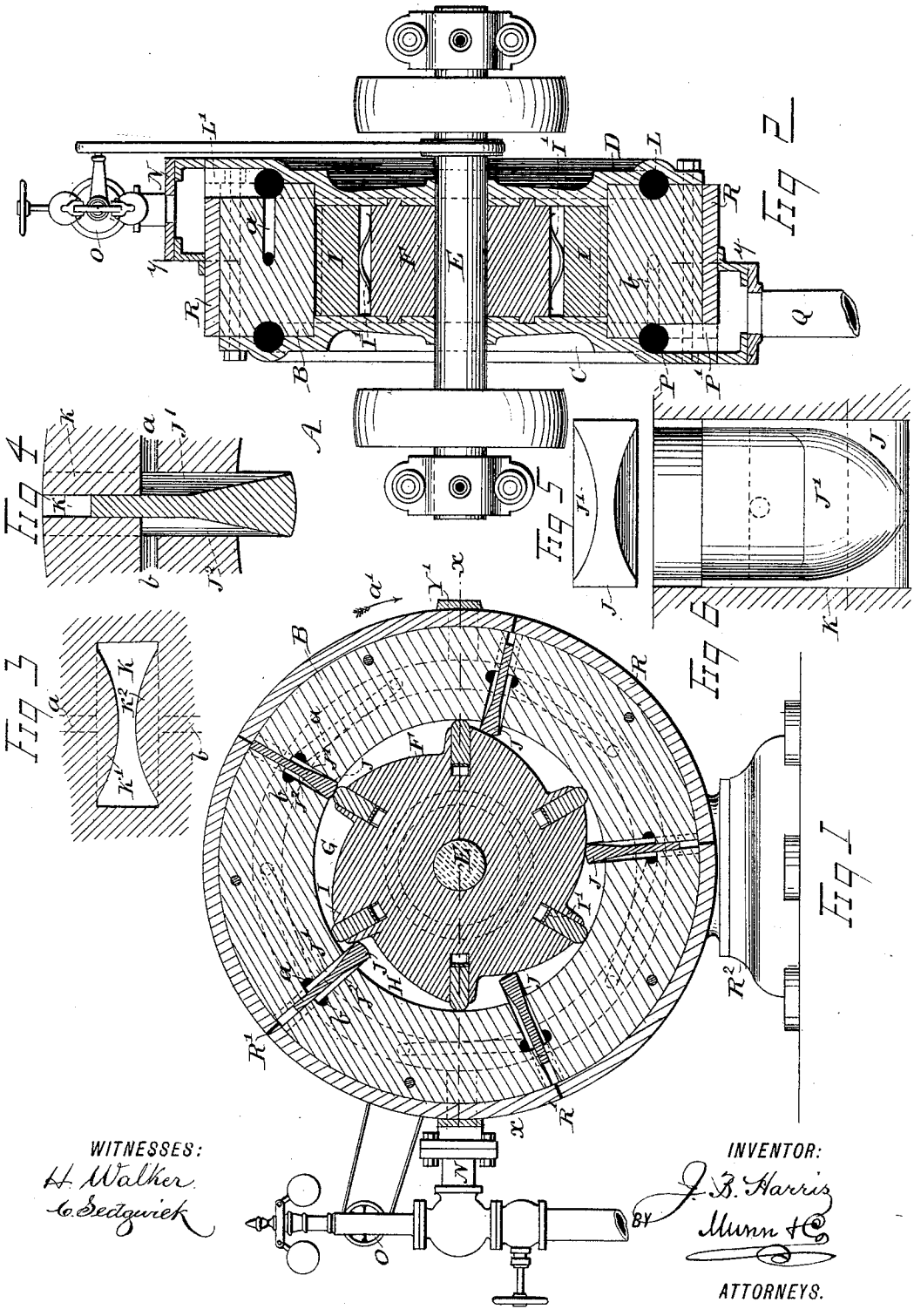
(No Model.) 2 Sheets—Sheet 1.

J. B. HARRIS.

ROTARY ENGINE.

No. 415,456. Patented Nov. 19, 1889.



WITNESSES:
H. Walker
C. Sedgwick

INVENTOR:
J. B. Harris
By Munn & Co
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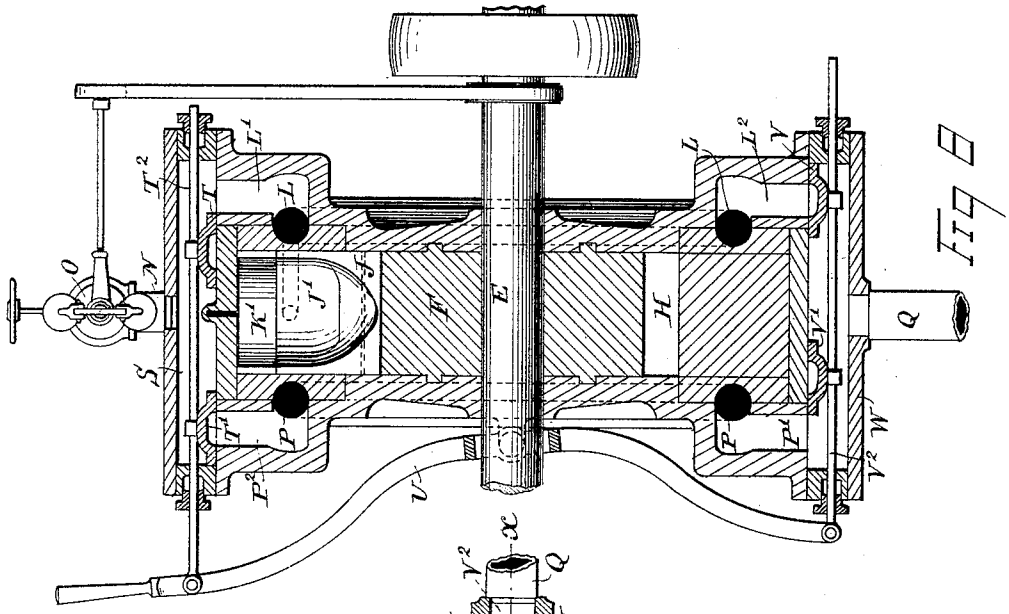


Fig 8

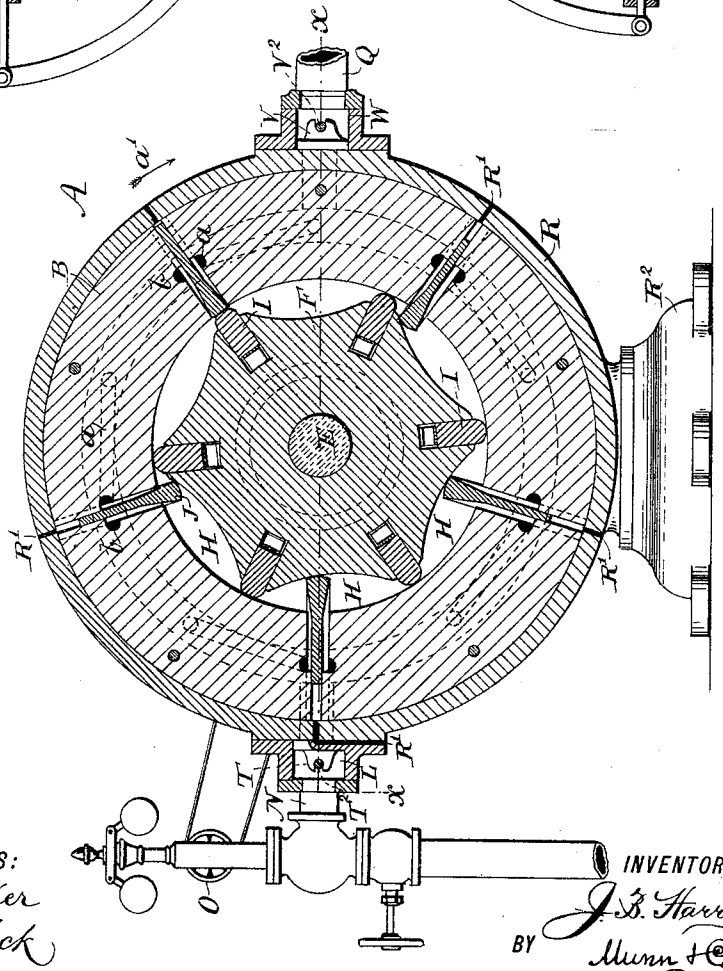


Fig 7

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UNITED STATES PATENT OFFICE.

JOHN B. HARRIS, OF EUTAW, ALABAMA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 415,456, dated November 19, 1889.

Application filed April 22, 1889. Serial No. 308,093. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. HARRIS, of Eutaw, in the county of Greene and State of Alabama, have invented a new and Improved Rotary Engine, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved rotary engine which is simple and durable in construction and very effective in operation, utilizing the agent to the fullest advantage.

The invention consists of certain parts and details and combinations of the same, as will be fully described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional side elevation of the improvement on the line *y y* of Fig. 2. Fig. 2 is a sectional plan view of the improvement on the line *x x* of Fig. 1. Fig. 3 is an enlarged section of the abutment-chest. Fig. 4 is an enlarged sectional side elevation of the abutment and the chest. Fig. 5 is an enlarged end view of one of the abutments. Fig. 6 is a face view of the same, showing the abutment-chest in section. Fig. 7 is a sectional side elevation of the improvement as adapted for reversing, and Fig. 8 is a sectional plan view of the same.

The improved rotary engine A is provided with a cylinder B, in which are fitted the heads C and D, in which is mounted to turn the main driving-shaft E, provided with the usual pulleys for transmitting the rotary motion of the driving-shaft to other machinery. On the main driving-shaft E is secured the piston F, which for single engines is made ratchet-shaped, as illustrated in Fig. 1, and for reversing-engines, as illustrated in Fig. 7, the piston F is made star-shaped.

The piston F turns in the cylinder B, and by its tooth-like projections G form spaces H between the inner surface of the cylinder and the periphery of the piston F. In the highest point of each tooth-like projection G is fitted a radially-arranged packing-plate I, pressed outward in contact with the inner surface of the cylinder by means of a spring I′, as is plainly shown in Figs. 1 and 2.

In the rim of the cylinder B are held to slide radially the abutments J, of which any desired number may be employed, being preferably placed equal distances apart, as shown. Each abutment J is mounted to slide radially in a slot K, formed in the rim of the cylinder B and connected near its middle at one side with a port *a*, leading into an annular groove L, formed by the head D and one side of the cylinder B. The annular groove L connects with an outwardly-extending groove L′, leading to the steam-inlet pipe N, on which is held the usual governor O, operated from the main driving-shaft E and serving to regulate the speed of the engine in the usual manner.

Directly opposite the steam-inlet port *a* is formed an exhaust-port *b*, leading into the slot K on the opposite side of the inlet-port *a*. The several exhaust-ports *b* lead into an annular groove P, formed by the head C and the side of the cylinder B. From the annular groove P leads an outwardly-extending groove P′, opening into the exhaust-pipe Q, leading to the outer air.

The cylinder B is surrounded on its periphery by a ring R, provided with small openings leading into the outer ends of the slots K. The abutment J is rounded slightly near its inner end, and at this end completely fills the inner end of the slot K. On the sides of the abutment J are formed grooves J′ and J², each of which grooves is curved at its outer end and fits onto a correspondingly-shaped projection K′ or K² in the slot K. The projections K′ and K² extend from the periphery of the cylinder B to the inlet and exhaust ports *a* and *b*, as is plainly shown in Fig. 4.

The operation is as follows: The live steam, passing through the inlet-pipe N and the groove L′ into the annular groove L, passes from the latter through the port *a* to the several openings K, containing the abutments J. The steam passing through one inlet-port *a* passes into the curved recess J′ of the abutment J, and forces the latter inward in firm contact with the periphery of the piston F. When the outermost point of the piston F has passed the abutment J, then the latter slides inward to its innermost position at the base of the respective tooth-like projection G. The mo-

ment the abutment J slides into the interior of the cylinder-opening communication is established between the interior of the cylinder and the live-steam port side of the slot K, so that the live steam from the port *a* passes through the curved recess J′ into the interior of the cylinder B, and exerts its pressure against the projection G, so that the piston F is turned in the direction of the arrow *a′* and the main shaft E is rotated. It will be seen that the live steam thus moves the abutment inward, and by the turning of the piston F the abutment is moved outward again by traveling on the back of the tooth-like projection G until it passes the packing-plate I. The exhaust-steam on the other side of the abutment J passes from the respective space H through the curved recess J^2 to the exhaust-port *b*, and from the latter into the annular groove P, which discharges into the groove P′, leading to the exhaust-pipe Q, which carries the exhaust-steam to the outside.

In order to adapt the engine for reversing, I connect the inlet-pipe N with a valve-chest S, secured on one side of the cylinder, as is plainly shown in Figs. 7 and 8. Into this steam-chest S leads the groove L′ from the annular groove L, and a similar groove P^2 leads from the annular exhaust-groove P. Over the inner ends of the grooves L′ and P^2 operate the valves T and T′, secured on a valve-rod T^2, extending to the outside of the steam-chest S, and pivotally connected with the lever U, fulcrumed near the middle of the cylinder B. The other end of this lever U is pivotally connected with a valve-rod V^2, extending into the exhaust-chest W, formed opposite the steam-inlet chest S. From this chest W leads the exhaust-pipe Q, and into this chest leads the groove P′, extending from the annular exhaust-groove P. The groove L^2 also connects with the interior of this chest, leading from the annular groove L, through which passes the live steam.

Over the grooves P′ and L^2 operate the valves V and V′, secured to the valve-rod V^2, connected with the lever U, previously mentioned. The valves V and V′ are similarly arranged, the only difference being that they are arranged opposite to the valves T and T′—that is, when the valve T, for instance, is disconnected from its groove L′, as shown in Fig. 8, the valve closes the groove L^2, leading to the annular groove L. When the valve T′ closes the groove P^2, leading to the annular groove P, as shown in Fig. 8, then the valve V′ is disconnected from the groove P′, leading to the said annular groove P.

It will be seen that when the valves are in the position shown in Fig. 8 the steam from the pipe N passes into the steam-chest S, and from the latter through the groove L′ into the annular groove L. The steam then passes through the port *a* to the interior of the cylinder, and the above-described operation is repeated. The piston F then travels in the direction of the arrow *a′*. When the operator now desires to reverse the engine, so that the piston F will travel in the inverse direction of the arrow *a′*, he moves the lever U so that the valve T will close the groove L′, while the groove P^2 is thrown into communication with the steam-chest S. The movement of the lever U also reverses the valves V and V′, so that the latter closes the groove thrown into communication with the exhaust-chest W. The steam entering the steam-chest S now passes through the groove P^2 into the annular groove P, and the ports *b* now become the live-steam ports, while the ports *a* become the exhaust-ports, and the exhaust, passing through the said ports into the annular groove L, passes from the latter to the exhaust-chest W and out of the exhaust-pipe Q. It is understood that for this form of engine a ratchet-shaped piston will not answer, and the piston must be made star-shaped, as shown in Fig. 7.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a rotary engine, the combination, with the rotary piston, of the cylinder provided with a radial slot K, having opposite rounding projections K′ K^2, opposite inlet and outlet ports *a b* at the inner ends of said projections, and the abutment J, having longitudinally-extending concavities J′ J^2 in its opposite faces decreasing in depth toward their inner ends, the concavities extending to the outer ends of the abutment to permit it to slide between the said projections, substantially as set forth.

2. The combination, with the rotary piston, of the cylinder provided with a series of radial slots K, contracted centrally and longitudinally at their outer ends by opposite rounding projections K′ K^2, opposite inlet and outlet ports *a b*, the annular supply and exhaust passages communicating respectively with said ports, and the abutments J, sliding in said slots and having longitudinal grooves or concavities extending from their inner to their outer ends, the inner ends of the grooves decreasing gradually in depth and the outer ends of the abutments fitting between rounding projections, substantially as set forth.

3. The combination, with the rotary piston, the surrounding cylinder having radial slots provided with opposite inlet and outlet ports, and sliding abutments therein, of the inclosing-ring R, provided with apertures R′, registering with the outer ends of said slots, and the cylinder-heads and the annular supply and exhaust channels, substantially as set forth.

4. In a rotary engine, the combination, with the cylinder provided with radial slots and inlet and outlet ports leading at opposite sides into the said slots, of cylinder-heads held on the said cylinder and forming with the latter annular grooves into which lead the said inlet and outlet ports, substantially as shown and described.

5. In a rotary engine, the combination, with the cylinder provided with radial slots and inlet and outlet ports leading at opposite sides into the said slots, of cylinder-heads held on the said cylinder and forming with the latter annular grooves into which lead the said inlet and outlet ports, and an abutment held to slide in the said slots and provided at opposite sides with grooves registering at all times with the said inlet and outlet ports, substantially as shown and described.

6. In a rotary engine, the combination, with the cylinder provided with radial slots and inlet and outlet ports leading at opposite sides into the said slots, of cylinder-heads held on the said cylinder and forming with the latter annular grooves into which lead the said inlet and outlet ports, an abutment held to slide in the said slots, and a piston held to turn in the said cylinder and provided with projections in contact with the inner surface of the said cylinder, the said abutments being forced in contact at their inner ends with the periphery of the said piston by the action of the motive agent entering through the said inlet-ports, substantially as shown and described.

7. In a rotary engine, the combination, with the cylinder provided with radial slots and inlet and outlet ports leading at opposite sides into the said slots, of cylinder-heads held on the said cylinder and forming with the latter annular grooves into which lead the said inlet and outlet ports, and inlet and outlet pipes connecting with the said annular grooves to admit and exhaust the motive agent, substantially as shown and described.

8. In a rotary engine, the combination, with the cylinder provided with radial slots and inlet and outlet ports leading at opposite sides into the said slots, of cylinder-heads held on the said cylinder and forming with the latter annular grooves into which lead the said inlet and outlet ports, an abutment held to slide in the said slots, and a piston held to turn in the said cylinder and provided with projections in contact with the inner surface of the said cylinder, the said abutments being forced in contact at their inner ends with the periphery of the said piston by the action of the motive agent entering through the said inlet-ports, and inlet and outlet pipes connecting with the said annular groove to admit and exhaust the motive agent, substantially as shown and described.

9. In a rotary engine, the combination, with the cylinder provided with radial slots and inlet and outlet ports leading at opposite sides into the said slots, of cylinder-heads held on the said cylinder and forming with the latter annular grooves into which lead the said inlet and outlet ports, an abutment held to slide in the said slots, and a piston held to turn in the said cylinder and provided with projections in contact with the inner surface of the said cylinder, the said abutments being forced in contact at their inner ends with the periphery of the said piston by the action of the motive agent entering through the said inlet-ports, inlet and outlet pipes connecting with the said annular groove to admit and exhaust the motive agent, and means, substantially as described, for reversing the motion of the engine, substantially as specified.

JOHN B. HARRIS.

Witnesses:
E. D. LIGHTFOOT,
H. M. JUDGE.