J. M. LIVELY.

ROTARY ENGINE.

APPLICATION FILED MAY 11, 1909.

951,479. Patented Mar. 8, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

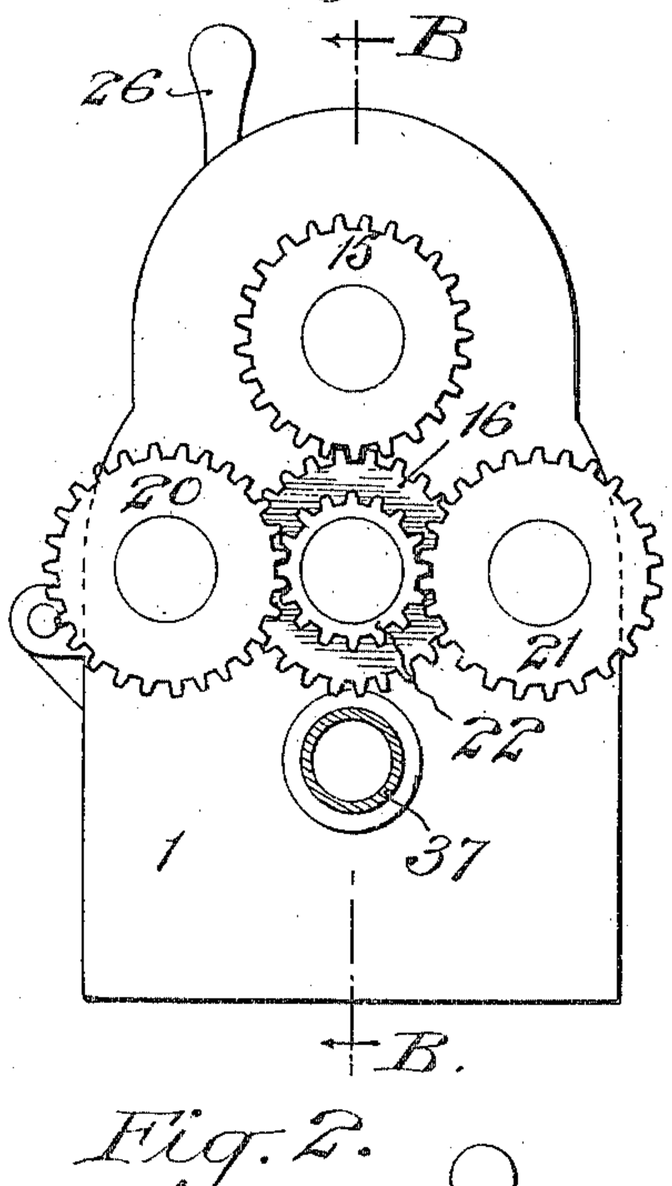

Fig. 3.

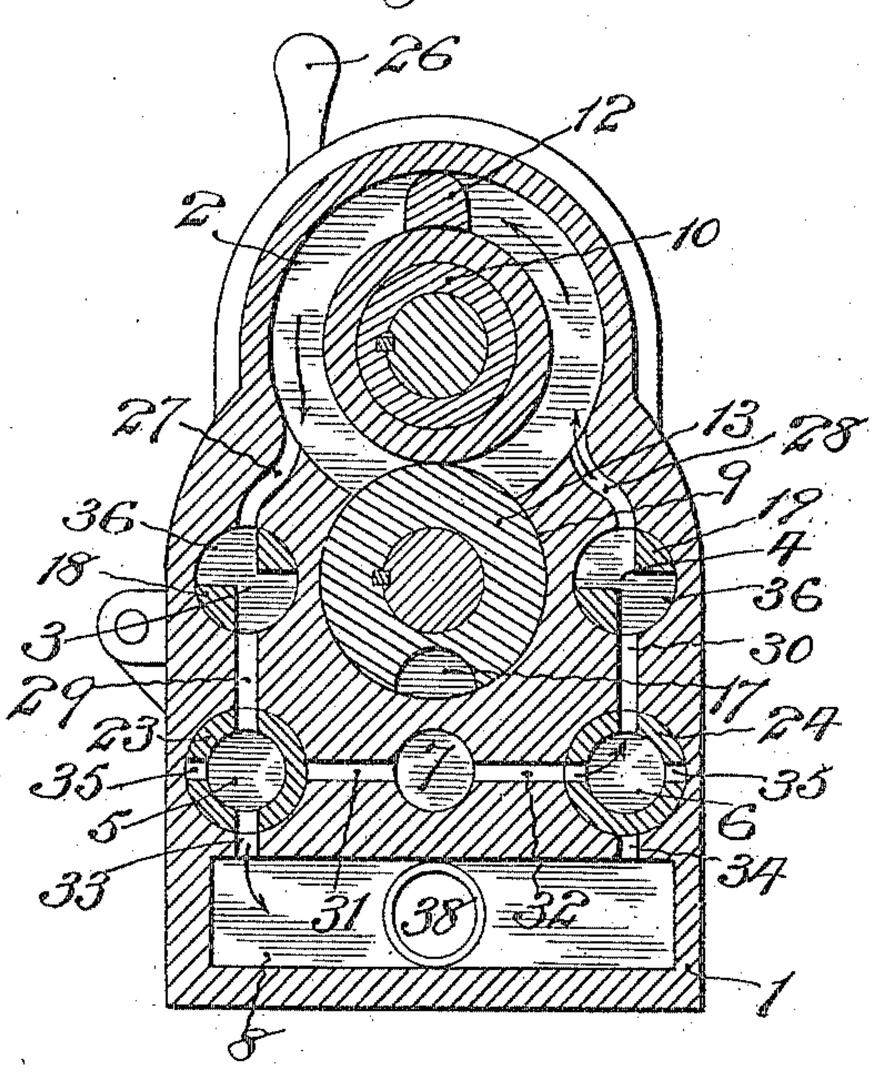

Fig. 2.

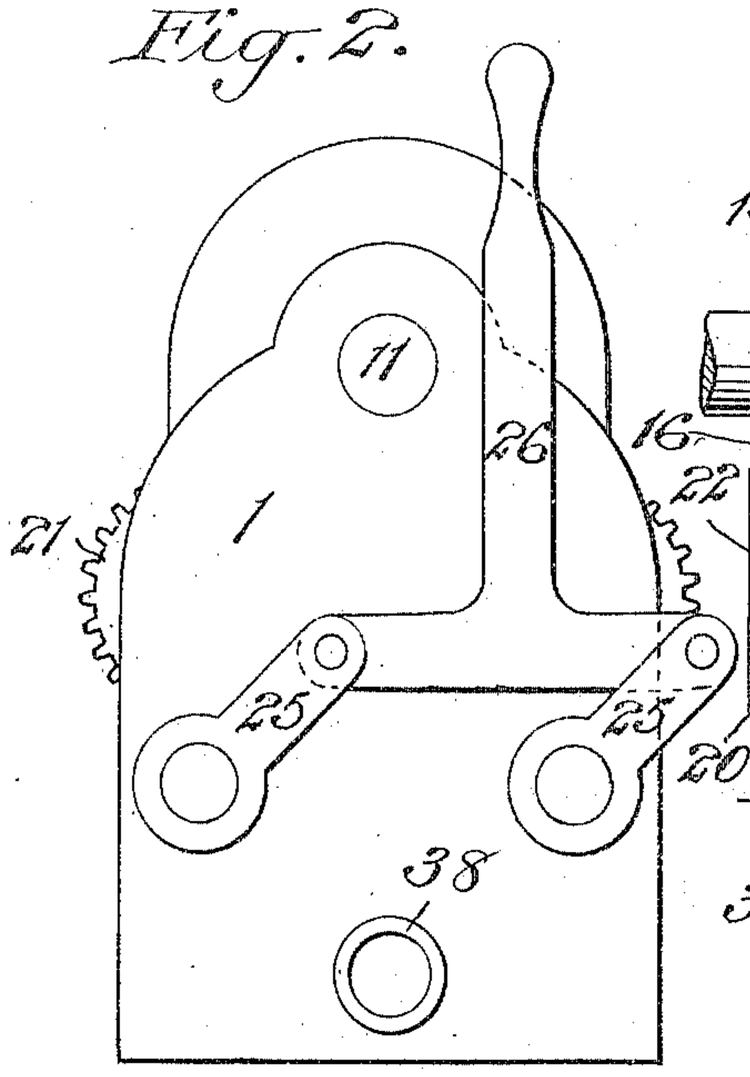

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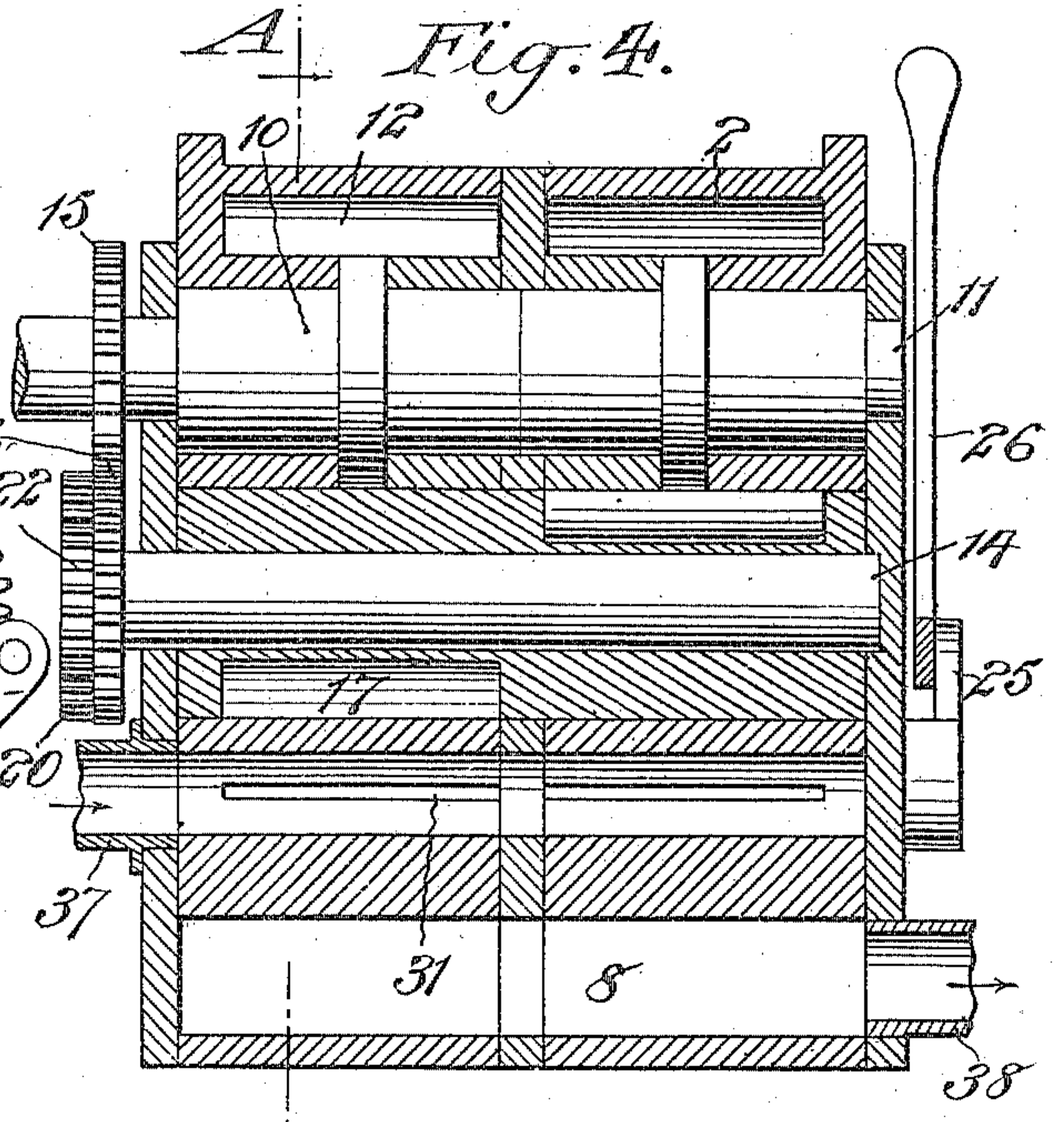
Fig. 4.



A

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2 SHEETS—SHEET 2.

Fig. 5.

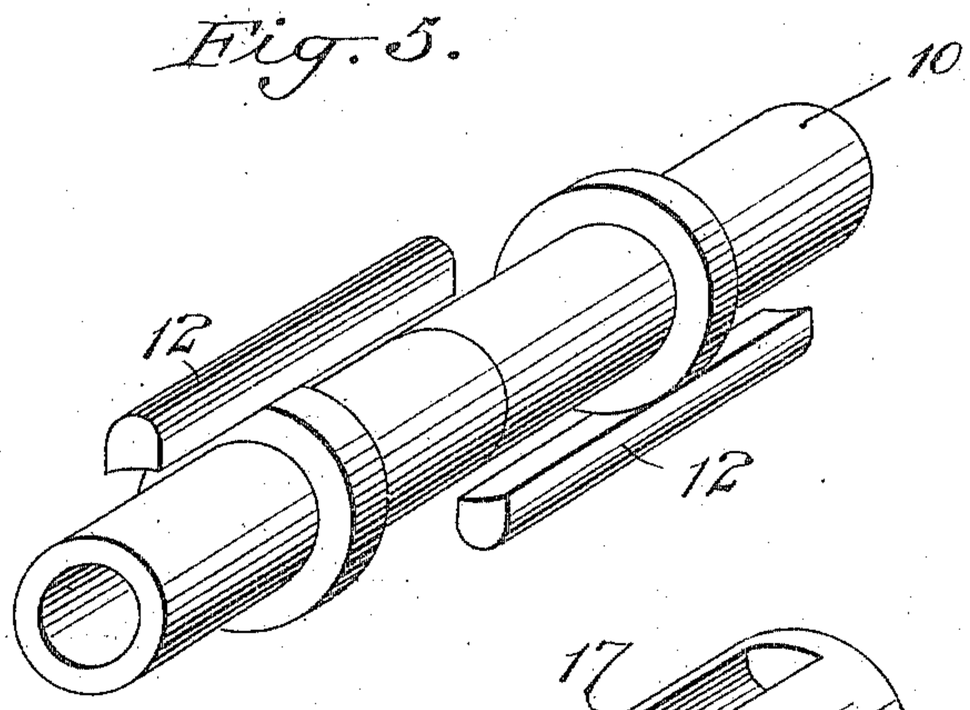


Fig. 6.

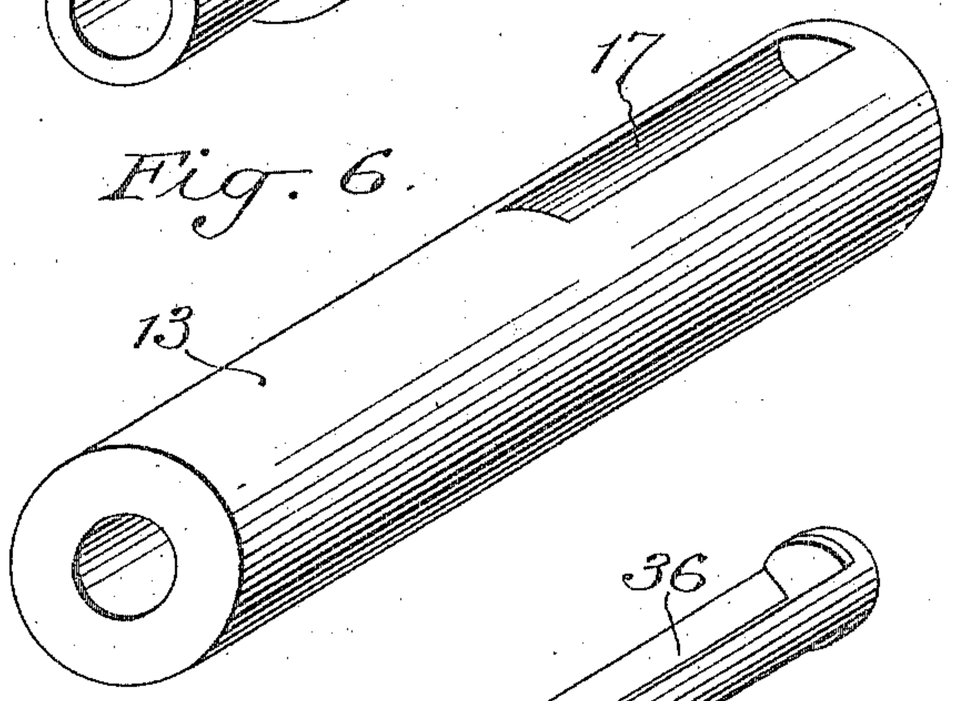


Fig. 7.

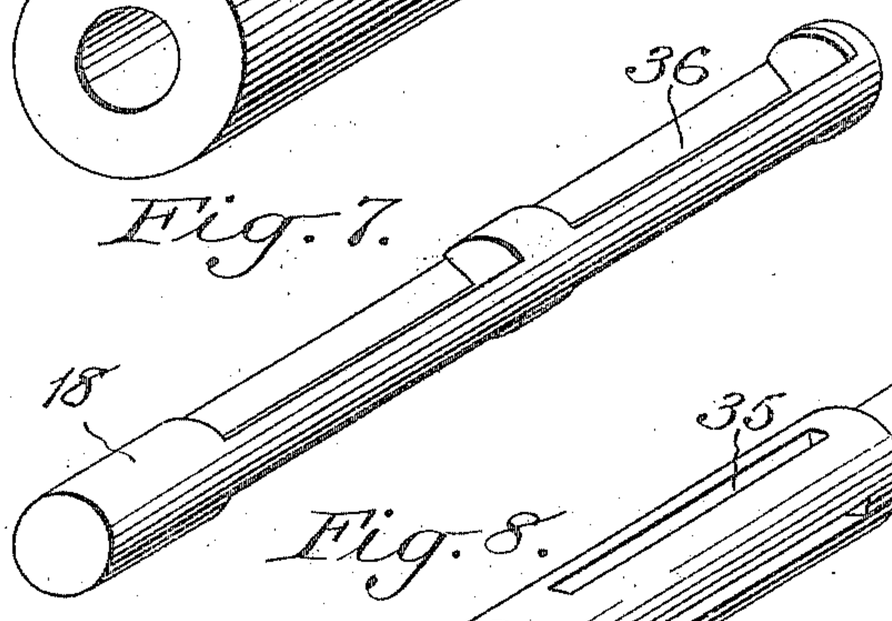
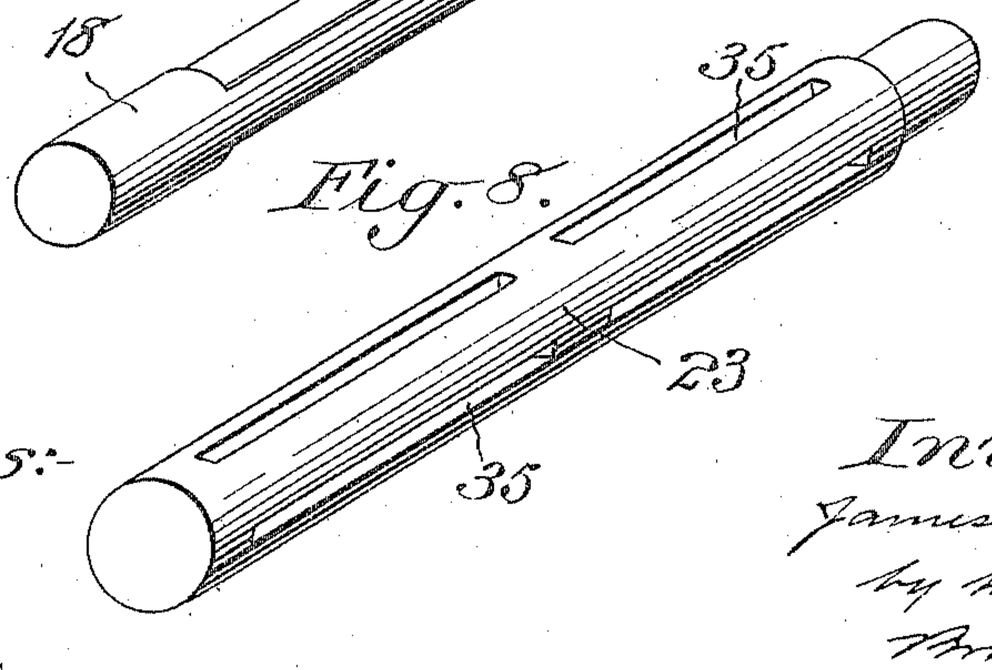


Fig. 8.



Witnesses:-
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UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

951,479. Specification of Letters Patent. Patented Mar. 8, 1910.

Application filed May 11, 1909. Serial No. 495,259.

To all whom it may concern:

Be it known that I, JAMES M. LIVELY, a citizen of the United States, and resident of the borough of Brooklyn, in the city and State of New York, have invented a new and useful Improvement in Rotary Engines, of which the following is a specification.

This invention relates to rotary engines, with the object in view of providing a machine of this character in which both the expansive and kinetic force of the motive fluid may be made available.

Another object is to provide such a device in which the valves are arranged so as to permit of a complete reversal of function.

A further object is to provide means for filling the pocket in the rotary abutment with live motive fluid to facilitate the rotation of the abutment.

A still further object is to provide valves of such shape that the passage of the motive fluid therethrough will facilitate their operation.

A still further object is to provide certain improvements in the form, construction and arrangement of the various parts whereby the above-mentioned objects may be effectively accomplished.

A practical embodiment of my invention is represented in the accompanying drawings, in which—

Figure 1 represents my rotary engine in end elevation showing the synchronizing gears, Fig. 2 represents an end elevation opposite to Fig. 1, Fig. 3 represents a vertical central section taken in the plane of the line A—A of Fig. 4, looking in the direction of the arrows, Fig. 4 represents a vertical central section taken in the plane of the line B—B of Fig. 1, looking in the direction of the arrows, Fig. 5 represents a detail view in perspective of the rotary piston, Fig. 6 represents a similar view of the rotary abutment, Fig. 7 represents a similar view of one of the rotary inlet and exhaust valves, and Fig. 8 represents a similar view of one of the manually operated valves.

I have chosen to illustrate my invention as embodied in a two-cylinder rotary engine in which there is a duplication of similar parts; but in the following description I shall confine myself to describing a single set of parts which would be used in connection with one of the cylinders.

The casing of the engine is denoted by 1 and is provided near its top with a transverse cylindrical piston chamber 2; near its opposite sides with transverse cylindrical valve chambers 3, 4, and 5, 6; near its bottom with an inlet chamber 7 and exhaust chamber 8; and about centrally with a transverse rotary abutment chamber 9. Within the piston chamber 2 is located a rotary piston 10, having its ends journaled in the casing (as indicated at 11) and provided with a piston head 12. Immediately below the piston 10 and intersecting the piston chamber 2, so as to be in contact with the piston, and located within the abutment chamber 9, I provide a rotary abutment 13, the ends of which are also journaled in the casing (as indicated at 14). This abutment is geared to the rotary piston in equal ratio by the gears 15, 16, and is provided with a pocket 17 for receiving the piston head 12 and permitting it to pass as the piston and abutment rotate. The gears 15, 16, being direct connected, cause the piston and abutment to rotate in opposite directions, and the ratio being equal permits of their being synchronized so that the piston head and pocket always meet in proper relation to each other.

The valve chambers 3, 4, are adapted to receive rotary double headed valves 18, 19, which are provided with solid ends journaled in the casing 1. These valves are geared to the rotary abutment by the two-to-one gears 20, 21, 22, this ratio being necessitated by the fact that the rotary valves, having two heads, would open and close communication to the piston chamber twice during each revolution of the piston if geared in equal ratio therewith. The gears 20, 21, being engaged by the same gear 22 are both driven so as to rotate in the same direction.

Directly beneath the rotary valves 18, 19, and mounted in the valve chambers 5, 6, are the manually operated valves 23, 24, which are also provided with solid ends fitted in journals in the casing 1. Levers 25 connected to a suitable T-handle 26 are provided for operating the valves 23, 24. The rotary valve chambers 3, 4, are connected with the piston chamber 2 by conduits 27, 28, arranged substantially at a tangent thereto, and with the manually operated valve chambers 5, 6, by conduits 29, 30.

The manually operated valve chambers are connected with the inlet chamber 7, by

the conduits 31, 32, and with the exhaust chamber 8, by conduits 33, 34.

The manually operated valves 23, 24, are provided with suitable ports 35, in the present instance three in each valve; and are adapted for opening and closing communication between the valve chambers 5, 6, and the valve chambers 3, 4, inlet chamber 7, and exhaust chamber 8: while the rotary valves 18, 19, are provided with suitable ports 36, in the present instance two in each valve; and are adapted for opening and closing communication between the valve chambers 3, 4, and the piston chamber 2, and valve chambers 5, 6. A pipe 37 serves to conduct the motive fluid from a source (not shown), to the inlet chamber 7; while another pipe 38 serves to open communication between the exhaust chamber 8 and atmosphere.

In operation, the manually operated valves 23, 24, may be set as shown in Fig. 3, and the piston 10 may be at rest in the position indicated in the same figure. Motive fluid is then admitted through the pipe 37 to the inlet chamber 7; it then passes through the conduit 32, valve chamber 6, conduit 30, valve chamber 4, and conduit 28, to the piston chamber 2, where it impinges against the piston head 12, and its kinetic energy causes the piston 10 to rotate in the direction indicated by the arrows. As the piston rotates from the position shown in Fig. 3 the rotary valve 18 gradually closes and is entirely closed when the piston has moved about one-fourth of a revolution from the position indicated. At the same point in the revolution of the piston, the rotary valve 19 closes, imprisoning a certain amount of motive fluid within the piston chamber 2 and the expansive force of this imprisoned motive fluid, together with the momentum of the piston, continues the latter rotating. After the piston head 12 has passed through the pocket 17, the valve 18 opens and permits the exhaust to escape through the valve chamber 3, conduit 29, valve chamber 5, conduit 33, into the exhaust chamber 8, and thence through the pipe 38 to atmosphere. This operation continues with a rapidly increasing speed of rotation of the piston, due to the fact that there are no reciprocating parts.

By moving the handle 26, the manually operated valves 23, 24, may be turned a part of a revolution, so that the valve 23 will communicate with the inlet chamber 7 and be cut off from the exhaust chamber 8, while the valve 24 will communicate with the exhaust chamber 8 and be cut off from the inlet chamber 7. Thus I may produce a complete reversal of functions of the valve, and cause the piston to rotate in the opposite direction. Furthermore, by means of the handle 26, the valves 23, 24, may be operated so as to admit more or less motive fluid to the piston chamber, thus regulating the speed of the engine. Each time the pocket 17 in the rotary abutment 9 passes through the piston chamber 2, it becomes filled with live motive fluid from the conduit 28, and carries the same around in its revolution, the motive fluid contained in the pocket acting as a sort of lubricant and greatly reducing the friction between the rotary abutment and the walls of the chamber 9. The fact that the conduit 28 is substantially tangential with respect to the piston chamber 2, causes the incoming jet of motive fluid to impinge itself against the piston head 12, near its outer end, where great power may be exerted due to the long leverage. The faces of the heads of the rotary valves 18, 19, being flat, form impact surfaces against which the motive fluid entering the chambers 3, 4, impinges with considerable force, thus aiding in the rotation of the said valves.

It is to be understood that in a double cylinder engine, such as I have indicated in the drawings, the heads on the two pistons are arranged diametrically opposite each other so that one of the two pistons will be under impulse from the incoming motive fluid, while the other piston head is nearing the limit of its active stroke, thus producing a continuous torque on the piston chamber.

It is obvious that various changes may be resorted to in the form, construction and arrangement of the different parts of my device without departing from the spirit and scope of the invention; hence I do not wish to limit myself strictly to the form herein shown and described, but

What I claim is: —

1. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, and rotary inlet and exhaust valves arranged to close both the inlet and exhaust at the same period in the revolution of the piston.

2. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, and rotary inlet and exhaust valves, the said valves being provided with impact surfaces whereby the passage of the motive fluid therethrough will aid their movement.

3. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves arranged to close both the inlet and exhaust at the same period in the revolution of the piston, and manually operated valves for reversing the supply of motive fluid to the piston.

4. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary

abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves, the said valves being provided with impact surfaces whereby the passage of the motive fluid therethrough will aid their movement, and manually operated valves for reversing the supply of motive fluid to the piston.

5. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves arranged to close both the inlet and exhaust at the same period in the revolution of the piston, and manually operated valves for controlling the supply and exhaust of the motive fluid to and from the piston.

6. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves, the said valves being provided with impact surfaces whereby the passage of the motive fluid therethrough will aid their movement, and manually operated valves for controlling the supply and exhaust of the motive fluid to and from the piston.

7. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves arranged to close both the inlet and exhaust at the same period in the revolution of the piston, and manually operated valves for controlling and reversing the supply and exhaust of the motive fluid to and from the piston.

8. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves, the said valves being provided with impact surfaces whereby the passage of the motive fluid therethrough will aid their movement, and manually operated valves for controlling and reversing the supply and exhaust of the motive fluid to and from the piston.

9. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves arranged to close both the inlet and exhaust at the same period in the revolution of the piston, and ports leading from the valves to the cylinder in a direction tangential to the latter.

10. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves, the said valves being provided with impact surfaces whereby the passage of the motive fluid therethrough will aid their movement, and ports leading from the valves to the cylinder in a direction tangential to the latter.

11. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, and rotary inlet and exhaust valves having their heads provided with flat faces for receiving the impact of the motive fluid passing through the valves for aiding the rotary movement of the same.

12. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston and rotary inlet and exhaust valves also driven from the piston and having their heads provided with flat faces for receiving the impact of the motive fluid passing through the valves for aiding the rotary movement of the same.

13. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, and rotary inlet and exhaust valves having their heads provided with flat faces for receiving the impact of the motive fluid passing through the valves for aiding the rotary movement of the same, the said valves being interchangeable as to functions.

14. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves having their heads provided with flat faces for receiving the impact of the motive fluid passing through the valves for aiding the rotary movement of the same, and manually operated valves for controlling and reversing the supply and exhaust of the motive fluid to and from the piston.

15. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves also driven from the piston and having their heads provided with flat faces for receiving the impact of the motive fluid passing through the valves for aiding the rotary movement of the same, and manually operated valves for controlling and reversing the supply and exhaust of the motive fluid to and from the piston.

16. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves having their heads provided with flat faces for receiving the impact of the motive fluid passing through the valves for aiding the rotary movement of the same, the said valves being interchangeable as to functions, and manually operated valves for controlling and reversing the supply and ex-

haust of the motive fluid to and from the piston.

17. A rotary engine comprising a cylinder, a rotary piston mounted therein, a rotary abutment intersecting the cylinder and driven from the piston, rotary inlet and exhaust valves, ports leading from the said valves to the cylinder, manually operated valves, ports connecting the manually operated valves with the rotary inlet and exhaust valves, a main motive fluid inlet, and ports connecting the said main inlet with the manually operated valves.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this twenty-fourth day of April 1909.

JAMES M. LIVELY.

Witnesses:
F. GEORGE BARRY,
HENRY THIEME.