W. A. SMITH.

PULSATING APPARATUS.

APPLICATION FILED FEB. 25, 1913.

1,196,040.

Patented Aug. 29, 1916.

3 SHEETS—SHEET 1.

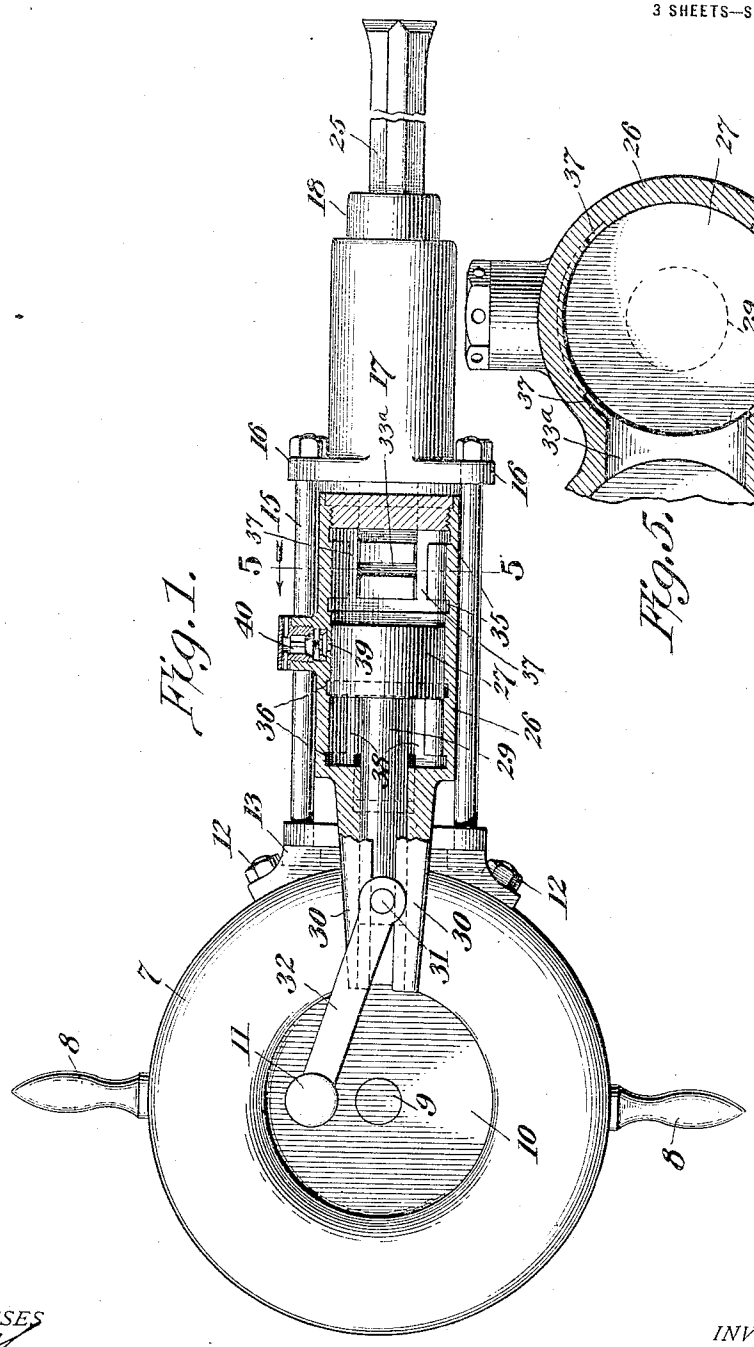


Fig. 1.

Fig. 5.

WITNESSES

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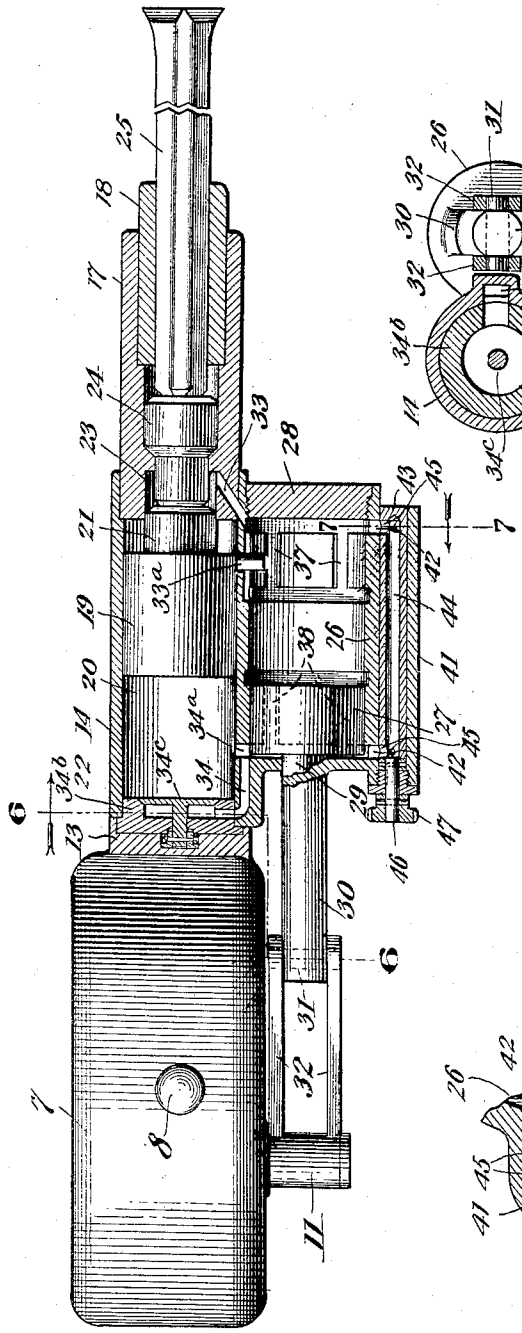


Fig. 2.

Fig. 6.

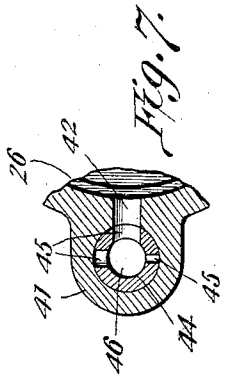


Fig. 7.

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3 SHEETS—SHEET 3.

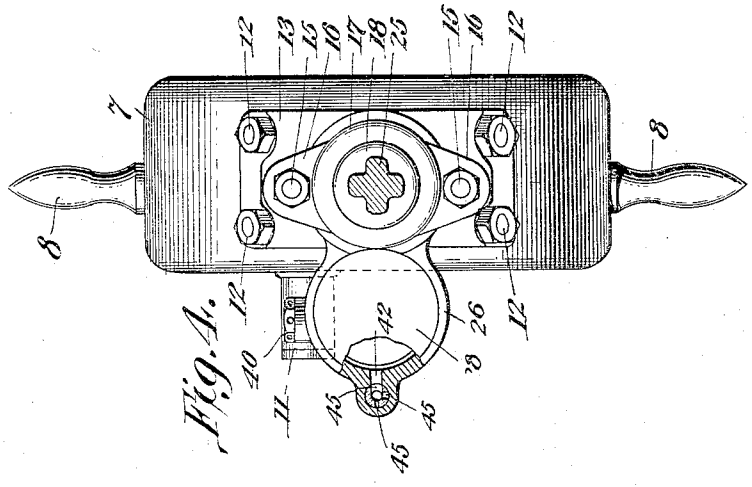


Fig. 4.

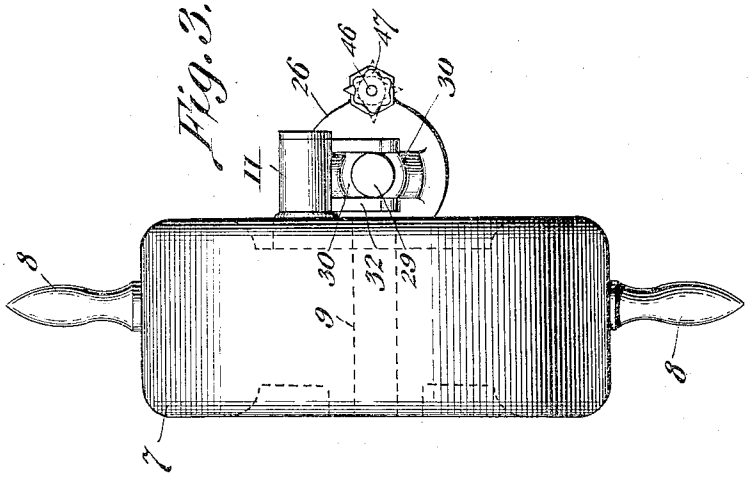


Fig. 3.

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UNITED STATES PATENT OFFICE.

WILLIAM A. SMITH, OF DENVER, COLORADO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE DENVER ROCK DRILL MANUFACTURING COMPANY, OF DENVER, COLORADO, A CORPORATION OF DELAWARE.

PULSATING APPARATUS.

1,196,040. Specification of Letters Patent. Patented Aug. 29, 1916.

Application filed February 25, 1913. Serial No. 750,606.

To all whom it may concern:

Be it known that I, WILLIAM A. SMITH, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented new and useful Improvements in Pulsating Apparatus, of which the following is a specification.

This invention relates to expansive fluid motors of the pulsating type, wherein motion is transmitted to a driven piston through the medium of air or other expansive fluid, which in itself is moved in opposite directions by a driving piston.

The primary object is to provide a motor of this type, in which the driven member is given forceful movement, and the prime mover is relieved to a material degree of the sudden shocks and strains to which this element is ordinarily subjected.

A further object is to provide means, whereby the pressure and strain upon the parts is relieved, while starting the motor, this means furthermore permitting the stopping of the effective action of the motor without the necessity of stopping the prime mover.

An embodiment of the invention that is at present considered a preferable one, is illustrated in the accompanying drawings, wherein:—

Figure 1 is a side elevation of the motor, with the driving cylinder shown in longitudinal section. Fig. 2 is a horizontal sectional view therethrough. Figs. 3 and 4 are respectively elevations of the ends of the motor. Fig. 5 is a cross sectional view on the line 5—5 of Fig. 1. Fig. 6 is a detail sectional view on the line 6—6 of Fig. 2. Fig. 7 is a detail cross sectional view on an enlarged scale on the line 7—7 of Fig. 2.

Similar reference numerals designate corresponding parts in all the figures of the drawings.

In the embodiment illustrated, an electric motor or prime mover is shown generally at 7, and may be of any desired or well known type. It is provided in the present instance, with oppositely disposed handles 8, though any means for mounting the drill may of course be employed. This motor has a shaft 9, to which is attached a crank disk 10, carrying a wrist pin 11. Secured to one side of the motor casing by bolts 12, or by any other suitable means, is a head block 13, forming one head of a driven cylinder member 14, that is secured to said head block by longitudinal bolts 15, these bolts, as shown clearly in Fig. 1, passing through ears 16 formed upon the rear end of a head 17 that is mounted on the end of the cylinder member 14 opposite to the head block 13. The head 17 in the present invention, constitutes a part of a drill chuck, which includes a sleeve 18. Located within the piston chamber 20 of the cylinder 14 is a reciprocatory driven hammer piston 19 having a reduced front end 21 that moves into and out of a reduced bore or pocket formed in the rear end of the head 17. This head 17 contains the usual tappet 24 that is thus interposed between the hammer piston 19 and the rear end of a drill bit 25 that is removably placed in the chuck.

Formed upon one side of the cylinder member 14 is a driving cylinder member 26 that is preferably integral therewith, and contains a solid reciprocatory piston 27. One end of the cylinder member 26 is closed by a head 28 and the piston 27 has a rod 29 projecting through the opposite end, this rod operating in a guideway formed by upper and lower spaced guide elements 30 that extend toward the side of the electric motor having the crank disk 10. The outer or rear end of the said piston rod 29 has a cross pin 31, on which are pivoted the ends of pitmen links 32 that are journaled on the pin 11 of the crank disk.

The front end portion of the piston chamber of the cylinder 26 communicates with the front pocket 23 of the cylinder member 14 through the medium of passageways or ports 33 and 33^a. The port 33, as clearly shown in Fig. 2, opens into the pocket 23. The port 33^a opens directly into the front end portion of the piston chamber 20. The rear end of the cylinder member 26 is in communication with the rear end of the piston chamber 20 through the medium of ports or passageways 34 and 34^a. The passageway 34 opens into the rear end of the piston chamber 20 through a valve seat member 34^b. The port 34^a opens into the rear portion of the piston chamber 20 in advance of its rear end. A spring-pressed check valve 34^c is mounted in the valve seat member 34^b, and while permitting the passage of air through the port 34 into the

chamber 20, prevents its retrograde movement from the rear end of the chamber through said port 34, as will be evident. The interior of the cylinder 26 is furthermore provided with relief passages in communication respectively with the ports 33 and 34. These relief passages, as shown, comprise annular grooves 35 and 36, formed in the end portions of the cylinder wall and connected by longitudinal passages 37 and 38. It will be noted by reference to Fig. 2 that the distance between the outer edges of the grooves 36 is slightly greater than the width or thickness of the piston 27. An inlet port 39 is also formed in the cylinder member 26 midway of its ends, and is controlled by an inwardly opening valve 40.

The cylinder member 26 is provided on its outer side with a longitudinal enlargement 41 having a by-pass therethrough communicating by means of ports 42 with the end portion of said cylinder on opposite sides of the piston 27. Arranged longitudinally in this by-pass is a rotary hollow valve 43 having a passageway 44 therethrough and a plurality of ports 45 that are of different cross sectional area. The valve is provided with a projecting stem 46, on which is placed an exposed actuating wheel 47. By turning this wheel, it will be evident that the different ports 45 may be brought into communication with the ports 42, or said ports can be completely cut off.

Briefly described, the operation of the structure is as follows: Assuming the parts in the position shown in Fig. 2, it will be evident that as the electric motor or prime mover 7 rotates the crank disk 10, the piston 27 will be forced forwardly. Therefore as soon as said piston 27 moves across the more central annular groove 36, the air in advance of the same will be compressed while a partial vacuum will be created in rear of said piston. The driven hammer piston 19 will therefore move rearwardly. As soon as the piston 27 reaches the limit of its forward movement, it will uncover the rearmost annular groove 35, and consequently the air under pressure in advance of said piston will escape rearwardly through the grooves 35 and 37 until the pressure is equalized. The piston 19 continues its rearward movement under the pressure of the air, and afterward under its own momentum until its rear end passes the port 34^a, whereupon a cushion will be formed between the rear end of the piston, and the rear wall of the cylinder. The said piston 19 will thus be brought to a stop without material shock. Upon the rearward movement of the piston 27, the air will first pass through the port 34 and opening the valve 34^c will operate to move the piston 19 forward, until the pressure in rear of said piston 27 is relieved by its taking the position illustrated in Fig. 2. The hammer 19 now strikes against the tappet 24, and the blow imparted thereto is transmitted to the drill bit. In case, the tappet 24 should be advanced or its forward movement should not be properly resisted, the smaller portion 21 of the piston 19 will enter the pocket 23, and a cushion will thus be formed in advance of the larger diameter of the piston 19, so that no damage will be done to the machine. However, in case the tool is properly against the work, the piston 19 will not advance entirely beyond the port 33^a, and therefore upon the forward stroke of the piston 27, the air will pass directly through said port 33^a into the front end of the cylinder 14. The relief of the air in advance of the piston 27 at the ends of its stroke is important in that it relieves shock and jar that is otherwise imparted to the prime mover or motor. Yet, it will be evident that the piston 19 will continue its travel under its own momentum irrespective of this relief until its blow is struck, or its action cushioned, as above explained. The valve-controlled inlet 39 allows the machine to charge itself with atmospheric pressure before the small extension 21 enters its pocket, so that the vacuum is relieved.

The employment of the valve 43 is advantageous, for in starting the machine, this valve can be placed "wide open," so that during the initial movement of the piston 27, the air will flow freely back and forth on opposite sides of the same. Then, by turning the valve, smaller ports thereof may be brought into communication with the ports 42 and the piston 19 thus be gradually brought into operation. When the full force of the machine is desired, this valve is turned so that the ports 42 are entirely cut off. However, when it is desired to strike light blows, either set of the smaller ports 45 can be brought into communication with the ports 42, and by bringing the largest ports into such communication, the piston 19 may be made substantially inactive, so that the drill bits can be changed without stopping the machine.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art, without further description, and it will be understood that various changes in the size, shape, proportion and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. A pulsating apparatus, comprising a cylinder and a piston therein operating on a tool, a second cylinder having spaced ports

communicating with the first cylinder, a motor operated solid piston in the second cylinder, and means for equalizing the pressure on opposite sides of said solid piston at each end of its stroke, said means permitting the compression of fluid in advance of the piston during its stroke.

2. A pulsating apparatus, having a cylinder member and a piston operating therein, another cylinder member and a piston operating therein, and passageways connecting the end portions of the cylinder members, one of said cylinder members having by-passes in its end portions comprising annular grooves that are spaced apart a distance greater than the thickness of the piston therein, and channels connecting said grooves.

3. A pulsating apparatus provided with cylinders having ports communicating with their corresponding ends, a solid chamber piston located in one cylinder, a solid piston located in the other cylinder, one of said cylinders having spaced annular channels in each end, and longitudinal channels connecting the same, the channels being uncovered by the piston in said cylinder at the ends of its stroke.

4. A pulsating apparatus, having a cylinder having a reduced pocket in its front end, a driven piston in the cylinder having a reduced plug movable into and out of the pocket, a chuck carried by the cylinder, a tappet located in the chuck and extending into the pocket, a check valve located in the rear end of the cylinder, another cylinder, a reciprocatory piston operating therein, spaced ports connecting the front end of the latter cylinder with its former cylinder, one of said ports opening into the pocket, the other opening into said cylinder in rear of the pocket, and spaced ports connecting the rear ends of the cylinders, one of said latter ports opening in rear of the check valve, the other in advance of the same.

5. A pulsator having communicating cylinders, pistons located in the cylinders, a by-pass conduit located longitudinally of one of the cylinders and having communication therewith, and a valve located longitudinally in said conduit for controlling the same.

6. A pulsator having communicating cylinders, pistons located in the cylinders, a by-pass conduit located longitudinally of one of the cylinders and having communication at its ends therewith, and a rotary valve located longitudinally in said conduit for controlling the same, said valve having an actuating device located at the rear end of the cylinder.

7. A pulsating apparatus having communicating cylinders, pistons located in the cylinders, a by-pass conduit located longitudinally of one of the cylinders and having ports at its ends opening thereinto, a rotary tubular valve journaled longitudinally in said conduit and having lateral ports that move into and out of register with the ports of the conduit, and an operating device for the valve located in rear of the cylinder.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WILLIAM A. SMITH.

Witnesses:
JAS. R. ELMENDORF,
C. E. KAISER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."