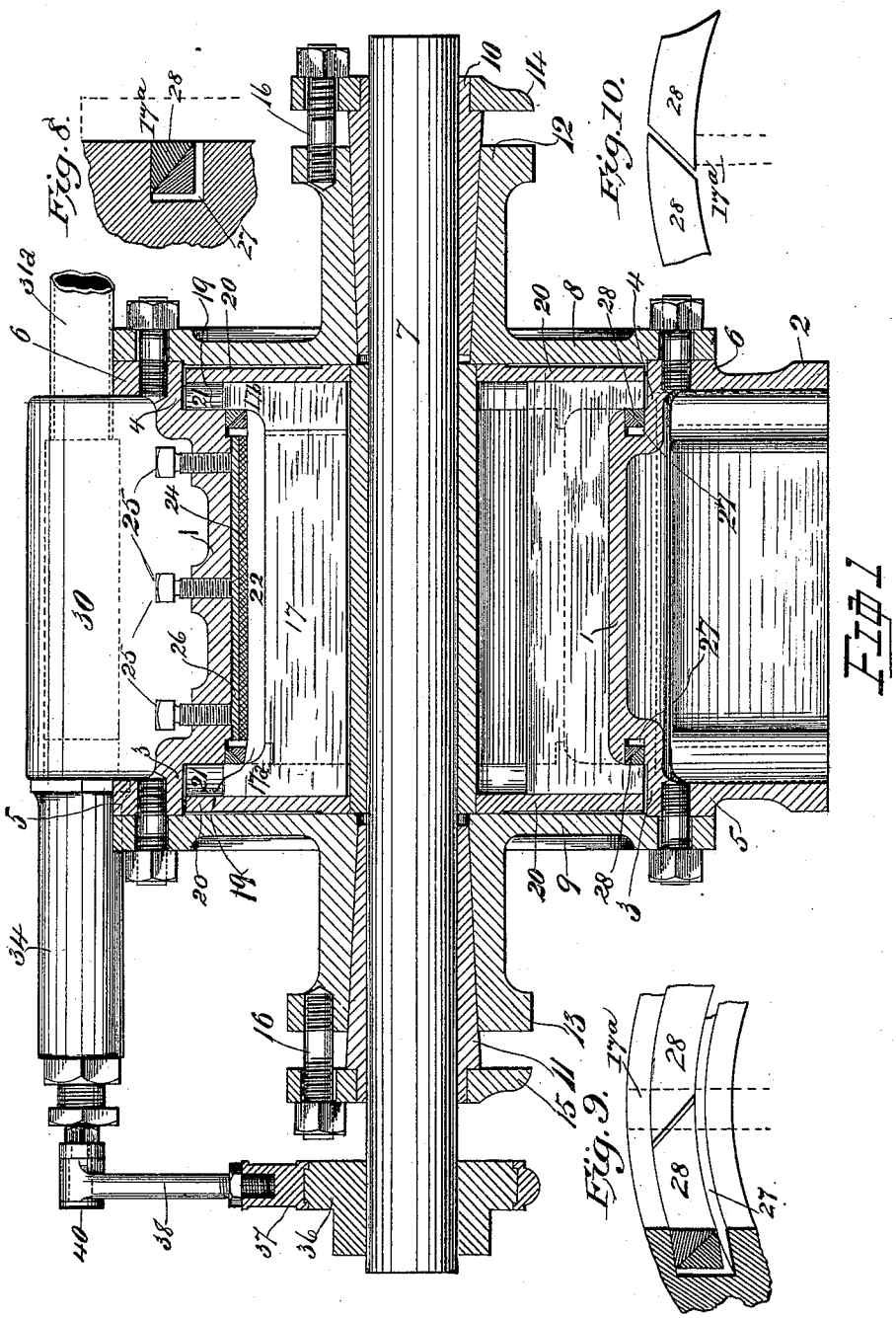
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W. G. & A. W. BILLINGS.

ROTARY ENGINE.

No. 447,535. Patented Mar. 3, 1891.



WITNESSES:
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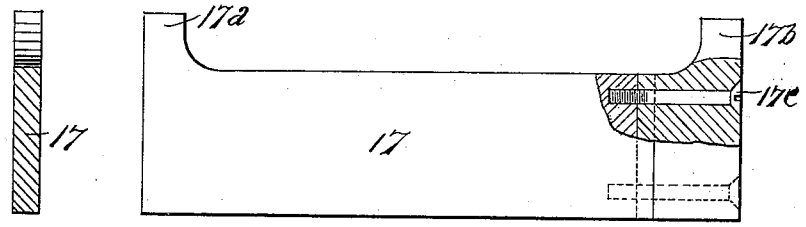


Fig 5 Fig 3

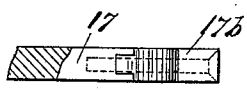


Fig 4

Fig 2

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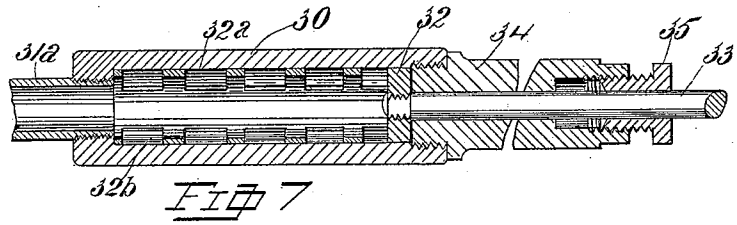


Fig 7

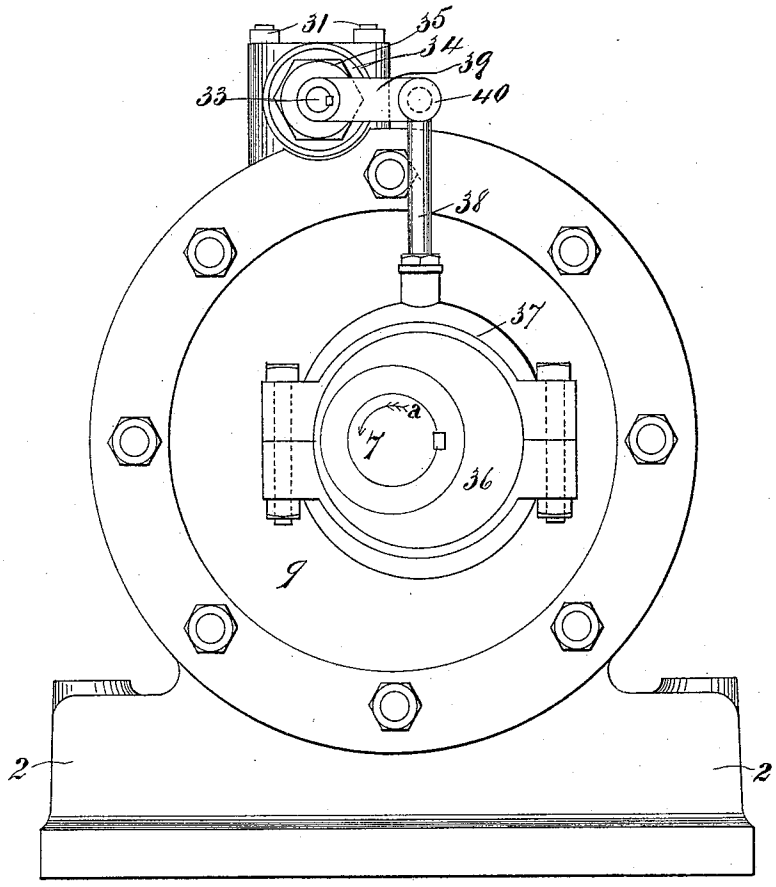


Fig 6

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UNITED STATES PATENT OFFICE.

WILLIAM G. BILLINGS AND AVERY W. BILLINGS, OF LARNED, KANSAS, ASSIGNORS OF ONE-THIRD TO ARTHUR T. BILLINGS, OF SAME PLACE.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 447,535, dated March 3, 1891.

Application filed June 23, 1890. Serial No. 356,325. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM G. BILLINGS and AVERY W. BILLINGS, citizens of the United States, residing at Larned, county of Pawnee, and State of Kansas, have invented new and useful Improvements in Rotary Engines, of which the following is a specification.

This invention relates to that class of rotary engines in which the main driving-shaft receives its rotative motion by means of radial and opposing blades or pistons which receive the force of the fluid alternately on one of their surfaces.

The object of the invention is to provide means whereby the leakage of the driving-fluid between the wearing-surfaces and guideways of the blades will be obviated; also to provide large wearing-guideways for the blades. These objects we attain by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional elevation of the engine. Fig. 2 is an end sectional elevation of the same. Fig. 3 is a longitudinal elevation of the blade or piston, partly in section, and showing the method of jointing and securing the end or lug of the blade. Fig. 4 is a part plan of the blade, showing the tongue-and-groove joint. Fig. 5 is an end sectional elevation of the blade. Fig. 6 is an end elevation of the engine, showing the eccentric and valve mechanism. Fig. 7 is a detail longitudinal section of the steam-chest and its valve. Fig. 8 is an enlarged section of the packing-rings and their groove. Fig. 9 is a front elevation of said rings, showing the joint of the outer expanding ring; and Fig. 10 is a side view of the expanding ring, also showing the joint.

Similar numbers and letters refer to similar parts throughout the several views, in which—

1 designates the main cylinder-shell. 2 is its base, and 3 and 4 are its enlarged ends, having the flanges 5 and 6, all integral with the shell.

7 designates the main shaft, having its axis of rotation parallel with and above or eccentric with the axis of the cylinder-shell 1, but is concentric with the enlarged ends of the cylinder ends, and consequently coincides with the axes of the covers 8 and 9.

10 and 11 designate the shaft-bearings, having their outer bearing-surfaces formed like a cone to fit in the sleeves 12 and 13, formed integral and concentric with the covers 8 and 9.

14 and 15 designate the adjusting-caps of the said bearings, adjustably secured to the sleeves 12 and 13 by the studs 16.

17 designates the radial blades or pistons provided with the lugs or wings 17^a and 17^b, one of which is removably secured to the blades 17 (as 17^b) by any suitable device, as the countersunk screw 17^c, for the purpose of permitting the blade to be introduced into the cylinder when the shaft 7, with its blade-carrier 18, is in position.

The blade or piston-carrier 18, secured firmly to the shaft 7 by a key or other suitable device, is provided with the guideways 19, wherein the blades 17 slide and fit neatly.

To the ends of the carrier 18 are removably secured the disks 20, on the inside faces of which are also formed the guideways 21, wherein the ends or lugs 17^a and 17^b of the blades 17 slide and neatly fit.

We provide the abutting strip 22 to bear on the top of the blade-carrier 18, neatly fitting the longitudinal groove 23, formed in the cylinder-shell 1, for the purpose of preventing loss of pressure of the steam or fluid due to leakage between the said blade-carrier and the inner top surface of the shell 1. We also provide the backing 24 (of hemp, asbestus, or other suitable material) as an auxiliary packing, and adjust the compactness of the same by means of set-screws 25, bearing on the backing-strip 26.

It will be observed that the centers of the opposite halves of the steam-cylinder-shell circles are slightly spread apart, as at *c* and *d*, (see Fig. 2,) for the purpose of exposing a greater surface of the blade 17 to the action of the steam during the period of the first half of its revolution.

On the ends of the cylinder-shell 1 and concentric therewith are formed the annular grooves 27, in which are fitted the wedge-sectioned packing-rings 28, against which the inner surfaces of the flanges or disks 20 bear to form a "steam-tight" joint.

It is evident that the packing-rings, owing to their elasticity, tend to expand outwardly

and to bear against the outer wall of the groove 27, while the inner ring is preferably formed in one solid piece and of an interior diameter greater than the diameter of the inner wall of the groove 27 and an exterior diameter equal to the diameter of the outer wall of said groove, thereby leaving a very small space between said ring and said inner wall of the groove through which the steam passes to the back of said rings to press them outwardly and to expand them by reason of their wedge-shaped sections.

29 designates the steam passage or port formed integral with the shell on the face 29^a, on which is secured the steam-chest 30 by the bolts 31, and 31^a is its steam-supply pipe.

32 designates the piston-oscillating valve, closely fitting and adapted to oscillate in the chest 30, and provided with the induction-ports 32^a and 32^b.

33 designates the valve-stem, and 34 is the valve-stem sleeve secured to the said steam-chest and provided with the threaded gland 35.

36 designates the eccentric secured to the shaft 7 by a key or other suitable device.

37 is the eccentric-strap, and 38 is its rod, adjustably secured to the said strap at one end, and has its other end pivoted to the end of the valve-lever 39 by the pin 40, removably secured thereto.

The operation of the machine is as follows: To start the engine the steam or fluid under pressure is admitted into the steam-chest through the pipe 31^a in the usual way and passes alternately through the ports 32^a and 32^b, formed in the valve 32, into and through the steam-passage 29, to and into the steam-chamber S^t and pressing against the radial blades 17 alternately, and rotating the shaft in the direction of the arrow *a* till the blade arrives at its bottom vertical position, at or about which position the steam is cut off, the port 32^a of the valve 32 having been rotated till it no longer coincides with the opening or port 29. The bottom blade, being acted upon by the expansive force of the steam continues to revolve, thus carrying its opposite upper blade into the position 17^d, as shown in dotted lines, (see Fig. 2,) at which position the valve-port 32^b is opened to again admit steam to the chamber S^t and rotate the blade, at the same time assisting its opposite blade (which is at this part of its revolution resisting the pressure due to the expansion of the steam) to complete the revolution. The blades on arriving at the top opening or port 41 permit the used steam to freely escape to the atmosphere. The eccentric 35, secured to the shaft 7 and rotating therewith, oscillates or partially rotates the valve 32 in the usual well-known way, thus alternately opening and closing the communication between the valve-ports 32^a and 32^b and the steam-passage 29. The point of revolution at which the ports open and close is determined, when a fixed eccentric is employed, by the common and well-known rules for setting the eccentric on the ordinary slide-valve engine, and needs no description. When it is desirable to construct the engine with an automatic and a variable "cut-off," any suitable governor may be applied to the engine to manipulate the valve, either directly or by varying the throw of the eccentric operating the valve, in which latter case the eccentric must be adjustably and movably secured to the driving-shaft 7, as in the usual shaft-governor.

The location of the exhaust-port 41 is of great importance and must be at or about the top of the exhaust side of the cylinder. If the steam is exhausted at too early a stage of the revolution of the blade 17, equilibrium between the exhaust and the steam sides of the cylinders separated by the blade 17 would be destroyed and excessive pressure would be produced on the shaft-bearings, thereby pressing out the lubricant and producing excessive friction, which would soon be so great as to overcome the resistance of the steam on the blades and stop the engine.

Having thus fully described the construction and operation of our invention, what we claim as new and useful, and desire to cover by Letters Patent, is—

1. In a rotary engine, the combination, with the elliptically-formed steam-cylinder and a shaft having its axis located above the axes of the said cylinder, of the shaft, adjustable conical sleeve-bearings and their supporting-sleeves, a suitable piston-carrier, the piston-carrier disks, the radial pistons having the outwardly-extending wings 17^a, said wings overlapping and contacting with the annular duplex wedge-shaped steam packing-rings, said rings so arranged as to expand radially and outwardly by the steam-pressure and resting in grooves concentric with the steam-cylinder, and means for supplying and exhausting the steam to and from said cylinder, substantially as described.

2. In a rotary engine, the combination of the cylinder 1, the shaft 7, the adjustable journals, as 10 and 11, and means for securing and supporting the same, the packing-rings 28, the disks 20, the blade-carrier 18 and its wings 17^a 17^b, overlapping the ends of said cylinder and packing-rings, the exhaust-port 41, and balanced valve 32 and its peripheral ports 32^a, all combined and arranged substantially as described.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

WM. G. BILLINGS.
AVERY W. BILLINGS.

Witnesses:
JOHN R. BASIGER,
A. T. BILLINGS.