No. 776,882. PATENTED DEC. 6, 1904.

B. F. AUGUSTINE.

ROTARY ENGINE.

APPLICATION FILED OCT. 10, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

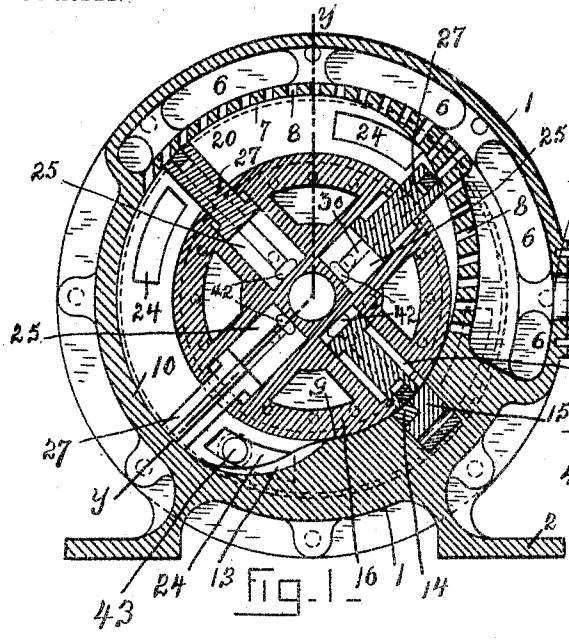


Fig. 1.

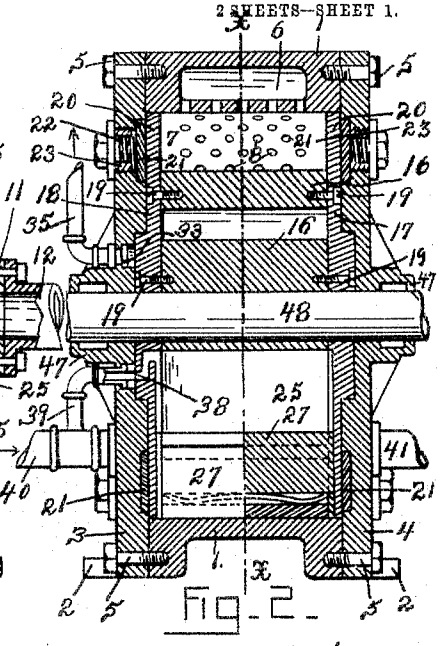


Fig. 2.

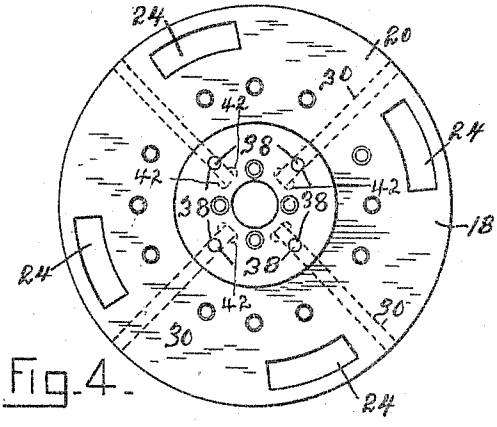


Fig. 4.

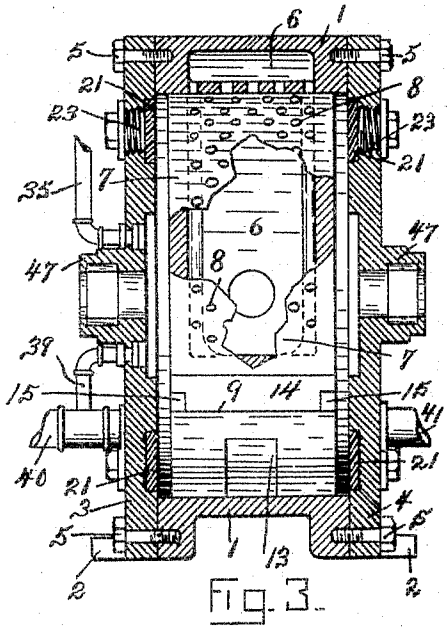


Fig. 3.

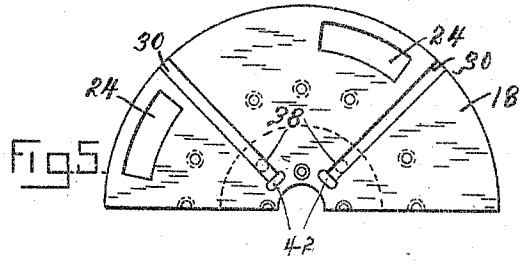


Fig. 5.

WITNESSES.

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B. F. AUGUSTINE.

ROTARY ENGINE.

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NO MODEL. 2 SHEETS—SHEET 3.

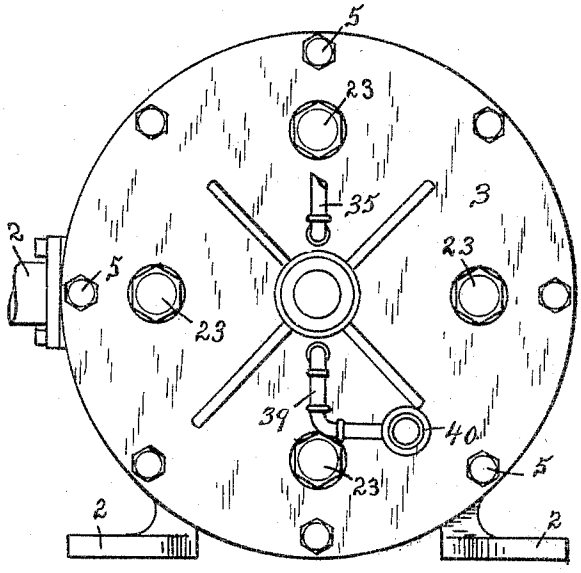


Fig. 6.

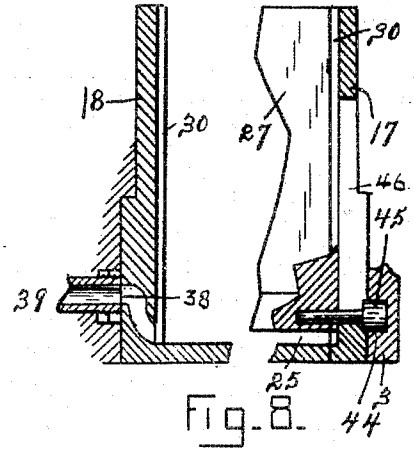


Fig. 8.

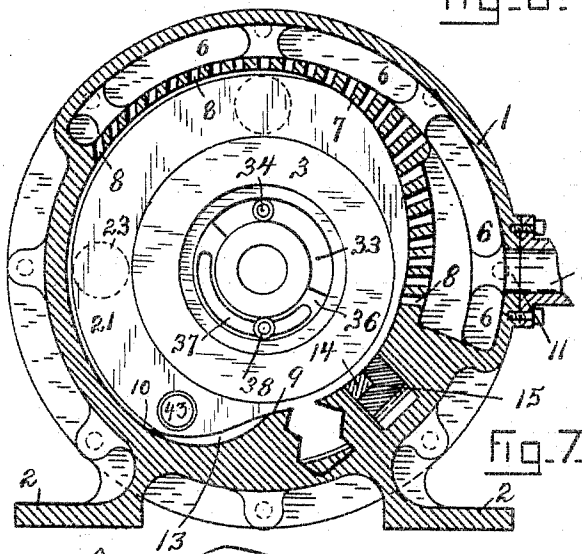


Fig. 7.

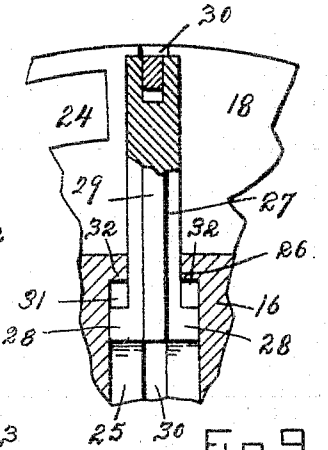


Fig. 9.

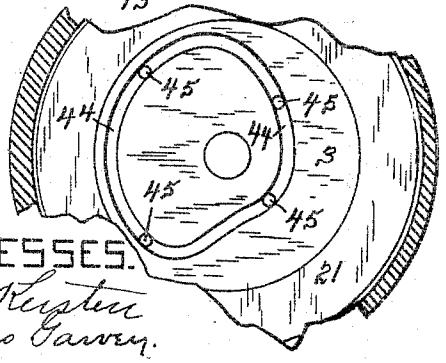


Fig. 10.

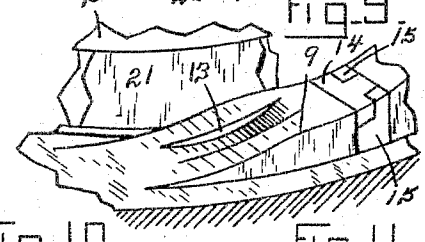


Fig. 11.

WITNESSES.

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No. 776,882. Patented December 6, 1904.

UNITED STATES PATENT OFFICE.

BENJAMIN F. AUGUSTINE, OF BUFFALO, NEW YORK.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 776,882, dated December 6, 1904.

Application filed October 10, 1904. Serial No. 227,769. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN F. AUGUSTINE, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, 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, reference being had to the accompanying drawings, and to figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rotary engines, and more particularly to that class which involves the employment of radially-reciprocating pistons.

The object of my invention is to provide an improved construction by means of which I am enabled to utilize a maximum expansion of the steam and to so construct and arrange the parts that as their frictional wear increases the operative joints become tighter, and consequently more effective.

To these ends my invention consists of certain details of construction and combination of parts, all of which will be fully hereinafter described and claimed.

In the drawings, Figure 1 is a central vertical longitudinal section taken in the line *x x* of Fig. 2. Fig. 2 is a central vertical transverse section taken in the line *y y* of Fig. 1. Fig. 3 is a similar section with the compound rotary cylinder removed. Fig. 4 is a side elevation of the outside face of one of the disks which are bolted to the compound rotary cylinder. Fig. 5 is an opposite side elevation of one-half of the disk shown in Fig. 4. Fig. 6 is a side elevation of the rotary engine complete. Fig. 7 is a section similar to Fig. 1 with the compound rotary cylinder removed. Fig. 8 is a detached detail, in section, of the modified cam-valve movement. Fig. 9 is a detached detail, partly in section, of one of the pistons. Fig. 10 is a detached detail of the modified cam-valve movement, and Fig. 11 is a fragmentary perspective of the by-pass.

Referring to the drawings, 1 is the cylindrical casing having the integral end-supporting bases 2 2.

3 and 4 are the inclosing side plates, which with casing 1 form the chamber in which the operative parts are assembled. These plates 3 and 4 are secured in position by the bolts 5.

47 47 are bearings in which the power-shaft 48 is journaled.

In the upper circumference of the cylindrical casing 1 is the concentric exhaust-chamber 6, its entire inner division-wall 7 being provided with a series of outlet-ports 8. It will be seen that this exhaust-chamber extends practically one-half of the circumference of the cylindrical casing 1. The inner wall of the cylindrical casing 1 at its highest central point commences to slightly curve inwardly to the right (see Figs. 1 and 7) until it reaches a point 9 diametrically opposite. From the point 9 the surface drops abruptly to the inner cylindrical wall 10.

11 is the outlet-orifice of the exhaust-chamber 6, opening into the exhaust-pipe 12.

13 (see Fig. 11) is a by-pass in the abrupt incline of the inner wall of the casing 1 just in advance of the point 9 in such wall.

14 and 15 15 are spring packing-blocks set into the inner wall of the casing 1 at the point where the abutment is formed. The block 14 exerts a steam-tight pressure inwardly against the compound rotary cylinder 16, rigid upon the power-shaft 48, and the blocks 15 15 exert a side steam-tight pressure against the disks 17 and 18, which are secured to the sides of the compound rotary cylinder by the countersunk bolts 19. (See Fig. 2.) These disks 17 and 18 fit snugly against the inner wall 10 of the cylindrical casing, being practically of the same diameter, such disks forming where they extend beyond the compound rotary cylinder annular flanges 20 20 of such compound rotary cylinder. These disks 17 and 18 may, if found desirable, be cast integral with the compound rotary cylinder.

21 21 are annular rings set loosely into the inner faces of the side plates 3 and 4 of the inclosing casing.

At preferably four spaced positions in the side plates 3 and 4 are located the springs 22, (see Fig. 2,) which bear against the outer faces of the annular rings 21 21. These springs are inclosed in the hollow plugs 23, which

have adjustable screw-threaded engagement with the side plates 3 and 4, by means of which the tension of the springs against the annular rings 21 21 may be regulated.

With the above construction I effect a steam-tight joint between the compound rotary cylinder and the inner faces of the side plates 3 and 4, besides making provision for taking up the frictional wear between such parts.

Both of the disks 17 and 18 are provided in their outer portions 20 with elongated concentric steam-inlet ports 24, preferably four in number.

The compound rotary cylinder 16 is composed of the four radial cylinders 25, having contracted outer openings 26. (See Fig. 7.) In each cylinder 25 is arranged a radial piston 27, its inner end being provided with the side flanges 28 28, (see Fig. 9,) which fit snugly against the side walls of the cylinder 25, the body of the piston passing snugly through the contracted opening 26 of the cylinder. Each piston 27 is provided with the side ribs 29 29, which have radial reciprocating movement in the radial grooves 30 on the inner faces of the disks 17 and 18. It will be seen from an inspection of Fig. 9 that the pistons 27 are of sufficient length to allow for a steam-space 31 between the side flanges 28 28 and the shoulders 32 32 on each side of the opening 26. This provision is made for a double purpose—first, to provide a cushion for partly neutralizing the centrifugal force exerted on the pistons, and, secondly, to allow for the frictional wear at the outer end of the pistons.

On the inner face of the side plate 3 (see Figs. 2 and 7) is cut the annular channel 33, having the exhaust-port 34 leading into exhaust-pipe 35. Within this channel 33 is set the segmental ring 36, having cut on its inner face the concentric channel 37, into which the steam-inlet port 38 leads, and 39 is the steam-inlet pipe which communicates with the inlet-port 38. The inlet-pipe 39 takes its steam from the main inlet-pipe 40, passing through the side plate 3, which provides the steam on one side for operating the pistons 27. The additional inlet-pipe 41, passing through the side plate 4, provides for the admission of steam to the pistons 27 on the opposite side of the inclosing casing, which effects a perfect balance of the action of the steam against the compound rotary cylinder.

In the disk 18 are located the steam-ports 42, four in number, which coöperate with the inlet and outlet ports 38 and 34 in the side plate 3 for operating the sliding pistons 27.

In operation, referring particularly to Fig. 1, it will be seen that the steam-chamber gradually narrows down on the right-hand side until its outer wall meets the compound rotary cylinder at the point where the packing-blocks 14 15 15 are located, at which point the abutment is formed. The piston 27 at this point is entirely sheathed within the cylinder, at which point the steam commences to enter behind the piston through the inlet-port 42 preparatory to forcing such piston outwardly. As it reaches the point 9 at the top of the abrupt incline the piston, being now forced outwardly, reaches the outer wall 10 down such incline without the slightest jarring of parts. At this point the inlet-ports 24 24 in the disks 17 and 18 and just behind the piston in operation reaches the inlet-ports 43 in the opposite annular rings 21 21 and steam is admitted behind the piston, thus forcing it forward. The instant that the port 24 passes the inlet-port 43 the incoming steam is cut off and the admitted steam commences its expansive effort against the piston until the next succeeding piston commences its descent down the abrupt incline. During such descent a sufficient portion of the expanding steam passes back through the by-pass 13 to balance the descending piston. As the piston in operation reaches the perforated inner wall 7 of the chamber 6 the steam starts to exhaust expansively through the outlet-ports 8 and continues to so exhaust until the piston again reaches its abutment. Simultaneously with the exhaust just described the steam behind the piston commences and continues to exhaust through the steam-port 42 into the annular channel 33, (see Fig. 7,) from which it escapes through port 43 into the exhaust-pipe 35.

The flanged piston, operating in the radial grooves 30 in the disks 17 and 18, effects two very important results. First, such construction holds the projecting piston from retarding side bearing against the sides of the cylinder under the pressure against the piston of the expanding steam, and, second, the forming of a steam-tight joint along the entire length of the exposed portion of the piston between the flange and its groove, which effectually prevents any escape of the expanding steam.

In Figs. 8 and 10 I have shown a modified form of the valve movement for forcing the pistons out of their cylinders into their operative positions, in which 44 is a cam-groove in the side plate 3, adapted for the operative reception of the pins 45 on each of the pistons 27, these pins riding in the radial slots 46 through the disks 17 and 18. (See Fig. 8.)

In the foregoing description and in the drawings I have described and shown a series of four radial pistons, which I prefer as possibly the most effective form; but it is apparent that a greater or less number would be operative, it being understood that two is the smallest number of pistons which would be operative.

I claim—

1. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders, a series of radial pistons

reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly to meet the compound rotary cylinder to form an abutment, an abrupt outward incline adjacent to the abutment, side annular flanges on the compound rotary cylinder, spring-pressed annular rings seated in the inner faces of the side plates of the casing and adapted for tight contact with the annular flanges on the compound rotary cylinder and means for introducing and exhausting the steam employed against the pistons and for forcing the pistons into their operative positions.

2. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly to meet the compound rotary cylinder to form an abutment, an abrupt outward incline adjacent to the abutment, a concentric exhaust-chamber in the casing having a perforated division-wall, side annular flanges on the compound rotary cylinder, spring-pressed annular rings seated in the inner faces of the side plates of the casing and adapted for tight contact with the annular flanges on the compound rotary cylinder and means for introducing and exhausting the steam employed against the pistons and for forcing the pistons into their operative positions.

3. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders, a series of ribbed radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly to meet the compound rotary cylinder to form an abutment, an abrupt outward incline adjacent to the abutment, side disks rigid with the compound rotary cylinder provided with radial grooves adapted for the sliding reception of the ribs on the radial pistons and means for introducing and exhausting the steam employed against the pistons and for forcing the pistons into their operative positions.

4. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders, a series of ribbed radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly to meet the compound rotary cylinder to form an abutment, an abrupt outward incline adjacent to the abutment, side disks rigid with the compound rotary cylinder provided with radial grooves adapted for the sliding reception of the ribs on the radial pistons, a concentric exhaust-chamber in the casing having a perforated division-wall and means for introducing and exhausting the steam employed against the pistons and for forcing the pistons into their operative positions.

5. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of ribbed radial cylinders, a series of radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly to meet the compound rotary cylinder to form an abutment, an abrupt outward incline adjacent to the abutment, side disks rigid with the compound rotary cylinder provided with radial grooves adapted for the sliding reception of the ribs on the radial pistons, side annular flanges on the compound rotary cylinder, spring-pressed annular rings seated in the inner faces of the side plates of the casing and adapted for tight contact with the annular flanges on the compound rotary cylinder and means for introducing and exhausting the steam employed against the pistons and for forcing the pistons into their operative positions.

6. In a rotary engine, in combination, a power-shaft, a compound rotary cylinder rigid on the power-shaft and composed of a series of radial cylinders, a series of ribbed radial pistons reciprocating in the radial cylinders, a casing surrounding the compound rotary cylinder, the inner wall of which curves inwardly to meet the compound rotary cylinder to form an abutment, an abrupt outward incline adjacent to the abutment, side disks rigid with the compound rotary cylinder provided with radial grooves adapted for the sliding reception of the ribs on the radial pistons, a concentric exhaust-chamber in the casing having a perforated division-wall, side annular flanges on the compound rotary cylinder, spring-pressed annular rings seated in the inner faces of the side plates of the casing and adapted for tight contact with the annular flanges on the compound rotary cylinder and means for introducing and exhausting the steam employed against the pistons and for forcing the pistons into their operative positions.

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

BENJAMIN F. AUGUSTINE.

Witnesses:
W. T. MILLER,
CHARLES GARVEY.