No. 638,570. Patented Dec. 5, 1899.

# C. E. FORSYTH.

## ROTARY ENGINE.

(Application filed Mar. 13, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

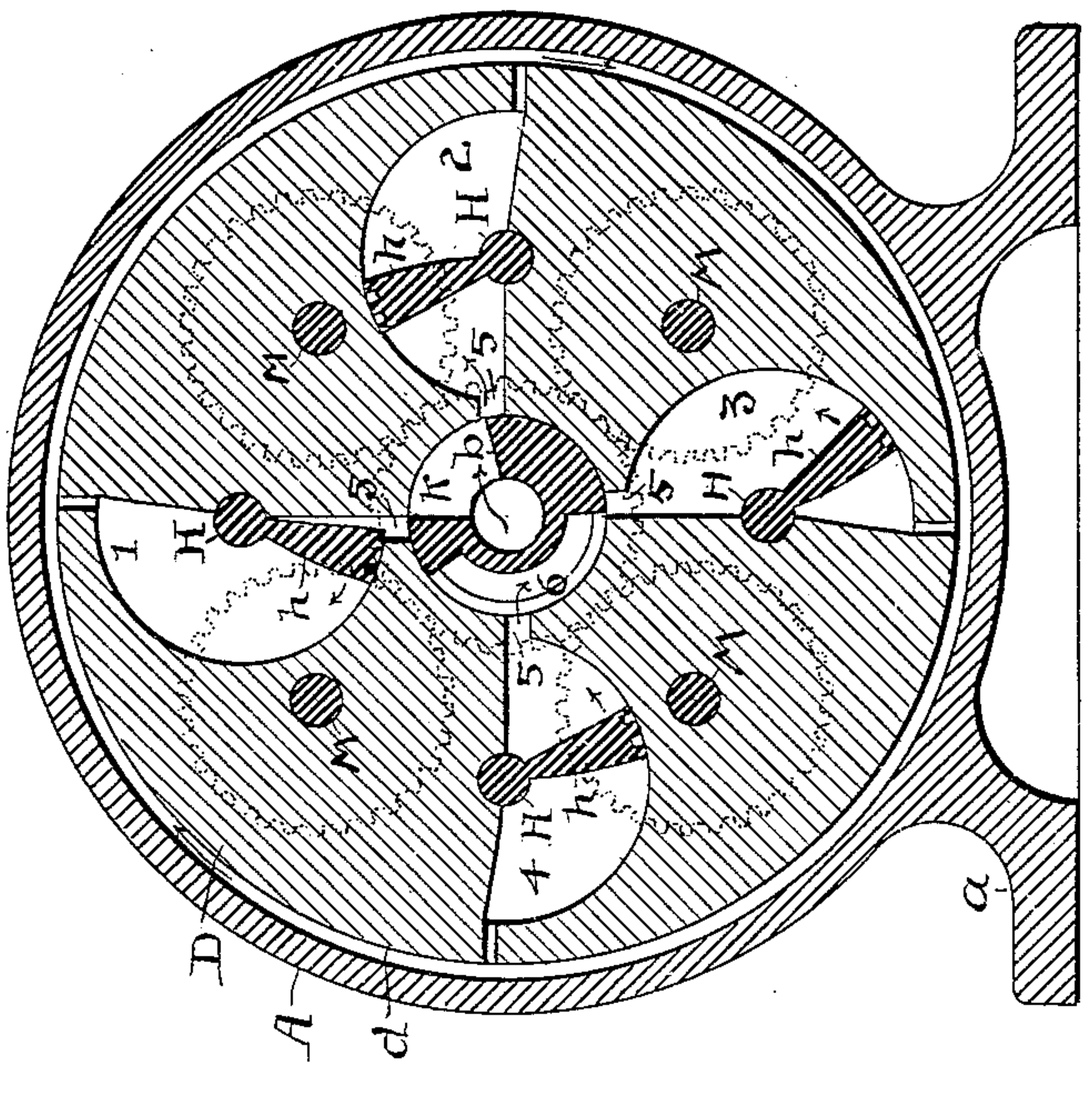
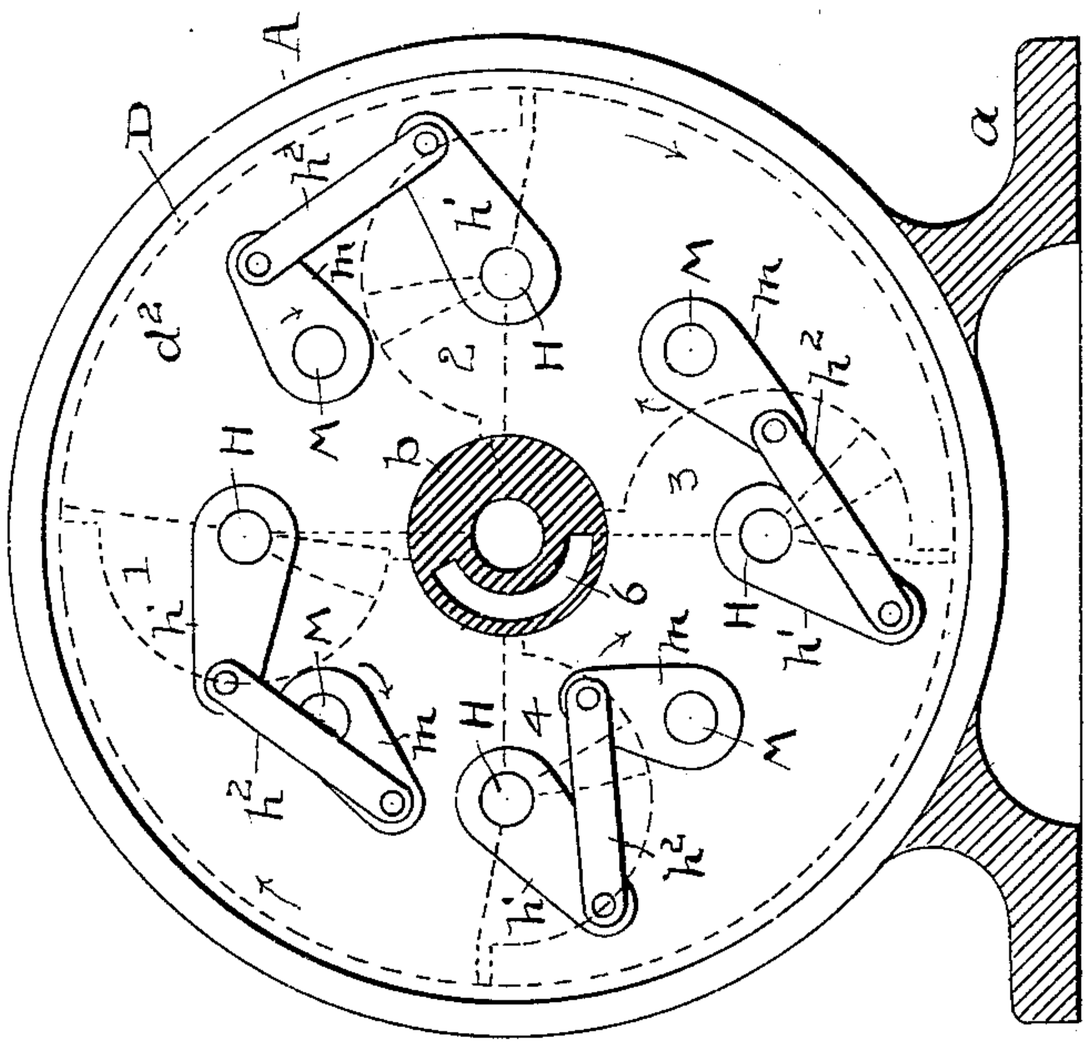



Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

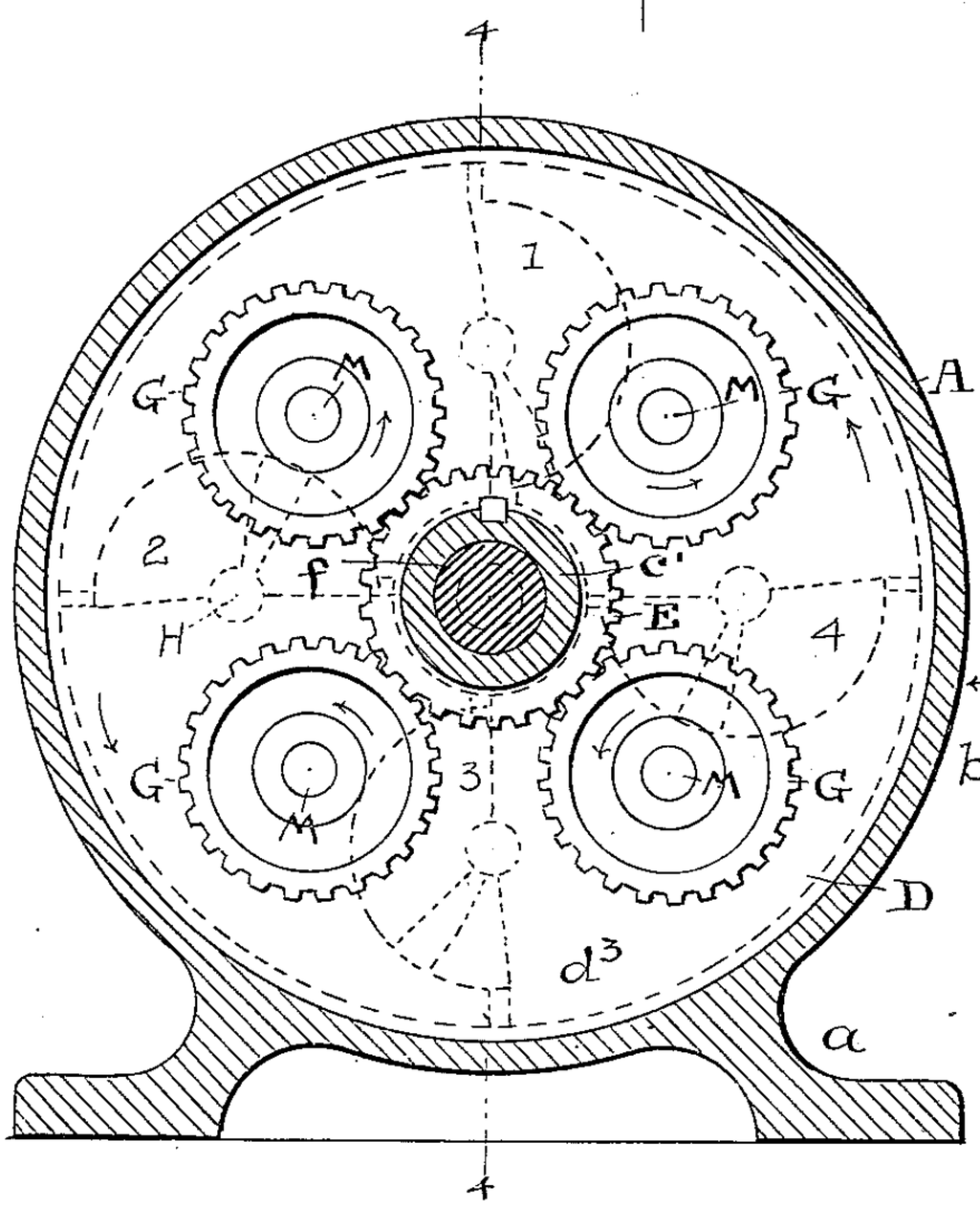
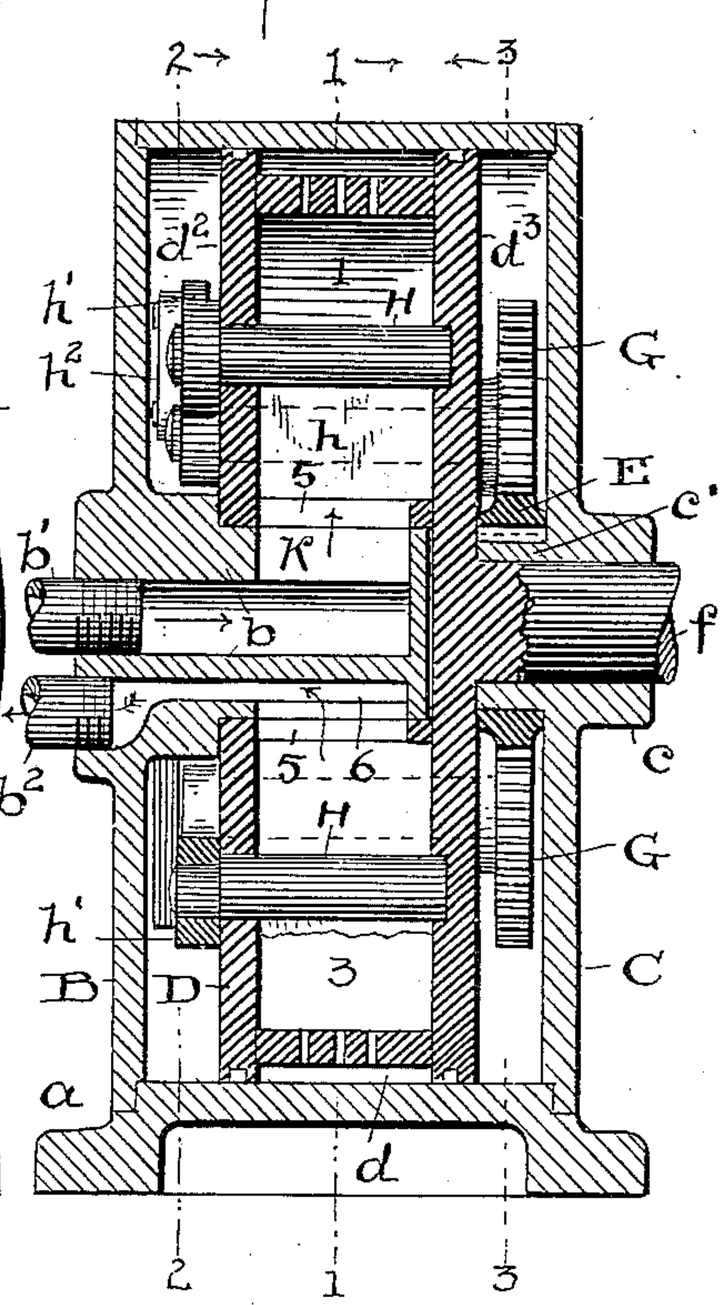



Fig. 4.



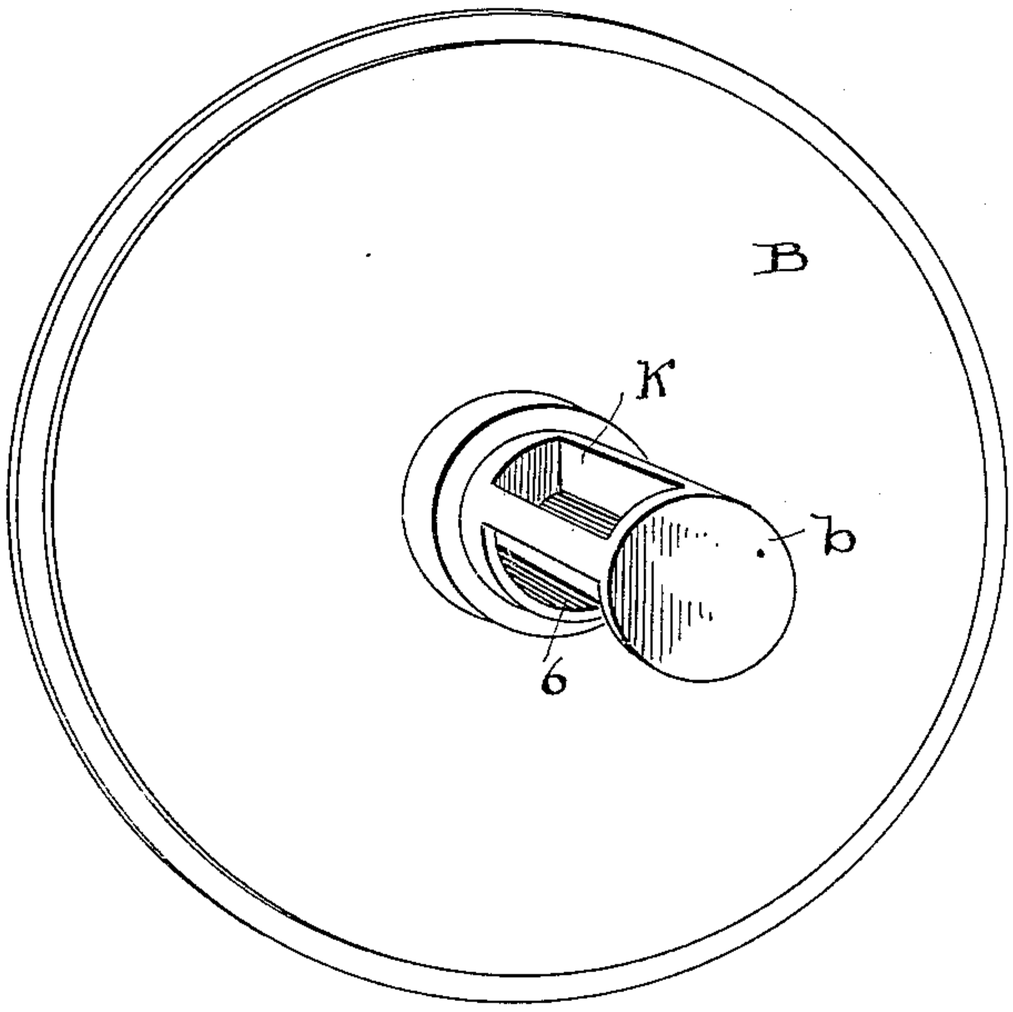




Fig. 5.

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# UNITED STATES PATENT OFFICE.

CHARLES E. FORSYTH, OF AKRON, OHIO, ASSIGNOR OF THREE-FOURTHS TO PHILIP F. HAAS, SMITH G. TIBBS, AND GEORGE HARTMAN, OF SAME PLACE.

## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 638,570, dated December 5, 1899.

Application filed March 13, 1899. Serial No. 708,803. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES E. FORSYTH, a citizen of the United States, residing at Akron, in the county of Summit and State of Ohio, have invented certain new and useful Improvements in Rotary Engines; and I do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to rotary engines; and the invention consists in the construction and combination of parts, substantially as shown and described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a cross-section of the engine in full elevation on line 1 1, Fig. 4. Fig. 2 is a cross-section in full elevation on line 2 2, Fig. 4. Fig. 3 is a cross-sectional elevation on line 3 3, Fig. 4. Fig. 4 is a cross-section on line 4 4, Fig. 3, the same being a section on the axis of the engine. Fig. 5 is a perspective view of the inner side of the side of the casing which carries the hub with the inlet and exhaust ports, cross-sections of which are seen in Figs. 1 and 2.

A represents what may be termed the "body" or "drum" of the casing, the same being fashioned, essentially, like a section of a cylinder and having the base $a$, on which the engine rests, integral therewith.

B is the front side of the casing, and C is the rear side formed in separate pieces and having each features peculiar to themselves, as will now appear. Thus the side B has an integral hub $b$ centrally on its inner side, with a through-opening substantially centrally thereof, in which connection is made by the inlet-pipe $b'$. The exhaust likewise is through this hub and connects with the exhaust-pipe $b^2$.

D is the motor-wheel complete in itself and revolving bodily in the main casing and in this instance provided with an integral spindle or shaft $f$, supported in the bearing $c$ in the side C of the casing. The wheel D for convenience in construction is made in three different parts, consisting of the body or central part $d$ and the two sides $d^2$ and $d^3$, screwed or bolted together into one, and the central part has a series of substantially half-moon cavities or chambers cast therein and numbered 1, 2, 3, and 4. These chambers are arranged, as shown, at equal distances from the center and from each other and all alike in all particulars, so that to understand clearly the use and operation of one with its associated mechanism is to understand all. Assuming, then, that the wheel D is in position for work, as in Fig. 4, it rests on its own shaft $f$ and is sleeved over the webbed hub $b$ of the main casing, and from this hub $b$ there are short ducts 5 to the several chambers 1 2 3 4, and all the ducts 5 are alike and enter said chambers in like places. There is also a gear E shown as stationarily mounted on an inwardly-projecting hub $c'$ on the inner side of side casing C, a spline serving to confine said gear in place. This affords leverage for the planetary gears G, meshing therewith and operating as hereinafter described.

In each half-moon chamber I place a steam-actuated vane or blade $h$, affixed to a shaft H, which extends through the side $d^2$ of the wheel into the open space between said wheel and the side of the inclosing casing and on which is fixed an arm $h'$, having a radius equal substantially to the radius of the blade $h$, though it may be something greater or less than this. Each arm $h'$ is connected by a link $h^2$ with a substantially similar but shorter arm $m$ on a shaft M, which passes entirely through the wheel into the open space on its opposite side and carries one of the planetary gears G, which meshes with the stationary gear E. The several gears G constitute the planetary system above referred to, revolving together and uniformly around wheel E as their center and all revolving together and getting their hold or leverage for rotation on said wheel E, which is stationary. Now to understand the operation suppose the steam to be entering chamber No. 1 through the port 5 and forcing the blade $h$ forward in the direction shown. As this occurs the power

thus exerted is communicated through shaft H to its arm $h'$ and through link $h^2$, lever $m$, and shaft M and its gear G to rotative engagement with gear E, and thus starting the wheel D in its working movement. Having made this start, steam continues to enter chamber No. 1 until port 5 is past the wide inlet area $k$ in the fixed hub $b$, when it is cut off and the steam is pocketed until it reaches the outlet area 6 of the exhaust-duct on the opposite side of the hub. Meanwhile, however, as soon as one steam-chamber passes out of communication with the inlet area $k$ the next steam-chamber—say No. 2—comes into communication with said area, and then No. 3, and so on successively and indefinitely, making round after round and with a like action in all the chambers. In these operations the blades $h$ traverse their chamber more or less completely from side to side, depending somewhat on the relative lengths of arms $h'$ and $m$ and link $h^2$, and in this instance the arms $m$ are about three-fourths the length of arms $h'$; but the arms $m$ always describe a complete circle around their axis and the gears G continue to revolve, first, under the impelling force of their own blades $h$ and thereafter by reason of the force of the other blades and their being geared with the stationary gear-wheel E. In these movements the several arms $h'$, links $h^2$, and arms $m$ assume successively the positions outlined in Fig. 2, and the reverse movement of each blade begins as its chamber reaches the exhaust area 6 in the hub $b$, Figs. 2 and 5, and as has occurred in the third position at the bottom in Fig. 2. Then as the fourth and last position of the movement is reached the blade comes back to starting-place, as seen clearly in chamber 4, Fig. 1. In this way I am enabled to get a direct and advantageous action of the steam on the four blades successively and in a manner which in the aggregate is equal to a continuous pressure on one of them, or the same as if I could follow one blade around on a complete circle with a full and undiminished head of steam all the way and continuously. That of course is not practicable, but this is, and its effect is such as to develop an engine wherein the steam is utilized and applied in the most effective manner, and an engine of extraordinary efficiency is obtained.

What I claim is—

1. In rotary engines, an outer casing, a motor-shaft and a wheel fixed thereon having a series of steam-chambers walled in upon all sides and a single inlet and outlet for each chamber, swinging blades in said chambers, and gears and lever-and-link mechanism to convey the power from the blades to the said wheel and shaft, substantially as described.

2. In rotary engines, a motor-wheel having substantially half-moon chambers at intervals an equal distance from its center, an oscillating blade in each chamber, a shaft for each blade, parallel shafts operatively connected with the blade-shafts, and means to convey the power thence to the motor-wheel, substantially as described.

3. The main casing, a motor-wheel inclosed therein having a separately-formed central portion with a succession of steam-chambers between at regular intervals and extending from side to side thereof, a blade and a shaft therefor in each chamber extending out through one side of said wheel, a parallel shaft connected with each of said blade-shafts by arm-and-link mechanism, and means to transmit the power from said parallel shafts to drive said motor-wheel, substantially as described.

4. In a rotary engine, the main casing, a motor-wheel in said casing and a stationary gear-wheel between said wheel and casing, a planetary system of gears on the outside of said motor-wheel meshing with said stationary gear, a series of rock-shafts in said wheel having arms on the opposite side from the said planetary gears, and vibratory blades in said motor-wheel having a shaft-and-link connection with said rock-shafts, substantially as described.

5. The casing having an inwardly-projecting hub with inlet and exhaust ports through the same, and a motor-wheel sleeved over said hub having a series of steam-chambers in open communication with the said ports, swinging blades in said chambers and means to convey power from said blades to said motor-wheel, said means comprising a series of parallel shafts having link connection at one end with the shafts of the said blades and power connections with the opposite ends of the said parallel shafts to drive the motor-wheel, substantially as described.

6. The main casing having an inwardly-extending hub provided with inlet and exhaust ports and a fixed gear mounted on the other side of the casing from said ports, in combination with a motor-wheel sleeved over said hub and having steam-chambers open to the ports through said hub, vibratory blades in said chambers, a series of planetary gears carried by said wheel and meshing with said fixed gear, and mechanism connecting said blades and series of gears comprising a series of shafts and links, substantially as described.

7. In a rotary engine, a motor-wheel having a series of steam-chambers, a blade for each chamber and a shaft for each blade having an arm at one end, a parallel shaft for each blade-shaft having an arm, and a link connecting the arm of the blade-shaft with the arm of the parallel shaft, and gears from said parallel shafts to communicate the power to the power-shaft, substantially as described.

8. The motor-wheel having a series of chambers of substantially half-moon form in cross-section, a blade adapted to oscillate in each

chamber and a shaft for each blade extending through the side of the wheel at one end, in combination with a parallel shaft for each blade-shaft and a link connecting the corresponding ends of said shafts, a stationary gear about the axis of the said motor-wheel on the side opposite said link connections, and a gear on each parallel shaft meshing with the said stationary gear, substantially as described.

Witness my hand to the foregoing specification this 9th day of March, 1899.

CHARLES E. FORSYTH.

Witnesses:

BERTHA A. WILSON,

W. O. WISE.