No. 641,199. Patented Jan. 9, 1900.

W. M. FARROW.

ROTARY ENGINE.

(Application filed Apr. 19, 1899.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

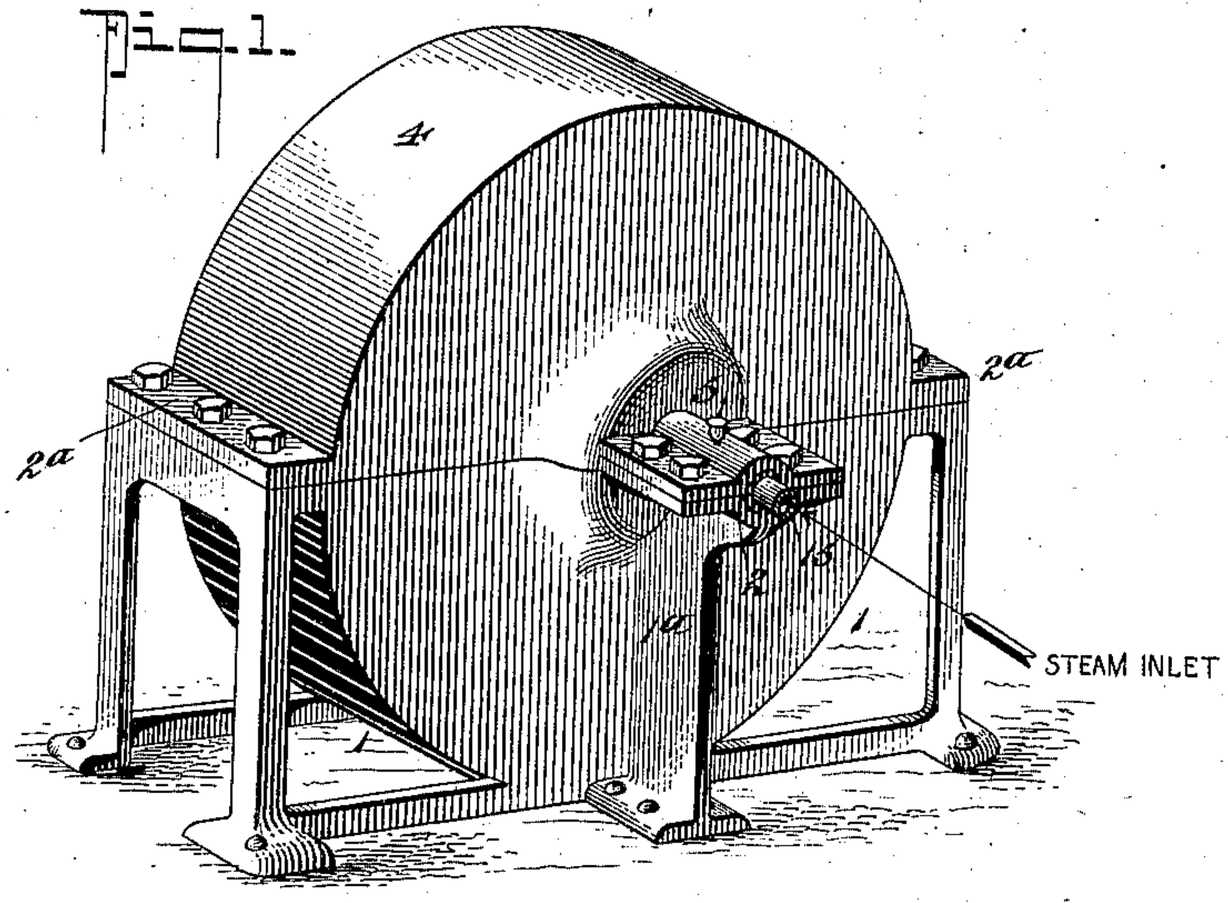


Fig. 6.

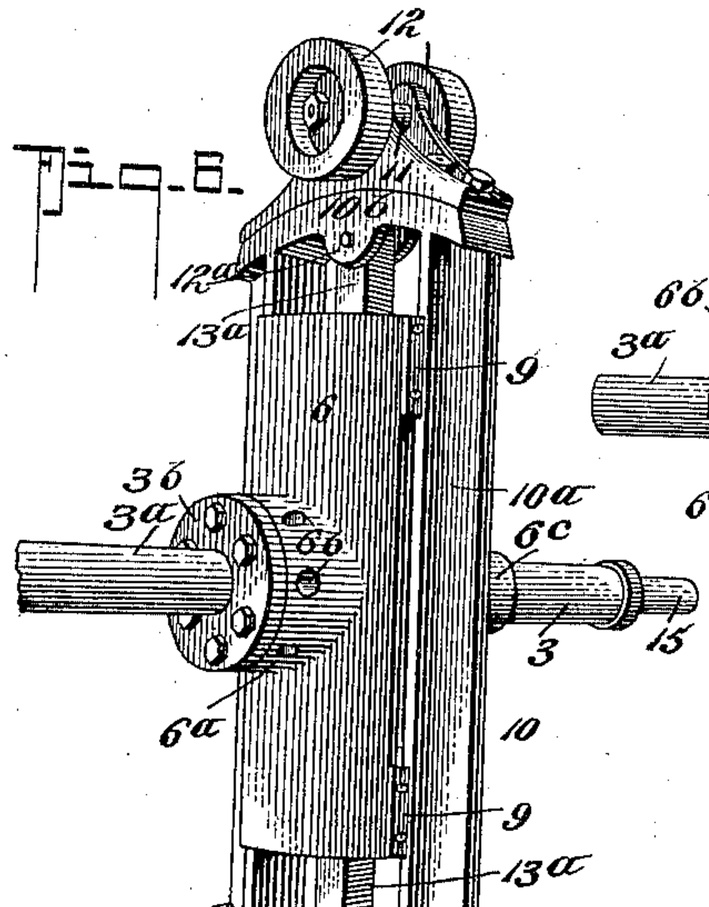


Fig. 7.

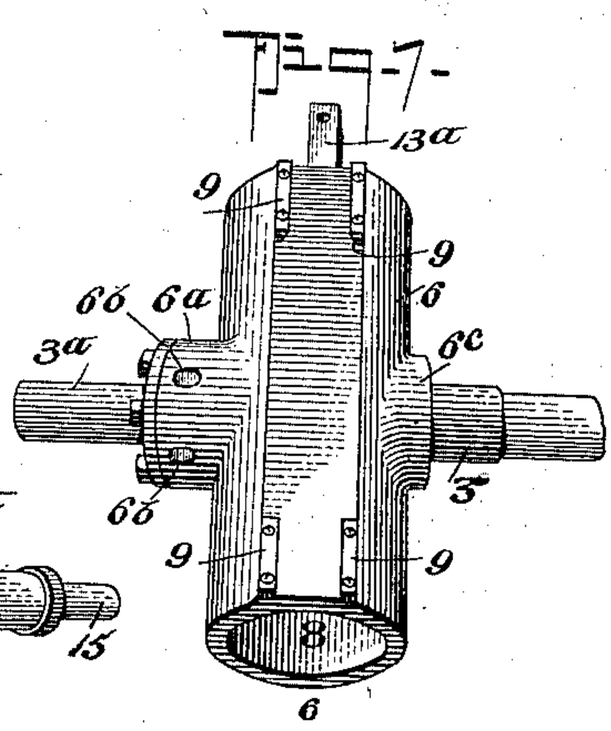


Fig. 5.

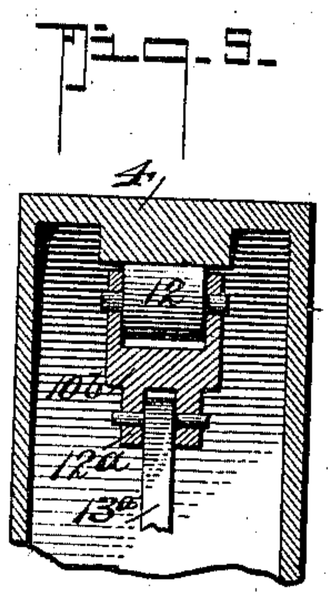
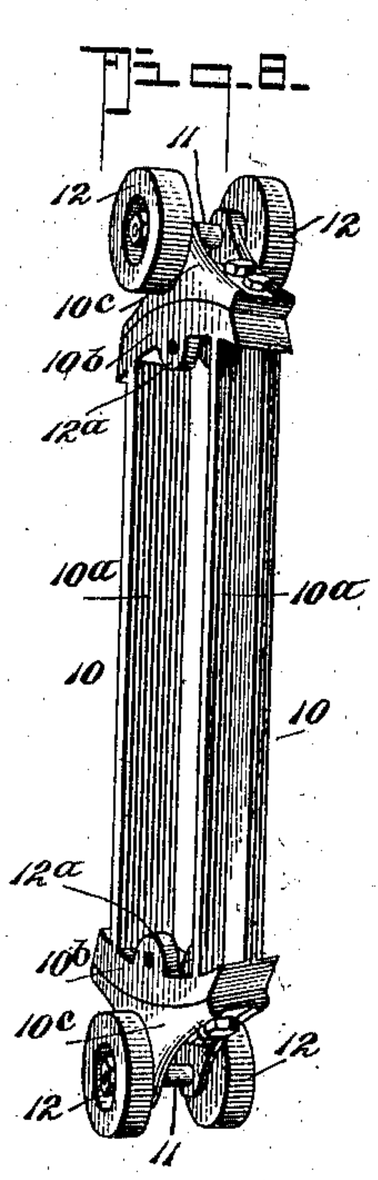


Fig. 8.



WITNESSES:

H. G. Dieterich

Louis Dieterich

INVENTOR

Wm. M. Farrow

BY

Fred G. Dieterich & Co.

ATTORNEYS

No. 641,199. Patented Jan. 9, 1900.

W. M. FARROW.

ROTARY ENGINE.

(Application filed Apr. 19, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

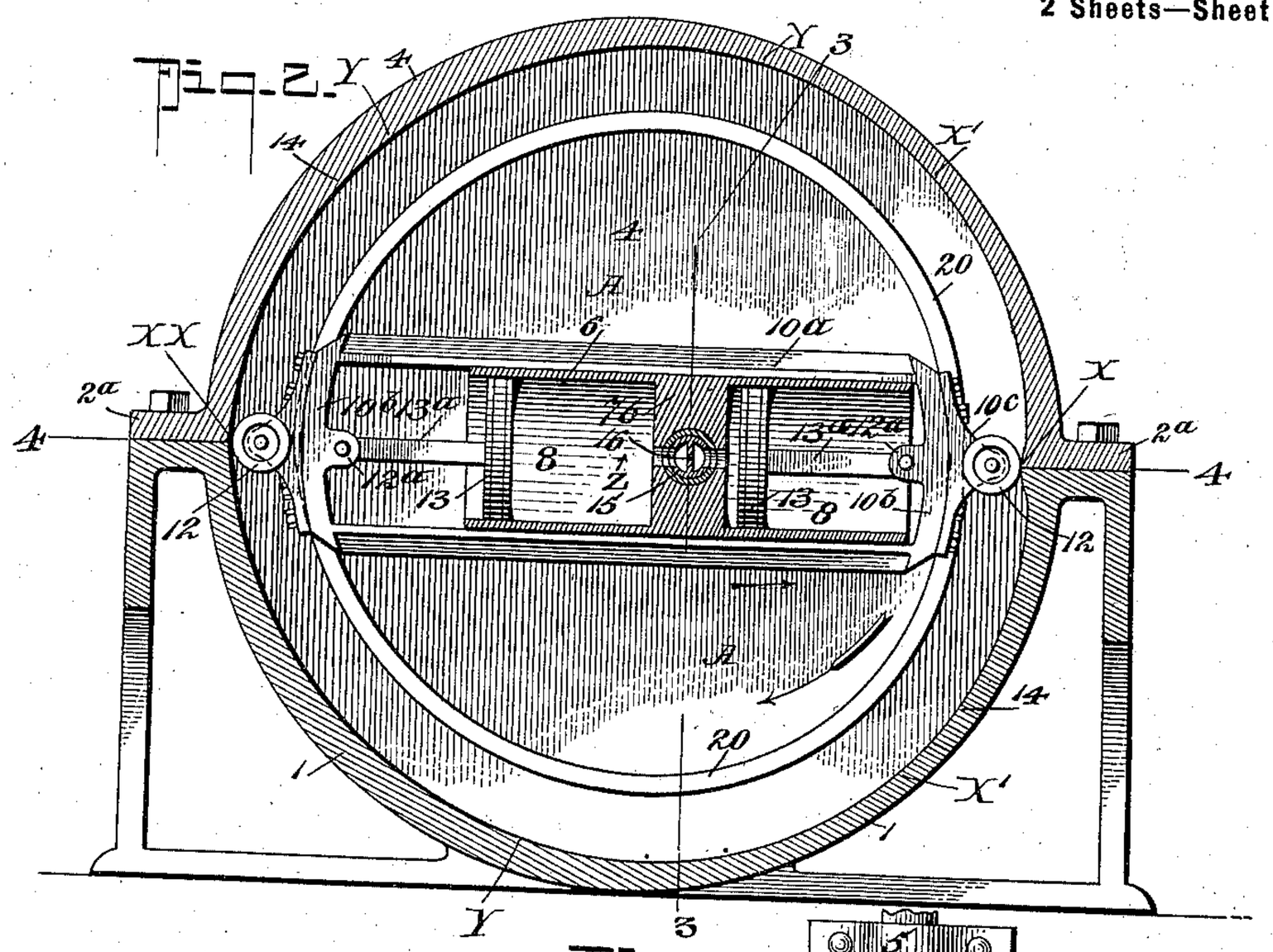


Fig. 3.

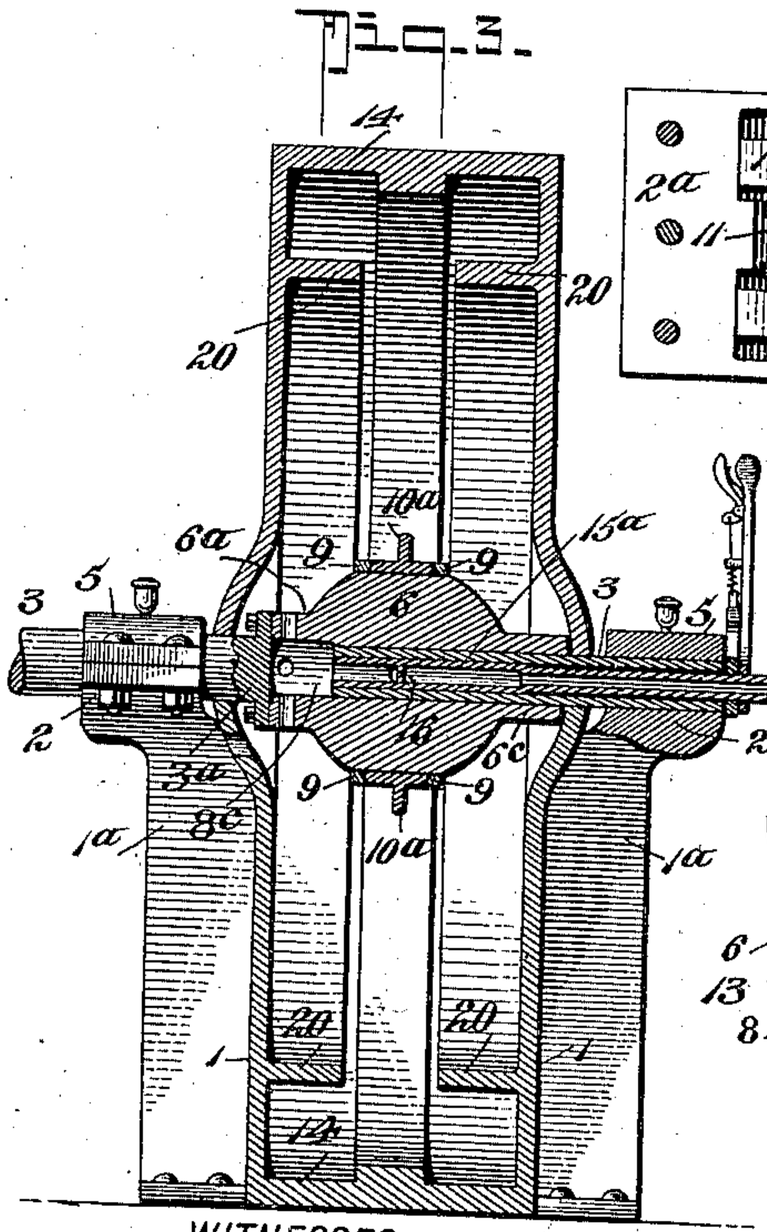


Fig. 4.

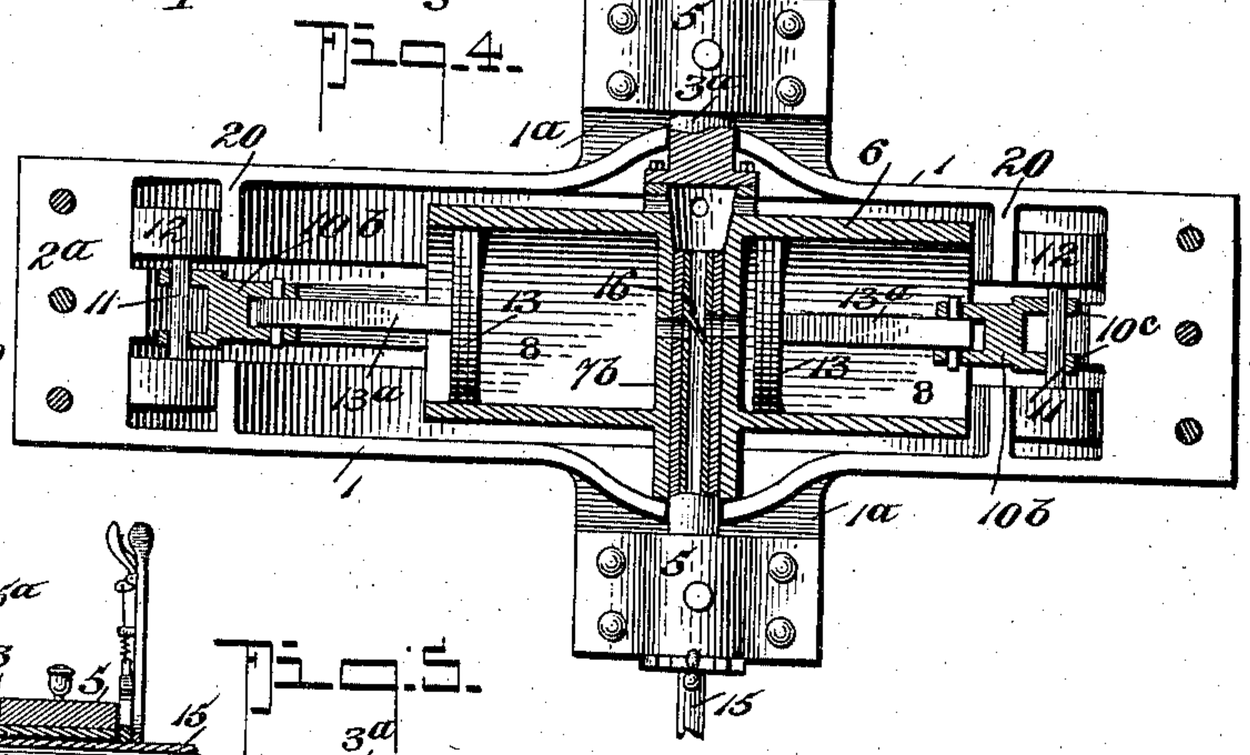


Fig. 5.

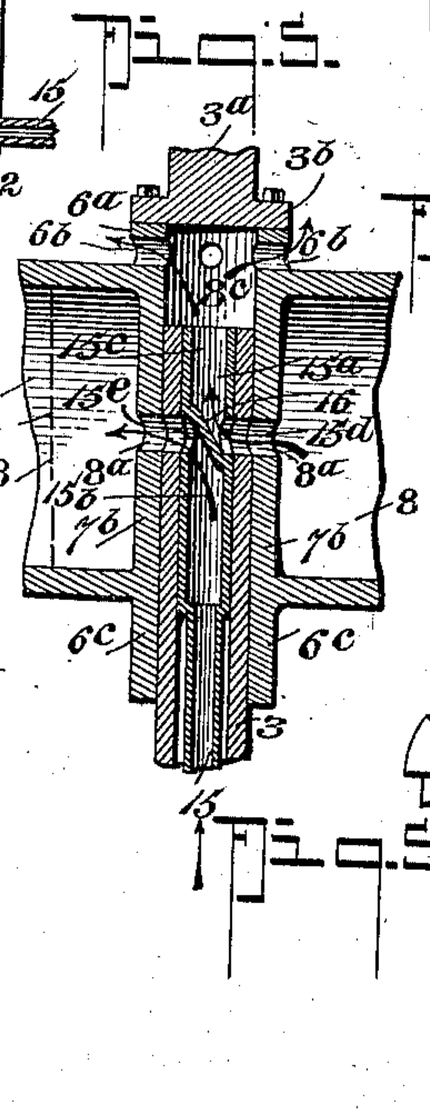


Fig. 5a.

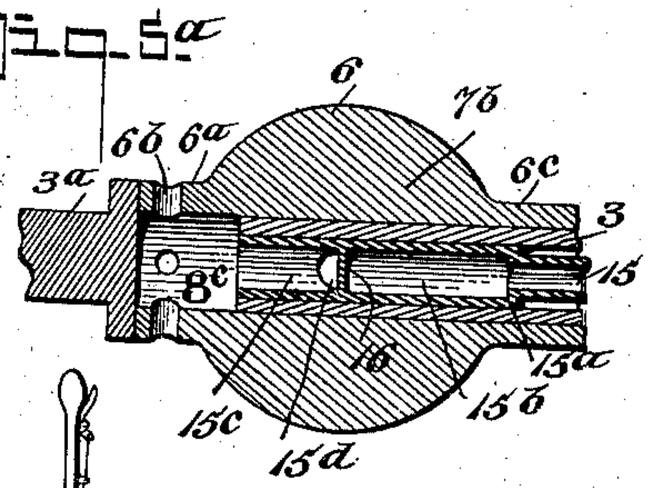
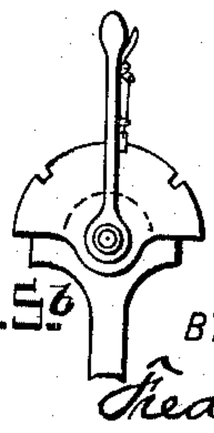


Fig. 5b.



WITNESSES:

H. G. Dieterich

Louis Dieterich

INVENTOR

Wm. M. Farrow

BY

Fred G. Dieterich & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

WILLARD M. FARROW, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR OF TWO-THIRDS TO A. FRED. JORSS AND L. C. BAILEY, OF SAME PLACE.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 641,199, dated January 9, 1900.

Application filed April 19, 1899. Serial No. 713,632. (No model.)

To all whom it may concern:

Be it known that I, WILLARD M. FARROW, residing at Washington, in the District of Columbia, have invented a new and Improved Rotary Engine, of which the following is a specification.

This invention relates to that type of rotary engines having a stationary valve and a plurality of cylinders projecting radially from the valve and made to revolve around it.

Primarily this invention has for its object to provide an engine of this kind embodying certain improvements whereby the same can be economically constructed and so effectively operate as to render it adaptable for all the ordinary driving purposes.

In its general construction my invention comprehends a straightway shaft rotatable about the stationary valve and eccentrically mounted within the casing, a pair of cylinders arranged tandem, rotatable with the shaft, and a piston in each of the cylinders moving radially outward by fluid-pressure and to their inward position by reason of their outer ends traversing the eccentric path of the internal chamber of the casing, the several parts being also so arranged that the piston will be forced forward both by direct and expansive fluid-pressure.

Another purpose of this invention lies in the providing a straightway shaft having a tubular portion forming an inlet; a cut-off valve held stationary within the tubular shaft, but capable of being set from the exterior of the shaft, whereby to reverse the direction of movement of the engine; a duplex cylinder concentrically mounted upon the shaft; a traversing frame reciprocally slidable on the duplex cylinder and having roller-bearings adapted to engage the eccentric fixedly-held abutment formed by the interior wall of the casing, and connections between the ends of the said frame and piston so arranged as to produce a continuous and uniform rotary action of the shaft with the least twist strain or jerky action so common in rotary engines.

Again, my invention seeks to provide, in an engine of this character, a traversing frame carrying abutting roller-bearings, in which the casing has its transverse plane or abutment-wall composed of two parallel annular ways provided with an internally-projecting guide and with which a duplex set of roller-bearings mounted on each end of the traversing frame is adapted to engage, whereby to hold the said frame from lateral strain during its rotary movement and the more positively to be held true in its bearings.

In its subordinate features the invention comprehends certain details of construction and combination of parts, such as will be first described in detail and then be specifically pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of my rotary engine. Fig. 2 is a vertical longitudinal section of the same. Fig. 3 is a transverse section thereof, taken on the line 3 3 of Fig. 2. Fig. 4 is a horizontal section taken practically on the line 4 4 of Fig. 2. Fig. 5 is a detail horizontal section illustrating the stationary valve and the tubular shaft-section operatively connected therewith. Fig. 5^a is a detail transverse section of the parts shown in Fig. 5. Fig. 5^b is a detail end view of the valve-shifting lever and detent device therefor. Fig. 6 is a perspective view of the traversing frame, with the duplex cylinder and the straightway shaft connected therewith. Fig. 7 is a detail view of the cylinder and the shaft detached from the traversing frame, and Fig. 8 is a detail perspective view of the traversing frame. Fig. 9 is a detail view of a modified form of my invention, hereinafter specifically referred to.

In its practical construction my invention embodies a casing consisting of a foundation-section 1, which may be of cast metal suitably framed, as shown in the drawings, or it may consist of a combined masonry and metal framing, as conditions may make most desirable. The foundation-section 1 forms the lower half of the engine-casing, and the said section has diametrically opposing projecting laterals 1^a 1^a, which form the saddles for the journal-bearings 2 for receiving the bearing-journals of the shaft 3.

4 indicates the upper or removable casing, which has a semicircular shape and has its transverse bearing portions 2^a formed with suitable flanges, whereby it can be conven-

iently and securely made fast to the base-section.

5 indicates the removable cap members for the journal-bearings, which have lubricating-cups, as shown.

In my construction of engine the drive-shaft 3 extends straightway through the casing eccentrically thereof, and such shaft is formed of two sections, one of which, 3^a, may be solid and terminates with a flanged inner end 3^b.

By referring now more particularly to Fig. 5, it will be noticed the flanged inner end of the shaft-section 3^a is securely bolted to the lateral hub 6^a of a tubular casing 6, which forms the engine-cylinder and which has a center division portion 7^b and end piston-chambers 8, each of which communicates by a port 8^a with the transverse tubular port 8^c of the cylinder, which is held to travel around the stationary valve presently referred to, and the said port 8^c communicates with a series of exhausts 6^b in the hub 6^a of the cylinder, as shown.

The cylinder 6 at the side diametrically opposite the hub 6^a has a lateral hub 6^c, to which the tubular shaft-section is made fast, as shown. The exterior surface of the cylinder at diametrically opposite sides has longitudinal dovetailed guides 9 to receive the side or straddle members 10^a 10^a of the traversing frame 10, the construction of which is best illustrated in Fig. 8, and the same comprises parallelly-arranged side members 10^a, the ends of which are joined by cross-heads 10^b, which terminate in outwardly-projecting bracket-ears 10^c, in each pair of which is held a transverse stub-shaft 11, and which shaft on its opposite ends has friction-rollers 12, which rollers are adapted to bear against and traverse the inner wall of the casing, as will presently more fully appear. Each cross-head 10^b has a pair of inwardly-projecting apertured ears 12^a, and to each pair of ears is connected a piston-rod 13^a, to each of which is integrally connected a piston-head 13.

The traversing frame 10 is carried upon the cylinder 6 and has a reciprocal movement thereon, which movement is utilized to impart the rotary motion to the cylinder and the shaft, such operation being positively and effectively accomplished by reason of the peculiar construction of the path or abutment way over which the roller ends of the frame 10 travel, such construction of the abutting path 14 being best illustrated in Fig. 2, by reference to which it will be seen that the dead-center line of the engine in the construction shown is at or near a horizontal plane and the orbit of such path 14 is of an elongated shape, one portion—that nearest the cylinder 6—being of a somewhat-greater circular sweep than the portion diametrically opposite, the purpose of which is best explained as follows:

In the practical construction of my engine the same is adapted to operate reversely; and for this purpose, assuming the point X to be the dead-line—that is, the line at which the piston is in to receive the fresh charge of live steam—the path dishes or convexes in reverse directions from the point X to the point Y, thereby increasing the distance from the imaginary central axis Z of the engine-casing from X to X′ and then gradually decreasing the distance to the point Y, which assumably is in line of the circle struck from the axis Z. From the points Y to the points XX the path 14 takes a convexed course, the degree of which is proportionate to the degree of concavity of the portion of the path from X to YY. It will thus be seen that the diameter of the internal chamber A, taken in any direction through the axis of the shaft and the cylinder, is alike, although the orbit-line over which the roller-bearings of the frame 10 pass constantly changes. The object in thus constructing the path or orbit over which the roller-bearings of the frame 10 pass, is to provide for a quick action of the pistons as they receive a live-steam impact. For example, should the cylinder be rotating in the direction indicated by the arrow and the valve be set to discharge live steam into the piston-chamber against the piston moved to its innermost position when the said piston reaches a plane at or below the horizontal line XX it is obvious that as the piston is thus forced out by reason of the gradually-increasing distance between the path 14 and the axis of the cylinder the tendency will be to cause the frame 10 to rotate in the direction of the arrow, the opposite end of the frame having a proper bearing against the path 14 by reason of it, during this movement, engaging with the convexed portion of the annular way 14.

In practice the valve mechanism is so arranged that the piston will be receiving live steam until it nearly reaches the extremity of its thrust, which in the construction shown occurs when the cylinder has made a quarter of a revolution, after which the live steam is cut off and the piston is held to its outermost position by steam expansion, and while it is thus held the rotary momentum of the cylinder will be increased by reason of the piston engaging with the gradually outwardly inclined portion of the upper dished section of the path 14, while the opposite end of the frame, which at this time is held tightly against the diametrically opposite convexed portion, is being pushed forward under live-steam pressure, it being understood that the slight resistance offered by the convexed portion over which one end of the frame passes is overcome by the momentum attained by reason of the opposite end of the frame being carried forward and its engaging with the outwardly-dished portions diametrically opposite the said convexed portion. It will be understood that the same results are attainable when the engine is driven in an opposite direction, which movement is accomplished by setting the valve, presently referred to,

to admit the live steam against the piston projecting radially toward the point X after the said piston has been moved to a point slightly above the horizontal axial line of the cylinder. It will be understood that the piston-chambers are arranged to exhaust at a suitable time previous to reaching the point where they are to receive a fresh live-steam impulse, it being also obvious that the centrifugal force of the engine will serve to hold the piston out during the time that they are exhausting.

The valve, which is held stationary, as before stated, comprises a tubular stem 15, adapted to be fitted into the hollow shaft-section and having its inner end 15^a slightly enlarged to fit steam-tight within the hollow core of the cylinder C, and the said end has a diaphragm 16, which divides the feedway into a live-steam portion 15^b and an exhaust-steam portion 15^c, the live-steam portion discharging through a port 15^e and the section 15^c communicating with the exhaust-port 15, and also communicating with the hollow core of the cylinder from the exhaust members through the several radial openings of the hub portion of the cylinder hereinbefore referred to. The ports 15^e and 15^d of the valve are elongated to a predetermined size, whereby the proper manipulation of the valve will provide for a quick or slow feed of steam into the piston-cylinders, such valve adjustment providing a simple and effective means for governing the speed of the engine. The stem of the valve projects through the end of the hollow shaft-section and in practice has a suitable lever-and-ratchet connection whereby to govern the set of the valve.

While it is not absolutely necessary for a proper operation of my invention, yet to hold the parts from undue vibration and provide a positive trackway for the working bearings of the end of the traversing frame to travel in I prefer to form annular guide-flanges 20, with which the inner faces of the rollers are adapted to engage, as clearly indicated in Figs. 3 and 4, said flanges, it being understood, following the contour of the path 14, against which the outer face of the said rollers engage.

From the foregoing description, taken in connection with the accompanying drawings, it is thought the advantages of my invention and the complete operation thereof will be readily understood. It will be observed the same is of a very few parts, which are relatively so combined as to render their manufacture easy and economical.

While I have shown the traversing frame provided with a double set of rolls at each end, as such arrangement provides for holding the cylinder from lateral strain and in consequence the shaft from being twisted or turned out of its true bearings by reason of the flange projecting inwardly between the rollers, whereby to divide the path 14 into two distinct members, it is obvious the end of the frame may be provided with but a single roller-bearing. (Indicated in Fig. 9.)

Assuming the parts to be in the position shown in Fig. 2 and the engine to be rotating in the direction indicated by the arrow, live steam being against the piston at the right, the said piston would tend to slide the frame 10 to the direction indicated by the arrow, and in consequence by reason of the dished path its roller at the right is made to engage and cause the said frame end, with the cylinder, to be rotated in the direction stated. When the piston has reached its outermost point, the live steam is cut off, assuming the valve to be so arranged, and the said piston is then held out to such position by steam expansion within the cylinder until it reaches a point at which it exhausts, after which it will be held out by centrifugal force until it is forced inward again by reason of the gradual inwardly-inclined plane of the path as it approaches the dead-center or horizontal plane.

It will be understood that the special detailed arrangement of parts shown in the drawings and hereinbefore described may be modified or varied without departing from the scope of the appended claims.

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

1. A rotary engine; comprising an annular trackway; a stationary valve disposed eccentrically of the trackway, said valve having inlet and exhaust ports; a duplex cylinder rotatably mounted upon the valve; a carriage longitudinally slidable upon the cylinder, said carriage having its ends engaging the annular trackway, said trackway having a pair of alternately-disposed and diametrically opposite eccentric orbits; the pistons and connections joining the pistons and the sliding carriage, all being arranged substantially as shown and described.

2. A rotary engine; comprising, in combination; a straightway shaft having a tubular portion provided with diametrically opposite ports; a stationary cut-off valve mounted within the tubular shaft; a double-ended cylinder mounted upon the shaft to rotate therewith, and having ports adapted to register with the shaft-ports; a piston operating in each end of the cylinder; a carriage rotatable with and reciprocally slidable on the cylinder; a trackway eccentric of the axis of the cylinder, said trackway having abutments or inclines for imparting a reciprocating action to the carriage as it rotates, substantially as described.

3. In a rotary engine; the combination with a straightway shaft; a stationary valve upon which the shaft rotates, said shaft having inlet and cut-off ports adapted to alternately aline the valve-ports; a tandem cylinder rotatable with the shaft; a carriage rotatable with the cylinder and a trackway within which the carrier rotates, said trackway having abutments for imparting a reciprocal

movement to the carrier and thereby rotate the cylinder, as set forth.

4. In combination; a closed casing having an annular internal trackway formed with a plurality of paths arranged eccentrically of the axis of the casing or track; a stationary valve eccentric with the track-paths; a duplex set of cylinders projecting radially through the valve and rotatable thereon; a piston within each cylinder; a carrier-frame rotatable with the cylinders and longitudinally slidable thereon, said carrier having bearings at its opposite ends engaging the annular trackway; the link connections joining the carrier and the pistons, all being arranged substantially as shown and for the purposes described.

5. The combination with the casing, said casing having an internal trackway formed with a plurality of eccentric abutment-surfaces; a straightway shaft passed eccentrically through the casing and having a tubular portion provided with oppositely-arranged ports; a valve movable within the tubular shaft-section; a cylinder rotatable on the shaft having a piston-chamber projected radially from opposite sides of the shaft, said chamber communicating with the hollow shaft inlet and exhausts; a piston working in each chamber; a yoke-frame held to rotate with and slidable longitudinally upon the cylinder, and link connections joining the pistons with the carriage, all being arranged substantially as shown and described.

6. The combination with the casing and the eccentrically-held straightway shaft, said shaft having a tubular section, the casing having an annular trackway formed with a plurality of eccentric portions, and the annular rims 20, running parallel with the trackway of the casing, said trackway being formed of two distinct portions; a feed and valve adjustably held within the tubular shaft, said valve having inlet and exhaust ports communicating through the shaft; a cylinder mounted upon the shaft to turn therewith, said cylinder having a radially-projecting piston-chamber at each side of the shaft and communicating therewith; the carriage 10, longitudinally slidable upon the cylinder and rotatable therewith, said cylinder having exhaust-ports communicating with the exhausts of the valve; the carriage having a pair of roller-bearings 12, at each end adapted to engage the trackway of the casing and the guide-tracks 20, and means for shifting the valve, all being arranged substantially as shown and for the purposes described.

WILLARD M. FARROW.

Witnesses:
FRED G. DIETERICH,
A. E. DIETERICH.