No. 638,375. Patented Dec. 5, 1899.

C. F. BAINTER.

ROTARY ENGINE.

(Application filed July 22, 1897.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

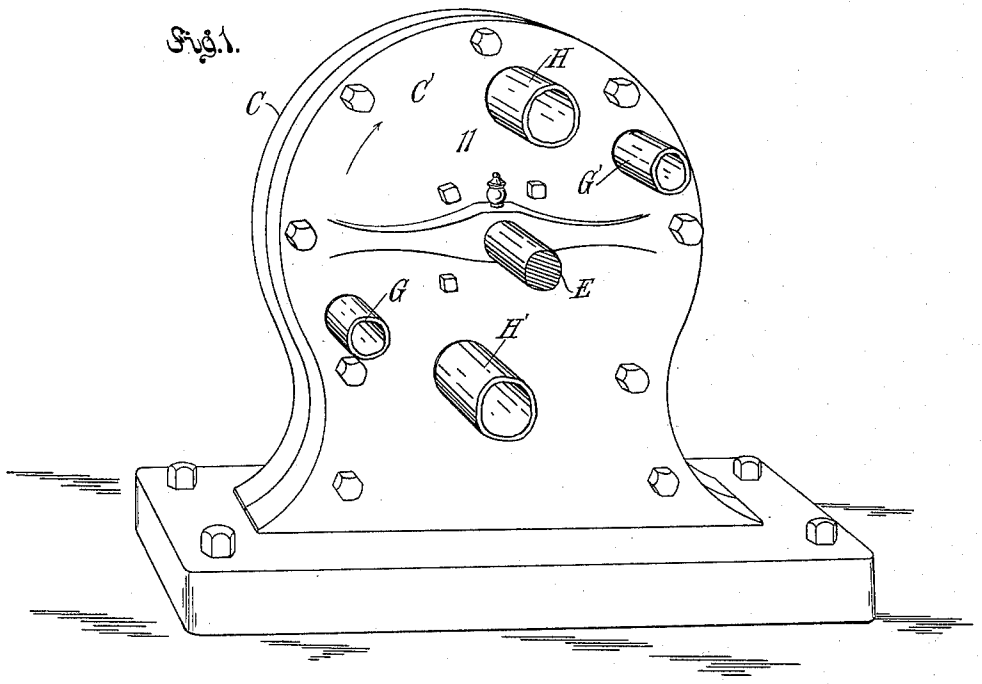
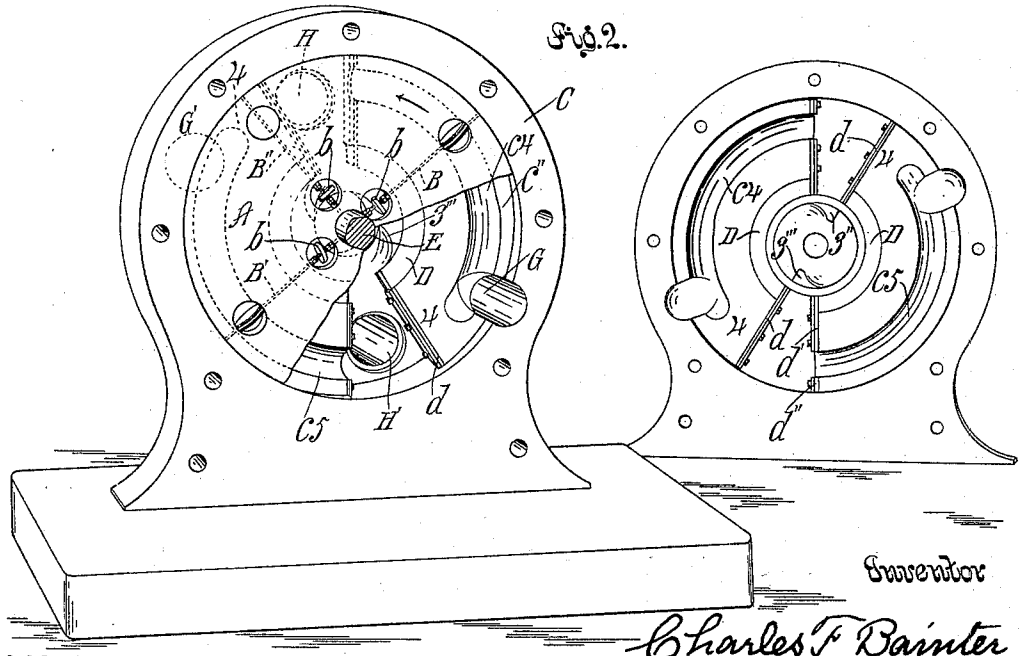


Fig. 2.



Witnesses
Terry Tingman.
E. A. Waterman

Inventor
Charles F. Bainter
by
Townsend Bros
his Attys.

No. 638,375. Patented Dec. 5, 1899.

C. F. BAINTER.

ROTARY ENGINE.

(Application filed July 22, 1897.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 4.

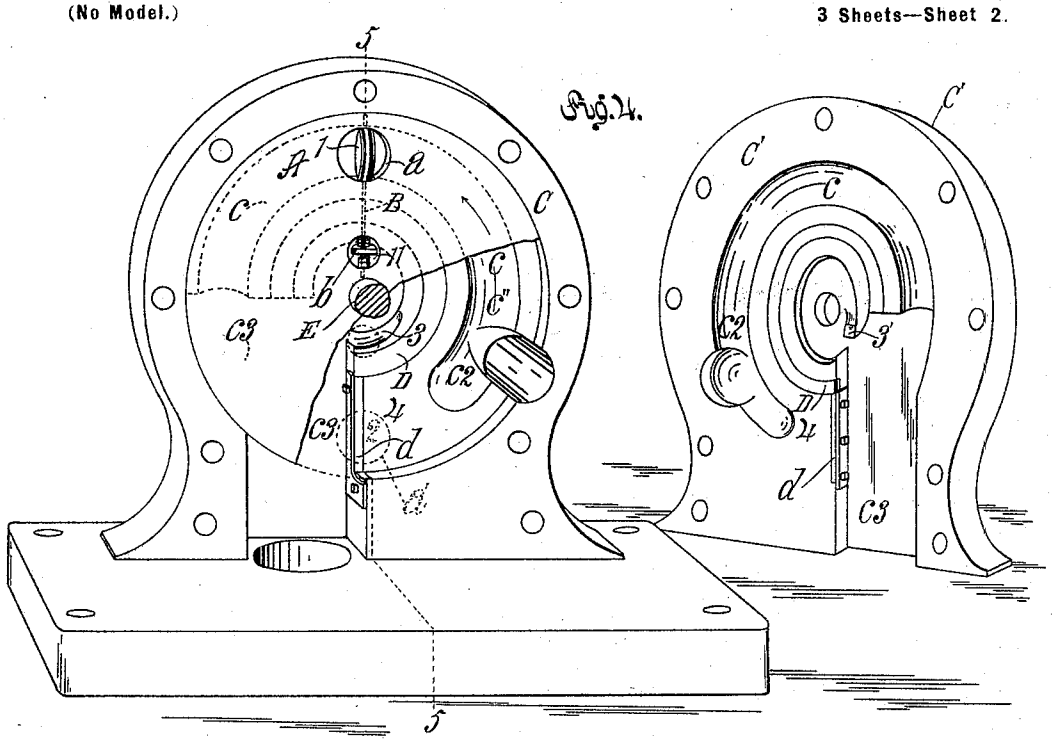


Fig. 5.

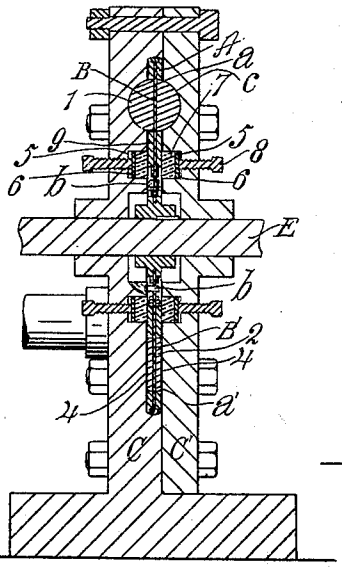
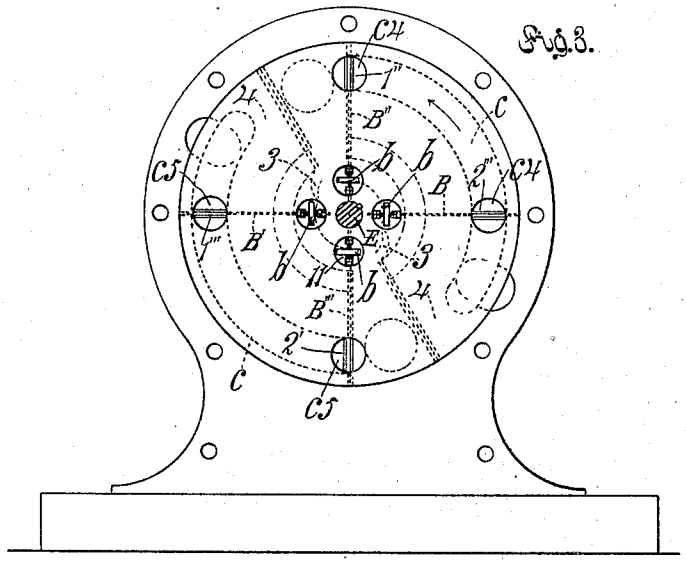


Fig. 3.



Witnesses
Perry Ingman.
E. A. Waterman

Inventor
Charles F. Bainter
by
Townsend Bros
his attys

No. 638,375. Patented Dec. 5, 1899.

C. F. BAINTER.

ROTARY ENGINE.

(Application filed July 22, 1897.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 6.

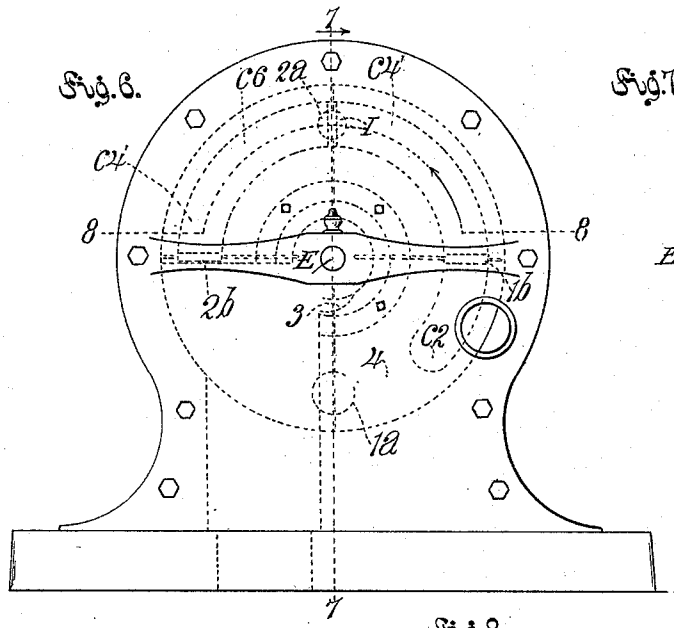


Fig. 7.

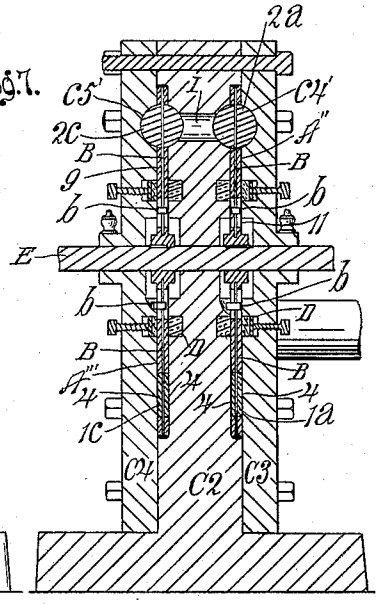


Fig. 8.

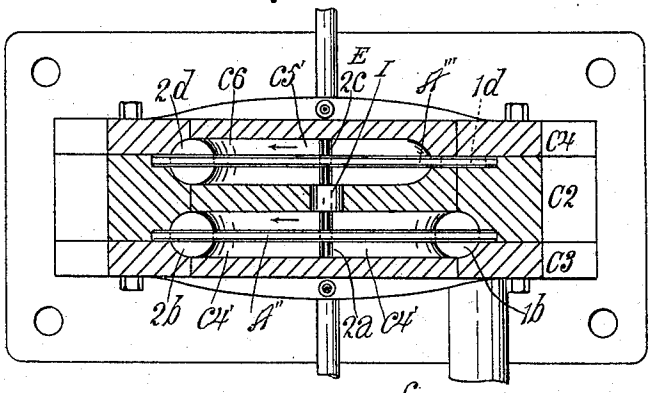


Fig. 9.

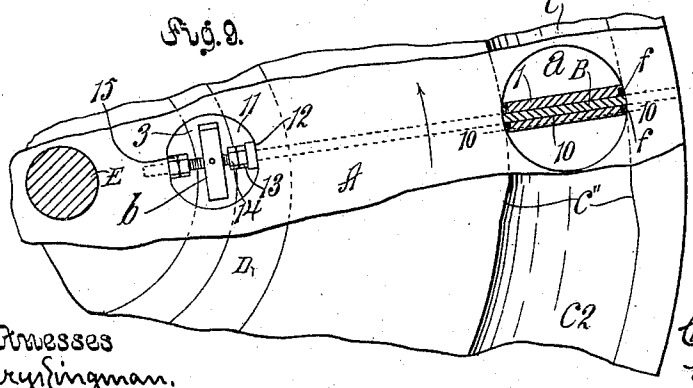
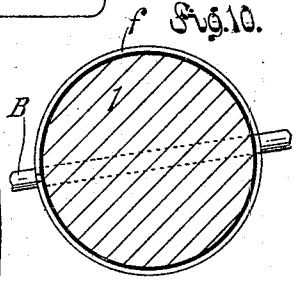


Fig. 10.



Witnesses
Jerry Lingman.
E. A. Waterman

Inventor
Charles F Bainter
by
Townsend Bros
his Attys

UNITED STATES PATENT OFFICE.

CHARLES F. BAINTER, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-HALF TO GEORGE W. POSSELL AND CHARLES M. PERSONS, OF SAME PLACE.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 638,375, dated December 5, 1899.

Application filed July 22, 1897. Serial No. 645,582. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. BAINTER, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Rotary Engine, of which the following is a specification.

The objects of my invention are to provide a rotary engine which will effectively utilize the direct pressure of steam from the generator to counterbalance the strain on the shaft of the engine, to construct a compound rotary engine, thereby to gain advantage from the expansion of the steam as well as from the direct steam-pressure from the generator, to provide a rotary engine which can be run at a low or high speed without loss of efficiency, and to use economically high and low pressure steam indiscriminately in the same engine. The engine can also be driven by compressed air and by water under pressure.

My invention relates to that class of engines which includes a rotary engine comprising a rotary plate having holes, with piston-heads respectively mounted to turn in such holes, a case for the rotary plate and fitting the same and provided with a cylinder which is the arc of a circle in the path of the piston-heads, a supply-chamber opening into the cylinder and an exhaust-port opening from the cylinder in the path of the piston-heads, means for turning the piston-heads and holding them in position transverse the rotary plate to pass through the cylinder, and means for turning the piston-heads into the plane of the rotary plate and holding them in such plane to allow them to enter the supply-chamber. The plate and heads are of uniform thickness, and the axis of the pivot of each head is in the mid-planes of the head and plate, so that when the head is turned into the plane of the plate the faces of the plate and head will be flush with the each other.

My invention includes the combination of two such rotary plates and piston-heads with their cylinders, supply-chambers, and exhaust-ports and with a port connecting the supply-chamber of the second rotary plate with the cylinder of the first rotary plate between the ends of such cylinder, preferably at the half-stroke of the piston, so that when the direct-acting piston-head has traveled half-way through its cylinder the steam or other expansible fluid will expand into the cylinder of the second rotary plate to drive a piston-head in such cylinder during the latter half of the stroke of the first piston-head, thus filling the chamber behind the heads in both of the cylinders during the latter part of the piston-stroke.

My invention also includes other features and combinations hereinafter described and claimed.

The accompanying drawings illustrate my invention.

Figure 1 is a perspective view of a rotary engine embodying my invention as applied in the form preferred for simple engines which use the steam without expansion. This view shows the outside of an engine having two steam-inlets, two exhaust-ports, and four piston-heads, thus to counterbalance the strain on the power-shaft. Fig. 2 is a detail looking at the opposite side of Fig. 1 with the cap of the case removed and turned to show the inside thereof and parts of the rotary piston-plate broken away to show one inlet and one exhaust port. The other inlet and exhaust port are indicated in dotted lines. Two piston-heads are shown in working position in the cylinders and another is shown in position between the abutments between the exhaust and the supply chamber. The other piston is omitted for clearness of illustration. Fig. 3 is an elevation looking toward the inlet and exhaust ports, the cap being removed to show the construction of the piston-plate. Fig. 4 is a detail view of a form of engine with one inlet and one exhaust port. The cap is removed and turned to show the interior, and a portion of the piston-plate is broken away to show the inlet and exhaust ports. Fig. 5 is a section of the engine on line indicated by 5 5, Fig. 4. Fig. 6 is an elevation of the high-pressure side of the compound engine. Interior parts are indicated in dotted lines. Fig. 7 is a vertical mid-section on line 7 7, Fig. 6, showing a compound single-expansion engine. Fig. 8 is a plan, with case in section, of a compound single-expansion engine. Line

8 8, Fig. 6, indicates the line of section. Fig. 9 is a fragmental sectional detail on a larger scale to show the taper at the entrance of the cylinder proper and also showing in section a piston-head just entering the cylinder. The taper of the mouth of the cylinder is exaggerated in order to be clearly shown. A portion of the piston-head and its bearing are also shown in this view. Fig. 10 is a section of a piston-head on line 10 10, Fig. 9.

Referring first to Figs. 4, 5, 9, and 10, A indicates a rotary piston-plate having holes $a a'$, with piston-heads 1 2, respectively, mounted to turn in such holes and fixed on shafts B B', respectively, which are journaled to the piston-plate.

C C' indicate the case for the piston-plate and fitting the same, the joint or faces where the piston-plate and the case come together being ground joints, so as to make a perfect fit without friction. The case is provided with a cylinder c, which is the arc of a circle in the path of the piston-heads, with a supply-chamber c^2, opening into the cylinder, and with an exhaust-port c^3, opening from the cylinder in the path of the piston-heads.

The steam-supply pipes G G' are made to open through the wall of the case, and I thereby avoid the difficulty of successfully packing the inlet-ports against the live-steam pressure. The exhaust-ports may be through the side wall, as at H H', or may be radial from the rotary plate, as at c^3, Fig. 4.

In the several views like characters refer to like parts; but in the forms of engine shown in Figs. 1, 2, 3, 6, 7, and 8 there is a greater number of cylinders and piston-heads than in Figs. 4 and 5, and indices are used with some of the characters to facilitate description.

I term the piston-head way c a "cylinder," although in the arc of a circle, for the reason that it performs the same office as the cylinder of a reciprocal steam-engine. Each of the piston-shafts B B', &c., is provided with projections or arms b, and the case is provided with guides 3 3', one or more facing each side of the piston-plate to operate the arms of the piston-head shafts, thereby to partially rotate the piston-heads, so as to bring them into position transverse the plane of the piston-plate and to hold such head in this position while the head is passing through the cylinder, and to turn the piston-head into the plane of the piston-plate, so as to fully chamber the head in the plate and allow the piston-head to pass between the ground faces of abutments 4 of the case to enter the supply-chamber c^2, which opens into the cylinder, and which supply-chamber is large enough to allow the piston-head to be turned again into position transverse the plane of the piston-plate.

4 indicates an abutment on each side of the piston-plate between the supply-chamber and the exhaust-port, and D indicates packing in the case to press against the piston-plate to prevent the escape of steam from the supply-chamber and cylinder. Packing D is applied to each member C and C' of the case and partially encircles the shaft E, on which the rotary piston-carrying plate is mounted. Packing is preferably arranged between the cylinder and the shaft on opposite sides of the rotary plate and also, as at d, at the rear side of the exhaust-port, along the edges of the abutments 4. It may also be applied, as at $d' d''$, on the opposite side of the exhaust-port.

5 indicates packing-grooves in arcs of circles provided in the case. 6 indicates packing-plates in the bottoms of such grooves.

7 indicates the packing material between the packing-plates and the rotary plate, and 8 indicates screws or other suitable means for adjusting the packing-plate, thus to properly apply the packing to the face of the piston-plate.

The shafts B of the piston-heads are preferably journaled in radial holes 9 in the piston-plate. Each of the piston-heads has a hole 10 through it, in which the piston-shaft is fixed. In constructing the machine a piston-head will be placed in its appropriate hole in the piston-plate and the shaft will be inserted through the hole 9 in the piston-plate and through the hole 10 in the piston-head.

11 indicates a hole in the plate, in which the arm b is to work. The shaft B is screw-threaded at its inner end, and when inserted through the plate so that its screw-threaded end comes into the hole 11 it will first be inserted into a bearing-collar 12, then screwed into a set-nut 13, then into a jam-nut 14, then into the arm b, and, if desired, into a jam-nut 15. The arm b is preferably in the form of a semicircle and is set in such position on the shaft B that when the plate rotates one end of the arm will be engaged by the guide 3, thereby to throw the arm and turn the shaft to bring the piston-head transverse the plate immediately after said head has entered the supply-chamber. The guide continues in a plain face around to such a point as to cause the arm to hold the piston-head transverse the rotary plate so long as the piston-head is in the cylinder. The guide 3' on the opposite side of the plate is arranged to engage the arm and turn it to throw the piston-head into the plane of the piston-plate while the piston-head is in the exhaust-port, so that when the hole in the plate in which the piston-head is mounted has reached the abutment 4 the piston-head will be chambered within the piston-plate and will readily pass the packing d and pass between the abutments and into the supply-chamber. Then the guide 3 will operate the arm to again throw the piston-head transverse the plate, and so on.

The intake-mouth of the cylinder is slightly tapering, as at c''.

f indicates metallic packing-rings around the piston-heads to pack the piston-heads while the same are passing through the cylinder, and the tapering form of the mouth of

the cylinder allows the expanded packing-ring to enter the cylinder and to become compressed by the walls of the cylinder.

The piston-heads, with their packing-rings, are turned to the arc of a circle to accurately fit the cylinder.

The bearing-collars 12 can be accurately adjusted by the set-nut 13 and jam-nut 14 to proper position in the hole therefor in the piston-plate, and the bearing-collar receives the pressure and wear produced by centrifugal force and the turning of the piston-head shaft. A pin through the set-nut or any other suitable means for holding the collar in place may be substituted for the jam-nut.

Preferably the piston-plate is provided with four piston-heads 1′ 1″ 2′ 2″, and where the engine is thus built the case is provided with two cylinders c^4 c^5, with a steam-inlet G G′ and an exhaust H H′ for each cylinder, as indicated in Figs. 1, 2, and 3. The purpose of this is to increase the power of the engine and to balance the pressure, applying it to the plate at two points equally upon opposite sides of the shaft. Two of the four piston-heads will thus always be in action at the same time, and in that case there are two arm-guides 3″ 3‴ on each side of the rotary plate, the same being arranged on opposite sides of the shaft. With cylinders of the same diameter doubling the number of cylinders and piston-heads doubles the power of the engine and the amount of steam used.

To expand the steam and get the effect of a compound engine, two or more rotary plates with appropriate piston-heads 1^a 2^a 1^b 2^b 1^c 2^c 1^d 2^d are used. These plates are preferably mounted upon the same shaft and are contained in the same case, which is virtually two cases, composed, as shown in Figs. 7 and 8, of a central member C^2 and two caps C^3 and C^4, and a port I is provided, opening from the cylinder $c^{4'}$ for the first rotary plate A″ between the ends of such cylinder (and preferably midway between such ends) and opening into the supply-chamber $c^{5'}$ for the second rotary plate A‴. Preferably said supply-chamber $c^{5'}$ is located at a point adjacent the middle of the cylinder $c^{4'}$ of the high-pressure side of the engine, so that the port I leads directly from the middle of the cylinder $c^{4'}$ to the supply-chamber $c^{5'}$, so that when the piston of the high-pressure side of the compound engine has passed port I the steam behind the piston will expand into the cylinder c^6 of the low-pressure side of the engine, at the same time exerting a pressure against the piston to force it on through to the end of the cylinder $c^{4'}$. The length of the cylinder c^6 of the low-pressure side of the engine is equal to the length of that portion of the cylinder $c^{4'}$ which the piston will pass through after it has passed port I, so that the steam will finally exhaust from both cylinders at the same time. In the compound engine there are twice as many pistons for each piston-plate as there are cylinders, so that when any piston shall have reached the low-pressure port I another piston will have entered the high-pressure cylinder, so that the steam does not exhaust into the low-pressure port under direct pressure from the generator or source of fluid-pressure, but will be cut off from such direct pressure by the intervening piston which has just entered the high-pressure cylinder. Then the steam inclosed between the two pistons in the high-pressure cylinder will expand to fill both cylinders. The pressure per square inch on both piston-heads will at the first part of the stroke of the low-pressure piston-head approximate the initial or direct pressure, and this will diminish proportionately to the increased volume until the two pistons reach their exhaust-ports, at which time the pressure per square inch will approximate one-half the initial pressure, less the loss by radiation, &c.

The piston-heads may be of any diameter and thickness desired and the piston-plate made to conform therewith, and the cylinders may be made of any desired radius. The greater the radius of the cylinder the greater is the leverage of the pistons on the shaft. If it is more desirable to make a cylinder of small diameter and great radius, this may be done, and vice versa.

Now, having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A rotary engine comprising a casing having an internal piston-cylinder forming an arc of a circle, an inlet and an outlet for the motive agent, abutments between the inlet and outlet, a rotary piston-plate having openings with piston-heads mounted to turn therein, a shaft for each piston-head extending through the head with its outer end having a bearing in the plate and also extending inwardly through the plate to an opening 11 therein, an arm extending laterally from the inner end of each piston-head shaft from the opening 11 in the plate, nuts applied to the piston-head shaft adjacent to the laterally-extending arms and in the opening 11, and guides located at opposite sides of the piston-plate and formed so as to turn the piston-heads across the piston-cylinder adjacent to the inlet and into the plane of the piston-plate where the piston-heads pass between the abutments, substantially as described.

2. A rotary engine comprising a casing having a plurality of internal piston-cylinders each of which is the arc of a circle, the intake-mouth of each cylinder being tapering, an inlet and an exhaust port for each cylinder, abutments between the inlet and exhaust ports, a rotary piston-plate having openings with piston-heads mounted to turn therein, packing-rings around the periphery of the piston-heads, and means for turning the piston-heads across the piston-cylinders adjacent to the inlets and in the plane of the piston-plate where the piston-heads pass between

the abutments, said cylinders and piston-heads being arranged so that at least two of the piston-heads will always be in action at the same time and the pressure will be applied to the plate at two points equally, or substantially so, upon opposite sides of the shaft, substantially as described.

3. A rotary engine comprising a casing having a plurality of piston-cylinders, a rotary piston-plate for each cylinder having openings with piston-heads mounted to turn therein, means for turning and holding the piston-heads across their respective cylinders while pressure is on the heads and into the plane of the plates while pressure is off the heads, and a port connecting one cylinder with the other, said cylinders and piston-heads being arranged so that the fluid-pressure passes from the high-pressure to the low-pressure cylinder as the piston-head of the high-pressure cylinder passes the port opening into the low-pressure cylinder and while another piston-head of the high-pressure cylinder is between said port and the source of direct-pressure supply, substantially as described.

4. A rotary engine comprising a casing having a plurality of piston-cylinders, a rotary piston-plate for each cylinder having openings with piston-heads mounted to turn therein, means for turning and holding the piston-heads across their respective piston-cylinders while pressure is on the heads and into the plane of the plates while pressure is off the heads, a port leading from between the ends of one cylinder into the other cylinder so that as one piston of the high-pressure cylinder passes said port the fluid-pressure behind said piston will expand into the other cylinder and exert pressure on the piston-heads in both cylinders beyond said port, the length of the low-pressure cylinder being equal to the length of that portion of the high-pressure cylinder beyond said port so that the steam will exhaust from both cylinders at the same time, and the piston-heads in the high-pressure cylinder being arranged so that one piston-head will intervene between the source of direct-pressure supply and said port thereby preventing the steam from passing through said communicating port under direct pressure from said source of supply, substantially as described.

5. A rotary engine comprising a casing having a plurality of piston-cylinders communicating one with the other through a port opening from one into the other, a number of piston-heads rotating in each cylinder, an inlet leading into one cylinder from the source of direct-pressure supply, and a separate exhaust from each cylinder beyond the communicating port between the two cylinders, the piston-heads in the direct-pressure cylinder being so arranged that a piston-head will always intervene between the source of direct-pressure supply and the communicating port between the two cylinders whereby as a piston of the direct-pressure cylinder passes the port communicating the two cylinders the fluid-pressure behind said piston will expand into the other cylinder and exert pressure on the pistons in both cylinders beyond said port and steam will be prevented from passing into the low-pressure cylinder under direct pressure from the source of such pressure-supply, substantially as described.

CHARLES F. BAINTER.

Witnesses:
JAMES R. TOWNSEND,
J. F. HOLBROOK.