication through the passage 57 leading from the bore 93, thus preventing the flow of live pressure fluid through port 58 to the rear side of the pilot valve 46 and thereby the forward feed is continued. The flow of fluid from the front end of the cylinder is diverted as through the annular groove 94, passage 98 and the bore 97 to actuate a piston 99 formed on the rear end of the plunger 95 to thrust the same forwardly and thus close the throw port 17. When it is desired to assume normal operation, the valve 92 will be released and the spring 100 thereunder will force the same outwardly.

When the drilling mechanism reaches its forward feeding limit, suitable means come into operation for automatically cutting out the forward feed and throwing on the reverse feed so as to withdraw the steel and thereby warn the operator, who may be running several such machines, that a resetting of the

steel is necessary as previously explained. This means comprises a spring pressed valve 105 reciprocally mounted in bore 106 formed in the lower side of the head 18, said bore being closed as by a vented plug 107 as shown in Figs. 1 and 16. During the forward feed the valve 105 will assume a position in the forward end of the bore 106 but upon the drill reaching its forward limit, a stem 108 projecting forwardly from the valve 105 will engage the stop member 39 mounted upon the cylinder 1 and cause said valve to be thrown in its rearward position as shown in Fig. 16 thereby allowing live fluid pressure to be admitted to the bore 97 to thrust the plunger 95 forwardly and shut off the throw port 17 which will, as previously explained, cause the piston 9 to be held in a rearward position. This means comprises a passage 110 leading from any suitable source of live pressure fluid such as the main control valve to an annular groove 111 formed in the periphery of the valve 105, ports 112 and 113 to the inner end of the bore 106 from which it will pass through passage 114 to bore 100 below valve 92 from which it passes to passage 98 to actuate the plunger head 99. It will be noted that the passages 57 leading to and from the bore 93 are not interrupted as in the manual operation of the valve 92. The result is that pressure on the rear side of the piston 9 being exhausted, relieves the pressure on the front side of the pilot valve 46 while the normal pressure on the front side of the piston 9 will be communicated through the passage 57 to the rear side of pilot valve 46 to cause the same to be thrown forwardly and thereby actuate the reverse feed as previously explained. During such operation it will also be noted that the hole will be cleaned due to the pressure fluid in the front end of the cylinder 6 discharging through the flutes in the rifle bar. Upon this reverse movement the stem 108 will move away from stop 39 but such movement will not affect the position of valve 105 due to live pressure fluid acting on its forward side, the area of which is great enough to overcome the pressure of the spring 115 disposed in the rear of said valve. The machine is consequently fed to its rearmost position. To re-start the machine it is necessary to close the main control valve or to interrupt the flow of live pressure through port 110 whereby the valve 105 will then be allowed to assume its front position and to open the throw ports 17 so that the valve 14 may assume its normal operation.

In Fig. 19 I have shown a modified form of means for shutting off the forward feed upon the drilling mechanism reaching its forward feeding limit, which comprises a spring pressed plunger 120 reciprocally mounted within a bore 121 formed in a bushing 122 which takes the place of the partition 32 shown in Fig. 1, and in which the tube 31 ter-

minates. Projecting forwardly from the piston 120 and through a nut 123, which takes the place of the nut 29 shown in Fig. 1, is a stem 124 adapted to engage the front end 125 of the feed cylinder, the nut 123 having a port 126 which takes the place of the bore 83 in the nut 29. The object of the valve 120 is to permit equalization of the pressure on both sides of the piston 28 and due to the difference in area of said sides, the piston when subjected to equal pressures will be fed in a reverse direction. To accomplish this, a passage 127 is formed throughout the length of the valve 120 with which radially extending ports 128 communicate while rearwardly spaced from said ports is an annular groove 129 communicating with radial ports 130. When the stem 124 engages the head 125 and is pressed rearwardly against the tension of the spring 131, groove 129 will register with port 132 formed in the member 122, thus permitting fluid on the rear side of the piston 28 to pass through ports 72, 132, passage 127 to the front side of the piston 28 which due to its larger area will thus cause the piston to be moved slightly backward until the stem 124 disengages the head 125 to thereby shut off the port 132. Upon disengagement of the stem 124 from the head 125, the pressure on the forward side of the piston will be exhausted out through the tube 31 and the piston will again be fed forward. The amount of travel of the piston to equalize the pressure and exhaust the same from the front side of the piston is very small so that the drilling mechanism assumes practically a stationary position.

In Fig. 20 I have shown how the same result may be accomplished by a somewhat simpler means which comprises a longitudinal passage 135 formed in the inner surface of the cylinder 1 and of little greater length than the piston 28. The result is that upon the rear end of the piston uncovering the rear end of the passage 135, actuating fluid will be allowed to flow to the front side thereof and thus prevent further forward movement of the piston 28.

It is not thought that further description of the mode of operation of the various elements is necessary in view of the operation as brought out in connection with each feature. It is to be noted, however, that I have provided an automatic drilling mechanism which an operator needs only to set up and thereafter pay practically no attention thereto, for if the mode of operation of the drilling motor or steel should become incomplete the machine will automatically be pulled out until normal running is resumed when the mechanism will be again fed forward and upon reaching its forward limit of movement, will automatically be fed back and held. In addition to these novel features, I have also

combined therewith suitable hole cleansing means.

In Figs. 21 and 22 I have shown a modified form of automatic feed controlled pilot valve which in some respects is similar to my preferred form. The operation of this valve differs from the other one in that upon initial operation of the drilling motor, said valve is moved to automatically shut off a reverse feed and to throw on the forward feed, whereas in my preferred form upon initial operation of the drilling motor the pilot valve is held stationary to allow the forward feed to operate and is thrown only when the motor stops so as to cut out the forward feed and throw in the reverse feed. More specifically, this valve comprises the usual sleeve 40 fixed within the housing 41 and within which is rotatably mounted the conical shaped main control valve 43. Formed in the valve 43 is a bore 140 having a pilot valve 141 reciprocally mounted therein and held at the forward end of the bore 140 when the drilling motor is not running as by the spring 142. When in this position, when the valve 43 is turned to on position, live fluid pressure will flow from the supply hose 48 to the front side of the feed piston 28 to impart reverse movement thereto as by a passage 143, annular groove 144 formed in the periphery of the valve 141, ports 145 and 146 formed in the valve 143 and sleeve 41, and terminating in the passage 81 leading to the conducting tube 31 disposed in the hollow piston rod 27. The rear side of the piston 28 is vented to the atmosphere as by the passage 70 and annular groove 147 also formed in the periphery of the valve 141 and ports 148 and 149 formed in the valve member 43 and sleeve 40 respectively. It will thus be seen that with the valve 141 in its forward position the reverse feed will be actuated. However, when the drilling motor has normal operation, pressure fluctuations in the rear end of the cylinder are communicated to the front end of the bore 140 to throw valve 141 to a rear position whereby the port 146 is shut off from communication with the live fluid pressure admitted through passage 143 and at the same time vents the passage 81 which is the reverse feed passage as by a passage 150, a port 151, the annular groove 147 and ports 148 and 149. The pressure fluctuations are transmitted to the front end of the bore 140 as by a passage 153, a port 154, a groove 155 and a port 156, all of which are formed in the valve 43, sleeve 40 and housing 41. When the valve is thrust to its rearward position, the live pressure fluid supply passage 143 is thrown into communication with the forward passage 70 as by ports 157 and 158 formed in the valve 43 and sleeve 40 respectively. It will thus be seen that upon starting of the motor the reverse and forward feed will be automatical-

ly shut off and thrown on respectively. The valve is held in substantially a stationary rear position, as the pressure fluctuations in the rear end of the cylinder occur so rapidly that the tension of the spring 142 is not sufficient to immediately thrust the pilot valve to its forward reverse position. However, should the operation of the motor become hindered in any manner such as to prevent reciprocation of the hammer piston, which might be by the steel sticking, the fluid in the rear end of the cylinder will be exhausted to atmosphere thereby relieving pressure on the pilot valve to allow the same to be thrown forwardly to control the forward and reverse feeds as above stated. A stem 159 projects rearwardly from the valve 141 and is adapted to be engaged by the stem 91 for the spotting operation as explained in connection with my preferred form.

While I have in this application specifically described several forms which my 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 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. A drilling mechanism comprising a pressure fluid actuated drilling motor, feeding means therefor, a main valve for controlling said motor, and a fluid actuated valve carried in said main valve for automatically controlling said feeding means.

2. A drilling mechanism comprising a pressure fluid actuated drilling motor having pressure variations therein during operation thereof, feeding means therefor, a main valve for controlling said motor, and pressure fluid operated controlling means including a pressure fluid actuated valve carried in said main valve for automatically controlling said feeding means, said latter control valve having a pressure fluid operating connection with said motor.

3. A drilling mechanism comprising a pressure fluid actuated drilling motor having pressure variations therein during operation thereof, feeding means therefor, a main valve for controlling said motor, and pressure fluid operated controlling means including a control valve carried in said main valve for automatically controlling said feeding means, and pressure fluid operating connections between the opposite ends of said latter control valve and said motor.

4. A drilling mechanism comprising a pressure fluid actuated drilling motor having pressure variations therein during operation thereof, feeding means for said motor, and pressure fluid operated controlling means for said feeding means controlled by said motor

including a pilot valve, and a pressure fluid operating connection between the opposite ends of said valve and said motor.

5 5. A drilling mechanism comprising a pressure fluid actuated drilling motor having pressure variations therein during operation thereof, feeding means for said motor, and pressure fluid operated controlling means for said feeding means controlled by said
10 motor including a pressure fluid actuated pilot valve, and a pressure fluid operating connection between the opposite ends of said valve and said motor.

15 6. A drilling mechanism comprising a pressure fluid actuated drilling motor having pressure variations therein during operation thereof and including a cylinder and a piston movable therein, feeding means for said motor, and pressure fluid operated controlling means for said feeding means controlled by said motor including a pressure fluid actuated pilot valve, and pressure fluid operating
20 connections between the opposite ends of said valve and the opposite ends of said cylinder.

25 7. A drilling mechanism comprising a pressure fluid actuated drilling motor having an automatic fluid distribution valve, actuating means for said valve including valve throwing passages, a hollow drill steel actuated by said motor, hole cleansing means cooperating with said steel, and means for controlling said cleansing means including a fluid actuated controlling valve associated with said fluid distribution valve for controlling one of said valve throwing passages.
30

35 8. A drilling mechanism comprising a pressure fluid actuated drilling motor having an automatic fluid distribution valve, actuating means for said valve including valve throwing passages, a hollow drill steel actuated by said motor, hole cleansing means cooperating with said steel, means for controlling said cleansing means including a fluid actuated controlling valve associated with said fluid distribution valve for controlling one of said valve throwing passages, and a manually operable valve for controlling operation of said valve.
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45 9. A drilling mechanism comprising a pressure fluid actuated drilling motor having an automatic fluid distribution valve, valve throwing ports controlling said valve, hole cleansing means cooperating with said motor, and means including a fluid actuated valve for controlling fluid flow through one of said valve throwing ports.
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55 10. A drilling mechanism comprising a pressure fluid actuated drilling motor having an automatic fluid distribution valve, valve throwing ports controlling said valve, hole cleansing means cooperating with said motor, means including a fluid actuated valve for controlling fluid flow through one of said valve throwing ports, and a manually oper-
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able valve for controlling operation of said latter valve.

11. A drilling mechanism comprising a drilling motor, a hollow drill steel actuated thereby, feeding means therefor, hole cleansing means cooperating with said steel, and means operative upon a predetermined feeding movement of said feeding means for controlling said hole cleansing means, said hole cleansing means including means operable at the will of the operator for controlling said cleansing means.
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12. A drilling mechanism comprising a drilling motor, a hollow drill steel actuated thereby, feeding means therefor, hole cleansing means cooperating with said steel, and means controlled by said feeding means for controlling said hole cleansing means.
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13. A drilling mechanism comprising a drilling motor, a hollow drill steel actuated thereby, feeding means therefor, hole cleansing means cooperating with said steel, and means controlled by said feeding means for controlling said hole cleansing means, said hole cleansing means including means operable at the will of the operator for controlling said cleansing means independently of the control of said feeding means.
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14. A drilling mechanism comprising a drilling motor, a drill steel actuated thereby, feeding means for said steel, hole cleansing means cooperating with said steel, and means operable upon a predetermined feeding movement of said feeding means for automatically controlling said feeding means, said automatic means including means for controlling said hole cleansing means.
90

15. A drilling mechanism comprising a drilling motor, a drill steel actuated thereby, feeding means for said steel, hole cleansing means cooperating with said steel, and means operable upon a predetermined feeding movement of said feeding means for automatically controlling said feeding means, said automatic controlling means including means for controlling said hole cleansing means and for controlling said motor.
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16. A drilling mechanism comprising a drilling motor, hole cleansing means cooperating therewith, means for positively feeding said motor forwardly and rearwardly, and means operative upon a predetermined forward feeding movement of said feeding means for automatically controlling said reverse feeding means, said automatic controlling means also including means for controlling said hole cleansing means.
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17. A drilling mechanism comprising a drilling motor, hole cleansing means cooperating therewith, means for positively feeding said motor forwardly and rearwardly, and means operative upon a predetermined forward feeding movement of said feeding means for automatically controlling said re-
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verse feeding means and said motor, said automatic controlling means also including means for controlling said hole cleansing means.

18. A drilling mechanism comprising a hollow drill steel, feeding means therefor, hole cleansing means cooperating with said drill steel, and means operable upon a predetermined feeding movement of said feeding means for automatically effecting operation of said hole cleansing means.

19. A drilling mechanism comprising a hollow drill steel, feeding means therefor, hole cleansing means cooperating with said drill steel, means operable upon a predetermined feeding movement of said feeding means for automatically effecting operation of said hole cleansing means, and manual operating means for said hole cleansing means cooperating with said automatic means.

20. A drilling mechanism comprising a hollow drill steel, feeding means therefor, hole cleansing means cooperating with said drill steel, means operable upon a predetermined feeding movement of said feeding means for automatically effecting operation of said hole cleansing means, and manual operating means for controlling said hole cleansing means, said manual operating means cooperating with said automatic means and being operable at the will of the operator and wholly independently of said feeding means.

21. A drilling mechanism comprising a drilling motor having a throttle valve and of the reciprocatory type, a drill steel actuated thereby, feeding means therefor, pressure fluid operated means automatically controlled by pressure changes in said motor caused by load changes on said motor for controlling said feeding means, and means operable independently of throttle valve movement for controlling said motor while said feeding means continues to normally operate.

22. A drilling mechanism comprising a drilling motor of the reciprocatory type, a drill steel actuated thereby, feeding means therefor, pressure fluid operated means automatically controlled by pressure changes in said motor caused by load changes on said motor for controlling said feeding means, and means associated with said automatic controlling means for controlling said motor while said feeding means continues to normally operate.

23. A drilling mechanism comprising a drilling motor having a throttle valve and of the reciprocatory type, a drill steel actuated thereby, feeding means therefor, pressure fluid operated means automatically controlled by pressure changes in said motor caused by load changes on said motor for controlling said feeding means, and means operable independently of throttle valve move-

ment and at the will of the operator for controlling said motor while said feeding means continues to normally operate.

24. A drilling mechanism comprising a drilling motor having a throttle valve and of the reciprocatory type, a drill steel actuated thereby, reverse and forward positive feeding means therefor, means automatically controlled by load changes on said motor for controlling both of said feeding means, and means operable independently of throttle valve movement and at the will of the operator for controlling said motor while said feeding means continues to normally operate.

25. A drilling mechanism comprising a drilling motor of the reciprocatory type having operator adjustable control means, a drill steel actuated thereby, forward and reverse positive feeding means therefor, means automatically controlled by load changes on said motor for reversing said feeding means, and means separate from said motor control means for controlling said motor while said feeding means continues to normally operate.

26. A drilling mechanism comprising a drilling motor having a fluid actuated distribution valve for controlling the fluid distribution thereto, a drill steel actuated by said motor, feeding means therefor, pressure fluid operated means automatically controlled by pressure changes in said motor caused by load changes on said motor for controlling said feeding means, and means for controlling said distribution valve for controlling said motor while said feeding means continues to normally operate.

27. A drilling mechanism comprising a drilling motor having a throttle valve and of the hammer type, a drill steel actuated thereby, feeding means therefor, rotation means for said steel, pressure fluid operated means automatically controlled by pressure changes in said motor caused by resistance to rotation for controlling said feeding means, and means operable independently of throttle valve movement for controlling said rotation means while said feeding means continues to normally operate.

28. A drilling mechanism comprising a drilling motor having a cylinder, a drill steel actuated by said motor, said motor including a reciprocating piston, a fluid distribution valve, and throwing ports for said valve communicating with said cylinder and controlled by said piston, pressure fluid operated means automatically controlled by load changes on said motor for controlling said feeding means, and means controlled by said feeding means and cooperating with one of said throwing ports to control said valve for controlling said motor while said feeding means continues to normally operate.

29. A drilling mechanism comprising a motor, means for feeding said motor, and pres-

sure fluid operated means for automatically stopping the operation of said motor when said feeding means has fed said motor a predetermined distance including a plurality of cooperating fluid controlling valves.

30. A drilling mechanism comprising a pressure fluid actuated motor having pressure changes therein during operation thereof, means for feeding said motor, and pressure fluid operated means for automatically stopping the operation of said motor when said feeding means has fed said motor a predetermined distance including a plurality of cooperating fluid controlling valves one of which is automatically controlled by pressure changes in said motor.

31. A drilling mechanism comprising a motor, means for feeding said motor, pressure fluid operated means for automatically stopping the operation of said motor when said feeding means has fed said motor a predetermined distance including a plurality of cooperating fluid controlling valves, and stationary abutment means with which one of said valves is engageable.

32. A drilling mechanism comprising a pressure fluid actuated motor having pressure changes therein during operation thereof, means for feeding said motor, pressure fluid operated means for automatically stopping the operation of said motor when said feeding means has fed said motor a predetermined distance including a plurality of cooperating fluid controlling valves, the operation of one of which is controlled by pressure changes in said motor and by said other valve.

33. A drilling mechanism comprising a pressure fluid actuated motor having a fluid distribution valve for controlling the distribution of pressure fluid thereto, feeding means for said motor, and means for controlling said feeding means including means for automatically controlling said distribution valve to control the drilling motor when said feeding means has fed said motor a predetermined distance.

34. A drilling mechanism comprising a pressure fluid actuated drilling motor of the impact type including a cylinder, a piston reciprocable therein, there being pressure variations in said cylinder at the opposite ends of said piston during operation of said motor, a drill steel actuated by said motor, feeding means therefor, rotation means for said steel, and pressure fluid operated means automatically controlled by resistance to drill steel rotation for controlling said feeding means, said automatic controlling means having a plurality of operative fluid connections with the ends of said cylinder.

35. A drilling mechanism comprising a pressure fluid actuated drilling motor of the impact type including a cylinder, a piston reciprocable therein, there being pressure variations in said cylinder at the opposite

ends of said piston during operation of said motor, a drill steel actuated by said motor, feeding means therefor, rotation means for said steel, and pressure fluid operated means automatically controlled by load changes on said motor for controlling said feeding means, said automatic controlling means having a plurality of operative fluid connections with the ends of said cylinder.

36. A drilling mechanism comprising a drilling motor, feeding means therefor, and pressure fluid operated means automatically operative upon a predetermined feeding movement of said feeding means for simultaneously controlling said feeding means and said motor, said automatic controlling means including cooperating valves, the operation of one of which being dependent upon the operation of another.

37. A drilling mechanism comprising a drilling motor, a drill steel actuated thereby, feeding means therefor, rotation means for said steel, means automatically controlled by resistance to drill steel rotation for controlling said feeding means, and means automatically operative upon a predetermined feeding movement of said feeding means for affecting operation of said automatic means to effect its controlling function.

38. A drilling mechanism comprising a pressure fluid actuated motor of the reciprocatory type having pressure variations therein during operation thereof, a drill steel actuated by said motor, feeding means therefor, rotation means for said steel, and pressure fluid operated means automatically controlled by resistance to drill steel rotation for controlling said feeding means, said automatic means having a plurality of pressure fluid connections with said motor.

39. A drilling mechanism comprising work performing means including a pressure fluid actuated motor of the reciprocatory type having pressure variations therein during operation thereof, feeding means for said work performing means, and pressure fluid operated means automatically controlled by load changes on said motor for controlling said feeding means, said automatic means having a plurality of pressure fluid connections with said motor.

40. A drilling mechanism comprising a pressure fluid operated drilling motor, a drill steel actuated thereby, feeding means for said steel, rotation means for said steel, pressure fluid operated means automatically controlled by pressure changes in said drilling motor caused by resistance to drill steel rotation for controlling said feeding means, and means operative upon a predetermined feeding movement of said feeding means for controlling said feeding means wholly independently of said rotation means.

41. A drilling mechanism comprising a drilling motor, a drill steel actuated thereby,

feeding means for said steel, rotation means for said steel, means automatically controlled by resistance to drill steel rotation for controlling said feeding means, and means associated with said automatic controlling means operative upon a predetermined feeding movement of said feeding means for controlling said feeding means wholly independently of said rotation means.

42. A drilling mechanism comprising a pressure fluid actuated drilling motor, a drill steel actuated thereby, feeding means for said steel, rotation means for said steel, manually operable means for normally controlling said motor and feeding means, pressure fluid operated means automatically controlled by pressure changes in said motor caused by resistance to drill steel rotation for controlling said feeding means, and supplemental means cooperating with said automatic controlling means and operable at the will of the operator for controlling said feeding means and motor.

43. A drilling mechanism comprising a fluid actuated drilling motor comprising a cylinder having pressure variations therein during operation thereof and including a reciprocable piston, a drill steel actuated thereby, rotation means for said steel comprising a ratchet and pawl mechanism cooperating with said piston, feeding means for said steel, and pressure fluid operated means automatically controlled by resistance to drill steel rotation for controlling said feeding means, said automatic controlling means having a plurality of operative fluid connections with said motor at the opposite ends of said cylinder.

44. A drilling mechanism comprising a pressure fluid actuated drilling motor comprising a cylinder having pressure variations therein during operation thereof, and a piston reciprocable in said cylinder, pressure fluid actuated feeding means therefor, a main valve for controlling both said motor and feeding means, and a supplemental pressure fluid operated controlling means including a feed controlling valve having a plurality of operative pressure fluid connections with said motor at the opposite ends of said cylinder, said latter valve being dependent upon the operation of said main valve.

45. A drilling mechanism comprising a pressure fluid actuated drilling motor comprising a cylinder having pressure variations therein during operation thereof, and a piston reciprocable in said cylinder, pressure fluid actuated feeding means for said motor, a main valve for controlling both said motor and feeding means, and a supplemental pressure fluid operated controlling means including a feed controlling valve arranged within said main valve and having a plurality of operative pressure fluid connections with said motor at the op-

posite ends of said cylinder, said latter valve being dependent upon the operation of said main valve.

46. A drilling mechanism comprising a pressure fluid actuated drilling motor having pressure variations therein during operation thereof, a drill steel actuated thereby, rotation means for said steel, pressure fluid actuated feeding means for said motor and drill steel, and pressure fluid operated means automatically controlled by pressure variations in said drilling motor caused by resistance to drill steel rotation for controlling said feeding means, said means including but a single fluid actuated valve and said valve having an operative fluid connection with said motor.

47. A drilling mechanism comprising a drilling motor, a drill steel actuated thereby, rotation means for said steel, means for positively feeding said steel forwardly and rearwardly, and means comprising but a single controlling member and said controlling member being automatically controlled by resistance to drill steel rotation for reversing said feeding means.

48. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, feeding means for said motor, and means for automatically controlling said feeding means including but a single fluid actuated controlling member and passage means communicating with said cylinder bore for controlling said controlling member.

49. In a drilling mechanism, a pressure fluid actuated percussive drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, pressure fluid operated feeding means for said motor, and means for automatically controlling the flow of pressure fluid to said feeding means including but a single fluid actuated controlling member and passage means communicating with said cylinder bore for controlling said controlling member.

50. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, pressure fluid actuated feeding means for said motor, and means for automatically controlling the flow of pressure fluid to said feeding means comprising but a single fluid actuated controlling member and passage means communicating with said cylinder bore for subjecting a portion of said member to the pressure in said motor.

51. In a drilling mechanism, a pressure fluid actuated drilling motor having a throttle valve and comprising a cylinder having a

bore, a piston in said bore and fluid distribution means for effecting reciprocation of said piston, feeding means for said motor, and means including a fluid actuated feed control member controlled by the pressure in said drilling motor for automatically controlling said feeding means to vary the operation of the latter, and means operable independently of throttle valve movement and at the will of the operator for controlling said motor while said feeding means continues normally to operate.

continues normally to operate, and means cooperating with a part of said latter means for controlling said feeding means.

56. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, feeding means for said motor, means including a fluid actuated feed control member controlled by the pressure in said motor for automatically controlling said feeding means to vary the operation thereof, means for controlling said motor while said feeding means continues normally to operate, and means cooperating with a part of said latter means for controlling said feeding means after the latter has fed said motor a predetermined distance.

57. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, a drill steel actuated by said piston, feeding means for said drill steel, means including a fluid actuated feed control member controlled by the pressure in the said motor for automatically controlling said feeding means to vary the operation thereof, hole cleansing means cooperating with said drill steel, means for controlling said motor while said feeding means continues normally to operate, said latter means including means for controlling said cleansing means to cleanse the drill hole, and means cooperating with a part of said latter means for controlling said feeding means.

58. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, forward and reverse positive feeding means for said motor, means including a fluid actuated feed control member controlled by the pressure in said motor for automatically controlling said feeding means to vary the operation thereof, means for controlling said motor while said feeding means continues normally to operate, and means cooperating with a part of said latter means for controlling said feeding means.

59. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, means for positively feeding said motor forwardly and rearwardly, and means controlled by the pressure in said motor for automatically reversing said feeding means comprising but a single fluid actuated controlling member, and passage means communicating with said

52. In a drilling mechanism, a pressure fluid actuated drilling motor having a throttle valve and comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, feeding means for said motor, means including a fluid actuated feed control member controlled by the pressure in said drilling motor for automatically controlling said feeding means to vary the operation thereof, and means operable independently of throttle valve movement for stopping said drilling motor while said feeding means continues normally to operate.

53. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston including a fluid distribution valve, feeding means for said motor, means including a fluid actuated feed control member controlled by the pressure in said drilling motor for automatically controlling said feeding means to vary the operation thereof, and means for controlling said valve to control said drilling motor without affecting the operation of said feeding means.

54. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, feeding means for said motor, means for automatically controlling said feeding means including a pilot valve and passage means communicating with said cylinder bore for subjecting said pilot valve to the pressure in said motor, and means cooperating with said valve for automatically stopping said feeding means when the latter has fed said motor a predetermined distance.

55. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, feeding means for said motor, means including a fluid actuated feed control member controlled by the pressure in said motor for automatically controlling said feeding means to vary the operation thereof, means for controlling said motor while said feeding means

cylinder bore for subjecting said controlling member to the pressure in said motor.

60. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, forward and reverse feeding means for said motor, and means for automatically controlling said feeding means comprising but a single fluid actuated feed controlling member for simultaneously controlling both said forward and reverse feeding means and passage means communicating with said cylinder bore for subjecting said controlling member to the pressure in said motor.

61. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, pressure fluid actuated feeding means for said motor, and means for automatically controlling said feeding means comprising but a single fluid actuated valve member and passage means communicating with said cylinder bore for subjecting a portion of said valve member to the pressure in said motor.

62. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, pressure fluid actuated feeding means for said motor, a main control valve for said motor, and means for automatically controlling said feeding means including a pressure fluid actuated valve carried within said main valve and passage means communicating with said cylinder bore for subjecting said pressure fluid actuated valve to the pressure in said motor.

63. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, a pressure fluid actuated feeding means for said motor, and means for automatically controlling said feeding means including but a single fluid actuated valve and passage means communicating with said cylinder bore for controlling said valve.

64. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston in said bore and fluid distribution means for effecting actuation of said piston, feeding means for said motor, and means for automatically controlling said feeding means comprising but a single fluid actuated controlling member and passage means communicating with said cylinder bore for subjecting said controlling member to the pressure within said motor cylinder.

65. In a drilling mechanism, a pressure fluid actuated drilling motor having pressure variations therein during normal operation thereof, feeding means for said motor, and means for automatically controlling said feeding means comprising but a single fluid actuated controlling member and means whereby said member is controlled by pressure variations in said motor during abnormal operation thereof.

66. In a drilling mechanism, a pressure fluid actuated drilling motor having pressure variations therein which occur rapidly during normal operation of said motor, feeding means for said motor, and means for automatically controlling said feeding means comprising but a single control valve and means whereby said valve is actuated to control said feeding means when the pressure variations in said motor become less rapid due to abnormal operation of said motor.

67. In a drilling mechanism, a pressure fluid actuated drilling motor having pressure fluctuations therein of varying intensity within a certain limit during normal operation of said motor, feeding means for said motor, and means for automatically controlling said feeding means comprising but a single fluid actuated controlling member and means whereby said member is actuated to control said feeding means when the pressure fluctuations become of an intensity outside of said limit.

68. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston, pressure fluid actuated feeding means for said motor, and means for automatically controlling the flow of pressure fluid to said feeding means including a control valve having opposed pressure areas and passages connecting the opposite ends of said cylinder bore with said pressure areas respectively.

69. In a drilling mechanism, a pressure fluid actuated drilling motor comprising a cylinder having a bore, a piston reciprocable in said bore and fluid distribution means for effecting reciprocation of said piston including passages leading to the opposite ends of said cylinder bore for supplying fluid to and exhausting fluid from the opposite ends of the cylinder bore, pressure fluid actuated feeding means for said motor, and means for automatically controlling the flow of pressure fluid to said feeding means including a control valve having opposed pressure areas and passages connecting said first mentioned passages with said pressure areas respectively.

70. In a drilling mechanism, a pressure fluid actuated drilling motor, a pressure fluid actuated reversible feeding means for said motor for feeding the latter in either direction, a main valve for controlling flow of pressure

fluid to said drilling motor, a valve arranged within said main valve for controlling the flow of pressure fluid to said feeding means to effect feed in either direction, and passages formed in said main valve and controlled by said second mentioned valve for conducting fluid to said reversible feeding means.

71. In a drilling mechanism, a pressure fluid actuated drilling motor, a pressure fluid actuated reversible feeding means for said motor for feeding the latter in either direction, a main valve for controlling flow of pressure fluid to said drilling motor and said feeding means, an auxiliary valve arranged within said main valve for controlling the flow of pressure fluid to said feeding means to effect feed in either direction, and passages formed in said main valve and controlled by said second mentioned valve for conducting fluid to said reversible feeding means.

72. In a drilling mechanism, a motor, forward and reverse positive feeding means therefor, a main control valve for controlling both said motor and said feeding means, passages directly controlled by said main valve for conducting fluid to said forward and reverse feeding means respectively, and auxiliary valve means for controlling both of said passages.

73. In a drilling mechanism, a motor, forward and reverse positive feeding means therefor, a main control valve for controlling both said motor and said feeding means, passages directly controlled by said main valve for conducting fluid to said forward and reverse feeding means respectively, and auxiliary valve means dependent upon the operation of said main valve for controlling both of said passages.

74. In a drilling mechanism, a motor, forward and reverse positive feeding means therefor, a main control valve for controlling both said motor and said feeding means, auxiliary valve means cooperating with and disposed within said main control valve for controlling said forward and reverse feeding means, and passages formed in said main valve and controlled by said auxiliary valve for conducting fluid to said forward and reverse feeding means respectively.

75. In a drilling mechanism, a motor, forward and reverse positive feeding means therefor, a hollow main control valve for controlling both said motor and said feeding means, auxiliary feed controlling means including valve means reciprocally mounted in said main control valve for controlling both of said feeding means, and passages formed in said main valve and controlled by said auxiliary valve for conducting fluid to said forward and reverse feeding means respectively.

76. In a drilling mechanism, a motor, forward and reverse positive feeding means therefor, a main valve for controlling both

said motor and said feeding means, said valve having a handle adapted to be grasped by the operator, auxiliary valve means for controlling said forward and reverse feeding means and including operating means arranged in juxtaposition to said main valve handle to enable the operator to control said auxiliary valve means and said main control valve by but a single hand without removing said hand from said main valve handle, and passages formed in said main valve and controlled by said auxiliary valve for conducting fluid to said forward and reverse feeding means respectively.

77. In a drilling mechanism, a motor, forward and reverse positive feeding means therefor, a main valve for controlling the flow of pressure fluid through said motor and said feeding means, said valve having a grasping handle and means associated with said grasping handle for enabling the operator to control the flow of fluid to both said forward and reverse feeding means with but a single hand without removing said hand from said main valve handle.

In testimony whereof I affix my signature.
THORE R. E. RUNDQVIST.

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