No. 835,589.

PATENTED NOV. 13, 1906.

W. WHEELER.

PNEUMATIC TOOL.

APPLICATION FILED DEC. 23, 1905. RENEWED OCT. 3, 1906.

2 SHEETS—SHEET 1.

FIG. 1

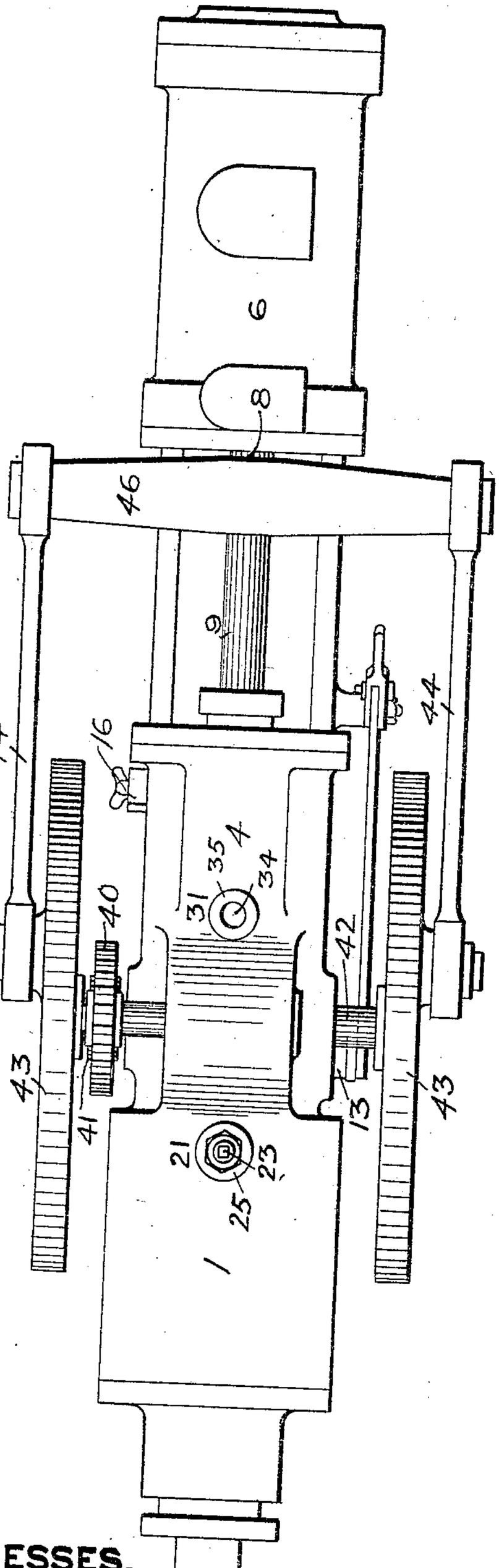


FIG. 8

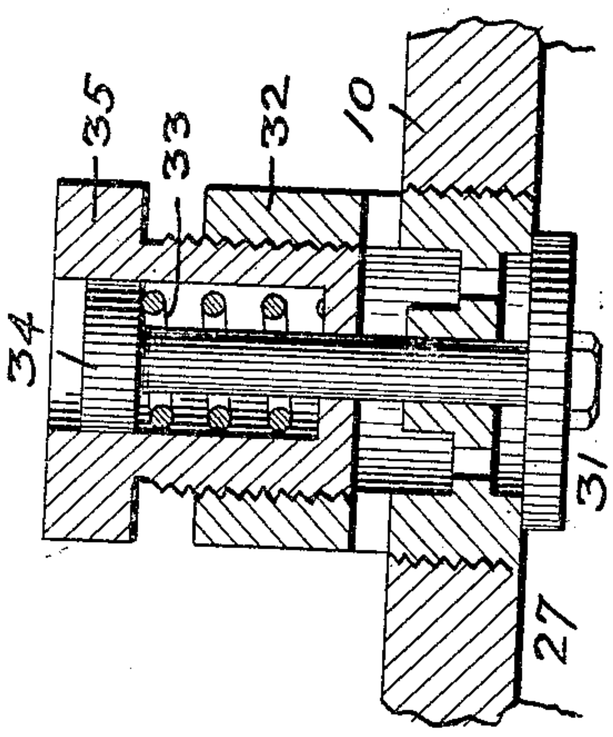


FIG. 7

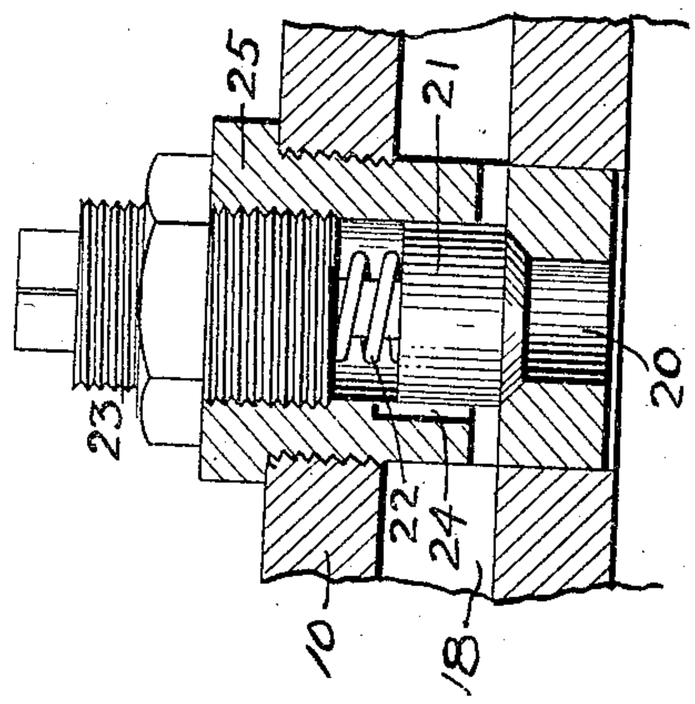
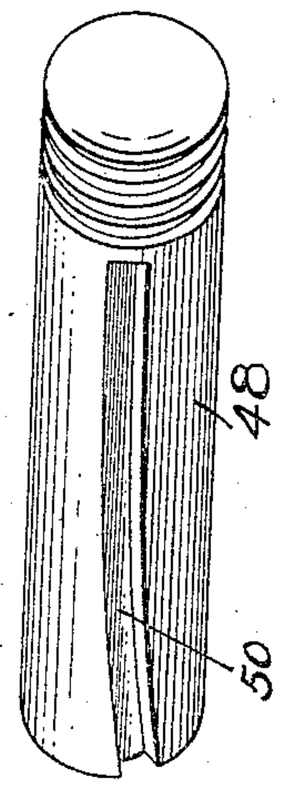


FIG. 5



WITNESSES.

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2 SHEETS—SHEET 2.

FIG. 2

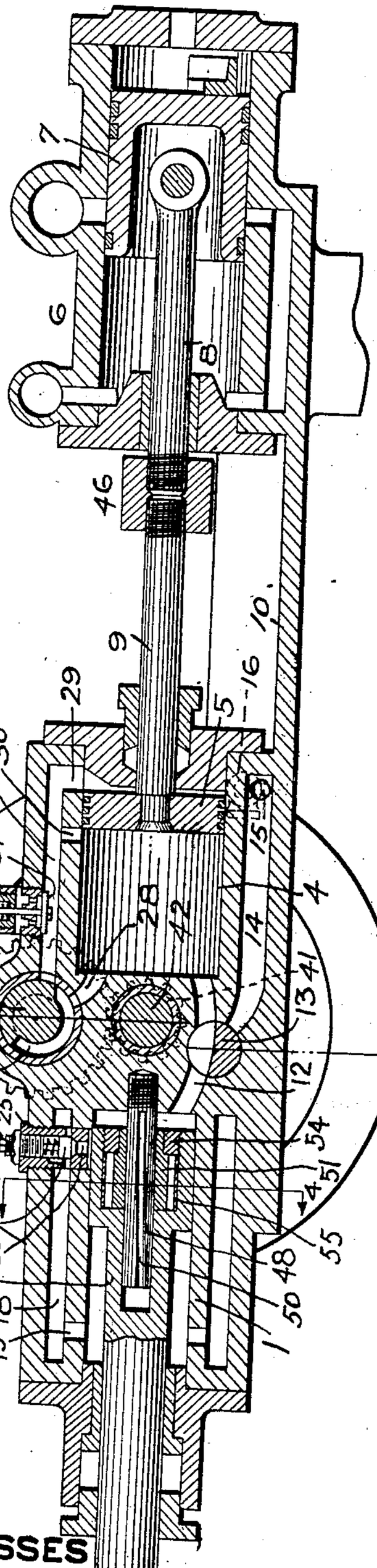


FIG. 4

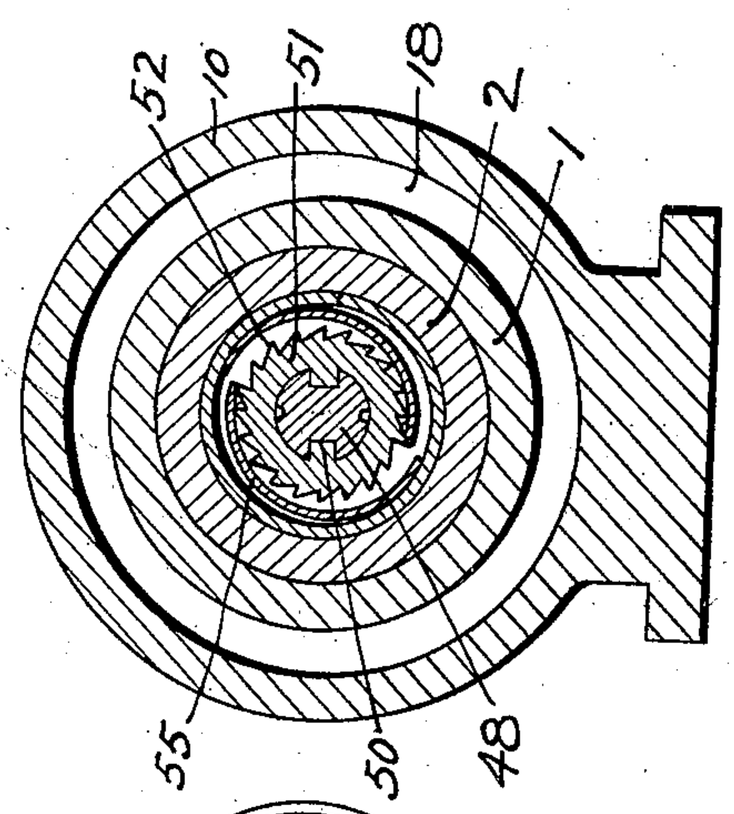


FIG. 6

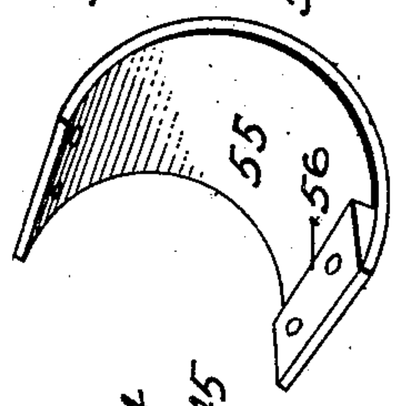
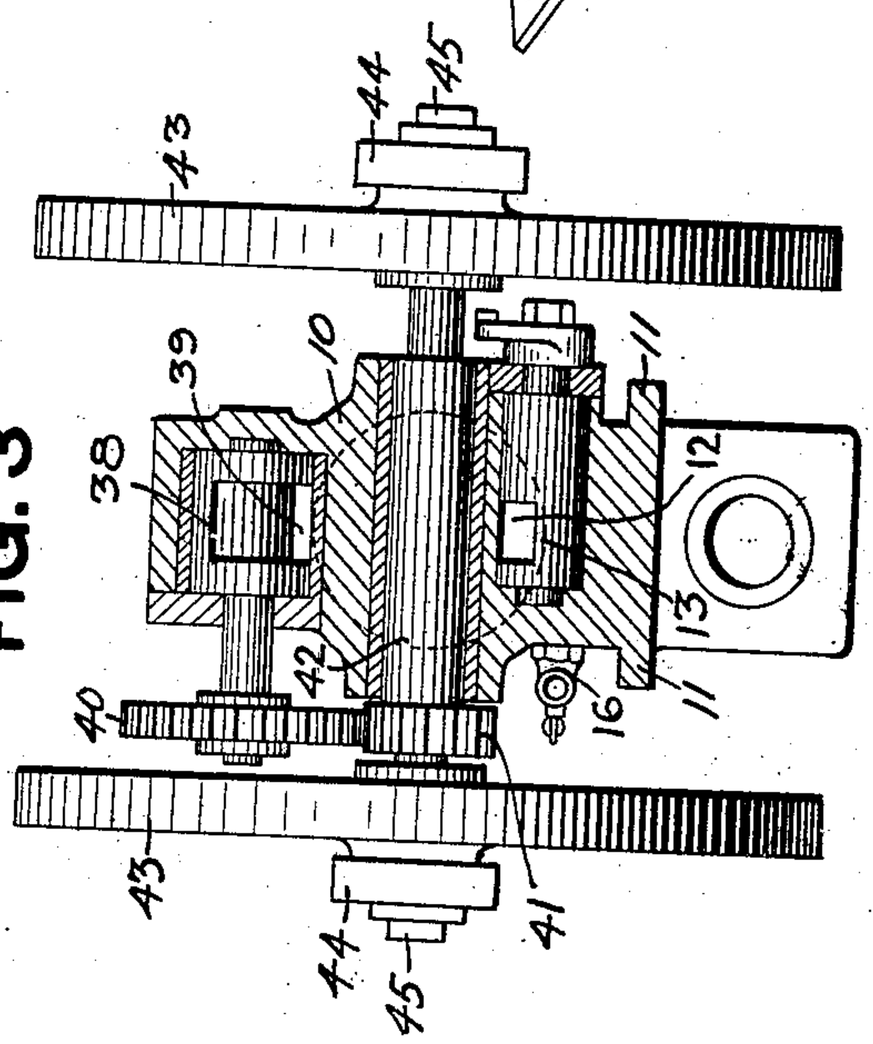


FIG. 3



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UNITED STATES PATENT OFFICE.

WELLS WHEELER, OF EAST PITTSBURG, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO FRANK W. CHATTIN, OF BUTTE, PENNSYLVANIA.

PNEUMATIC TOOL. REISSUED

No. 835,589. Specification of Letters Patent. Patented Nov. 13, 1906.

Application filed December 23, 1905. Renewed October 3, 1906. Serial No. 337,277.

To all whom it may concern:

Be it known that I, WELLS WHEELER, a resident of East Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Pneumatic Tools; and I do hereby declare the following to be a full, clear, and exact description thereof.

This invention relates to percussion implements, such as rock-drills and the like. Its object is to provide an implement of this character which is actuated pneumatically and in which the implement itself and the source of power are self-contained—that is, the implement, the compressor, and the compressor-motor all being mounted on the same base.

The specific objects of the invention are to provide an implement of the character named in which the tool is automatically lifted or withdrawn after actuation by means of compressed air and to so regulate the compressor as to secure a preliminary compressing of the air and to so control the air that it will not act upon the tool-piston at each reciprocation of the compressor-piston, but on the contrary will be preliminarily compressed, so that when it does act upon the tool-actuating piston it will have sufficient tension to give an effective blow.

For the attainment of the foregoing objects the invention consists of the arrangement of parts hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a plan view of the device. Fig. 2 is a vertical longitudinal section through the same. Fig. 3 is a transverse section on the line 3 3, Fig. 2. Fig. 4 is a transverse section on the line 4 4, Fig. 2. Figs. 5 and 6 are detail views of the tool-rotating means. Figs. 7 and 8 are enlarged sectional views of the check and inlet valves.

The invention comprises a suitable tool-actuating cylinder 1, in which is the tool-actuating piston 2, which at its outer end is provided with a socket or chuck 3 for receiving the drill or other tool, a compressor-cylinder 4, containing a compressing-piston 5, a motor 6, which may be of any suitable type, but which is shown as a standard two-cycle gasolene-engine, and its movable element—viz., the piston 7, connected by suitable rods 8 and 9 to the compressor-piston 5 for reciprocating the latter. All of these elements are mounted upon a common base or support, such as the casting 10, and, in fact, in the specific form illustrated the tool-actuating cylinder, the compressor-cylinder, the motor-cylinder, and the base member 10 are formed as a single integral casting; but obviously this can be varied without departing from the spirit of the invention. The base member 10 is provided with suitable means, such as the wings 11, for mounting on a tripod or other suitable support, as will be readily understood by those skilled in the art. Inasmuch as the motor may be of any suitable type, it has not been deemed necessary to illustrate it in detail.

The compressor-cylinder 4 and tool-actuating cylinder 1 are connected by means of a port 12, which is controlled by a suitable valve 13, by means of which said port may be closed—as, for instance, when starting the implement in order to permit the gasolene-motor to attain the desired speed. When the port 12 is closed, the valve 13 connects the cylinder 4 with a passage 14, having an outlet 15 to the atmosphere. This outlet is controlled by a suitable cut-off valve or cock 16, so that when the motor is running and it is desired to stop the tool-actuating piston, as may be necessary when changing drills and the like, the outlet 15 may be throttled in order to oppose resistance to the reciprocation of the piston 5 in order to prevent the engine from racing.

The tool-actuating piston is driven forwardly by air entering behind said piston. It is retracted by means of compressed air contained in the chamber 18, which is connected to the forward end of the cylinder-chamber 1 by means of a port 19. The chamber 18 is connected to the rear end of the cylinder-chamber 1 by means of a port 20, which is controlled by a suitable reducing-valve, such as the check-valve 21, which is backed by means of a spring 22. The tension of said spring may be adjusted by means of a suitable screw 23. A port 24 leads from the chamber 18 to the outer face of the valve 20, so that the valve will be held to its seat not only by the spring 22, but by the air-

pressure contained in the chamber 18. For convenience of manufacture the valve, the spring 22, and adjusting-screw 23 are all mounted in a removable plug 25, in which the valve-seat is formed.

It will be apparent that if the air in the cylinder 4 entered the actuating-cylinder 1 at each reciprocation of the piston 5 it would not be sufficiently compressed to give an efficient blow to the piston 2. I therefore make provision for preliminarily compressing the air before it acts upon the piston 2. This is accomplished by providing a by-pass 27, which is connected to the outlet end of the cylinder 4 through a port 28 and to the inlet end of the cylinder by a port 29. A port 30 also connects this by-pass with the chamber of the cylinder 4 in front of the piston 5 when the latter is in its rearmost position. The inlet-valve is shown at 31, this being mounted in a suitable plug 32 and being arranged to open inwardly. It is normally held to its seat by means of a spring 33, arranged at one end to bear against a head 34 on the outer end of the valve-stem and against an adjustable plug 35. This valve opens by the suction produced by the travel of the piston 5, thus drawing air into the cylinder in a well-understood manner.

The by-pass 27 is controlled by suitable valve mechanism arranged to keep said by-pass open during a predetermined number of reciprocations of the piston 5 in order to secure the preliminary compressing of the air and to then close said by-pass so that the air in front of the piston on the next forward reciprocation thereof will be forced into the cylinder 1 to actuate the piston 2. This valve mechanism may be of various forms. It is shown as a rotating plug-valve 38, having a suitable groove 39 for establishing communication between the port 28 and by-pass 27 when said valve is in a certain position. This plug-valve will be rotated from any suitable moving part of the mechanism. As shown in the drawings it is provided with a gear 40, which meshes with a similar gear 41 on a shaft 42. The latter extends through suitable bearings in the casting 6 and preferably will be provided with a fly wheel or wheels 43 for steadying the movement thereof. The shaft 42 is rotated by means of connecting-rods 44, connected at one end to wrist-pins 45 on the fly-wheels 43 and at their opposite ends being connected to a cross-head 46, secured to the rods 8 and 9. For convenience of assembling the rods 8 and 9 are threaded into the cross-head. It will be obvious that the reciprocation of the cross-head 46 will impart rotation to shaft 42, and this movement by means of the gears 40 and 41 will impart rotary movement to the valve 38.

The gears 40 and 41 will be of such relative sizes as to rotate the valve at the desired speed to maintain the by-pass 27 open during the desired number of reciprocations of the piston 5 and will then close said by-pass. The gears shown in the drawings have a ratio of one to two, so that the valve 38 will be given a complete rotation during each two reciprocations of the pistons 5. Consequently upon one reciprocation of piston 5 the by-pass 27 will be open and on the next reciprocation it will be closed. This will secure one blow of the actuating-piston 2 for each two reciprocations of the piston 5. Obviously, however, by changing the ratio of the gears 40 and 41 and correspondingly modifying the length of the groove 39 in the valve 38 it will be possible to secure a blow of the piston 2 for each third, fourth, fifth, or other number of reciprocations of the piston 5.

In rock-drilling, &c., it is necessary, or at least desirable, to rotate the tool. This I accomplish as follows: The piston 2 is made hollow, and projecting into the same is a stud or rod 48, provided with a spiral groove or spline 50, this stud being fixedly secured to the main casting by threading the same therein, as shown. Surrounding this stud or rod is a sleeve 51, provided with a spline or groove to engage the spiral groove or spline on the stud, and on its outer face being provided with ratchet-teeth 52. This sleeve is connected to the piston 2, so that it must reciprocate therewith, such as by a bushing 54, threaded in the outer end of the piston behind the sleeve 51. A spring pawl or detent 55 has one end fixed to the piston 2 and its opposite end provided with a tooth 56, arranged to engage the teeth on the sleeve 51. When the piston is driven forwardly, the sleeve 51 will be rotated by means of the spiral groove or spline 50, the pawl during the forward movement sliding idly over the ratchet-teeth 52. On the return movement of the piston the sleeve 51 will be rotated in the opposite direction, and as the tooth 56 of the pawl will be in engagement with a ratchet-tooth on said sleeve, the rotation of said sleeve will act to rotate the piston 2 and with the latter the tool carried thereby.

The operation of the implement shown is as follows: If a gasolene-motor is used, the valve 13 will be turned by hand, so as to cut off the port of the tool-actuating cylinder and open the cylinder 4 to the port 14, thus preventing the air from offering resistance to the piston 5. This position of the valve 13 will be maintained until the motor has acquired its necessary speed, when the valve 13 will be turned to open communication between the cylinders 4 and 1. When the piston 5 moves forwardly and the valve 38 closes the by-pass, the suction generated will open the inlet-valve 31, thus drawing air into the rear end of the cylinder. During the backward

movement of the piston this air will be compressed in the by-pass 27 and will escape through the port 30 into the forward end of the cylinder. On the next forward stroke of the piston 5 the valve 38 will have opened the by-pass and the air in front of the piston 5 passes through the by-pass 27 to the rear end of the cylinder and will not be forced into the cylinder 1 with sufficient tension to move the tool-actuating piston 2. This preliminary compressing of the air will continue as long as the by-pass 27 is open. As soon, however, as the valve 38 has been rotated to the position to again close said by-pass the piston 5 on its next forward reciprocation will force the compressed air in front of the same through the port 12 into the cylinder 1, thus moving the tool-actuating piston 2 with sufficient force to produce an efficient blow.

On the first admission of air to the cylinder 1 and as soon as the piston 2 has uncovered the port 20 the valve 21 will be raised, permitting air to flow into the chamber 18. The valve 21 will remain open until the pressure in the chamber 18 plus the tension of the spring 22 overbalances the pressure in the cylinder 1, when said valve will be closed. On future admissions of air to the cylinder 1 the valve 21 will be raised only in case the pressure in the chamber 18 plus the tension of the spring 22 is less than the pressure in the cylinder 1. Consequently the valve 21 acts as a regulating check-valve to control the pressure in the chamber 18 and to prevent the air from being drawn out of said chamber when the piston 5 moves backwardly.

After a forward movement of the tool-actuating piston 2 in the manner just described and as soon as the piston 5 begins to move backwardly it will create a suction in the cylinder 1, or at least will greatly reduce the pressure in said cylinder. Consequently the air in the chamber 18 will pass through the port 19 and act on the forward face of the piston 2, thus positively retracting the latter. During the reciprocations of the piston 2 said piston and the tool carried thereby will be rotated on each return stroke of the piston by the means hereinafter described.

When it is desired to change tools, it is not necessary to stop the motor 6. The valve 13 will be turned to cut off the communication between the pressure and tool-actuating cylinders and will connect the compressing-cylinder with the port 14 and through the same to the air. The valve 16 will be partially closed during this operation in order to throttle the port 15 and offer sufficient resistance to the piston 5 to prevent the engine from racing.

The implement described is entirely self-contained. It has all the advantages of a pneumatically-operated tool and does away with the necessity of a separate power-plant and the extensive pipings which are necessary with pneumatic tools as at present constructed and operated. At the same time the air is given sufficient preliminary compression to give an effective blow to the tool.

What I claim is—

1. In a percussion implement, the combination of a tool-actuating cylinder, a piston therein, a compressing-cylinder and piston therein, connections between said cylinders, a by-pass connecting the ends of the compressing-cylinder, and valve mechanism arranged to keep said by-pass open during a predetermined number of reciprocations of the compressing-piston and close the same during the next reciprocation of said piston.

2. In a percussion implement, the combination of a tool-actuating cylinder, a piston therein, a compressing-cylinder, a piston therein, connections between said cylinders, a by-pass connecting the ends of the compressing-cylinders, a movable valve controlling said by-pass, and means for moving said valve so arranged as to hold the by-pass open for a predetermined number of reciprocations of the compresser-piston and to then close the same during a forward stroke of the compressor-piston.

3. In a percussion implement, the combination of a tool-actuating cylinder, a piston therein, a compressing-cylinder, a piston therein, connections between said cylinders, a by-pass between the ends of said compressing-cylinder, a rotary valve controlling said by-pass, and gearing actuated from the compressor-actuating means and arranged to rotate the valve at such speed as to hold the by-pass open during a predetermined number of reciprocations of the compressor-piston and to then close the same.

4. In a percussion implement, the combination of a tool-actuating cylinder, a piston therein, an air-compressing cylinder, connections between said cylinders, a motor connected to the compressor, a base common to said cylinders and motor, and valve mechanism arranged to secure the actuation of the tool-piston only at predetermined reciprocations of the compressor-piston.

5. In a percussion implement, the combination of a tool-actuating cylinder having an inlet-port into its rear end, a piston therein, a chamber connected by ports to the forward end and to the rear end of said tool-actuating cylinder, and a spring-actuated regulating check-valve seating toward the actuating-cylinder and controlling the inlet-port to said chamber.

6. In a percussion implement, the combination of a tool-actuating cylinder having an inlet-port into its rear end, a piston therein,

a chamber having a port connecting to the forward end of the tool-actuating cylinder and also having an inlet-port, a check-valve seating toward the actuating-cylinder and controlling the inlet-port, a spring arranged to hold the check-valve to its seat, and connections for admitting pressure from said chamber to the outer end of said valve to assist the spring in holding the valve to its seat.

In testimony whereof I, the said WELLS WHEELER, have hereunto set my hand.

WELLS WHEELER.

Witnesses:
ROBERT C. TOTTEN,
J. R. KELLER.