A. C. SAVIDGE.

ROTARY ENGINE.

APPLICATION FILED MAR. 27, 1909.

968,268. Patented Aug. 23, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

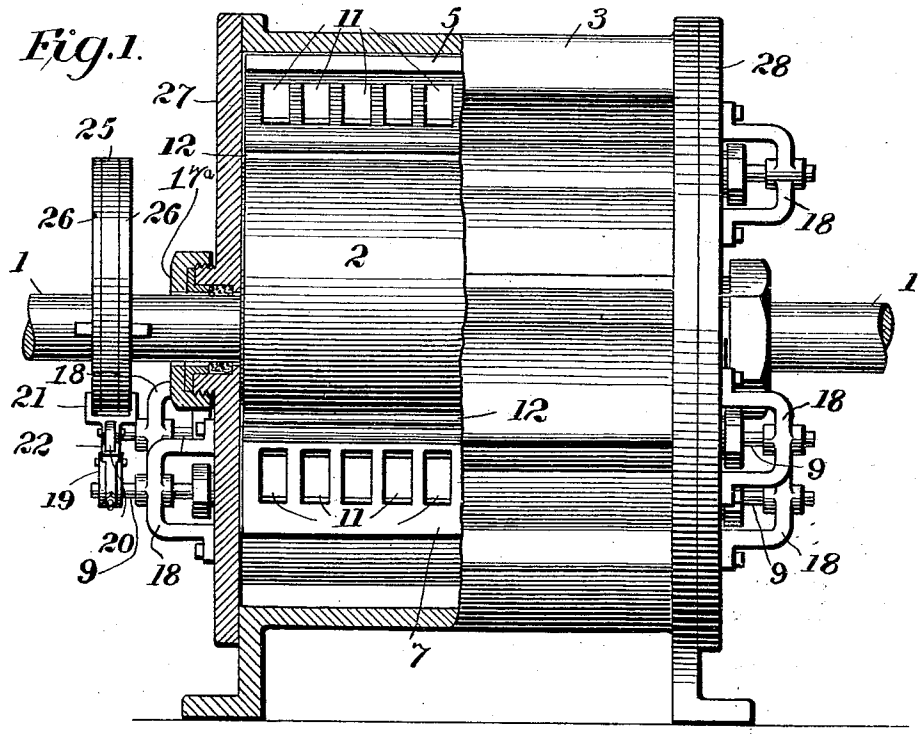
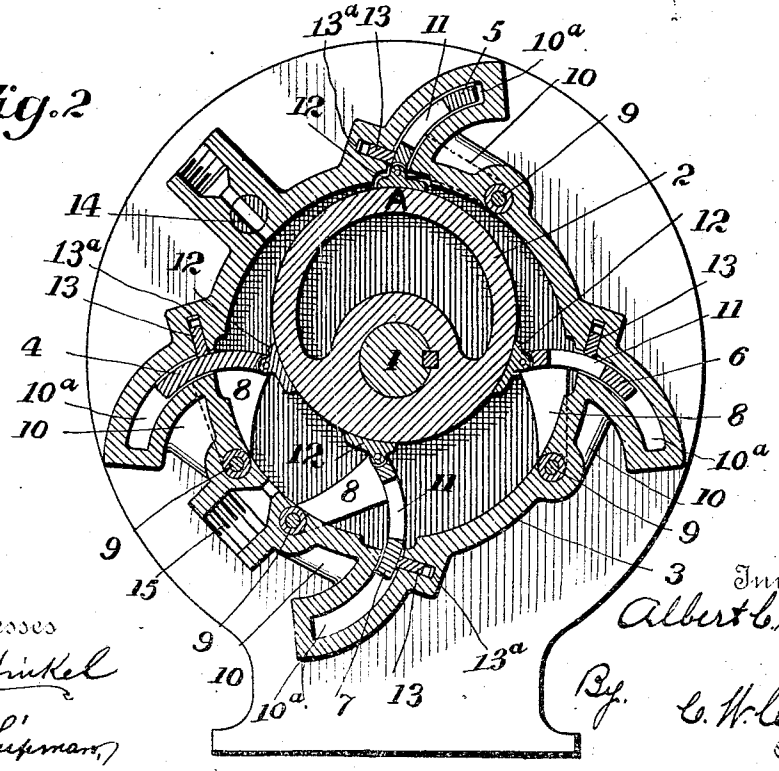


Fig. 2



Witnesses

J. G. Stinkel

C. F. Shipman

Inventor

Albert C. Savidge

By C. W. Clement

Attorney

A. C. SAVIDGE.

ROTARY ENGINE.

APPLICATION FILED MAR. 27, 1909.

968,268.

Patented Aug. 23, 1910.

2 SHEETS—SHEET 2.

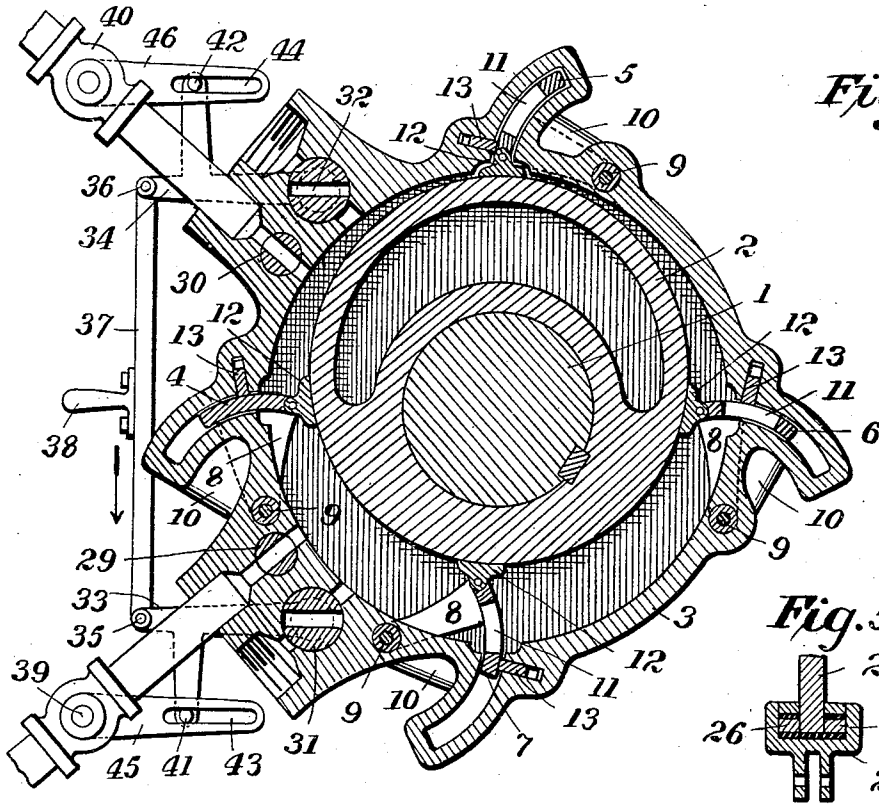


Fig. 3

Fig. 5

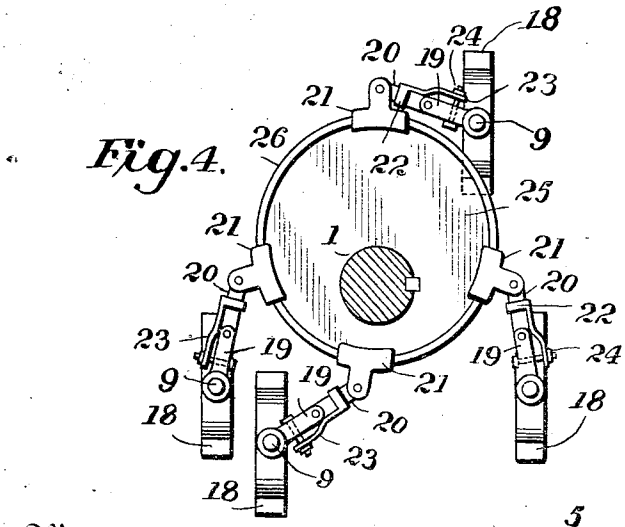


Fig. 4.

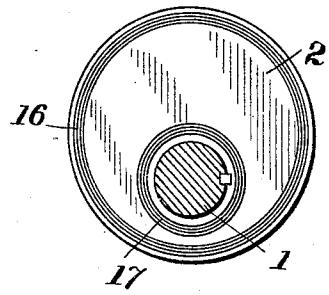


Fig. 6.

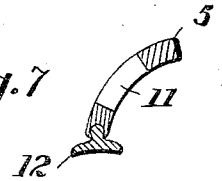


Fig. 7

Witnesses

J. G. Hinkel

C. E. Shipman.

Inventor

Albert C. Savidge

By C. H. Lemmon

Attorneys

UNITED STATES PATENT OFFICE.

ALBERT C. SAVIDGE, OF SUNBURY, PENNSYLVANIA.

ROTARY ENGINE.

968,268. Specification of Letters Patent. **Patented Aug. 23, 1910.**

Application filed March 27, 1909. Serial No. 486,068.

To all whom it may concern:

Be it known that I, ALBERT C. SAVIDGE, a citizen of the United States, residing at Sunbury, in the county of Northumberland and State of Pennsylvania, have invented new and useful Improvements in Rotary Engines, of which the following is a specification.

This invention comprises improvements in rotary engines whereby the steam space within the engine is divided into several compartments and the steam or other fluid which operates the engine is admitted from one compartment to another in succession to act upon the piston.

In the accompanying drawing, which illustrates my invention, Figure 1 is a side elevation partly in central longitudinal section, of an engine embodying my improvements; Fig. 2 is a transverse central section through the engine shown in Fig. 1; Fig. 3 is a central transverse section through a similar engine provided with reversing mechanism and ports; Fig. 4 is a side view of the eccentric and connecting parts, external to the engine casing, for holding the valves or gates within the engine in contact with its piston; Fig. 5 is a sectional view taken through the rim of the eccentric shown in Fig. 4; Fig. 6 is an end view of the piston; and, Fig. 7 is a detail view showing a modification, in which the shoe upon the gate is connected to the gate in a different way from that shown in the other views of the drawing.

Referring to Figs. 1, 2, 4, 5 and 6 of the drawing, 1 indicates the engine shaft upon which is eccentrically mounted a drum piston 2, arranged within an outer casing 3. The shaft is to be supported by suitable bearings, external to the casing, but not shown in the drawings. The casing is provided with a valve 14 for admitting steam to its interior, which valve may be left constantly open while the engine is in use, or intermittently opened and closed during each rotation of the piston, as hereinafter mentioned, and a constantly open exhaust port 15 is also provided in the peripheral wall of the casing. Between the inlet and exhaust ports is arranged an abutment comprising a curved plate 4 having a shoe 12 pivotally connected thereto, the shoe bearing constantly against the periphery of the piston. This abutment prevents the steam from passing directly from the inlet to the exhaust port. The curved abutment plate is connected to one or more rocker arms 8 which are secured to a rock shaft 9 passing longitudinally through the casing. The curved abutment plate 4 moves back and forth in a recess 10^a as the piston rotates and the rocker arms 8 swing in recessed portions 10 of the casing. A packing rod 13, which may be continuous in short cylinders, or in several sections, for longer cylinders is arranged in a recess in the casing and pressed against the abutment plate by a suitable spring 13^a. Gates or valves 5, 6 and 7 are arranged at suitable distances apart around the casing, these gates being similar in all respects to the abutment 4 except that in the gates openings 11 are provided to permit steam to pass through, while the abutment is continuous so as to prevent the passage of steam. The gates are connected to rock shafts 9 by arms 8 and packings 13 bear against the gates.

The ends of the piston are preferably provided with packing rings 16 near the periphery and with similar rings 17 surrounding the shaft, which rings prevent the escape of steam through the openings for the shaft at the ends of the casing. Stuffing boxes 17^a may also be arranged in the heads 27 and 28, surrounding the shaft, for preventing the escape of steam.

The rock shafts 9 are journaled in suitable brackets 18 at the ends of the casing and upon each shaft is rigidly secured an arm 19 which, in turn, is flexibly connected to a shoe 21 by a link 20 and a spring 23, said spring being secured at 22 to the link 20 and connected to an adjustable bolt 24 in the arm 19, whereby the tension of the spring may be varied. The eccentric disk 25 has lateral flanges 26 and the shoes 21 are formed so as to fit around these flanges, as shown in Fig. 5. The flanged eccentric 25 is secured to the shaft, external to the casing, and as the eccentric revolves the shoes 21 are moved toward and from the axis of the shaft by the eccentric, as will be obvious, and the shafts 9 caused to rock. The abutment plate 4 and the gates 5, 6 and 7, being connected through the arms 8 to the shafts 9, the rocking motion of the shafts will be communicated to the abutment and gates. The periphery of the eccentric 25 is concentric with the periphery of the piston, and, therefore, the movements of the shoes on the eccentric will cause cor-

responding movements of the abutment and gates, and the shoes 12 on the latter will be constantly held against the periphery of the piston, with a yielding pressure which is governed by the tension of the springs 23. If desired, eccentrics 25 may be arranged at both ends of the casing and each may be connected to the shafts 9 by connections similar to those shown in Fig. 4, but ordinarily a single eccentric will suffice. Suitable stuffing boxes will be arranged around the rods 9 where they pass through the ends of the casing. The gates and abutment divide the steam space of the casing into a series of compartments, the first in the series being that opposite the inlet valve 14 and between the abutment 4 and gate 5, the second compartment being between the gates 5 and 6, the third being between the gates 6 and 7 and the fourth or last compartment being the one opposite the exhaust port between the gate 7 and the abutment 4. The inlet valve 14 may be operated by an eccentric upon the shaft (not shown) so as to open one or more times during the rotation of the piston.

The operation of the engine shown in Figs. 1 and 2 is as follows: When the high point A of the piston (Fig. 2) has passed slightly beyond the inlet port, in moving to the right, or in a clockwise direction, the valve 14 opens and admits steam into the first compartment, the gate 5 at this time being closed. When the point A of the rotating piston reaches a certain position between the gates 5 and 6 the inward movement of the gate 5 opens the port 11 therein (the gate 6 being at this time closed) and steam enters from the first compartment into the second compartment. The steam will then act directly or expansively upon the piston in both compartments depending upon whether or not the admission valve is open or closed. A further movement of the piston closes the gate 7 and opens the gate 6 allowing the steam to enter into the third compartment, where the steam will act upon the piston as in the previous compartment until the point A in the piston reaches a certain position between the gate 7 and abutment 4, when the gate 11 will open and allow the steam to pass directly through the exhaust port 15. The inlet valve 14 closes before the gate 7 opens, and when the high point A in the piston passes the inlet port the valve 14 again opens and the operations are repeated. If it is desired to use the steam expansively the valve 14 will be arranged to close at any desired point in the revolution of the piston; but when it is desired to use the live steam pressure throughout the stroke of the piston the operation will be as above described. It will readily be understood, from an inspection of Fig. 2, that the free exhaust from each compartment of the casing will be allowed until that compartment is about to be used for the admission of steam. It is necessary to have one abutment, but the engine may have one or any desired number of gates.

Fig. 3 in the drawing shows a rotary engine of similar construction and operating upon the same principle as that described in connection with Figs. 1 and 2, but provided with reversing mechanism and ports. As shown in Fig. 3, at one side of the abutment 4 the casing is provided with inlet and exhaust valves 30 and 32, respectively, and at the opposite side of the abutment are arranged other steam and exhaust valves 29 and 31, respectively. If the exhaust valve 32 is closed and exhaust valve 31 is open at the same time that steam is shut off from admission valve 29 and steam is admitted to admission valve 30 the engine will rotate in the same direction as previously described in Fig. 2, when admission valve 30 is properly operated for that purpose. If the exhaust valve 31 is closed and the exhaust valve 32 is open at the same time that the steam is shut off from admission valve 30 and steam is admitted to admission valve 29, the engine will operate in an opposite direction to that previously described in Fig. 2, when admission valve 29 is properly operated for that purpose, and the principle of operation will be substantially the same as previously described. On this figure is shown a reversing mechanism for positively controlling the steam through these valves so that the various ones may be in a proper position for the operation of this engine in the desired direction. This reversing mechanism directly controls the position of the exhaust valves 31 and 32 and directly controls the admission of steam to the admission valves. The admission valves 29 and 30 are operated by any proper valve mechanism not shown here. In this figure 33 and 34 are arms directly operating the exhaust valves 31 and 32. Pivotally attached to the end of these arms at 35 and 36 is the operating rod 37 on which is placed operating handle 38. 39 and 40 are steam valves placed in the steam feed pipe or an extension of or to the casing proper, and on the supply side of the admission valves 29 and 30. Pins 41 and 42 are placed on the arms 33 and 34 and the action of these pins in the slots 43 and 44, when the lever 37 is moved, determines the position of the arms 45 and 46 and therefore the position of the steam valves 39 and 40 which these arms control. The reversing mechanism is here shown in a neutral position with both exhaust valves closed and both steam valves 39 and 40 so adjusted as to be closed. The movement of the lever 37 in the direction shown by the arrow places the engine in condition to be operated in a clock-wise di-

rection as previously described and the movement of operating lever in the opposite direction will allow engine to be operated in the opposite direction.

In general, from the drawings and description, it is readily seen that the rotating piston is simply made, with no steam packing rods necessary in its peripheral surface as in some types of rotary engines, nor is any direct contact necessary between the periphery of the rotating piston and the casing as in some other types of rotary engines.

In the operation of a rotary engine, as herein described, I obtain, in effect, a continuous utilization of the initial charge of steam by admission of said initial charge to successive sections, inside the casing, at such periods that the clearance between the rotating piston and the casing, in each successive compartment, is practically a minimum and at about such periods that the action of the steam is effective in producing rotation in the proper direction.

I do not limit my engine to the use of steam, but it may be utilized in connection with any gases or fluids which are suitable for its operation. If the engine is attached to a source of power and the admission valve, in the first section of casing, is open, the engine may be utilized as a pump and I desire to protect the above for this purpose also.

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 inlet and exhaust ports, a shaft, a piston eccentrically mounted upon said shaft within the casing, an abutment bearing upon the periphery of said piston between said ports, and a gate bearing upon the periphery of the piston and dividing the steam space into compartments, said gate being adapted to open and close communication between successive compartments during each revolution of the piston.

2. A rotary engine comprising a casing having inlet and exhaust ports, a shaft, a piston eccentrically mounted upon said shaft within the casing, an abutment bearing upon the periphery of said piston between said ports, and a plurality of gates, also bearing upon the periphery of the piston and adapted to open in succession during each revolution of the piston.

3. A rotary engine comprising a casing having inlet and exhaust ports, a shaft, a piston eccentrically mounted upon the shaft within the casing, an abutment and one or more gates having shoes pivotally attached thereto and bearing upon the periphery of the piston, said gates dividing the steam space into several compartments and having openings therethrough, and said gates being adapted to open in succession and admit steam from the first compartment into the several compartments in succession.

4. A rotary engine comprising a casing having inlet and exhaust ports, a shaft, a piston eccentrically mounted upon said shaft within the casing, an abutment between said ports a plurality of gates bearing upon the periphery of the piston and dividing the steam space into compartments, said gates having openings or ports therethrough and adapted to open in succession as the piston rotates to admit steam from the first or inlet compartment into the remaining compartments in succession.

5. A rotary engine comprising a casing having inlet and exhaust ports, a shaft, a piston eccentrically mounted upon said shaft within the casing, an abutment between said ports, a gate bearing upon the periphery of the piston and dividing the steam space into compartments, said gate being adapted to open as the piston rotates and admit steam from the first or inlet compartment into a succeeding compartment.

6. A rotary engine comprising a casing having inlet and exhaust ports, a shaft, a piston eccentrically mounted upon said shaft within the casing, an abutment, and one or more gates, adapted to bear against the periphery of said piston, and means for holding said abutment and gates with a yielding pressure against said piston comprising, an eccentric secured to the engine shaft, shoes movable by said eccentric, rock shafts each having an arm yieldingly connected by means of a spring to one of said shoes and an arm connected to one of said gates or said abutment.

7. A reversible rotary engine comprising a casing, a shaft, a piston eccentrically mounted upon said shaft within the casing, an abutment bearing upon the periphery of said piston, one or more gates each bearing upon the periphery of the piston, said abutment and gates dividing the steam space into compartments and said gates being adapted to open and close communication between the compartments, in succession, during each revolution of the piston, said casing having inlet and exhaust ports communicating with the compartments at each side of the abutment, and valves for controlling said ports.

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

ALBERT C. SAVIDGE.

Witnesses:
C. W. CLEMENT,
C. F. SHIPMAN.