No. 785,077.

PATENTED MAR. 21, 1905.

L. BERGMAN.

ROTARY ENGINE.

APPLICATION FILED MAY 14, 1904.

2 SHEETS—SHEET 1

Fig. 2.

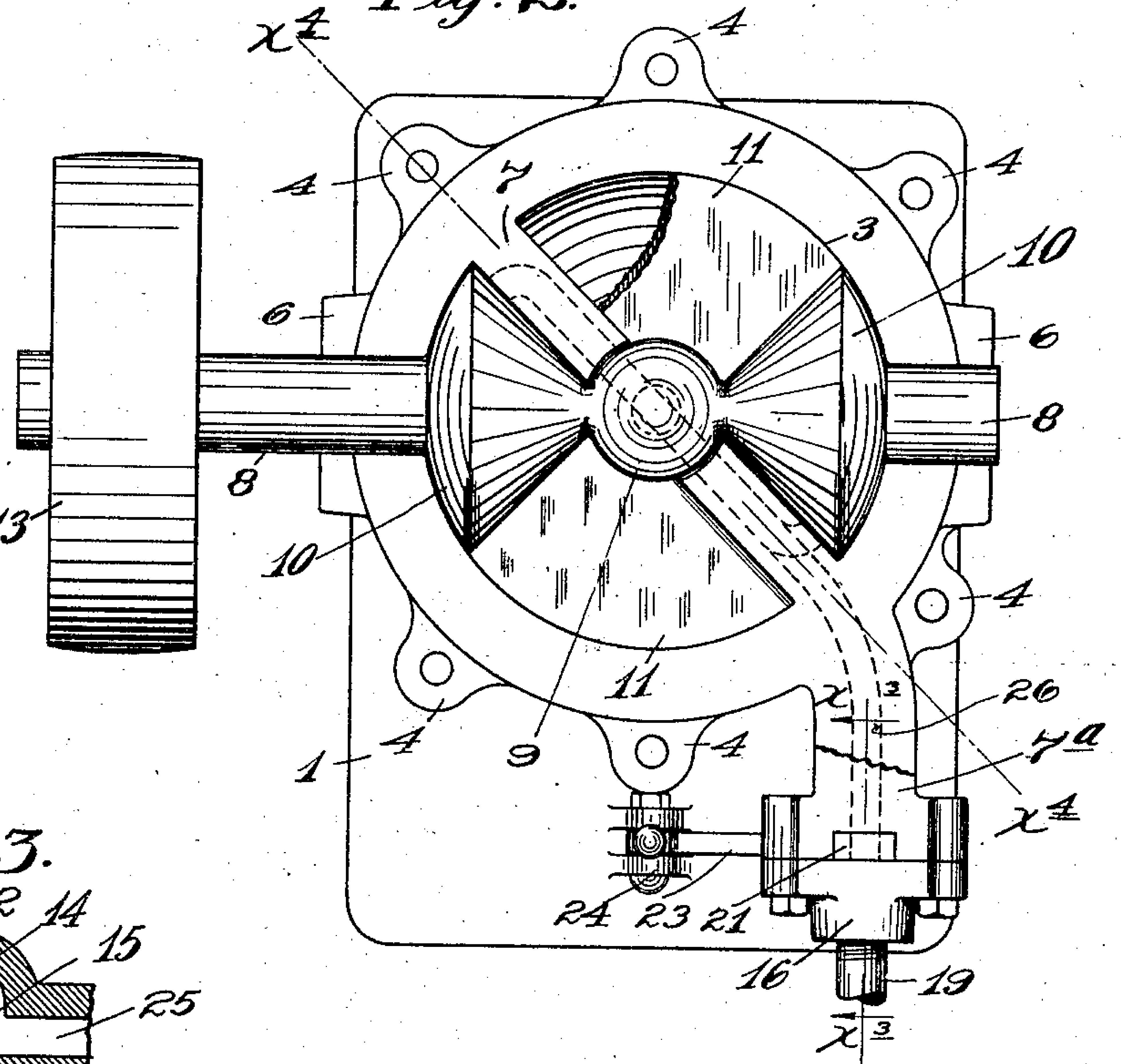


Fig. 3.

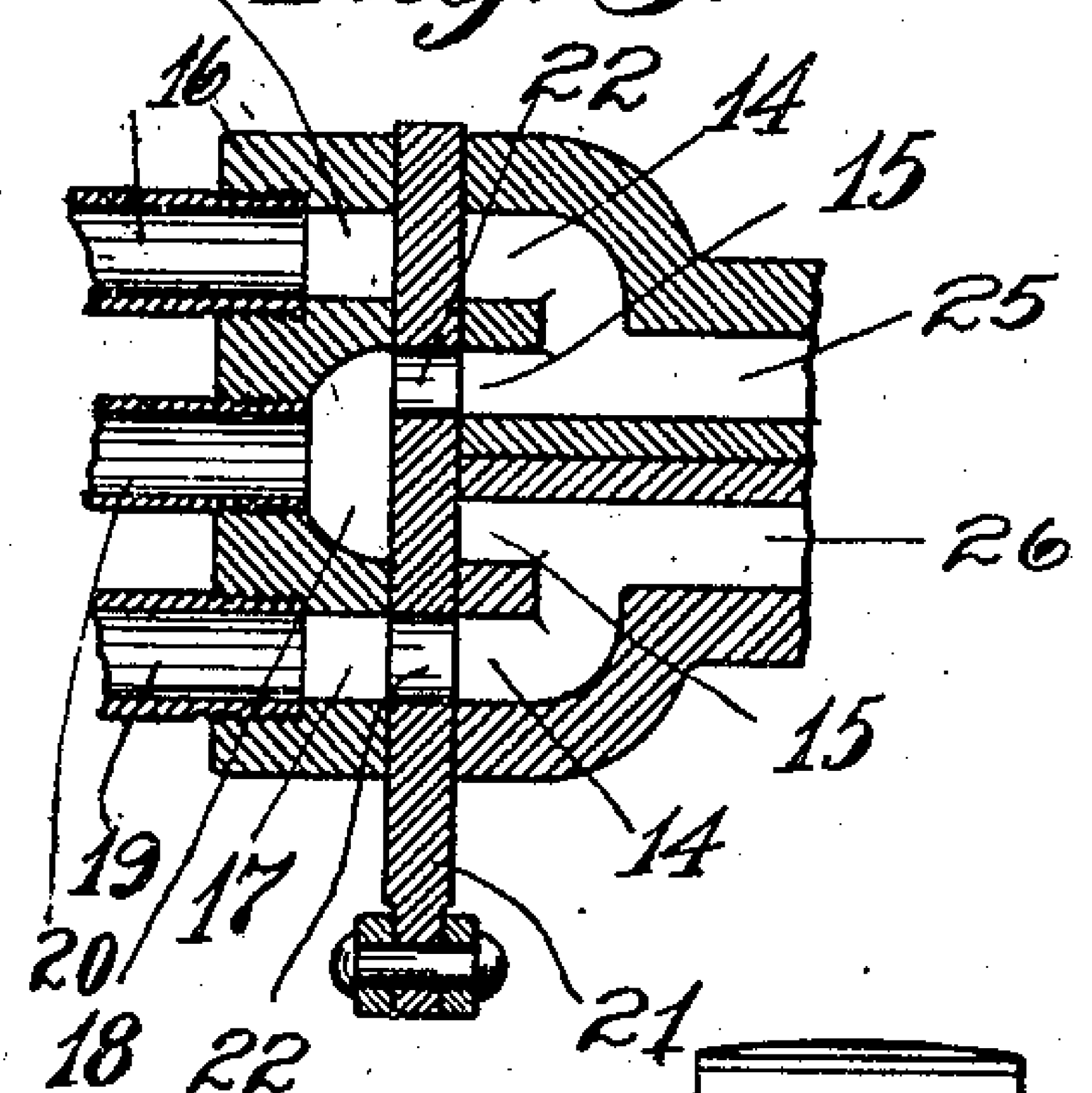
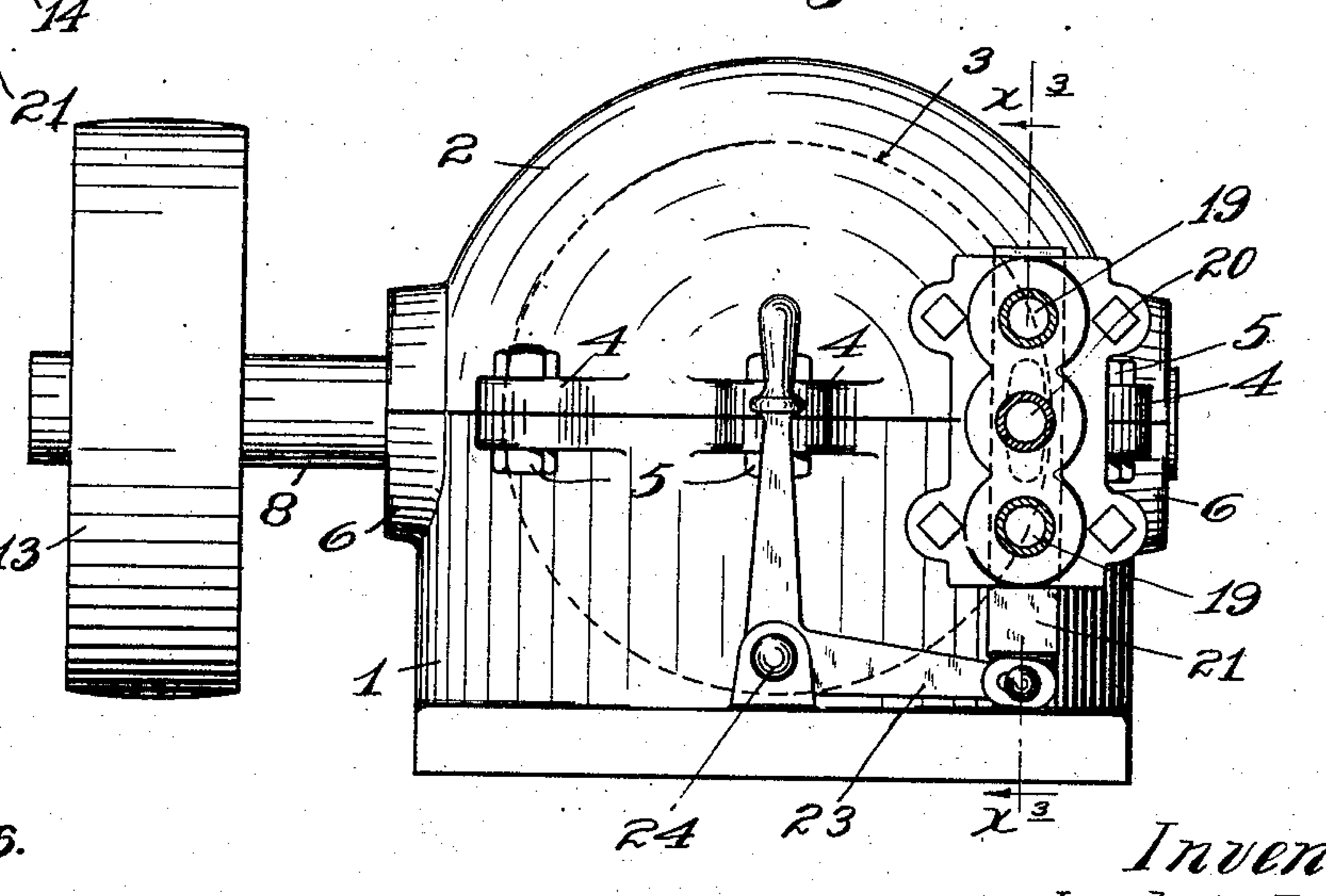


Fig. 1.



Witnesses.

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2 SHEETS—SHEET 2.

Fig. 4.

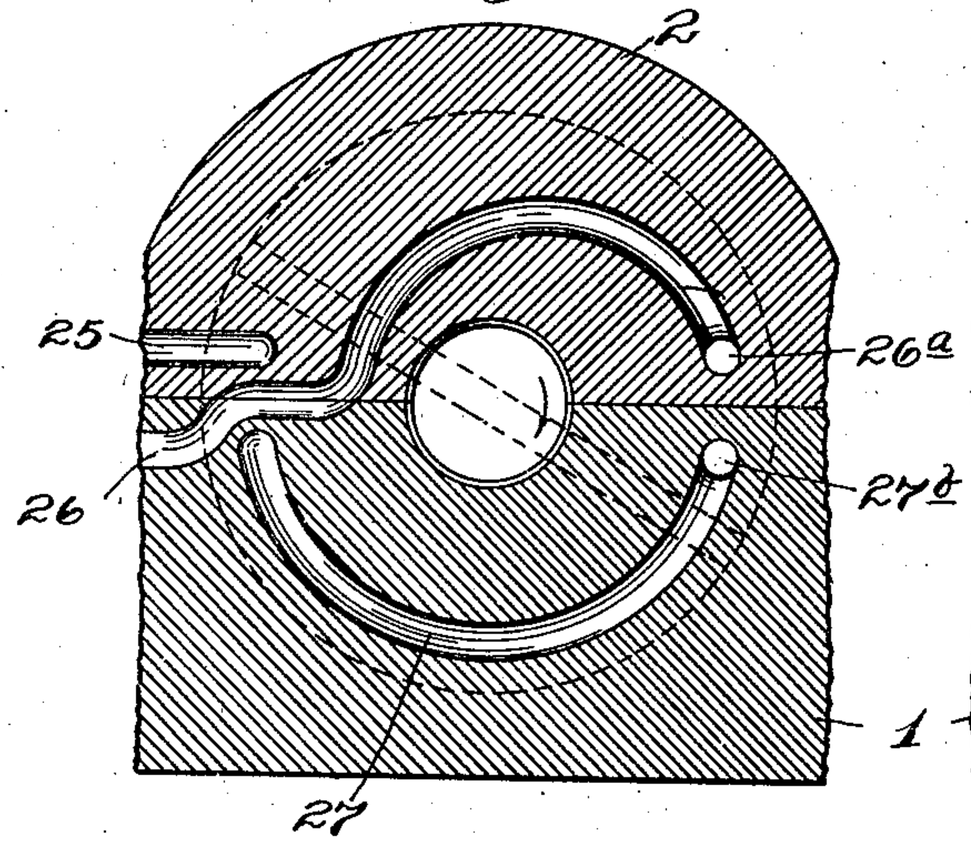


Fig. 6

Fig. 4a

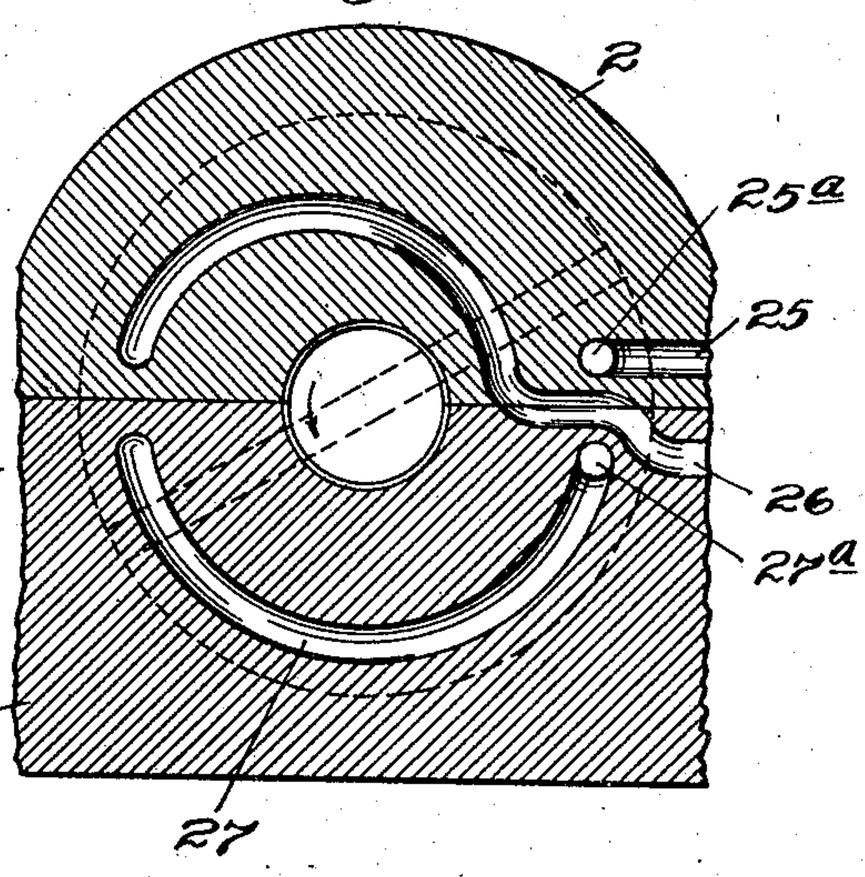


Fig. 5

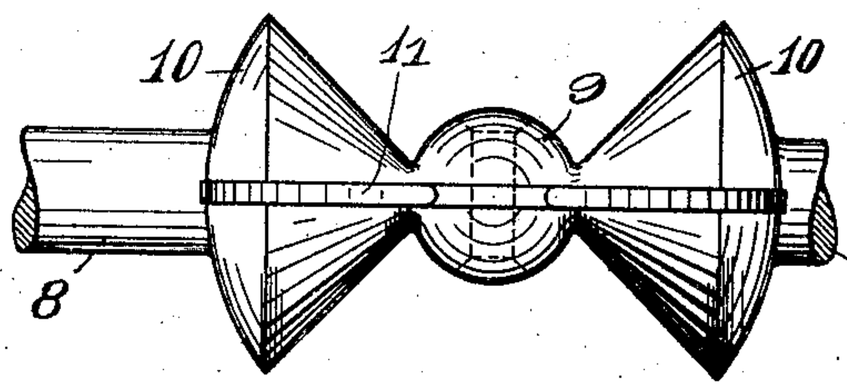
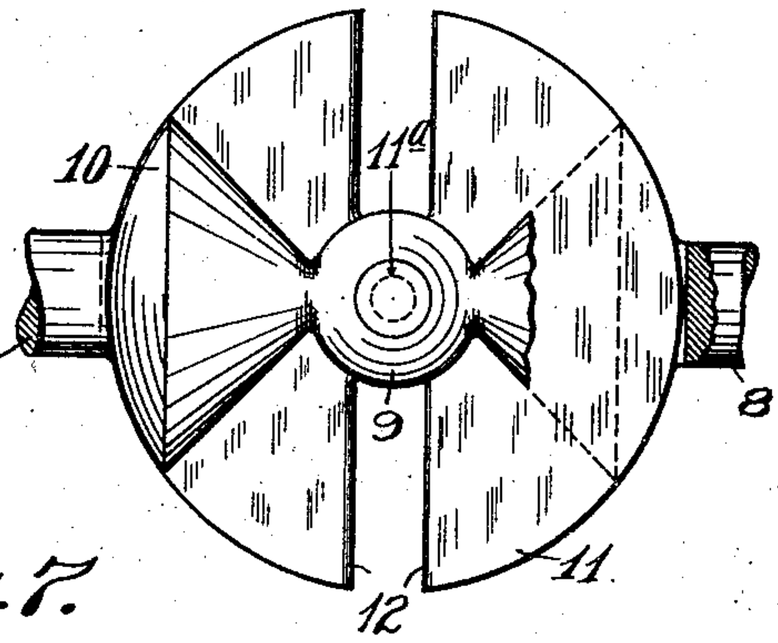
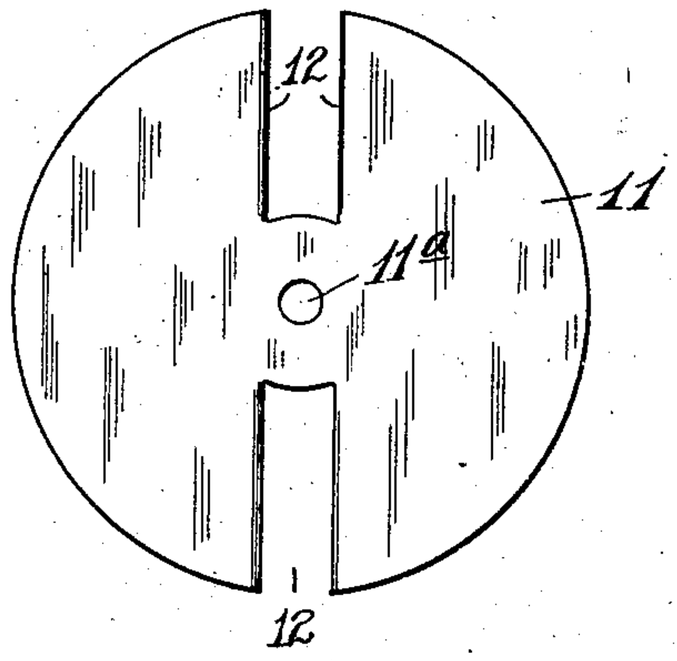


Fig. 7.





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UNITED STATES PATENT OFFICE.

LUDWIG BERGMAN, OF CASS LAKE, MINNESOTA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 785,077, dated March 21, 1905.

Application filed May 14, 1904. Serial No. 207,894.

To all whom it may concern:

Be it known that I, LUDWIG BERGMAN, a citizen of the United States, residing at Cass Lake, in the county of Cass and State of Minnesota, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to rotary engines, and has for its object to improve the same in the several particulars hereinafter noted.

The invention consists of the novel devices and combinations of devices hereinafter described, and defined in the claim.

In the accompanying drawings, which illustrate my invention, like characters indicate like parts throughout the several views.

Figure 1 is a side elevation showing the complete engine. Fig. 2 is a plan view of the engine with the upper portion of the piston-seat casting removed from working position and some parts being broken away. Fig. 3 is a detail in vertical section on the line x^3 x^3 of Fig. 1. Figs. 4 and 4^a are vertical sections taken on the line x^4 x^4 of Fig. 2, the section parts being turned one toward the left, the other toward the right. Fig. 5 is a detail showing in plan view the rotary piston and its propelling-blade, some parts being broken away. Fig. 6 is a side elevation of the parts shown in Fig. 5, and Fig. 7 is a plan view showing the propelling-blade removed from working position.

The numeral 1 indicates the base, and the numeral 2 the top, of a divided piston-seat casting, which members are formed with supplemental sections of a spherical piston-seat 3. The said members 1 and 2 are joined in a horizontal plane which intersects the center of the piston-seat 3, and the said sections are provided with projecting lugs 4, through which short nutted bolts 5 are passed to rigidly but detachably connect the said two members. Members 1 and 2 are provided with supplemental bearing-hubs 6, which are axially alined in a horizontal plane at diametrically opposite points.

The piston-seat 3 is divided in two compartments or piston-seats proper by a vertical dividing web or partition 7, formed in part on the member 1 and in part on the member 2.

A horizontally-disposed shaft 8 extends to supplemental piston-seats and is journaled in the bearing-hub 6. This shaft 8 is provided with a spherical intermediate section 9, which closely engages the seat formed in the oblique partition 7, and on the opposite sides of said partition it is formed with conical piston-heads 10. The outer extremities of these piston-heads 10 closely fit the spherical walls of the supplemental piston-seats 3, and the conical surfaces of these piston-heads engage tangentially one with each side of the oblique partition 7, so that the said partition is caused to serve as an abutment, as will presently more fully appear. The two piston-heads 10 and the intermediate connecting-ball 9 are slit, and working through this slit is an approximately circular or disk-like propelling-blade 11, pivoted at 11^a. The periphery of this propelling-blade 11 fits the spherical surface of the divided piston-seat 3, and it is formed with long diametrically extended notches 12. The disk 11 is divided into a pair of supplemental propelling-blades which work one in each of the supplemental piston-seats. As shown, the piston-shaft 8 is provided with a pulley 13, from which motion may be transmitted through a belt. (Not shown.)

The oblique partition or abutment 7 at one extremity projects beyond the casting 1 2 and is formed with two exhaust-ports 14 and two admission-ports 15. To the outer extremity 7^a of the partition 7 is bolted or otherwise secured a block 16, which is formed with exhaust-ports 17, with an admission-cavity 18. Exhaust-pipes 19 lead from the ports 17 to suitable points of exhaust. A steam-supply pipe 20 leads from a source of steam-supply to the cavity 18. A reciprocating admission-valve 21 works between the working seat formed between the abutting surfaces of the block 16 and of the abutment extension 7^a. This valve is formed by a pair of ports 22, which are so spaced that one

thereof will register with one pair of alined exhaust-ports 14 17 when the other registers with one of the admission-ports 15 and the cavity 18, as shown in Fig. 3. As shown, the valve 21 is adapted to be moved into different positions by a bell-crank lever 23, which, as shown, is pivoted to a lug 24 on the base-casting 1.

The upper ports 14 and 15 lead to a port 25, while the lower ports 14 15 lead to a port 26, which ports 25 26 are formed entirely within the oblique abutment 7. The port 25 opens into the right-hand piston-seat above the horizontal plane of its axis at 25^a and as best shown in Fig. 4^a. The port 26 opens into the left-hand piston-seat at 26^a, which port-opening 26^a is located at a point nearly diametrically opposite to the port-opening 25^a, but above the horizontal plane of the axis of the piston-seat. (See particularly Fig. 4.) An intermediate port-opening 27 runs through the lower portion of the oblique abutment 7 and opens at one end at 27^a into the right-hand piston-seat below the port-opening 25^a. At its other extremity said port 27 opens into the left-hand piston-seat below the port-opening 26^a, as indicated at 27^b in Fig. 4.

The engine illustrated is a reversible compound engine; but it may be constructed as a simple single engine.

Operation: In view of the obliquity of the abutment 7 with respect to the axis of the piston 10 it of course follows that under rotation of the pistons the supplemental propelling-blades 11 will be oscillated back and forth through the pistons. It also follows that when live steam is admitted, by the adjustment of the valve 21 as shown in Fig. 3, through the port 25 and into the right-hand piston-seat slightly above the line of tangential contact between the right-hand piston 10 and the abutment 7 the pistons will be rotated in the direction indicated by the arrows in Figs. 2, 4, and 4^a. When the valve 21 is adjusted as shown in Fig. 3, the passage of the steam after it has entered the right-hand piston-seat, as above described, is as follows: The steam acts upon the left-hand impelling-blade 11 until the pistons have made nearly one complete rotation and the impelling-blade has passed the port-opening 27^a, whereupon the steam passes through said port-opening 27^a into the port 27 and is caused to travel backward nearly but not quite the distance of a half-rotation and then enters the left-hand piston-seat through the port 27^b, which port is located below the horizontal plane of the axis of the piston. The steam then acts on the left-hand impelling-blade 11 during nearly the complete rotation of the pistons until after the said impelling-blade has passed the port-opening 26^a, whereupon the steam is exhausted out through the port 26, lower valve-port 22, lower exhaust-ports 14 22, and lower exhaust-pipe 19. To reverse the engine, it is only necessary to move the valve 21 downward, so as to open up the port 26 to live steam and the port 25 to exhaust, thereby causing the steam to travel a course just reversed from that previously traced.

From what has been said it will be understood that the engine described is capable of many modifications within the scope of my invention as herein set forth and claimed. The device described as a "rotary engine" is, nevertheless, capable of use as a rotary pump when the pistons thereof are positively driven by force applied to their shaft exterior of the engine.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

In a rotary engine, the combination with a base member 1 and top member 2, formed with an approximately spherical piston-seat 3, divided into compartments by an oblique abutment 7, of the conical rotary pistons 10 connected by a spherical head 9 and having shaft extensions 8 journaled in said members 1 and 2, said pistons having tangential contact with said abutment 7 and said head 9 fitting a seat in said abutment, the disk-like impelling-blade 11 working diametrically through said pistons 10 and head 9, and notched at 12 to embrace said abutment 7, and suitable admission and exhaust ports leading to and from the piston-seat compartments, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

LUDWIG BERGMAN.

Witnesses:
FRED W. SMITH,
H. SELBERG.