C. B. RICHARDS.

FLUID OPERATED TOOL.

APPLICATION FILED DEC. 22, 1909.

1,037,535.

Patented Sept. 3, 1912.

3 SHEETS—SHEET 1.

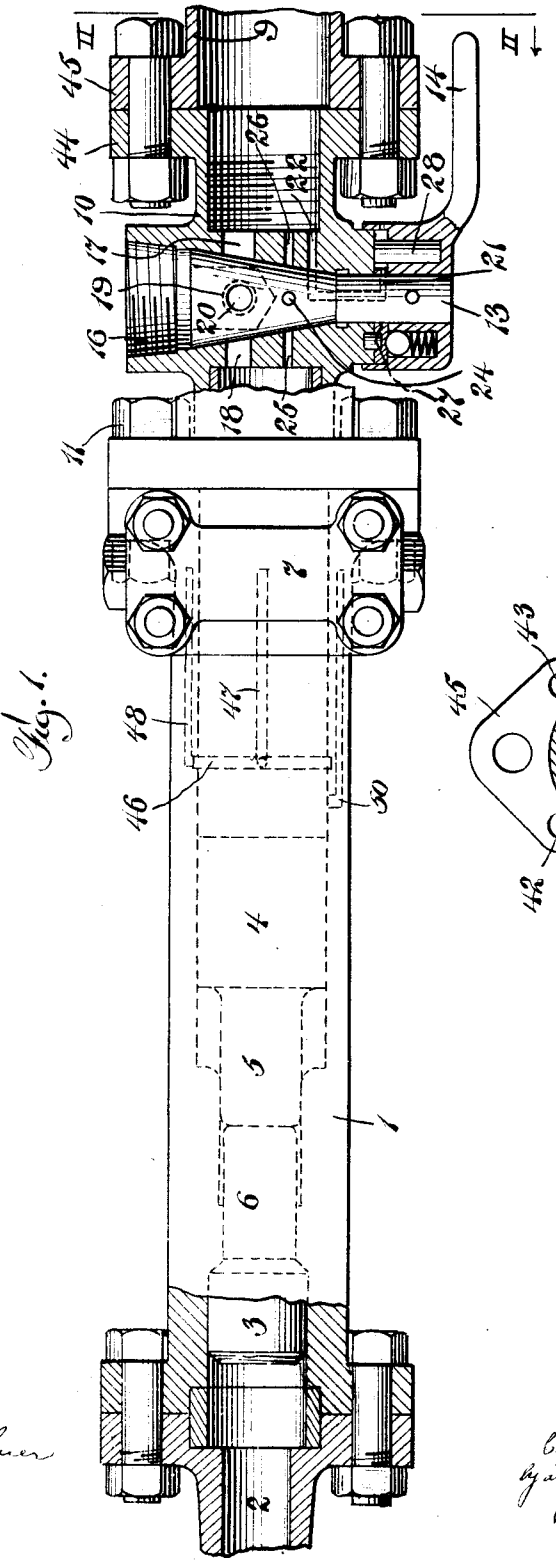

Fig. 1.

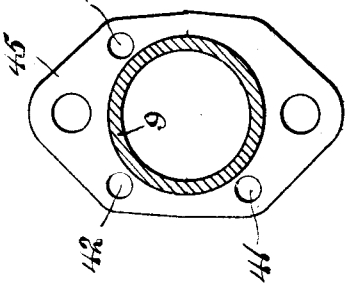

Fig. 2.

WITNESSES

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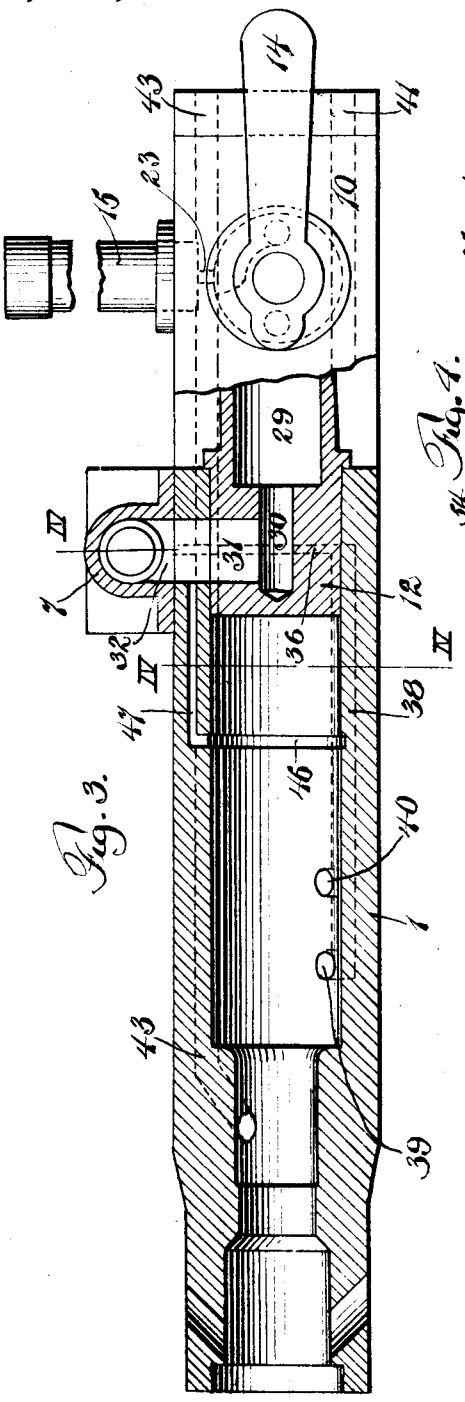

Fig. 3.

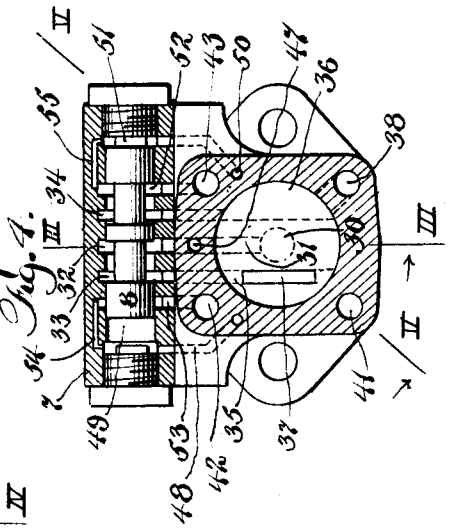

Fig. 4.

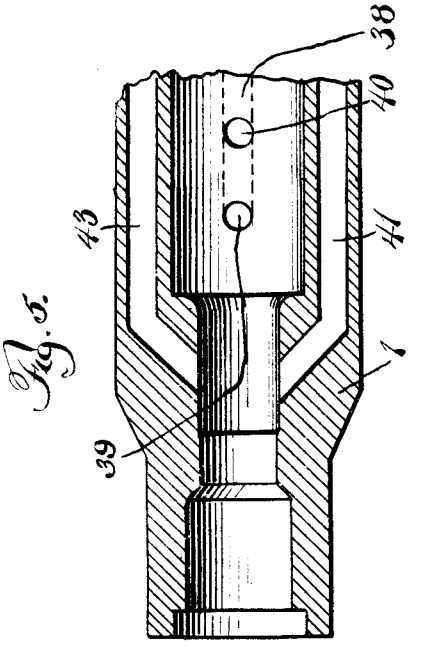

Fig. 5.

WITNESSES

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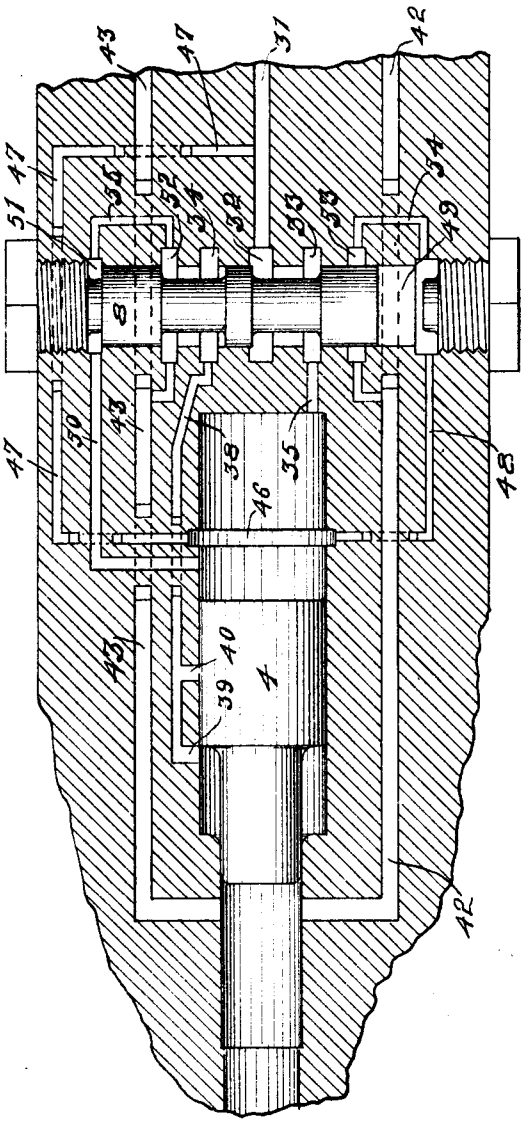

Fig. 6

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UNITED STATES PATENT OFFICE.

CHARLES B. RICHARDS, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE CLEVELAND ROCK DRILL COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

FLUID-OPERATED TOOL.

1,037,535. Specification of Letters Patent. **Patented Sept. 3, 1912.**

Application filed December 22, 1909. Serial No. 534,412.

To all whom it may concern:

Be it known that I, CHARLES B. RICHARDS, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Fluid-Operated Tools, of which the following is a specification.

The invention relates to fluid operated tools and particularly fluid operated drills; and has for its primary objects; the provision of an improved means for controlling the supply of operating fluid and oil to the operating parts; the provision of improved means whereby the operation of the drill is stopped when the machine reaches the limit of its feed or the drill steel breaks; and the provision of an improved exhaust arrangement whereby the entire exhaust of fluid occurs at the rear. One embodiment of the invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a plan view of the device, partially in section at the throttle to show the means for controlling the supply of fluid and oil.

Figure 2 is a section on the line II—II of Figure 1,

Figure 3 is a side elevation partially in section on the line III—III of Figure 4,

Figure 4 is a section on the line IV—IV—IV of Fig. 3,

Figure 5 is a section through the front end of the machine on the line V—V of Figure 4, and Fig. 6 is a diagrammatic sectional view showing the arrangement of the ports and passages when the parts are in the positions indicated in Figs. 1 and 4 and at the instant just preceding the shifting of the controlling valve to secure the rearward movement of the piston.

Referring first to the general arrangement of parts as shown in Figures 1, 3 and 4: 1 is the operating cylinder; 2 is the head secured to the cylinder by means of the bolts shown; through which head a drill steel (not shown) is adapted to reciprocate; 3 is the anvil for engaging the rear end of the drill steel; 4 is the piston or piston hammer (Fig. 1) which piston hammer is provided with a reduced forward end or shank 5 adapted to take against the shank 6 of the anvil; 7 is the valve chest seated upon the top of the cylinder; 8 is a piston valve working in the valve chest (Fig. 4); 9 is a feed cylinder, the front portion only of which is shown and which may be of any approved type, such cylinder being secured to the member 10 by means of the bolts shown; 10 is a connecting member or body portion secured at its front end to the cylinder 1 by means of the bolts 11; 12 is a plug (Fig. 3) upon the body portion 10 which plug fits into the rear end of the cylinder and is provided with air passages communicating with the valve chest and with the cylinder; 13 is a rotary throttle or admission valve provided with an operating handle 14; and 15 is a handle, which handle is hollow and serves as an oil reservoir.

The fluid supply pipe is connected at 16 (Fig. 1), and fluid supplied to the feed cylinder and operating cylinder respectively by means of the passages 17 and 18, the hollow valve 13 being provided with a pair of passages 19 and 20 for registering with the passages 17 and 18. The passages 17 and 19 are slightly larger than the passages 18 and 20 so that fluid is admitted to the feed cylinder before admission to the operating cylinder and the device is fed up to the work before the operative parts in the operating cylinder begin to work. Exhaust from the feed cylinder occurs through the passage 21 in the valve, which passage registers with the passage 22 when the throttle is in the cut off position illustrated in Figure 1. The handle 15 is a pipe filled with oil, and a passage 23 (Fig. 3) leads from the handle to the transverse passage 24 in the valve 13. When the valve is in the cut off position shown in Fig. 1, the recess 24 is filled with oil, and when the valve is rotated to permit the passage of fluid into the cylinders the passage 24 registers with the passages 25 and 26, and the oil in the recess or passage 24 flows into the

two cylinders. The handle 14 is stopped in its extremes of movement by means of the plate 27 which is cut away as indicated in dotted lines in Figure 3, and engages the pin 28 carried by the handle.

The admission passage 18 communicates with the passage 29, and this passage 29 in turn communicates with the passages 30 and 31 leading to the groove 32 in the valve chest (Figs. 3 and 4). The groove 32 communicates either with the groove 33 or the groove 34 depending upon the position of the valve 8, and the grooves 33 and 34 communicate respectively with passages 35 and 36, the lower portions of the passages 35 and 36 being formed by milling slots into the opposite sides of the plug 12. A slot 37 (Fig. 4) is cut from the front side of the plug 12 into the passage 35, thus serving as admission means to the rear side of the piston hammer. The lower end of the slot or passage 36 communicates with an exhaust passage 38 extending longitudinally of the cylinder as indicated in Figure 5, and having the openings 39 and 40 leading into the interior of the cylinder. Three other exhaust passages 41, 42, 43 (Figs. 4 and 5) extend from the front end of the cylinder back through the cylinder, the body portion 10 and the flange 45 (Fig. 1), with their exits as indicated in Figure 2, which figure is taken on the line II—II of Figure 1. The passage 42 is located on the opposite side of the operating cylinder from the passage 43 and corresponds throughout to such passage 43. The shank 6 (Figure 1) of the anvil 3 normally covers the ends of the exhaust ports 41, 42 and 43, but as indicated in Figure 1, the bore of the cylinder at this point is sufficiently large to permit of the exhaust when the bore is occupied by the shank 6. A groove 46 (Figs. 1 and 3) is provided near the rear end of the cylinder, and passages 47 and 48 lead respectively from this groove to the groove 32 in the valve chest, and the chamber 49 in such valve chest (Fig. 4). Another passage 50 (Figs. 1 and 4) also leads from the rear end of the cylinder to the chamber 51 in the valve chest. Grooves 52 and 53 are also provided in the valve chest, and have passages leading to the exhaust passages 42 and 43 as indicated in Figure 4. Small passages 54 and 55 connect the chambers 49 and 51 respectively with the grooves 53 and 52.

The operation is as follows, assuming that the hammer piston is in the position indicated in Figures 1 and 6, the valve being in the position indicated in Figures 4 and 6, and the admission valve 13 turned so that fluid is admitted to the passage 18. Pressure is admitted to the rear side of the piston hammer 5 through the passages 29, 30, 31, 32, 33, 35 and 37 (Figs. 3 and 4). At this time the fluid in front of the hammer piston is being freely exhausted through the exhaust passages 38, 41, 42 and 43. At this time also pressure is being applied from the cylinder to shift the controlling valve 8 and such valve must shift in order to secure the rearward movement of the piston hammer. This pressure is applied to the chamber 49 through the passage 48 and to the chamber 51 through the passage 50, and is continuously exhausting from such chambers through the passages 54 and 55 leading to the grooves 53 and 52, but as the passage 50 is somewhat larger than the passage 48, the pressure in the chamber 51 overbalances that in the chamber 49, and the valve 8 is shifted to the left from the position of Fig. 4. This shifting of the valve causes the central collar on the valve to cut off the communication between the grooves 32 and 33, and opens up communication between the grooves 32 and 34, and the fluid passes through the passages 34, 36 and 38 to the port 39 in front of the piston and forces it rearward. During this rearward movement, the pressure from the rear side of the piston 4 is exhausted through the passages 37, 35, 33, 53, and 42, through the passages 48, 49, 54, 53 and 42, and through the passages 50, 51, 55, 52 and 43. When the rear end of the piston 4 reaches a position covering the end of the passage 50, and the groove 46, pressure to the chamber 51 in the valve chest is cut off, and pressure to the chamber 49 is supplied from the passage 31 via the passage 47, the groove 46 and the passages 48, thus moving the valve to the right to the position of Figure 4, thus completing the cycle.

The port 40 leading to the passage 38 (Figs. 3 and 5) constitutes a means for securing the stoppage of the mechanism in case the drill steel breaks, or in case the machine is fed ahead to its extreme limit. Under these conditions the piston 4 moves forward to such a position that its rear end uncovers the port 40. This permits the fluid behind the piston to exhaust freely so that there is not sufficient pressure remaining to actuate the valve 8 and the machine consequently stops.

From the foregoing it will be seen that all the fluids exhausted from the machine pass rearwardly through the exhaust ports 41, 42 and 43, and that there is no lateral or front exhaust whatever. It will also be seen that the means for supplying oil to the machine is a compact simple and effective one, the pipe 15 serving the double function of a handle and of a storage reservoir. Various advantages incident to the construction will be apparent to those skilled in the art.

Having thus described my invention and

illustrated its use, what I claim as new and desire to secure by Letters Patent is the following:—

1. In a fluid operated tool; the combination with a cylinder and piston; of a valve for controlling the admission of fluid to the cylinder having pressure receiving surfaces to move it in opposite directions; means for intermittently supplying fluid to one of the surfaces from the cylinder; means for intermittently supplying fluid to the other of the surfaces; and means for automatically stopping the movement of the valve comprising an exhaust port leading to the outer air and uncovered by the piston when a position in advance of its normal forward position is reached, whereby the pressure in the cylinder is reduced and rendered insufficient to operate the valve.

2. In a fluid operated tool; the combination with a cylinder and piston; of a valve for controlling the admission of fluid to the cylinder having pressure receiving surfaces to move it in opposite directions; means for intermittently supplying fluid at different pressures to both of the surfaces from the cylinder whereby the valve is moved in one direction; means for intermittently supplying fluid to one of the surfaces only for moving the valve in the other direction; and means for automatically stopping the movement of the valve comprising an exhaust port leading to the outer air and uncovered by the piston when a position in advance of its normal forward position is reached, whereby the pressure in the cylinder at such time is rendered insufficient to move the valve.

3. In a fluid operated tool; the combination with a cylinder and piston; of a valve for controlling the admission of fluid to the cylinder having pressure receiving surfaces to move it in opposite directions; means for intermittently supplying fluid to one of the surfaces from the cylinder to move it in one direction; means for intermittently supplying fluid to the other of the surfaces to move it in the other direction; exhaust means from the front side of the piston leading to the outer air and controlled by the valve; and a port thereto normally covered by the piston and adapted to permit a reduction of pressure in the cylinder sufficient to render such pressure ineffective to move the valve when the piston reaches a point in advance of its normal position and uncovers such port.

4. In a fluid operated tool; the combination with a cylinder and piston; of a valve for controlling the admission of fluid to the cylinder; means whereby the valve is shifted by means of fluid pressure from the cylinder behind the piston; and automatic stop means comprising an exhaust passage leading to the outer air and uncovered by the piston when it reaches a point in advance of its forward normal extreme of movement, whereby the pressure behind the piston is reduced to a point which renders it ineffective to shift the valve and secure a backward movement of the piston.

5. In a fluid operated tool; the combination with a cylinder and piston; of a valve for controlling the admission of fluid to the cylinder; a passage leading to the valve and uncovered by the piston as it moves forward, whereby the valve is shifted by means of fluid pressure from the cylinder behind the piston; automatic stop means comprising an exhaust passage leading to the outer air and uncovered by the piston when it reaches a point in advance of its forward normal position whereby the pressure behind the piston is reduced to a point which renders it ineffective to shift the valve and secure a backward movement of the piston; and means against which the piston impinges for normally preventing the uncovering of the said port when the tool is in operation.

6. In a fluid operated tool; the combination with a cylinder and piston; of an automatic fluid operated valve for controlling the admission of fluid to the cylinder; an exhaust passage extending rearwardly from the front side of the piston; a second passage extending rearwardly from the front side of the piston, and serving under the control of the valve, alternately as an admission and exhaust passage; and a passage controlled by the valve whereby the said second passage discharges into the said exhaust passage.

7. In a fluid operated tool; the combination with a cylinder and piston; of an automatic fluid operated valve for controlling the admission of fluid to the cylinder; an exhaust passage extending rearwardly from the front side of the piston; a second passage extending rearwardly from the front side of the piston, and serving under the control of the valve, alternately as an admission and exhaust passage; a third passage extending from the rear side of the piston, and serving, under the control of the valve, alternately as an admission and exhaust passage; and passages controlled by the valve, whereby the said second and third passages discharge into the said exhaust passages.

8. In a fluid operated tool; the combination with a cylinder and piston; of an automatic fluid operated valve for controlling the admission of fluid to the cylinder; exhaust passages extending rearwardly from the front side of the piston and exhausting at the rear of the tool; other passages to the front and rear of the piston, serving alternately as exhaust and admission passages;

and connecting passages whereby these passages exhaust into the said rearwardly extending exhaust passages.

9. In a fluid operated tool; the combination with a cylinder and piston; of an automatic fluid operated valve for controlling the admission of fluid to the cylinder; exhaust means extending rearwardly from the front side of the piston; passages to the front and rear of the piston, serving alternately as exhaust and admission passages; and connecting passages, under the control of the valve, whereby these passages exhaust into the said rearwardly extending exhaust means.

In testimony whereof I have hereunto signed my name in the presence of the two subscribed witnesses.

CHARLES B. RICHARDS.

Witnesses:
F. W. GREVE,
ARTHUR SCOTT.