(No Model.) 2 Sheets—Sheet 1.

J. N. HARTZELL.

ROTARY STEAM ENGINE.

No. 523,280 Patented July 17, 1894.

Fig. I.

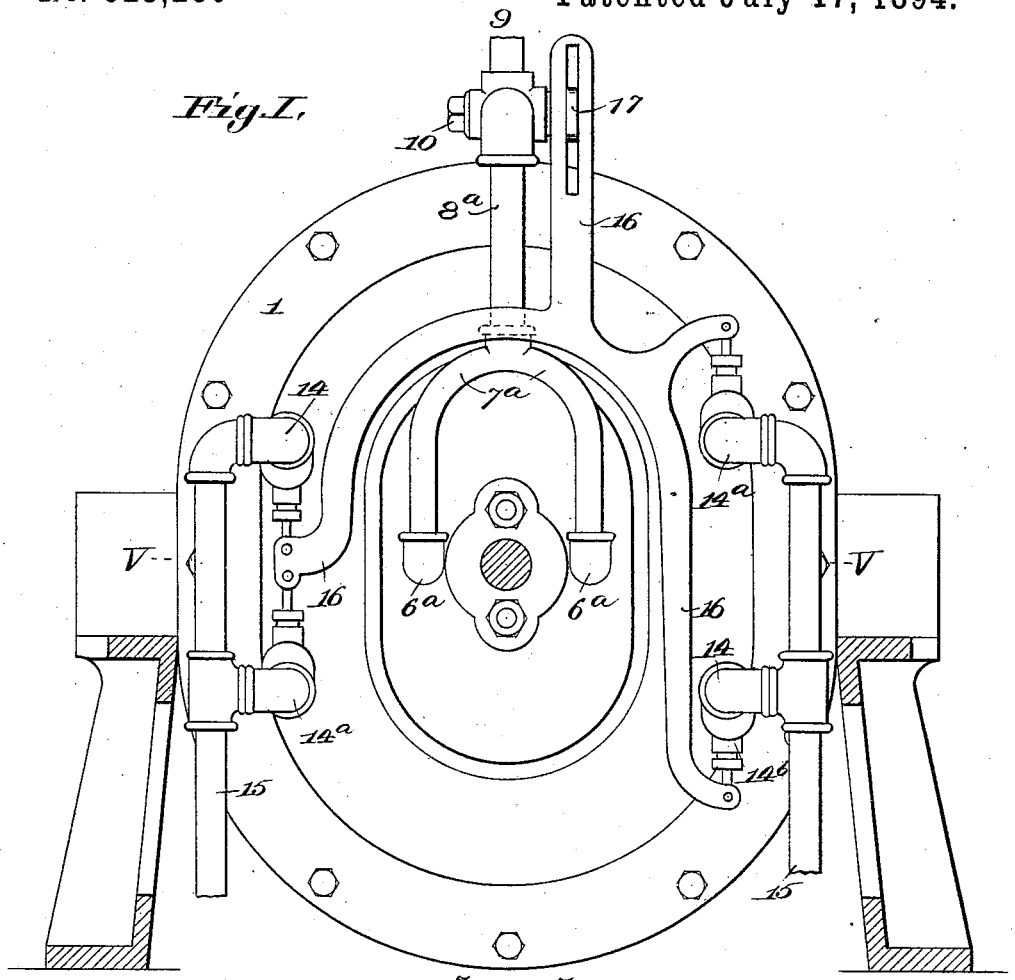
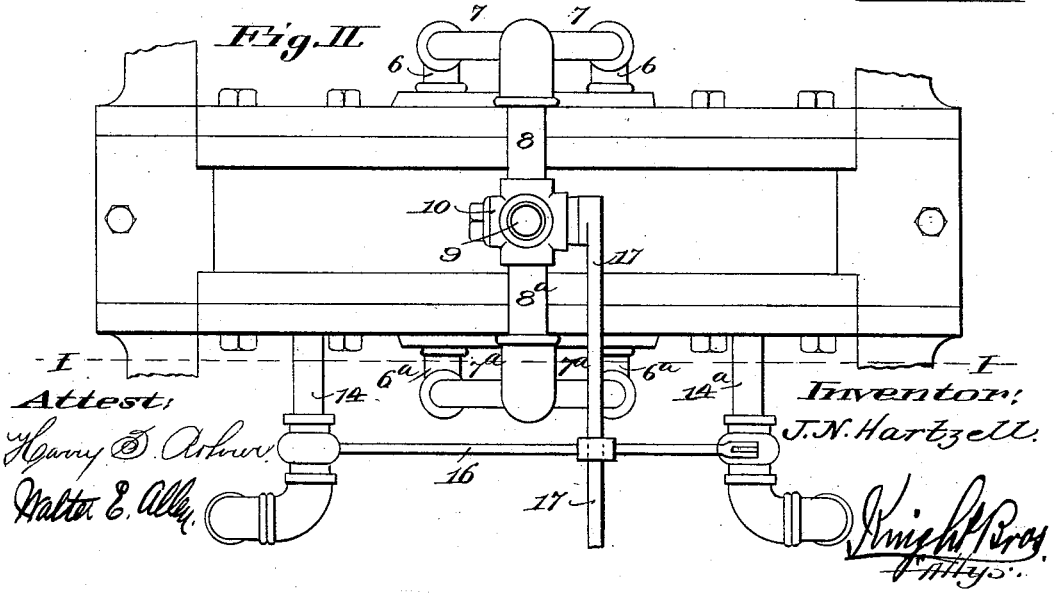


Fig. II.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. III.

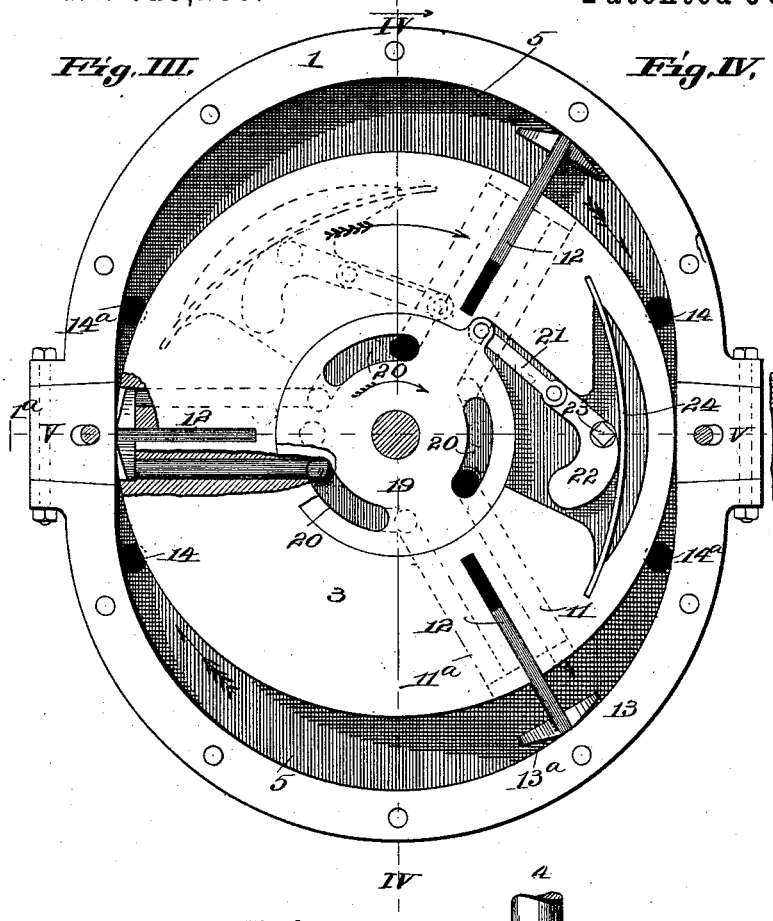


Fig. IV.

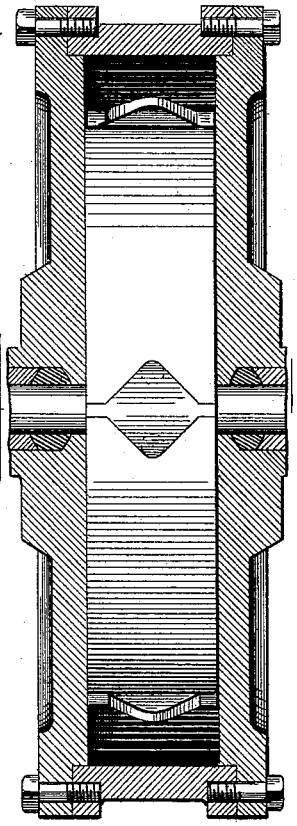


Fig. V.

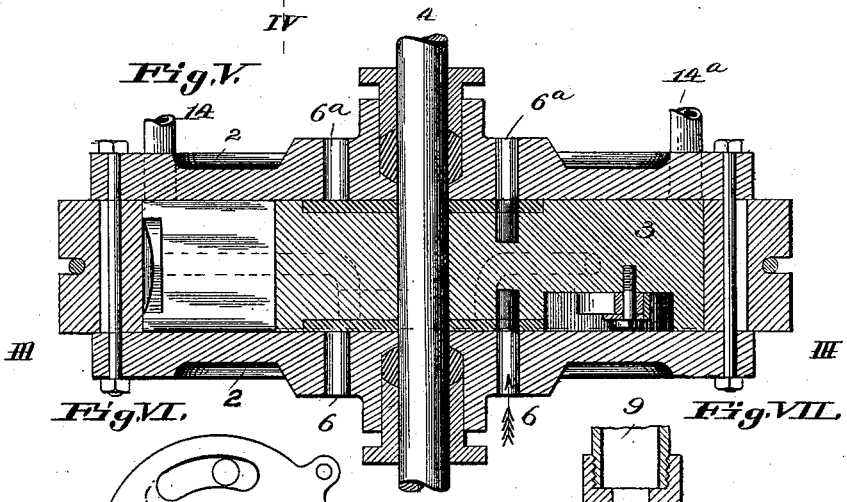


Fig. VI.

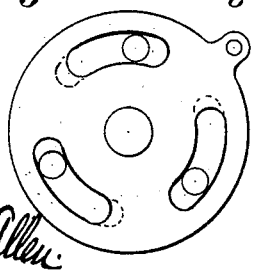
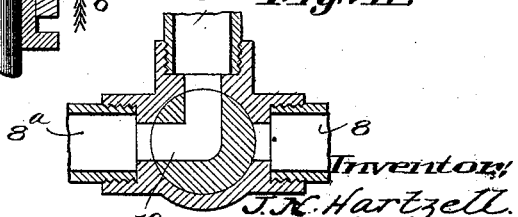


Fig. VII.



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UNITED STATES PATENT OFFICE.

JAMES N. HARTZELL, OF CAPE GIRARDEAU, MISSOURI.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 523,280, dated July 17, 1894.

Application filed September 13, 1893. Serial No. 485,422. (No model.)

To all whom it may concern:

Be it known that I, JAMES N. HARTZELL, of Cape Girardeau, in the county of Cape Girardeau and State of Missouri, have invented a certain new and useful Improvement in Rotary Steam-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My improved, rotary steam engine is constructed with a casing, with two ends formed in circular arcs, of about equal radius to the runner, separated by straight blocks, so as to form an ellipsoid, with a crescent shaped steam chamber in each end. The interposed blocks are adjustable radially to compensate for wear, and provide tight abutments between the live steam and exhaust chambers. Two steam ports are provided in each head for running in opposite directions, communicating with ports in each face of the runner, controlled by concentric disk valves connected with a centrifugal governor on each side, for cutting off the steam, so as to reduce the period of steam entrance to correspond with the rapidity of revolution, thus regulating the movement of the engine to the power required, or the speed desired, and working the steam expansively during a portion of the movement. The runner is provided with preferably three radially moving pistons. From the central ports on the respective faces of the runner, steam passages extend radially outward on each side of the radial pistons, their outer ends being closed by lips, projecting each way from the extremities of the pistons, so that the pressure of entering steam throws the pistons outward against the inner periphery of the casing. The exhaust is through simple ports, near the periphery of the casing, two such ports, at diametrically opposite points, being used for running in one direction, and another similar pair of ports for running in the other direction, as hereinafter explained.

In the accompanying drawings, Figure I is an elevation of a rotary engine, illustrating my invention. Fig. II is a top view of the same. Fig. III is a face view from the opposite side with one of the heads removed. Fig. IV is a section on the line IV—IV, Fig. III, showing the runner in elevation. Fig. V is a section on the lines V—V, Figs. I and III. Fig. VI is a detail view of one of the governor valves. Fig. VII is a detail section of a two-way steam cock, employed for reversing.

1 represents the ellipsoidal casing, and 2 the heads secured thereto, by bolts, in customary manner.

3 is the circular runner, keyed upon a shaft 4, and working within the casing 1, so as to leave a crescent formed steam space 5, in each end of the casing, the ends of the casing being formed on circular arcs of about equal radius to the runner, separated by wedge-shaped blocks 1^a, having straight inner faces. The said blocks are adjustable radially to compensate for wear, and by contact with the periphery of the runner, form abutments for the steam.

Two steam ports 6, 6^a are provided in each head 2, near the center, each pair of ports being in communication with branch pipes 7, 7^a, which are united in pipes 8, 8^a communicating with the steam supply pipe 9, through a two-way cock 10, by which steam may be turned into either pipe 8 or 8^a for running the engine in either direction. The ports 6 communicate with steam passages 11, 11^a, opening longitudinally to either face of the runner, and extending radially outward on each side of the radially moving pistons 12. The said pistons are provided with lips 13, 13^a, covering the outer ends of the respective steam pasages 11, 11^a, so that the pistons 12 will be driven outward by the ingress of steam, into contact with the inner periphery of the casing 1. The exhaust is through ports 14, 14^a, near the periphery of the casing, one pair of exhaust ports, 14, 14, at diametrically opposite points, being employed for running in one direction and another pair 14^a, 14^a, for running in the other direction. I have shown the two ports 14, 14^a, on each side united in a pipe 15 and these pipes 15 may be united in a common discharge pipe (not shown), but the arrangement of the discharge pipes from the exhaust ports is unimportant. The exhaust ports 14, 14 are opened and the other pair 14^a, 14^a, closed simultaneously (or vice versa)

by gate valves 14^b, operated by a system of links and levers 16, 17, connected with the two-way steam cock 10, so that by a single movement the steam and exhaust valves may be reversed for running the engine in opposite directions. In order to control the speed of motion, in accordance with the power required, or the speed of rotation desired, and to work the steam expansively during a portion of the movement, I employ concentric disk valves 19, 19^a, on each face of the runner, having concentric slots 20, which control the length of exposure of the steam passages 11, 11^a, to the inlet ports 6, 6^a. For this purpose the disk valves are connected by links 21, with weighted bell-cranks 22, fulcrumed at 23 in the runner, and by their cam-shaped weighted ends bearing outwardly against resisting springs 24, so that by the centrifugal force applied by a rapid rotation, the springs 24 being pressed back, the arms of the weighted levers 22, connected with the links 21, will draw the disk valves around in the direction indicated by the arrow in Fig. III, reducing the exposed length of the concentric ports 20, thereby cutting off the steam at any desired point.

In operation, the steam pipe 8, and the exhaust ports 14, being open, and the pipes 8^a and the exhaust ports 14^a closed, steam passes through the branch pipes 7, to the ports 6, 6, thence through the governor valve ports 20, to the radial steam passages 11, coming in contact with the lips 13, and forcing the radially moving pistons 12 outward, as shown in Fig. III. These pistons are held outward in contact with the inner periphery of the casing by centrifugal force, and it will be apparent that the steam entering through the inlet passages 11, will force the runner around in the direction indicated by the large arrow thereon in Fig. III, the exhaust steam escaping through the ports 14, as indicated by the arrows in the chambers 5. By admitting steam at two opposite points I balance the pressure on the runner, thus reducing friction and wear. The length of the straight or parallel surfaces of the casing 1 which constitute the abutments, and are formed chiefly of the straight inner faces of the blocks 1^a should be equal to about one fourth the diameter of the runner as here shown. This gives the radially sliding pistons 12 an even and gradual contraction as they approach the abutments and a gradual expulsion as they pass from the same. This is of especial value to effect smooth and easy running under high speed. The adjustment of the blocks 1^a admits of taking up wear and maintaining practically steam-tight joints between them and the periphery of the runner, and the proportions given provide working steam chambers equal in circumferential length to the distance between the pistons, thus giving the full length of the steam chamber to the direct pressure or expansive pressure of the steam. In order to run in the other direction, it is only necessary to reverse the two-way cock 10, closing communication with the inlet pipe 8 and opening communication with the inlet pipe 8^a, at the same time reversing the gate valves of the exhaust ports. The steam will then enter through the inlet passages 11^a on the runner communicating with the opposite face thereof and with the inlet steam ports 6^a. The exhaust ports 14 being closed, the steam will exhaust through the ports 14^a, and a rotary movement in the opposite direction will result on the principle already described.

I claim as my invention—

1. A rotary engine constructed as herein described with steam inlets through the head near the center, exhaust outlets near the periphery, radial steam passages through the runner and an annular disk valve in the face of the runner controlling the admission of steam to the radial passages therein, substantially as set forth.

2. A rotary engine, constructed with steam inlets near the center, exhaust outlets near the periphery, radial steam passages through the runner, and radially sliding pistons provided with lips which cover the outer ends of the steam ports when the pistons are retracted, and receive the steam pressure to eject the pistons against the inner periphery of the casing in taking steam, as explained.

3. A rotary steam engine constructed as herein described with steam inlets through each head near the center, exhaust outlets near the periphery, a runner having radially sliding pistons and steam passages extending radially through the runner on opposite sides of said pistons communicating with said steam inlets in the respective heads and connecting pipes and a reversing valve for directing the steam to either side for running the engine in either direction as explained.

4. A rotary engine constructed as herein described with an ellipsoidal casing consisting of two circular arcs and interposed wedge shaped blocks having straight inner faces and adjustable radially, substantially as and for the purpose set forth.

5. A rotary engine constructed substantially as herein described, with an ellipsoidal casing, a runner working therein, having radially sliding pistons provided with lips projecting in opposite directions from their outer ends, steam inlets in the respective heads of the casing, communicating with ports in the opposite faces of the runner, radial steam passages in the runner communicating with said ports, and delivering steam on opposite sides of the pistons, covered at their outer ends by the lips thereon, exhaust ports near the periphery of the casing, and a suitable cock to control the admission of steam to the respective passages on one or the other side

of the pistons, for running in either direction, as explained.

6. The combination of the cylinder 1, heads 2, 2, having steam ports 6, the runner 3 having radial steam passages 11 communicating with said ports, the annular disk cut off valve 19 controlling the connection with said steam ports and a centrifugal governor 21, 22, operating said cut off valve as explained.

JAMES N. HARTZELL.

In presence of—
OCTAVIUS KNIGHT,
ALBERT M. EBERSOLE.