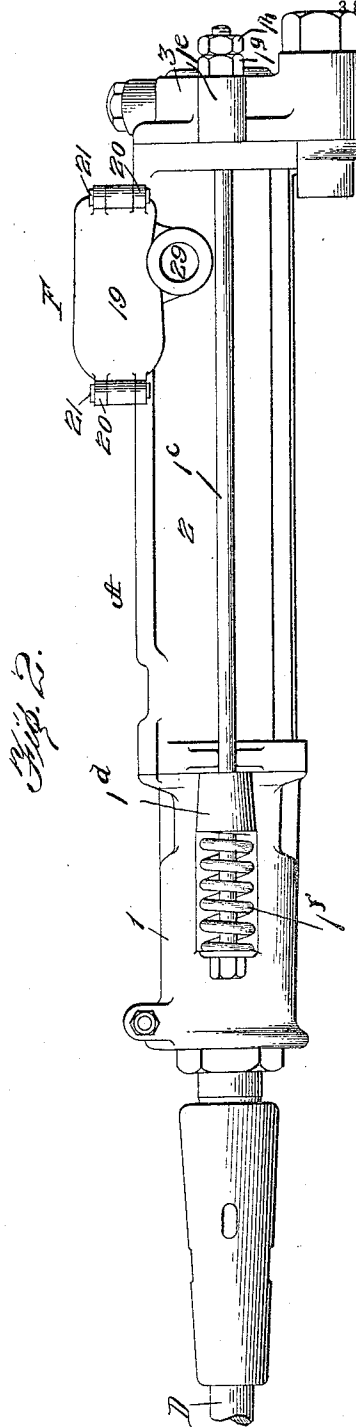
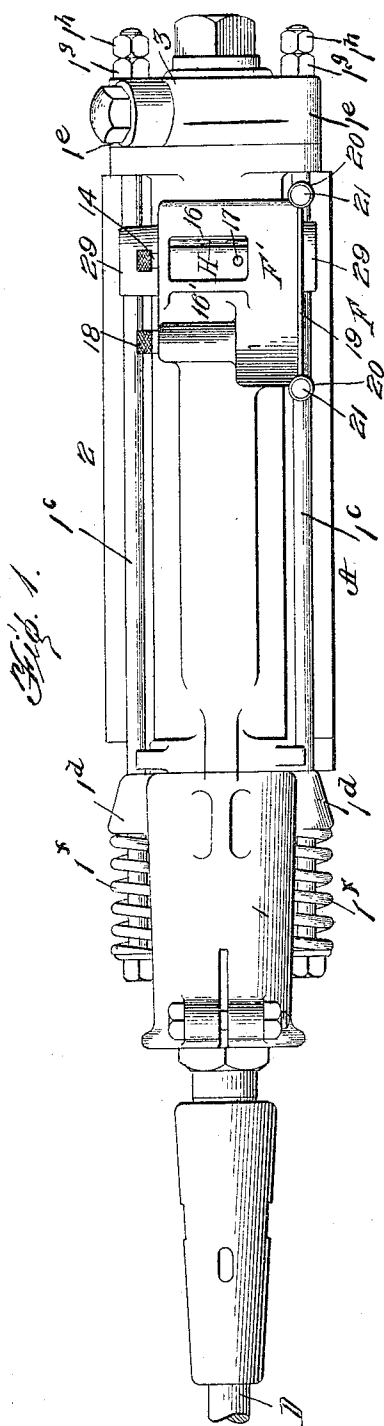


W. L. SMITH.
 DRILLING MECHANISM.
 APPLICATION FILED MAR. 8, 1908.

950,193.

Patented Feb. 22, 1910.

3 SHEETS—SHEET 1.



Witnesses:
Paul J. Lathrop
N. Curtis Hammond

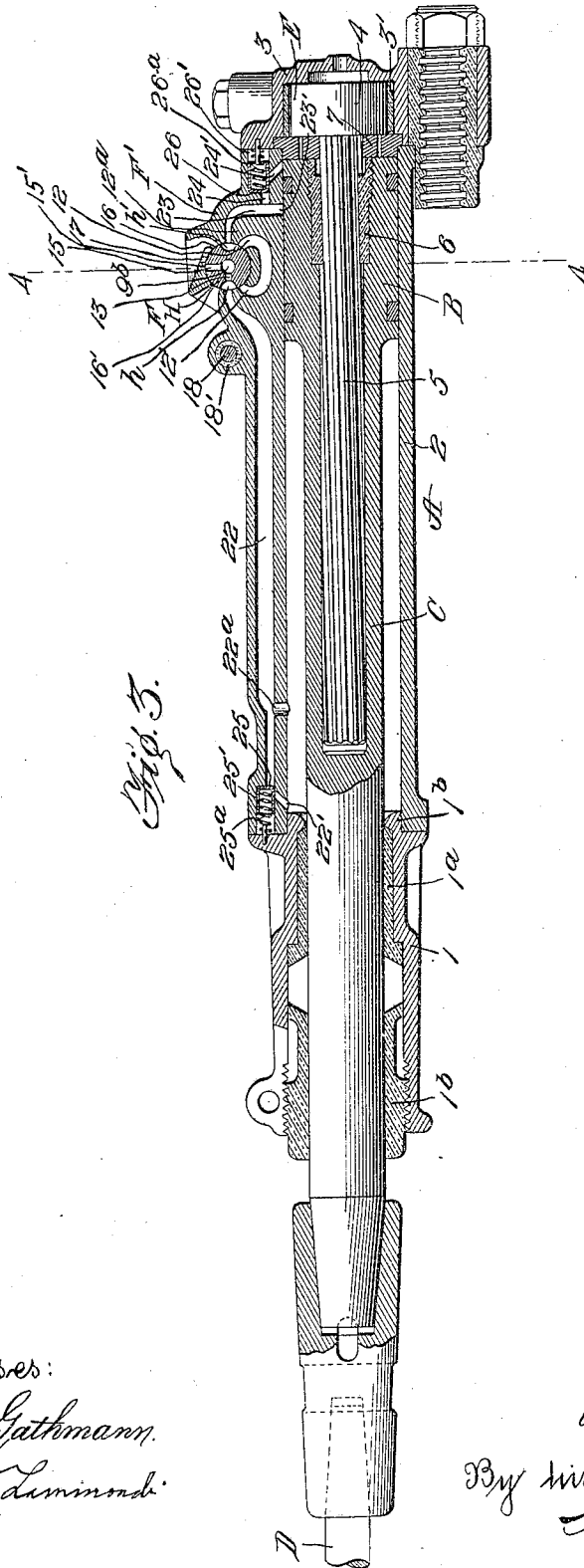
Inventor
W. L. Smith
 By his Attorney
H. H. Bliss

W. L. SMITH.
 DRILLING MECHANISM.
 APPLICATION FILED MAR. 8, 1906.

950,193.

Patented Feb. 22, 1910.

3 SHEETS—SHEET 2.



Witnesses:
Paul J. Gathmann.
N. Curtis Laminardi.

Inventor
W. L. Smith.
 By his Attorney
H. H. Jones.

950,193.

W. L. SMITH.
 DRILLING MECHANISM.
 APPLICATION FILED MAR. 8, 1906.

Patented Feb. 22, 1910.

3 SHEETS—SHEET 3.

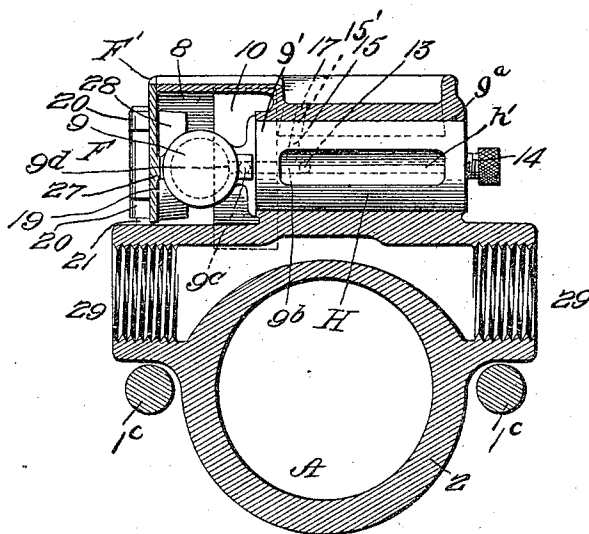


Fig. 4.

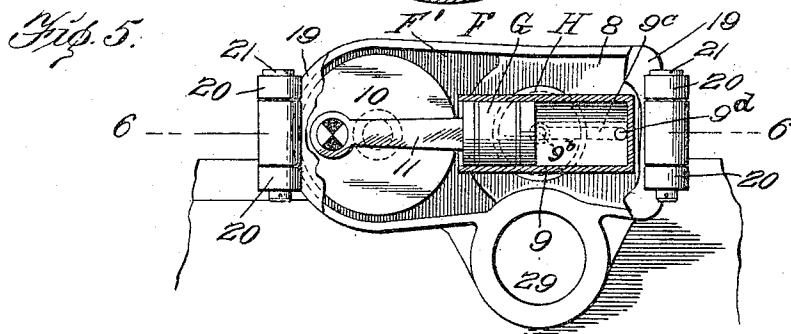


Fig. 5.

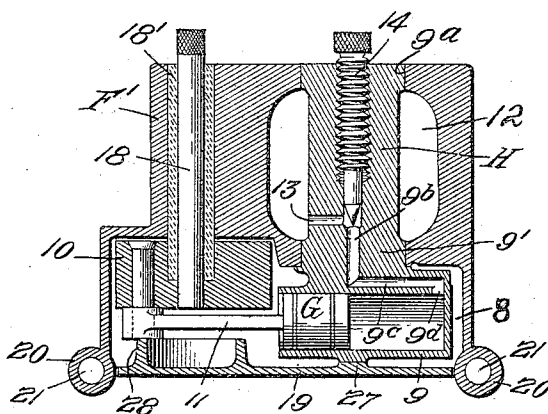


Fig. 6.

Witnesses:

Paul J. Hathmann.
 N. Curtis Lammond

Inventor.

W. L. Smith.

By his Attorney

H. H. Weiss

UNITED STATES PATENT OFFICE.

WILLIAM L. SMITH, OF COLUMBUS, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
THE JEFFREY MANUFACTURING COMPANY, A CORPORATION OF OHIO.

DRILLING MECHANISM.

950,193.

Specification of Letters Patent.

Patented Feb. 22, 1910.

Application filed March 8, 1906. Serial No. 304,908.

To all whom it may concern:

Be it known that I, WILLIAM L. SMITH, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to improvements in drilling mechanism, it pertaining particularly to rock drills of the class in which the drill or bit is both reciprocated and rotated, the power for effecting the same being some sort of elastic fluid.

One of the objects of the invention is to provide a valve mechanism for controlling the inlet of and exhaust of the fluid medium from either side of the bit or drill actuating piston, automatically and entirely independently of the position of the piston within its cylinder.

Another object of the invention is to provide means for controlling the speed of operation of said valve, whereby the speed of travel of the said piston may be accelerated while at the same time the length of its stroke will be diminished or vice versa. By means of thus adjusting the travel of the piston it is possible either to cause it to make the drill or bit deliver a certain number of powerful blows per minute at a relatively long stroke, or a greater number of weaker blows at a shorter stroke in the same period of time.

Other objects of the invention will be disclosed from the description of a mechanism embodying my improvements which I have herein chosen for the purpose of illustrating it.

Figure 1 is a plan view of a drill and mechanism embodying my improvements. Fig. 2 is a side elevation of the same. Fig. 3 is a central vertical longitudinal section of the same. Fig. 4 is a section on the line 4-4, Fig. 3. Fig. 5 is a view partly in side elevation and partly in section of the oscillating valve-actuating engine and its housing or casing. Fig. 6 is a section on the line 6-6, Fig. 5.

In the drawings—A indicates as an entirety the housing or casing in which the main or drill bit-actuating piston operates.

This housing or casing may be of any desired shape, but as shown, is preferably substantially cylindrical. B represents the main piston within said housing or casing, C the piston rod or hammer rod carried thereby, D the drill bit, and E the ratchet and rife mechanism for causing the rotation of the said main piston.

F represents an auxiliary motor or engine arranged in a housing or casing F' and having a supplementary valve-actuating piston G. H represents a valve actuated by said engine and adapted to control the inlet and exhaust of elastic fluid from either side of the main piston in the main cylinder or casing and also to control the inlet and exhaust of said fluid behind the supplemental piston G.

The cylinder or casing A is preferably formed in three parts detachably secured together, of which the forward one is indicated by 1, the middle one by 2, and the rear or head end of the cylinder is indicated by 3. These parts may be connected together with their axes in longitudinal alinement in any suitable manner. The front part 1 is bushed at 1^a to snugly receive and guide the hammer or piston rod C and is also bushed at 1^b for the same purpose, this latter bushing screwed into place, as indicated. It also has the reduced rear part 1^b which fits snugly within the front end of the part 2. The parts of the cylinder are preferably held yieldingly together by means of rods or bolts 1^c, 1^c at either side of the framework. At their forward ends they are mounted in lugs or projections 1^d, 1^d, at either side of the part 1 and at their rear ends they pass through lateral lugs or projections 1^e, 1^e, on the part 3. 1^f, 1^f, are recoil springs interposed between the front head end of each bolt and the adjacent lug 1^c, and 1^g, 1^g, are nuts fitted to the rear end of each bolt and each adapted to engage the adjacent lug 1^e in order to adjust the tension on the spring 1^f at the front end of the bolt.

1^h, 1^h, are lock nuts.

The head end 3 of the cylinder casing or housing is centrally recessed on its front inner side as indicated at 3' to receive the ratchet and pawl mechanism 4 which may be of any well known type and may operate in the

well known manner to hold the rifle bar 5, which is secured to and controlled by the ratchet wheel, stationary when the piston B is traveling in one direction to effect the desired rotation of the piston and to turn freely when the piston is traveling in the opposite direction.

6 is a sleeve screw threaded into the rear end of the main piston B and carrying internal spiral ribs which cooperate with the walls of the rifled grooves in the rifle bar 5.

7 is an annular plate interposed between the parts 2 and 3 of the casing or housing.

The part 2 of the sleeve or casing in which the cylinder B operates carries the upwardly extending supplemental frame or housing F' for the supplemental engine F and the valve H which it controls. This supplemental frame may be either formed integrally with the cylinder part 2 or may be detachably secured thereto in any desired manner.

At one side thereof this supplemental frame F' is recessed as indicated at 8 to receive the oscillating engine cylinder 9, the fly wheel 10, and the connecting rod 11 between the said fly wheel and the piston G within the oscillating cylinder. This oscillating cylinder has projecting from it at one side the cylindrical or tubular extension or projection 9' which extends through the substantially cylindrical passageway in the supplemental frame F' and to the walls of which it is fitted with steam-tight joints. This projection has formed integrally with it or detachably secured to it the cylindrical valve H having its outer end fitted with a steam-tight joint in the adjacent walls of the supplemental engine frame, as indicated at 9^a. 12 is the inlet chamber for the elastic fluid within the supplemental frame F', it extending upward at 12', 12^a at either side of the trunnion valve H. This trunnion valve H is longitudinally grooved at diametrically opposite points as indicated at h and h'.

13 is a duct leading transversely into the trunnion valve H from one side thereof and opening at its outer end in the groove h and communicating at its inner end with a duct 9^b leading longitudinally through the trunnion valve and the part 9' of the oscillating cylinder. At its inner end this duct 9^b communicates with a duct 9^c in the cylinder wall of the supplemental engine, which latter duct communicates through a port 9^a with the interior of the cylinder 9.

14 is a needle valve for controlling the area of the port through which the duct 13 delivers motive fluid to the duct 9^b.

15 is a duct leading radially through the trunnion valve from the duct 9^b therein and having a port 15' on the periphery of said valve.

16 is an exhaust duct from the valve

chamber on the side of the valve H and 16' is an exhaust duct from the valve chamber on the front side of said trunnion valve.

17 is an exhaust duct arranged intermediate of the exhaust ducts 16 and 16'.

18 is a fly wheel shaft for the fly wheel 10, it extending transversely through the supplemental frame F' and having at its outer end a knurled section adapted to be grasped by the hand and turned in order to turn the fly wheel off dead center should it be stationed there when it is desired to start the engine F.

19 is a closing plate or door for the recess 8 in the supplemental frame. This door may be carried by tubular lugs arranged at either end and fitted between tubular lugs 20 carried by the supplemental frame, pins 21 serving to hold the cooperating lugs in alinement.

22 is a duct leading from the valve chamber 12 to the front end of the cylinder 2 and communicating with the interior thereof through a port 22'. This duct is also arranged to communicate with the interior of the cylinder through a port 22^a at some distance back from the port 22'.

23 is a duct communicating at one end with the valve chamber and at its other end through the port 23' with the interior of the cylinder 2 near its rear end.

24 is a duct communicating at its front end with the duct 23 and at its rear end through a port 24' with the interior of the cylinder 2, substantially at its rear end.

25 is a valve arranged to cut off the flow of elastic fluid through the port 22' from the duct 22. This valve may be fitted in a recess 25' in the front end of the cylinder 2 and may be held so as to normally close the passageway through the duct 22 by means of a spring 25^a.

26 is a valve arranged to cut off the flow of elastic fluid through the port 24' from the duct 24. This valve is arranged in a recess 26' in the walls of the cylindrical part 2 at its rear end and is held so as normally to close the passageway for air through the duct 24 by means of a spring 26^a.

The oscillating cylinder 9 and the fly wheel 10 are kept in proper relation to each other and are held in place within the engine housing F' against lateral movement by means of bosses 27 and 28 carried by the cover plate 19 and engaging respectively with the cylinder and with the crank pin carried by the fly wheel.

29 is an inlet duct for motive fluid leading through the walls of the cylindrical part 2 and communicating with the inlet or valve chamber 12 in the supplemental engine chamber or housing F'.

The operation of the mechanism is as follows: In order to start the mechanism the fly wheel 10 is turned until the oscillating

cylinder 9 is slightly inclined to the horizontal and the piston is directing the crank pin downwardly around the lower part of its circle of travel, at which time the groove h in the valve H is in communication with the steam chest 12 in the supplemental casing or housing F'. Steam is then admitted to the steam chest and it rushes into the groove h and thence through the ducts 13, 9^b and 9^c into the oscillating cylinder 9 and drives the piston G relatively downward and forward within its cylinder. The crank pin then starts on its upward travel and as it does so the oscillating cylinder is rocked so as to cut off communication between the groove h and the valve chest 12 and as the crank pin passes dead center and travels upwardly along its upper path of travel the oscillating cylinder rocks the valve H so as to establish communication between the valve chest 12 and the duct 23 through the groove h' . The steam then rushes down through this duct 23 and forces the valve 26 back against the action of the spring 26' and establishes communication through the port 24' with the rear end of the cylinder 2 behind the piston B. The main piston is then driven forward within its cylinder since at the same time the groove h in the valve H has uncovered the exhaust port 16' and established communication with the outside air both with the front part of the main cylinder 2 and with the oscillating cylinder 9. At this same time the exhaust duct 15 through the oscillating valve has been brought into communication with the supplemental exhaust duct 17 from the valve chest, thus insuring that the oscillating cylinder will be properly exhausted irrespective of the adjustment of the needle valve 14. If this needle valve has been adjusted so as to throttle down the entrance of motive fluid to the oscillating cylinder 9 and to cause a relatively slow movement of the piston therein and consequently a relatively small number of oscillations thereof per minute, the main piston B will move forward in its cylinder beyond the port 22^a before motive fluid is introduced to its front side to drive it rearwardly. This latter action will occur when the oscillating cylinder 9 has swung back the valve H so as to establish communication between the valve chest 12 and the ducts 13 and 22. As soon as this occurs the motive fluid will rush through the latter duct and force the valve 25 back against its spring and then enter the front end of the cylinder through the port 22' and will drive the main piston rearwardly. At this same time of course motive fluid will be entering the oscillating cylinder through the ducts 13, 9^b and 9^c as before described and the piston therein will be acted upon to keep up the swinging motion of the cylinder.

With the above operation of the machine,

when the oscillating valve H is operating relatively slowly, the stroke of the main piston will be a relatively long one and the blows delivered by it will be proportionately hard. When it is desired, however, to deliver a greater number of shorter blows though relatively weaker ones, the needle valve 14 may be adjusted so as to permit the relatively rapid operation of the engine F and the consequent relatively rapid oscillation of the valve H. This will tend to open and close the various steam ports of the mechanism in such manner as to cause the main piston B to reciprocate between the ports 22^a and 23' in the main cylinder. In this latter case the action of the valve is so rapid as to cause the motive fluid to enter the main cylinder at points before the main piston reaches the end of the cylinder and to change its direction of travel and keep it reciprocating through relatively short distances.

When the main piston is operating at relatively slow speed and high power it will be seen that the valves 25 and 26 at front and rear end, respectively, of the main cylinder, cut off the escape of motive fluid from said cylinder through the ducts 22 and 24, after the front and rear ends of the main piston B cut off the ports 22^a and 23', respectively, and the motive fluid then remaining between the end of the piston and the adjacent end of the cylinder serves to cushion the piston and prevent strains to the entire mechanism.

It will be noted that a single unitary valve is employed both for controlling the ducts for the inlet to and exhaust from the main cylinder of the motive fluid and inlet to and exhaust from the oscillating cylinder of the motive fluid and that a single motor is employed for operating the said valve. In other words, this one valve controls the travel in both directions of both the main piston B and the piston G.

The valves 25 and 26 controlling the ports 22' and 24' are so arranged that when the piston B is operating on its long stroke the motive fluid which is compressed between either end of the piston and the adjacent end of the cylinder operates to cushion the travel of the piston in one direction and to start it to travel in the reverse direction and during this cushioning the motive fluid, which may be at a higher pressure than the pressure of the fluid supply, cannot escape from the cylinder, but as soon as this cushioning pressure drops below the pressure of the fluid supply the said valves 25 and 26 at once open to admit motive fluid to the cylinder and cause the piston to continue to travel in the direction in which it is started. The arrangement of these valves is such as to insure certain and quick starting of the piston B irrespective of what relative position it may be in within the cylinder with reference to either of the valves.

In mounting the fly wheel 10 of the supplemental motor F I have found it advisable to employ a bushing 18' for the fly wheel shaft 18 which extends well into the fly wheel, as indicated at 18^a, in order to support the same relatively near to the crank pin side thereof.

I claim—

1. In a drilling mechanism, the combination with a cylinder having inlet and exhaust ports for motive fluid, and a blow-imparting mechanism having a piston arranged to operate in said cylinder, of a supplemental valve-actuating motor having an inlet and exhaust port for motive fluid and a single valve actuated by said motor and adapted to control the flow of motive fluid both to and from the main cylinder and to and from the cylinder of the said supplemental motor.

2. In a drilling mechanism, the combination with a main cylinder having inlet and exhaust ports for motive fluid, and a blow-imparting mechanism adapted to reciprocate in said cylinder, of a supplemental valve-actuating motor having an inlet and exhaust port for the motive fluid, and a single oscillating valve actuated by said supplemental motor and adapted to control the inlet and exhaust of motive fluid both through the said ports of the main cylinder and the said ports of the supplemental motor.

3. In a drilling mechanism, the combination with a main cylinder having inlet and exhaust ports for motive fluid and a reciprocating blow-imparting mechanism arranged to reciprocate in said cylinder, of a supplemental oscillating engine having a cylinder with a piston adapted to reciprocate therein and a port for the inlet and exhaust of the motive fluid, and an oscillatory valve connected to said oscillating cylinder and arranged to move therewith and adapted to control the flow of motive fluid both through the ports of the main cylinder, and the port of said auxiliary cylinder.

4. In a drilling mechanism, the combination with a main cylinder, having at either end inlet and exhaust ports for motive fluid, and a blow-imparting mechanism having a piston arranged to reciprocate in said cylinder, of a supplemental oscillating engine having a cylinder with a port for the inlet and exhaust of the motive fluid and a piston arranged to reciprocate in said cylinder, and a single oscillatory valve connected with and arranged to oscillate with said oscillatory cylinder, and adapted to control the flow of motive fluid both through the port in said cylinder and through the ports at front and rear of said main cylinder.

5. In a rock drilling mechanism having a reciprocating cutting tool, the combination of a main casing, a supplemental casing formed

with an open side, a valve seat, and a recess adjacent to the said open end, a main controlling valve, a supplemental motor connected directly with the valve for operating it, the valve occupying the valve seat in the said supplemental casing, and the motor the recess therein, and a closure for the open end of the supplemental casing arranged to assist in holding the valve and motor in place, substantially as set forth.

6. In a drilling mechanism, the combination of a main cylinder, a valve chamber having inlet and exhaust ports for motive fluid, ducts leading from said valve chamber to the opposite ends of said main cylinder and each having two ports through which it communicates with the interior of said cylinder, one of said ports of each pair being relatively nearer to the adjacent end of said cylinder than the other one, an oscillating motor having a cylinder with a reciprocating piston therein, and a valve in said valve chamber connected with and arranged to oscillate with said oscillatory cylinder and adapted to control the flow of motive fluid through said ducts to and from either end of said main cylinder, said valve having a duct for the inlet and exhaust of motive fluid from the said oscillating cylinder.

7. In a drilling mechanism, the combination of a main cylinder, a valve chamber having inlet and exhaust ports for motive fluid, ducts leading from said valve chamber to the opposite ends of said main cylinder and each having two ports through which it communicates with the interior of said cylinder, one of said ports of each pair being relatively nearer to the adjacent end of said cylinder than the other one, an oscillating motor having a cylinder with a reciprocating piston therein, a valve in said valve chamber connected with and arranged to oscillate with said oscillatory cylinder and adapted to control the flow of motive fluid through said ducts to and from either end of said main cylinder, said valve having a duct for the inlet and exhaust of motive fluid from the said oscillating cylinder, and a needle valve for throttling the flow of motive fluid through said valve.

8. In a drilling mechanism, the combination of a main cylinder, a valve chamber having inlet and exhaust ports for motive fluid, ducts leading from said valve chamber to the opposite ends of said main cylinder and each having two ports through which it communicates with the interior of said cylinder, one of said ports of each pair being relatively nearer to the adjacent end of said cylinder than the other one, an oscillating motor having a cylinder with a reciprocating piston therein, a valve in said valve chamber connected with and arranged to oscillate with said oscillatory cylinder and adapted to control the flow of motive fluid

through said ducts to and from either end
of said main cylinder, said valve having a
duct for the inlet and exhaust of motive
fluid from the said oscillating cylinder, a
5 needle valve for throttling the flow of mo-
tive fluid through said valve, a supplemental
exhaust duct from said valve chamber, and
a supplemental exhaust duct communicat-
ing at one end with the first described duct
10 in said valve, and having its other end ar-
ranged to communicate with the said sup-
plemental exhaust duct leading from the
valve chamber.

9. In a drilling mechanism, the combi-
15 nation with a cylinder having inlet and
exhaust ports for motive fluid, and a blow-
impacting mechanism having a piston ar-

ranged to operate in said cylinder, of a sup-
plemental valve-actuating motor having an
inlet and exhaust ports for motive fluid, a 20
single valve actuated by said motor and
adapted to control the flow of motive fluid
both to and from the main cylinder and to
and from the cylinder of the said supple-
mental motor, and a manually operated 25
throttle valve for controlling the flow of
motive fluid from the said single valve to
the said supplemental motor.

In testimony whereof I affix my signature,
in presence of two witnesses.

WILLIAM L. SMITH.

Witnesses:

S. J. WHITE,
H. S. RANSOM.