

No. 761,602.

PATENTED MAY 31, 1904.

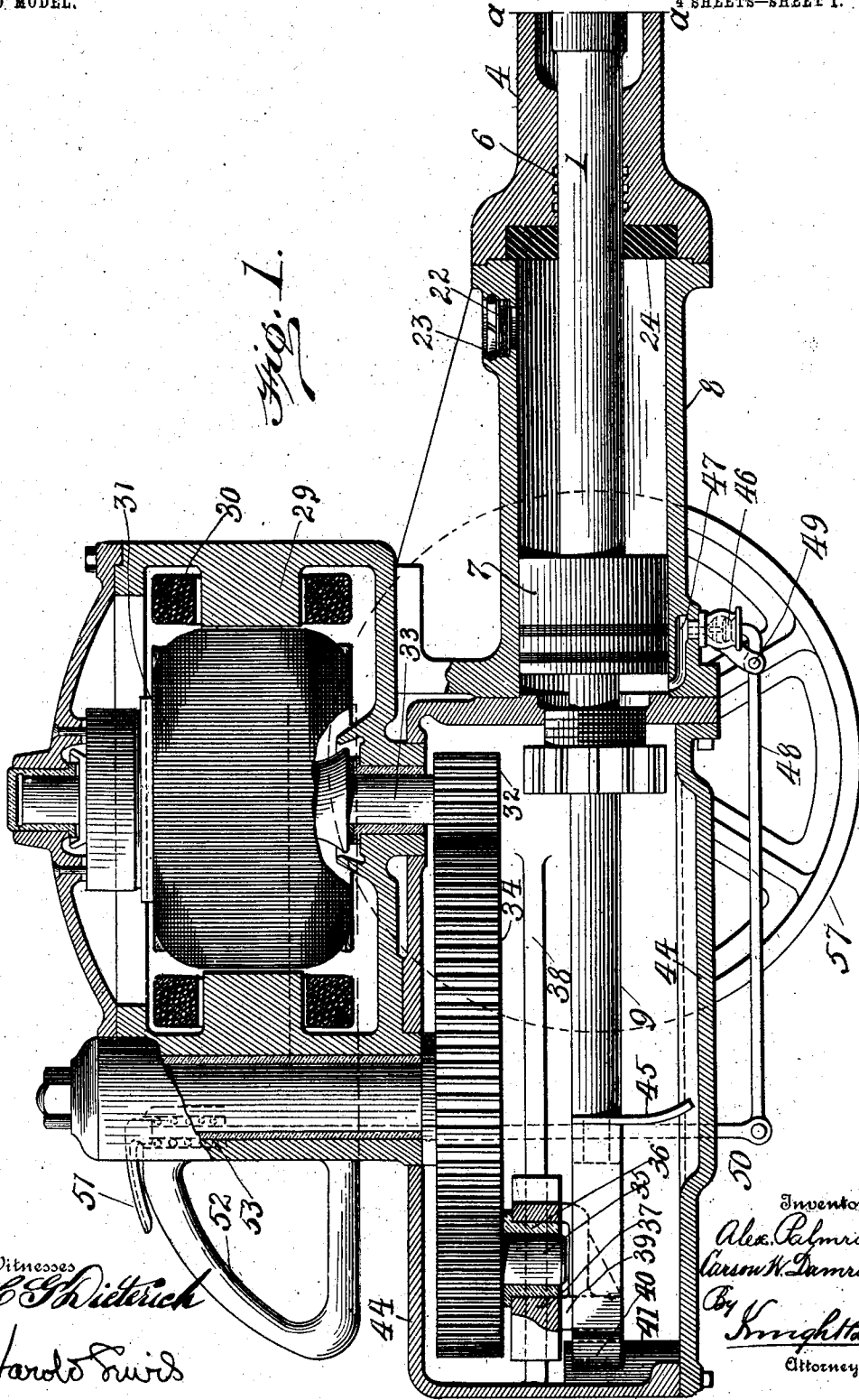
A. PALMROS & C. W. DAMRON.  
FLUID PRESSURE TOOL.

APPLICATION FILED SEPT. 6, 1902. RENEWED SEPT. 28, 1903.

NO. MODEL.

4 SHEETS—SHEET 1.

*Fig. 1.*



Witnesses  
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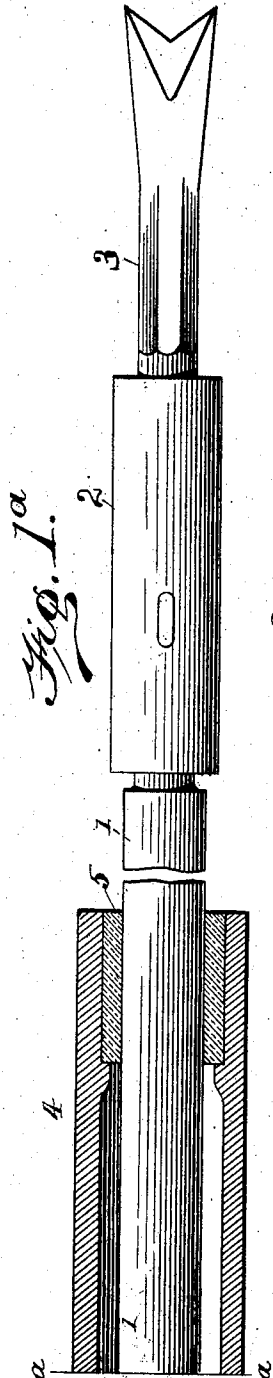
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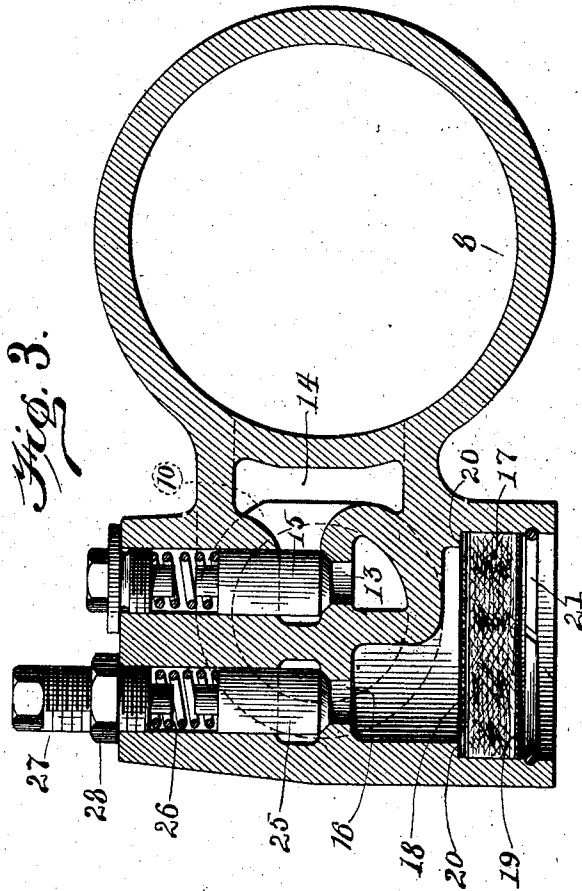
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NO MODEL.

4 SHEETS—SHEET 2.



*Fig. 1. a.*



*Fig. 3.*

Witnesses

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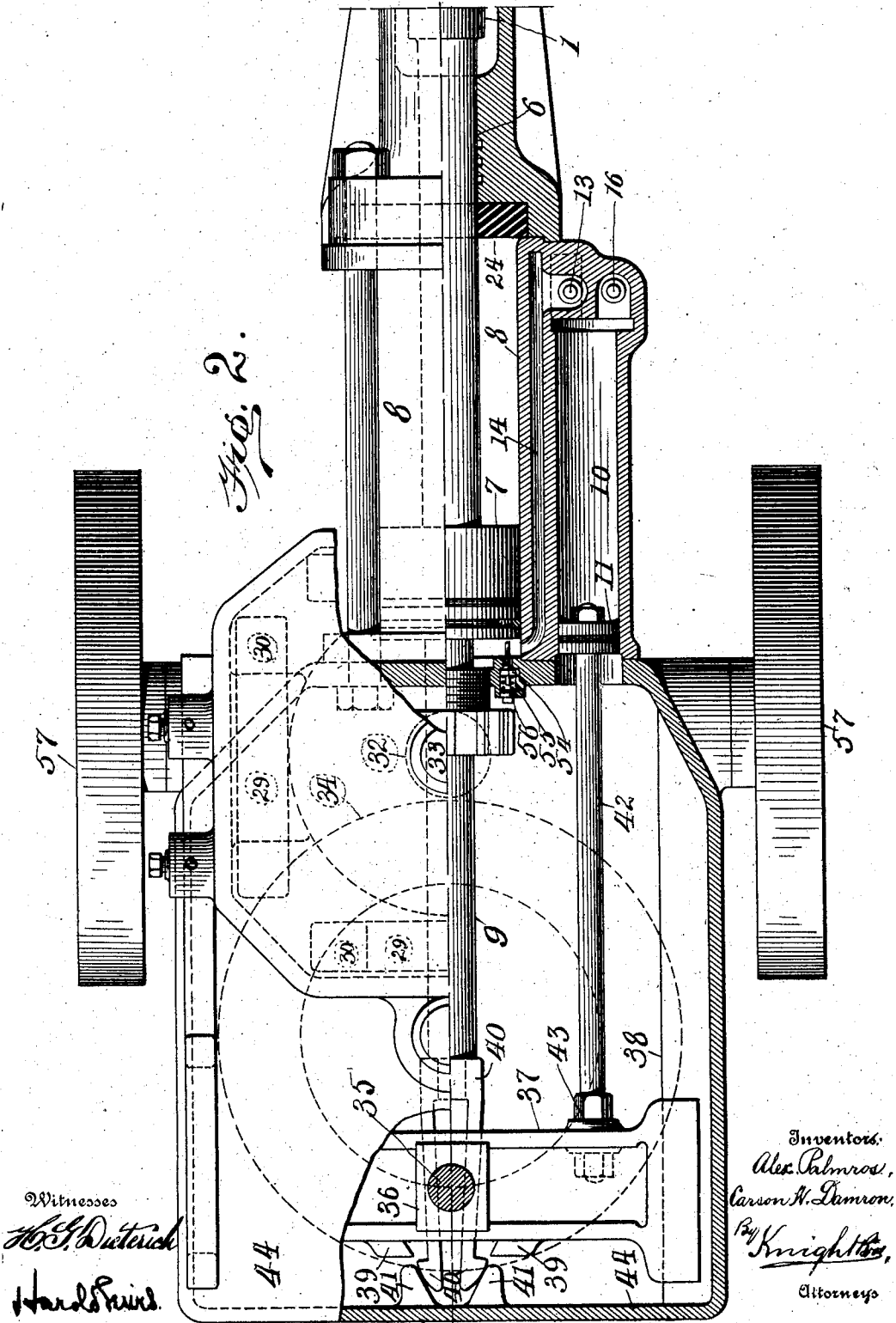
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4 SHEETS—SHEET 3.



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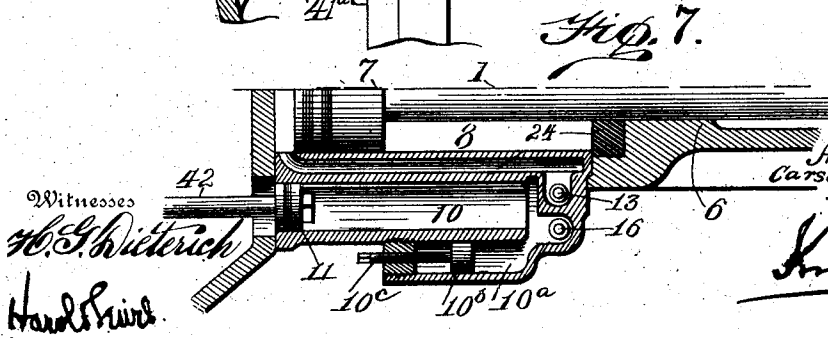
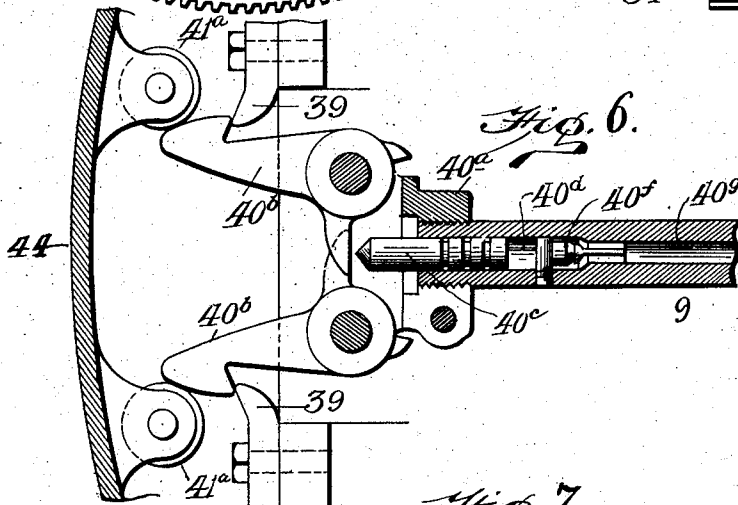
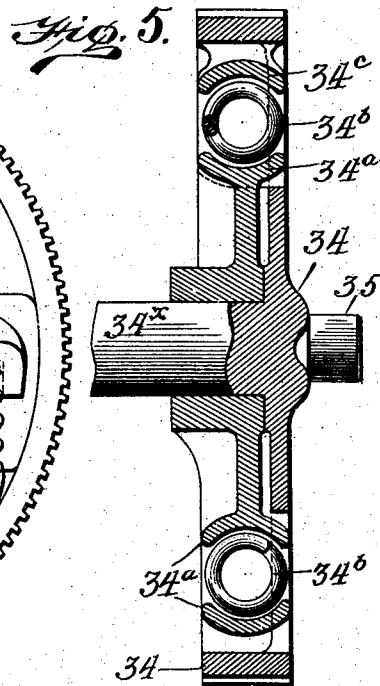
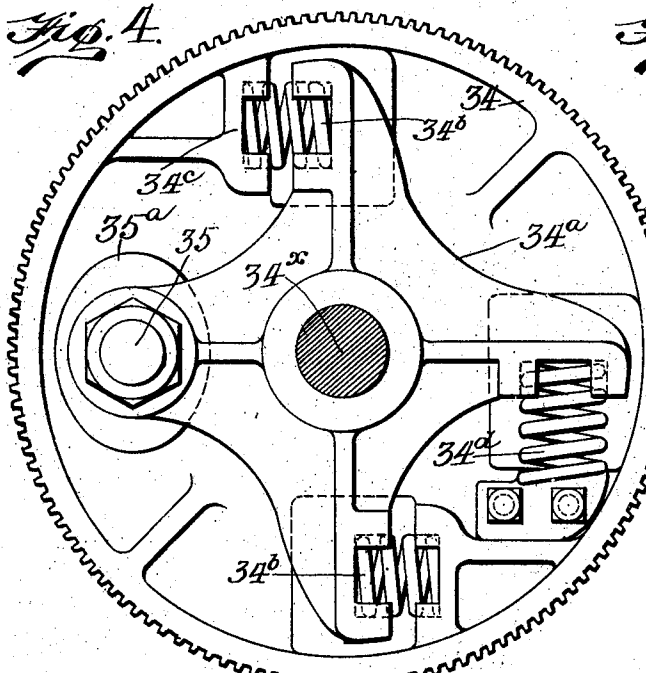
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NO MODEL.

4 SHEETS—SHEET 4.



Witnesses  
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# UNITED STATES PATENT OFFICE.

ALEXANDER PALMROS AND CARSON W. DAMRON, OF FAIRMONT, WEST VIRGINIA.

## FLUID-PRESSURE TOOL.

**SPECIFICATION** forming part of Letters Patent No. 761,602, dated May 31, 1904.

Application filed September 6, 1902. Renewed September 28, 1903. Serial No. 174,875. (No model.)

*To all whom it may concern:*

Be it known that we, ALEXANDER PALMROS, a citizen of Finland, and CARSON W. DAMRON, a citizen of the United States, both residents of Fairmont, in the county of Marion, State of West Virginia, have invented certain new and useful Improvements in Reciprocating Tools, of which the following is a specification.

Our invention is applicable in general to reciprocating tools that perform their work by strokes or percussion, such as mining-machines, rock-drills, riveting-machines, chipping or chiseling machines, &c. Tools of this kind have generally been actuated in one of two ways—namely, by having a fluid-pressure medium supplied from an exterior source operate the reciprocating part in both directions or by having working mechanism on the tool impart movement in one direction and at the same time compress an elastic medium, which when the reciprocating part is released imparts the stroke in the opposite direction. The former of these two plans of operation is unsatisfactory, because of the expense and inconvenience of developing the fluid-pressure or of conducting it through any great distance, and the latter plan of operation has heretofore been unsatisfactory, because when a spring was used as the elastic medium the duration of its effective usefulness was too short, and when air was used the compression obtained was only that resulting from the inward movement of the tool-piston and such compression did not give back sufficient work to develop the requisite stroke in the outward direction. Especially was this the case where there was any loss of the elastic medium by leakage.

Our invention operates upon the principle of having working parts on the tool which are actuated by power from an external source develop pressure in an elastic medium, which when released will project the tool-stock to cause it to perform its work, and employs air as such elastic medium, but also embodies auxiliary means for developing and maintaining the efficiency of pressure in such elastic

medium above that which is obtainable from the mere inward stroke of the tool-piston. 50

One feature of our invention consists in providing a pump independent of the tool-piston which supplies the fluid medium under pressure to the tool-cylinder, said pump being preferably actuated by the same working mechanism which retracts the tool-stock and arranged to maintain an initial pressure in the tool-cylinder which will so augment the pressure developed by the instroke of said piston that upon release of said tool-stock the full amount of power required for the stroke will be given out.

Another feature of our invention consists in means for regulating the work of the auxiliary compressor, so as to control the force of the tool's stroke as well. 65

Another feature of our invention consists in combining an electric motor with a fluid-pressure tool of the character described whereby the tool may be actuated more conveniently from a distant source of power, and other advantages are attained, as hereinafter explained. 70

Further features of our invention consist in novel details of construction hereinafter described, whereby the objects of our invention are successfully carried out. 75

The use of electricity, which has become general in operating mines, and the expense and inconvenience of conducting fluid-pressure for any considerable distance have combined to create a great demand for a successful electrically-operated mining-machine. Our present invention is not only peculiarly adapted for embodiment in mining-machines, but it fully meets the aforesaid demand. For this reason we shall disclose our invention by way of illustration as embodied in an electrically-actuated mining-machine and set forth some features of novelty incident to such a use of our invention. 80

In the accompanying drawings, forming part of this specification, Figure 1 is a vertical longitudinal section of an electrically-operated mining-machine constructed in accordance with our invention, the forward or operating 85

end being cut off on the line *a a*. Fig. 1<sup>a</sup> is a sectional elevation of said forward or operating end. Fig. 2 is a plan view, partly in section, of the machine shown in Fig. 1. Fig. 3 is a vertical transverse section through the intake of the auxiliary pump, the adjustable valve controlling such intake, the tool-cylinder, and the check-valve between said pump and tool-cylinder. Figs. 4 and 5 are respectively a side elevation and an axial section of the large gear-wheel in the reducing-gear between the motor-armature and the retracting connections, showing the preferred construction of such wheel with cushioning means introduced between the gear-wheel and the crank-pin carried by it. Fig. 6 represents in sectional plan the preferred construction of the grip on the retracting-bar and parts cooperating therewith; and Fig. 7 is a sectional detail view of the tool-cylinder, the pumping-cylinder for supplying pressure medium therefor, and means for regulating the work of the pumping-cylinder.

1 represents a reciprocating tool-stock, which, as shown in Fig. 1<sup>a</sup>, may be provided with a socket 2 to receive any form of bit, in the present instance a mining-pick for chipping or breaking down coal. This stock may work in a guide 4 through packing 5, Fig. 1<sup>a</sup>, and bearing 6, Fig. 1, and extends inward beyond said guide for connection with the parts that are to control its movements. To continuously retract the stock and drive it forward with a heavy percussive stroke, to continue these movements in rapid recurrence, and to regulate both as to rapidity of recurrence and force of each stroke are the main objects to be attained.

Projecting the tool is accomplished by providing the stock 1 with a piston 7, working in a cylinder 8, which we shall designate as the "tool-cylinder," and compressing an elastic medium, such as air, behind said piston on its inward movement, so that when the stock is released the pressure behind the piston imparts the forward stroke, a retracting-bar 9 projecting from the piston beyond the rear end of the cylinder for engagement with retracting means to be described. Reinforcing pressure behind the piston is essential, since compression that would be produced by mere backward movement of piston 7, starting with the air contained in the cylinder at atmospheric pressure, would be insufficient to give the desired stroke to the piston, being even insufficient to complete the outward movement of said piston where there is any loss from leakage, which is unavoidable in some degree. Hence we maintain in the cylinder from some collateral source, preferably a compressor or pump, an initial pressure considerably above atmosphere, so that the piston is driven to the end of its cylinder with a continuing force, and the large increase of the pressure due to retracting the tool-piston

and operating on the piston at the beginning of its stroke is ample to insure the desired percussion. One convenient way to thus reinforce compression in the tool-cylinder is by providing an air-pump 10, having a piston 11, whose rod 42 extends rearwardly and is connected with a reciprocating part of the retracting mechanism, to be described, said pump 10 communicating through a port 13, Figs. 2 and 3, at its forward end, with a channel 14 leading to the rear end of the tool-cylinder, a check-valve 15 being located in said port.

To guard the interior of the cylinder against dust, the intake 16, Fig. 3, of the air-pump 10 is covered by a saturated sponge-like mass 17, confined between perforated disks 18 19, of which the upper disk 18 is retained by a shoulder 20 in the intake and the lower disk 19 by an expansible split ring 21. In working in coal or rock especially and in all work to some extent dust is created, which would be drawn into this suction-opening unless strained out of the air. Hence the protecting-screen described adds greatly to the life of the parts. A similarly-constructed screen 22 is located for a similar purpose in the opening 23 at the forward end of the tool-cylinder 8, through which air passes in and out to keep the pressure at atmosphere in front of the projecting piston 7 as it reciprocates. The position of opening 23 is such that the piston 7 is air-cushioned at its forward limit. 24 represents an additional cushion of rubber, fiber, or other substance for absorbing shocks.

Regulating the force of the stroke of the tool is accomplished by varying the quantity of air (and consequently the pressure) introduced into the tool-cylinder by pump 10, for which purpose the intake 16, Fig. 3, which is closed by a valve 25, unseated by the incoming air, may be loaded by a spring 26 with any desired pressure by adjusting a set-screw 27, having lock-nut 28. On the inward stroke of the pump-piston 11 air under external atmospheric pressure will not enter the intake 16 until the difference in pressure between pressure inside of the valve and the atmospheric pressure without is sufficient to unseat the said valve. If the pressure on the spring 26 is slight, this unseating will occur almost immediately after the pump-piston begins to recede, and a full charge of air will be drawn in on the instroke of the pump-piston and expelled into the tool-cylinder on the outstroke of said piston, and the working pressure developed by the retraction of the tool-piston will be very great. If, however, the compression of spring 26 is materially increased by screwing in the screw 27, the valve 25 will not unseat until a considerable vacuum has been developed back of the valve by the inward movement of the pump-piston, and consequently the amount of air entering at each stroke of said pump-piston will be pro-

portionately less than when the valve is only lightly loaded by its spring. The compression of air in the pump may be further regulated by having an auxiliary air-chamber 10<sup>a</sup>, with a head 10<sup>b</sup>, adjustable by a screw 10<sup>c</sup>. Adjusting the head 10<sup>b</sup> changes the size of the compression-chamber and regulates the degree of compression produced by each stroke of the pump. The quantity of air forced into the working cylinder being reduced, the working pressure in said cylinder will be correspondingly reduced. By these means the work of the tool can be regulated to a nicety, a heavy percussive stroke being given for one character of work and a very much modified stroke being obtainable for another character of work where a lighter stroke would be more appropriate.

Retracting the tool is accomplished through means of a constantly-running electric motor of high speed, the field-poles 29 of which, with their windings 30, are shown in section in Fig. 1 and in dotted lines in Fig. 2, while the armature 31 of said motor is shown in elevation in Fig. 1 and its general location indicated by dotted lines in Fig. 2. Rotation of armature 31 imparted to the retracting mechanism is so greatly reduced by a small pinion 32 on the armature-shaft 33 and the large gear-wheel 34 that the armature 31 serves as a very effective fly-wheel to prevent any material fluctuation in the rotation of the retracting mechanism resulting from the intermittent load placed upon it. To avoid shock resulting from the intermittent imposition of load on the motor-armature, a yielding or cushioning connection is inserted in the connection between the armature and the retracting mechanism, which may be of any suitable construction. We have shown a very effective construction of cushioning device or elastic gearing in Figs. 4 and 5, wherein 34<sup>a</sup> represents a spider mounted with freedom of rotation upon the shaft 34<sup>x</sup> of the gear-wheel 34, and 34<sup>b</sup> represents springs introduced between the arms of said spiders and abutments 34<sup>c</sup>, carried by the gear-wheel 34. The spider 34<sup>a</sup> carries a crank-pin 35, through which the retracting stroke is imparted to the tool, which pin 35 works through an enlarged opening 35<sup>a</sup> in the wheel 34. When the parts driven by the pin 35 engage the tool to retract it, the load imposed upon the wheel 34 causes the relative rotation of the spider 34<sup>a</sup> thereon, with consequent compression of springs 34<sup>b</sup>, which thus absorb the shock. 34<sup>d</sup> represents a balancing-spring located between the rear side of one of the spider-arms and a suitable seat on wheel 34, so as to limit the rotation of the spider backward and impose a suitable initial load on the springs 34<sup>b</sup> and keep the wheel 34 with its spider 34<sup>a</sup> in proper relation. The crank-pin 35 on the large gear-wheel 34 fits into the sliding block or bushing 36, which reciprocates in a slidably-

mounted yoke 37, whereby the rotary motion of the crank-pin is converted into the reciprocating motion of the yoke 37. The yoke 37 is guided in a right line by the tracks 38 and carries on its under side a pair of beveled horns 39, which reciprocate with said yoke in the line of the axis of the tool-stock. Mounted upon the inner or rear end of the retracting-bar 9 of the tool-stock 1 is a grip, formed by a pair of spring gripping-dogs 40, which on the forward or outward movement of the yoke 37 will engage with the horns 39 and cause the retracting-bar 9, with piston 7 and tool-stock 1, to be retracted on the inward movement of said yoke. This grip is such that the yoke will engage with it or pick it up at any point at which they may meet, except at the rearmost limit of the grip's movement, and the machine is thus enabled to start at whatever position the piston 7 may be located. 41 41 represent releasing-stops formed to receive the grip 40 when the latter approaches its rearward limit of movement and press the dogs together to disengage them from the horns 39. This disengagement occurs just before the yoke 37 completes its rearward movement and immediately the release is effected the pressure which has been developed in cylinder 8 by the backward movement of piston 7 forces the said piston forward and imparts the working stroke to the tool-stock 1. The construction of these parts is such that this operation may continue with any degree of rapidity.

To operate the pump-piston 11, rod 42 of said piston extends rearward and has a fixed connection at 43 with the yoke 37. The piston 11 is thereby reciprocated synchronously with the yoke 37 and makes a full stroke for each stroke of the working piston 7.

44 represents a casing which completely incloses the retracting mechanism with the exception of the motor, and this casing is made sufficiently tight to contain oil, within which the parts may be made to operate to secure constant lubrication and easy running.

45 represents a blade carried by the extension 8, by which to keep the oil in the casing 44 in circulation.

A preferred construction of retracting-grip is shown in Fig. 6, wherein the pair of spring-dogs are replaced by pivoted dogs 40<sup>b</sup>, forced normally apart by a pressure-pin 40<sup>c</sup>, working in a cylinder 40<sup>d</sup>, which is closed by check 40<sup>e</sup> and communicates through a passage 40<sup>f</sup> with a tool-cylinder. Each time compression takes place in the tool-cylinder the cylinder 40<sup>d</sup> is charged with pressure, which projects the pin 40<sup>c</sup>, said pressure being confined by the check-valve 40<sup>e</sup>, and the effective spring-pin is thus provided for holding the dogs 40<sup>b</sup> normally apart. The releasing-stop may be provided with antifricition-rollers 41<sup>a</sup> to advantage to engage the dogs 40<sup>b</sup> already described.

Stopping, starting, and working the piston may be readily accomplished by providing means within convenient reach of the operator for opening the rear or compression end of the cylinder 8—such, for instance, as a check-valve 46, communicating through a passage 47 with the cylinder 8, seating under the pressure within said cylinder and having an unseating-lever 48 fulcrumed at 49 and controlled by a rod 50, terminating in a thumb-piece 51 adjacent to the controlling-handle 52 of the machine and having a spring 53, which holds said rod normally elevated. In starting the machine thumb-piece 51 is depressed and through it the valve 46 is unseated, so as to prevent the development of any pressure behind piston 7 until the armature 31 has reached full speed of revolution. By moving a suitable controller (not shown) onto full-speed notch, after which the thumb-piece 51 is released, the valve 46 seats itself and the development of pressure and the operation of the tool commence. In this way no substantial load is placed upon the motor until after it has gotten into full operation and can operate with its fly-wheel effect upon the machine. The valve 46, with its controlling mechanism, serves another important function, in that it permits the operator to arrest the stroke of the tool-stock at any time if for any reason it should be desirable to do so without stopping the motor.

Automatically arresting the stroke of the tool in the event that the body or pick becomes stuck fast in the coal or other material being operated upon is provided for by locating a valve 54 in the rear head of the cylinder 8, holding it by a spring 55 with sufficient pressure to prevent its unseating by the ordinary working pressure in said cylinder and providing it with a stem 56, that will be encountered by the piston 7 when the latter moves backward farther than the rear limit of its normal reciprocation—that is to say, the rear limit to which it is moved by the yoke 37. In tools of this character, and particularly when used for mining or breaking down mineral, the machine is mounted upon wheels, such as 57, or otherwise supported, so that it will automatically move forward as far as the pick permits. Under this condition when the pick becomes stuck and cannot be withdrawn the relative movement which is taking place between it and the parts in which it is mounted causes the machine as a whole to move forward, while the pick remains stationary. In thus running forward the machine naturally will bring the rear end of the cylinder 8 closer to the piston 7 than in the ordinary operation of the tool, and this extraordinary movement of the piston 7 causes unseating of the valve 54, the escape of pressure behind piston 7, and the arresting of the tool-stock, inasmuch as there is no pressure left behind the piston 7 to bring it forward and no such pressure

can be developed by the pump so long as the valve 54 is open. The reciprocating drill-stock thus remains at rest until the machine is shut down or forcibly released from the mineral and set in operation again, the motor being arrested, if desired, or the tool-stock being held inoperative by use of the controlling-valve 46.

We have described with more or less minuteness the details of construction of the machine selected to illustrate our invention, but desire it to be understood that while we thus describe and claim the disclosed adaptation of our invention to a mining-machine and certain individual features of construction of said machine we do not limit ourselves to this particular use of the invention.

Having thus described our invention, what we claim as new therein, and desire to secure by Letters Patent, is—

1. In combination with a fluid-pressure-driven tool, having means for developing fluid-pressure by its instroke, a pump maintaining a supply of fluid-pressure medium to the working cylinder of the tool.

2. In combination with a fluid-pressure-driven tool, having means for developing fluid-pressure therein, an auxiliary pump supplying the fluid-pressure medium under initial pressure to the working cylinder of the tool.

3. In combination with a fluid-pressure-driven tool, developing fluid-pressure by the movement of its piston in one direction, and moving in the opposite direction under the expansion of the fluid medium thus compressed; a pump supplying the fluid-pressure medium to the pressure-cylinder of the tool.

4. In combination with a fluid-pressure-driven tool, developing fluid-pressure by the movement of its piston in one direction, and moving in the opposite direction under the expansion of the fluid medium thus compressed; a pump supplying the fluid-pressure medium to the pressure-cylinder of the tool, and means for controlling such supply of fluid-pressure medium.

5. In combination with a fluid-pressure-driven tool, developing the main actuating fluid-pressure by the movement of its piston in one direction, and moving in the opposite direction under the expansion of the fluid medium thus compressed; a pump supplying the fluid-pressure medium to the pressure-cylinder of the tool, under pressure, and maintaining a normal supply of such pressure medium therein under initial pressure.

6. In a power-driven tool, the combination of a motor, a cylinder, a tool-piston in said cylinder operating the tool, moved in one direction by the motor, and moving in the other direction under the influence of fluid-pressure in the cylinder, and a pump supplying the fluid-pressure medium to the cylinder.

7. In a power-driven tool, the combination of a motor, a cylinder, a tool-piston in said

cylinder operating the tool, moved in one direction by the motor, and moving in the other direction under the influence of fluid-pressure in the cylinder, and a pump supplying the fluid-pressure medium to the cylinder, operated by said motor.

8. In combination with a fluid-pressure-driven tool, developing fluid-pressure by the movement of its piston in one direction and moving in the opposite direction under the expansion of the fluid medium thus compressed; a pump supplying the fluid-pressure medium to the pressure-cylinder of the tool, means for controlling such supply of fluid-pressure medium, a handle for directing the tool, and a connection extending to the handle actuating the means for controlling the supply of fluid-pressure medium.

9. In a power-driven tool, the combination of a motor, a cylinder, a tool-piston in said cylinder operating the tool, moved in one direction by the motor, and moving in the other direction under the influence of fluid-pressure in the cylinder, a pump supplying the fluid-pressure medium to the cylinder, means for regulating the supply of fluid-pressure, and a connection actuating said regulating means.

10. In a power-driven tool, the combination with the motor, a sleeve, a piston in said sleeve, operating the tool, moved in one direction by the motor, and moving in the other direction under the influence of fluid-pressure developed in the cylinder, and a relief-valve located in the end of said cylinder, and unseated by an abnormal stroke of the piston to relieve pressure behind the piston, as explained.

11. The combination with the retracting-bar and the motor-shaft, of a gear-wheel geared to the motor-shaft, a spider concentric with said gear-wheel, a cushioning device interposed between the gear-wheel and the spider, a slidably-mounted yoke, a block or bushing adapted to slide in the yoke, a crank-pin connecting the block or bushing and the spider, and connection between the retracting-bar and the yoke adapted to release the said bar at one end of its stroke.

12. A drill-carrying element, mechanism for retracting said drill-carrying element and compressing air, means for advancing said drill-carrying element through the medium of the compressed air so produced, and auxiliary means for supplying compressed air to maintain a desired pressure.

13. A drill-carrying element, mechanism for retracting said drill-carrying element and compressing air, means for advancing said drill-carrying element through the medium of the compressed air so produced, auxiliary means for supplying compressed air to maintain a desired pressure, and means for controlling the pressure of the compressed air.

14. A cylinder, a piston therein, a drill-

carrying element connected to the piston, means for advancing said piston by compressed air, a mechanism for retracting said piston to compress air for advancing the piston, and auxiliary means for supplying compressed air to the cylinder.

15. In a tool, in which the tool-bar is projected by fluid-pressure and retracted by a motor, an automatically engaging and releasing grip that disengages at the end of the in-stroke and engages after completion of the outstroke of the machine; said grip consisting of a pair of dogs on the part to be retracted, normally spaced apart, a pair of horns on a part reciprocated by the motor, engaged by said dogs, and stops at the rear limit of the dogs' motion releasing said dogs from the horns at the completion of the in-stroke.

16. In a tool, in which the tool-bar is projected by fluid-pressure and retracted by a motor, an automatically engaging and releasing grip that disengages at the end of the in-stroke and engages after completion of the outstroke of the machine; said grip consisting of a pair of pivoted dogs on the part to be retracted, a pair of horns on a part reciprocated by the motor, engaged by said dogs, a pin engaging said dogs to force them apart, carried by the part to be retracted, and releasing-stops at the rear limit of movement of the dogs, engaging the latter and releasing them when they complete their motion.

17. In a tool, in which the tool-bar is projected by fluid-pressure and retracted by a motor, the combination of a part reciprocated by the motor, having horns, a retracting-bar connected with the piston which operates the tool member, a pair of dogs pivoted on the retracting-bar adapted to engage the horns on the reciprocating part, a pin mounted in a bar in the reciprocating bar, pressing said dogs in engagement with the horns, a passage communicating fluid-pressure from the working cylinder of the tool to the said pin, and a releasing-stop at the rear limit of movement of the dogs, engaging the latter and displacing them from the horns as the retracting-bar reaches its rear limit.

18. In combination with a compressed-air-operated tool, compressing air by its stroke in one direction and projected by the expansion of the air thus compressed, an auxiliary pump supplying air to the main compression-cylinder and a strainer for the intake of said auxiliary pump.

The foregoing specification signed this 1st day of September, 1902.

ALEXANDER PALMROS.  
CARSON W. DAMRON.

In presence of—

E. F. HARTLEY,  
JOHN L. WAGNER.