J. L. MITCHELL.

PNEUMATIC DRILL.

APPLICATION FILED JAN. 31, 1908.

977,894.

Patented Dec. 6, 1910.

2 SHEETS—SHEET 1.

FIG. 1

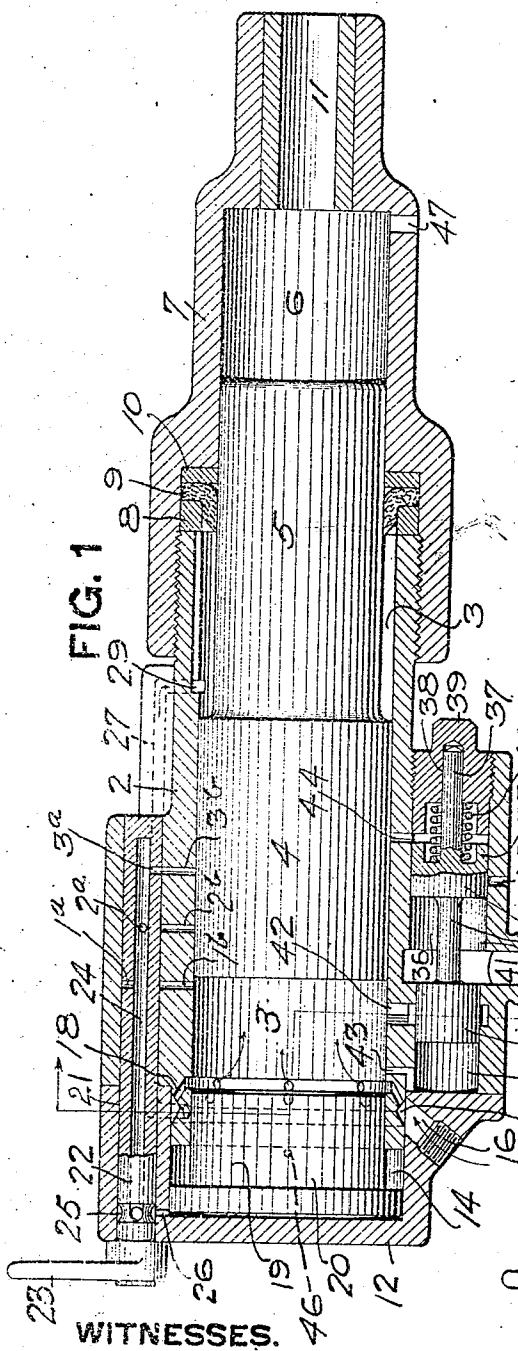
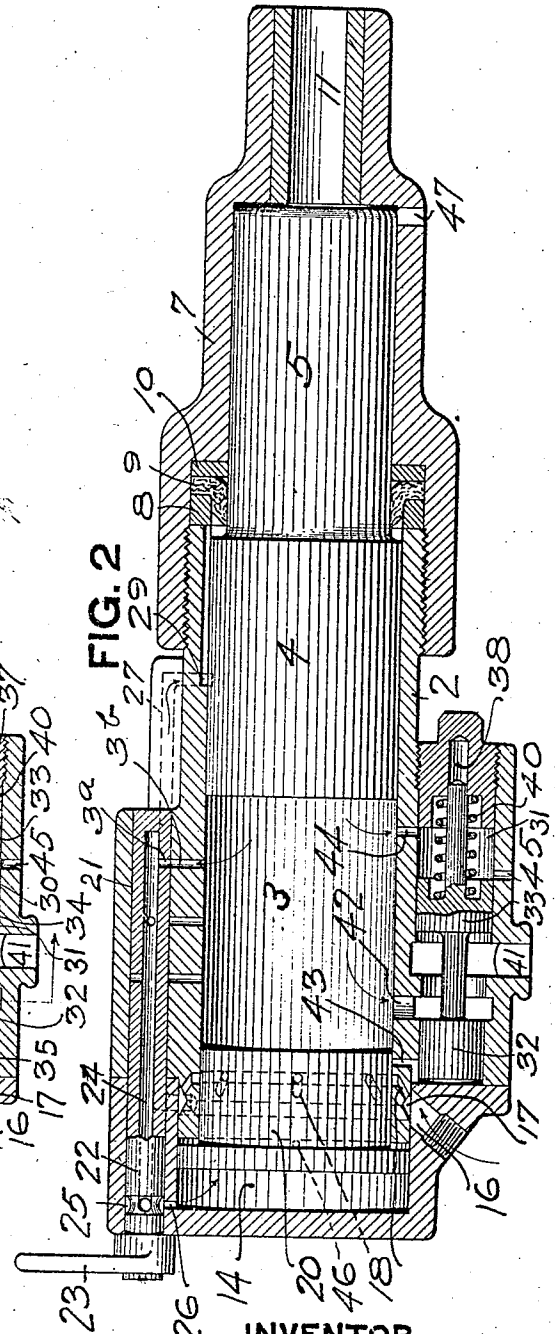


FIG. 2



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2 SHEETS—SHEET 2.

FIG. 3

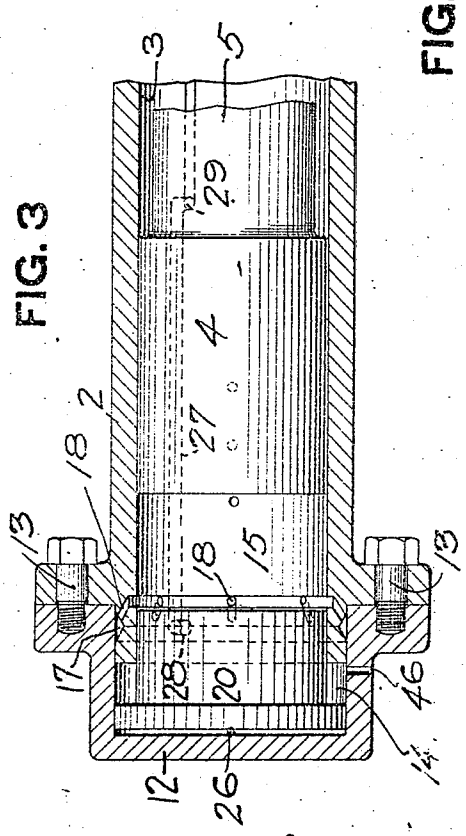


FIG. 5

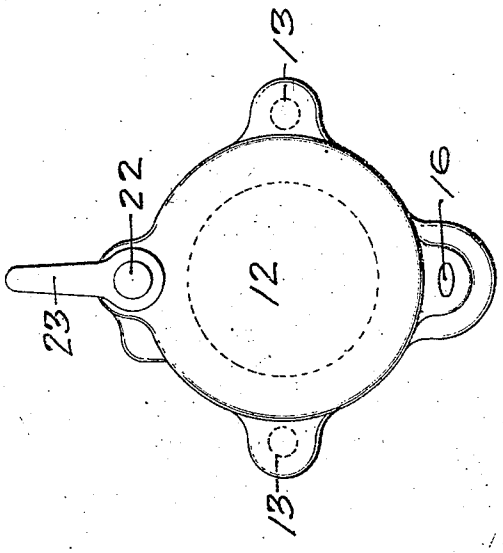
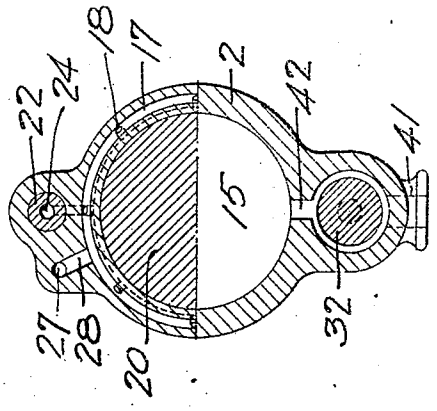


FIG. 4



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PNEUMATIC DRILL.

977,894. Specification of Letters Patent. Patented Dec. 6, 1910.

Application filed January 31, 1908. Serial No. 413,603.

To all whom it may concern:

Be it known that I, JONAS L. MITCHELL, a resident of Denver, in the county of Denver and State of Colorado, have invented a new and useful Improvement in Pneumatic Drills; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to valve mechanism for fluid operated hammers, drills, coal punchers or other apparatus in which a reciprocating motion is desired.

The object of my invention is to simplify the construction of such valve mechanism whereby the number of parts are reduced to a minimum and at the same time labor and cost of manufacture.

My invention comprises the novel features hereinafter set forth and claimed.

In the drawings Figure 1 is a longitudinal section of a suitable shell or casing showing my improved valve mechanism and arrangement of ports; Fig. 2 is a like view showing the piston and the position of the parts when the piston has completed its forward stroke; Fig. 3 is a longitudinal section taken at right angles to Fig. 1, showing the cut-off valve in its rear position; Fig. 4 is a cross section on the line 4—4, Fig. 1, and Fig. 5 shows the rear end of the back head.

In the drawings the numeral 2 designates a suitable shell or casing within which is the cylindrical chamber 3 containing the piston 4. The piston 4 has the extension 5 which is adapted to enter the bore 6 formed by the extension piece 7 connected to the casing 2. A crimp ring 8 bears against the end of the casing 2 and is contained within the extension piece 7. A crimp 9 is interposed between the ring 10 and the crimp 8 so as to form a close packing joint. The chuck 11 is secured within the extension 7 and is adapted to hold the tool to be struck by the hammer 5 where the device is to be employed as a pneumatic hammer or coal puncher. The head 12 is secured to the casing 2 by means of the screws 13. The head 12 is of larger diameter than the casing 2 and forms the chamber 14. The whole casing, therefore, may be said to be divided into chambers 3, 14 and 6.

The inlet port 16 is formed in the head 12 and said inlet port communicates with the annular groove 17 which has the ports 18 leading into the chamber 3. These ports 18 are controlled by the cut-off valve 19 contained within the chamber 14 and adapted to move back and forth therein. This valve 19 has the extension or neck portion 20 which is adapted to enter the chamber 3 of the shell or casing 2 and so act to open and close the ports 18.

Contained within a suitable seat 21 formed in the shell or casing 2 is the controlling valve 22 which is operated by means of the handle 23. This valve 22 has the port 24 extending longitudinally thereof and is provided with ports 1^a, 2^a, and 3^a adapted to be brought into communication with ports 1^b, 2^b, and 3^b respectively formed in the shell or casing 2. The port 24 of the valve 22 communicates with the annular groove 25 formed in said valve and said groove communicates with the port 26 leading to the chamber 14. Formed within the shell or casing 2 is the port 27 which communicates at its rear end with the by-pass port 28 formed in the shell or casing 2. The port 27 at its front end communicates with the chamber 3 at 29.

An exhaust valve 30 is contained within the chamber 31 formed to receive it in the shell or casing 2. This valve comprises the piston portions 32 and 33 connected by the stem 34. The piston portion 32 works in the chamber 35 and the piston portion 33 in the chamber 36. Secured to the piston portion 33 of the exhaust valve 30 is the stem 37 which is adapted to enter the seat 38 formed in the head 39. A spring 40 is interposed between the head 39 and the piston portion 33, said spring acting as a differential in a manner fully hereinafter set forth. The main exhaust port 42 communicates with the chamber 3 and communicates with the atmosphere through the port 41. A port 43 leads from the chamber 3 to the chamber 35 and a port 44 communicates with the chamber 36. A port 45 leads from the chamber 36 to the atmosphere.

A relief port 46 leads from the chamber 14 to the atmosphere. A relief port 47 leads from the bore 6 to the atmosphere. With the parts in the position indicated in Fig. 1 the air entering the inlet 16 passes by the ports 18 into the chamber 3 and the air immediately passes by the port 43 into the chamber 35 and moves the exhaust valve to the position indicated in Fig. 1, shutting off the main exhaust port 42. The pressure admitted to the chamber 3 carries forward the piston 4 and said pressure continues to be

directed against said piston until said piston passes the port 3^b which has previously been brought into communication with the port 3^a of the valve 22. Just as soon as the piston 4 passes the port 3^b the pressure is permitted to escape through the valve 22 and by the port 26 into the chamber 14. The air admitted to the chamber 14 acts upon the enlarged head of the valve 19 which gives a sufficient differential pressure to advance said valve to the position indicated in Fig. 2 to close the ports 18 leading to the chamber 3. The piston completes its forward stroke under the expansion of the air. When the piston in its forward stroke passes the port 44 the fluid pressure enters the chamber 36 and acts upon the piston portion 33 of the exhaust valve. This pressure, together with the differential pressure furnished by the spring 37, moves the exhaust valve to the position shown in Fig. 2, opening the main exhaust 41 to the atmosphere. At the same time the pressure in the chamber 35 passes out through the port 43. The piston is returned by the pressure passing by the port 27 and by-pass port 28 to the front end of the cylinder or chamber 6. As soon as the piston on its return stroke passes the exhaust port 42 it forms a compression which moves the valve 19 and prevents the piston from striking said valve.

By the above construction I thus provide a valve which not only acts as a cut-off but at the same time as an admission valve to control the entrance of the air, thereby greatly simplifying the construction and reducing the number of parts.

What I claim is:

1. The combination of a suitable shell or casing having a piston chamber and inlet and exhaust ports, a piston, an exhaust valve, means for directing the fluid pressure against said valve to close said exhaust port as said piston advances, and means for directing fluid pressure against the opposite end of said valve to open said exhaust when said piston has completed or substantially completed its stroke.

2. The combination of a suitable shell or casing having a piston chamber and inlet and exhaust ports, a piston, an exhaust valve, means for directing fluid pressure against said valve to close said exhaust port as said piston advances, and means for directing fluid pressure from said chamber against the opposite end of said exhaust valve when said piston has completed or substantially completed its stroke.

3. The combination of a suitable shell or casing having a piston chamber and inlet and exhaust ports, a piston, a double piston exhaust valve, means for directing fluid pressure against one of the pistons of said valve to close said exhaust port when said piston advances, and means for directing fluid from said chamber against the opposite piston of said exhaust valve to open said exhaust when the piston has completed or substantially completed its stroke.

4. The combination of a suitable shell or casing having a piston chamber and inlet and exhaust ports, a piston, a double piston exhaust valve, means for directing the fluid pressure against one piston of said exhaust valve to close said exhaust port as said main piston advances, a spring acting against the opposite piston of said exhaust valve, and means for directing fluid pressure from said chamber against said last named piston of said exhaust valve when said main piston has completed or substantially completed its stroke.

In testimony whereof, I the said JONAS L. MITCHELL have hereunto set my hand.

JONAS L. MITCHELL.

Witnesses:

BELLE FAIRLEY,

CHARLES J. MUNZ.