(No Model.) 2 Sheets—Sheet 1.

W. RICE.

ROTARY ENGINE.

No. 502,585. Patented Aug. 1, 1893.

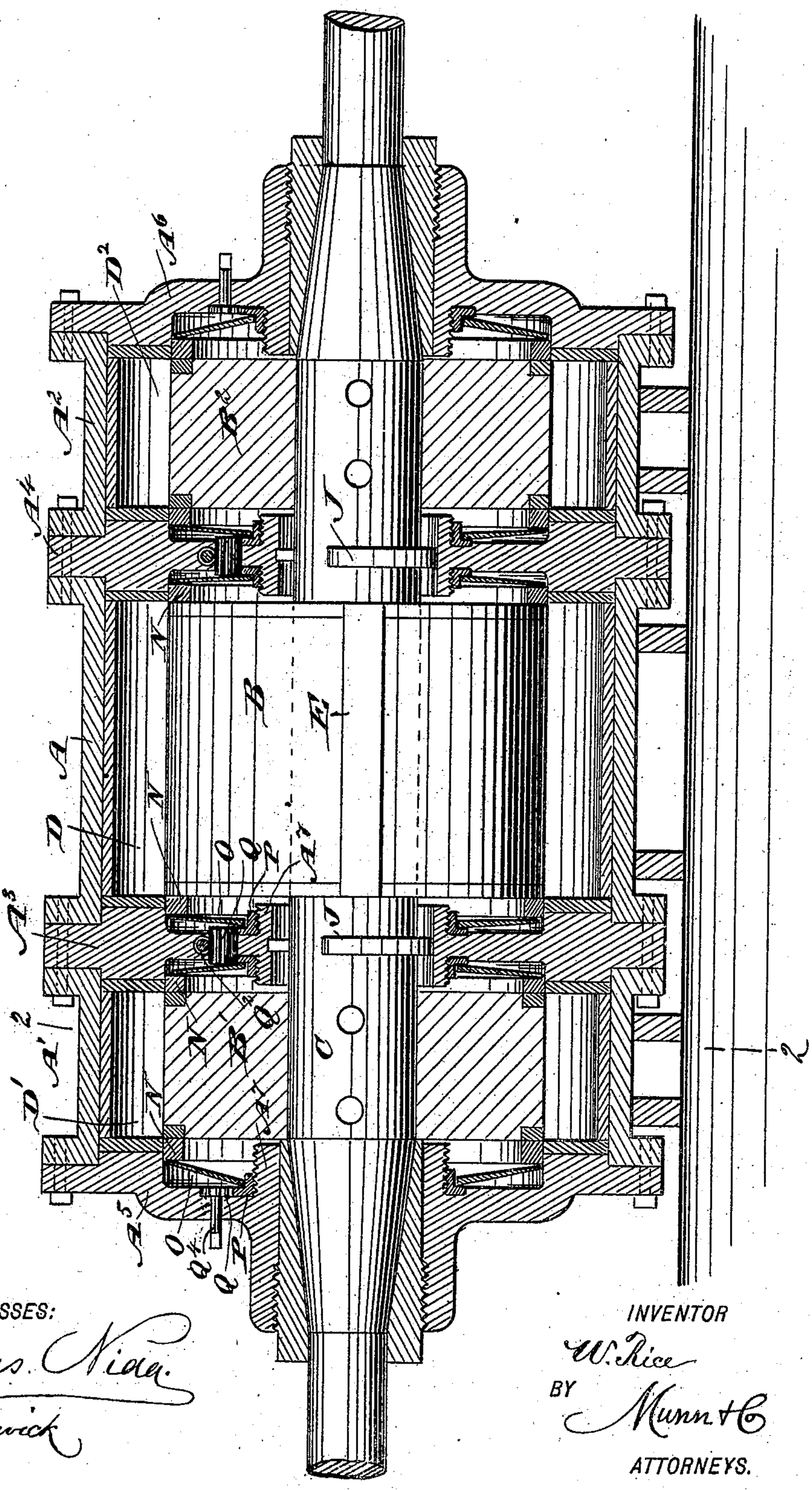

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig: 3.

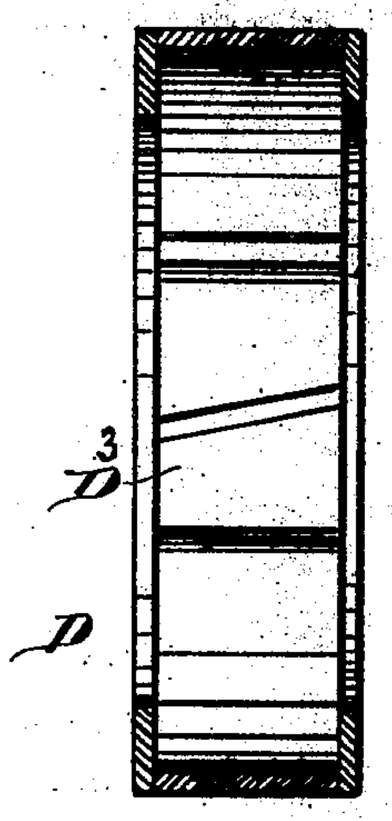


Fig: 2.

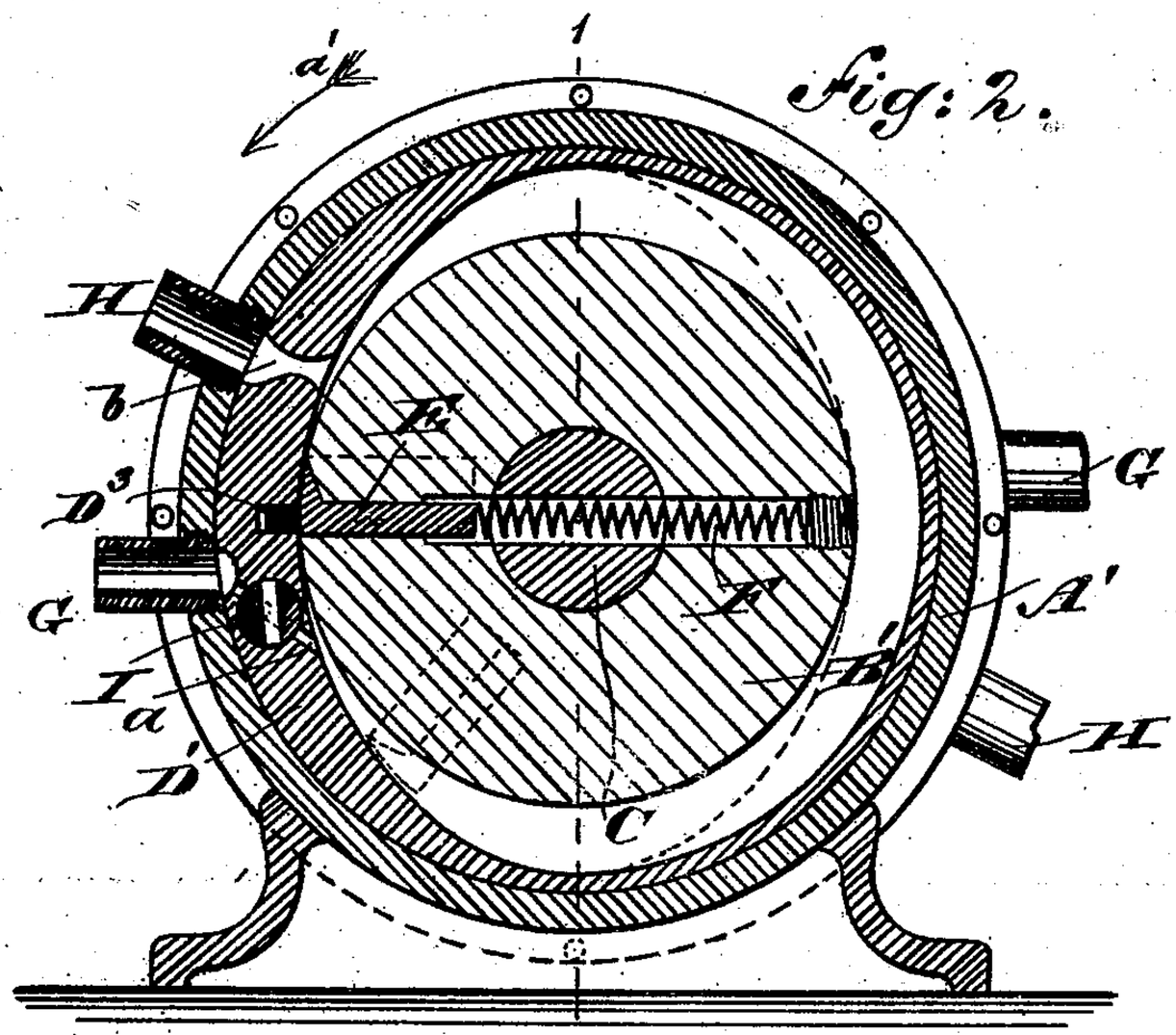


Fig: 5.

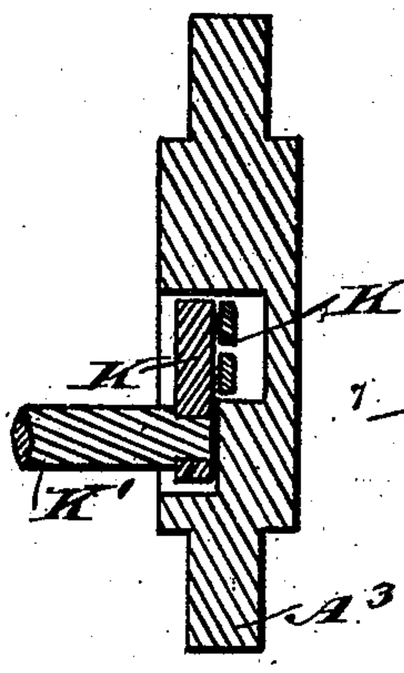


Fig: 4.

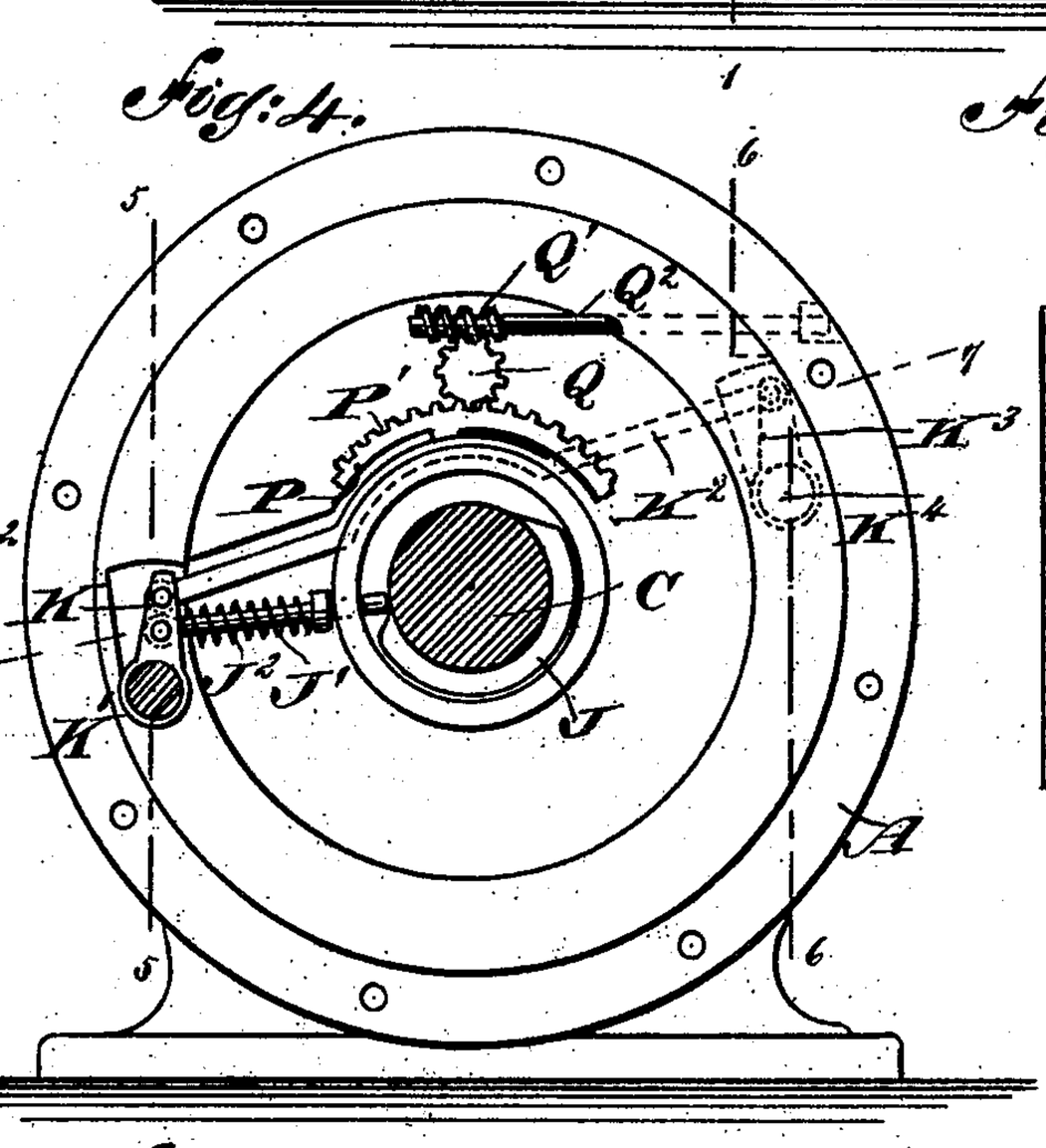


Fig: 6.

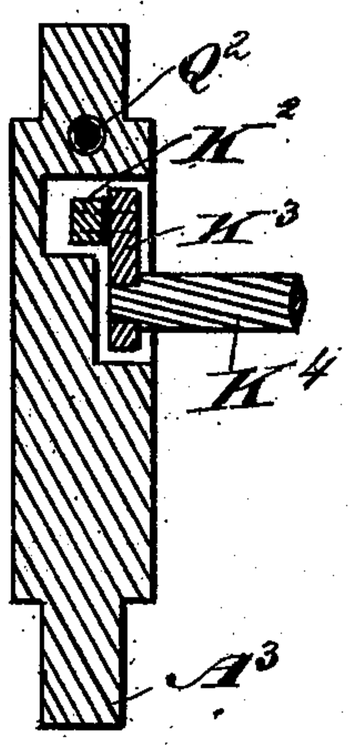
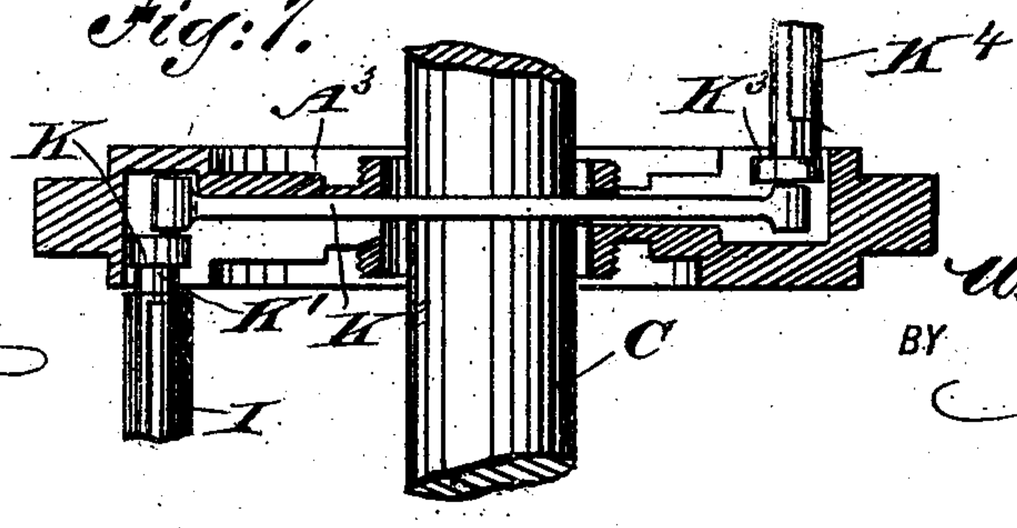


Fig: 7.



WITNESSES:

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UNITED STATES PATENT OFFICE.

WENTWORTH RICE, OF RAPID CITY, SOUTH DAKOTA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 502,585, dated August 1, 1893.

Application filed October 10, 1892. Serial No. 448,483. (No model.)

To all whom it may concern:

Be it known that I, WENTWORTH RICE, of Rapid City, in the county of Pennington and State of South Dakota, 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, very effective in operation, perfectly balanced and arranged to utilize the motive agent very economically and to the fullest advantage.

The invention consists of a cylinder, a piston turning therein, and a cut-off valve arranged in the cylinder close to the piston, to shorten the inlet port for cutting off the steam at any time during the revolution of the piston, to use the steam expansively in the cylinder.

The invention also consists of certain parts and details and combinations of the same, as will be hereinafter described 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 1—1 of Fig. 2. Fig. 2 is a transverse section of the same on the line 2—2 of Fig. 1. Fig. 3 is a transverse section of one of the cylinder linings. Fig. 4 is a side elevation with parts in section of the valve gear. Fig. 5 is a sectional side elevation of the same on the line 5—5 of Fig. 4. Fig. 6 is a similar view of the same on the line 6—6 of Fig. 4; and Fig. 7 is a sectional plan view of the same on the line 7—7 of Fig. 4.

The improved rotary engine is provided with a main cylinder A and two auxiliary cylinders A′ and A^2, each about one-half the size of the main cylinder A. The auxiliary cylinders A′ and A^2 are located on opposite sides of the main cylinder A and are divided from the same by the cylinder heads A^3 and A^4 respectively. The outer ends of the auxiliary cylinders A′ and A^2 are closed by the cylinder heads A^5 and A^6 respectively.

In the cylinders A, A′ and A^2 are mounted to turn the pistons B, B′, B^2 respectively, all three secured on a shaft C journaled in suitable bearings arranged on the outermost heads A^5 and A^6, as plainly illustrated in Fig. 1. The peripheral surfaces of the several pistons B, B′, and B^2 come in contact at one point with a packing bar D^3 arranged diagonally in each lining D, D′ and D^2 for the cylinders A, A′ and A^2 respectively. As plainly shown in Fig. 2, each lining gradually decreases in size in opposite directions from the respective bar D^3 so as to form the necessary steam compartment between the lining and the peripheral surface of the respective piston.

In each of the pistons B, B′, and B^2, is fitted to slide an abutment E arranged radially in suitable bearings in the respective piston, the inner end of each abutment being pressed by a spring F held in the respective piston B, B′ or B^2. The abutment E in the main piston B however, is arranged on the opposite side of the abutments in the other pistons B′ and B^2 and in a like manner the lining D is arranged with its bar D^3 on an opposite side from that of the other linings in the cylinders A′ and A^2.

In the heavy portion of each lining is formed an inlet port *a* and an exhaust port *b*, the said ports being located on opposite sides of the packing bar D^3, as plainly shown in Fig. 2. The port *a* connects with an inlet pipe G and an exhaust pipe H connects with the port *b*. It is understood that the inlet pipes G for the cylinders A′ and A^2 are arranged on one side of the engine, while the inlet pipe G for the main cylinder A is arranged on the opposite side of the engine, as plainly shown in Fig. 2. The exhaust pipes are similarly arranged.

The valves I for the auxiliary cylinders A′ and A^2 are actuated from cams J secured on the main driving shaft C and arranged in the cylinder heads A^3 and A^4. On each of the cams J abuts a rod J′ held in contact with the cam by a spring J^2 pressing on the said rod J′, as plainly illustrated in Fig. 4. The outer end of the rod J′ is pivotally connected with an arm K secured on the valve stem K′ of the valve I for the respective auxiliary cylinder A′ or A^2.

The inner ends of the valve stems K′ of valves I are each provided with a crank arm K connected by links K^2 with the arms K^3 on the ends of the valve K^4 of the main cylinder.

These links K^2 extend across the engine through recesses in the heads A^3 A^4 and actuate the main valve K^4 which is on the opposite side of the engine from the valves I I. It will be seen that when the shaft C rotates, the cams J impart an outward sliding motion to the rods J′ so that the arms K receive a swinging motion, thus actuating simultaneously all the valves for the three cylinders A, A′ and A^2. The arrangement of the valves with their respective inlet ports *a* is such that when the valve opens steam is admitted to all the three cylinders A, A′ and A^2 at the same time and the steam will be simultaneously cut off in the three cylinders. As the steam acts on the oppositely arranged pistons in the main cylinder and the auxiliary cylinders, the engine is perfectly counterbalanced. During the time the cams J do not actuate the rods J′, the latter are forced inward against the shaft C by the action of the springs J^2.

It is understood that the steam enters the respective steam compartment at the time the abutment E of the corresponding piston has passed the port *a*, the valves I or K^4 then being open so that the steam pressure is against the abutment to turn the piston in the direction of the arrow *a*′. The exhaust takes place at all times through the respective port *b* it being, however, understood that the port *b* is open to receive the exhaust after the abutment E is passed.

In order to make steam-tight joints at the ends of the pistons, I provide a packing ring N on each end of each piston, the said packing ring pressing against the sides of the lining and the respective face of the piston B, B′, or B^2. The packing ring N is forced in contact with the face of the respective piston by means of a dished flat ring O the inner edge of which is engaged by a flanged nut P screwing on a threaded offset A^7 formed on the respective head A^3, A^4, A^5 or A^6. It is understood that for the heads A^3 and A^4 two such threaded offsets A^7 are formed on both sides of the heads as plainly shown in Fig. 1. The threaded nuts P are each provided with a segmental gear P′ engaged by a gear wheel Q of which the gear wheels journaled in the heads A^3 and A^4 are in mesh with a worm Q′ held on a transversely-extending shaft Q^2 extending through the respective head to the outside to be turned by means of a wrench or other suitable tool applied to the outer end of the shaft. The gear wheel Q in the heads A^5 and A^6 is held on a shaft Q^4 the end of which extends to the outside of the head and can be turned from the outside by applying a wrench or other tool. Now, it will be seen that when the gear wheels Q are turned, the nuts P can be screwed toward or from the face of the desired piston B, B′ or B^2 so that the nut exerts pressure against the dished ring O, to force the outer end of the latter with more or less power against the packing ring N, or to release the pressure on the said dished ring, according to the direction in which the gear wheel Q is turned. It will be seen that by these means any leakage from one cylinder to the other can be prevented, the steam being thus confined to its respective steam space to fully utilize the power of the steam to turn the shaft C, as above described. It will be seen that the cams J can be arranged so as to cut off during any time of the strokes of the pistons B, B′ and B^2, so that the steam can work expansively in the cylinders to the end of the stroke and before the respective abutment opens to the port *b*. It will further be seen that by the arrangement of a main cylinder and the auxiliary cylinders, as described, a continuous rotary motion is given to the shaft C so that the engine is properly balanced.

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

1. A rotary engine comprising a main cylinder, two auxiliary cylinders on opposite sides thereof and taking steam at an opposite side to that of the main cylinder, pistons in said cylinders and provided with abutments, a driving shaft carrying the pistons and provided, within recesses in the inner cylinder heads, with cams, a cut off valve turning in each cylinder; the ends of the main valve and the inner ends of the valves of the auxiliary cylinders being provided with cranks connected by links extending across the main shaft through recesses in the inner cylinder heads, and spring pressed pins mounted in the inner cylinder heads in the path of the said cams and pivotally connected with the cranks of the valves of the auxiliary cylinders, substantially as set forth.

2. In a rotary engine, the combination with a piston and a packing ring abutting thereagainst, of a traveling nut mounted on an externally threaded projection on the inner face of the cylinder head concentric with the axis of the piston, a dished ring on said projection engaging said packing ring with its rim and engaged at its outer convex face by said nut, and means for rotating the nut from the exterior of the cylinder, substantially as set forth.

3. The combination with the cylinder having an externally threaded projection on the inner face of its head concentric with its piston rod opening, the rotary piston and a packing ring, of the dished ring upon the said projection and bearing against the packing ring, a nut mounted on the said projection and bearing against the outer convex face of the ring; said nut also provided with gear teeth, and a shaft entering the cylinder and geared to said nut, substantially as set forth.

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