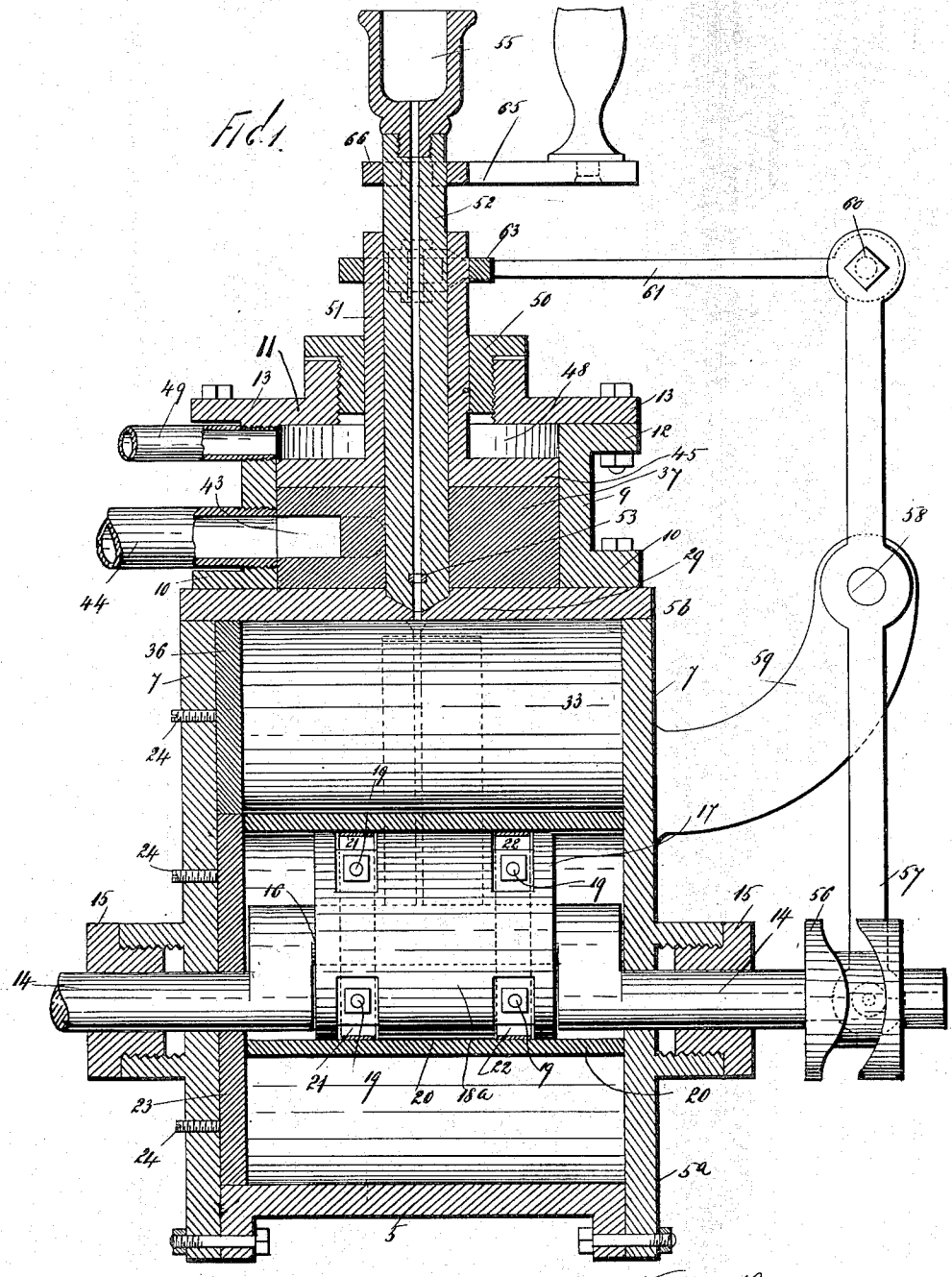
No. 661,524. Patented Nov. 13, 1900.

N. HENQUIN.

ROTARY ENGINE.

(Application filed Mar. 6, 1900.)

(No Model.) 3 Sheets—Sheet 1.



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(No Model.) 3 Sheets—Sheet 2

FIG. 2.

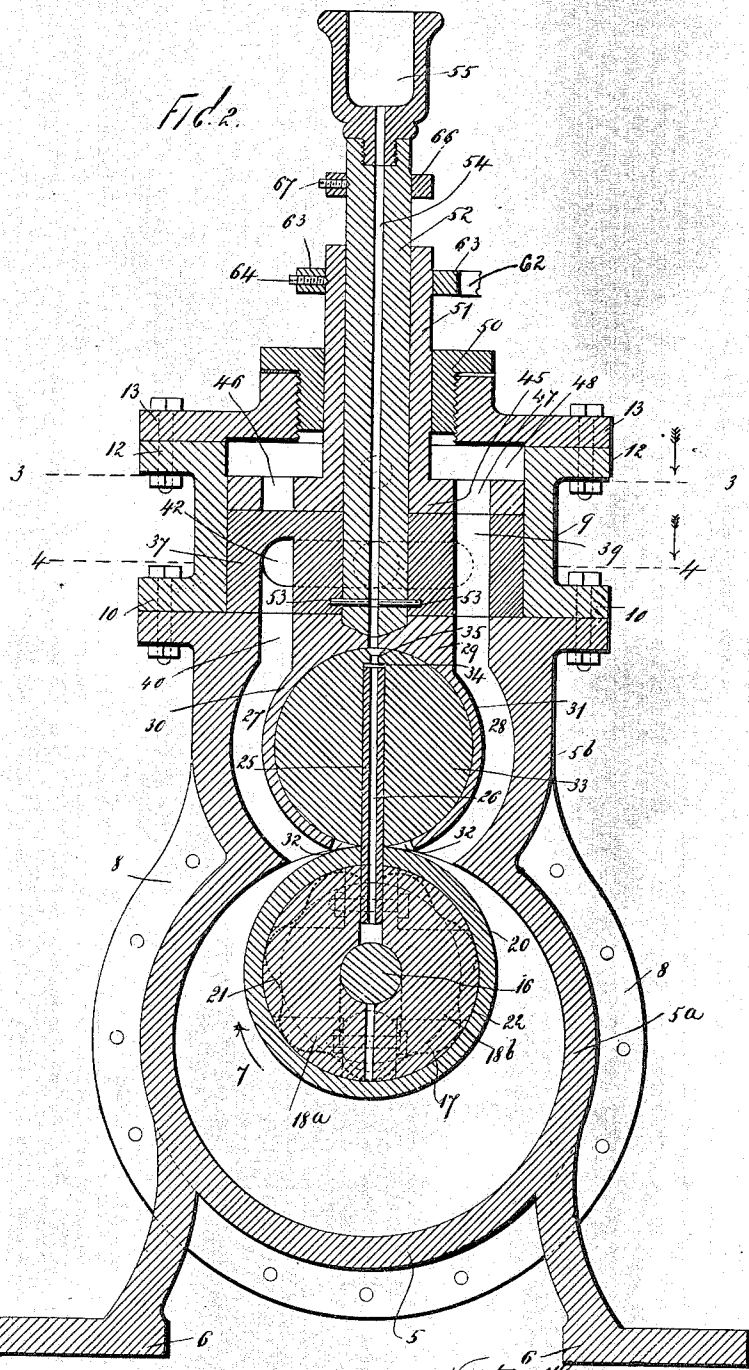

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FIG. 3

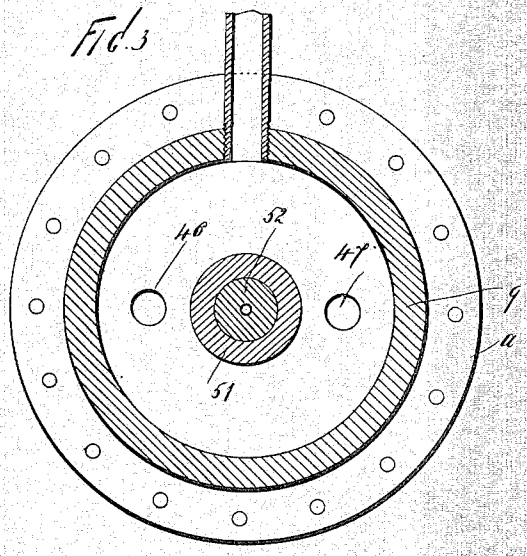
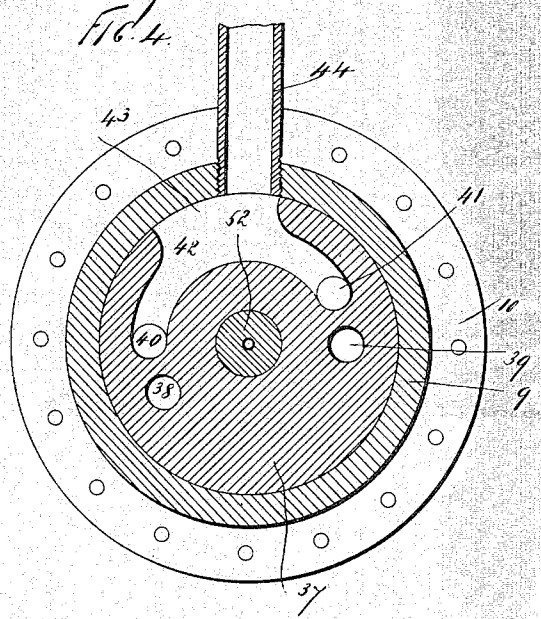


FIG. 4.



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UNITED STATES PATENT OFFICE.

NESTOR HENQUIN, OF SCHENECTADY, NEW YORK.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 661,524, dated November 13, 1900.

Application filed March 6, 1900. Serial No. 7,457. (No model.)

To all whom it may concern:

Be it known that I, NESTOR HENQUIN, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Rotary Engines, of which the following is a full and complete specification, such as will enable those skilled in the art to which it appertains to make and use the same.

This invention relates to rotary engines; and the object thereof is to provide a rotary engine positive in action, economical in steam consumption, and which shall furnish a maximum of power for the steam consumed.

With the above and other objects in view my invention consists in the construction and arrangement of parts hereinafter specified.

In the accompanying drawings, forming part of this specification, in which like reference characters denote corresponding parts in the several views, Figure 1 is a longitudinal vertical section of a rotary engine constructed according to my invention, several of the operative parts being shown in full lines; Fig. 2, a central vertical transverse section thereof; Fig. 3, a section of Fig. 2 upon the line 3 3 thereof, and Fig. 4 a section of Fig. 2 upon the line 4 4 thereof. Figs. 3 and 4 are upon an enlarged scale.

In the practice of my invention I provide a cylinder-casing 5, which is mounted upon suitable bases 6 and provided with detachable heads 7, which are fitted to flanges 8 thereon. Mounted upon the cylinder-casing 5 is a communicating valve-casing 9, which is bolted thereto by means of flanges 10 and is provided with a detachable cap 11, bolted thereto by means of flanges 12 and 13. The power-shaft 14 of the engine is journaled in the heads 7 of the cylinder, passing through stuffing-boxes 15, and is provided with a crank-elbow 16 within the cylinder.

The piston which I employ is denoted by the general reference character 17, is cylindrical in form, and embodies a piston-head consisting of two semicylindrical members 18^a and 18^b of less length than the inner longitudinal dimension of the cylinder-casing 5 and which are bolted about the crank-elbow 16, being recessed upon the plane portions of their perimeters to form a bearing which receives the crank-elbow. Each of the piston-head members is recessed in its curved perimeter to receive bolts 19, by which the members are bolted to the crank-elbow. About the piston-head members 18^a and 18^b is fitted a cylindrical jacket 20, which is approximately of a length equal to the inner longitudinal dimension of the cylinder-casing 5 and which is bound frictionally to the head members 18^a and 18^b by means of plurally-curved springs 21 and 22, which are shown in section in Fig. 1 and in dotted lines in Fig. 2 and which are arranged in peripheral grooves formed in the head members 18^a and 18^b. These springs bear upon the inner periphery of the jacket 20 and form a firm connection between the heads 18^a and 18^b and the said jacket.

At one end of the cylinder-casing 5 and within the same at the bottom thereof is arranged a packing-disk which fits tightly between the adjacent end of the piston-jacket 20 and the cylinder-head 7 and is capable of adjustment by means of adjusting-screws 24, which are operatively mounted in the adjacent piston-head. The diameter of the piston 17 is considerably smaller than the inner diameter of the cylinder-casing 5, as clearly shown in the drawings, and its operation follows circularly the contour of the inner periphery thereof. The crank-elbow 16 operates within the cylindrical piston-jacket 20. The piston 17 is provided with a piston-rod or vane 25, the lower end of which is bolted between the piston-head members 18^a and 18^b by means of the bolts 19 or secured thereto in any other suitable manner and is preferably oblong in form and provided with a longitudinal oil-passage 26, the lower end of which opens above the crank-elbow 16, whereby oil introduced therethrough will be freely admitted to the coengaging bearing-surfaces of the piston-head members 18^a and 18^b and the crank-elbow 16. The vane 25 is of a width coincident with the interior length of the cylinder throughout the portion thereof exterior of the piston-jacket 20.

The cylinder-casing 5 is divided into two parts or members—namely, 5^a, in which is formed the cylinder proper in which the piston operates, and 5^b, which communicates therewith and in which are formed cylinder

steam-ports 27 and 28, which are separated by a web 29, formed longitudinally of the cylinder-casing member 5^b at the top and centrally thereof. The web 29 extends from end to end of the cylinder-casing member 5^b and is provided with two segmental depending flanges 30 and 31, which are formed with a radius of a circle having a central point midway therebetween. The flanges 30 and 31 extend likewise from end to end of the cylinder-casing member 5^b and are separated by a space 32 at their lower ends.

The steam-ports 27 and 28 are arranged, respectively, between the flanges 30 and 31 and the respective adjacent sides of the cylinder-casing member 5^b and communicate with the cylinder at either side of the space 32. Mounted between the flanges 30 and 31 is a cylindrical rocking roller-bearing 33, which extends approximately from end to end of the space therebetween.

The piston-rod or vane 25 is slidably mounted in a diametrical chamber 34, formed in the roller-bearing 33, and the relative dimensions of the chamber 34, vane 25, and piston 17 are such that when the piston is in engagement with the lowermost inner periphery of the cylinder-casing the vane 25 will still project at its upper end within the chamber 34, and that when the piston 17 is in engagement in its upper periphery with the lower portion of the roller-bearing 33 the said vane 25 will approximately fill the chamber 34, which extends approximately diametrically through the bearing 33. The bearing 33 is provided with an oil-passage 35, which communicates with the chamber 34 and is formed in alinement therewith radially of the roller-bearing 33. As the piston 17 operates within the cylinder under actuation of the steam admitted thereto by either one of the ports 27 and 28, as hereinafter described, it travels about the cylinder in a circular path in engagement with the walls thereof, revolving the crank-elbow 16 and shaft 14, and the vane 25 operates to maintain constant the movement of the piston relative to the crank-elbow 16 and also receives to a considerable extent the impact of the steam assisting in the actuation of the piston.

Arranged within the casing member 5^b at one end thereof is a packing-disk 36, which fits the adjacent ends of the flanges 30 and 31 and web 29, as well as one end of the roller-bearing 33, forming a steam-tight joint of the several parts with which it engages. The packing-disk 36 is adjustable by means of an adjusting-screw 24, mounted in the adjacent cylinder-head 7.

Mounted within the valve-casing 9, at the bottom thereof, said casing being provided with a circular inner periphery, is a reverse-valve plate 37, (shown upon an enlarged scale in Fig. 4,) provided in radial lines thereof, which are less than one hundred and eighty degrees apart, with two transverse feed-ports 38 and 39, respectively. The valve-plate 37 is also provided with two exhaust-ports 40 and 41, which open at the bottom thereof, but do not open through the top thereof, and both of which communicate with an exhaust-chamber 42, which is segmental in form and provided with a wide mouth portion 43, which opens at one side of the valve-plate 37 and communicates at all times with an exhaust-pipe 44, which is fixed in the valve-casing 9 at one side thereof. The exhaust-chamber 42 is not open at the top or bottom of the valve-plate 37 and only through the mouth 43. The exhaust-ports 40 and 41 are arranged in lines radially of the valve-plate 37, which are less than one hundred and eighty degrees apart, and the preferable relative arrangement of the feed-ports 38 and 39 and the exhaust-ports 40 and 41 is such that the ports 41 and 39 are arranged at one side of the valve-plate and separated relatively by a distance measured upon the circumference of a circle passing through both thereof equivalent to the circumferential distance measured upon the same circle between the ports 38 and 40.

The ports 27 and 28 in the cylinder-casing member 5^b are arranged diametrically oppositely therein, and the relative arrangement of the ports 27 and 28 and the ports 38, 39, 40, and 41 in the valve-plate 37 is such that when the valve-plate 37 is turned into position to bring the port 39 into communication with the port 28 the port 27 will be in communication with the port 40. It follows, therefore, that when the valve-plate 37 is turned to bring the port 38 into communication with the port 27 the port 41 will be in communication with the port 28. Hence, as hereinafter described, as the steam is admitted always through the ports 38 and 39 and exits through the ports 40 and 41, when the port 39 is admitting steam to the port 28 the port 40 is receiving exhaust-steam from the port 27, and when the port 38 is admitting steam to the port 27 the port 41 is receiving exhaust-steam from the port 28. It is seen from the above that the ports 27 and 28 alternately operate upon reversal of the engine as feed and exhaust ports, respectively.

Mounted turnably upon the reverse-valve plate 37 is a feed-valve plate 45, (shown in detail in Fig. 3,) provided with two diametrically oppositely arranged transverse ports 46 and 47, respectively, which are arranged to respectively alternately register with the ports 38 and 39 in the valve-plate 37 upon rotation of the valve-plate 45. Above the valve-plate 45 is formed the steam-chest 48, which is fed with steam through a supply-pipe 49 at one side of the valve-casing 9. The steam-chest 48 is closed at the top by a stuffing-box 50, centrally through which passes a turnable valve-sleeve 51, which is formed integral or otherwise rigidly connected with the valve-plate 45. Passing turnably through the valve-sleeve 51 is a reverse-valve rod 52, which likewise passes turnably and centrally through the valve-plate 45 and centrally through the valve-

plate 37, being fixed thereto by keys or pins 53, and the valve-rod 52 projects above the valve-sleeve 51 and is provided with a central oil-passage 54, arranged to communicate with the oil-passage 35 in the roller-bearing 33. The valve-rod 52 is provided at its upper end with an oil-cup 55, which communicates with the oil-passage 54, and it is manifest that with the parts of the engine in the relative position shown in Fig. 2 oil is free to pass from the cup 55 through the passages 54 and 35, the chamber 34 in the bearing 33, and the passage 26 in the vane 25 and on to the crank-elbow 16, thoroughly oiling the same. It is also manifest that the oil flowing from the lower end of the passage 54 will lubricate the roller-bearing 33 and the inner bearing-surface of the cylinder proper.

The shaft 14 is provided with a cam 56, in connection with which operates in the usual or any desired manner the lower end of a cut-off rod 57, which has a rocking bearing at 58 upon an arm 59, secured to the adjacent end of the cylinder-casing 5. Pivoted to the upper end of the cut-off rod 57 at 60 at one end is a cut-off rod 61, the other end of which is pivoted to an arm 62, connected with the sleeve 51 by means of a collar 63 passed thereabout and detachably connected therewith by means of a set-screw 64. The arm 62 is shown in Fig. 2 and in dotted lines in Fig. 1. A reversing-handle 65 is detachably connected with the valve-rod 52 by means of a collar 66 and a set-screw 67 passed therethrough. The cut-off rod 57 is so operatively connected with the cam 56 and the cut-off rod 61 and arm 62 are so operatively connected with the valve-sleeve 51 that with the parts in the positions shown in the drawings the feed-valve 45 will be oscillated to intermittently bring the port 47 into communication with the port 39 at predetermined intervals determined by the several phases of movement of the piston 17 in the cylinder, whereby steam is admitted from the steam-chest 48 to the cylinder at just such times as the piston traveling in the cylinder in the direction of the arrow in Fig. 1 shall have passed the port 28, allowing ingress of steam therethrough. As the steam carries the piston downwardly in the direction of the arrow, the latter extending from end to end of the cylinder and being maintained in close contact with the cylinder's inner periphery by the crank-elbow 16, and the vane 25 also extending from end to end of the cylinder, the exhaust-port 27 is maintained closed until such phase of movement of the piston as shall bring the latter beyond the exhaust-port. When the piston shall have moved into a position approximately diametrically opposite that in which it first receives the impact of the steam, the cam 56 cuts the steam from the feed-ports 47 and 39, and the latter ports are not again opened until the piston has passed the lower orifice of the port 28. When the piston has passed the lower orifice of the port 27, the exhausted steam will pass out therethrough.

When it is desired to reverse the engine, the handle 65 is turned to rotate the valve-rod 52 and valve 37, bringing the port 46 into registration with the port 38 and shutting off communication between the port 39 and port 47, furthermore bringing the port 27 into communication with the port 38 and the port 28 into communication with the port 41. It is therefore evident that the port 28 thus becomes the exhaust-port and the port 27 the feed-port.

By means of the relative construction and arrangement of parts herein described I provide an engine of few and simple parts and economical to operate, the friction of the operative parts being minimized. It is manifest that the piston 17, being directly connected with the power-shaft, imparts the direct impulses of the steam thereto, and said piston having a sliding bearing and a partial rolling bearing within the cylinder and upon the crank-elbow moves with but slight frictional resistance. The engine is easily reversed, and the separate parts thereof are readily detachable for repair and cleaning.

I do not limit myself to the specific construction and arrangement of parts herein specified, but reserve the right to vary the same within the scope of my invention.

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

1. In a rotary engine, a cylinder, a shaft passed therethrough and provided with a crank-elbow therein, and a piston rotatably mounted upon said crank-elbow comprising a piston-head embodying two members which are clamped about the crank-elbow, a projecting vane which is clamped between said piston members, a jacket which is passed about said piston-head members, and a spring element interposed between said piston-head and jacket, substantially as shown and described.

2. In a rotary engine, a cylinder, a shaft passed therethrough and provided with a relatively movable piston, said piston being provided with a vane, a rocking bearing mounted in the engine exterior of the cylinder and with which the vane is loosely connected, said rocking bearing and said vane being provided with oil-passages whereby oil may be introduced to the bearing-surface of said piston upon said shaft, substantially as shown and described.

3. In a rotary engine, a cylinder, a shaft passed therethrough, and provided therein with a crank-elbow, a piston rotatably mounted upon said crank-elbow, a rocking bearing mounted exteriorly of the cylinder and provided with a transverse chamber, said piston being provided with a vane which is slidably mounted in the chamber in said rocking bearing, an ingress and an exit port formed at

either side of said rocking bearing and communicating with said cylinder, a valve mounted above said rocking bearing and provided with ports arranged to be brought into registration with said ingress and exit ports, said valve being provided with a valve-rod and with a longitudinal oil-passage arranged to communicate with the chamber in said rocking bearing, said vane being also provided with an oil-passage through which oil may be admitted to the bearing-surface of said piston upon said crank-elbow, substantially as shown and described.

4. In a rotary engine, a cylinder, a shaft passed therethrough provided with a crank-elbow therein, a piston rotatably mounted upon said crank-elbow and comprising a piston-head embodying two members which are passed about the crank-elbow, a projecting vane which is clamped between said piston-head members, a jacket which is passed about said piston-head members, and within which said crank-elbow operates, and a spring element interposed between said piston-head and jacket, said piston-head members being of less length than said jacket, substantially as shown and described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of the subscribing witnesses, this 3d day of March, 1900.

NESTOR HENQUIN.

Witnesses:
CHRIS. HENQUIN,
ALEX. J. THOMSON.