D. L. McFARLANE.

POWER DRILL.

APPLICATION FILED MAR. 21, 1907.

993,699.

Patented May 30, 1911.

4 SHEETS—SHEET 1.

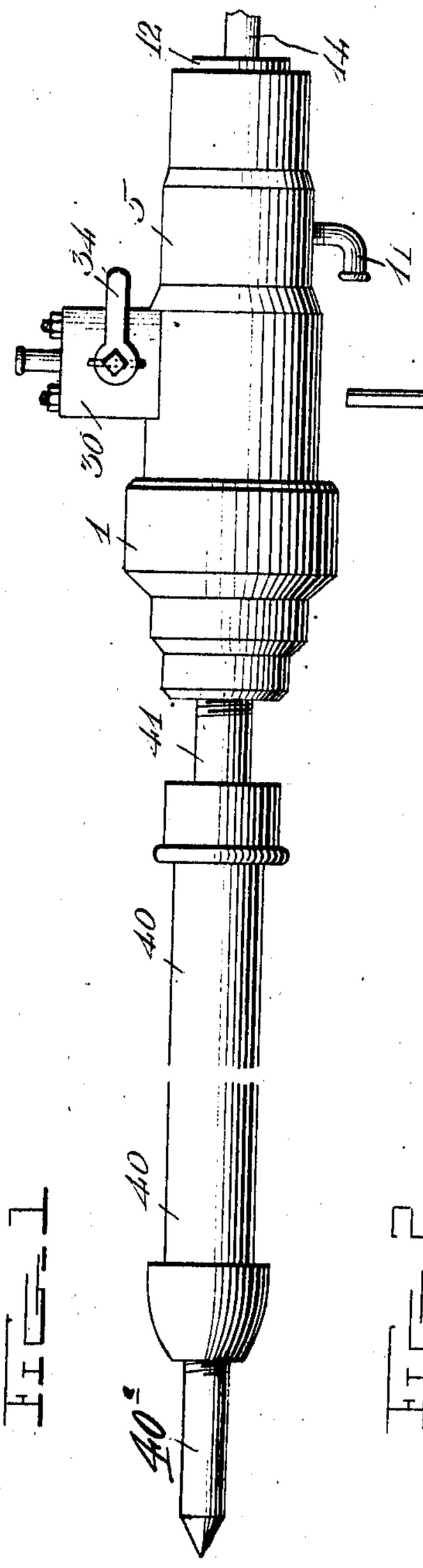

FIG. 1

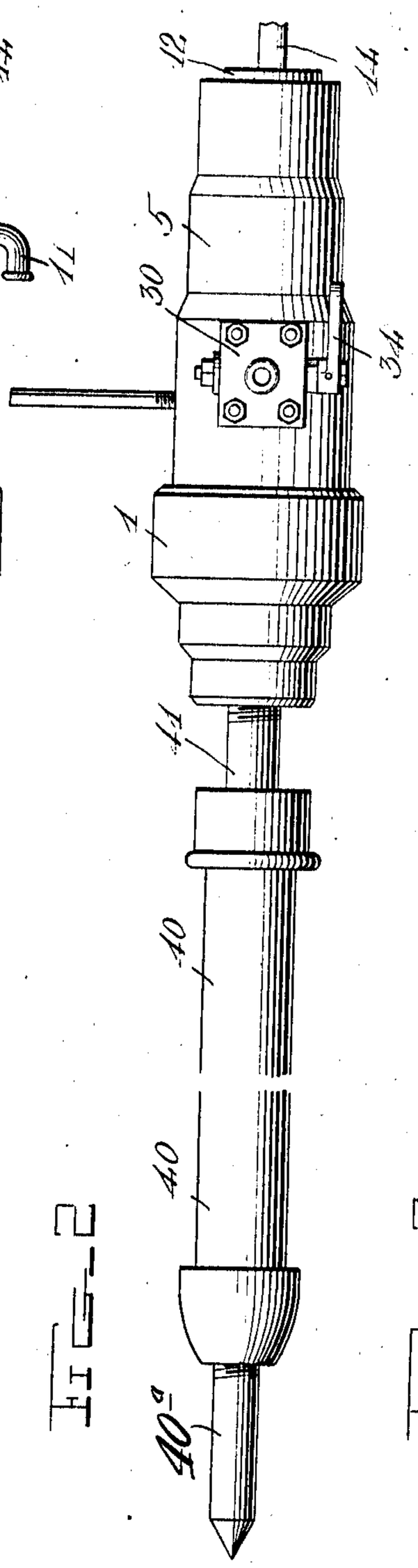

FIG. 2

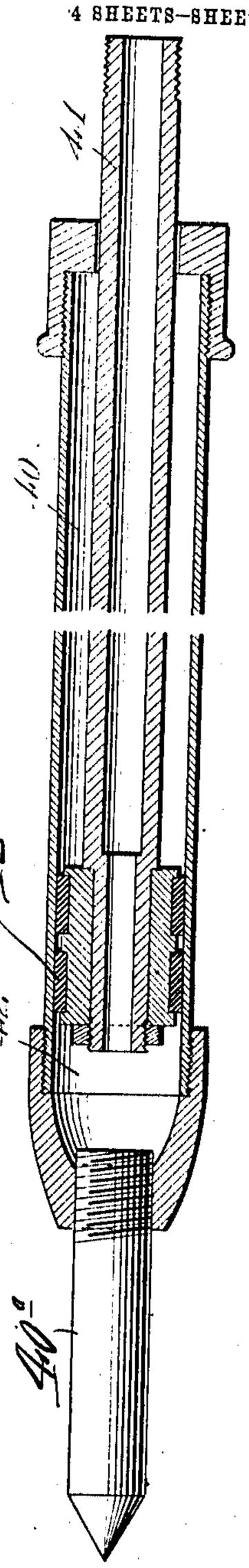

FIG. 3

Witnesses

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4 SHEETS—SHEET 2.

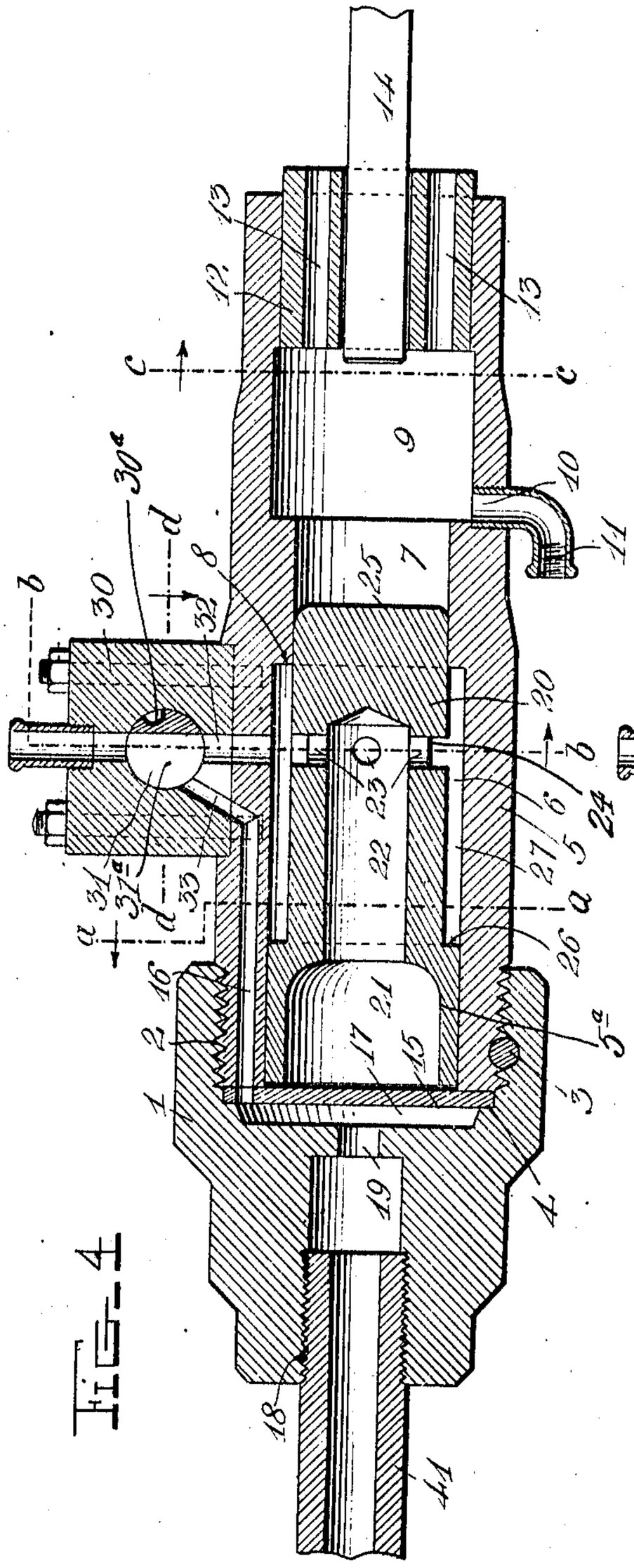

FIG. 4.

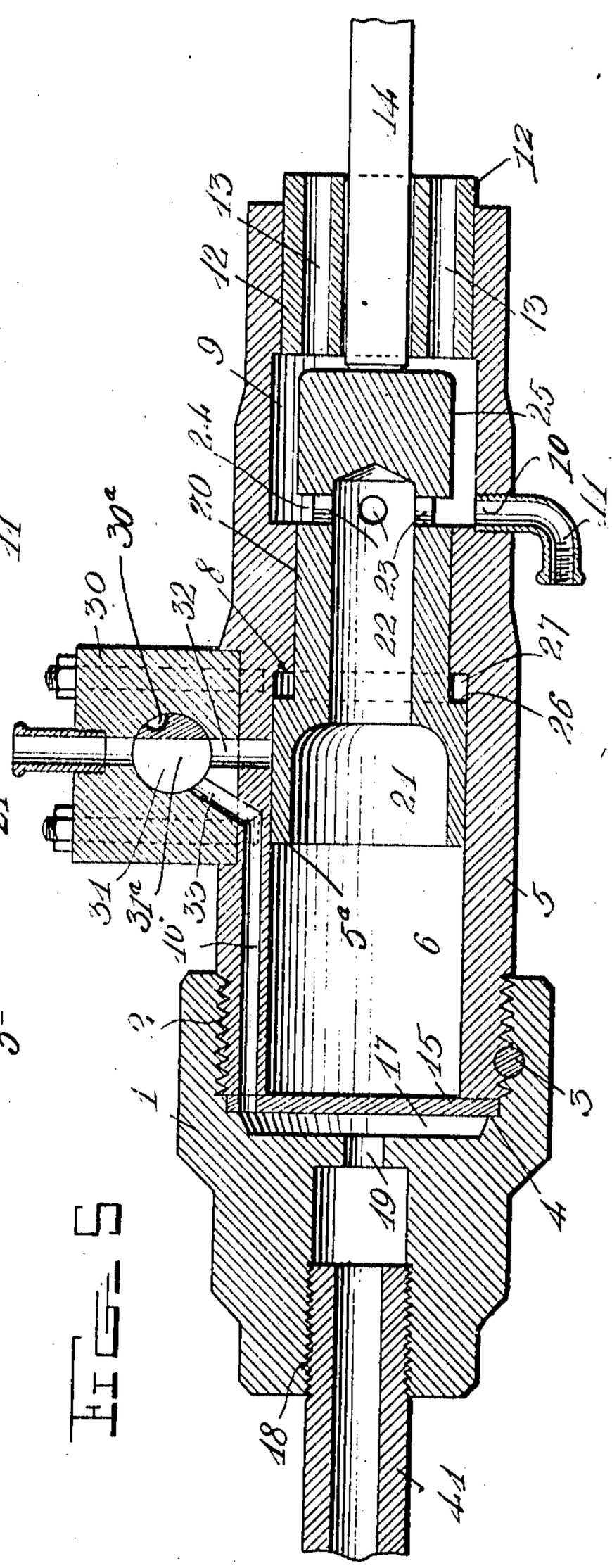

FIG. 5.

Witnesses

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4 SHEETS—SHEET 3.

FIG. 1

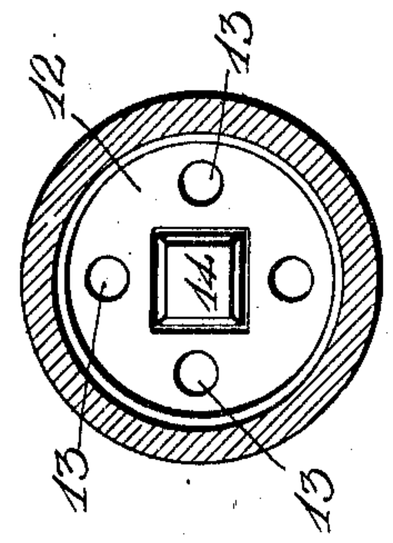


FIG. 2

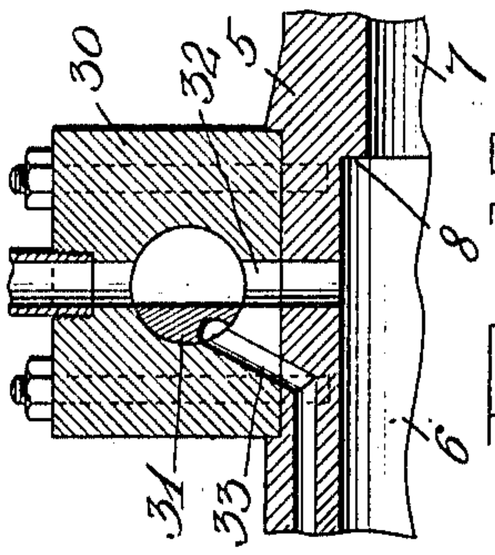


FIG. 3

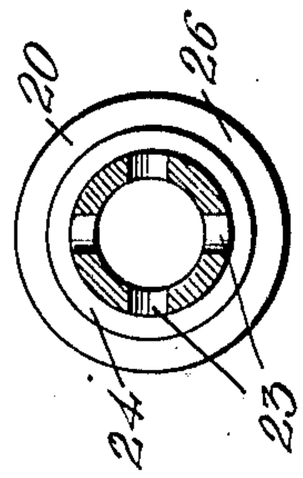


FIG. 7

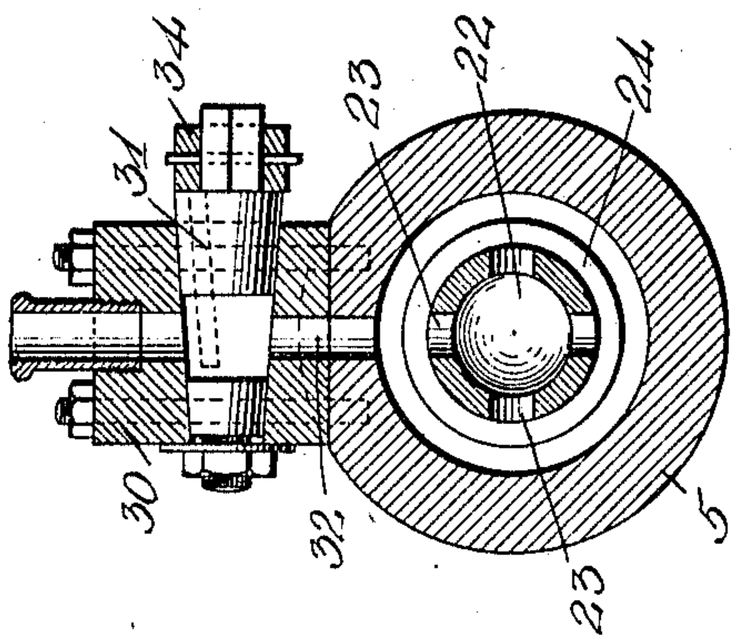


FIG. 5

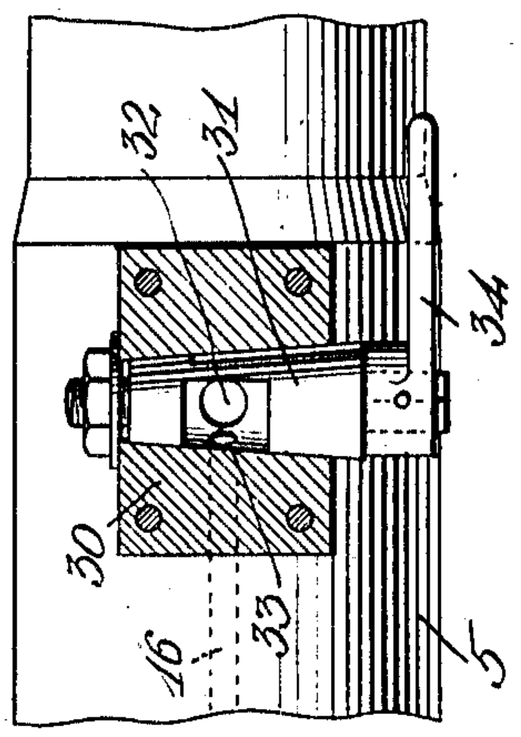


FIG. 6

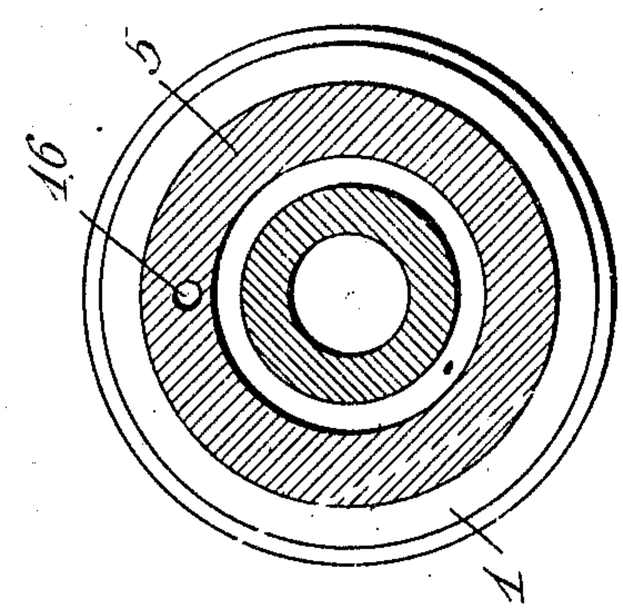
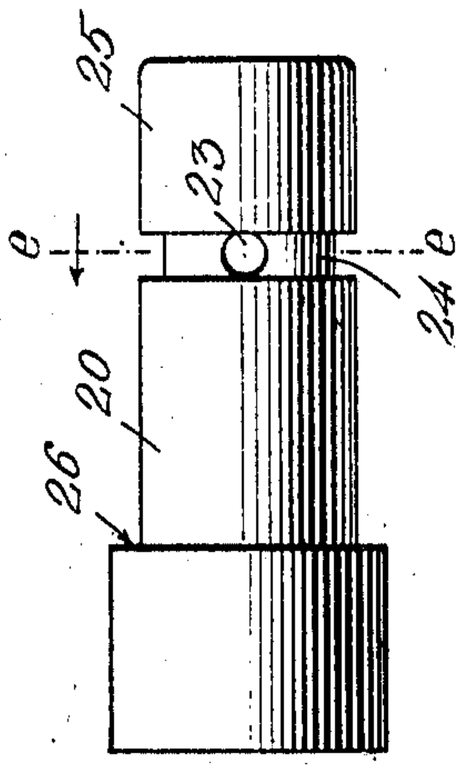


FIG. 11



Witnesses

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4 SHEETS—SHEET 4.

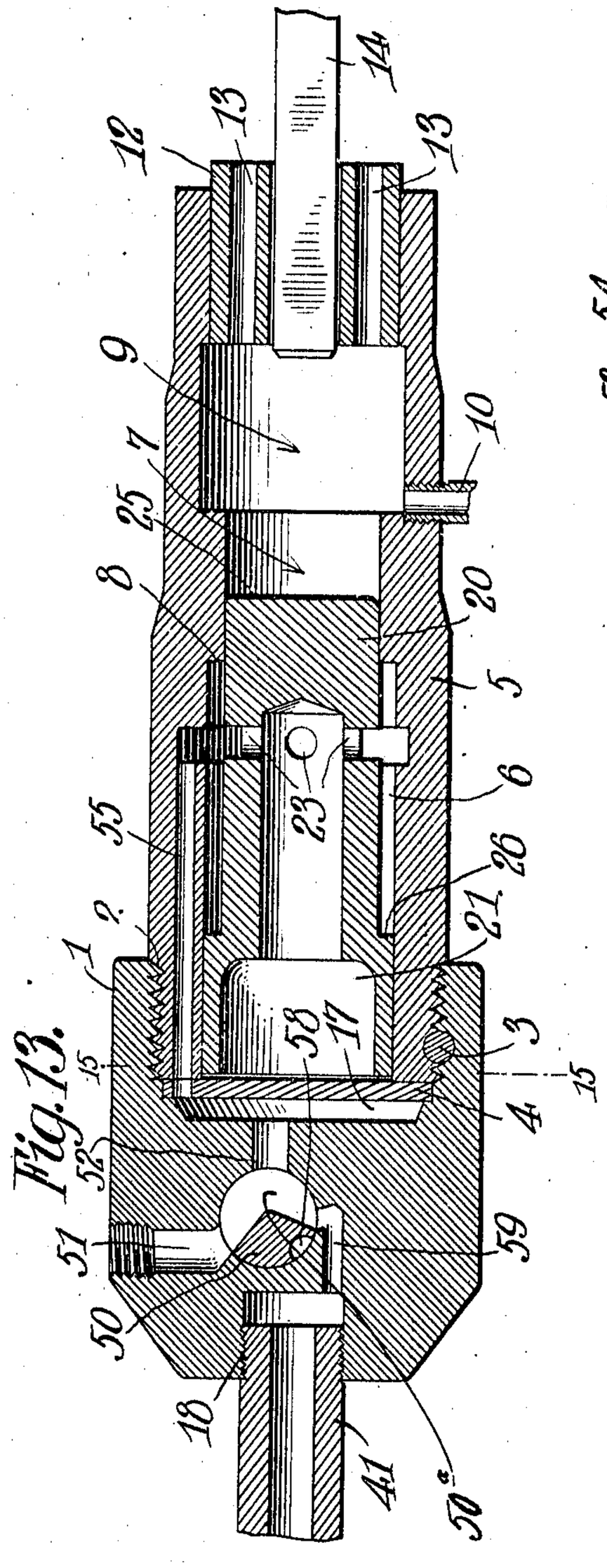

Fig. 13.

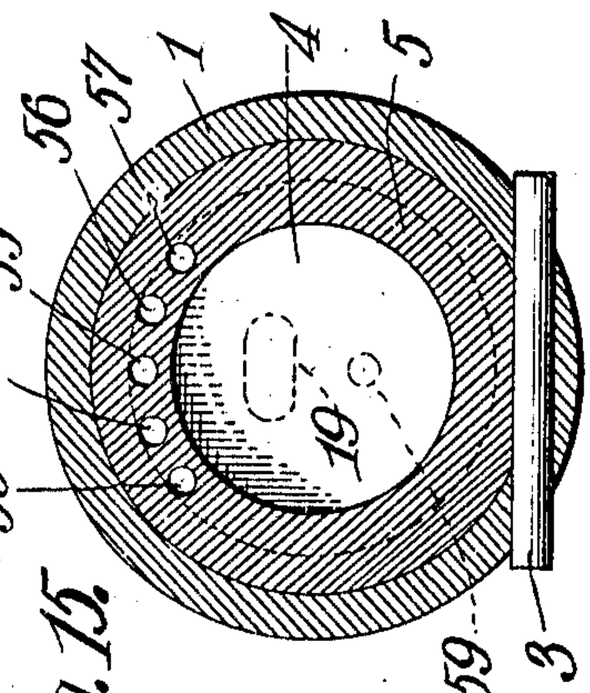

Fig. 15.

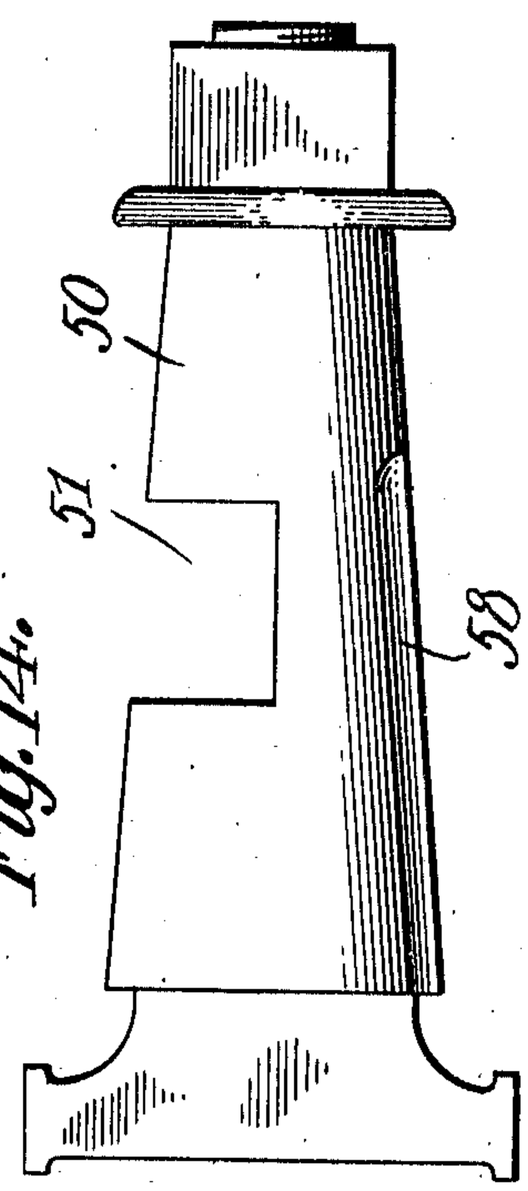

Fig. 14.

Witnesses
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UNITED STATES PATENT OFFICE.

DUNCAN LAREN McFARLANE, OF VICTOR, COLORADO.

POWER-DRILL.

993,699 Specification of Letters Patent. Patented May 30, 1911

Application filed March 21, 1907. Serial No. 363,640.

To all whom it may concern:

Be it known that I, DUNCAN L. McFARLANE, a citizen of the United States, residing in Victor, in the county of Teller and State of Colorado, have invented certain new and useful Improvements in Power-Drills, of which the following is a specification.

My invention relates to power drills or hammers of the class in which a piston is reciprocated by a motive fluid such as compressed air or steam, within a cylinder to which the motive fluid is admitted and from which it passes to the interior of the piston which it drives and from which it is exhausted at the end of its forward stroke, such piston being arranged to strike a drill or other tool at the end of its forward movement.

The object of my invention is to improve generally the construction of such mechanism and to employ such mechanism in connection with feeding mechanism which is operated by the motive fluid; the admission of the motive fluid to the feeding mechanism, and also to the piston, being so regulated by a valve that the motive fluid may, if desired, be admitted simultaneously to the feed mechanism and to the piston, or it may be admitted to either of these separately, such valve being provided with means whereby the motive fluid may exhaust from the feed mechanism if desired.

The cylinder has at one end an expansion chamber and at the opposite end an exhaust chamber, and has also a chamber of less diameter between the expansion and exhaust chambers provided with a shoulder at its junction with the expansion chamber. The bore of the piston is enlarged at its rear end and is formed with ports for admission of the motive fluid while the piston is in the expansion chamber and for exhaust when the piston projects into the exhaust chamber. The piston has an annular shoulder in rear of the ports between which and the shoulder in the cylinder some of the motive fluid is caught and compressed on the forward movement of the piston, the arrangement being also such that the supply of the motive fluid to the cylinder and to the interior of the piston is entirely cut off for a portion of the forward stroke of the piston whereby the motive fluid is put under high compression in a space between the two shoulders, above mentioned, which, at that time, has no communication with either the admission or exhaust ports. An annular groove is formed around the piston at the outer ends of the admission ports thereof whereby the entrance to the interior of the piston of the motive fluid is facilitated and likewise its exhaust is made more speedy and complete.

In the accompanying drawings,—Figure 1 shows a side elevation of a power drilling apparatus embodying my improvements. Fig. 2 is a plan view of the same. Fig. 3 shows a vertical section of the feed mechanism. Fig. 4 and the remaining figures are on a larger scale. Fig. 4 shows a vertical central section of the reciprocating piston, its cylinder and certain parts connected therewith, the piston being in its rearmost position. Fig. 5 is a similar view with the piston in its forward position. Fig. 6 shows a transverse section on the line *a*—*a* of Fig. 4. Fig. 7 shows a transverse section on the line *b*—*b* of Fig. 4. Fig. 8 shows a transverse section on the line *c*—*c* of Fig. 4. Fig. 9 shows a transverse section on the line *d*—*d* of Fig. 4 through the valve mechanism. Fig. 10 shows a vertical section through the valve mechanism with the valve in position to shut off the supply to the feed mechanism. Fig. 11 shows a side elevation of the piston. Fig. 12 shows a transverse section of the piston on the line *e*—*e* of Fig. 11. Fig. 13 shows a vertical central section of a modified form of apparatus. Fig. 14 shows a side elevation of the valve employed in this modification, and Fig. 15 shows a transverse section on the line 15—15 of Fig. 13.

Referring to Figs. 1 to 12 inclusive, the power cylinder 5, as shown, is formed with an expansion chamber 6 and an exhaust chamber 9 between which is an intermediate chamber 7 of less diameter than either of the other chambers. The exhaust chamber has an exhaust port 10 with which communicates a pipe 11 which may be threaded, as shown, to receive a plug if desired. In the outer portion of the exhaust chamber is a plug 12 having exit ports 13 leading toward the working part of the drill 14 which extends through a suitable opening in the plug and projects into the exhaust chamber in position to receive blows from the reciprocated piston. As shown in Fig. 8, the inwardly projecting portion of the drill 14 is square and fits a square opening in the plug 12. The opposite end of the cylinder 5 is connected by screw threads 2 with a coupling 1 to

which it may be locked by a key 3. The rear end of the expansion chamber 6 is closed by a diaphragm 15 fitting a shoulder 4 in the coupling and between which and the adjacent face of the coupling there is a space 17 which communicates by way of a passage 16 in the wall of the cylinder 5 with the admission valve, hereinafter referred to, and also by means of a passage 19 in the coupling with the interior of a hollow rod 41 secured to the coupling at 18 and extending into a cylinder 40, as shown in Fig. 3. This cylinder carries a pin 40ª on its outer end which is adapted to be placed in contact with some rigid surface to form an abutment or brace for the apparatus when in operation. The rear end of the hollow rod 41 is provided with a piston head and packing 42ª and the arrangement, as clearly indicated in Fig. 3, is such that if a motive fluid be admitted through the hollow rod 41, the cylinder 40 and the pin 40ª carried thereby will be forced rearward, or the rod 41 and the parts connected therewith will be forced forward. In this way the drill may be fed or pressed to its work. The piston 20 is made hollow for the greater portion of its length but has a solid striking head 25. The forward and middle portion 22 of the bore of the piston is of comparatively small diameter but it is enlarged into an expansion chamber 21 of much larger diameter at the rear. The rear portion 5ª of the piston surrounding the expansion chamber 21 is of such diameter as to fit snugly the walls of the chamber 6 as it reciprocates back and forth. The middle and forward portion of the piston is of considerably smaller diameter, fitting snugly the walls of the chamber 7, thus forming a shoulder 26, as indicated in Fig. 4, which coöperates with a shoulder 8 at the junction of the forward end of the chamber 6 with the chamber 7 in the manner hereinafter described.

Near its forward end but some distance in rear thereof, the piston is formed with radial admission ports 23, which communicate with a groove 24 in turn communicating with the space 27 in the expansion chamber 6 surrounding the forward portion of the piston. To this space 27 the motive fluid is admitted through a port 32 leading from a valve 31 in a valve casing 30 to which the motive fluid is admitted. The valve 31 controls the admission of the motive fluid to the space 27 and also to the conduit 33 leading to the passage 16 that is in communication with the feed mechanism. The valve 31 is chambered at 31ª in such manner, as clearly indicated in Fig. 4, that the motive fluid may be admitted to the feed mechanism and to the space 27 of the expansion cylinder simultaneously. By reversing the position of the valve, in the manner indicated in Fig. 10, the admission of the motive fluid to the feed mechanism may be entirely cut off and at this time the motive fluid is exhausted from the feed mechanism through a passage 30ª indicated in Figs. 4, 7 and 10. Thus I may so control the motive fluid as to cause the drill to be fed or pressed to its work, or I may remove this pressure, which is especially desirable when cutting out ribs from a defective hole. The valve has a handle 34 by which it may be conveniently operated.

In Fig. 4 the piston is shown in its rearmost position. The motive fluid enters the space 27, which it fills, and also passes to the interior of the piston, which latter moves forward until the admission ports 23 pass into the chamber 7. As soon as this is accomplished, the admission of the motive fluid to the interior of the piston is stopped, but there is yet no exhaust and the motive fluid is still admitted to the space 27 between the shoulders 8 and 26. As the piston moves forward the ports 23 open to the exhaust chamber 9 and the expanded fluid rushes out through the chamber 9 and through the passages 13 and blows away chips, etc., around the drill. Soon after this, the enlarged portion 5ª of the piston passes the admission port 32 and cuts off communication between this port and the space 27, so that as the piston moves farther forward, the fluid between the shoulders 26 and 8 is put under high compression, there being at this time no communication either with the exhaust or with the admission ports. Immediately after this, the piston strikes a blow on the drill and the compressed fluid between the shoulders 8 and 26 obtains such a tension that it moves the piston rearward until it assumes the position shown in Fig. 4 when the operations above described will be repeated.

The groove 24, before referred to, enables the motive fluid to more readily enter the admission ports 23 and to more quickly exhaust therefrom. This groove also provides additional space for entrapping the motive fluid which is carried with the piston and exercises its expansive force even while the grooved portion of the piston is in the chamber 7.

In Figs. 13, 14, and 15 I have shown a modification. In Fig. 13, the coupling 1, as shown, carries the valve mechanism. The valve 50 is of the form shown in Fig. 14. It is arranged in a suitable valve seat in which it turns. It has a port 50ª adapted to communicate with the entrance port 51 for the motive fluid, and also with a port 59 leading to the feed mechanism and a port 52 leading to the chamber 17 which communicates with the space 27 in the expansion chamber 6 by means of a plurality of channels 53, 54, 55, 56 and 57 formed in the top wall of the cylinder 5. The front ends of these channels are located about where the

entrance port 32 is located in Fig. 4, namely, some distance in rear of the shoulder 8, and the operation of the piston in the cylinder is the same as that described in connection with Fig. 4. The valve 50 is provided with a port 58, shown in Figs. 13 and 14, which is so arranged that when admission of the motive fluid to the feed mechanism is cut off, the motive fluid may exhaust from the feed mechanism. In other respects the apparatus is the same as that before described.

I claim as my invention:—

In a device of the class described, a cylinder having spaced expansion and exhaust chambers and a connecting passage between the chambers, the passage being of less diameter than the chambers; a hollow piston fitting closely in the expansion chamber and provided with a reduced end fitting closely in the passage but spaced from the wall of the expansion chamber, there being an inlet port to the expansion chamber, which port the piston is adapted to close; the bore of the piston being enlarged adjacent one end of the piston, and being contracted in the reduced end of the piston; there being a circumscribing, superficial groove in the reduced end of the piston, and an inlet port leading from said groove into the contracted portion of the bore of the piston, the piston in its forward movement positioning the inlet port of the piston alternately in the passage and in the exhaust chamber, to close the port in the one instance, and to open it in the other, the closure of said port and the closure of the inlet port to the expansion chamber serving to confine a portion of the actuating fluid in the expansion chamber for compression, to secure a return of the piston.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

DUNCAN LAREN McFARLANE.

Witnesses:

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