M. W. SHERWOOD.

DRILLING MACHINE.

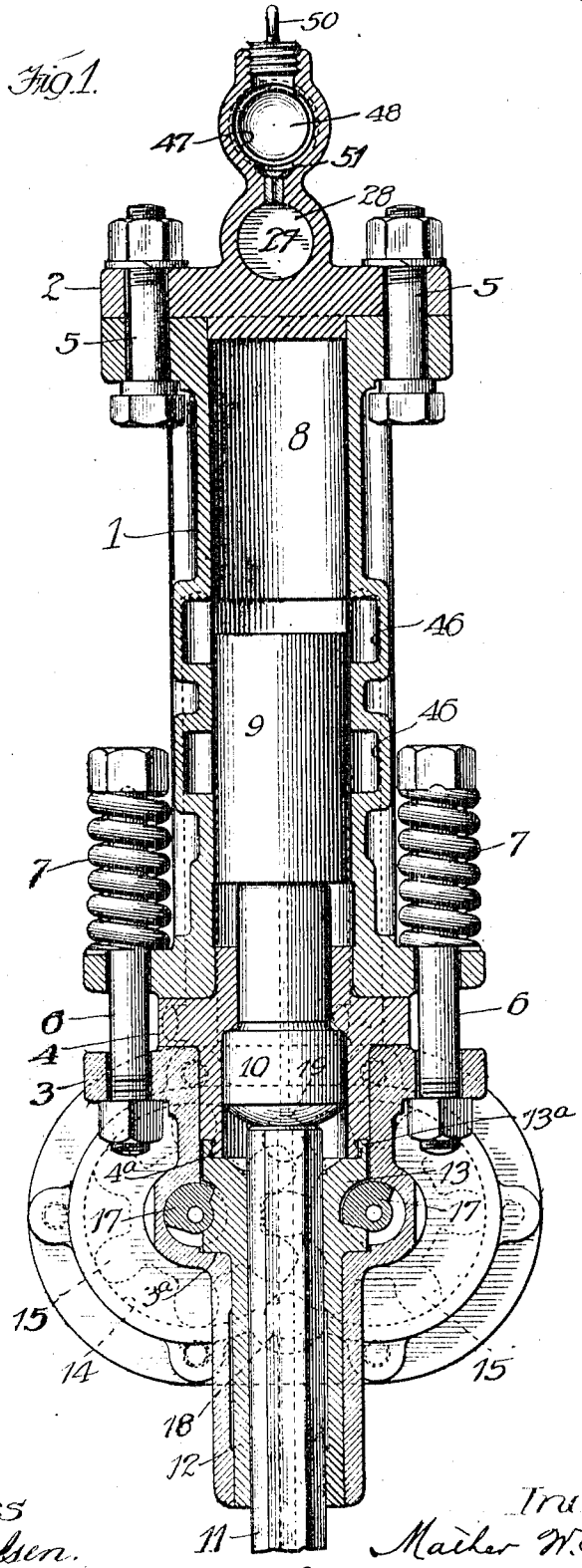
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Patented Nov. 3, 1914.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses
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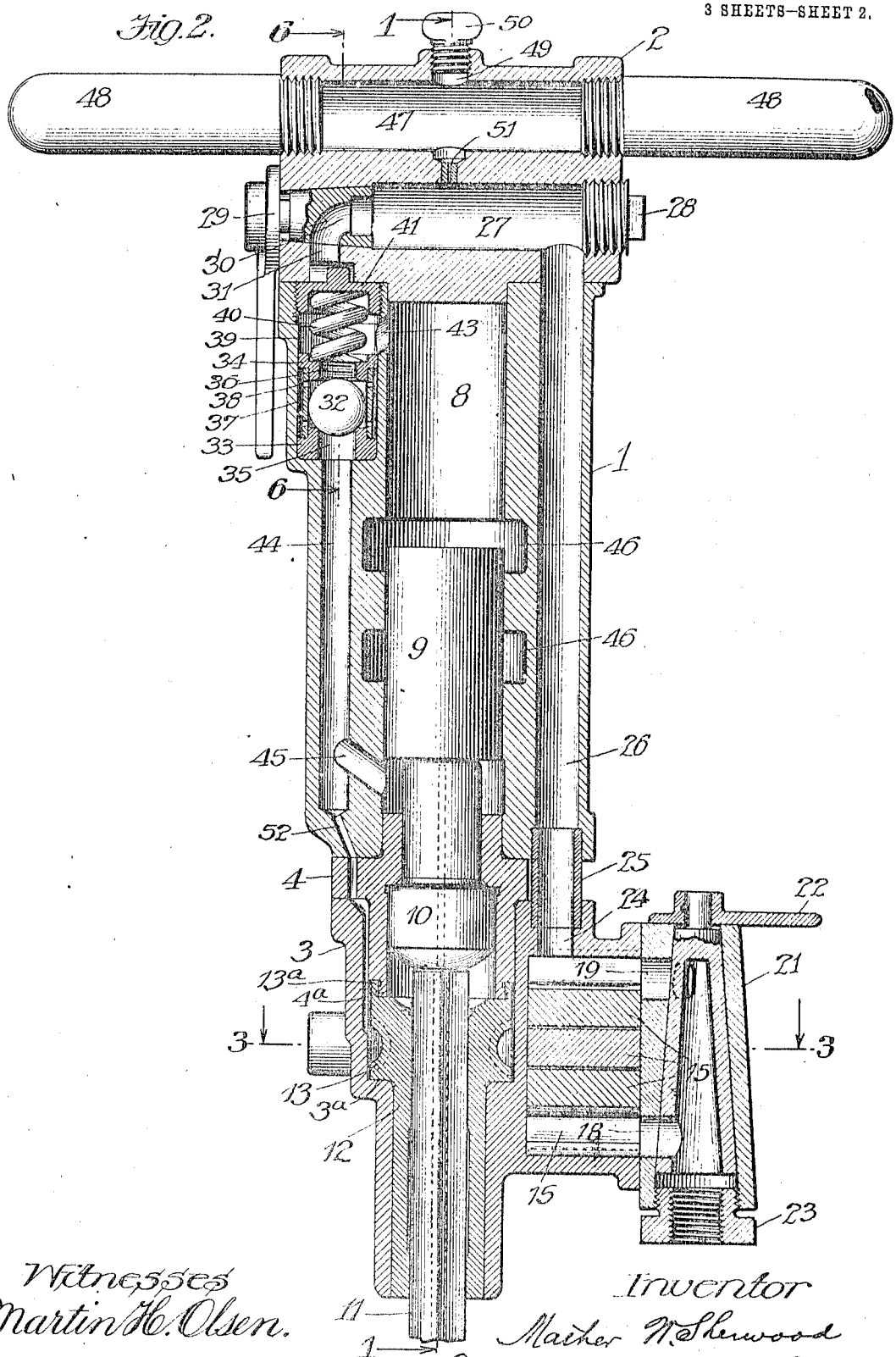
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

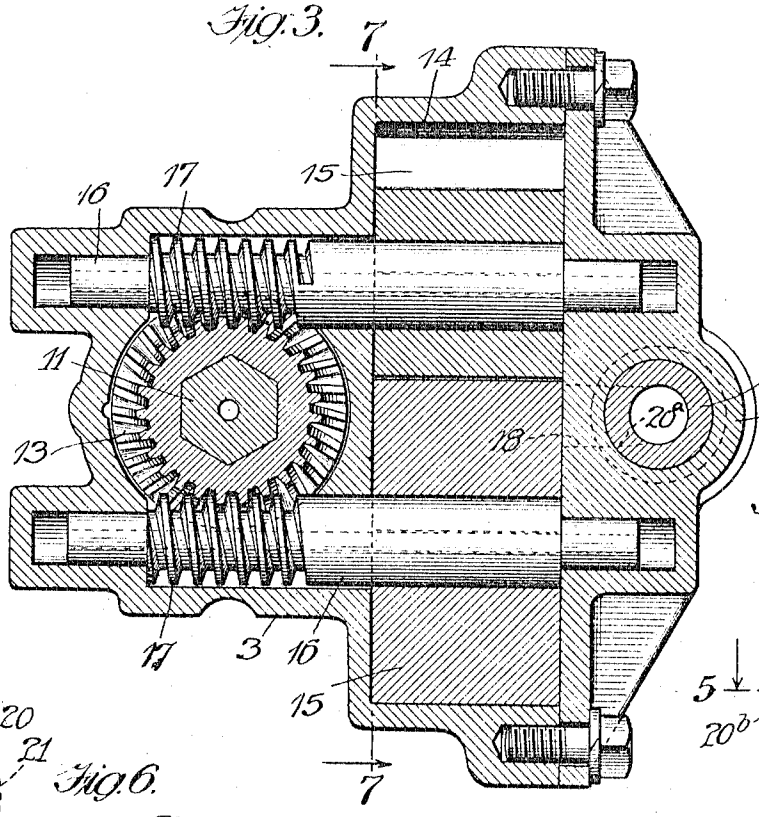


Fig. 4.

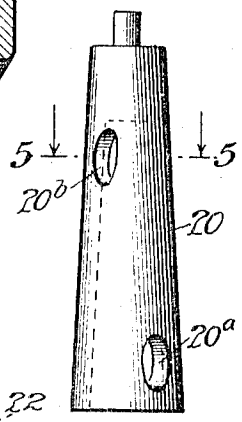


Fig. 5.

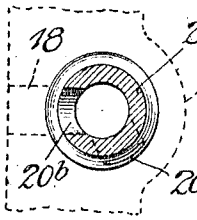


Fig. 6.

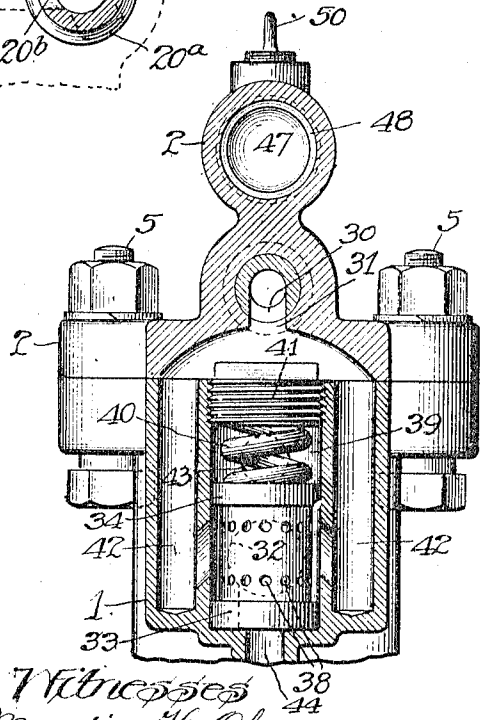
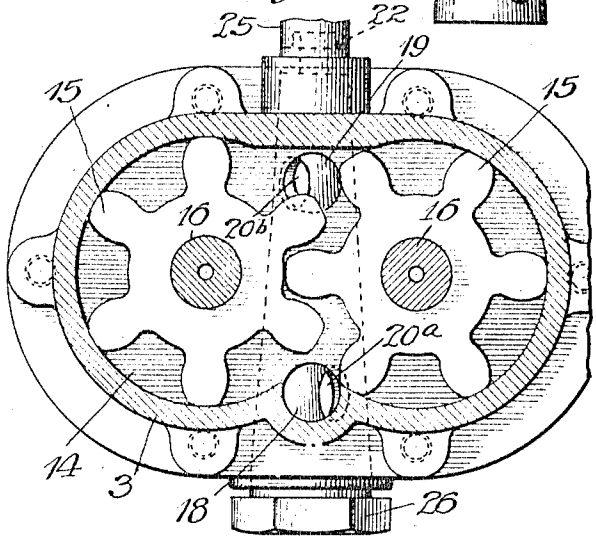


Fig. 7.



Witnesses

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UNITED STATES PATENT OFFICE.

MATHER W. SHERWOOD, OF FRANKLIN, PENNSYLVANIA, ASSIGNOR TO CHICAGO PNEUMATIC TOOL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW JERSEY.

DRILLING-MACHINE.

1,116,139. Specification of Letters Patent. Patented Nov. 3, 1914.

Application filed February 2, 1914. Serial No. 816,086.

To all whom it may concern:

Be it known that I, MATHER W. SHERWOOD, a citizen of the United States, residing at Franklin, in the county of Venango and State of Pennsylvania, have invented certain new and useful Improvements in Drilling-Machines, of which the following is a specification.

My invention relates to a motive fluid operated drilling machine of that type employing a fluid operated motor mounted on the machine for rotating the drill bit or steel during the time of operation of the drilling engine. The object of my invention is to provide a simple, efficient and reliable machine of this type possessing many advantages in construction and mode of operation and results over the drilling machines heretofore in use.

Heretofore it has been proposed to drive the rotation motor by the exhaust of the drilling engine, that is to say, the motor has been driven by the motive fluid which has operated and passed through the engine and which has then been admitted to the motor for the purpose of operating it and consequently rotated the drill bit. There are several objections to such construction among which may be mentioned first the fact that the action of the engine is interfered with by back pressure inasmuch as the exhaust flows to the rotation motor instead of directly to the atmosphere, with the result that in order to accomplish any successful result the drilling engine would necessarily require larger sized parts and ports of large carrying capacity, and second the fact that the necessarily low pressure of exhaust as compared with the high pressure of the live motive fluid would require a large sized rotation motor in order to approximate any successful result.

It has also been proposed to drive the rotation motor by live motive fluid supplied directly and independently of the motive fluid supplied to the drilling engine but this construction is also open to several objections, among which may be mentioned first the waste of motive fluid by the rotation motor especially when it is of the rotary type and second the absence of any automatic controlling feature with the result that constant and accurate manipulation of a controlling valve to the motor would be required in order to vary the speed between racing when the drill bit ran free and to slow down when the bit is stalling or inclined to stick.

A drilling machine embodying my invention overcomes the above-mentioned objections.

One of the main features of my invention is the driving of the rotation motor directly by the live fluid and the driving of the drilling engine by the exhaust from the motor, that is to say the motor is driven by the live fluid and the exhaust of the motor is delivered to the drilling engine for operating the latter which itself exhausts directly to the atmosphere.

There are many practical advantages in favor of my construction including the following: First, the power required to operate the rotation motor is only about five per cent. and the motive fluid passes through the motor in a dense state with the result that comparatively small-sized parts are permissible. Second, any leakage through the motor is entirely immaterial, the rotation being still sufficiently powerful and the motive fluid not being wasted because it flows from the motor to the engine for operating the latter. Third, the motor is automatically and perfectly regulated by reason of the fact that the flow of motive fluid through the motor is governed by the consumption of the motive fluid by the engine, which consumption is practically constant. Fourth, there is automatically increased power of the rotation and decreased power of the drilling engine when the bit stalls or begins to stick, both of which effects are desirable in such event. Fifth, there are also advantageous features of mechanical construction such as the use of two gears or worms operating on opposite sides of the gear of the sleeve holding the bit, representing a balanced construction.

In the drawings Figure 1 is a central longitudinal sectional elevation of a drill embodying my invention; Fig. 2 is a similar section taken on the line 1—1 of Fig. 2; Fig. 3 a cross section on the line 3—3 of Fig. 2 but on a larger scale; Fig. 4 an elevation of the throttle valve plug; Fig. 5 a cross section on the line 5—5 of Fig. 4; Fig. 6 a sectional elevation on the line 6—6 of Fig. 2 and Fig. 7 a sectional elevation on the line 7—7 of Fig. 3.

My invention may be embodied in ma-

chines of different construction and of different type and while in the present instance I have shown the same as embodied in a hand drill yet it will be understood that it may be embodied in any percussive machine requiring a rotary movement of the tool.

The particular construction and embodiment herein illustrated has been selected for the purpose of giving a clear and accurate description of my invention and I will now proceed to describe the same with that understanding.

As herein shown the drilling machine comprises essentially the drilling engine and the fluid pressure operative mechanism for rotating the drill bit or steel. The machine comprises three main parts, to wit, the body or main cylinder 1, a back head 2 and a front head 3 between which and the cylinder is interposed a bushing 4. The back head is secured to the cylinder in suitable manner as by means of short bolts 5. The front head is secured to the front end of the cylinder in suitable manner as by means of the bolts 6 provided with the usual cushioning springs 7.

The cylinder 1 is provided with the piston chamber 8 within which reciprocates a hammer piston 9 adapted to deliver its blows upon the shank of a striking piece or anvil 10 which in turn transmits or delivers the blows to the inner end of the usual drill bit or steel 11.

The front head 3 provides a bearing for a rotatable drill sleeve 12 whose inner enlarged end is formed as a worm gear 13. The front face of this gear bears against a shoulder 3^a in the interior of the front head and the rearward face of such gear is provided with a marginal flange extension 13^a which slips over a similar but forwardly-extending flange 4^a at the front end of the bushing 4.

The front head is extended laterally and provided thereat with two circular partially overlapping chambers 14 within which are mounted to rotate two similar rotors 15. These rotors are in the form of toothed wheels whose teeth mesh and which are adapted to be rotated by motive fluid introduced into said chambers at a point adjacent their intermeshing sides. These rotors are secured to shafts 16 arranged parallel to each other and journaled in suitable parallel bearing openings in the front head as shown in Fig. 3. These shafts are provided intermediate their length with worm portions 17 meshing with the worm gear 13 at opposite sides thereof thereby balancing the structure and the strain on opposite sides of such worm gear.

The chambers 14 are provided with a motive fluid supply port and passage 18 entering the same at the lower side of such chambers at a point adjacent the intermeshing portions of the rotors. These chambers are provided at their top with an exhaust port and passage 19 for exhausting the motive fluid after it has passed upwardly through the chambers and has rotated the rotors in its passage.

So far as my invention in its broader aspect is concerned it would be sufficient to merely connect the port 18 with any suitable source of motive fluid governed by any suitable throttle valve and admitting or shutting off the motive fluid through the port 18. However, in order to increase the practical efficiency of this machine I prefer to provide it with a hand throttle of the construction illustrated in Figs. 2, 4 and 5. This throttle valve comprises a tapered plug 20 fitting in a correspondingly tapered valve chamber forming a seat therefor in a casing 21. The upper end of the valve is provided with a handle 22 and the lower end of the chamber has screw-threaded thereinto a coupling nut 23 into which is screwed the coupling of a supply hose or the like communicating with a source of motive fluid. This valve plug is hollow and provided near its lower end with a side port 20^a and at its upper end with a side port 20^b, both of which communicate with the interior of the plug. The port 20^a is adapted to register with the port and passage 18 and the port 20^b with the port and passage 19. When the valve is in a position in which the port 20^a registers with the port 18 the other port 20^b is out of register with its port 19. It will be understood that by these means and in this manner the motive fluid may be caused to pass through the chambers 14 and to thereby rotate the rotors or such motive fluid may be by-passed around such rotors by being admitted to the chambers 14 through the port 19.

The port 19 communicates with the outlet or exhaust port 24 which in turn communicates through a hollow dowel pin 25 with a longitudinal supply passage 26 in the cylinder 1. This latter passage communicates at its upper end with a transverse enlarged passage or chamber 27 in the back head. One end of this chamber is closed by a screw plug 28 and the other end is provided with a throttle valve 29 having a passage 30 communicating at all times with the chamber 27 and adapted in one position of such valve to communicate with a port 31 leading to the valve chamber.

The valve chamber which is formed at the rearward end of the cylinder 1 may be of any desired construction and operation for controlling the admission of the motive fluid to and from opposite ends of the piston chamber 8. In the present instance this distributing valve is of the ball type comprising a ball 32 adapted to seat upon one or the other seats 33 and 34 in order to control the

two ports 35 and 36 respectively. These seats form a part of a valve cage, the remaining part being a shell 37 interposed between such seats and provided with inlet ports 38. The valve cage is contained within a valve chamber 39 and the parts of such cage are held together and in the forward end of the chamber by means of the spring 40 bearing at its forward end against the valve seat 34 and at its rear end against the screw plug 41 closing that end of the valve chamber. The annular space between the inner wall of the valve chamber and the shell 37 communicates with the supply port 31 through the two large supply ports 42, Fig. 6, and the rearward end of the valve chamber communicates with the adjacent end of the piston chamber 8 by the port 43. The port 35 communicates with the longitudinal passage 44 in the cylinder 1 which in turn communicates with the front end of the piston chamber 8 through the cross port 45.

The drilling machine being constructed as above explained operates as follows: Assuming that the throttle valve 20 is turned to the position shown in Fig. 2 and motive fluid is supplied through the coupling 23. Such fluid enters the rotor chambers 14 through the port 18 and causes these rotors to rotate in opposite directions. As a result of the rotation of these rotors the worms 17 are rotated and inasmuch as they both mesh with the worm gear 13 and on opposite sides thereof, such gear is thereby rotated, causing a rotation of the drill sleeve 12. It will be understood that this sleeve has a central angular opening of a size and shape to receive the drill bit so that such bit will be rotated by the rotations of the sleeve.

The exhaust from the rotor chambers passes through the ports and passages 24, 26, 27, 30, 31 and 42 to the valve chamber. Assuming that the piston 9 is on its forward stroke and has delivered its blow to the anvil 10, the rear end of the piston chamber will be quickly exhausted after the piston has passed by the rearward one of the two exhaust grooves 46 whereupon the live air in the front part of the valve chamber surrounding the seat will act upon the ball valve 32 and force it from its seat 33 and upon its other seat. The live motive fluid will now pass to the front end of the piston chamber to return the piston to its rearward position and when such piston has cleared or uncovered the forward one of the exhaust grooves 46 the ball valve will be moved to its position illustrated in Fig. 2 and the live air will be admitted to the rearward end of the piston chamber 8 to drive the piston forwardly. Thus the drilling engine is operated by the exhaust from the rotors with the several advantageous and practical results set forth in the preamble.

If it is desired to operate the drilling engine by the direct motive fluid and not by the exhaust the throttle valve 20 is turned to a position to cause its port 20^b to register with the port and passage 19 whereupon the motive fluid will be by-passed around the rotors and will be admitted direct to the drilling engine.

The back head is provided with a transverse oil supply chamber 47 into whose ends screws the two handles 48 thereby closing the ends of such chamber. This chamber is provided with a filling opening 49 closed by a screw plug 50. The bottom of this oil or lubricating chamber is provided with a small opening 51 for the passage of the oil from such chamber into the path of the motive fluid passing to the distributing valve and the operating parts of the engine. The oil is carried by the motive fluid through the drilling engine for the purpose of lubricating the moving parts and whatever oil passes through the passage 44 and does not enter the front end of the piston chamber 8 continues downwardly through the small passage 52 extending through the lower end of the cylinder, the bushing and front head. The lower end of this oil passage or duct 52 enters the interior of the front head 3 at a point adjacent the worm gear, thereby lubricating the latter together with the worms and the bearings of the two shafts 16.

By the use of my invention I am enabled to overcome the objections and to attain the various advantages in construction, operation and results as set forth in the preamble.

By preference the bushing and the gear portion of the drilling sleeve have the slip joint connection hereinbefore described in order to prevent the entrance by any possibility of any chips or the like from passing from the space adjacent the anvil and inner end of the drill bit to the gearing, thereby preserving the latter from injury and wear.

I claim:

1. In a drilling machine, the combination, with the drilling engine, of means for effecting the rotation of the drilling tool including a fluid pressure actuated motor operatively connected with the tool, the exhaust of the motor communicating with the inlet of the engine for operating the latter.

2. In a drilling machine, the combination, with the drilling engine, of means for effecting the rotation of the drilling tool including a fluid pressure actuated motor operatively connected with the tool, the exhaust of the motor communicating with the inlet of the engine for operating the latter, and a valve governing the admission of motive fluid to the engine either direct thereto or indirect through the motor.

3. In a drilling machine, the combination, with the drilling engine, of means for effect-

ing the rotation of the drilling tool including a fluid pressure actuated motor operatively connected with the tool, said motor being of the rotary type, and means for supplying live motive fluid direct to the motor, the exhaust of such motor communicating with the inlet of the engine for operating the latter.

4. In a drilling machine, the combination, with the drilling engine, of means for effecting the rotation of the drilling tool including a fluid pressure actuated motor operatively connected with the tool, means of communication between the exhaust of the motor and the inlet of the engine for operating the latter, such motor having a casing provided with an inlet, and a valve in said casing for supplying live motive fluid either direct to the engine through said communication, or indirect thereto through the motor and through said communication.

5. In a drilling machine, the combination, with the drilling engine, of means for effecting the rotation of the drilling tool including a fluid pressure actuated motor operatively connected with the tool, said motor including a casing and two intermeshing toothed rotors therein, such casing having a live motive fluid inlet port in position to admit the fluid to the intermeshing portions of the rotors and having an exhaust port communicating with the engine for supplying the exhaust of the motor thereto for driving the engine.

6. In a drilling machine, the combination, with the drilling engine, of means for effecting the rotation of the drilling tool comprising a sleeve adapted to receive the tool and mounted to rotate on the front end of the engine, a gear wheel on said sleeve, driving gears meshing with said gear on opposite sides thereof and acting simultaneously thereon, and a fluid pressure actuated motor mounted on the engine and operatively connected with said driving gears.

7. In a drilling machine, the combination, with the drilling engine, of means for effecting the rotation of the drilling tool comprising a sleeve adapted to receive the tool and mounted to rotate on the front end of the engine, such sleeve having a portion thereof formed as a worm gear, a pair of driving worms meshing with said gear on opposite sides thereof and operating in unison to drive it, and a fluid pressure actuated motor mounted on the engine and operatively connected with said driving gears.

8. In a drilling machine, the combination, of the drilling engine including a cylinder, a front head, a drilling sleeve bearing therein and having at one end a gear portion, a bushing interposed between the cylinder and front head, said bushing and gear portion having a slip joint connection, and means for rotating the sleeve.

9. In a drilling machine, the combination, of the drilling engine including a cylinder, a front head, a drilling sleeve bearing therein and having at one end a gear portion, a bushing interposed between the cylinder and front head, said bushing and gear portion having projecting overlapping flanges, and means for rotating the sleeve.

10. In a drilling machine, the combination, of the drilling engine including a cylinder, a front head, a drilling sleeve bearing therein and having at one end a gear portion, a back head on the cylinder provided with a motive fluid passage for conducting the fluid to the engine, and having an oil supply communicating with such passage, a distributing valve communicating with said passage and with passages entering opposite ends of the cylinder, said cylinder and front head having an oil passage leading from the lower end of the passage to the front end of the cylinder and passing through the front head to said gear portion.

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