H. SCHUMACHER.

PNEUMATIC TOOL.

APPLICATION FILED OCT. 28, 1909.

984,112.

Patented Feb. 14, 1911.

3 SHEETS—SHEET 1.

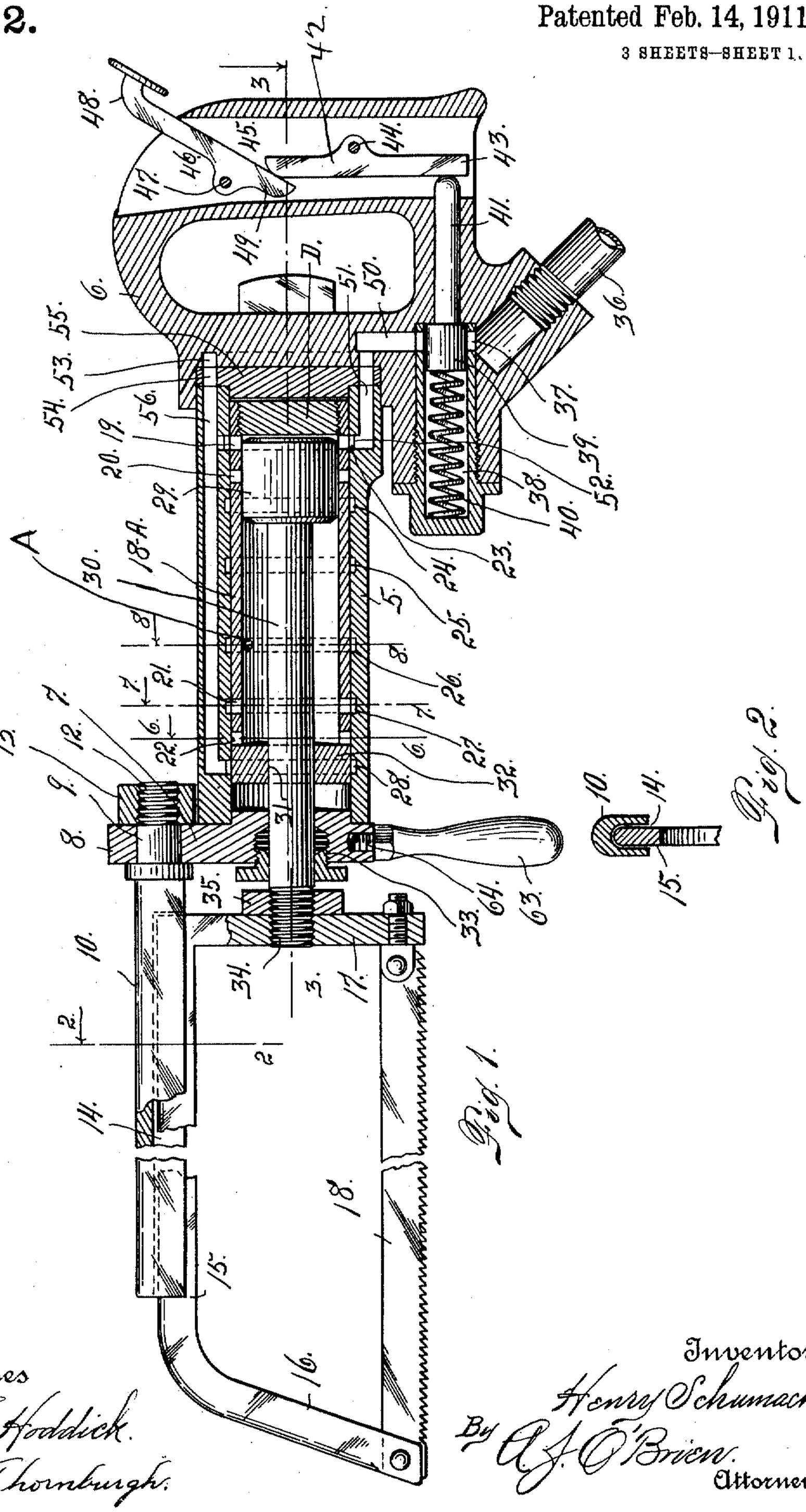

Fig. 1.

Fig. 2.

Witnesses

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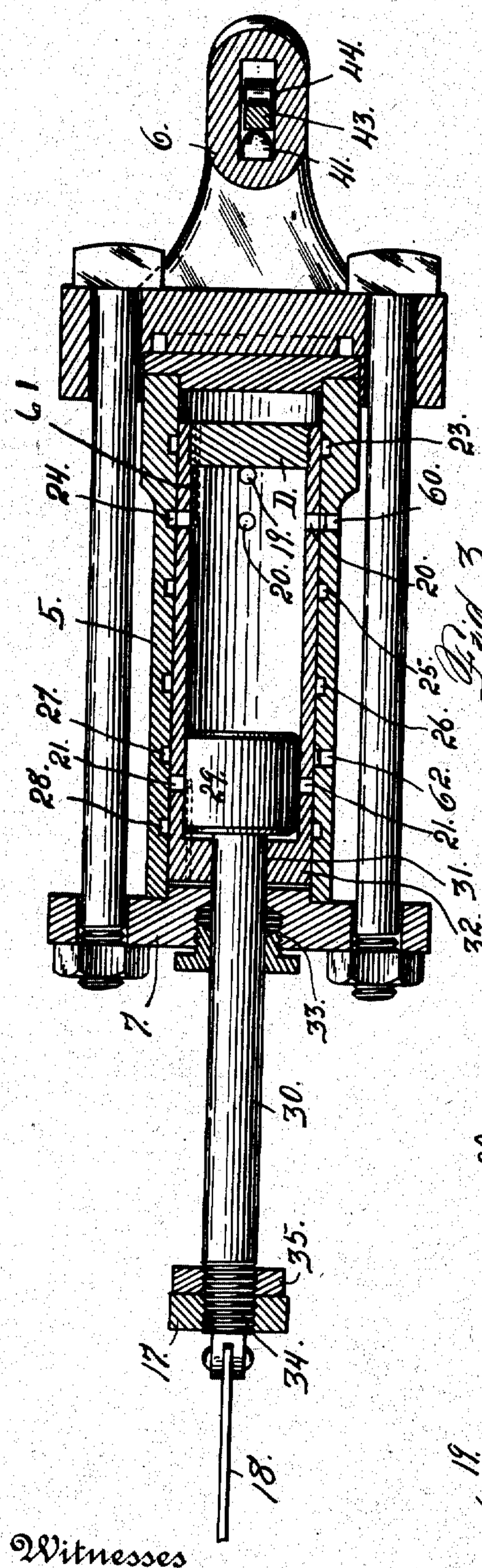

Fig. 3.

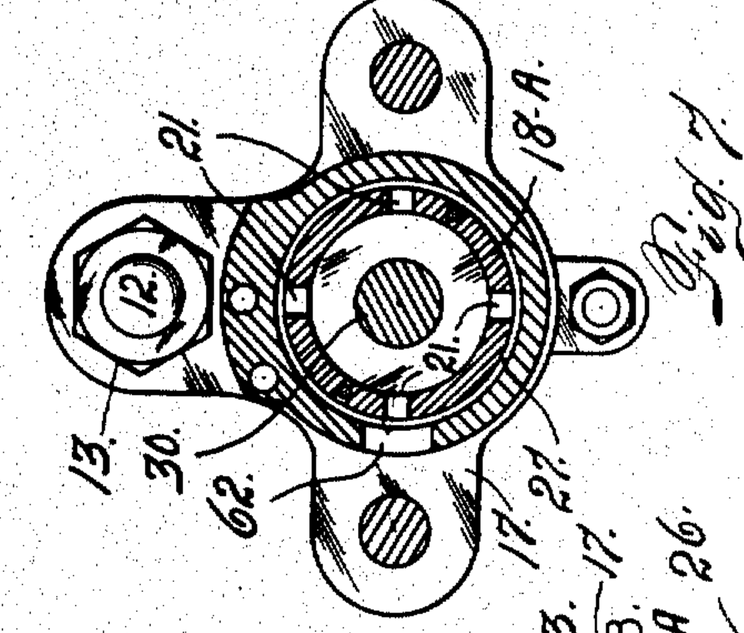

Fig. 7.

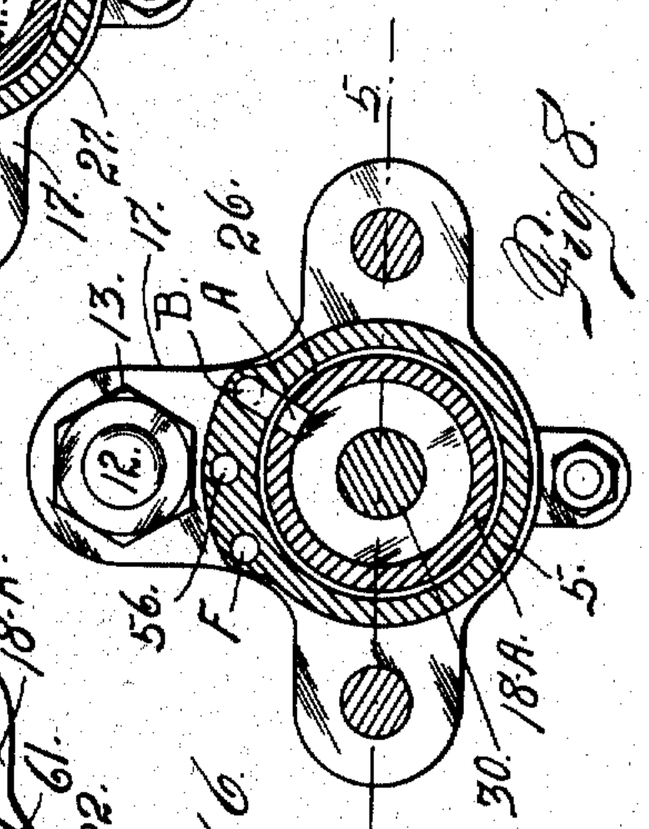

Fig. 8.

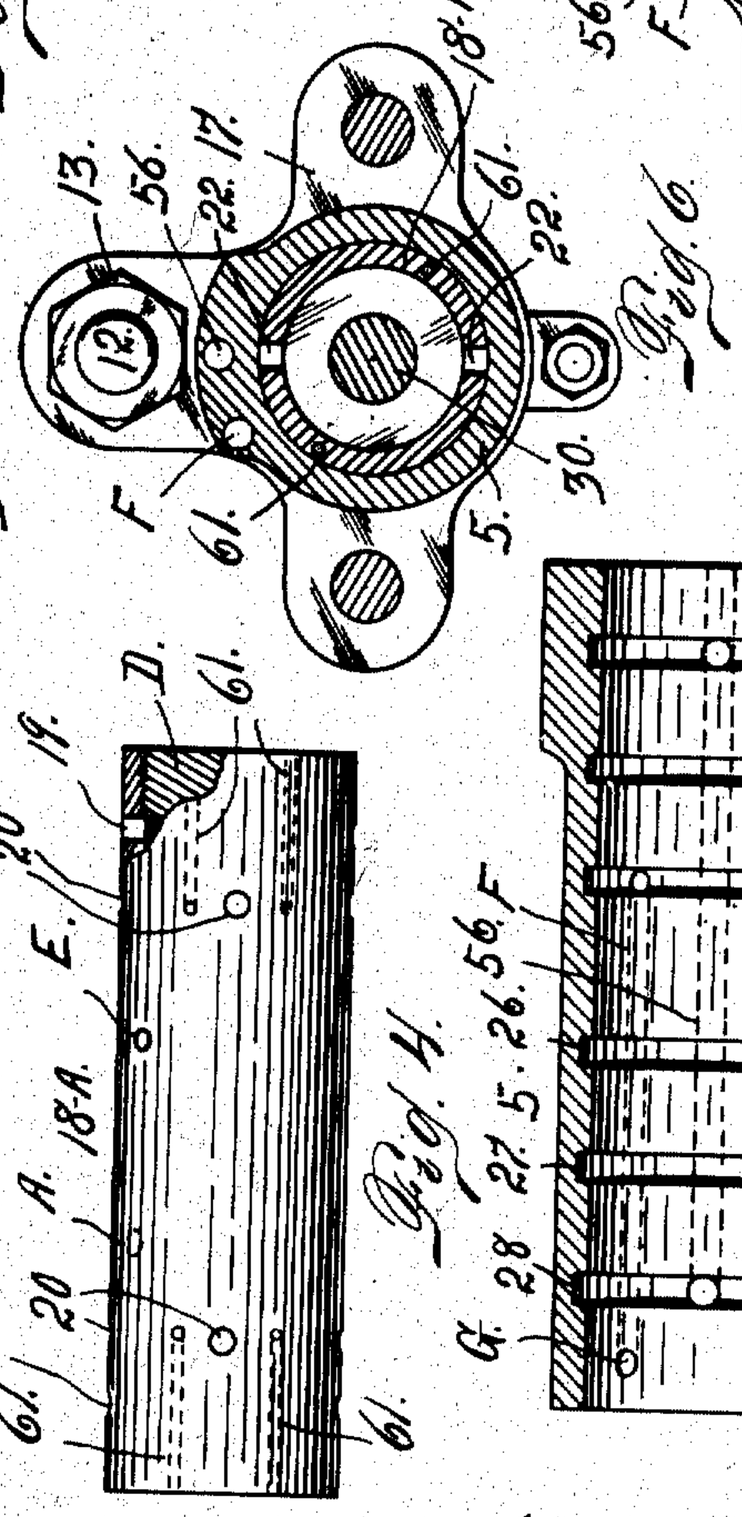

Fig. 6.

Fig. 4.

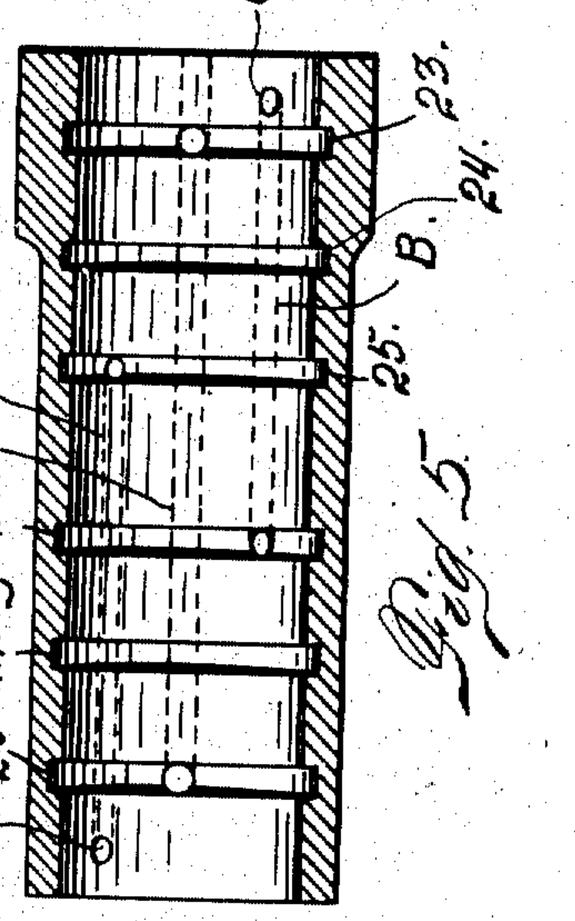

Fig. 5.

Witnesses

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3 SHEETS—SHEET 3.

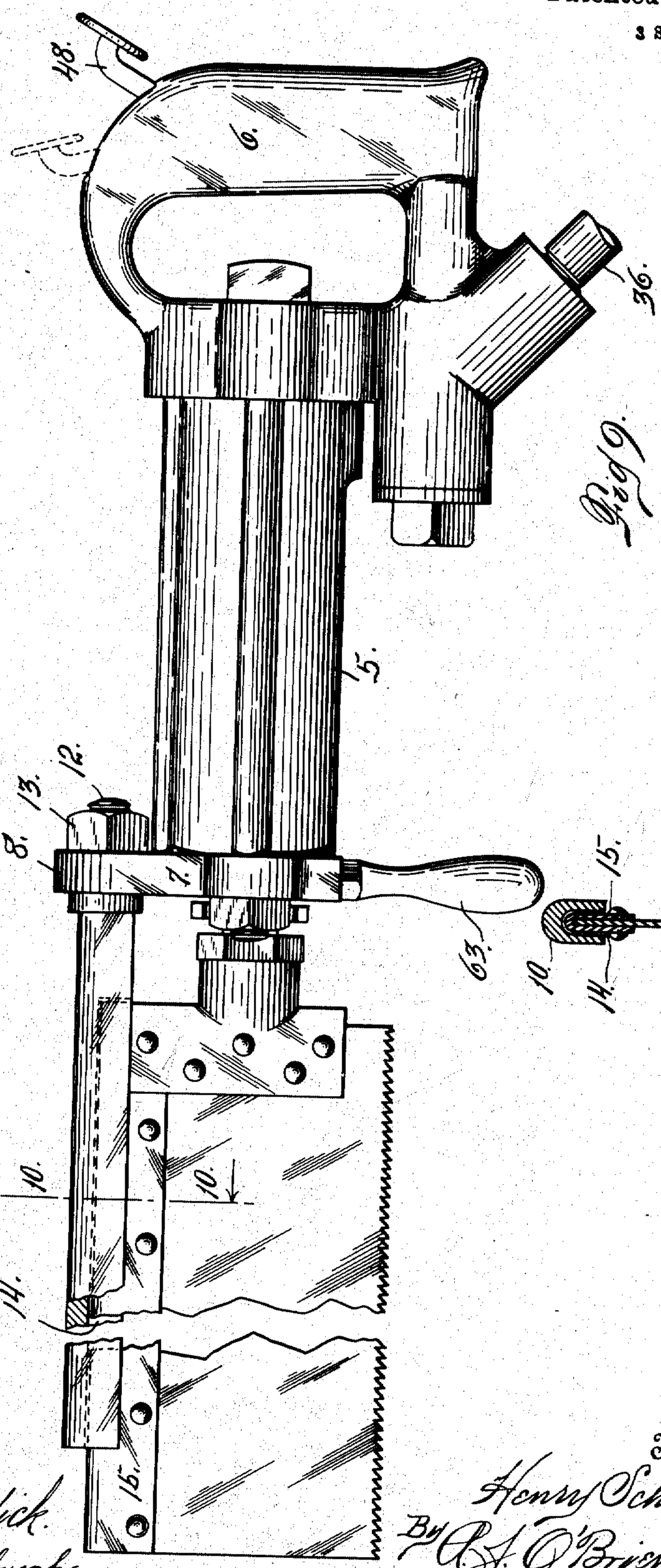

Fig. 9.

Fig. 10.

Witnesses

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UNITED STATES PATENT OFFICE.

HENRY SCHUMACHER, OF DENVER, COLORADO.

PNEUMATIC TOOL.

984,112. Specification of Letters Patent. Patented Feb. 14, 1911.

Application filed October 28, 1909. Serial No. 525,169.

To all whom it may concern:

Be it known that I, HENRY SCHUMACHER, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Pneumatic Tools; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates generally to pneumatic tools, but more specially to motive-fluid-operated engines or motors having a cylinder and a reciprocating piston connected with a device to be operated by imparting a reciprocating movement. In the present instance the engine is illustrated in connection with a saw. It is evident, however, that any other device may be connected with the stem of the piston and it will therefore be understood that the use of the engine or motor is not limited to the operation of the particular device shown. It may be stated, however, that my improved construction of engine or motor is exceedingly well adapted for use in operating a saw, and the latter is therefore illustrated in the drawing.

In my improved engine, I employ a longitudinally-movable bushing, or sleeve, mounted in the chamber of the cylinder and having a limited degree of movement for controlling the admission and exhaust of motive fluid for operating the piston, the latter being located within the bushing, which is closed at both ends.

Provision is made for admitting motive fluid from the piston chamber of the bushing, to the opposite ends of the cylinder, between the closed ends of the bushing and the extremities of the cylinder chamber, for automatically shifting the bushing longitudinally, to control the admission and exhaust of motive fluid for operating the piston, as above stated.

Having briefly outlined my improved construction, I will proceed to describe the same in detail, reference being made to the accompanying drawing, in which is illustrated an embodiment thereof.

In this drawing: Figure 1 is a longitudinal section taken through the engine or motor, the saw frame being also shown partly in section. Fig. 2 is a section shown on the line 2—2, Fig. 1. Fig. 3 is a horizontal section taken on the line 3—3, Fig. 1, looking downwardly, or in the direction of the arrow adjacent said line. Fig. 4 is a detail view of the bushing movably mounted within the cylinder and actuated by the piston to open and close the induction ports at the opposite extremities of the cylinder. Fig. 5 is a longitudinal section of the cylinder shown in detail. Figs. 6, 7 and 8 are cross sections taken on the lines 6—6, 7—7, and 8—8, respectively, Fig. 1. Fig. 9 is a side view of a slightly modified form of the device, shown, for the most part, in elevation, the saw portion of the device being partly broken away. Fig. 10 is a cross-section taken on the line 10—10 of Fig. 9.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a cylinder, whose rear portion is provided with a handle 6, and whose forward extremity is equipped with a head 7, having an upwardly-projecting apertured lug 8, through which passes the rear end 9 of a guide 10, the rear extremity of the guide being threaded, as shown at 12. To this threaded end of the guide is applied a nut 13, whereby the guide is securely held in place. This guide projects forwardly from the forward extremity of the cylinder and is provided with a longitudinal groove 14, adapted to receive the back 15 of a saw frame, which has a forwardly-located, downwardly-extending part 16, and a rearwardly-located, depending part 17. The saw blade 18 is attached to the lower extremities of the parts 16 and 17.

Located within the cylinder 5 is a longitudinally-movable bushing 18^{A} having rearwardly-located ports 19 and 20, and forwardly-located ports 21 and 22. The cylinder, within which the bushing is movably mounted, is provided with interior, circumferential grooves 23, 24, 25, 26, 27 and 28 arranged in the order named from the rear toward the front extremity of the cylinder. Within the bushing 18^{A}, a piston 29 is mounted to reciprocate. This piston is provided with a stem 30 which protrudes through an opening 31 formed in the forward end 32 of the bushing 18. This piston stem passes through a stuffing box 33, located in the forward head 7 of the cylinder, the said

head being open to receive the piston stem. The forward extremity 34 of this stem protrudes beyond the cylinder and is connected with the rear member 17 of the saw frame, the piston stem being threaded into a threaded opening in the said frame and secured by a lock nut 35.

When the device is in use, the piston is reciprocated in the cylinder bushing through the instrumentality of motive fluid admitted thereto and suitably controlled to perform the aforesaid function. The mechanism whereby this function is performed will now be described in detail.

Connected with the lower part of the handle 6, is a conduit 36, which is in communication by means of a port 37, with a chamber 38, in which is located a valve 39 normally held at its rearward limit of movement by a spiral spring 40. This normal position of the valve cuts off the air, or other motive fluid, from the cylinder of the device. The valve is provided with a rearwardly-extending stem 41, arranged to be acted on by the arm 43 of a lever 42, fulcrumed at 44, in a recess 45, formed in the handle of the tool. This lever is arranged to be actuated by a lever 46, fulcrumed at 47, and having a protruding extremity 48, conveniently constructed and arranged to be operated by the hand of the user, while grasping the handle of the tool. The lower arm 49 of the lever 46 occupies a position in front of the upper extremity of the lever 42.

The handle of the tool is provided with a passage 50 communicating with a duct 51, which is in communication with a port 52 formed in the wall of the cylinder and communicating with the interior circumferential groove 23 of the cylinder.

Assuming that the parts are in the position shown in Fig. 1, and also assuming that the valve 39 is shifted to uncover the ports 37, the motive fluid will flow through the passage 50, thence to a circumferential groove 53 at the rear of the cylinder, thence through ports 54 in the rear head 55 of the cylinder, thence to a duct 51 and a passage 56 leading to the ports 52 formed in the cylinder and communicating with the interior, circumferential groove 23 of the cylinder, and thence through ports 19 of the bushing 18^A, to the rear of the piston 29. This live motive fluid imparts the forward movement to the piston and also the forward stroke to the saw or other device, by virtue of the fact that the latter is connected with the piston stem. At the same time the motive fluid flows through the passage 56 to the forward extremity of the cylinder, where the said passage communicates with the circumferential groove 28 of the cylinder. As the piston, during its forward movement, approaches the forward extremity of the bushing, it uncovers a port A of the bushing communicating with the groove 26 of the cylinder, the latter being in communication with a passage B in the wall of the cylinder and extending rearwardly to the rear extremity of the cylinder with which it communicates by a port C. The live motive fluid enters the port A of the bushing, passing thence to the groove 26 of the cylinder and thence through the passage B to the rear of the cylinder, entering the chamber of the cylinder through the port C, acts on the read head D of the bushing, moving the latter forwardly. In this event, the parts are in the position shown in Fig. 3, and the live motive fluid exhausts from the piston chamber through the port 20 of the bushing, the groove 24 of the cylinder and the port 60 of the cylinder. At the same time the live motive fluid flows through the passage 56 to the forward extremity of the piston chamber, which it enters through the groove 28 of the cylinder and ports 22 formed in the bushing, which are now in register with the groove 28 of the cylinder. The entrance of this live motive fluid to the forward extremity of the piston chamber results in the rearward movement of the piston, which imparts a corresponding movement to the saw. As the piston approaches its rearward limit of movement, it uncovers a port E in the bushing, the latter being in communication with the annular groove 25 of the cylinder, the latter communicating with a passage F leading rearwardly from the groove 25, the said passage being formed in the wall of the cylinder and entering the rear extremity of the cylinder chamber through a port G. The live motive fluid following the ports and passages last stated enters the cylinder chamber forward of the front head of the bushing and imparts the rearward movement to the latter, whereby the parts are returned to the position illustrated in Fig. 2, after which the operation heretofore described is repeated, thus imparting the reciprocating movement to the saw. After the piston has completed its rearward movement, as last explained, the motive fluid in the piston chamber forward of the piston exhausts through the bushing ports 21, the annular cylinder groove 27 and an exhaust port 62, formed in the cylinder. (See Figs. 3 and 7.)

The bushing 18^A is provided with small ducts 61 located near its opposite extremities, these ducts in the forward extremity of the bushing having their rear extremities in communication with the annular groove 27 of the cylinder, whereby the motive fluid forward of the front head of the bushing is allowed to leak out of the portion of the piston chamber forward of the said bushing head, in order to permit the bushing to move forwardly just before the piston completes its forward movement.

It will be understood from an inspection of the drawing, that the rear extremities of the forward ducts 61 of the bushing, are in a cross sectional plane cutting the ports 21 of the bushing. Hence the live motive fluid in leaking out through the ducts 61, passes first into the annular grooves 27 of the cylinder and thence through the ports 21 of the bushing into the piston chamber of the bushing; while when the bushing is at its forward limit of movement and while the piston is making its forward stroke, the motive fluid in the rear of the rear head D of the bushing, leaks out through the forward ducts 61 of the bushing into the annular groove 24 of the cylinder and thence through the bushing ports 20 into the piston chamber of the bushing.

The forward extremity of the cylinder is provided with a depending auxiliary handle 63 having a stud 64 inserted in a threaded opening formed in the forward head of the cylinder. The object of this auxiliary handle is to enable the user to properly operate the tool. The auxiliary handle is grasped by the left-hand while the right-hand holds the rear extremity of the tool.

Having thus described my invention what I claim is:

1. In an engine or motor, the combination with a cylinder and a reciprocating piston, of a cylindric, distributing sleeve or bushing closed at both extremities and circumferentially interposed and longitudinally-movable between the piston and the cylinder, and means for the automatic admission of motive fluid from the piston cylinder of the bushing alternately to the opposite extremities of the cylinder chamber, for shifting the bushing to control the admission and exhaust of motive fluid in operating the piston, the opposite ends of the bushing having relatively small passages to admit the motive fluid between the opposite ends of the bushing and the adjacent extremities of the cylinder chamber, to leak into the bushing to permit the latter to move longitudinally in the cylinder.

2. In an engine or motor, the combination with a cylinder and a reciprocating piston, of a cylindric sleeve or bushing located within the chamber of the cylinder, the piston being located within the said sleeve, the sleeve and cylinder having induction and eduction ports, and also provided with ports and passages for the automatic admission of motive fluid from the piston chamber of the bushing to the opposite extremities of the cylinder, for alternately shifting the bushing in opposite directions to control the admission and exhaust of motive fluid, the cylinder having circumferential grooves with which the ports of the cylinder communicate, the opposite ends of the bushing having relatively small passages communicating respectively with one of the grooves in the opposite ends of the cylinder chamber to admit the motive fluid between the ends of the bushing and the opposite extremities of the cylinder, to leak out in time to permit the longitudinal movement of the bushing, as described.

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

HENRY SCHUMACHER.

Witnesses:

A. J. O'Brien,

Jessie Hobart.