J. E. FRIEND.

ROTARY ENGINE.

APPLICATION FILED SEPT. 6, 1907.

902,225.

Patented Oct. 27, 1908.

4 SHEETS—SHEET 1.

FIG. 2.

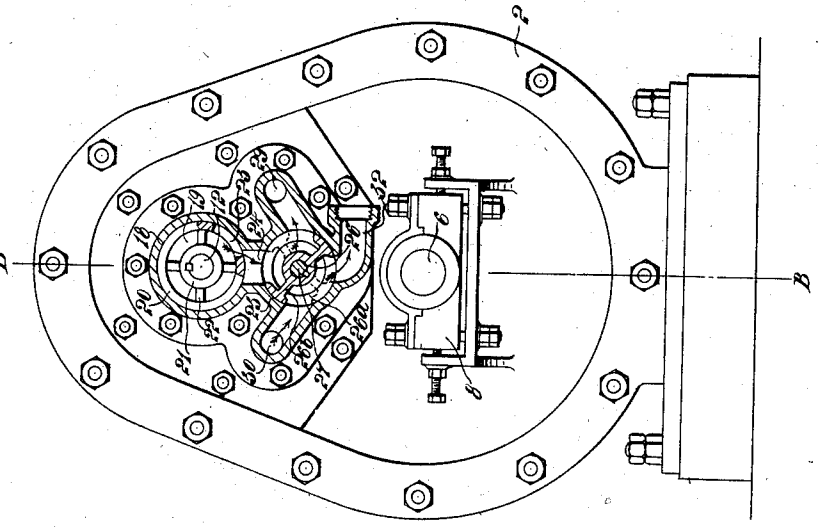
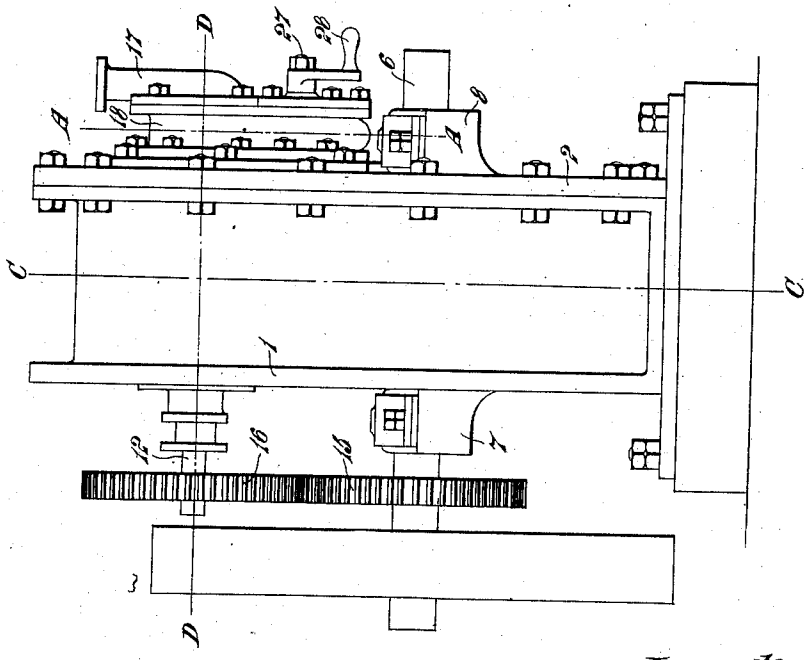


FIG. 1.



Witnesses.

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4 SHEETS—SHEET 2.

FIG. 4.

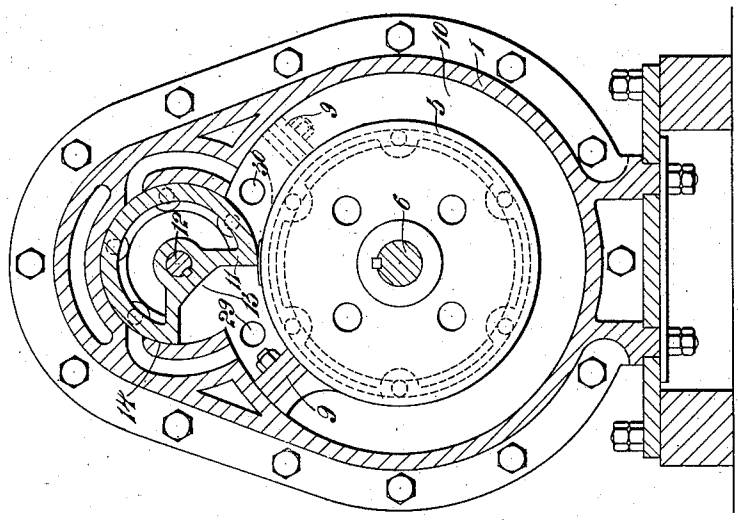
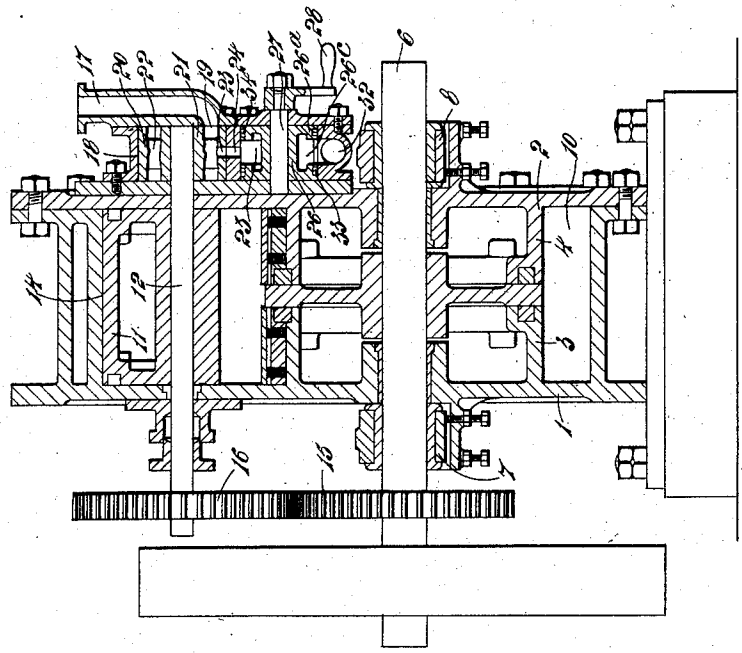


FIG. 3.



Witnesses.

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4 SHEETS—SHEET 3.

FIG. 5.

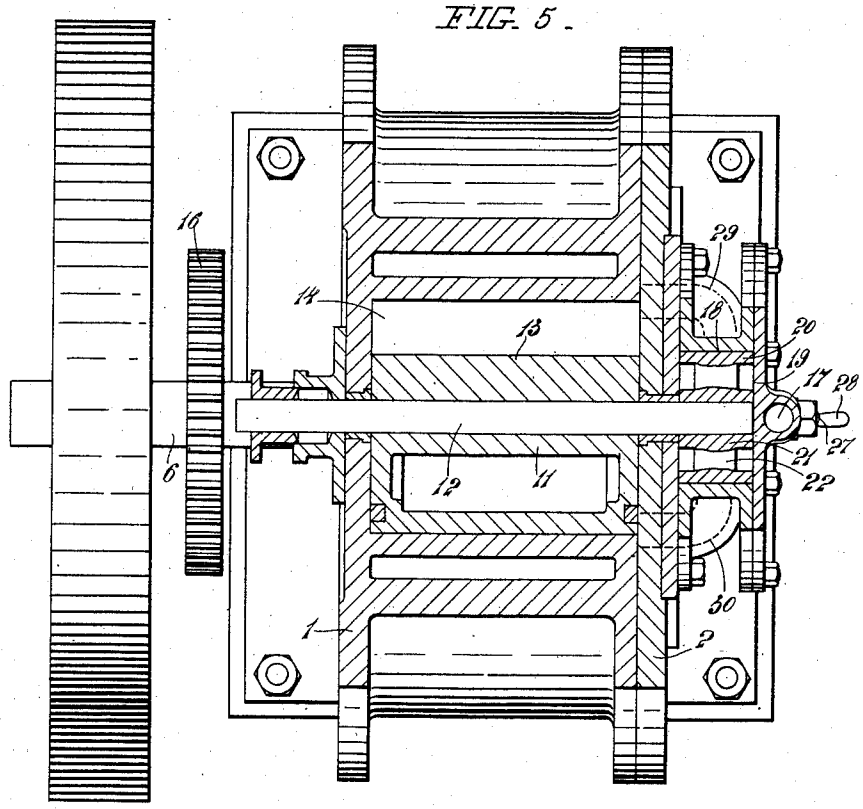


FIG. 6.

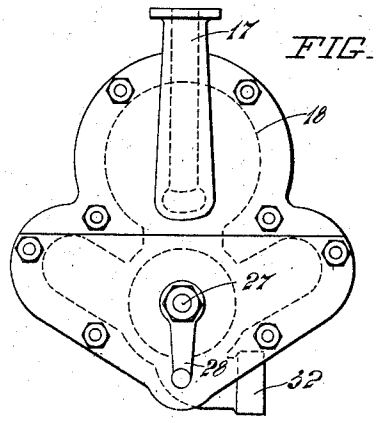
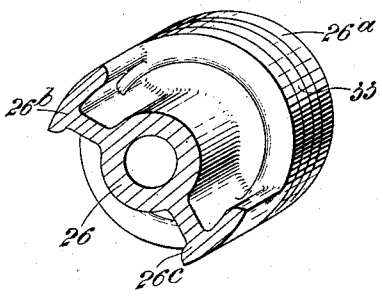


FIG. 7.



Witnesses.

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ROTARY ENGINE.

APPLICATION FILED SEPT. 6, 1907.

902,225. **Patented Oct. 27, 1908.**

4 SHEETS—SHEET 4.

FIG. 8.

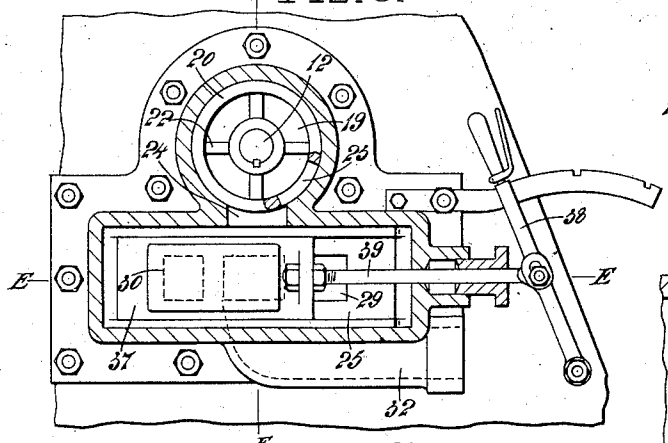
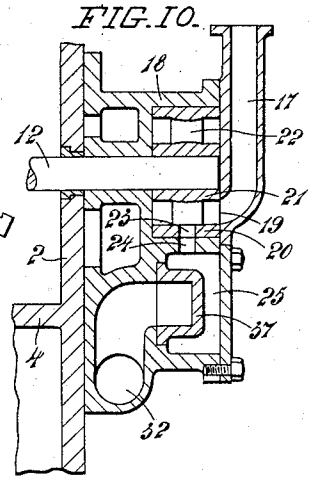


FIG. 10.



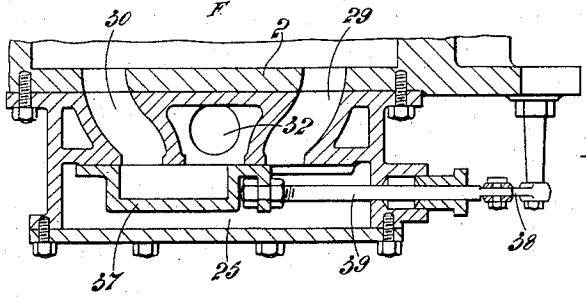


FIG. 9.

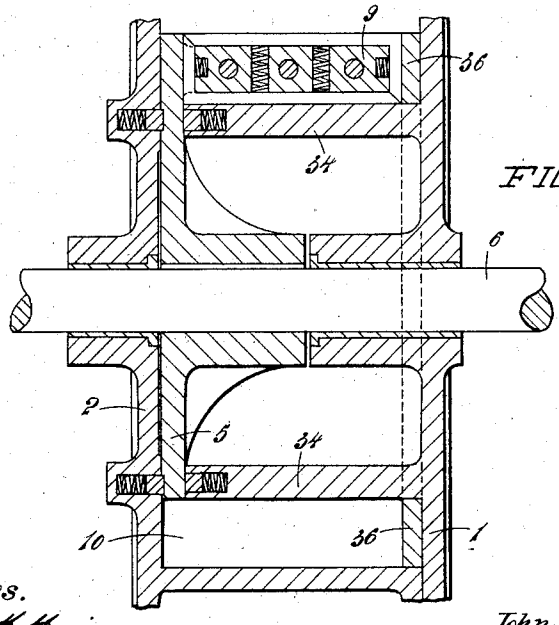


FIG. 11.

Witnesses.

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UNITED STATES PATENT OFFICE.

JOHN EDWARD FRIEND, OF ANNANDALE, SYDNEY, NEW SOUTH WALES, AUSTRALIA.

ROTARY ENGINE.

No. 902,225. Specification of Letters Patent. Patented Oct. 27, 1908.

Application filed September 6, 1907. Serial No. 391,682.

To all whom it may concern:

Be it known that I, JOHN EDWARD FRIEND, a subject of His Majesty the King of Great Britain and Ireland, residing at Albion street, Annandale, Sydney, New South Wales, in the Commonwealth of Australia, have invented certain new and useful Improvements in Rotary Steam-Engines, of which the following is a specification.

This invention relates to rotary steam engines in which a piston revolves in an annular chamber synchronously with the rotation of an abutment, and the object of the invention is to provide improved steam admission mechanism, and a combined exhaust and reversing valve.

The drawing accompanying this specification illustrates the invention:—

Figure 1 is a front elevation, Fig. 2 a side elevation partly in section on line A—A, Fig. 1, Fig. 3 a longitudinal sectional elevation on line B—B, Fig. 2, Fig. 4 a sectional elevation on line C—C, Fig. 1, Fig. 5 a sectional plan on line D—D, Fig. 1, Fig. 6 a front elevation of a steam chest, Fig. 7 a perspective sectional view of an exhaust and reversing valve, Fig. 8 a sectional elevation of a steam chest, Fig. 9 a sectional plan on line E—E, Fig. 8, Fig. 10 a sectional elevation on line F—F, Fig. 8, and Fig. 11 a sectional elevation of a modified form of disk and piston.

The casing 1 has a cover 2 and circular walls 3 and 4 projecting towards each other. A space between the ends of the said walls is occupied by a disk 5 secured upon a shaft 6 mounted co-axially with the casing 1 in bearings 7 and 8.

A rectangular piston 9 fitting the annular chamber 10 formed by the casing and the circular walls 3 and 4 is integral with or fixed to the disk 5, and is revoluble in the annular chamber.

A circular abutment 11 secured upon a spindle 12 has a groove 13 and is rotatable in a circular recess 14 formed in the top of the casing 1. Toothed wheels 15 and 16 secured upon the shaft 6 and spindle 12 respectively are geared together and have equal numbers of teeth, so that the abutment rotates synchronously with the revolution of the piston, which is so adjusted with regard to the abutment that at each revolution it enters the groove 13 and thus passes the abutment.

Steam is admitted to the annular chamber by a pipe 17 which communicates with the interior of a steam chest 18, fitted with a valve 19 secured upon the spindle 12. This valve consists of a circular rim 20 connected to a boss 21 by spokes 22. A port 23 is provided in the rim 20 and a corresponding port 24 forms a communication between the chest 18 and a circular chamber 25 containing a valve 26 having circular ends 26^a and wings 26^b and 26^c fitting the chamber. The valve is fixed upon a spindle 27 and operable by a handle 28. Ports 29 and 30 form communications between the chamber 25 and the annular chamber 10 of the casing 1.

As shown in Fig. 2 the valve 26 is set to admit steam through the port 29 to the annular chamber 10 as shown by the arrows, and exhaust steam from the chamber will pass from the port 30 to the exhaust pipe 32. The valve 19 is so set that its port admits steam to the annular chamber when the piston 9 is in the position shown by full lines in Fig. 4, or in the position shown by dotted lines in the same figure, the exhaust ports being open continuously. The valve 26 is made steam tight at its ends with the chamber 25 by packing rings 33 and 34.

To reverse the engine the valve 26 is rotated by the handle 28 until it assumes the position shown by dotted lines in Fig. 2, when steam will be admitted to the port 30 and exhaust steam will pass out by the port 29.

I have described the disk 5 arranged centrally within the casing 1 between the circular walls 3 and 4, but the disk may be located next to the cover 2, as shown in Fig. 11, with a single circular wall 34 extending from the back of the casing to the disk. In this case the piston subtends the disk wholly on one side thereof, and the inner ends of the pistons are united together by a ring 36.

Figs. 8, 9 and 10 show a modified form of valve 37 to replace the valve 26. The valve 37 is the usual "D" shaped valve, operable by a hand lever 38 and spindle 39. As shown in the drawing the exhaust steam is directed by the valve from the port 30 to the exhaust pipe 32, and steam is free to pass from the port 24 to the port 29.

What I do claim and desire to secure by Letters Patent of the United States is:—

1. A rotary steam engine, comprising a casing having an annular chamber, a shaft co-axial with the annular chamber, a piston

revoluble therein, and secured upon the shaft, a circular abutment having a groove and fitting a corresponding recess at the top of the annular chamber, a spindle upon which the abutment is mounted, a toothed wheel secured upon the shaft, a second toothed wheel secured to the spindle and gearing with the first toothed wheel, a steam chest having a port communicating with the annular chamber, a valve secured upon the spindle and having a port through its circular rim adapted to register with the port of the steam chest, substantially as set forth.

2. In a rotary steam engine, the combination with a steam chest of a valve having a port through its circular rim, means for rotating the valve, a chamber communicating by a port with the steam chest, a reversing valve fitting the chamber, a spindle to which the reversing valve is secured, and a handle secured upon the spindle, substantially as set forth.

3. A rotary steam engine, comprising a casing having an annular chamber, a shaft co-axial with the annular chamber, a piston revoluble therein, and secured upon the shaft, a circular abutment having a groove and fitting a corresponding recess at the top of the annular chamber, a spindle upon which the abutment is mounted, a toothed wheel secured upon the shaft, a second toothed wheel secured to the spindle and gearing with the first toothed wheel, a steam chest having a port, a valve secured upon the spindle and having a port through its circular rim adapted to register with the port of the steam chest, a chamber communicating by the said port with the steam chest, a reversing valve in the chamber and means for operating the reversing valve, substantially as set forth.

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

JOHN EDWARD FRIEND.

Witnesses:

ERNEST SMITH BALDWIN,

HENRIE HAMPTON RAYWARD.