

APPLICATION FILED SEPT. 23, 1913.

2 SHEETS--SHEET 1.

Fig. 1.

Fig. 3.

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Fig. 3.

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 ROTARY FLUID PRESSURE MOTOR.  
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1,124,409.

Patented Jan. 12, 1915.

2 SHEETS—SHEET 2.

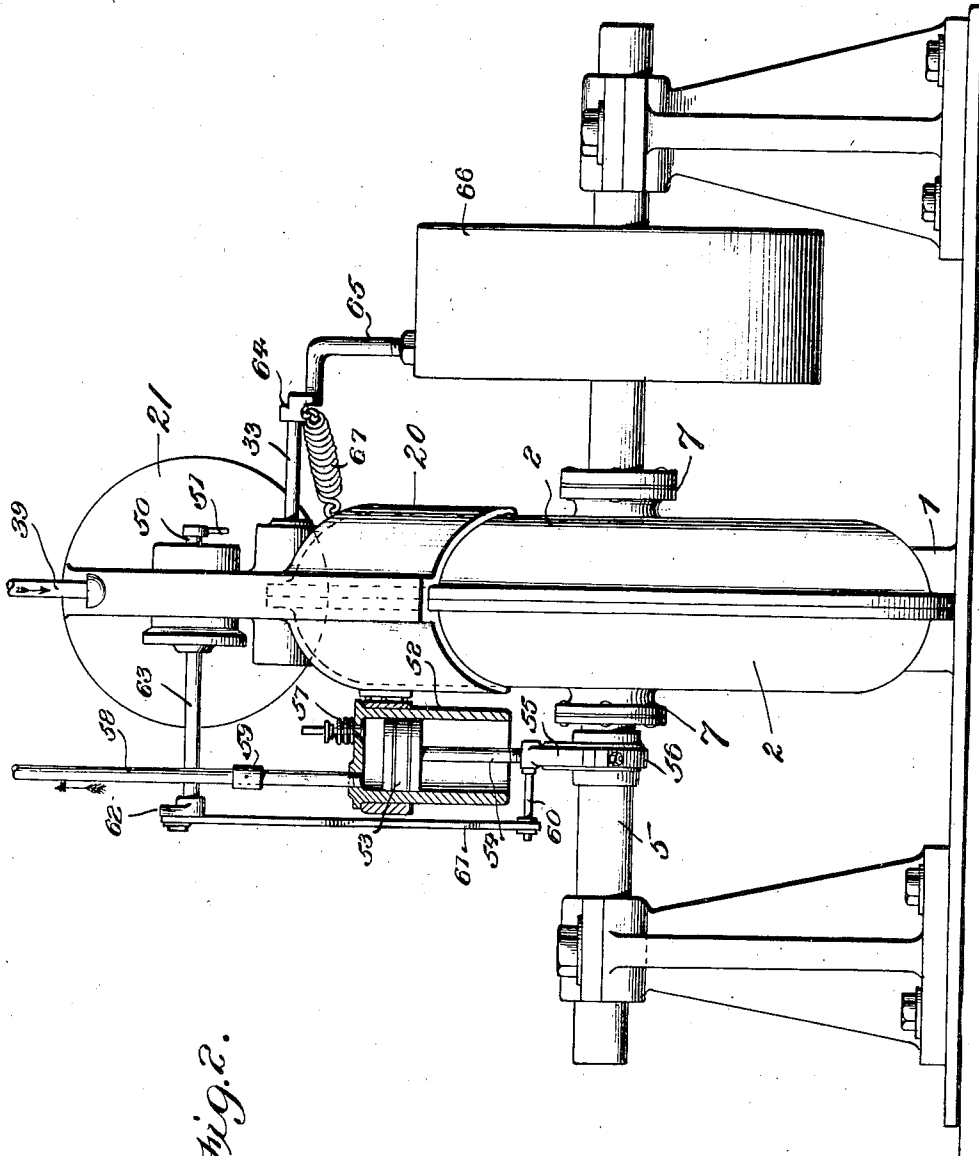


Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## ROTARY FLUID-PRESSURE MOTOR.

1,124,409.

Specification of Letters Patent.

Patented Jan. 12, 1915.

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*To all whom it may concern:*

Be it known that I, FRANCIS M. FLOYD, citizen of the United States, residing at Elkville, in the county of Jackson and State of Illinois, have invented certain new and useful Improvements in Rotary Fluid-Pressure Motors, of which the following is a specification.

This invention relates to rotary fluid pressure motors and more particularly to that type in which the fluid under pressure is in the nature of the products of combustion of a gaseous explosive mixture.

As is well known, in the ordinary type of rotary explosive engines the pistons directly receive the impact of the mixture as it is exploded, but in a motor so constructed there is always considerable vibration, which it is the primary object of the present invention to obviate.

In the motor embodying the present invention the impact of the exploded charge is not received directly by the piston but is absorbed and the products of combustion subsequently directed with great velocity against the piston. In accomplishing this result the charge is first exploded in the combustion chamber which at the time of the explosion of the charge is out of communication with the piston chamber and after the force of the explosion has been absorbed in the combustion chamber the exploded charge or the products of combustion are conducted to the piston chamber and directed against the piston head therein.

In the accompanying drawings: Figure 1 is a vertical longitudinal sectional view through the motor embodying the present invention. Fig. 2 is a view in front elevation thereof. Fig. 3 is a horizontal sectional view on the line 3—3 of Fig. 1.

In the drawings the base of the motor is indicated by the numeral 1 and supports the sections of the casing which constitutes the body of the motor and forms the piston chamber as will be presently explained. These casing sections are of annular form and are indicated each by the numeral 2, they being provided with peripheral flanges bolted together as at 4.

The motor shaft is indicated by the numeral 5 and keyed or otherwise fixed thereon is the rotor 6 of the motor, which rotor carries the piston head as will be presently explained.

The casing sections 2 are provided axially each with stuffing box 7 fitting the motor shaft 5 and the outer portions of the sections are in cross section substantially semi-circular as indicated at 8 so that when the sections are assembled there will be provided an annular piston chamber 9. In order to prevent leakage of the fluid from this chamber, annular packing rings 10 are seated in grooves 11 formed in the contacting sides of the casing sections and rotor 6 immediately inwardly of the portions 8 of the casing sections. The support for the piston head is preferably in the nature of a block 12 which is fitted into a recess 13 formed in the periphery of the rotor 6 and held in place by means of a transverse pin 14 in the manner shown in Fig. 1 of the drawings. This block projects beyond the periphery of the rotor 6 and disposed against the block is the piston head which is indicated by the numeral 15, this head being of a diameter to fit snugly within the piston chamber 9 and is secured in place against the face of the block by means of a bolt 16 or any other suitable fastening element. It will be observed by reference to Fig. 1 that the working face of the piston head 15 is substantially radial to the axis of the rotor and in order that the full force of the driving fluid may be received by the piston there is secured to this said working face a supplemental head 17 having a working face 18 which is angularly disposed with respect to the working face of the head 15 and which is approximately tangential to the periphery of the rotor.

The piston chamber is provided preferably near its top with an inlet port 19 through which the fluid under pressure is admitted and it will be observed that this port passes through the wall of the casing on such a line that the motor fluid issuing therefrom will flow directly toward the face of the piston head 15 and the face 18 of the supplemental head 17.

As before stated, the motor includes in its structure a combustion chamber and this chamber includes a base 20 which is secured in any suitable manner upon the top of the casing 2. The casing is in the form of a cylinder 21 which is divided at a point between its ends by a partition 22 having a central opening through which is slidably fitted a rod 24 having secured at one end an

impact head 25 fitting slidably within the cylinder at one end thereof. This impact head, as will be presently explained, constitutes a head of the explosion chamber and may yield at the time the explosion takes place. A spring 26 is fitted upon the rod 24 and bears at one end against the head 25 and at its other end against the partition 22 and serves to yieldably resist the movement of the head 25 toward the said partition. Fixed upon the outer end of the rod 24 is a piston head 27 working in the other end of the cylinder and located at the other side of the partition 22 and disposed upon the rod 24 between the head 27 and the partition 22 is a spring 28 which serves to cushion the movement of the head 25 in a direction away from the partition 22 or more specifically speaking, toward the closed or fixed end or head 29 of the cylinder. At this end the cylinder is provided with a port 30 which registers with the port 19, and mounted for oscillatory movement in a bore 31 intersecting the port 30, is a valve 32, the stem 33 of which extends at one end exteriorly of the casing or cylinder. This valve is to be oscillated in a manner to be presently explained so as to open and close the port 30 to control the admission of the motor fluid to the piston chamber 9. The cylinder 21 at its outer end is open and in its open end is arranged a valve seat 34 having openings 35 establishing communication between the interior of the cylinder at this end thereof and the atmosphere. These openings are normally closed by a check valve 36 yieldably held to its seat by means of a spring 37. It may be stated at this point that when the valve is resting against its seat the cylinder at its outer end will be closed to the atmosphere and it will, therefore, be apparent that air confined within this end of the cylinder will serve to cushion the movement of the piston head 27 upon movement of the impact head 25 toward the partition 22. The base 20 for the cylinder 21 is formed with a passage 38 in communication with which is a pipe 39 leading from an air tank 40. A passage 41 is also formed in the base and is in communication with a liquid fuel supply pipe 42. A three-way valve 43 is mounted for oscillatory movement in the base and has branches 45 and 46 adapted to be brought into registration with the passages 38 and 41 respectively. The other branch 47 of this valve is designed to register with one end of a passage 48 which communicates with the interior of the combustion chamber through the head 29 of the cylinder. A throttle valve 49 is mounted in the base 20 and may be rotated to control the passage of the explosive mixture through the passage 48 to the combustion chamber. One end of the stem of this valve extends ex-

teriorly of the base as indicated at 50 and is provided with a hand lever 51 by means of which the valve may be manipulated.

In order that air may be supplied to the tank 40 and stored therein under pressure, there is provided an air pump which includes a cylinder 52 mounted upon one side of the base 20 directly above the motor shaft 5. A piston 53 works within the cylinder 52 and the rod of this piston, indicated at 54, is connected to the strap 55 of an eccentric 56 fixed upon the motor shaft, it being understood that upon rotation of the said shaft reciprocatory motion will be imparted to the piston. Air is admitted to the closed end of the cylinder by a check valve 57 and is led from the cylinder by way of a pipe 58 which communicates with the tank 40 and in which is interposed a suitable check valve 59. At this point it will be understood that as the piston is reciprocated air will be forced through the pipe 58 into the storage tank 40. As a means for operating the valve 43 the strap 55 of the eccentric is provided with a laterally projecting pin 60, to which is connected the lower end of a rod 61 fitted at its upper end to an arm 62 fixed upon the stem of the said valve 43, this stem being indicated by the numeral 63. It will now be apparent that as the motor shaft is rotated oscillatory movement will be imparted to the arm 62 thereby rocking the valve 43 so as to successively open and close the passages 38, 41 and 48, simultaneously.

As a means for operating the valve 32 automatically the stem of this valve is provided with a tappet arm 64 coöperating with which is a finger 65 mounted upon the fly wheel 66 for the motor, which fly wheel is secured upon the shaft 5. A spring 67 is connected to the arm 64 and normally holds the same in the path of movement of the finger 65 and in position to close the valve 32, it being understood that at each revolution of the shaft 5 the arm 64 will be engaged by the finger 65 and the valve 32 will be rocked to open position to establish communication, momentarily, between the combustion chamber and the power chamber.

Fitted in the wall of the cylinder 21 is a spark plug 68 of any ordinary type.

In order that lubrication may be supplied to the impact head 25 and piston head 27 the wall of the cylinder is formed with an oil passage 69 having branches 70 which communicate with the interior of the cylinder 21 at opposite sides of the partition 22 therein, a lubricator 71 having its stem fitted in the said passage 69. By reference to Fig. 1 it will be observed that the branches 70 of the passage 69 are in communication with each other and consequently they form a bypass for the air within the cylinder between the heads 25 and 27 and there-

by prevent compression of the air between these heads and the partition 22 as the heads reciprocate.

The operation of the motor is as follows:

5 As the parts are illustrated in Fig. 1 of the drawings the valve 32 has been opened by the engagement of the finger 65 with the tappet arm 64 and the fluid in the combustion chamber has been allowed to enter the  
10 piston chamber 9 and forcibly strike the piston head 15. As the finger 65 rides out of engagement with the tappet arm 64 the spring 67 will act upon this arm to quickly close the valve 32 and the parts are so ad-  
15 justed that immediately following the closing of this valve the valve 43 will be opened allowing air under pressure from the tank 40 to flow through the passage 38, thereby sucking into the passage 48 a suit-  
20 able volume of the explosive fluid entering through the passage 41. As this mixture leaves the end of the passage 48 the liquid fuel will be atomized and the required vol-  
25 ume of gaseous explosive mixture having been supplied to the combustion chamber the valve 43 automatically closes and the mixture is fired. The impact due to the explosion of the charge within the combus-  
30 tion chamber will act directly against the impact head 25 and this head will be momentarily forced in the direction of the partition 22 against the tension of the spring 26. The spring 26, after the force  
35 of the impact has been expended or absorbed, will then begin to act to return the impact head to its normal position or to the position shown in Fig. 1 and at the same  
40 time the finger 65 will again engage with the tappet arm 64, thereby opening the valve 32 and allowing the products of com-  
45 bustion, which are, as will be readily understood, under great pressure, to enter the piston chamber at a high velocity and im-  
50 pinge against the piston of the rotor therein with sufficient force to drive the rotor around the power piston chamber. As the piston passes the exhaust port 72 which is  
55 provided in one wall of the piston chamber, the fluid is allowed to exhaust and the piston again assumes a position in advance of the inlet port 19. The operation heretofore  
60 described has been in the meantime repeated and as the piston assumes about the position shown in Fig. 1 the valve 32 will  
again be opened to admit a fresh charge of fluid. It will be apparent that as the im-  
65 pact head 25 is forced toward the partition 22 the air contained in the cylinder 21 between the valve seat 34 and the piston  
head 27, will be compressed and will there-  
by serve to cushion such movement of the parts, the return movement of the parts being cushioned by the spring 28.

If desired, the wall of the cylinder 21 may

be provided with a suitable water jacket 65 indicated by the numeral 73.

From the foregoing description of the invention it will be seen that in the operation of the motor the impact of the explosion is not borne by the piston 15 but by the yield-  
70 able impact head 25 of the combustion chamber and consequently there will be practically no vibration of the motor when running.

Having described my invention, what I  
75 claim is:

1. In a motor of the class described, the combination with a piston and its chamber, of a combustion chamber disposed approxi-  
80 mately tangential to the piston chamber, a cushioning head within the combustion chamber and constituting one wall of the chamber, means for admitting an explosive  
charge to the combustion chamber, means  
85 for exploding the charge, ports forming communication without change of direction between one end of the combustion chamber and the piston chamber, and means operat-  
90 ing to close communication between the chambers at the period of explosion of the charge and to open communication between  
said chambers subsequent to such period.

2. In a motor of the class described, the combination with a piston and its chamber, of a combustion chamber arranged approxi-  
95 mately tangential to the combustion chamber, a spring-pressed impact head within the combustion chamber constituting one wall thereof, means for admitting an explosive  
charge to the combustion chamber, means  
100 for exploding the charge, and means operating to close communication between the chambers at the period of explosion of the charge and to open communication with  
said chambers subsequent to such period.

3. In a motor of the class described, the combination with a piston and its chamber, of a combustion chamber communicating  
105 directly with the piston chamber, an impact head slidably mounted in said combustion chamber, a spring bearing against said head and resisting its sliding movement in one  
direction, means for admitting an explosive  
charge to the combustion chamber, means  
110 for exploding the charge, and means operating to close communication between the chambers at the period of explosion of the charge and to open communication between  
said chambers subsequent to such period,  
115 whereby the expansion of the spring will force the exploded charge directly against the piston.

4. In a motor of the class described, the combination with a piston and its chamber, of adjacent combustion and air chambers,  
120 an impact head slidably mounted in the combustion chamber, a piston head slidably mounted in the air chamber, a connection

between the heads, springs bearing against noncorresponding sides of the heads, means for admitting an explosive charge to the combustion chamber, means for exploding the charge, and means operating to close communication between the combustion and piston chambers at the period of explosion of the charge and to open communication between said chambers subsequent to such period.

5. In a motor of the class described, the combination with a piston and its chamber, of a combustion chamber, an air compression chamber, a partition dividing the chambers, an impact head mounted for sliding movement in the combustion chamber, a piston head mounted for sliding movement in the air compression chamber, a connection between the heads, a spring bearing against each side of the partition and against the respective heads, means for admitting an explosive charge to the combustion chamber, means for exploding the charge, and means operating to close communication between the combustion and piston chambers at the period of explosion of the charge and to open communication between said chambers subsequent to such period.

6. In a motor of the class described, the combination with a piston and its chamber, of a combustion chamber arranged approximately tangential to the piston chamber and having direct communication therewith, a head mounted within the chamber and adapted to yield at each explosion within the chamber, means tending to return the head to initial position, means for cushioning the head in each direction of its travel, means for admitting an explosive charge to the chamber, means for exploding the charge, and means operating to close communication between the chambers at the period of explosion of the charge and to open communication between said chambers subsequent to such period.

7. In a motor of the class described, a motor shaft, a piston chamber, a piston carried by the shaft for rotation therewith and working in said chamber, a combustion chamber, a fuel inlet, an air inlet, said fuel inlet and air inlet having a common com-

munication with the combustion chamber, a pump actuated by said shaft for supplying air through the air inlet to mingle with the fuel and form the explosive charge entering the combustion chamber, means for exploding the charge, and means operating to close communication between the chambers at the period of explosion of the charge and to open communication between said chambers subsequent to such period.

8. In a motor of the class described, a motor shaft, a rotor fixed upon the said shaft, a piston casing, a piston head carried by the rotor and working in said casing, the casing having an inlet port, a supplemental head secured to the piston having a working face angularly disposed relative to the working face of the piston-head to be presented toward said port when the piston is in advance thereof, and a combustion chamber communicating with the piston chamber through said inlet port.

9. The combination of a working chamber, a piston therein, a motor shaft actuated by said piston, a combustion chamber, a fuel supply port, an air supply port, a single port forming a communication between the combustion chamber and the fuel supply and air supply ports, a valve common to all said ports, operative connections between the motor shaft and said valve to control admission to the combustion chamber, means for igniting a charge in the combustion chamber, and means for establishing communication between the combustion chamber and the working chamber.

10. The combination of a working chamber, a combustion chamber in connection therewith, an air chamber, pistons in the combustion chamber and the air chamber, a connection between said pistons, means for cushioning the travel of the pistons in both directions, and a by-pass between the air chamber and the combustion chamber.

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

FRANCIS M. FLOYD. [L. S.]

Witnesses:

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R. B. AKEN.