

B. L. QUAYLE & H. L. CUMMINS.
 ROTARY ENGINE.

APPLICATION FILED APR. 5, 1912.

1,058,331.

Patented Apr. 8, 1913.

4 SHEETS-SHEET 1.

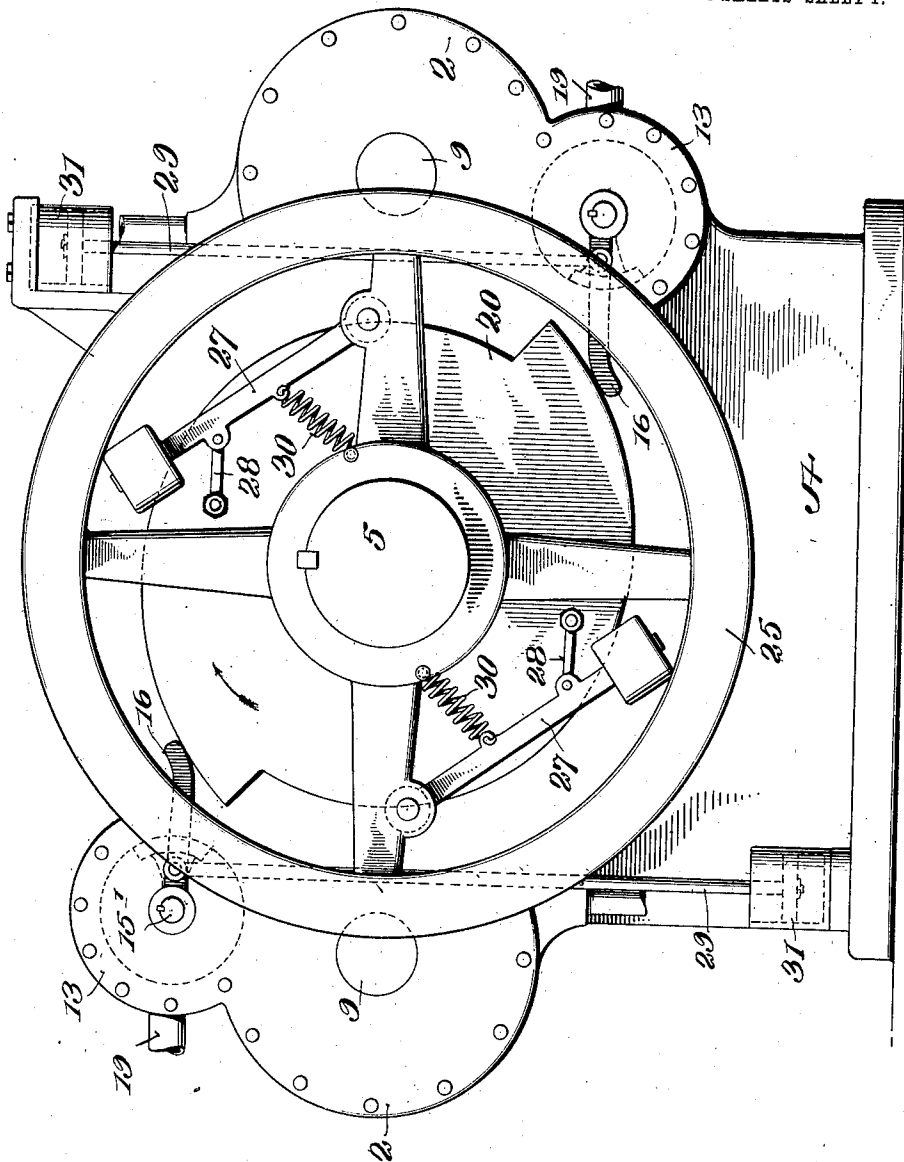


Fig. 1.

Witnesses
Helge M. May,
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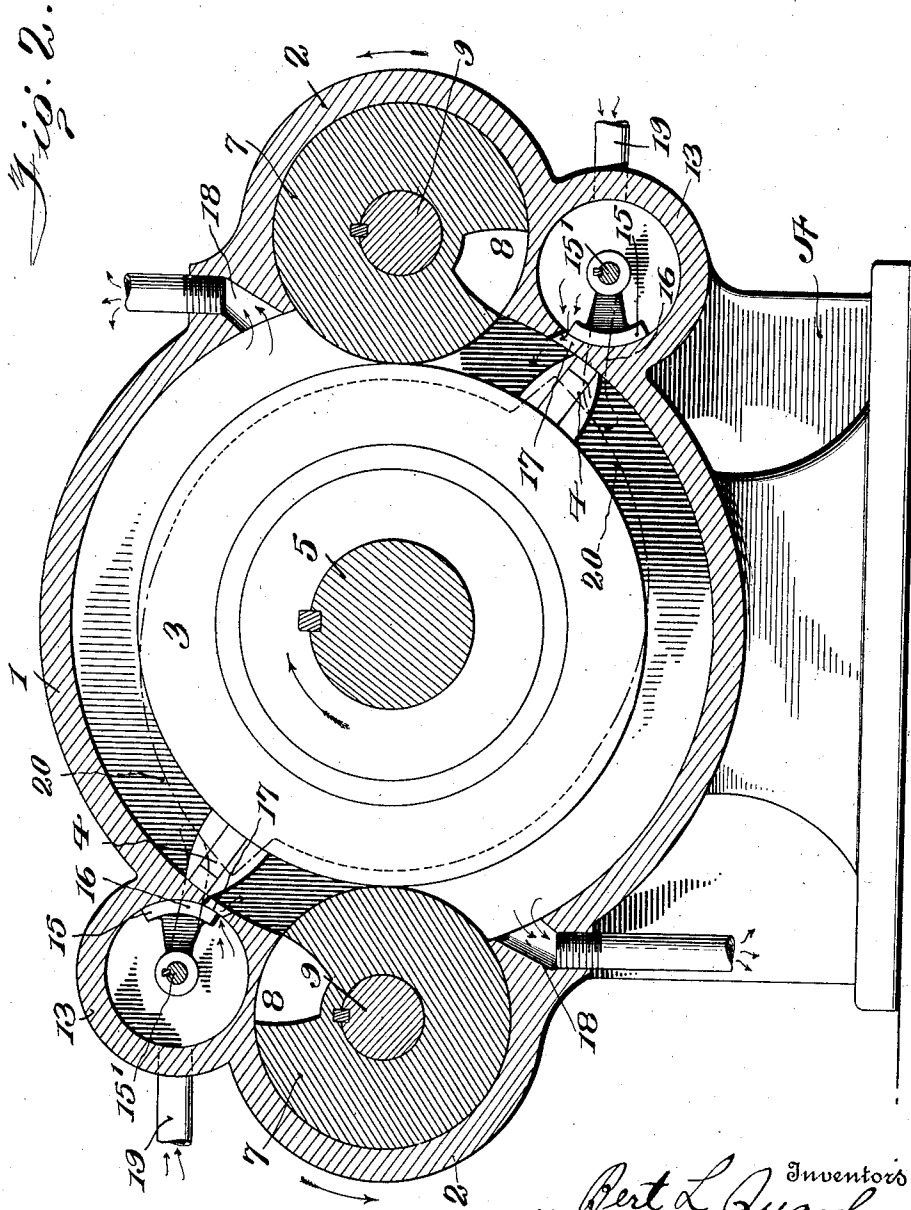
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4 SHEETS—SHEET 2.



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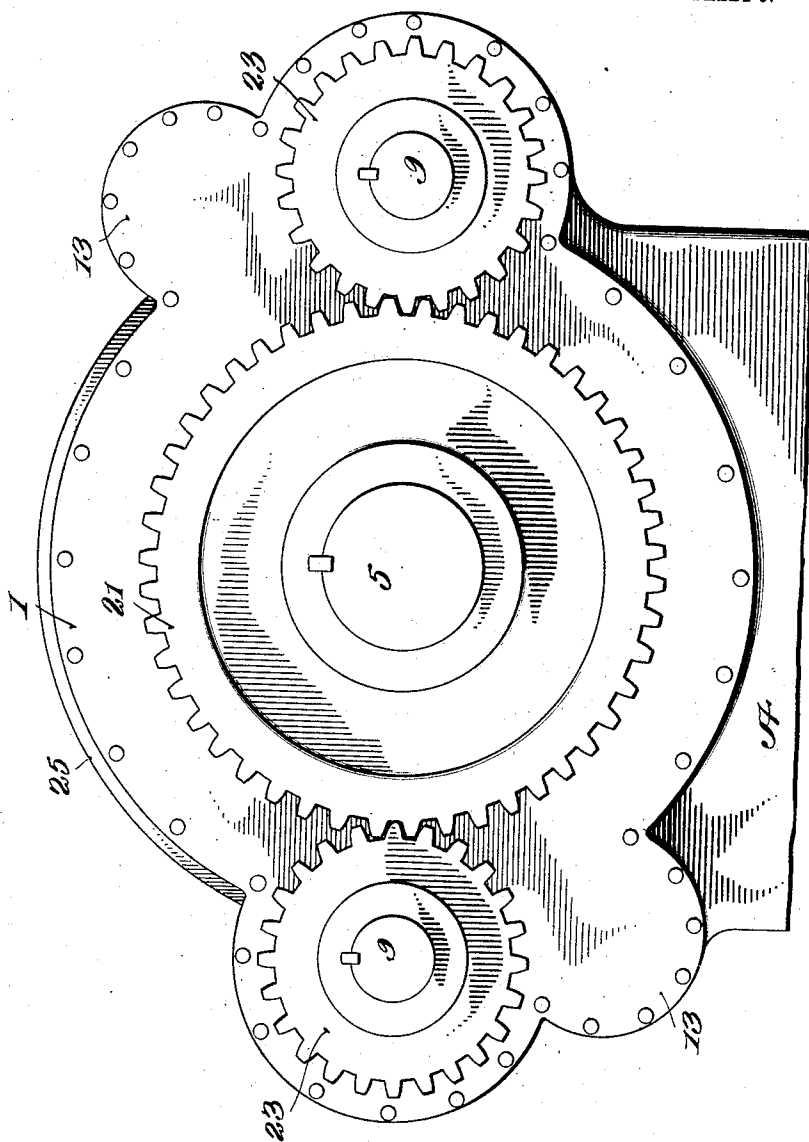
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Fig. 3.



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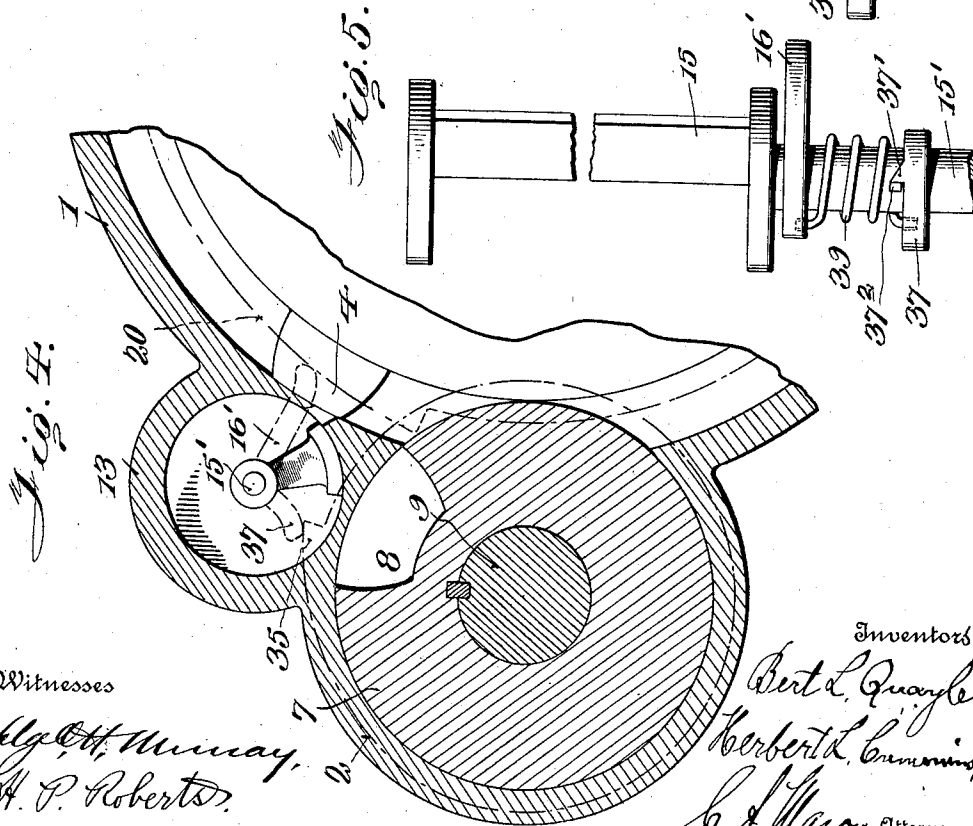
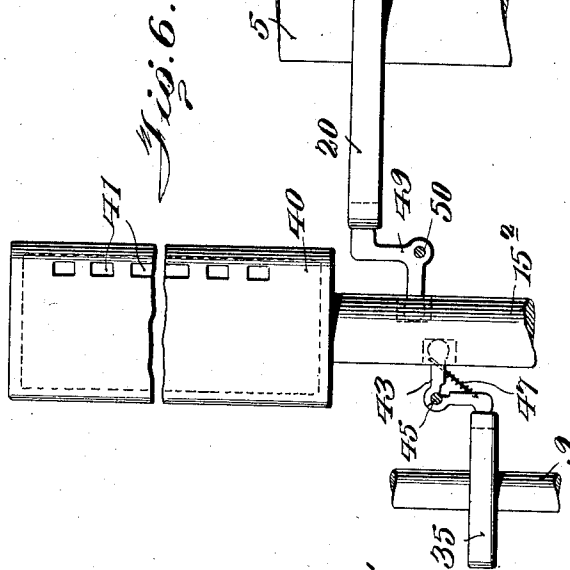
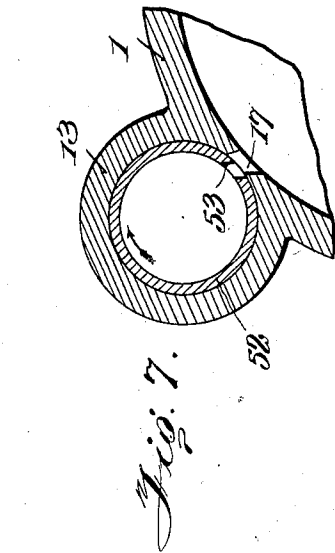
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4 SHEETS—SHEET 4.



Witnesses

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UNITED STATES PATENT OFFICE.

BERT L. QUAYLE AND HERBERT L. CUMMINS, OF EAST ELY, NEVADA.

ROTARY ENGINE.

1,058,331.

Specification of Letters Patent. • Patented Apr. 8, 1913.

Application filed April 5, 1912. Serial No. 688,656.

To all whom it may concern:

Be it known that we, BERT L. QUAYLE and HERBERT L. CUMMINS, citizens of the United States, residing at East Ely, in the county of White Pine and State of Nevada, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

This invention relates to rotary engines in general and more particularly to certain improvements in rotary engines of the type shown in United States Letters Patent No. 1,017,139, granted February 13, 1912.

One of the objects of the present invention is to provide a rotary engine of the type referred to and employing a main or driving rotor carrying pistons, and side rotors having recesses to receive the pistons, and in which the steam, air, gas, or other fluid is admitted directly to the cylinder of the piston rotor instead of through ports leading to the side rotors, thereby reducing the clearance to a minimum.

Another object of the invention is to provide a construction in which the size of the side rotors is reduced to one-half the size of the piston rotor, thereby rendering it possible to employ a single piston-receiving recess in each side rotor, as well as securing an arrangement wherein a fuller expansion of steam or other gas is secured, as compared with the older arrangement. Under the present improvements the sole functions of each of the side rotors are, first, to afford a passage for the pistons, through the single recess in the side rotors, and second, to provide a base or fulcrum for the steam or gas as it acts expansively in forcing the pistons forward.

A further feature of the present improvement is the elimination of one of the two sets of balancing pressure pockets which were necessitated by the former design of engine, namely, the set of pockets which were arranged to balance the constant pressure from the boiler, or other source, which was applied through ports leading from the passages extending part way around the cylinders of the side rotors.

With these, and other objects in view, the invention consists in the construction and arrangement of parts hereinafter more particularly described and claimed.

In the drawings: Figure 1 represents an end elevation of an engine embodying the present invention, and showing a governor

mechanism therefor; Fig. 2 is a longitudinal vertical sectional view; Fig. 3 is an elevation of the end of the engine opposite to that shown in Fig. 1; Fig. 4 is a sectional detail illustrating a modified form of valve-controlling mechanism; Fig. 5 is a plan view of the valve mechanism shown in Fig. 4; Fig. 6 is a plan view illustrating, diagrammatically, a modified form of valve and its operating mechanism; and Fig. 7 is a sectional detail view of still another modification.

Referring first to Figs. 1, 2 and 3, the engine casing A comprises a suitable base and three compartments 1, and 2, 2. The central compartment 1 receives the driving rotor 3 which is fast to the main shaft 5 supported in bearings in the casing, and the rotor 3 carries two diametrically arranged pistons 4, 4, which are projected to engage the inner wall of the compartment 1, clearance spaces being provided between the inner surface of the compartment and the periphery of the rotor, as shown in Fig. 2, the ends of which spaces are provided with exhaust ports 18. The side rotors 7, 7, rotatably mounted in the compartments 2, 2, are secured to shafts 9, 9, which are supported by bearings in the casing A. The diameter of each of these side rotors is equal to one half the diameter of the rotor 3, and the side rotors each have a single recess 8 which is so located as to receive the pistons 4, during the rotation of the rotors. As shown in Fig. 3 one end of shaft 5 carries a gear 21 which meshes with two gears 23, 23, carried respectively, by the shafts 9 of the side rotors, each of the gears 23 being provided with one-half the number of teeth as the gear 21. From this construction it follows that on each complete rotation of the rotor 5 in a clockwise direction, for example, the rotors 7 are caused to make two complete rotations in an anti-clock-wise direction, the recesses 8 of each side rotor being made to receive each piston 4, alternately, and the cylindrical surfaces of the side rotors being maintained in abutting contact with the peripheral surface of the rotor 3.

Referring now to the valve mechanism illustrated in Fig. 2, the casings 13, arranged adjacent the compartments 2, and at diametrically opposite points on the compartment 1, have steam inlets 19, and support in suitable bearings valve stems 15' to which are fast oscillating valves 15 of the Corliss

type, to control the ports 17 leading to the compartment 1. Located outside of each valve chamber and connected with the valve stem is a cam finger 16, and when the valve is closed this finger extends in a direction which is substantially on a line connecting the axis of the valve stem with that of the shaft 5. A cam 20 (see Figs. 1 and 2) is rotatively mounted on the shaft 5 and is connected with said shaft through weighted governor arms 27 which are pivoted to a fly wheel 25 at one end, and near the opposite end are connected to links 28, which are in turn pivoted to the cam 20. The springs 30 connect the hub of the fly wheel 25 with the arms 27 at points intermediate the connections of these arms with the fly wheel, and with the links 28. The outer ends of the finger 16 normally rest upon the periphery of the cam 20 and rods 29 are pivotally connected to these fingers, and at the other ends carry pistons 31 fitting cylinders which are supported from the main frame, and form dash posts to control the movements of the valve and return them to closed position when the cam fingers 16 are released from the action of the cam, following the opening movement of each valve. The cam 20 is so designed as to pick up the valve fingers and open the valves at the proper time to admit steam behind the pistons 4, such action serving to raise the pistons 31 of the dash pots, creating a partial vacuum therein, so that when the fingers escape from the cam projections the valves will be closed by the atmospheric pressure acting upon the outer sides of the dash pot pistons.

As the position of the cam 20 on the shaft 5 is determined by the governor mechanism in accordance with the speed of the engine it will be seen that an automatic variable cut-off of the steam is, by the construction above described, effected so as to use the steam expansively in proportion to the load on the engine, the dash pot method of return for the valve being a preferable form for engines designed for low speed work (*e. g.*, up to 150 revolutions per minute). Where, however, the engine is employed for high speed work the dash pot feature need not be employed, and preferably the modified form of valve mechanism illustrated in Figs. 4 and 5 will be used. In this modified construction a valve of the Corliss type, the same as shown in Fig. 2, is employed, and the valve stem is equipped with two valve operating fingers, 37 and 16', the former to be actuated by a cam 35 which is fast on the side rotor shaft 9 and serving to move the valve in a direction for uncovering the steam port 17, and the latter to be actuated by the cam 20 carried by the shaft 5, and serving to reversely actuate the valve for closing said port. Under this modified

form, it will be observed, the valve is opened in a clock-wise direction, and is closed in a contra-clock-wise direction, instead of the reverse of these operations, as illustrated in the form shown in Fig. 2. With said modification, it will be seen, the cam 20, which is carried by the rotor shaft 5 and may be governor controlled as in the construction first described, is in coöperative relation to a cam carried by the side rotor shaft to effect, in connection with the governor mechanism, the variable cut-off. An important feature of this embodiment of the invention is that under conditions of very light load, the valve may not open fully, nor, in some instances, need it open at all. In order to prevent an interference between the cams 35 and 20 in this construction, the devices shown in Fig. 5 are employed. As therein illustrated, the cam finger 16' which is fixed on the valve stem 15', is connected by the torsion spring 39 with the cam finger 37, so as to provide for relative yielding movements of these cam fingers. The finger 37 is loosely mounted on the stem 15', and is provided with a shoulder 37' normally held against a rigid stop 37² on the shaft 15'. When, then, the load on the engine is lightened to such an extent that the engine tends to race, the governor will shift the cam 20 so as to cause the latter to pick up the finger 16' before the finger 37 has escaped over the point of the cam 35. The connection of the finger 37 through the torsion spring 39 will then permit said finger to yield so that the valve will be prevented from fully opening the port 17, or said port may not be opened at all by the valve operating mechanism. Under these conditions the finger 37 would pass over the point of the cam 35, tightening the torsion spring, and permitting on its return the shoulder 37' to snap back against the stop 37².

Fig. 6 illustrates the elements of another valve mechanism which may be employed with those improvements, and wherein an axially reciprocating valve 40 in the form of a hollow cylinder and having a series of ports 41, is used in lieu of the oscillating valve heretofore described. The valve 40 may be arranged in the casing 13, which latter will be provided with a plurality of ports with which the ports 41 in the valve will register to admit steam, and in which these ports will be out of registry when the steam is cut off. In order to effect reciprocating motion of this valve in the direction of its axis a rigid bell crank 49 is pivoted at 50 to the casing, and has one end in connection with a recess in the valve stem 15² and its opposite end in position to be actuated by the cam 20; while a second bell crank 43, pivoted at 45 to the casing, has one arm similarly connected to a re-

cess in the valve stem, while its other arm is in position to be actuated by a cam 35 carried by the side rotor shaft 9. The arms of the bell crank 43 are yieldingly connected by a spring and rod 47, as shown, and said arms are independently hinged to the pivot 45. In the use of this valve mechanism the opening movement would be effected through the cam 35 and bell crank 43, which would serve to actuate the valve in one direction along its axis to open the steam ports, while a reverse movement of the valve along its axis would be effected through the cam 20 and bell crank 49, to close the steam ports. In the event that the cam 20 should actuate the bell crank 49 to reverse the movement of the valve before the bell crank 43 had been released by the cam 35, the spring 47 would permit relative yielding movement of the two arms of bell crank 43 and the action would be the same as that of the construction shown in Figs. 4 and 5, under similar conditions.

Fig. 7 illustrates a rotary valve 52, provided with a port 53, for admitting steam to, or cutting it off from port 17 leading to the driving rotor, and which form of valve may be employed in lieu of those heretofore described, if desired. Any suitable geared connections from the main shaft 5 to a stem carried by the valve 52, or from either of the side rotor shafts to the valve stem, could be employed for effecting rotary movement of this valve in proper time relation to admit steam to the pistons of the rotor 3, and to cut off, as desired. With this form of valve a governing mechanism such as shown for example, in Fig. 1, would be applied to control the throttle valve of the engine, instead of for controlling the time of cut-off for the rotary valve.

In the operation of this engine the steam is admitted through the inlets 19 to the valve chambers 13, and at about the time the pistons clear the ports 17 the cam fingers are picked up by the cam 20 to open the valves and admit steam behind the pistons, which acts thereon expansively until the pistons reach the exhaust ports 18, when the exhaust steam is discharged. The governing mechanism so controls the position of the cam 20 on the shaft 5, that the time of cut-off is regulated according to the speed of the engine in the manner in which governors of this type usually operate. With this design of engine the side rotors have but a single recess which is covered by the wall of the compartment 2 before steam is admitted to the pistons, so that at no time are the recesses in the side rotors charged with steam, or other gas, as the intake port leads directly into the compartment of the piston rotor, instead of through ports leading into the compartments of the side rotors. By this design, also, the diameter of

the side rotors is reduced to one half the diameter of the main or driving rotor. By this improvement also the clearance of the engine is reduced to a minimum, as it now consists only of the volume of the port 17.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. A rotary engine comprising a casing having two side compartments and an intermediate compartment, the latter provided with exhaust ports, a rotor in the intermediate compartment carrying diametrically disposed pistons with a space between said rotor and the walls of its compartment, rotors carried by the side compartments each having a single recess therein, valves operating to admit fluid directly to the intermediate compartment, and mechanism to open said valves after said recesses have reached a position to be closed by the casing.

2. A rotary engine comprising a casing having two side compartments and an intermediate compartment, the latter provided with exhaust ports, a rotor in the intermediate compartment carrying diametrically disposed pistons with a space between said rotor and the walls of its compartment, rotors carried by the side compartments each having a single recess therein, oscillating valves operating to admit fluid directly to the intermediate compartment, fingers carried by the valve stems, a rotarily adjustable cam on one of the rotor shafts having engagement with said fingers for positively moving the valves in one direction, and means for moving the valves in the opposite direction when the fingers are released by said cam.

3. A rotary engine comprising a casing having two side compartments and an intermediate compartment, the latter provided with exhaust ports, a rotor in the intermediate compartment carrying diametrically disposed pistons with a space between said rotor and the walls of its compartment, rotors carried by the side compartments each having a single recess therein, oscillating valves for admitting fluid directly to the intermediate compartment, fingers carried by the valve stems, a rotarily adjustable cam to act on said fingers and thereby impart movements directly to the valves, and governor mechanism for actuating said cam to vary the cut-off in accordance with the speed of the engine.

4. A rotary engine comprising a casing having two side compartments and an intermediate compartment, the latter provided with exhaust ports, a rotor in the intermediate compartment carrying diametrically disposed pistons with a space between said rotor and the walls of its compartment, rotors carried by the side compartments each

having a single recess therein, valves for admitting fluid directly to the intermediate compartment, fingers connected with each of said valves, means permitting relative yielding movement of said fingers, cams carried respectively by the piston and side rotor shafts for engaging the fingers to effect opening and closing movements of the valves, and means to vary the time of engagement of one of said cams and its finger for each valve in accordance with the speed of the engine.

5. A rotary engine comprising a casing having two side compartments and an intermediate compartment, the latter provided with exhaust ports, a rotor in the intermediate compartment carrying diametrically disposed pistons with a space between said rotor and the walls of its compartment, rotors carried by the side compartments each having a single recess therein, valves for admitting fluid directly to the intermediate compartment, fingers connected with each of said valves, means permitting relative yielding movement of said fingers, cams carried respectively by the piston and side rotor shafts for engaging the fingers to effect opening and closing movements of the

valves, and a governor to control the time of engagement of the valve-closing cam with its fingers in accordance with the speed of the engine.

6. A rotary engine comprising a casing having compartments, a rotor in one compartment provided with a radial piston, said rotor being disposed to provide a space between its periphery and the compartment, a rotor carried by another compartment and having a recess to receive said piston, an oscillating valve to control the flow of steam to the first-named compartment, a finger carried by the stem of said valve, a rotarily adjustable cam having engagement with said finger and adapted to thereby directly impart movements to the valve in one direction, governor mechanism for actuating said cam to vary the point of cut off, and yielding means to impart opposite movements to the valve.

In testimony whereof we affix our signatures in presence of two witnesses.

BERT L. QUAYLE.

HERBERT L. CUMMINS.

Witnesses:

CHARLES S. CHANDLER,
FRANCIS J. REILLY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."