No. 826,670. PATENTED JULY 24, 1906.

R. KLANN.

ROTARY ENGINE.

APPLICATION FILED APR. 4, 1906.

3 SHEETS—SHEET 1.

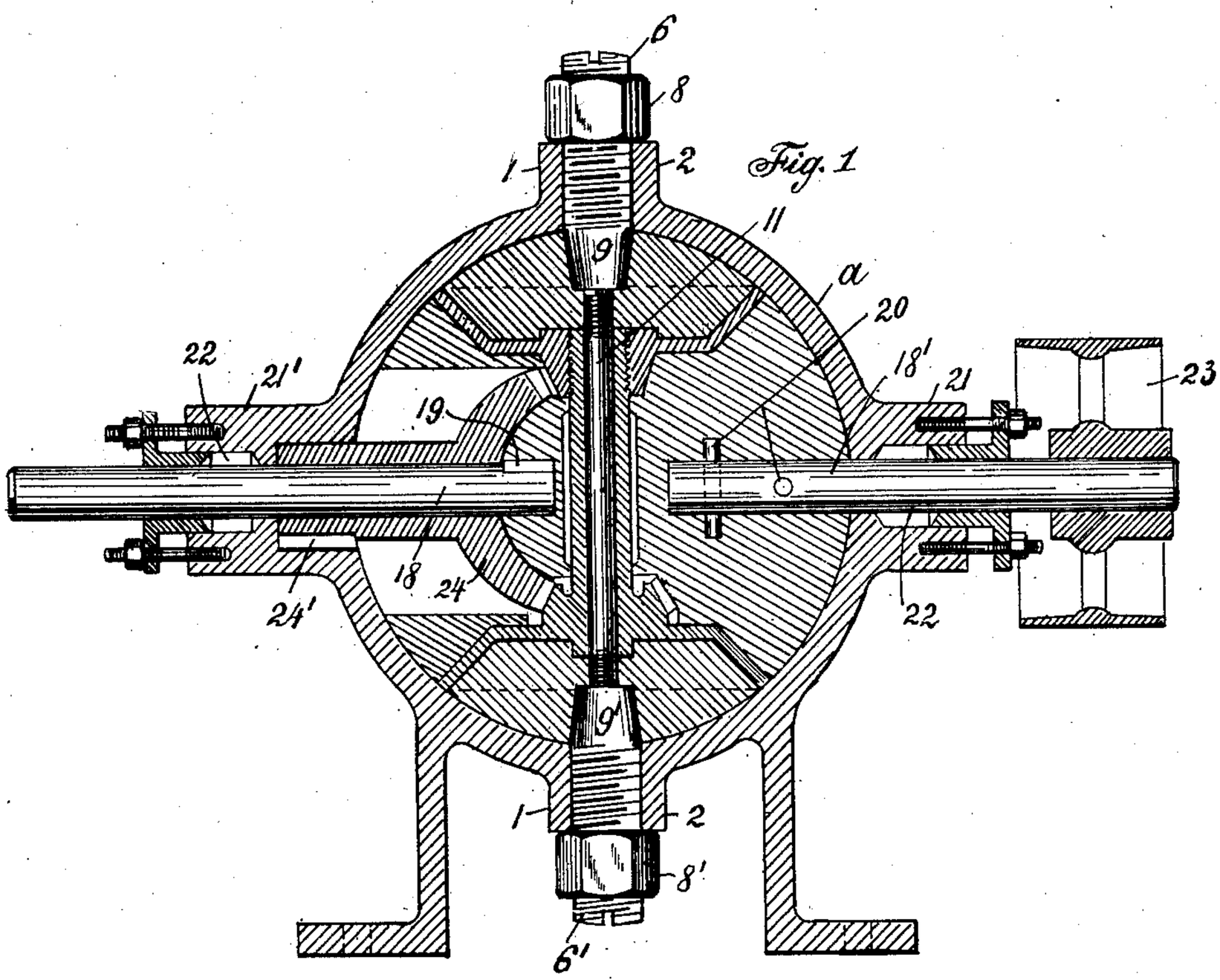


Fig. 1

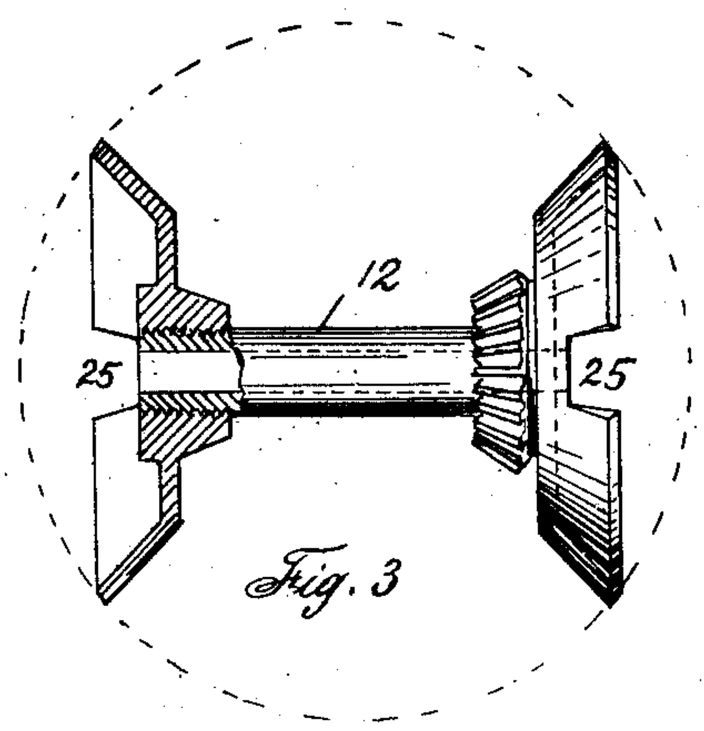


Fig. 3

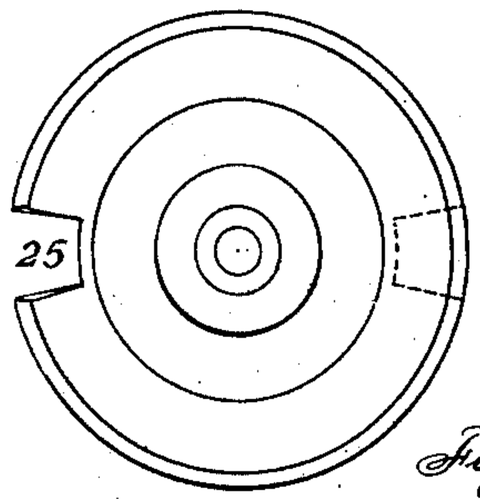


Fig. 4

WITNESSES

Otto Knuz

J. C. Goosmann

INVENTOR

Rudolph Klann

By Robt. Klotz

Atty.

No. 826,670. PATENTED JULY 24, 1906.

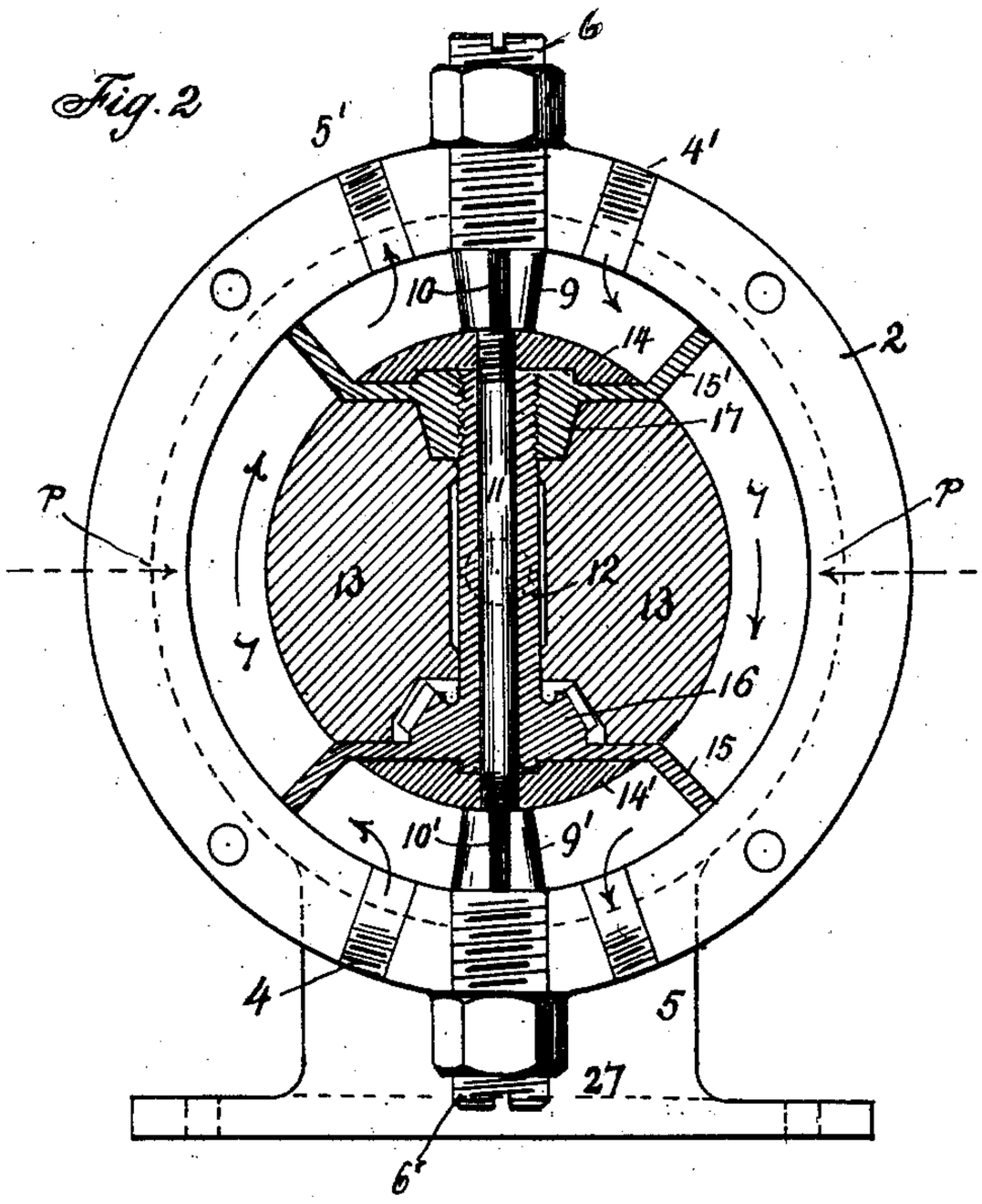
R. KLANN.

ROTARY ENGINE.

APPLICATION FILED APR. 4, 1906.

3 SHEETS—SHEET 2.

Fig. 2



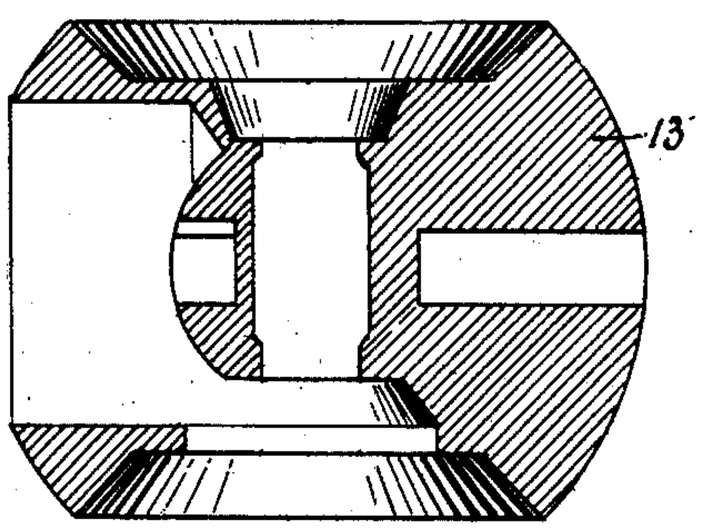


Fig. 5

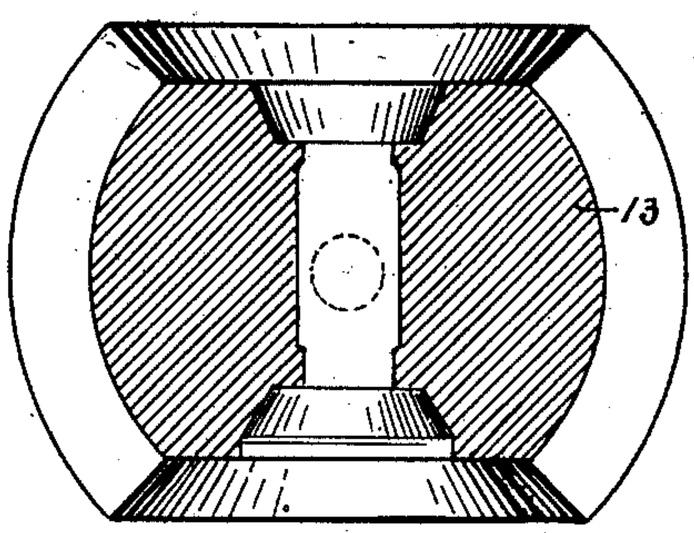


Fig. 6

WITNESSES

Otto Kurz

J. L. Goosmann

INVENTOR

Rudolph Klann

By Robt. Klotz

Atty.

No. 826,670. PATENTED JULY 24, 1906.

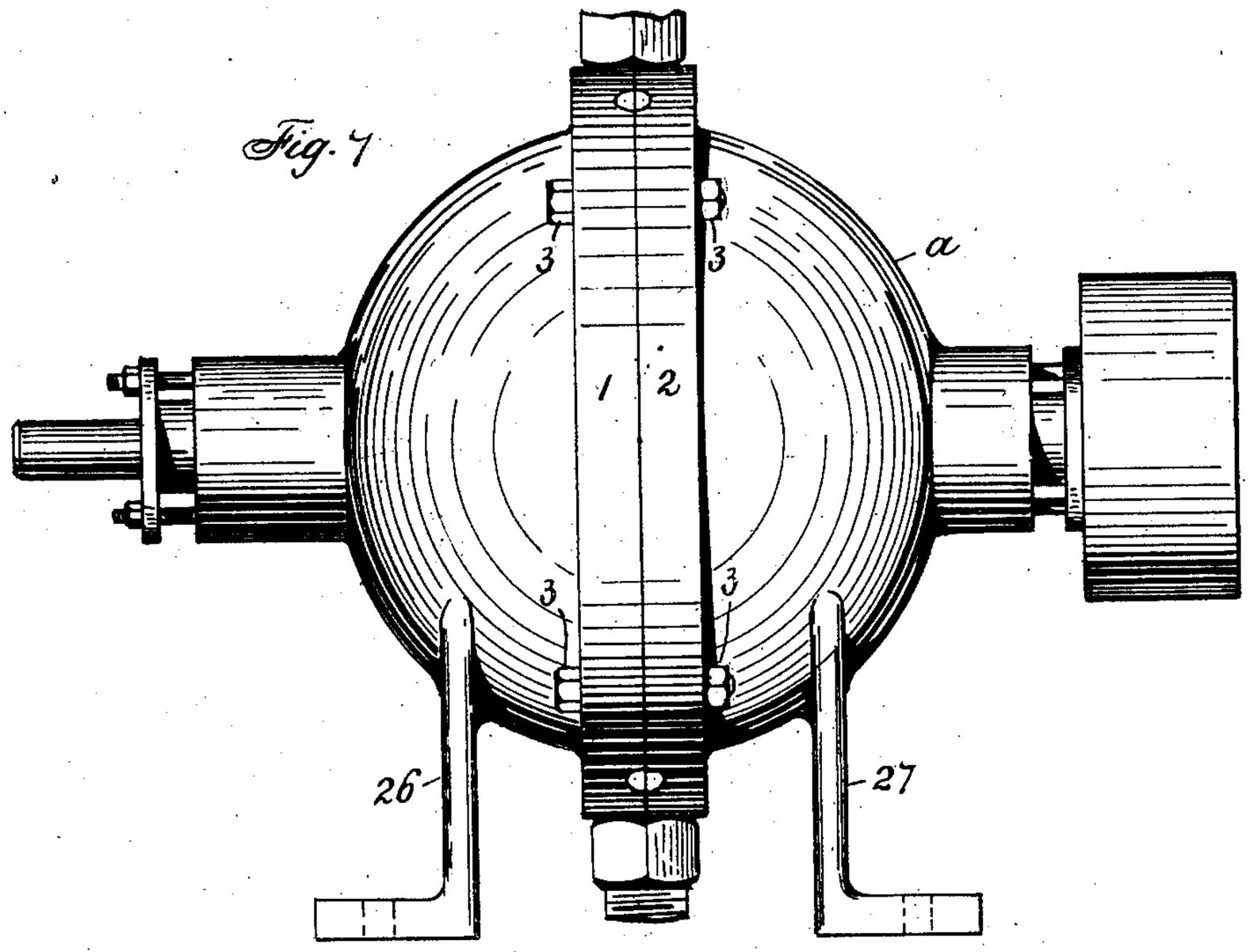
R. KLANN.

ROTARY ENGINE.

APPLICATION FILED APR. 4, 1906.

3 SHEETS—SHEET 3.

Fig. 7



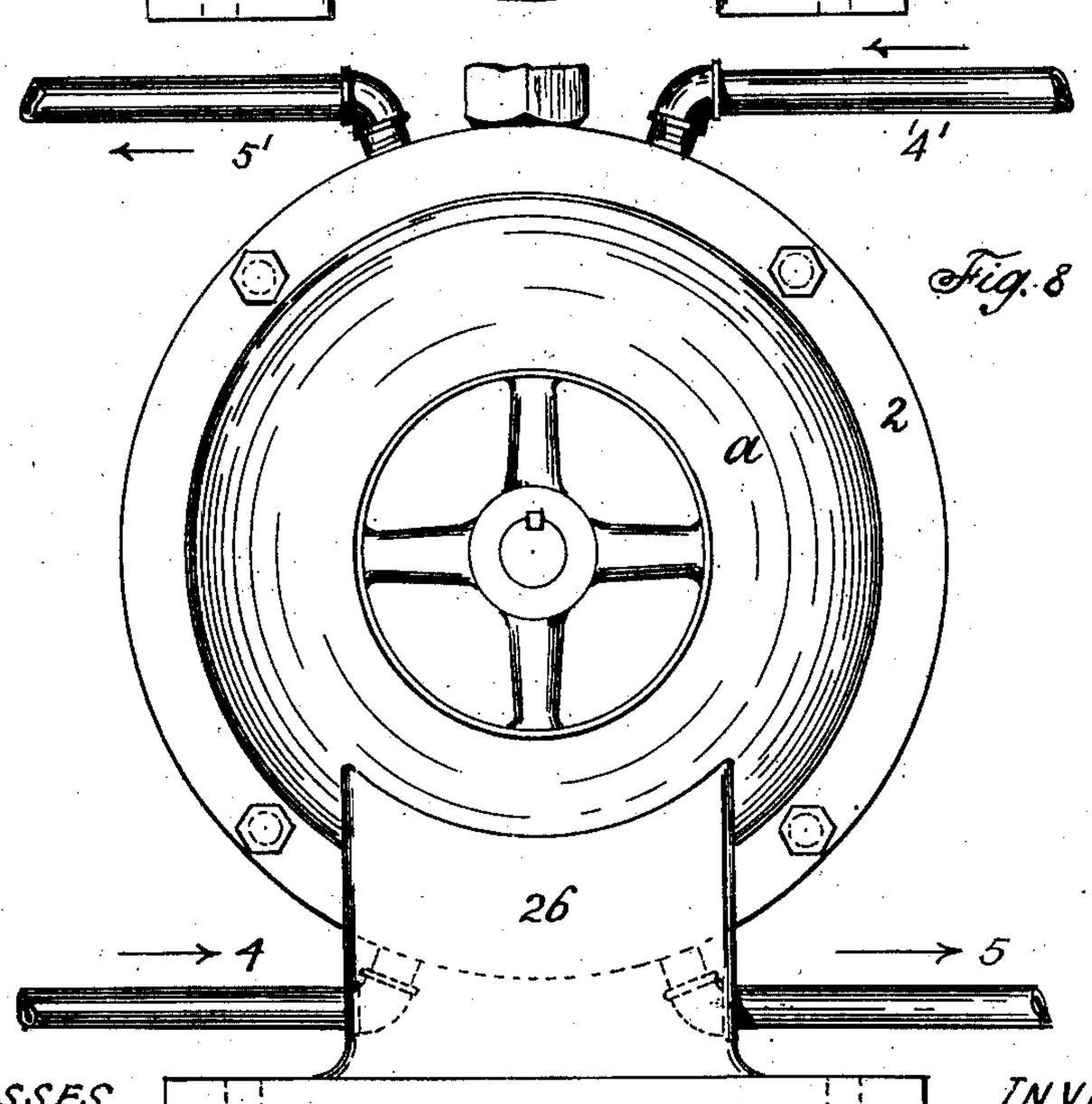


Fig. 8

WITNESSES

Otto Stenz

J. C. Goosmann

INVENTOR

Rudolph Klann

By Robt. Klotz

Atty

UNITED STATES PATENT OFFICE.

RUDOLPH KLANN, OF CHICAGO, ILLINOIS.

ROTARY ENGINE.

No. 826,670. Specification of Letters Patent. Patented July 24, 1906.

Application filed April 4, 1906. Serial No. 309,775.

To all whom it may concern:

Be it known that I, RUDOLPH KLANN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare that the following is 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 particularly to that class of rotary engines which are operated by the impact of the steam upon piston-blades forming intersections between the admission and exhaust port, thereby dividing the intervening space into several chambers. Owing to the fact that the power is obtained by the impact of fluid-pressure, such as steam or compressed gas, upon one or more piston blades or vanes, this engine resembles a turbine in the above particular. On the other hand, it contains all the elements of a rotary engine.

The novel features of it consists principally in the fact that peripheral piston-vanes have been omitted.

Instead of resorting to the above construction I have adopted a piston-spool contrivance which divides the steam-space between admission and exhaust ports into several chambers without creating undue pressure or friction upon the inner surface of the cylinder-shell. In so doing the contrivance receives the full benefit of the steam impact, and owing to the fact that the piston-vanes are firmly journaled in the center of the revolving part undue pressure against the inner surface of the cylinder-shell is avoided.

Another very important point of superiority in my invention is in the fact that the impact and the expansion of the steam cannot act retroversally against the direction of the rotary movement, for the reason that only one of the surfaces dividing the active steam-chamber is movable, while the other is rigidly connected with the stationary shell.

My invention further consists in the novel construction and combinations of parts hereinafter described, and illustrated in the accompanying drawings, in which—

Figure 1 is a complete sectional longitudinal elevation through the machine, showing the revolving part with the shafts therein, as well as the journals and stuffing-boxes. Fig. 2 is a cross-sectional elevation showing the complete steam-space and the method of dividing it. Fig. 3 is a horizontal view of the piston-spool, partly in section. Fig. 4 is a plan view of the same piston-spool, showing the relative position of the passage-notches. Fig. 5 is a sectional longitudinal elevation through the revolving body. Fig. 6 is the sectional cross-elevation through the same body; and Figs. 7 and 8 represent, respectively, the exterior front and side view.

The shell *a* is made in two halves, being provided with flanges 1 and 2, as shown in Fig. 7, which are flanged together by means of bolts 3. There are two steam-admission and two exhaust pipes, one of each for each half of the machine, Fig. 8.

The steam-admission pipes are designated 4 and 4′ and the exhaust-pipes 5 and 5′.

Referring to Fig. 1, *a* again shows the shell of the machine. 1 and 2 are the respective flanges. 6 and 6′ are screw-plugs which extend through flanges 1 and 2 into the steam-space 7, forming a stationary partition therein, being set by set-nuts 8 and 8′ and packed on both sides of cones 9 and 9′, which extend into the steam-space, by suitable steam-packing 10 and 10′. Axle 11 passes through the center of the revolving part, its axis being located end for end in the center of steam-space 7. Upon axle 11 piston-spool 12 is rotatably fitted, while the axle is held stationary with the center core 13 by shoulder-pieces 14 and 14′, which are tightly screwed upon the axle and secured with it, so as to prevent its turning. Piston-spool 12 is so fitted with relation to the center core 13 and shoulder-pieces 14 and 14′ as to revolve freely around axle 11. The piston-spool consists of four parts—namely, the spool-shank 12, two bowl-shaped piston-disks 15 and 15′, and bevel-gear 16, which latter forms one solid part with the shank and piston-disk 15. Piston-disk 15′ is provided with a tapped hub 17, by means of which it is secured with the threaded end of the shank. The upturned rims of piston-disks 15 and 15′ extend through steam-space 7, touching the inner surface of the shell *a* in a line vertical thereto and divide steam-space 7 into several chambers, as shown in Fig. 2. The center core 13 revolves in the direction indicated by arrows. It is provided with two separate shafts 18 and 18′, Fig. 1, which are fastened thereto by key 19 and pins 20. These shafts have one common axis and are journaled in journals 21 and 21′, which form part of the shell *a*. The

escape of steam at the outer end of the journals is prevented by suitable stuffing-boxes 22. A driving-pulley 23 is keyed to shaft 18′ outwardly of shell *a*. Piston-spool 12 is made to revolve around axle 11 whenever the center core 13 revolves in the direction of the arrows. This is accomplished by its gear connection with stationary bevel-gear 24, which is loosely fitted upon shaft 18 and keyed into the journal part 21′ of shell *a* by key 24′, so that it becomes stationary therewith. The rotary movement of the piston-spool is required in order to provide a passage through the upturned piston-disk rim 15 and 15′ for the stationary screw-plugs 6 and 6′ whenever the said piston-disk rim reaches the location of the screw-plugs, which occurs four times during every revolution of the center core 13. Passage in the piston-rim 15 and 15′ is provided by notches 25, one of which is cut into each rim. Piston-spool 12 is so geared with the stationary bevel-gear 24 as to revolve twice around its axle 11 during each revolution of the center core 13, and notches 25 are so located that they will appear in steam-space 7 as soon as the point of location of each screw-plug is reached, thereby allowing the latter's passage. As soon as the respective points have been passed the solid part of the piston-disk rim again enters the steam-space, forming a steam-abutment therein, while the notch disappears within center core 13. It will thus be seen that two separate and distinct movements occur, each of which has its axis in a plane which is at a right angle to the other. It is possible so to pack the crown of each disk-rim as to entirely avoid steam-leakage from one steam-chamber into the other or into the exhaust. Both ends of the piston-spool—that is, piston-disk 15, with its bevel-gear 16, and piston-disk 15′, with its hub 17—are of the same weight in order to balance as much as possible the centrifugal force, which acts upon the piston-spool when the center core revolves at a high speed, thereby preventing uneven friction at the respective ends of the spool. Each notch must provide passage for each screw-plug twice. It follows that during the length of travel of the center core 13, which length must correspond with the diameter of the piston-disks at the point where connection with the inner surface of shell *a* is established, the piston-spool 12 must make one half-revolution around its axle 11.

In Fig. 2 the position of the piston-disks is shown to fully divide the steam-space at two points on each side of the shell. As soon as steam is turned on the impact of same strikes the upper right-hand shoulder of piston-disk rim 15′ and at the same time the lower left-hand shoulder of piston-disk rim 15 and revolves the complete center body around its axis in the plane of shafts 18 18′. By the time that each opposite shoulder of the piston-disk rims 15 15′ has reached the stationary screw-plug 6 6′ piston-spool 12 has been sufficiently rotated around its axis in the plane of axle 11 by its gear connection with stationary bevel-gear 24 as to move its notch 25 into the steam-space, which allows each screw-plug to pass through the notch in the respective piston-disk rim without obstruction, or rather the notch in the forward and rotatably-moving disk-rim allows free and unobstructed passage to the respective stationary screw-plugs. As soon as the said opposite shoulder of each piston-disk rim has passed steam-admission openings 4 and 4′ it receives the second steam impact, so that the steam impact is made to strike each pair of shoulders of the piston-disk rim 15 and 15′ in consecutive order—that is, twice during one revolution of the center body. It will be seen that the volume of steam inclosed within the bowl-shaped piston-disk 15′, as well as 15, is without further effect one way or the other as soon as the opposite shoulder of each piston-disk rim has passed the respective steam-admission opening and, having rotated sufficiently so as to receive the next full impact of the steam, has inclosed the said volume of steam between its two solid shoulders. This practically dead volume of steam is then carried forward between the two respective shoulders until exhaust-openings 5 and 5′ have been reached and uncovered, when it escapes through its exhaust connection into the atmosphere.

It will be seen by inspecting the position of the respective shoulders of each piston-disk in Fig. 2 that the above remarks regarding the inclosure of a proportionate volume of steam within the shoulders of the bowl-shaped piston-disk applies in the same measure to the steam inclosed between shoulders 15 and 15′ on both sides of the steam-space, considering the vertical screw-plugs 6 and 6′ as the dividing-line, whereby the steam-space 7 is divided into a left-hand and a right-hand space. It may be permissible in this connection to direct attention to the fact that the volume of steam, which must be considered practically dead when inclosed between the shoulders of the piston-disk 15 and 15′ in the position as shown in Fig. 2, may be made useful for the purpose of compounding by allowing its exit at points *p* and before the regular exhaust-port has been reached, which points are indicated by arrows in dotted lines. The full benefit of the tension of the so inclosed steam when drawn off at the points so indicated could be obtained for the said purposes of compounding without counteraction upon the forward movement of the rotating core 13 because of the fact that two surfaces of equal area—namely, shoulders of piston-disk 15 15′—would be exposed to the counteraction of such back pressure. The ef-

fect of the back pressure upon each shoulder would be the same—*i. e.*, one in the direction and one against the direction of the rotary movement of the center core 13—and therefore *nil*. The complete body of the machine rests upon legs 26 and 27, whereby it may be secured to a suitable foundation.

I do not restrict myself to the construction as shown, as many changes regarding dimensions, arrangements, and the like may become necessary in the practical construction of the machine, which changes may be made without departing from the spirit and scope of my invention.

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

1. In an engine, the combination, with a ball-shaped shell, a revolving core therein, a steam-channel in said revolving core which completely encircles the latter, two stationary screw-plugs forming steam-abutments in said steam-channel thereby dividing said steam-channel into a left and a right hand steam-space, substantially as described.

2. In an engine, the combination, with a ball-shaped shell, a revolving core therein, a steam-channel in said core which completely encompasses the latter, two screw-plugs stationary with the shell and forming steam-abutments in said steam-channel, thereby dividing the latter in two equal parts, a steam admission and exhaust port leading through the shell into each steam-space and providing properly-located steam admission and exhaust openings for each steam-chamber, substantially as described.

3. In an engine, the combination, with a ball-shaped shell, a revolving core therein, a steam-channel in said core which completely encompasses the latter, a plurality of screw-plugs stationary with the shell and forming a plurality of steam-abutments within said steam-channel, thereby dividing the latter into a plurality of steam-chambers, a steam admission and exhaust port for each steam-chamber, substantially as described.

4. In an engine, the combination, with a stationary shell, a revolving core therein, a horizontal shaft fixed to said revolving core and journaled in the said shell, whereby the said rotary core is made to revolve in the horizontal plane, a piston-spool 12 rotatably mounted within the said revolving core and in a plane, which intersects the horizontal piane in which the said center core rotates at right angles, substantially as described.

5. In an engine, the combination, with a stationary shell, a core revolving in the horizontal plane within the said shell, a piston-spool rotatably mounted within the said revolving core and rotating in a plane, which intersects at right angles the horizontal plane in which the said center core rotates, a bevel-gear affixed to the said rotating piston-spool, and a stationary bevel-gear fixed to the stationary shell and in gear connection with the said bevel-gear of the piston-spool, substantially as described.

6. In an engine, the combination, with a stationary shell, a core revolving in a horizontal plane therein, a piston-spool rotatably mounted within said core, revolving in a plane which intersects at right angles the plane in which the core revolves, means by which the said piston-spool is made to rotate as soon as the core revolves, substantially as described.

7. In an engine, the combination of a rotary core revolving in the horizontal plane and having a steam-channel cut into its circumference, with a piston-spool revolving within said core in a plane which intersects at right angles the plane in which the core revolves, bowl-shaped piston-disks affixed to said piston-spool extending into the steam-channel and establishing steam-abutments therein, substantially as described.

8. In an engine, the combination, with a stationary shell, a rotary core revolving in the horizontal plane therein, a steam-channel in said core, a piston-spool mounted within the said rotary core and revolving therein in a plane which intersects at right angles the horizontal plane in which the said core revolves, bowl-shaped piston-disks affixed to said piston-spool extending into the said steam-channel, forming steam-abutments therein and establishing a sliding connection with the inner surface of the shell at right angles thereto, a plurality of stationary abutments extending into the said steam-channel, a plurality of steam admission and exhaust ports to correspond with the number of steam-chambers provided by the said piston-disks in connection with the said stationary steam-abutments, substantially as described.

9. In an engine, the combination, with a stationary shell, a core revolving in the horizontal plane within the said shell, a steam-channel in said core, rotating therein in a plane which intersects at right angles the horizontal plane in which the said core revolves, bowl-shaped piston-disks affixed to the said piston-spool, extending into the said steam-channel forming steam-abutments therein, a plurality of stationary steam-abutments extending into the said steam-channel, a gear connection whereby the said piston-spool is made to revolve as soon as the center core rotates, notches cut into the said upturned rims of the bowl-shaped piston-disks for the purpose of allowing passage for the stationary steam-abutments through the said piston-disks, substantially as described.

10. In an engine, the combination, with a stationary shell, a rotary core journaled therein, a steam-channel cut into said rotary core, a piston-spool rotably mounted within

the said core in a plane intersecting the plane of the latter, stationary abutments in the said steam-channel, piston-disks the rims of which extend into the said steam-channel forming abutments therein, notches in the said piston-disks for the purpose of providing passage through the latter for the said stationary steam-abutments, gear connection whereby the piston-spool is made to rotate within the center core as soon as the latter revolves, fluid admission and exhaust ports leading to and from the various chambers formed within the said steam-channel by the said stationary as well as the movable abutments, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RUDOLPH KLANN.

Witnesses:

OTTO KURZ,

J. C. GOOSMANN.