(No Model.)

3 Sheets—Sheet 1.

# R. P. PARK.

## ROTARY ENGINE.

No. 310,077. Patented Dec. 30, 1884.

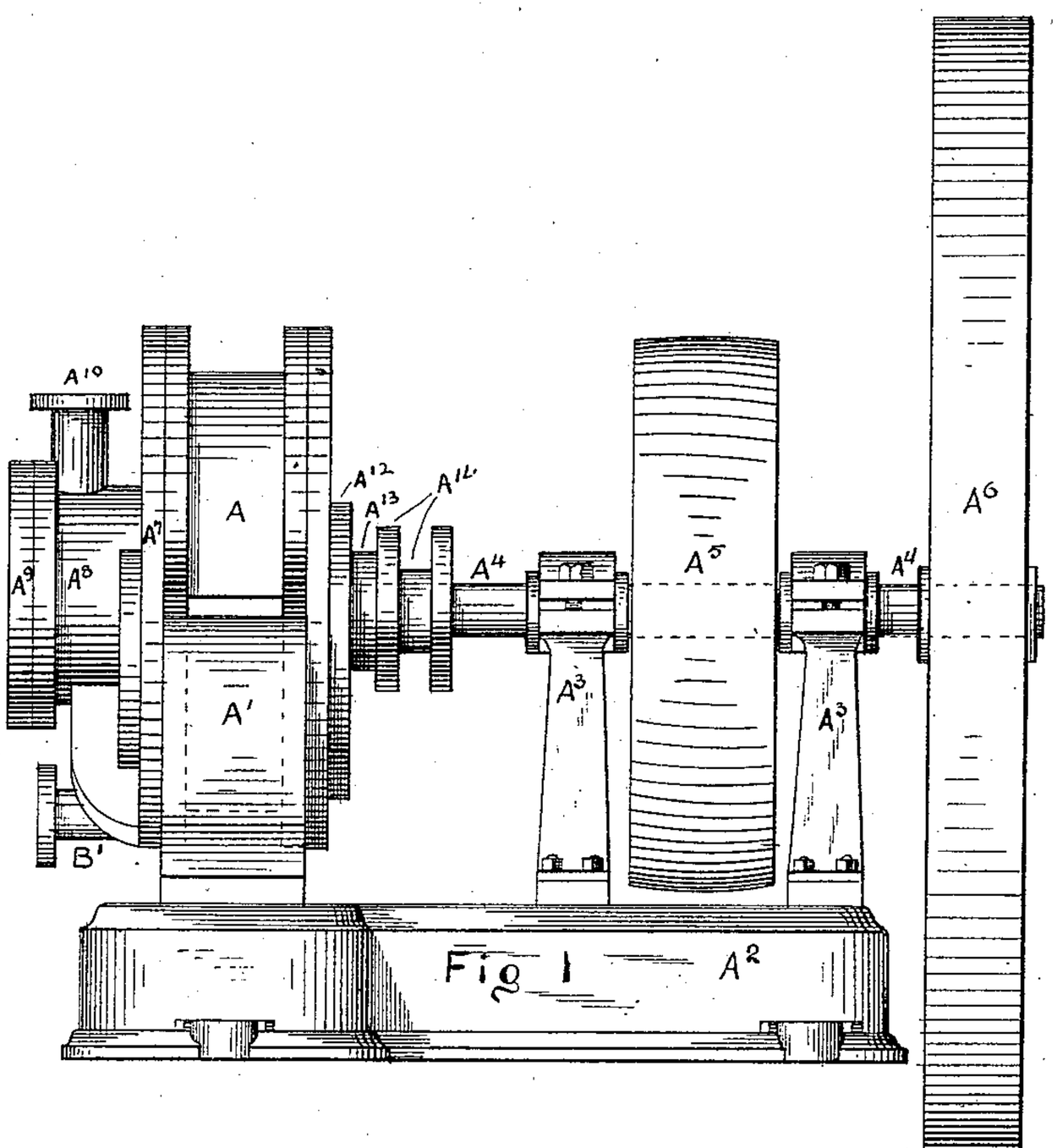


Fig 1




Fig 2

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Inventor:
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By his attys
R. D. Smith

(No Model.) 3 Sheets—Sheet 2.

# R. P. PARK.

## ROTARY ENGINE.

No. 310,077. Patented Dec. 30, 1884.

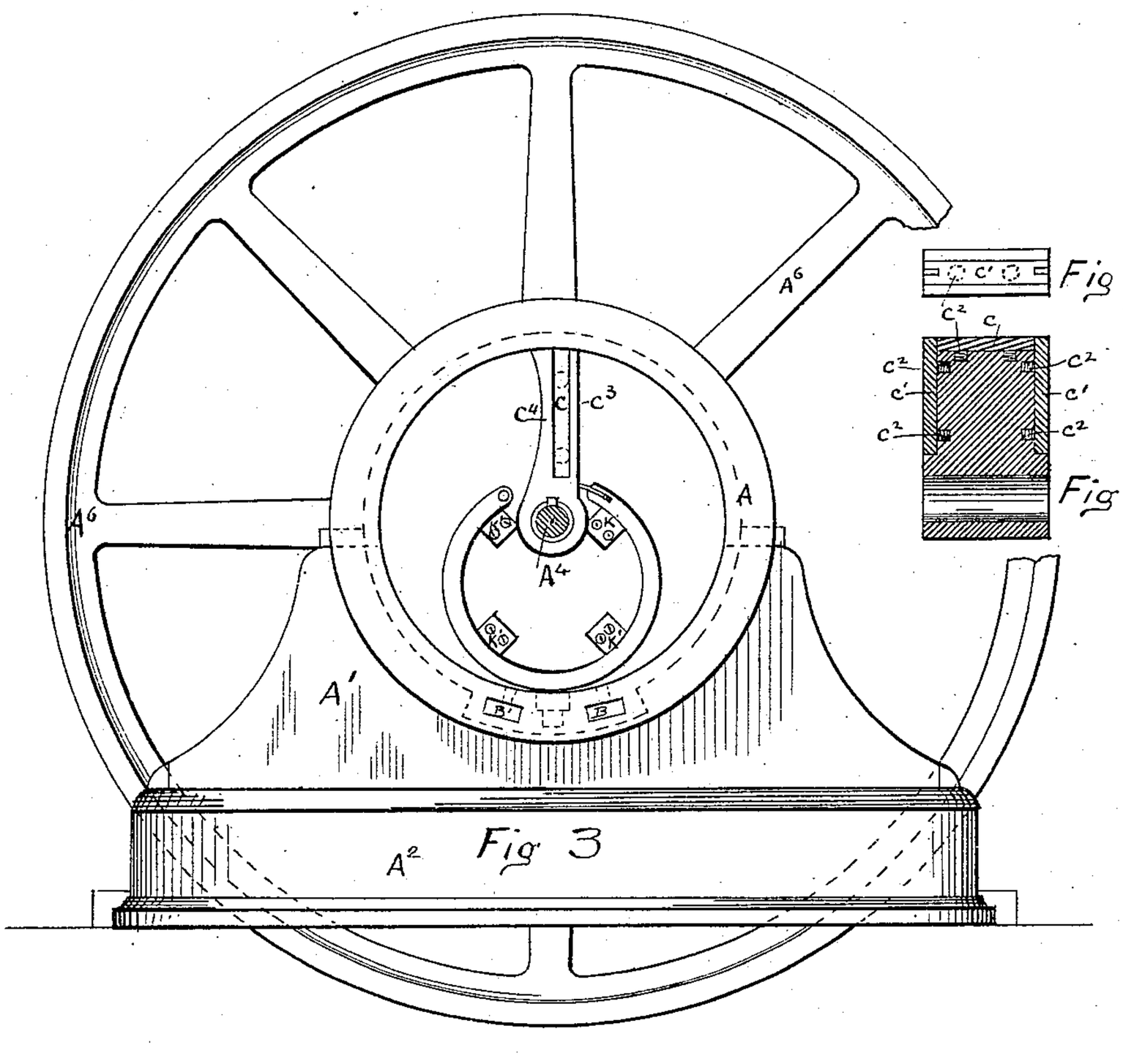


Fig 3




Fig 7

Fig 6

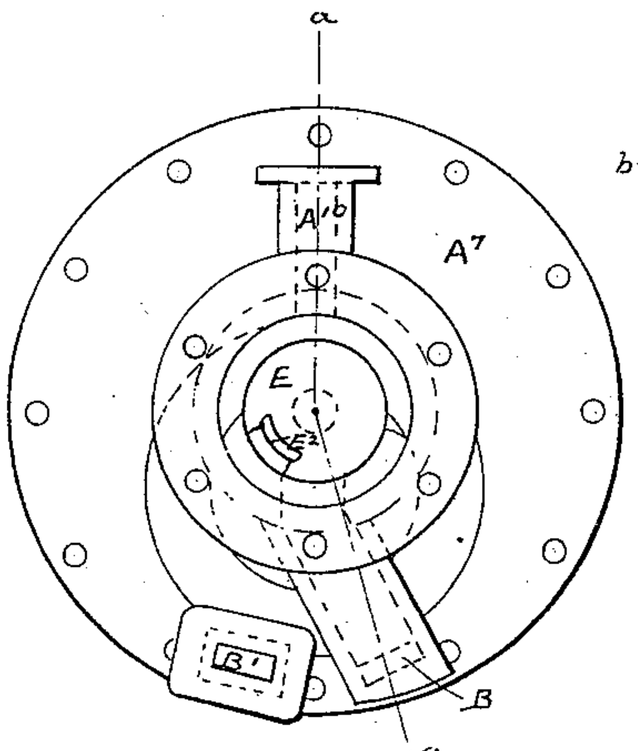


Fig 4

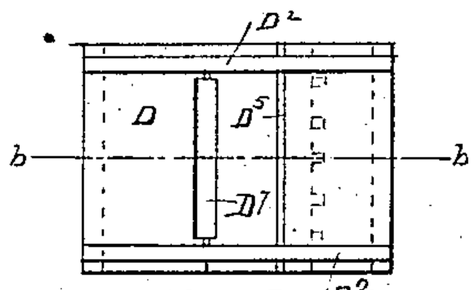


Fig 8

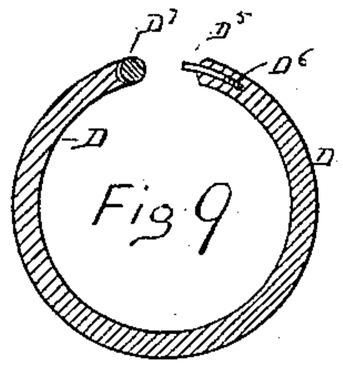


Fig 9

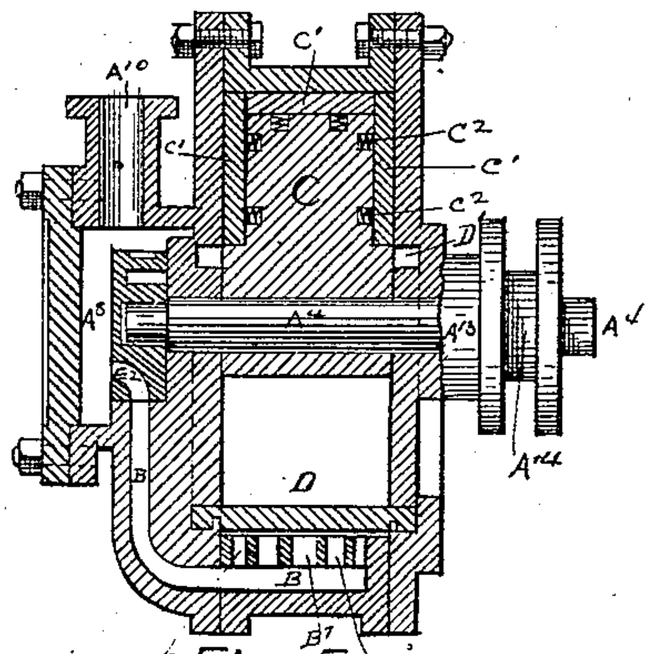


Fig 5

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(No Model.) 3 Sheets—Sheet 3.

# R. P. PARK.

## ROTARY ENGINE.

No. 310,077. Patented Dec. 30, 1884.

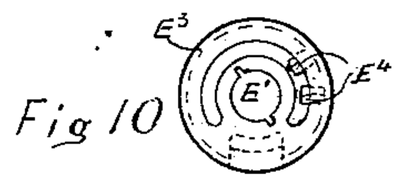


Fig 10

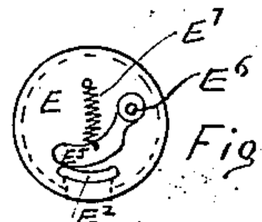


Fig 11

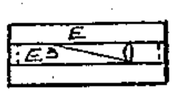


Fig 12

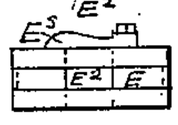


Fig 13

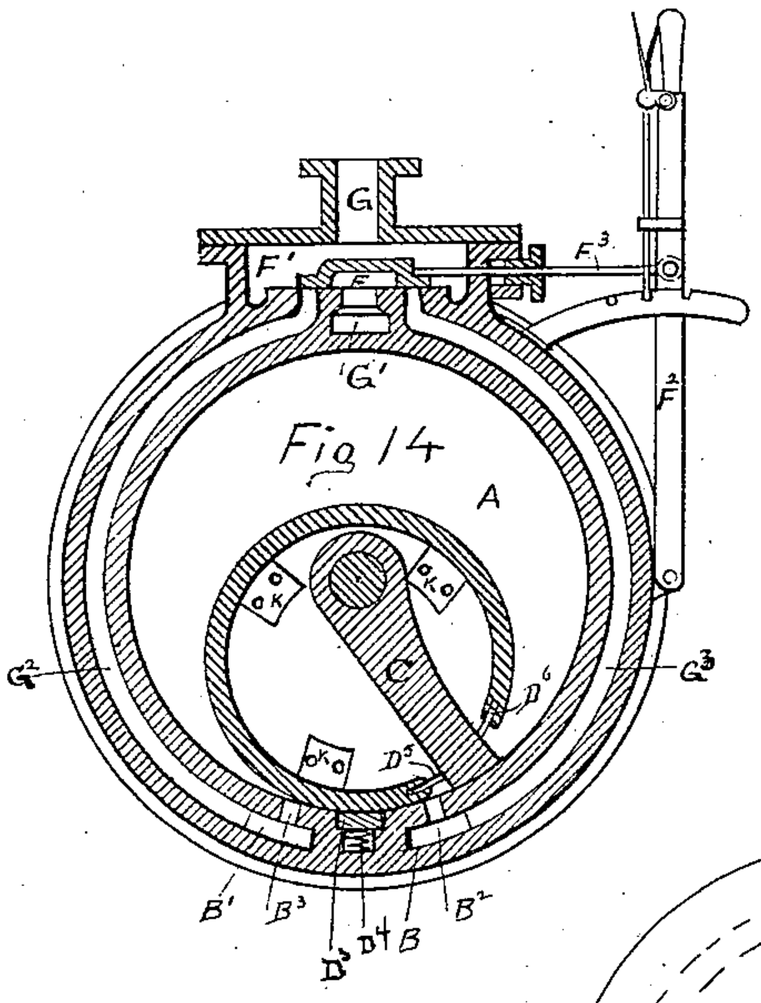


Fig 14

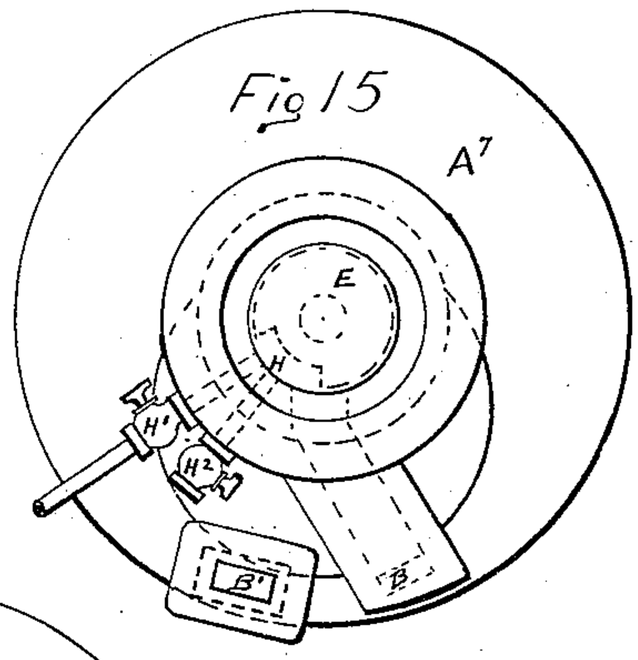


Fig 15

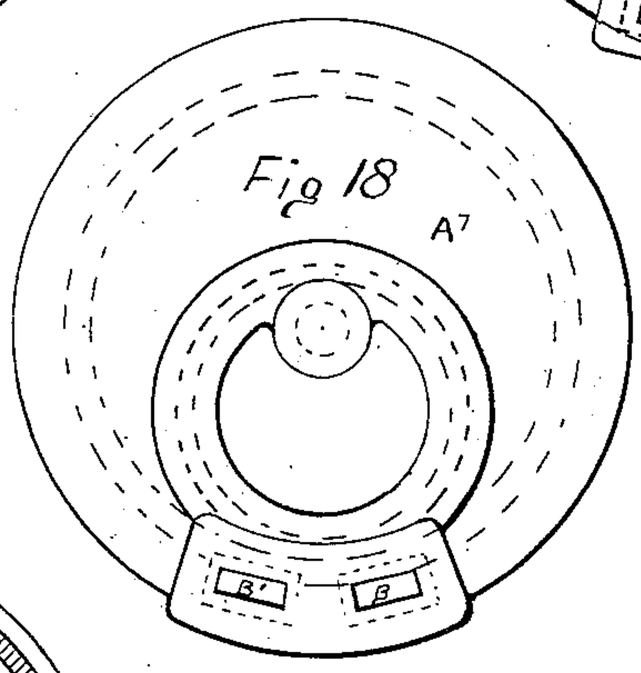


Fig 18

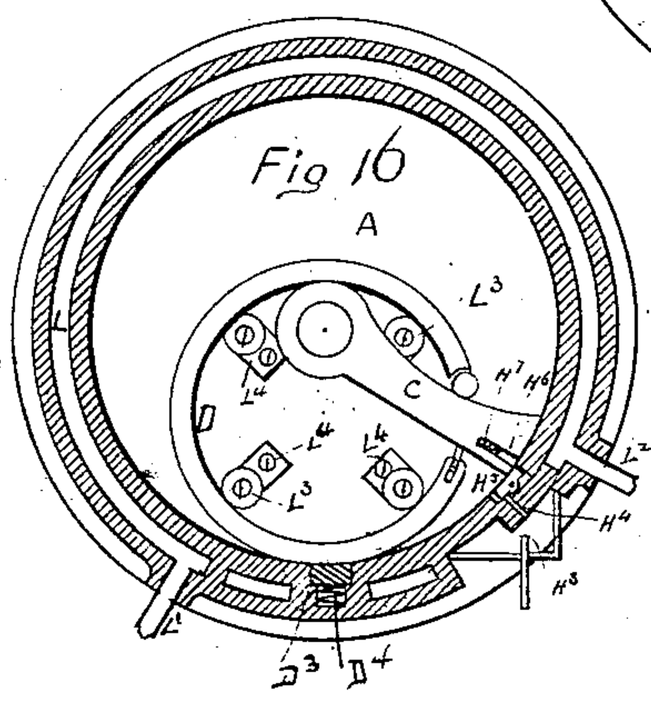


Fig 16

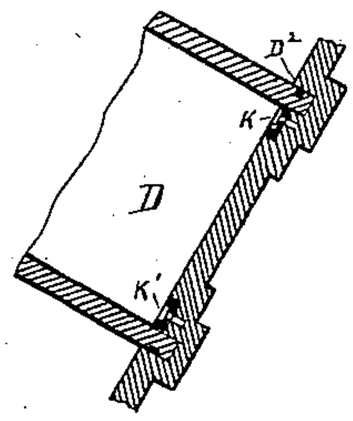


Fig 14a

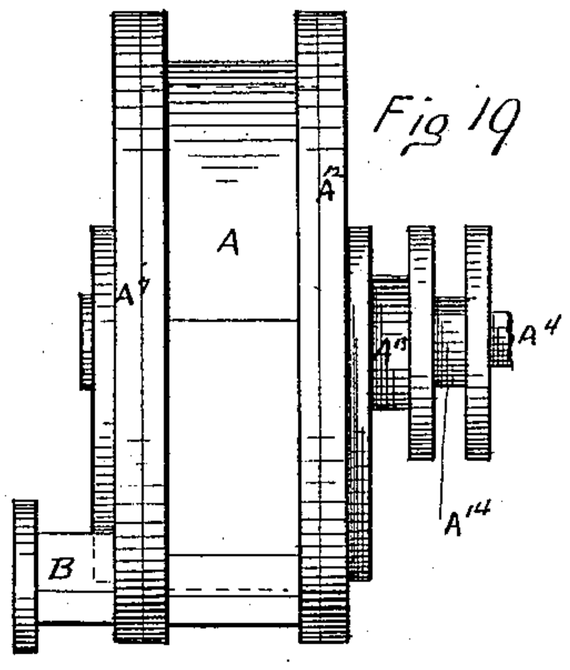


Fig 19

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# UNITED STATES PATENT OFFICE.

RICHARD PICKUP PARK, OF NORMANBY ROAD, SOUTH MELBOURNE, VICTORIA.

## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 310,077, dated December 30, 1884.

Application filed June 5, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD PICKUP PARK, a subject of the Queen of Great Britain, residing at Normanby Road, South Melbourne, in the British colony of Victoria, engineer, have invented new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention of improvements in rotary engines has been designed for the following purposes:

First, for providing a means whereby the steam in rotary-engine cylinders may be worked expansively by the introduction of a rotary cut-off valve having an adjustable port or steam-supply opening therein, and fitted on the engine-shaft and working in a suitable valve-chest. This valve also carries a governor for regulating the speed of the engine when used single-acting, (or working only one way.)

Secondly, in providing an arm-piston made curved on the one side and flat on the other, and having its edgewise wearing-surfaces packed with metallic strips, which are held up by small spiral springs fitted into said arm-piston.

Thirdly, in providing a divisional ring, which is sprung into the grooves provided in covers or ends of cylinder, to form a perfectly steam-tight joint. This ring is fitted with metallic packing-rings on its outer periphery, near both its ends. The gap edge of this divisional ring at the back of the arm-piston has a transverse groove formed in it, which is filled in with a metallic strip seated on small spiral springs. The front gap edge is fitted with a small steel friction-roller attached thereto, and which travels on the curved face of said arm-piston. It will be obvious that when this divisional ring is used in a reversing rotary engine it would require to have the metallic strip and springs on both sides of the gap, so as to insure a perfect steam-tight joint.

Fourth, in providing at the bottom of the cylinder a metallic joint-piece or pad carefully fitted in a recess formed therein and seated on spiral springs, as before, to insure a good steam-tight joint between it and the before-mentioned divisional ring, thereby preventing the steam from passing from steam to exhaust side of same at this point.

When it is required to use my improvements in an expansive reversing rotary engine, an additional ordinary slide-valve or a suitable cock, or some such mechanical means, is required to conduct the steam from one side of the piston to the other, as desired. My improvements may also be used in compound rotary engines by simply placing the cylinders side by side and allowing the steam, after being used in the high-pressed cylinder, to pass into the low-pressed cylinder, as is already well known; or they may be separate and distinct cylinders placed on convenient beds and the steam conducted from the high-pressure exhaust-pipe to the low-pressure valve-chest by suitable pipes, and I make the cylinders of such proportion to one another as to get the best results possible out of the steam used.

When my invention is used for an atmospheric engine, the rotary valve and other parts similar to that used for steam purposes would be required. When used as a water-engine, the rotary valve and valve-chest would not be required. When used as a gas-engine, a special rotary valve, together with other attachments, is required, which I will hereinafter describe.

When my rotary water-engine cylinder and piston is worked by some other motive power, it makes a very serviceable suction or force pump.

Referring to the drawings, Figure 1 shows side elevation; Fig. 2, plan, with the cylinder shown in horizontal section and the valve-piston removed; and Fig. 3, end elevation, with the cylinder-cover removed, of my improved rotary engine. Fig. 4 is an end elevation of the cylinder-cover with the steam-chest cover taken off. Fig. 5 is a vertical section of cylinder through line *a a*, Fig. 4. Figs. 6 and 7 are longitudinal section and end view of the arm-piston. Fig. 8 is an outside elevation of the divisional ring, and Fig. 9 a cross-section on the line *b b* in Fig. 8. Figs. 10, 11, 12, and 13 are four different views of the rotary cut-off valve. Fig. 14 is a vertical section of a cylinder for a reversing rotary engine, and Fig. 14ª is section of part of cover and part of

divisional ring, showing the section of compensating or wearing pieces. Fig. 15 is an end elevation of the cylinder-cover with the valve-chest cover removed, and Fig. 16 vertical section of said cylinder as designed for a gas-engine. Fig. 18 is an end and Fig. 19 a side elevation of my rotary-engine cylinder as constructed for a water-engine or pump.

Figs. 1 to 13 represent the several views and details of a single-acting rotary engine designed for being worked expansively either by steam or air, and in which A represents the cylinder fitted on the jacket A′, which is secured to the bed-plate $A^2$. This bed-plate also carries the two standards $A^3$, in the bearings of which the engine-shaft $A^4$ works, and on which are keyed the pulley $A^5$ and fly-wheel $A^6$.

On the back cylinder-cover, $A^7$, is cast or formed the valve-chest $A^8$, which has a suitable cover, $A^9$.

$A^{10}$ is a steam or air supply branch, and B′ the exhaust branch, the former leading into the valve-chest and the latter projecting from the cylinder-cover $A^7$, but leading from the exhaust-passage at bottom of cylinder A, similarly marked. The front cylinder-cover, $A^{12}$, is provided with a stuffing-box, $A^{13}$, and gland $A^{14}$, as is usual for steam-joints.

B and B′ are the steam and exhaust passages formed in the bottom of the cylinder, and having the line of the port-holes $B^2$ and $B^3$ for communicating with the interior of said cylinder A. The steam-passage B leads upward through the back cylinder-cover, $A^7$, and enters the valve-chest $A^8$ through the valve-face $B^4$. The arm-piston C, which is keyed on the engine-shaft $A^4$, is recessed or grooved on its end and on both edges and fitted with the metallic strips C′, which are cushioned or seated on the spiral springs $C^2$, placed in the holes provided for them, thereby forming a perfect steam or air tight joint. It will be noticed that the back face, $C^3$, of this arm-piston is made perfectly flat, and the front face, $C^4$, is curved, as shown, so as to vary the opening or gap in the divisional ring D as little as possible when in work. The divisional ring D is sprung into and revolves in the annular grooves D′, cut or formed in the cylinder-covers, and has metallic rings $D^2$ sunk in on its outer periphery near its ends, so as to prevent steam escaping through the before-mentioned annular grooves D′. At the bottom of the cylinder this ring travels on the metallic strip or pad $D^3$, let into the recess in the bottom of cylinder, and which rests on the spiral springs $D^4$. The edge of this ring in the gap at the back of the arm-piston has a groove formed in it, in which is fitted a metallic strip, $D^5$, forced forward by the small spiral springs $D^6$. The front edge in said gap has a friction-roller, $D^7$, working in bearings formed thereon. There are also four compensating or wearing pieces, K, fitted flush into cylinder-covers inside said divisional ring D, as shown. These pieces are made adjustable by being fixed in their recesses by the screw-pins K′, which pass through oblong slots provided in said wearing-pieces K, so as to allow them to be set to fit the inner circumference of divisional ring D and prevent undue pressure on outer circumference of same. The rotary adjustable cut-off valve E has keyways E′ cut in it, which fit on the feathers or pins fixed to the engine-shaft $A^4$, which carry and revolve said valve. This valve has a port, $E^2$, as shown, and a recess formed on its outer periphery, in which are fitted the two portions of a metallic ring, $E^3$, which is divided diagonally, as shown in Fig. 12, directly opposite to the port $E^2$. The one half of this ring $E^3$ is a fixture and the other half is secured to the valve E by the countersunk headed bolts $E^4$, which pass through oblong holes in said valve, thereby providing a means for adjusting the length of the port $E^2$. $E^5$ is the governor, pivoted to the valve on the tap-bolt $E^6$, and controlled by the spiral spring $E^7$. This valve is turned on its outer circumference to work on valve-face $B^4$, and faced up at the back to work on the facing provided on front cylinder-cover, thereby preventing the escape of steam from chest to cylinder.

Fig. 14 illustrates a vertical section of the cylinder of a reversing rotary engine, in which the additional parts necessary to convert the before described single-acting into a reversing engine are shown, and which may be worked expansively by the before-described rotary cut-off valve. In this figure similar letters indicate similar parts to those previously referred to, and in addition thereto F is a slide-valve working on the valve-face in the valve-chest F′, and connected to the hand-lever $F^2$ by the valve-spindle $F^3$.

G is the steam-supply branch, and G′ the upper exhaust-port.

$G^2$ and $G^3$ are the annular passages leading from the ports in valve-face to the passages B′ and B at the bottom of the cylinder, before referred to. The divisional ring D for a reversing-engine requires to have both its edges abutting on the arm-piston C, fitted with the metallic strip $D^5$ and spiral springs $D^6$, so as to form a steam-joint on either side of said arm-piston.

Fig. $14^a$ shows section of part of cylinder-cover and part of divisional ring D, with the before-referred-to compensating or wearing strips K fitted in position.

Figs. 15 and 16 illustrate the additions and alterations necessary for working my improved rotary engine by the explosion and consequent expansion of a given quantity of gas fed at regular intervals; or, to speak more simply, for converting it into a gas-engine. For this purpose the port now marked H in the rotary valve E is somewhat different, as it has no side opening, it being now simply a recess or chamber, as shown. The valve-face supply and exhaust passages are similar to

those previously described. The gas-supply pipe H′ and air-pipe H² are fixed in the positions shown. A gas jet or flame, H³, is also placed, as shown, opposite the hole H⁴, which is controlled by a trigger or flame-regulating valve, H⁵, pivoted in a recess inside of the cylinder, A. This is opened by means of the sliding pin H⁶, which is forced forward at the desired position by means of the spring H⁷, which, together with said pin, is fitted in the end of the arm-piston C.

The annular passage L, formed around the cylinder, is used in my gas-engine as a cold-water jacket, into which the water is fed through the inlet-pipe L′ and finds egress through the outlet-pipe L², as shown. Alternative set-up or wearing pieces are shown in Fig. 16, where there are four friction-rollers, L³, let into cylinder-covers and fitted onto four slide-pieces, L⁴, fixed to said covers, as before.

Figs. 18 and 19 illustrate elevations of my rotary cylinder A as altered for either a water-engine or a suction-pump, the internal parts of cylinder being a fac-simile of that previously described for a steam-engine. It will be noticed that the valve-chest and ports leading therefrom, and consequently the rotary cut-off valve, have been dispensed with, and that the inlet and outlet ports B and B′ in the bottom of cylinder simply project far enough from cover to allow them to be connected to the supply and discharge or the suction and delivery for either an engine or pump.

The mode of operation in a single-acting engine—that is, an engine working one way only, as described with reference to Figs. 1 to 13—is as follows: Steam or air being supplied through the branch pipe A¹⁰ into valve-chest A⁸, from whence, when the port E² in the rotary cut-off valve E is traveling over port B in valve-face B⁴, steam or air is admitted through said passage B into the cylinder A, and pushes forward the arm-piston C until such time as the port E² in said rotary valve E has traversed over the port B in said valve-face B⁴, after which the blank face of the valve passes over same, which cuts off the steam or air supply to cylinder, and, the steam or air expanding, still forces round the piston C and its attached divisional ring D until the piston C has passed over the exhaust-port B′, when the steam or air is free to escape, and, the arm-piston C moving forward to the required distance beyond the steam or air port B, the steam or air is again admitted and the foregoing operation repeated until the engine is stopped by closing the supply-cock.

The speed of the engine is regulated by the governor E⁵, attached to the rotary valve E. This governor gate acts by centrifugal force and is opposed by the reactionary pull of a spring to close the inlet-port when the speed becomes too great, and to open it again as the speed decreases, the pivotal center E⁶, on which said gate moves, being at one side of the port. The spring E⁷ tends to move said gate away from the port in opposition to centrifugal force, which tends to move said gate outward to close the port. The tension of said spring may be regulated, as desired, by well-known means, so that it will resist said centrifugal force until a certain speed has been obtained, after which the centrifugal force will overcome the spring, and said gate will move over the mouth of the port, closing it more and more as the speed increases, and finally checking the further acceleration by cutting off the inflow. This result may be regulated by adjusting the tension of the spring, so as to have the gate move to the required point at a greater or less speed, as desired.

The operation of the double-acting or reversing engine is similar to the foregoing, so far as the action of the rotary cut-off valve E and the steam on the piston is concerned, and so far as its being admitted in one port and exhausting through the other; but the conducting of the steam into the required passage leading to said ports B and B′ is accomplished by the slide-valve F, operated by the hand-lever F². The steam then being admitted through the passage on the one side, after doing its duty in the cylinder, finds exit through the opposite passage, and finally exhausts under the slide-valve F into the atmosphere or otherwise; and in the case of a compound engine the exhaust-steam either enters direct into the adjoining low-pressed cylinder or into the valve-chest on said low-pressed cylinder.

The operation in a rotary gas-engine which is fitted with my special valve hereinbefore described is that the required quantity of gas and air is admitted through recess in chamber H in said rotary cut-off valve and through gas-passage B into cylinder, and the piston, rotating, opens the trigger-valve H⁵, which allows enough gas to escape through hole H⁴ to ignite the gas in said cylinder. This trigger-valve H⁵ is almost immediately closed by reason of the arm-piston C quickly passing over it, thereby preventing the flame from being blown out by the explosion of contained gas. The consequent explosion and expansion of the contained gas then forces the piston C forward until the exhaust-port B is reached, when the above mechanical movements will be again repeated. During the working of the gas-engine a current of cold water is caused to pass through the annular passage L around cylinder. If it were desired to make this gas-engine reversible, a trigger-valve, H⁵, would be required on the other side of piston also, and the gas and air would have to be led from the rotary cut-off valve to the opposite port and side of piston, the gas being then ignited on that side only for the time being.

The operation in my rotary engine driven by water-power is as follows: The rotary valve E, valve-chest A⁸, and ducts or passages leading therefrom to ports in bottom of cyl-

inder would not be necessary. The water would be simply admitted in the one port and its force exerted on that side of piston C until the exhaust or discharge port was reached, where the water would find sufficient area for exit, and so on. If the reverse motion was desired, the water would require to be fed on the opposite side, and so on, as is well known.

I also desire to state that my rotary engine, as before described, can be used as a rotary suction or force pump—that is, by its arm-piston C being on and consequently driven by one of my before-described rotary engines affixed to the same bed, when the power would be direct-acting; or the rotary pump may be driven by having a pulley fixed on its piston-shaft, which is driven by a belt off pulley on some other power, or by spur-gearing or otherwise. The operation would be that the inlet-pipe to pump-cylinder would be fixed to the port on the one side of said cylinder and the discharge fitted to the port on the other side.

Having thus described the nature of my invention and the manner of performing same, I would have it understood that what I believe to be new, and therefore claim as my improvements in rotary engines, is—

1. The rotary adjustable cut-off or expansion valve E, provided with a peripheral groove and port $E^2$, and with the divided metallic ring $E^3$, fitted on the engine-shaft $A^4$, substantially as herein described and explained.

2. The metallic arm-piston C, keyed on engine-shaft $A^4$, made flat on one side and concave on the other, and having its end and two edges grooved out to receive strips of metallic packing C′, combined with the rotating eccentric ring D, held up by small spiral springs $C^2$, substantially as herein described and explained, and as illustrated in my drawings.

3. The divisional ring D, whose edges abut on the before-described arm-piston, and have metallic packing-strips $D^5$, held forward by spiral springs $D^6$, substantially as herein described and explained, and as illustrated in my drawings.

4. The compensating or wearing pieces K, fitted flush in the cylinder-covers $A^7$ and $A^{12}$ inside said divisional ring D, substantially as and for the purpose herein described and explained, and as illustrated in my drawings.

5. The combination of the special rotary cut-off chamber-valve E, the trigger-valve $H^5$, operating-pin $H^6$, spring $H^7$, and gas and air supply pipes H′ and $H^2$, with the cylinder having an outer jacket, L, through which a current of cold water flows, and the before-described arm C, piston, and divisional ring D, for the purpose of producing a gas-engine, substantially as herein described and explained, and as illustrated in Figs. 15 and 16 of the drawings.

6. The governor $E^5$, attached by a tap-bolt, $E^6$, to the rotary valve E and controlled by a spiral spring, $E^7$, also affixed to valve and governor, all substantially as herein described and explained, and as illustrated in my drawings.

7. The arm-piston C, flat on one side and concave on the other, so as to present the same transverse area within the gap of the ring D at all points of its revolution, combined packing $D^5$ in said ring on the rear side of said piston, and the friction-roller $D^7$ in said ring at the front side of said piston.

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