W. E. CARR.

DRILL.

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992,847.

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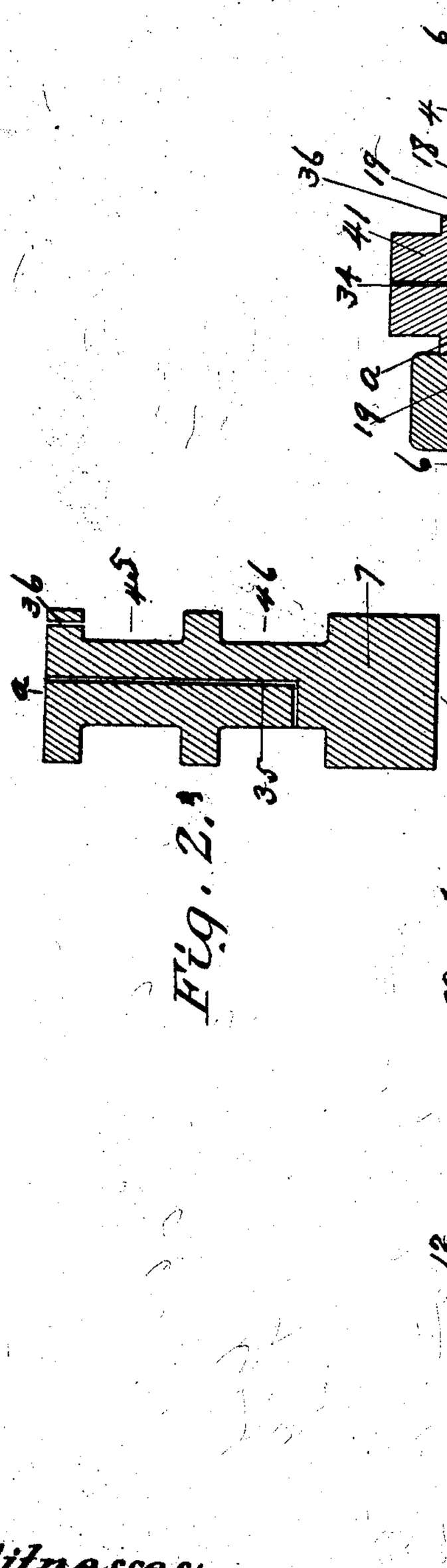

Fig. 2.

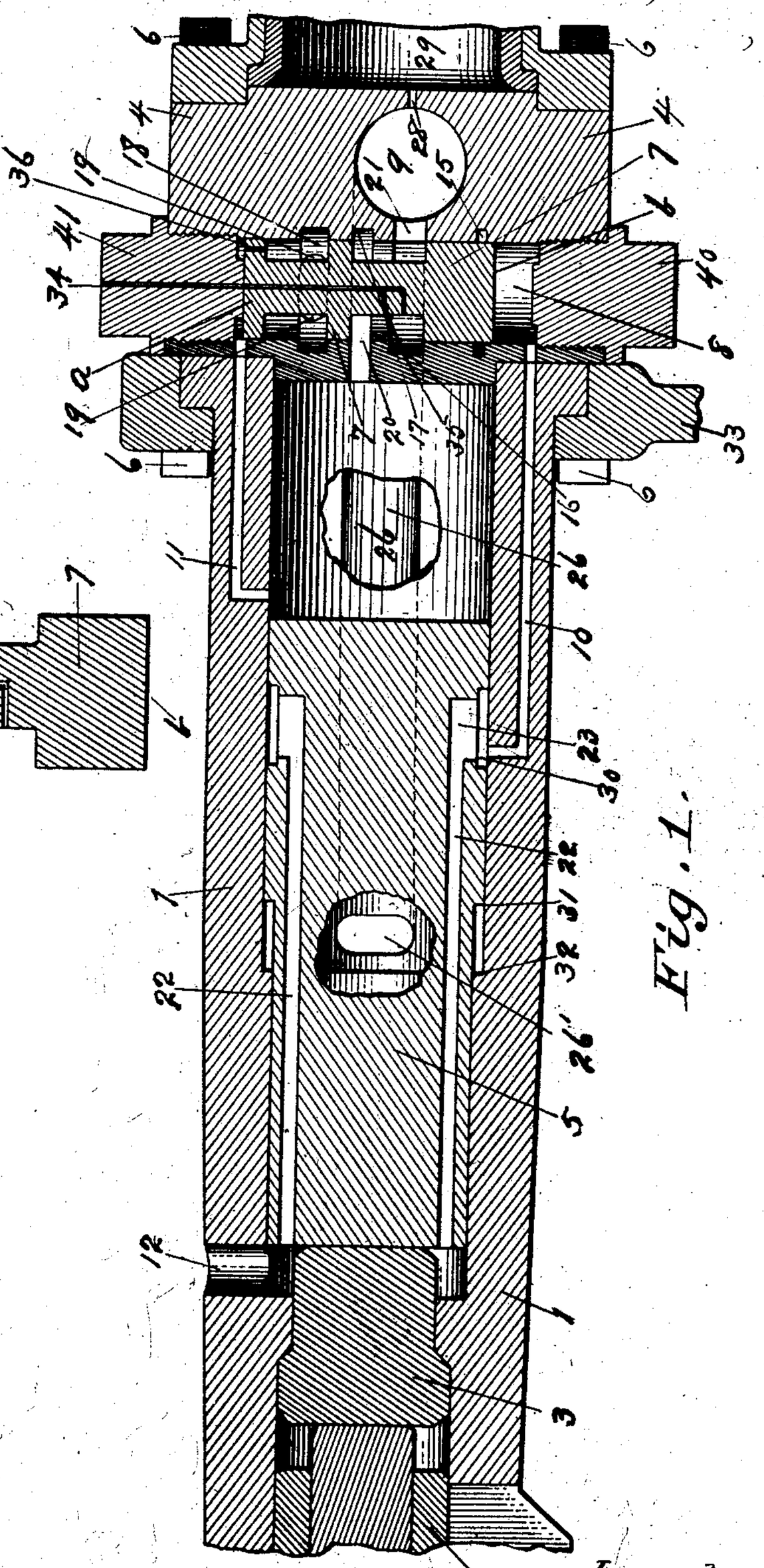

Fig. 1.

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UNITED STATES PATENT OFFICE.

WALTER E. CARR, OF TELLURIDE, COLORADO.

DRILL.

992,847. Specification of Letters Patent. Patented May 23, 1911.

Application filed May 28, 1909. Serial No. 499,049.

To all whom it may concern:

Be it known that I, WALTER E. CARR, a citizen of the United States, residing at Telluride, in the county of San Miguel and State of Colorado, have invented certain new and useful Improvements in Drills, of which the following is a specification.

My invention relates to pneumatic hammer drills, and my purpose is to provide the means for holding, directing and striking a drill that is automatic, easily placed in position, economical in the use of air, and one that possesses great power and rapidity of stroke. These objects I attain by the device illustrated in the accompanying drawings, in which similar letters of reference indicate like parts throughout the several figures.

Figure 1, is a longitudinal section. Fig. 2, is a section of the reciprocating valve.

The cylinder 1 having a differential interior, preferably of about one-fourth of an inch, has fitted on one end a drill chuck 2, and a tappet 3 that constitute the closure for that end of said cylinder, and on the other end of said cylinder 1 is fastened the valve casing 4 that forms the closure for that end, between which closures the hammer piston 5 is made to operate. In the wall of said cylinder 1 are the conduits 10 and 11 that conduct the motive fluid to the reciprocating valve 7—conduit 10 to one end marked *b*, and conduit 11 to the other end marked *a*—and thus supply therethrough a part of the actuating force to said valve 7, and in the wall of said cylinder is also the starting conduit 26, that enters the interior of said cylinder at port 26′. Also through the wall of said cylinder 1 is cut the exhaust port 12 near the tappet 3, which port allows free exit of air from the conduit 10 to release the reciprocating valve 7, and from the interior of the casing 1 to prevent the cushioning of the hammer piston 5. This conduit 10 is formed in the wall of the cylinder 1, and extends from the bottom thereof practically one half the length of said cylinder, and opens to the interior of said cylinder at a point which would be adjacent to channel 30 on said hammer piston when said hammer piston contacts with the tappet 3. The conduit 11 commences on the opposite side at the end and in the wall of said cylinder 1 and opens to the interior of said cylinder immediately below the point where the piston hammer 5 would stop when in striking contact with tappet 3. Through conduit 10 is conveyed the motive fluid, to the reciprocating valve 7 on the *b* end thereof, and through the conduit 11 is conducted the motive fluid to the other, or *a*, end of said reciprocating valve 7. The valve casing 4, is firmly held against the end of said cylinder 1 by the bolts 6, which bolts 6 also secure to said machine the feed cylinder 23, and the turning handle 33. Within said valve casing 4 is cut a cylindrically shaped valve chamber 8, transverse in position to the piston chamber. The said valve chamber 8 is closed at the ends by the threaded plugs 40 and 41, plug 41 has a horizontal conduit 34 cut therethrough to form an air exit, and thus prevent the cushioning of said reciprocating valve 7. Within the said valve chamber 8 is made to operate the reciprocating valve 7. The valve chamber 8 is enlarged by four annular channels 15, 16, 17 and 18, concentric with said valve chamber 8. From one of said channels, 18, exhaust ports 19 are cut to the bottom of the valve casing 4. From another of said annular channels, 16, is cut hammer-piston port 20 into the interior of said cylinder 1, and through said port is introduced the motive fluid to the larger end of the piston hammer 5. Through the valve casing 4, and transverse in direction to the reciprocating valve chamber 8, but on a lower plane thereto is cut the valve chamber 9, from which chamber a port 25 is provided, that is in alinement with said starting conduit 26 in the wall of the cylinder 1. From said chamber is cut the valve port 21. Within said chamber 9 is fitted a rotatably movable valve, shaped to conform to the interior of its chamber 9, and hollowed out at one end and fitted on the other end with an operating handle. From the hollowed interior of said valve a passageway is provided, similar in shape, but only adjacent in position, when the valve is so turned, to the said valve port 21. From said hollowed interior another passage way is cut, slot like, or elongated in form, and opposite in direction to said other

passage way, and adjacent to a similar port 28 cut through the bottom of said valve casing 4, the purpose being to permit the motive fluid to enter the feed cylinder 29 of the drill, and hold the drill against the rock to be cut. And to release the motive fluid in said feed cylinder, and to remove the drill, a port, and a conduit leading therefrom, are cut in the periphery of said valve. The reciprocating valve 7 has two circumferential channels cut therein, marked 45 and 46. Channel 45, when in position adjacent to the annular channel 16 and 17, and channel 46, when in position adjacent to the annular channel 17 and 18 co-act with said channels and form passage ways, or inlet and outlet conduits for the motive fluid.

The hammer piston 5 has its upper portion made smaller than its lower portion, which lower portion fits closely the lower portion of the interior of cylinder 1, and whose upper portion is similarly fitted to the upper portion of said cylinder, and adapted to form a friction joint therebetween, except between the shoulder 31 on the hammer piston and 32 in the cylinder. The difference in the size of the two parts of said piston hammer 5 is preferably about $\frac{1}{4}$ of an inch, as shown at shoulder 31. Around the lower part of said hammer piston 5 is cut an annular channel 30, and from the upper end of said hammer piston 5, are provided conduits 22, opening into said annular chamber 30, through the slotted openings 23. This annular channel 30 and conduits 22 permit the motive fluid that is held in the conduit 10 and against the end *b* of reciprocating valve 7, to escape therethrough when channel 30 on the piston hammer 5, is adjacent to the opening of conduit 10. This releases said valve and permits its return when the motive fluid is applied to the other end, or the *a* end of the valve. A longitudinal conduit 35 is cut internally through said valve 7, and through the flange on said valve is cut a conduit 36, the purpose being to aid conduit 11, and to furnish a part of the actuating fluid to the *a* end of the valve 7, by allowing the motive fluid to pass through the conduit 35, from the annular channel 16, and supply thereby a part of the motive fluid to the *a* end of said valve, the motive fluid exhausting through the conduit 36, and passing out through the exhaust ports 19, thereby supplying a constant pressure on the *a* end of said valve that is reduced by the constant exhaust through conduit 36.

In operation the motive fluid is introduced through a hose that is threadably connected to the chamber 9, and enters through port 25, and conduit 26, into the cylinder chamber immediately below the shoulder 31, and surrounds the forward portion of the piston hammer 5. This forces the piston hammer to the end of said chamber, if it is not already there, and the fluid flows through the conduit 10 and strikes the *b* flange of the reciprocating valve 7, and drives it to the position shown in Fig. 1. The motive fluid is then turned into the feed cylinder 29, through the valve port 24 and port 28. This raises the device in position for work, with the drill in contact with the rock. The rotary valve is then turned until the port in the valve is adjacent to the port 21 in the valve casing 4. This position permits the motive fluid to enter the reciprocating valve chamber 8 through the annular channels 16 and 17 and pass through the hammer piston port 20 and strike the hammer piston 4 with the exhaust force of the full area of the larger end of said piston. This force overcomes the constantly maintained opposite force on the shoulder 31; and the hammer piston 5 strikes the tappet or drill with the full force of the motive fluid on the face, less the area of the annular shoulder 31. When the hammer piston 5 in its forward movement reaches the position so that the annular channel 30 is adjacent to the upper opening of conduit 10, the motive fluid which is not only that in said conduit, but also that bearing against the end of the reciprocating valve 7, is released and exhausts through the slotted opening 23, conduits 22 and exhaust port 12. This leaves valve 7 ready to receive the reverse or opposite movement. When said piston hammer 5 passes the entrance to conduit 11, the motive fluid from behind the hammer piston 5 strikes the *a* end of the reciprocating valve 7, and forces it to the other end of the valve chamber 8. This action of said valve closes channel 16 and opens channel 18. The motive fluid behind the hammer piston 5 then exhausts through ports 20, 17, 18 and 19.

Having thus described my invention I desire to secure by Letters Patent and claim:

1. In combination with a cylinder having a differential chamber, a casing on one end thereof, a hammer-piston, a shoulder thereon, means for supplying constant fluid pressure on the shoulder of said hammer-piston, means for supplying motive fluid to the larger end of said hammer-piston, which means consists of a reciprocating valve, two annular channels thereon, a conduit from one of said channels internally through said valve to the end thereof, and an exhaust port from said end of said valve to the other channel, as and for the purposes described.

2. In combination with a cylinder having a differential chamber, a casing on one end thereof, conduits therein leading into said chamber, a hammer-piston, a shoulder thereon, means for supplying constant fluid pressure on the shoulder of said hammer-piston, means for supplying motive fluid to the larger end of said hammer-piston,

which means consists of a reciprocating valve, two annular channels thereon, a conduit from one of said channels internally through said valve to the end thereof, and an exhaust port from said end of said valve to the other channel, as and for the purposes described.

3. In combination with a cylinder having a differential chamber, a hammer-piston, a shoulder thereon, means for supplying constant fluid pressure on the shoulder of said hammer-piston, which means consists of conduits in the wall of said cylinder, means for supplying motive fluid to the larger end of said hammer-piston, which means consists of a reciprocating valve, two annular channels thereon, a conduit from one of said channels internally through said valve to the end thereof, and an exhaust port from said end of said valve to the other channel, as and for the purpose described.

4. In combination with a cylinder having a differential chamber, a casing on one end thereof, a hammer-piston, a shoulder thereon, means for supplying constant fluid pressure on the shoulder of said hammer-piston, which means consists of conduits in said casing and in the wall of said cylinder, means for supplying motive fluid to the larger end of said hammer-piston, which means consists of a reciprocating valve, two annular channels thereon, a conduit from one of said channels internally through said valve to the end thereof, and an exhaust port from said end of said valve to the other channel, as and for the purpose described.

5. In combination with a cylinder having a differential chamber, a casing on one end thereof, a valve chamber in said casing, annular channels in said chamber, a hammer-piston having a differential area corresponding to the interior of said chamber, a shoulder on said hammer-piston, means for supplying constant fluid pressure on the shoulder of said hammer-piston, a reciprocating valve, two annular channels thereon adjacent to the channels in said valve chamber, a conduit from one of said channels on said valve internally through said valve to the end thereof, and means for supplying constant reduced fluid pressure to one end of said valve, as and for the purpose described.

6. In combination with a cylinder having a differential chamber, a hammer piston, a shoulder thereon, means for supplying constant fluid pressure on the shoulder of said hammer piston, means for supplying motive fluid to the larger end of said hammer-piston, which means consists of a reciprocating valve, two annular channels thereon, a conduit from one of said channels internally through said valve to the end thereof, and an exhaust port from said end of said valve to the other channel, as and for the purpose described.

7. In combination with a cylinder having a chamber of two different diameters, a piston therein, one portion with less diameter than the other, means for supplying constant fluid pressure on the shoulder of said hammer-piston, means for supplying motive fluid to the larger end of said hammer-piston, which means consists of a valve chamber, a closure for each end thereof, a reciprocating valve, two annular channels thereon, a conduit from one of said channels internally through said valve to the end thereof, as and for the purpose described.

8. In a machine of the class described, the combination of a cylinder, a valve casing on one end, a cylindrically shaped valve chamber in said casing, two annular channels in said chamber, a reciprocating valve adapted to operate in said chamber, two annular channels thereon, an internal conduit from one of said last mentioned channels to the end of said valve, an exhaust port from said end of said valve to the other channel, and a hammer-piston adapted to operate in said cylinder, as and for the purpose described.

9. In a machine of the class described, the combination of a cylinder, a valve casing on one end, a valve chamber in said casing, a fluid conduit in said casing, a piston adapted to operate in said cylinder, formed with one portion of said piston of smaller diameter than the other and having an annular channel cut near one end, internal longitudinal conduits leading from the other end of said piston to said channel, an annular shoulder on said piston under constant fluid pressure in one direction and means for moving said piston in the other direction, which means consists of a reciprocating valve adapted to operate in said valve chamber, two annular channels thereon, an internal conduit leading from one of said channels to the end of said valve and an exhaust conduit from said valve to the other channel, as and for the purpose described.

10. In a machine of the class described, the combination of a casing, a valve chamber therein, four annular channels in said casing concentric with said valve chamber, exhaust ports leading from the two outer of said channels, a cylinder secured to said casing, and having a differential bore, a piston operating in said cylinder, a shoulder thereon, a combined inlet and exhaust conduit leading from said valve chamber into said cylinder, a cylindrically shaped valve the ends of which are of equal area in said valve chamber adapted to change the direction of the motive fluid through said conduit, and means whereby the motive fluid is constantly supplied to said shoulder.

11. In combination with a cylinder having a differential chamber, a hammer-piston, a shoulder thereon, means for supplying constant fluid pressure on the shoulder of said

hammer-piston, means for supplying motive to the larger end of said hammer-piston, which means consists of a reciprocating valve, two annular channels thereon, a conduit from one of said channels internally through said valve to the end thereof, as and for the purpose described.

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

WALTER E. CARR.

Witnesses:
L. J. Wood,
J. A. Phillips.