R. WALL.

ROTARY ENGINE.

APPLICATION FILED FEB. 21, 1910.

973,897.

Patented Oct. 25, 1910.

2 SHEETS—SHEET 1.

FIG. 1.

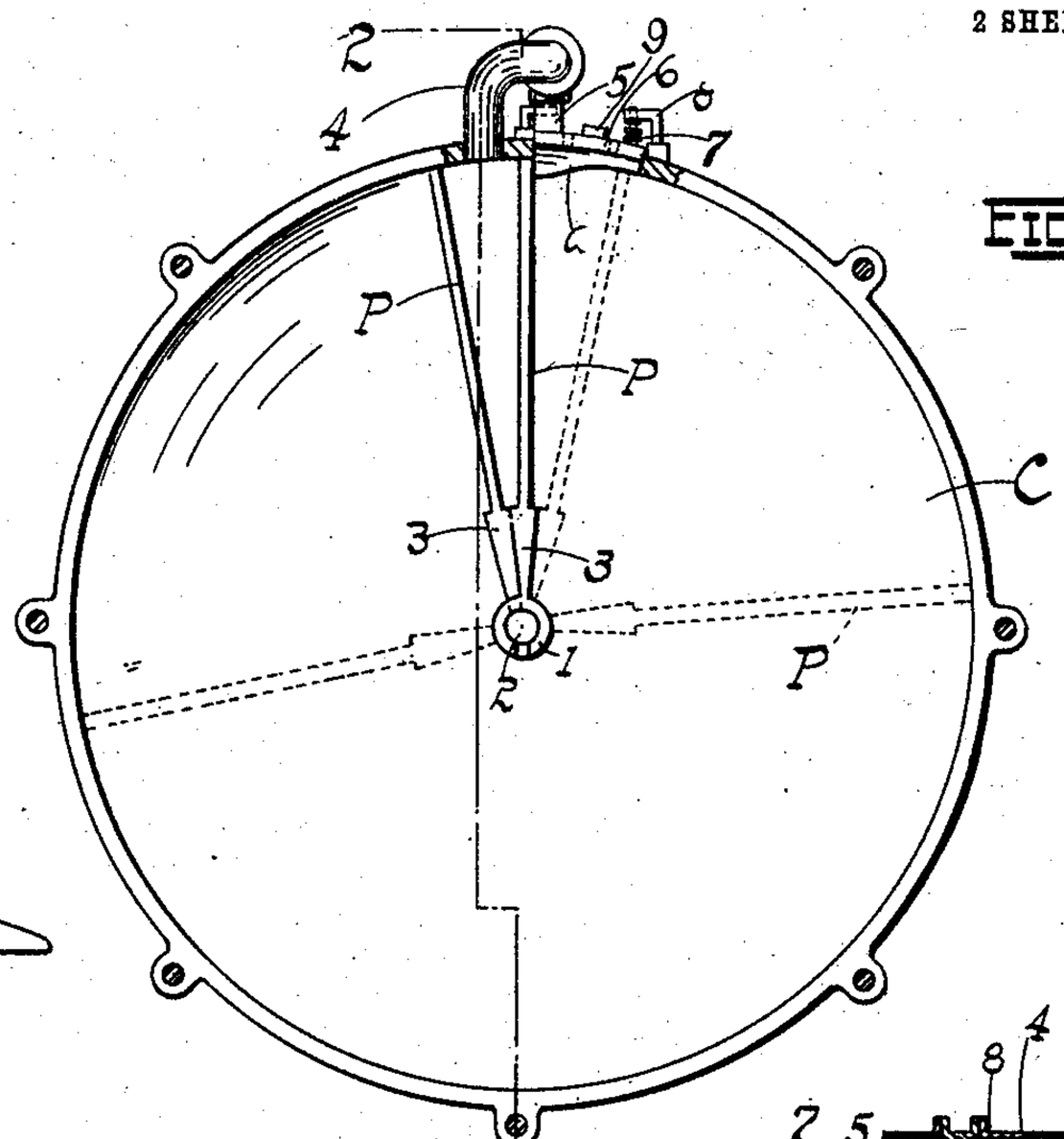


FIG. 4.

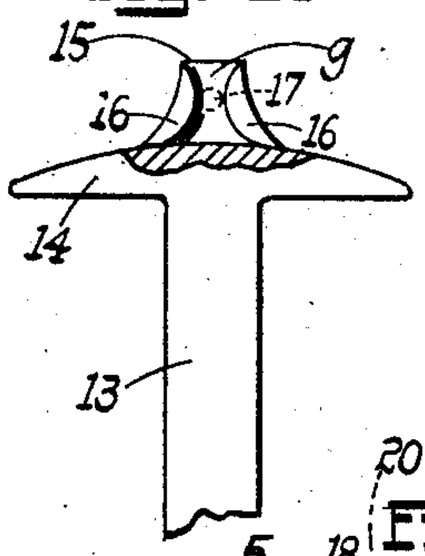


FIG. 3.

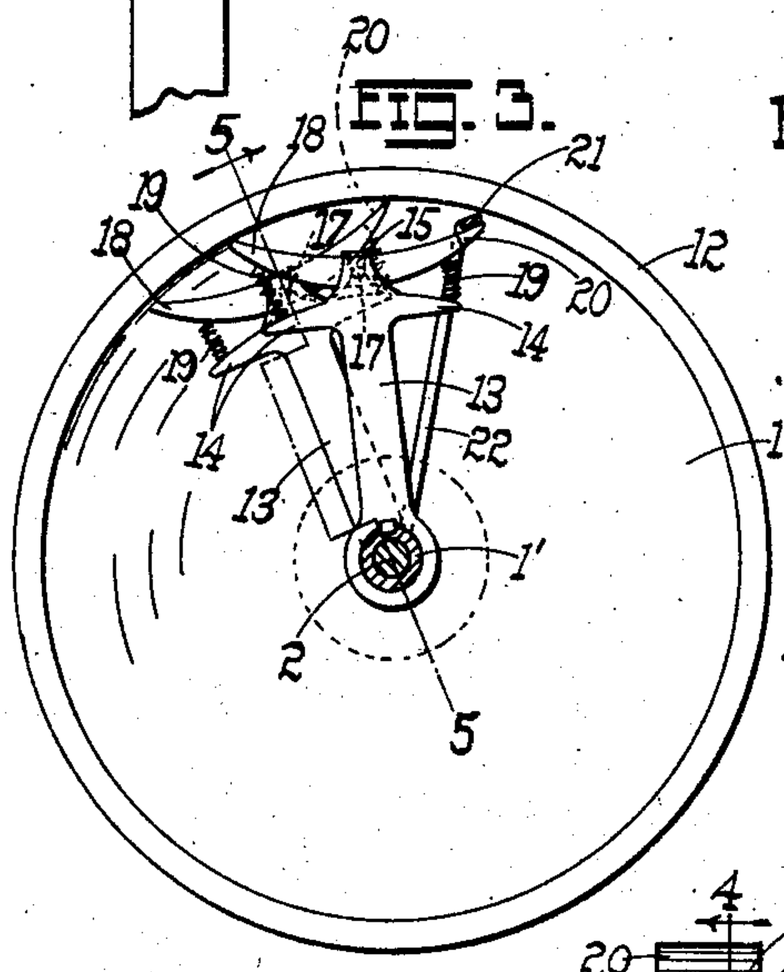


FIG. 2.

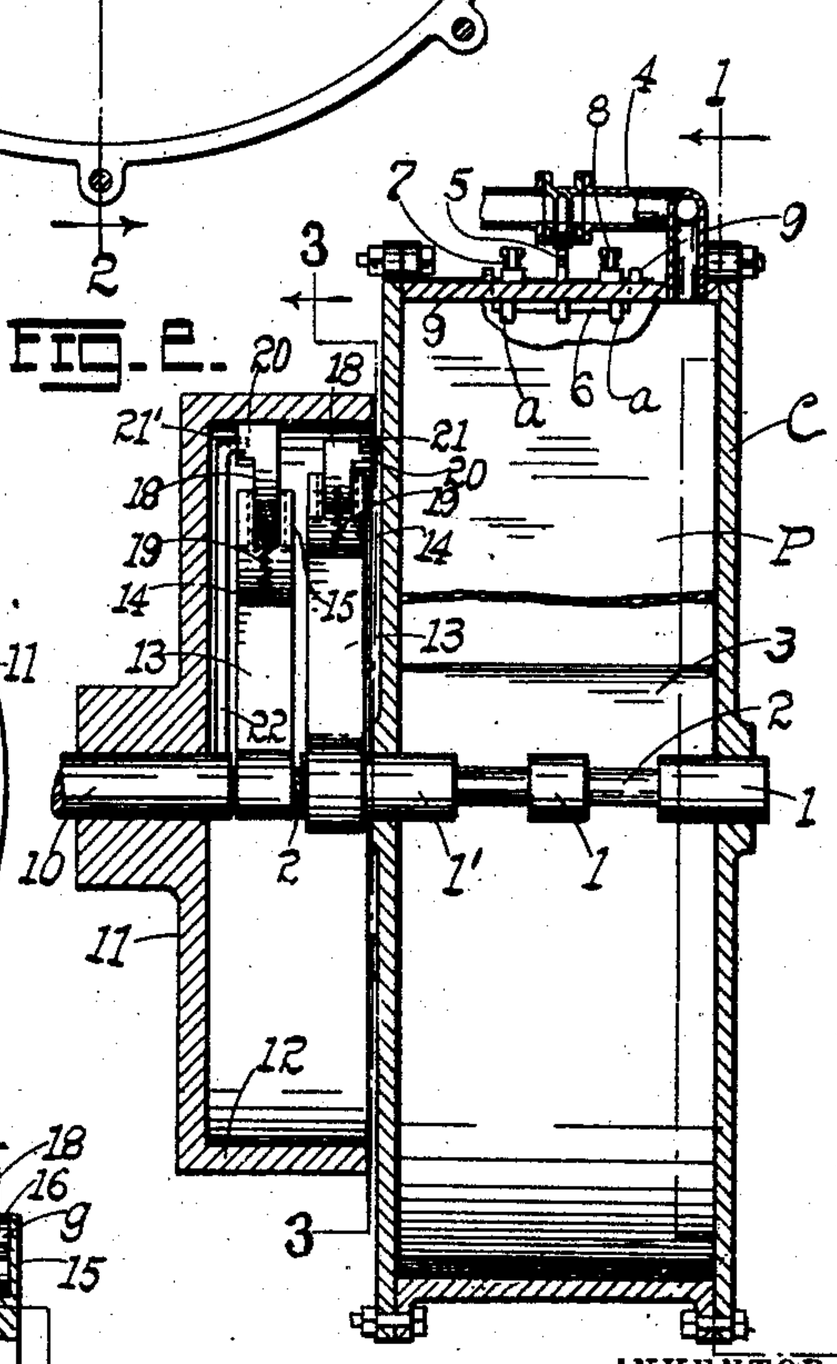
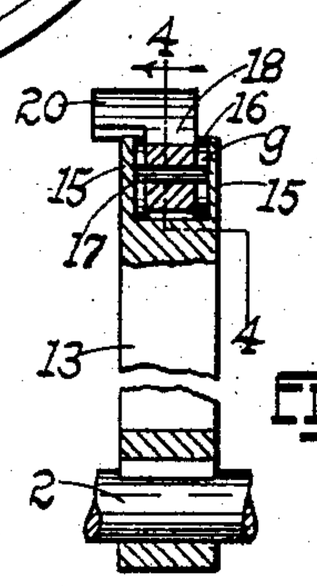


FIG. 5.



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ROTARY ENGINE.

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2 SHEETS—SHEET 2.

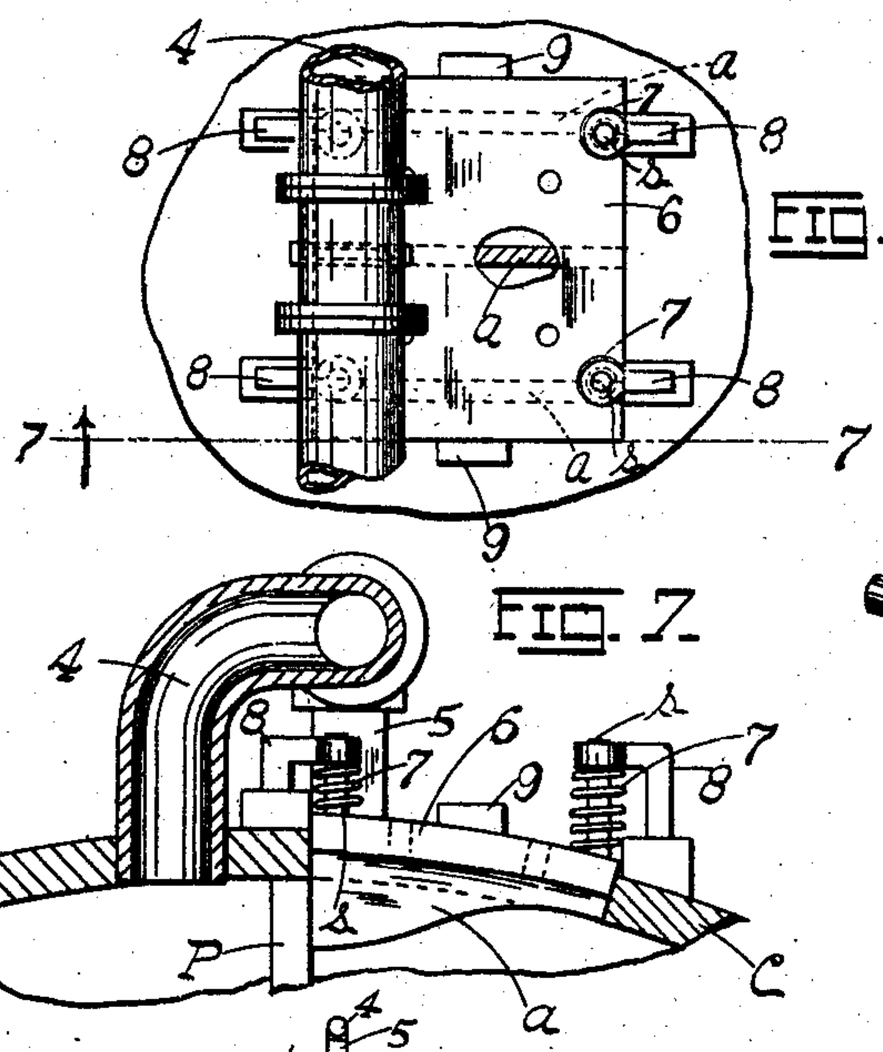

FIG. 6.

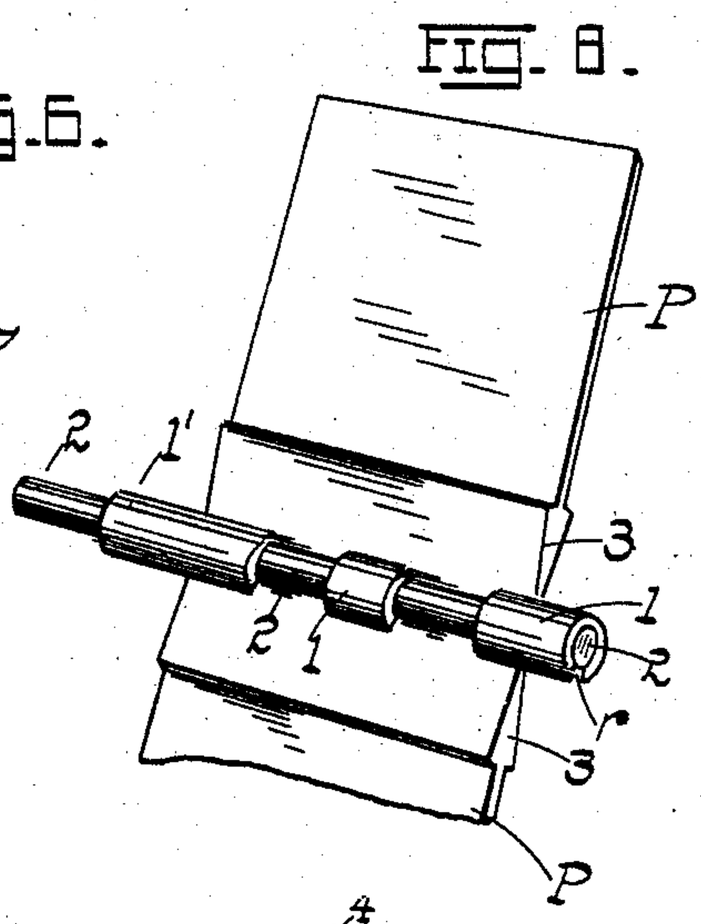

FIG. 8.

FIG. 7.

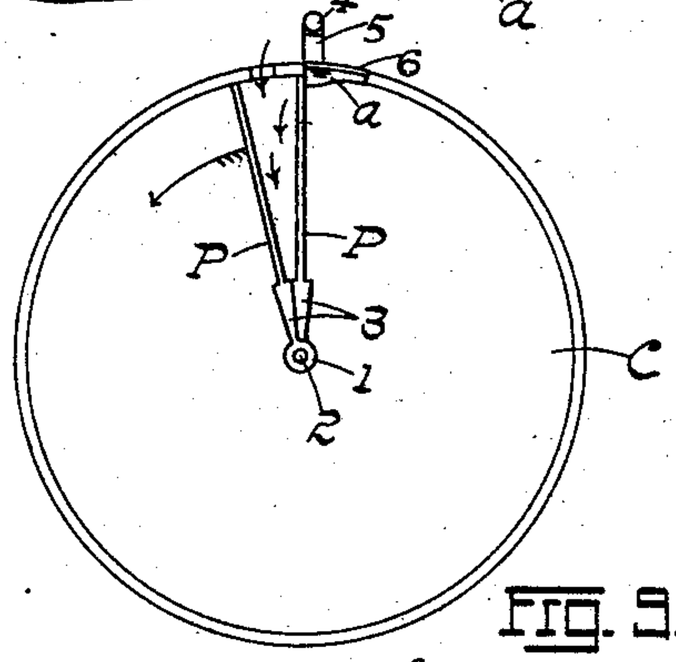

FIG. 9.

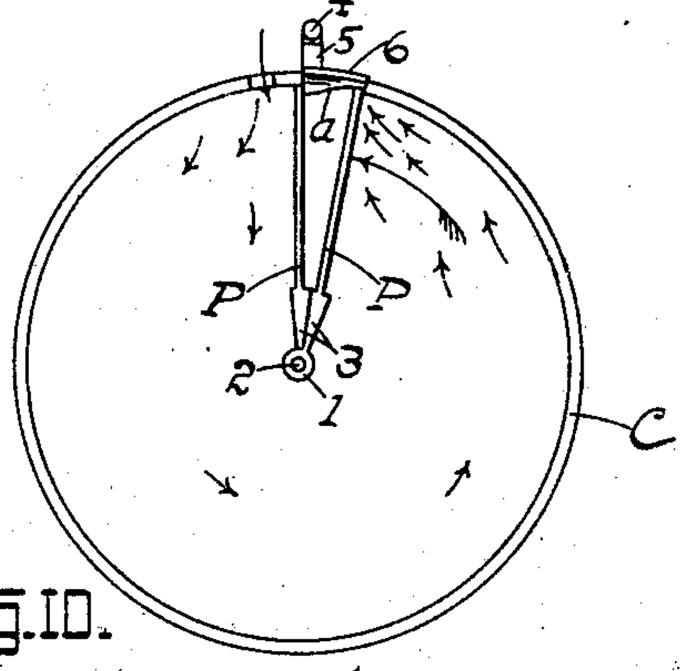

FIG. 10.

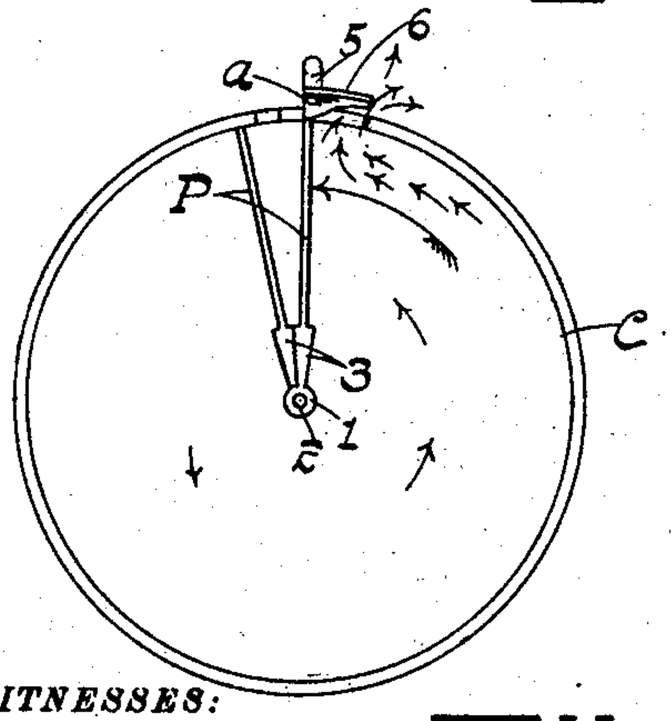

FIG. 11.

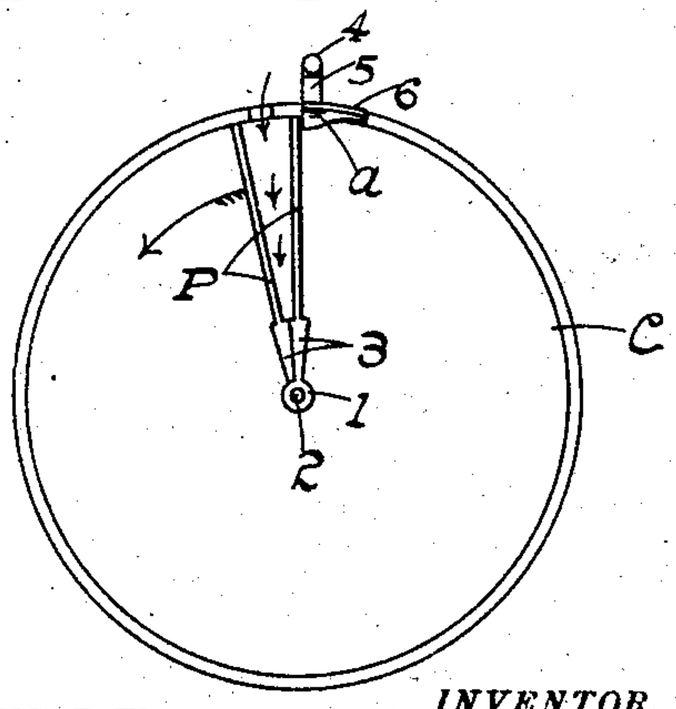

FIG. 12.

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UNITED STATES PATENT OFFICE.

ROBERT WALL, OF ST. LOUIS, MISSOURI.

ROTARY ENGINE.

973,897. Specification of Letters Patent. **Patented Oct. 25, 1910.**

Application filed February 21, 1910. Serial No. 545,143.

To all whom it may concern:

Be it known that I, ROBERT WALL, a subject of the Emperor of Germany, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Rotary Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in rotary engines; and it consists in the novel details of construction more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is a vertical end section on the plane of division between the cylinder body and face plate thereof on the line 1—1 of Fig. 2; Fig. 2 is a transverse section on the line 2—2 of Fig. 1; Fig. 3 is a section taken on the line 3—3 of Fig. 2 between the cylinder and the rotating disk mounted adjacent thereto; Fig. 4 is a sectional detail on the line 4—4 of Fig. 5 taken through one of the crank-arms attached to the hinge-axis or pintle of piston-blade, the clutch or gripper being omitted; Fig. 5 is a sectional detail on line 5—5 of Fig. 3, showing the crank-arm with clutch or gripper in position; Fig. 6 is a top plan of the exhaust-valve and portion of the steam-pipe surmounting the same; Fig. 7 is a section on the line 7—7 of Fig. 6, with a section of the elbow of the steam-pipe not shown in Fig. 6; Fig. 8 is a perspective of the assembled piston-blades, detached; and Figs. 9, 10, 11, 12, are diagrammatic views illustrating four successive stages in a single revolution of a piston-blade.

In its simplest form, the present invention contemplates a cylinder provided with a pair of piston-blades mounted in hinged relation about the cylinder axis, a rotation being imparted to one piston at a time, the opposite piston for the time being remaining stationary and serving as an abutment for the motor-fluid delivered into the cylinder between the pistons which are kept normally at a slight divergence or angle at the beginning of each rotation or stroke. From these successively rotating pistons rotation is imparted to any suitable rotatable member, pulley, or the like.

The objects of the invention as just outlined, and to be more particularly described later on, are (1) to dispense with the use of cranks, (2) to provide a direct rotary motion to the member intended to transmit the power, (3) to provide a construction which will permit an expansion of the motor-fluid for a full rotation of the piston, (4) to eliminate jarring, (5) to provide a simple construction of engine, (6) to effect a saving of the motor-fluid, (7) to produce an engine which shall be light and compact, (8) to economize space, (9) to make an engine which will be certain and positive in action and capable of variation in speed.

The invention possesses further and other advantages better apparent from a detailed description thereof, which is as follows:—

Referring to the drawings, C represents a stationary cylinder of conventional form and construction, in which are confined two pistons or blades P, P, mounted in hinged relation to one another along the axis of the cylinder. The preferred construction for hinging the blades together is as shown in the drawings, one of the blades terminating in a series of loops 1, 1′, recessed or slit at the bases, as shown at *r*, the opposite blade being provided with a cylindrical enlargement or pintle 2 which is inserted through the loops, the widths of the recesses *r* being sufficient to allow for the free passage of the blade therethrough. The terminal loops 1, 1′, are then mounted in the end walls or heads of the cylinder as shown. This form of hinge is well known in the art, no claim being made thereto, except that in the present instance one of the loops 1′ and one end of the pintle 2 are extended somewhat beyond the cylinder head for a purpose to presently appear.

Near the bases of the blades are disposed the wedge-shaped ribs 3, 3 (which may or may not be continuous throughout the width of the blade) which, when the blades come together keep the blades at a slight divergence or at angle to one another (Fig. 1) the space thus formed between the blades being that into which the motor-fluid (steam, gas, compressed air, water and the like, though the present engine is specially designed for steam) is conducted for imparting rotation to the pistons. The motor-fluid enters through the supply-pipe 4 which

taps the cylinder at the periphery (though it may tap it on the side), a gate-valve 5 cutting off the supply during the interval of exhaust as presently to be described. The gate-valve 5 is in the form of a projecting wing carried by or forming a part of a reciprocating exhaust valve 6, the latter being provided on its under face with a series (one or more) of inclined or triangular ribs *a*, *a*, over which the blades travel thereby forcing the valve upwardly or to an open position. The moment a blade has passed the valve the latter returns to closed position, the bases of the triangular ribs forming abutments or arresting devices against a rotation of the blade in the opposite direction. The valve 6 is forced to its closed position by compression springs 7 interposed between it and the angle brackets 8 overhanging the valve, the latter being guided in its movements by the lugs 9, 9 projecting from the cylinder wall on either side of the valve, and by the guide stems *s* encircled by the springs 7 and loosely operating through the brackets 8. When the exhaust valve is fully open, it forces the wing 5 across the passage of the supply-pipe 4 thus cutting off the supply of the motor-fluid during the period of exhaust.

Disposed adjacent to, and in the line of the axis of the cylinder is a stationary axle or bearing 10 about which is free to rotate a disk 11 provided with a peripheral flange 12, the member 11 and its flange 12 thus in effect forming a pulley from which power may be transmitted in any way known to the art. If desirable, the outer face of the flange 12 might be geared and the power be transmitted to a second gear and so on. No claim is made however, to any method or means of transmission as it can be accomplished in a variety of ways. Into the space within the flange 12 projects the extended terminal loop 1′ of one of the blades, and the extension of the pintle 2 of the opposite blade, the pintle extending to a point contiguous to the end of the bearing 10. These projecting ends respectively carry the crank-arms 13, (though crank disks would be full equivalents) terminating in cross-arms 14, 14. At the bases of the cross-arms are formed pairs of ears or lugs 15, 15, provided with opposite inwardly curved rib formations or guides 16, 16, forming grooves *g*, which receive the ends of the guide-pin 17 carried at the center of the bowed and tapering gripper member or clutch 18 operating between the lugs, the sharp edges of the clutch engaging the inner (roughened) surface of the flange 12. The engagement is assured and emphasized by the compression springs 19 interposed between the cross-arms 14, 14, and the adjacent portions of the clutches. The depth of the groove *g* between the ribs 16 is sufficient to allow for a slight oscillation of the clutch about one end or edge as a fulcrum, a feature availed of as presently to be seen. The rear end of each clutch or gripper 18 (that is to say the end which is in the rear for a rotation of the crank-arm 13 or its blade P, in a given direction) terminates in a lateral offset or lug 20, a tappet or tripping pin 21 being in the path of travel of the offset identified with the clutch carried by the crank-arm secured to the loop 1′, and a tappet or finger 21′ at the end of an arm or rod 22 secured to the end of the axle or bearing 10 being in the path of travel of the offset of the other clutch member. These tripping devices or tappets are so located that they trip the clutches of the piston-blades as the latter reach the ends of their respective rotations.

The operation of the engine may be best described in connection with the diagrammatic views shown in Figs. 9 to 12 inclusive, and Fig. 3. Let us assume (Fig. 9) that the piston-blades are at their initial position, the gate-valve 5 being open and the exhaust-valve 6 closed. The motor-fluid enters the space between the two diverging blades, one of the blades being locked against rotation by the bases of the wedges or ribs *a*, *a*, thereby forming an abutment for the fluid which thus drives the other blade forward as shown by the arrows in the figures referred to. The revolving blade continues in its rotation until the rib 3 thereof impinges against the corresponding rib of the stationary blade (Fig. 10), the impact due to the momentum, dislodging said stationary blade (Fig. 11) the revolving blade continuing in the same direction, and the motor-fluid raising the exhaust-valve 6 and escaping into the atmosphere. With the raising or unseating of the exhaust valve, the gate-valve or wing 5 is moved across the passage of the supply-pipe 4, so that during the interval of exhaust no live steam or other motor-fluid can enter the space between the blades. It may be stated in passing that the opening of the exhaust valve does not depend on the edge of the blade passing under the wedges *a*, *a*, such opening being effected by the pressure of the motor-fluid without the assistance of the blade. The only time the blade mechanically opens the valve is when there is no steam in the cylinder, or after the steam has been cut off entirely at the throttle and the engine is running by its own momentum only. The moment the revolving blade has passed off the edges of the ribs *a*, *a* (Fig. 12) the exhaust valve under the action of the springs 7 is forced to closed position by which time the blade is now locked against a reverse rotation, the gate-valve opened, and the motor-fluid now again enters between the blades driving before it the sec-

ond blade which in its turn displaces the first blade and so the operation goes on continuously. As each blade revolves it carries its crank-arm 13 around with it, and the gripper or clutch 18 at the free end of the arm seizes the flange 12 of the disk 11, and thus rotates the latter about the axle or bearing 10. Since however, both ends of the clutch grip into the flange 12 during the driving operation, it follows that some provision must be made to release one of the ends of such clutch when its particular blade comes to a rest; otherwise while one clutch would tend to drive the disk 11, the other would simply hold or grip it against rotation. So that, as a blade comes to its position of rest the tappet 21 (21′) by striking the offset 20 of the clutch oscillates the latter about the forward end as a fulcrum sufficiently to release the opposite or rear end of the clutch from its grip on the flange 12, the latter slipping or sliding along the still engaging end while rotating under the impelling action of the clutch of the revolving blade. Of course, the moment the temporarily stationary blade is dislodged from its position of rest under the impact of the revolving blade, the offset 20 slips off the tappet 21 (21′) by which time the clutch of the impinging blade (which now becomes the stationary blade) is disengaged. The moment the tilted end of the clutch has slipped off its tappet or pin (21, 21′) both ends of the clutch become available for seizing the flange 12 and imparting rotation to the member 11. It follows therefore, that first one blade drives the disk 11, and then the other blade does the driving, the clutch of the blade which is temporarily at rest releasing its grip on the flange 12.

Having described my invention, what I claim is:—

1. In a rotary engine, a cylinder, a pair of piston-blades successively rotating within the cylinder about a fixed axis, an exhaust valve on the cylinder mounted in the path of travel of the blades, and means on the valve for holding one of the blades at rest while the other blade is rotating.

2. In a rotary engine, a cylinder, a pair of piston-blades successively rotating within the cylinder about the axis thereof, an exhaust valve mounted in the path of travel of the blades and opening at the end of a rotation for each blade, a conduit for delivering the motor-fluid into the cylinder, and means controlled by the opening movement of the exhaust valve for cutting off the supply of the motor-fluid.

3. In a rotary engine, a cylinder provided with a pair of axially mounted normally diverging successively rotatable piston-blades, means for conducting the motor-fluid to the space between the blades, an exhaust valve on the cylinder mounted in the path of travel of the blades, means on the valve for holding one of the blades stationary during the travel of the other blade, and a valve controlled by the exhaust-valve for cutting off the supply of the motor-fluid during the period of exhaust.

4. In combination with a cylinder provided with a pair of rotatable piston-blades following each other in succession around the axis of the cylinder, a rotatable member disposed about the said axis on the outside of the cylinder, and clutches coupled to the respective blades and disposed at equal distances from the common axis thereof and successively rotating said member with the successive rotations of said blades.

5. In combination with a cylinder provided with a pair of rotatable piston-blades following each other in succession around the axis of the cylinder, a rotatable member disposed about said axis on the outside of the cylinder, clutches coupled to the respective blades and disposed at equal distances from the common axis thereof for engaging said member and driving the same with the rotation of the blades, means for holding one of the blades stationary during a rotation of the other blade, and means for disengaging the clutch of the stationary blade from the rotatable member aforesaid.

6. In a rotary engine, a cylinder, a pair of piston-blades mounted in hinged relation about the cylinder axis, an exhaust valve on the cylinder mounted in the path of travel of the outer ends of the blades and adapted to be unseated by the blade, means for restoring the valve to its position behind the blade after the latter has passed the valve, the valve having a formation preventing a rotation of the blade in an opposite direction, means on the blades for maintaining them at a minimum divergence or angular separation upon the completion of a rotation of a blade, thereby leaving a chamber between the blades for the admission of the motor-fluid, and means for conducting said fluid to the chamber.

7. In a rotary engine, a cylinder, a pair of piston-blades mounted in hinged relation about the cylinder axis, hinge-extensions leading from the blades outside the cylinder head, a rotatable member provided with an annular rim mounted about the extension of the cylinder axis adjacent to the cylinder head, clutches coupled to the hinge-extensions of the blades and engaging the inner surface of the rim at two points, and capable of a limited oscillation about one point as a fulcrum, and tappets for disengaging one end of each clutch at the completion of a rotation of a blade, the blades making each a complete revolution and coming to a stop successively one after the other.

8. In a rotary engine, a cylinder, a pair of piston-blades successively rotating within the cylinder about the axis thereof, means for holding one of the blades stationary during a single rotation of the other blade, a rotatable flanged wheel mounted outside the cylinder, and suitable clutches rotated by the blades and adapted to successively engage the flange of the wheel and impart rotations thereto, and means for sufficiently disengaging the clutch identified with the blade which is at rest, to prevent interference thereby with the driving action of the clutch of the revolving blade.

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

ROBERT WALL.

Witnesses:
EMIL STAREK,
FANNIE E. WEBER.