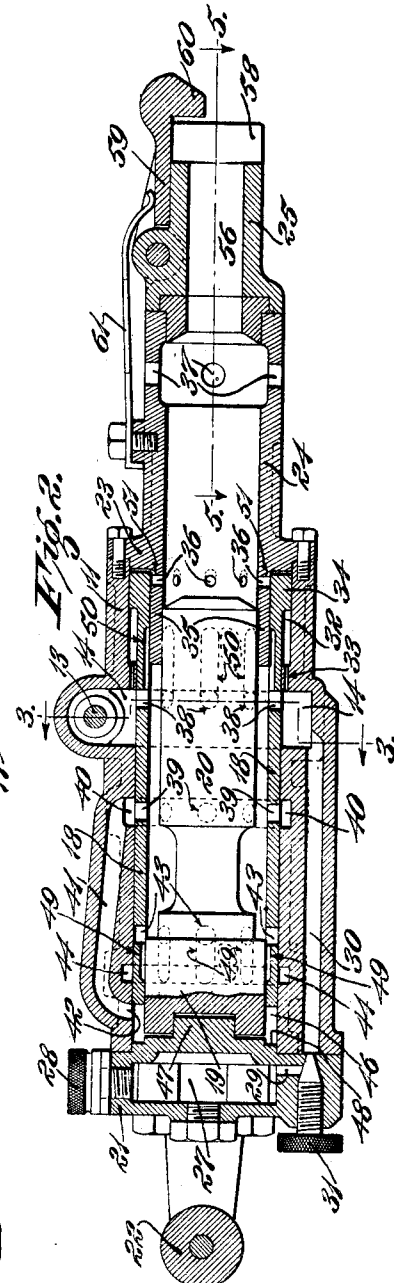
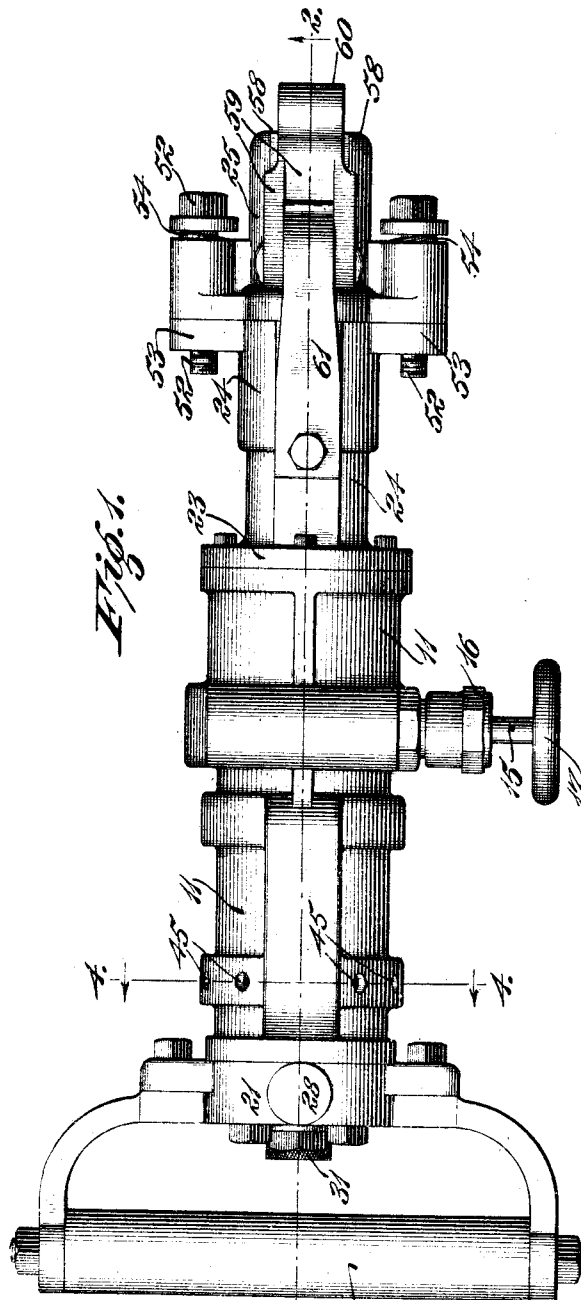


B. BRAZELLE.
PNEUMATIC TOOL.
APPLICATION FILED JAN. 6, 1913.

1,132,649.

Patented Mar. 23, 1915.

2 SHEETS—SHEET 1.



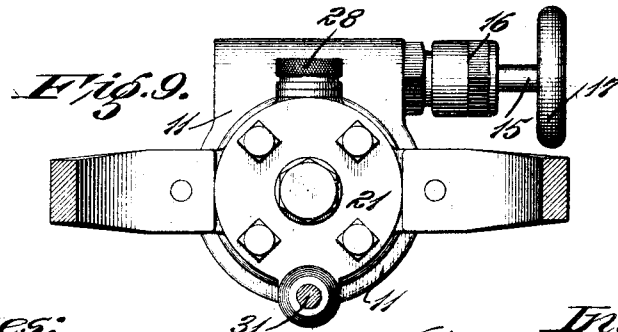
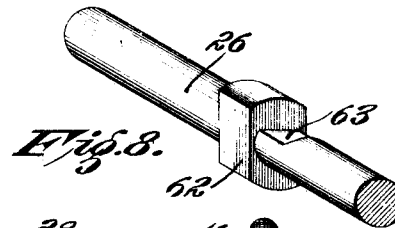
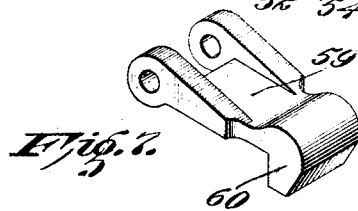
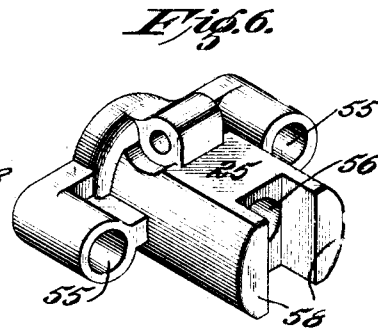
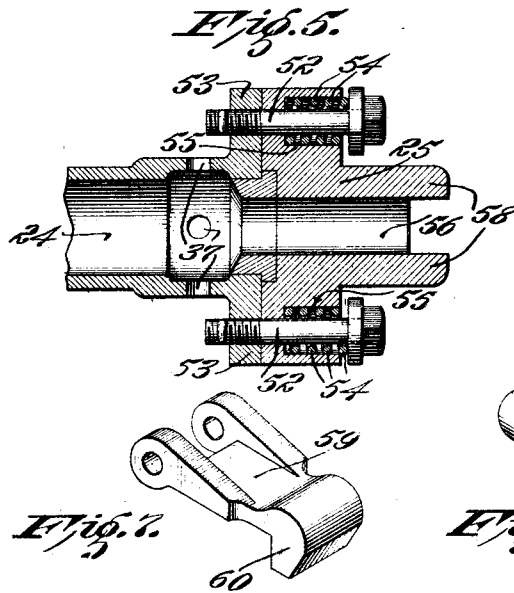
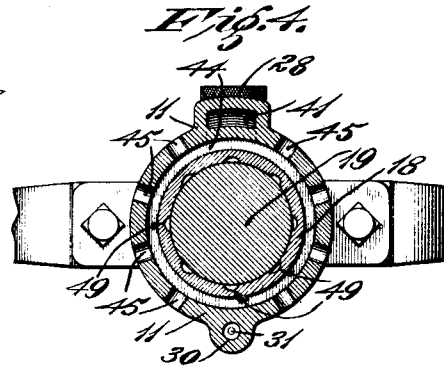
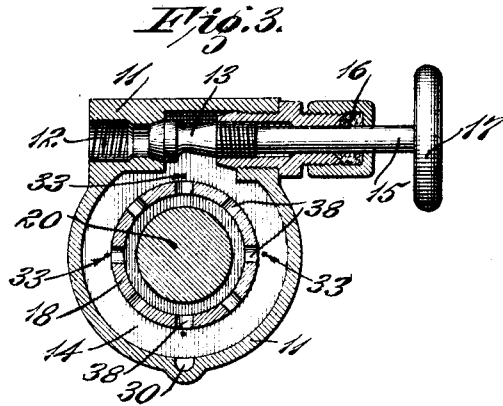
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Inventor:
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By Law & Campis Attys.

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1,132,649.

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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

BENJAMIN BRAZELLE, OF ST. LOUIS, MISSOURI.

PNEUMATIC TOOL.

1,132,649.

Specification of Letters Patent.

Patented Mar. 23, 1915.

Application filed January 6, 1913. Serial No. 740,312.

To all whom it may concern:

Be it known that I, BENJAMIN BRAZELLE, a citizen of the United States, and a resident of the city of St. Louis and State of Missouri, have invented a new and useful Improvement in Pneumatic Tools, of which the following is a specification.

This invention relates to power actuated portable impact tools, such as rock drills, chipping and calking hammers, and the like, in which the shank of the tool is supported in the end of an engine cylinder and is struck repeated blows by a free piston, or hammer, therein, the reciprocation of the hammer in the cylinder being caused by fluid pressure which is usually supplied to the device through a flexible hose from a fixed source of supply.

The object of this invention is the improvement of the power cylinder, and its co-operating parts, of a single acting fluid pressure engine, and the adaptation thereof to a pneumatic tool.

The improvements reside in the valves and coöperating parts for directing and controlling the motive fluid which reciprocates the hammer, in the means for cushioning the valve and hammer, in the means for supplying lubricant to the moving parts, in the means for holding the tool and for absorbing the force of the blow when the tool is out of contact with the object being worked upon, and in the shape and arrangement of the several parts comprised in the device, as hereinafter described; and what I consider to be my invention is particularly set forth in the appended claims.

In describing the invention, reference is had to the accompanying drawings, illustrating one form of the invention.

In the drawings, in which like figures are used to designate like parts in all the views, Figure 1 is a top view of my device, with the tool removed; Fig. 2 is a central longitudinal section through the device on the line 2—2 in Fig. 1; Fig. 3 is a transverse section through the device on the line 3—3 in Fig. 2, looking in the direction of the arrows; Fig. 4 is a transverse section through the device on the line 4—4 in Fig. 1, looking in the direction of the arrows; Fig. 5 is a central longitudinal section through the tool socket, on the line 5—5 in Fig. 2; Figs. 6, 7, and 8 are isometric views of the tool socket, latch, and shank of the

tool; and Fig. 9 is a view of the head end of the device with the handle broken away.

The device illustrated in the drawings comprises a power cylinder 11 having a tapped opening 12 adapted to receive a connection for an air hose or other pipe leading to a source of supply of fluid under pressure. The flow of air is regulated by means of a screw throttle valve 13 arranged in an annular pressure chamber 14 in the cylinder wall. The stem 15 of the valve projects out from the chamber through the gland 16 and is fitted with a hand wheel 17. Slidable longitudinally within the cylinder, and extending nearly the entire length thereof, is a sleeve valve 18, coöperating with the cylinder inlet and exhaust ports for controlling the flow of air to and from the cylinder. The differential piston end 19 of the hammer 20 has a free sliding fit within the sleeve valve. The inner or head end of the cylinder is closed by a hollow cylinder head 21 rigidly secured thereto, and provided with a handle 22 for holding and manipulating the device. The tool end of the cylinder is partly closed by an annular cylinder head 23 rigidly secured thereto, and having a hollow cylindrical outer extension 24 within which the striking end of the hammer is guided. The end of the cylinder extension 24 is fitted with a tool socket 25 adapted to receive the shank 26 of a chisel, drill bit, rivet set, or other impact tool for operating on stone or metal.

The chamber 27 in the hollow cylinder head 21 may be filled with grease through a threaded opening closed by a thumb screw 28. From this chamber communicating passages 29, 30, lead to the annular pressure chamber 14. The free communication between the passages 29, 30 may be closed or regulated by a thumb screw valve 31 arranged in the cylinder head.

Within the cylinder 11, at the outer or tool end thereof, is an annular chamber 32, in communication at its inner end with the chamber 14 by means of a series of small holes or ducts 33. The sleeve valve 14 has a differential pressure flange 34 on its outer end which has a sliding fit in the chamber 32, and the pressure on the inner side of this flange always tends to hold the valve in its outer position, as shown in Fig. 2. The annular cylinder head 23 has an annular flange portion 35 projecting within the cylinder

and forming an inner extension of the hammer guiding portion 24. This annular flange 35 fits within the flanged end of the sleeve valve, and has a series of ports 36 communicating with the chamber 32 near its outer end. When the hammer is at the inner end of its stroke, as shown in Fig. 2, these ports 36 are uncovered by the end of the hammer and are open to the atmosphere through the holes 37 in the outer extension 24 of the cylinder head. The portion of the chamber 32 between the ports 36 and the cylinder head serves as an air pocket to cushion the sleeve valve at the end of its outer stroke.

The sleeve valve 18 has a circumferential series of inlet ports 38 through it near its flanged end. These inlet ports 38 are in communication with the pressure chamber 14 whatever the position of the valve. A second circumferential series of ports 39 pierce the sleeve valve between the ports 38 and the inner end of the valve. This second series of ports is covered by the piston at about one-half stroke and the flow of fluid to the head end of the cylinder thereby cut off, and therefore the ports 39 are called cut-off ports. When the valve is in its outer position, the ports 39 register with an annular intermediate pressure chamber 40 in the cylinder wall between the chamber 14 and the head end of the cylinder. This intermediate pressure chamber 40 communicates through a passage 41, which extends lengthwise of the cylinder wall, with an inlet port 42 in the head end of the cylinder. This cylinder inlet port 42 is uncovered by the sleeve valve when the latter is in its outer position; but when the valve is in its inner position its inner end covers the port 42 and closes communication between the intermediate pressure chamber 40 and head end of the cylinder. The sleeve valve has a circumferential series of exhaust ports 43 through it near its inner end. When the valve is in its inner position these exhaust ports register with an annular exhaust chamber 44 in the cylinder wall near the head end of the cylinder, and between the cylinder inlet port 42 and intermediate pressure chamber 40. Holes 45 through the cylinder wall open from the exhaust chamber 44 into the atmosphere.

Except for the piston portion, the hammer is a solid cylinder of uniform diameter for the greater part of its length, having a free sliding fit in the outer cylinder head extension 24. The outer or striking end of the hammer is beveled. Toward the inner end of the hammer, and spaced from the piston portion, there is an annular groove 46, of a length somewhat greater than the distance from the end of the inner extension 35 of the annular cylinder head to the ports 36 therein; so that when the hammer is near

the outer end of its stroke, these ports 36 are in communication through the annular groove 46 with the inlet ports 38 and pressure chamber 14.

The piston end of the hammer is recessed centrally to receive a cylindrical projection 47 on the inside face of the hollow cylindrical head when the hammer is at the inner end of its stroke. The space in the recessed piston forms an air pocket to cushion the hammer at the inner end of its stroke. An annular groove 48 is cut around the inner edge of the hollow cylinder head of the same width as the thickness of the sleeve valve. The end of the sleeve valve enters this groove near the inner end of its stroke, and the air pocket thus formed cushions the valve at the inner end of its stroke. Shallow grooves 49 and 50 are cut in the inner surface of the sleeve valve lengthwise thereof, leading from the inlet and exhaust ports, respectively, toward the ends of the valve. These grooves permit a flow of air from and to these ports after the piston has overrun them, and thus prevent stalling of the piston at the ends of its stroke. Shallow grooves 51 are cut in the outer surface of the inner extension 35 of the annular cylinder head extending from the ports 36 toward the cylinder head. These grooves are not deep enough to spoil the air cushion at the end of the outer stroke of the sleeve valve, but permit a flow of air to the chamber 32 beyond the end of the valve if it overtravels the ports, and thereby prevent stalling of the valve.

The tool socket 25 is yieldingly secured to the end of the cylinder extension 24 by means of screws 52 threaded into lugs 53 on the cylinder extension. There is a narrow gap between the heads of the screws and the tool socket, and coil springs 54, incased in cylindrical recesses 55 on each side of the tool socket, provide a cushion between the screws and tool socket. The tool socket has a round axial hole 56 through it to receive the shank 26 of the tool, which projects through the tool socket into the cylinder extension. At its inner end the tool socket is fitted with a hard steel bushing to receive the impact of the hammer in case no tool is in place in the socket. The outer end of the tool socket terminates in two parallel jaws 58, between which fit shoulders 62 on the tool shank spaced a short distance from its end. This arrangement insures that the tool and hammer cylinder shall always have the same relative angular position and enables the tool to be rotated with the cylinder by the handle 22. A latch 59 is pivotally mounted on the tool socket, and the catch 60 is held normally in a notch 63 in the tool shank next the shoulder 62 by means of the flat spring 61.

The operation of my device is as follows:

The desired tool to be used is inserted with its shank in the socket 25 and its shoulders between the jaws 58, and the latch is snapped in place to secure the tool in the device. The cutting end of the tool is placed in contact with the work, and the throttle valve 13 is opened to any desired extent by means of the hand wheel 17. The air or other fluid under pressure enters the pressure chamber 14, which is of considerable capacity, and which serves as a reservoir of fluid under pressure within the device. This pressure is transmitted through the ports 38 to the fluid on the outer side of the piston 19, which causes the hammer to move to the inner end of its stroke. At the same time pressure is transmitted through the ducts 33 to the fluid on the inner side of the valve flange 34, and when the outer end of the piston uncovers the ports 36 the sleeve valve will be moved to the outer end of its stroke by the fluid pressure on the inner side of the flange 34. The valve and piston will then be in the position shown in Fig. 2, and fluid under pressure will pass through the ports 39 into the intermediate pressure chamber 40 and thence to the head end of the cylinder. As soon as the total fluid pressure on the inner or head end of the piston is greater than the fluid pressure on the outer annular piston area the piston will start on its out stroke. Fluid under pressure will continue to flow through the ports 38, 39 and 42 until the piston covers the cut-off ports 39, and at this point the further supply of fluid under pressure to the intermediate pressure chamber 40 will be cut off, but the fluid already in this chamber, and in the head end of the cylinder will expand and continue to drive the piston forward on its out stroke. The fluid in the annular spaces surrounding the hammer within the sleeve valve is slightly compressed, and is partly driven out through the ports 38 into the pressure chamber 14, which is of considerable capacity in order to accommodate the efflux. Toward the end of the out stroke of the hammer the groove 46 therein uncovers the ports 36 leading to the outer end of the valve flange chamber 32, and admits fluid under pressure thereto. As the outer end of the sleeve valve is of greater area than the inner side of the flange 34, the fluid pressure on the outer end of the valve will be greater than the fluid pressure on the inner side of the flange, which will cause the valve to move to the inner end of its stroke, thus closing the inlet ports 42 to the head end of the cylinder and opening the exhaust ports 43 leading therefrom. The fluid in the head end of the cylinder will escape into the atmosphere, but the fluid in the intermediate pressure chamber 40 and passage 41 will be confined therein.

When the fluid pressure on the head end of the piston has been reduced to the point

where it is less in total effect than the fluid pressure on the outer side of the piston, which will occur at about or soon after the time that the hammer reaches the end of its out stroke and brings up against the end of the tool shank, the greater pressure on the outer side of the piston will cause the hammer to move in the reverse direction toward the head end of the cylinder. The ports 36 will be closed by the hammer shortly after it starts on its return stroke and will retain the fluid under pressure within the outer end of the valve chamber 32 and thereby hold the valve in its inner position until near the end of the in stroke of the hammer. When the hammer nears the inner end of its stroke the ports 36 will be uncovered and opened to the atmosphere, and the sleeve valve will return to its outer position, closing the exhaust ports 43 and opening the inlet and cut-off ports, ready for a repetition of the cycle of operation.

Heretofore, single acting engines for impact tools have not been satisfactory in service on account of the excessive back pressure upon the outer side of the piston on the out stroke due to the fact that the fluid in front of the piston cannot be driven back through the valves into the supply pipe fast enough to prevent high compression in the annular space surrounding the hammer in front of the piston. In this device this defect is avoided by the provision of the pressure chamber 14 into which this fluid can readily pass from in front of the piston. Moreover, the arrangement of an intermediate pressure chamber enables a cut-off at half stroke or less to be used without danger of stalling the piston. The fluid in this intermediate chamber is not exhausted into the atmosphere with the contents of the head end of the cylinder, but that remaining at the end of the power stroke when the exhaust valve is opened is stored up for the next power stroke. Furthermore, heretofore the proper lubrication of fluid pressure engines for impact tools has been difficult to maintain under actual working conditions. In this device the lubricant used is non fluid oil or grease, which is placed in the hollow cylinder head. The heat generated in the cylinder by the compression of the fluid in the head end thereof warms the grease and causes it to creep slowly through the passage 29 and past the thumb screw valve. The out stroke of the piston compresses the fluid in front of it and drives some of it into the pressure reservoir chamber 14, and thus there is a constant flow of fluid in and out of the duct 30 due to the fluctuation of fluid pressure within the chamber 14 during the operation of the device. This constantly reversing flow or surging of fluid within the duct 30 is partly communicated through the valve and duct 29 to the fluid in the hollow

cylinder head; and the result is that some of the melted grease in the duct 29 is picked up and carried out into the chamber 14 and mingled with the fluid therein, and eventually carried into the sleeve valve, where it serves to lubricate the valve, piston and hammer. The more fluid under pressure admitted to the engine and the harder it works, the hotter it gets and the more will the grease be warmed and carried into the working parts of the device to lubricate them.

Having described my invention in detail, I do not desire to be limited to the precise form and arrangement of the parts as shown, as it is evident that modifications may be made without departing from my invention.

What I claim as my invention and desire to secure by Letters Patent is as follows:

1. In a single acting fluid pressure engine a cylinder having a pressure reservoir chamber, a sleeve valve slidable within said cylinder having inlet ports open to said chamber in all positions of said valve, a differential piston slidable in said sleeve valve, said valve inlet ports communicating with the outer end of said cylinder, communicating passages in said cylinder wall connecting said outer end with the head end of said cylinder, said valve having ports adapted to uncover the inner end of said passages in one position of said valve, and means for moving said valve at the end of each out stroke of the piston to cover the ends of said passages.

2. In a single acting fluid pressure engine a cylinder having a pressure reservoir chamber, a sleeve valve slidable within said cylinder having inlet ports open to said chamber in all positions of said valve, a differential piston slidable in said sleeve valve, said valve inlet ports communicating with the outer end of said cylinder, and intermediate pressure reservoir chamber in said cylinder wall, communicating passages in said cylinder wall connecting said outer end with said intermediate chamber and with the head end of said cylinder, said valve having ports adapted to uncover the inner end of said passages in one position of said valve, and means for moving said valve at the end of each stroke of the piston.

3. In a single acting fluid pressure engine a cylinder having a pressure reservoir chamber, a sleeve valve slidable within said cylinder having inlet ports open to said chamber in all positions of said valve, a differential piston slidable in said sleeve valve, said valve inlet ports communicating with the outer end of said cylinder, communicating passages in said cylinder wall connecting said outer end with the head end of said cylinder, said valve having ports about midway of its length adapted to uncover the inner end of said passages in one position of said valve, said ports being closed by said piston during the last part of its out stroke,

and means for moving said valve at the end of each out stroke of the piston to cover the ends of said passages.

4. In a single acting fluid pressure engine a cylinder having a pressure reservoir chamber, a sleeve valve slidable within said cylinder having inlet ports open to said chamber in all positions of said valve, a differential piston slidable in said sleeve valve, said valve inlet ports communicating with the outer end of said cylinder, an intermediate pressure reservoir chamber in said cylinder wall, communicating passages in said cylinder wall connecting said outer end with said intermediate chamber and with the head end of said cylinder, said valve having ports about midway of its length adapted to uncover the inner end of said passages in one position of said valve, said ports being closed by said piston during the last part of its out stroke, and means for moving said valve at the end of each stroke of the piston to cover the ends of said passages.

5. In a single acting engine, the combination of a power cylinder comprising two axially arranged communicating chambers of different diameters, the chamber of larger diameter being closed at one end and provided with an enlarged annular extension at its opposite end surrounding the chamber of smaller diameter, a hollow cylindrical valve having an annular flange at one end slidably arranged in said larger chamber with its flanged end arranged within said annular extension, a differential piston reciprocating within said valve and said smaller cylinder chamber, and means controlled by said piston for admitting fluid under pressure to the end of said annular extension of the chamber of larger diameter.

6. In a fluid pressure engine having a power cylinder comprising two axially arranged communicating chambers of different diameters, one end of the larger chamber being closed, said closed end containing an axial recess forming an extension of said larger chamber, an annular recess in said cylinder forming an enlargement of said larger chamber, a hollow cylindrical valve slidably arranged in said larger chamber with one end extending into said axial recess, an annular flange surrounding said valve and arranged in said annular recess, said cylinder wall being provided with a passage connecting said enlargement with said smaller chamber, and a piston within said cylinder adapted to uncover said passage at the end of its stroke.

7. In a fluid pressure engine having a power cylinder comprising two axially arranged communicating chambers of different diameters, one end of the cylinder being closed and containing an axial recess forming an extension of the chamber of larger

diameter, said cylinder containing an annular groove surrounding the chamber of smaller diameter and forming an extension of the chamber of larger diameter, a hollow cylindrical valve having an annular flange slidably arranged in said cylinder with one end extending into said axial recess and said flange extending into said groove, means for admitting fluid under pressure to said annular groove on each side of said flange, and means for periodically exhausting fluid under pressure from one end of said groove. 10

Signed at St. Louis, Missouri, this thirtieth day of December, 1912.

BENJAMIN BRAZELLE.

Witnesses:

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ANDREW KESSLING.