J. W. CHADWICK.

FLUID MOTOR.

APPLICATION FILED APR. 21, 1916.

1,306,301. Patented June 10, 1919.

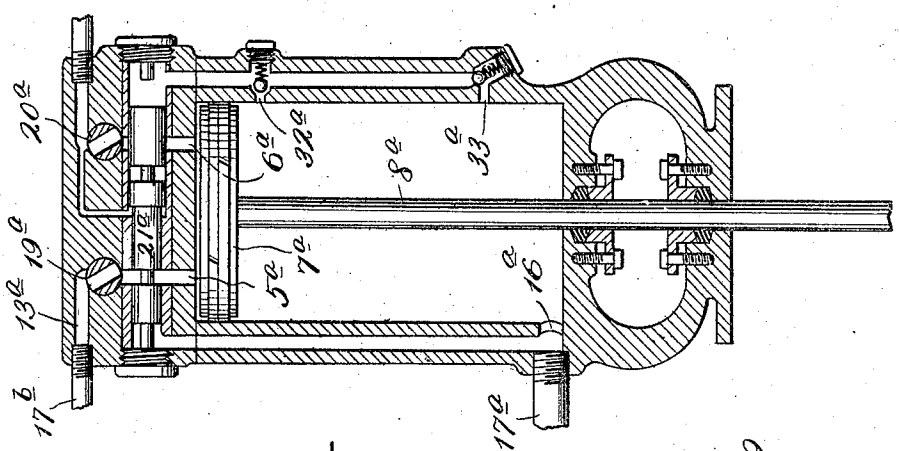


FIG. 3.

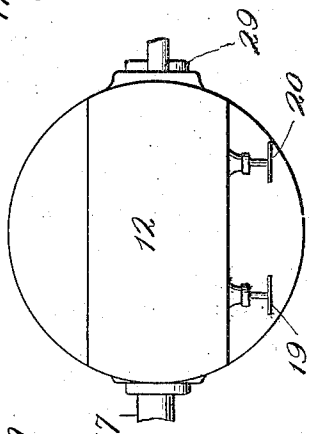
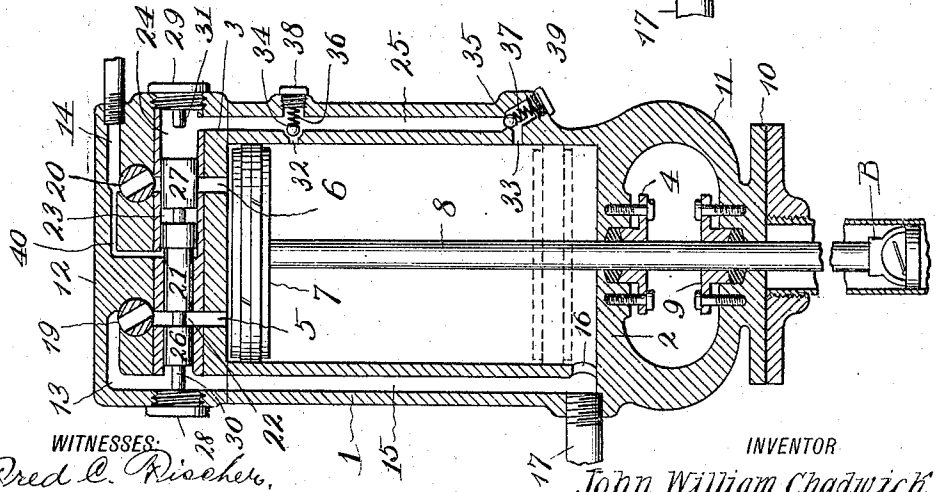


FIG. 2.

FIG. 1.



WITNESSES:

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FLUID-MOTOR.

1,306,301. Specification of Letters Patent. Patented June 10, 1919.

Application filed April 21, 1916. Serial No. 92,654.

To all whom it may concern:

Be it known that I, JOHN WILLIAM CHADWICK, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Fluid-Motors, of which the following is a specification.

My invention relates to improvements in fluid motors of that type in which an expansive medium such as steam, compressed air, etc., is employed as the motive force.

My objects are to produce an efficient motor of simple and inexpensive construction; one free of external working parts, and one whereby maximum power is obtained at a minimum consumption of motive fluid.

While susceptible to other uses my motor is particularly efficient in pumping deep wells of oil, water, brine, etc., as the novel construction and arrangement of the interior mechanism of said motor enables me to utilize the weight of the pumping mechanism in effecting the down stroke of the motor piston, so that only a minimum amount of motive fluid is required to coact with said weight in accomplishing the down stroke.

Other features will hereinafter appear, and in order that the invention may be fully understood, reference will now be made to the accompanying drawings, in which:

Figure 1 is a central vertical section of a motor constructed in accordance with my invention.

Fig. 2 is a plan view of the motor.

Fig. 3 is a central vertical section of a modified form of motor.

In carrying out the invention, I employ a vertically-disposed cylinder 1 closed at its ends by cylinder heads 2 and 3, the lower one of which has a stuffing box 4, while the upper one has inlet and outlet ports 5 and 6, respectively.

7 designates a piston reciprocably mounted in the cylinder 1 and provided with a relatively heavy piston rod 8, extending down through the stuffing box 4 and also through a stuffing box 9 in a cap 10 connected by a yoke 11 to the cylinder head 2.

12 designates a valve chest mounted upon the cylinder head 3 and having inlet and exhaust ducts 13 and 14 to communicate with inlet and outlet ports 5 and 6, respectively. The duct 13 communicates with a duct 15 extending vertically through the cylinder wall and communicating at its lower end with a port 16, in the lower end of the cylinder 1. A supply pipe 17 threaded into the lower portion of the cylinder 1 communicates with the duct 15 and the port 16.

The flow of motive fluid through the ducts 13 and 14 is manually controlled by valves 19 and 20 and automatically controlled by an unbalanced slide valve 21 having ports 22 and 23 to alternately communicate with said ducts 13 and 14, respectively, as will hereinafter appear. The unbalanced valve 21 is reciprocably mounted in a chamber 24, communicating at one end with the ducts 13 and 15 and at its opposite end with a duct 25, vertically arranged in the cylinder wall at a point diametrically opposite the duct 15.

As disclosed by Fig. 1, the unbalanced valve 21 has terminals of different area, the small area 26 being adjacent the ducts 13 and 15 and the large area 27 being adjacent the duct 25, for purposes which will hereinafter appear. Plugs 28 and 29 are threaded into the steam chest at opposite ends of the chamber 24 and provided with stops 30 and 31, respectively, for the adjacent ends of the valve 21 to abut.

The duct 25, in addition to communicating with one end of the chamber 24, communicates with the interior of the cylinder through ports 32 and 33 in which ball-check valves 34 and 35 are yieldingly seated by coil springs 36 and 37, respectively. A relief port 40 extends from the chamber 24 to the exhaust duct 14, for a purpose which will hereinafter appear. The port 32 is located a distance below the cylinder head 3, slightly greater than the thickness of the head of piston 7, while the port 33 is located a distance above the cylinder head 2, slightly greater than the thickness of the head of said piston 7. Hence the piston head successively passes said ports 32 and 33, at each stroke.

The operation is as follows: Motive fluid at its maximum pressure enters the port 16 beneath the piston 7 and forces the same toward the top of the cylinder 1. As the piston 7 travels upward the inlet port 5 is closed by the valve 21, while the outlet port 6 is open to permit the motive fluid above the piston to exhaust through the outlet duct 14. When the piston 7 passes above the port 32, the check valve 34 is forced open by the motive fluid, a portion of which enters the

duct 25 and the chamber 24. The check-valve 34 is closed by the spring 36, after the pressure in the duct 25 is substantially equal to the pressure below the piston 7. As the fluid enters the chamber 24, as above described, it acts upon the large area of the valve 21 and shifts the same to the left, Fig. 1, thus closing the outlet port 6 and opening the inlet port 5, so that fluid may enter the cylinder above the piston 7 and, aided by the weight of the pumping mechanism B connected to the piston rod 8, force the piston 7 on its down stroke. As the piston is aided on its downward stroke by its own weight and the weight of the parts attached thereto, it necessarily follows that the motive force entering the inlet port 5 may be proportionally reduced for the sake of economy and this is accomplished by partly closing the valve 19. As the piston travels below the port 33 and thus cuts off the high pressure therefrom, the high pressure motive fluid which entered the duct 25 and the chamber 24 through the port 32, unseats the valve 35 and returns to the cylinder through the port 33, after which said valve 35 is closed by the spring 37. This relieves the large area of the valve 21 of high pressure and consequently said valve is again shifted to the right against the stop 31 by the high pressure fluid constantly acting upon the small area of the valve 21. As the valve 21 shifts to the right it closes the inlet port 5 and opens the outlet port 6, so that the piston may be again forced upward by the high pressure beneath the same.

When the piston 7 travels downward the greater portion of the high pressure fluid is forced thereby back into the supply pipe 17 for further use, as only sufficient fluid is permitted to flow through the valve 19 to coact with the piston load to force said piston on its downward stroke.

When the valve 21 is in the position disclosed by Fig. 1, any leakage of motive fluid around the intermediate portion of said valve escapes through the relief port 40, and hence will not tend to overbalance the pressure on the large area of said valve and shift the same to the right.

From the foregoing description, it is apparent that while motive fluid of comparatively high pressure is employed to move the piston on its upstroke, only a small part of said motive fluid is required to force the piston downward. Hence the escape of motive fluid through the exhaust duct 14 is reduced to a minimum.

In the modified form disclosed by Fig. 3, the construction and operation are substantially the same as that disclosed by Fig. 1, except that motive fluid of high pressure never reaches the inlet duct 13^a, as the same communicates through a supply pipe 17^b with a source of supply of much less pressure than that with which the supply pipe 17^a communicates. This construction renders it unnecessary to reduce the high pressure fluid to lower pressure before acting on top of the piston and also renders the valve 19^a less liable to leakage, as it is never subjected to high pressure. As the parts of the modified form bear the same numerals with exponents as the corresponding parts of the preferred form disclosed by Fig. 1, it is deemed unnecessary to enter into a further description of the construction and operation of said modified form.

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

In a motor of the character described, a vertically-disposed cylinder having a constantly open port at its lower end and inlet and outlet ports at its upper end, an unbalanced valve to alternately open and close the inlet and outlet ports of said upper end, longitudinal ducts in the cylinder wall to conduct motive fluid to the ends of said valve to actuate the same, two ports leading into the cylinder from one of the ducts, one of said ports being located below the upper cylinder head a distance slightly greater than the thickness of the piston head, the other port being located above the lower cylinder head a distance slightly greater than the thickness of said piston head, a relatively heavy piston in the cylinder, and check valves coacting with said piston to control the passage of motive fluid through the two last-mentioned ports, so that the pressure on one side of the unbalanced valve will vary sufficiently to effect the operation of the same.

In testimony whereof I affix my signature in the presence of two witnesses.

JOHN WILLIAM CHADWICK.

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