No. 636,829. Patented Nov. 14, 1899.

C. E. MILLER.

ROTARY ENGINE.

(Application filed Feb. 3, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

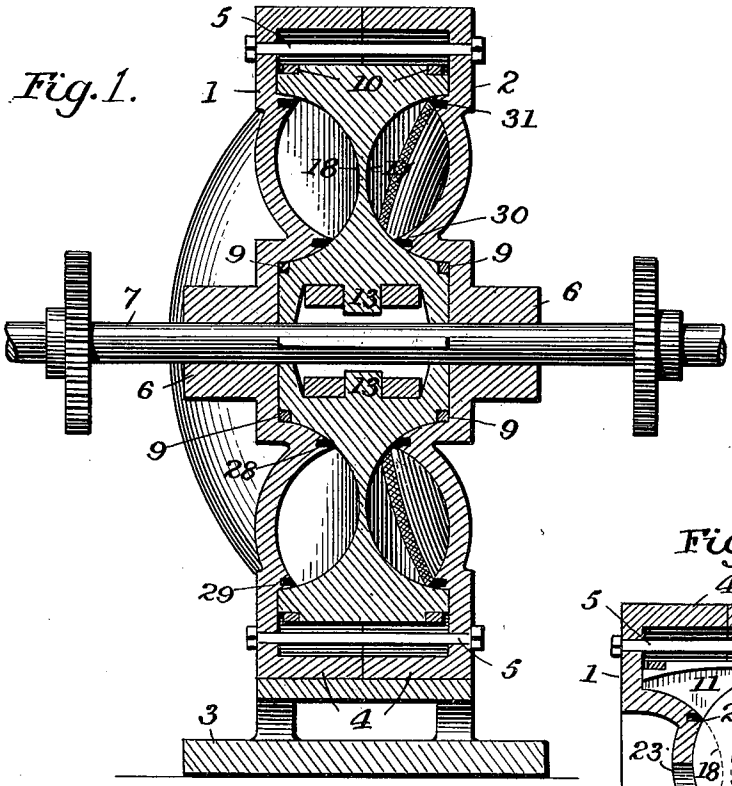


Fig. 6

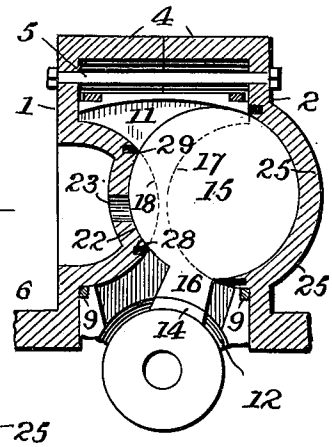
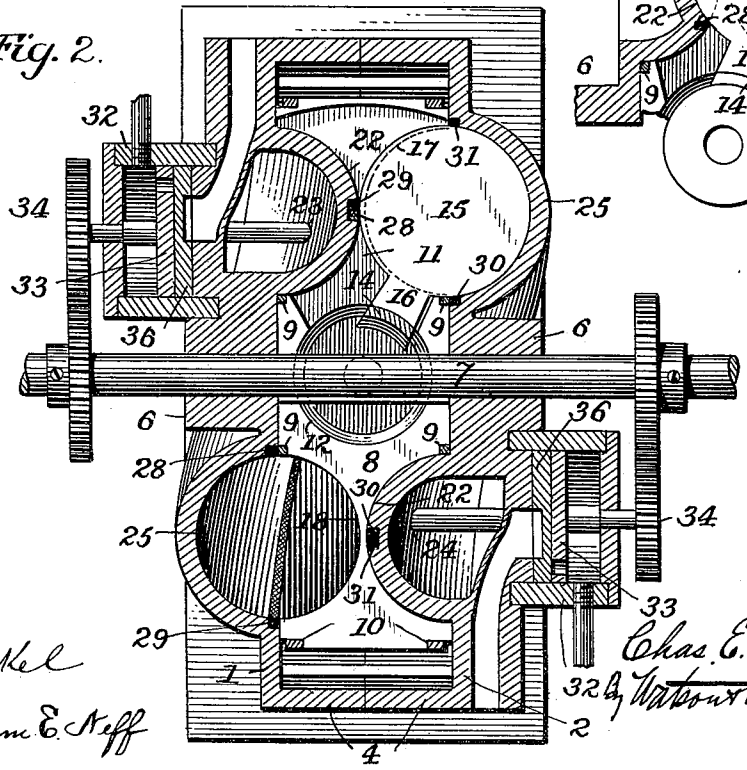


Fig. 2.



Witnesses
J. G. Finkel
William E. Neff

Inventor
Chas. E. Miller
By Watson & Watson
Attorneys

No. 636,829. Patented Nov. 14, 1899.

C. E. MILLER.

ROTARY ENGINE.

(Application filed Feb. 3, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

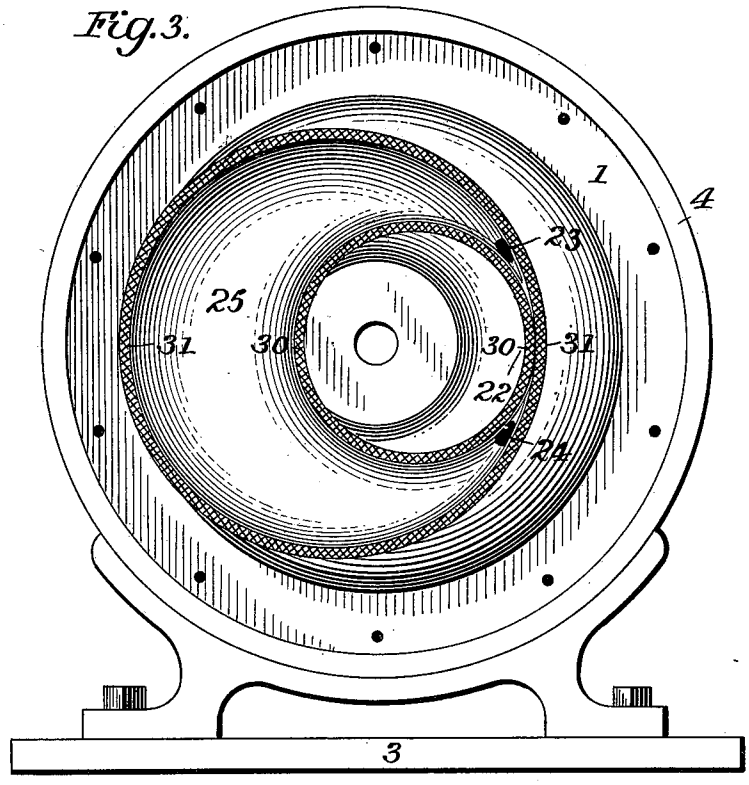


Fig. 4.

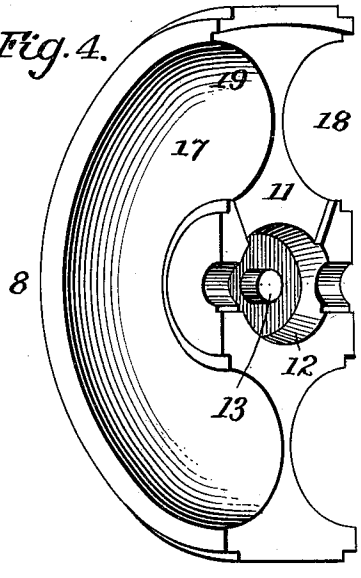
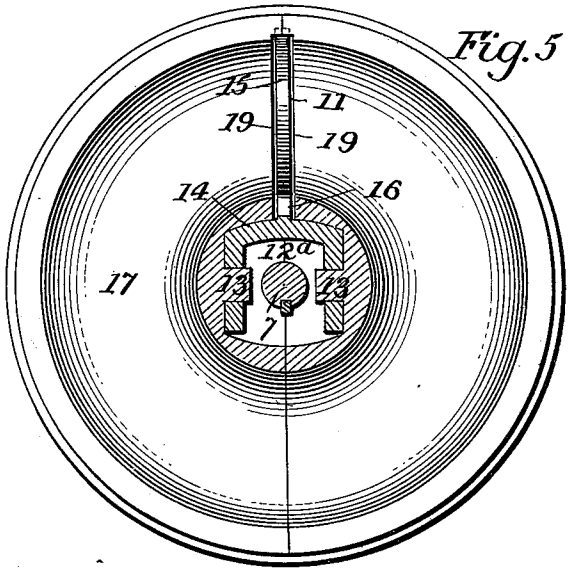


Fig. 5



Witnesses

J. J. Finkel

William E. Neff

Inventor

Charles E. Miller

By Watson & Watson

Attorneys

UNITED STATES PATENT OFFICE.

CHARLES E. MILLER, OF SCRANTON, PENNSYLVANIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 636,829, dated November 14, 1899.

Application filed February 3, 1899. Serial No. 704,386. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. MILLER, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

The object of my invention is to provide a rotary steam-engine in which the frictional resistance is small in proportion to the piston area exposed to the force of the steam.

In the accompanying drawings, which illustrate my invention, Figure 1 is a vertical section through the center of the engine. Fig. 2 is a horizontal section through the center of the engine, the position of the piston being shown between the inlet and exhaust ports. Fig. 3 is an interior side view of one-half of the engine-casing. Fig. 4 is a perspective view of one-half of piston-carrier. Fig. 5 is a side view of the piston-carrier, partly in section, showing the piston in position; and Fig. 6 is a view illustrating the relative positions of the piston and carrier when the former is receding from one of the inlet-ports or approaching an exhaust-port.

Referring to the drawings, 1 and 2 indicate the opposite halves of the steam casing or cylinder of my improved engine, said casing being mounted upon a suitable base 3. Each side of the casing is, as shown in Fig. 3, circular in form and provided with a peripheral flange 4, which abuts against a similar flange upon the opposite side of the casing, forming thereby the cylindrical wall of the casing. The two parts of the cylinder are held together by suitable bolts 5, which pass through the sides near the periphery. The casing is provided centrally of its opposite sides with suitable bearings 6, in which the shaft 7 is journaled. Within the casing and keyed or otherwise suitably secured to the shaft is a piston-carrier 8, the perimeter of which is concentric with the shaft. For convenience in assembling the piston-carrier is made in halves, as shown, which are afterward secured together with steel bands 9 and 10, which are shrunk onto the hub and face of the carrier. A radial slot or opening 11, passing through the web of the carrier, is formed between the opposing faces of the parts, and the hub of each part is formed with a circular recess 12 at right angles to the line of the shaft, as shown in Fig. 4, so that when the parts are put together a hollow space 12^a will be formed in the central part of the hub, which space opens into the slot 11. Formed integral with each half of the piston-carrier and projecting into the space 12^a at right angles to the shaft is a stud 13, the studs on each half being opposed to each other and forming journals for the opposite sides of the yoke 14, to which a circular piston 15 within the opening 11 is connected by a neck 16.

The web of the piston-carrier is continuous throughout, with the exception of the radial opening for the piston, and its opposite sides between the hub and the rim are grooved out, leaving annular concave surfaces 17 and 18. The opposite faces of the slot 11 are provided with a suitable packing 19, and the perimeter of the piston 11 is also provided with packing-rings. As the web of the piston-carrier is not intended to form a bearing-surface for the support of the piston and to receive the strains put upon the piston by the steam-pressure, it may be made quite narrow, so as to cover but a small portion of the piston area. The web forms the dividing-partition between the steam-chambers in the opposite sides of the casing and need only be thick enough to have the required mechanical strength for this purpose.

The opposing walls of the casing are provided with annular guideways 20 and 21, within which the piston 15 travels, these guideways being inclined to the plane of the piston-carrier, so that as the latter revolves the piston will oscillate through the opening 11. As shown in Figs. 2 and 3, each guideway consists of a part which is convex at a point 22 between the inlet and outlet ports 23 and 24, merging from convexity at this point into a semicircular concave groove at the diametrically opposite point 25. The guideways in the opposite sides of the casing are alike in all respects, but are arranged so that the part of greatest convexity in one will be opposite the part of greatest concavity in the other.

The space between the piston-carrier and the concave surface of each guideway forms a steam-space into which steam is admitted for driving the piston. The abutment-sur-

faces are formed between the convex portion 22 of each guideway and the opposing concave surfaces of the piston-carrier. The inlet and outlet ports for each steam-space are of course located on opposite sides of the abutment in the usual manner, as shown in Fig. 3. In Fig. 2, 23 represents the inlet-port for one steam-space and 24 the exhaust-port for the other steam-space, or vice versa, according to the direction of rotation of the piston.

In order to preserve steam-tight joints between the piston, the casing, and the carrier, I arrange packing-rings 28, 29, 30, and 31 along the edges of the guideways, said packing-rings abutting against the piston-carrier and also against the edge of the piston-disk in its travels. The rings thus arranged on each wall of the casing are eccentric to each other, as shown in Fig. 3, and meet between the inlet and outlet ports at the point of greatest convexity. These rings are the only packings required between the carrier and the casing, and the abutment between the inlet and outlet ports is formed at the meeting-point of the packing-rings.

By mounting the piston upon the studs or trunnions 13 I avoid the heavy friction which would otherwise occur between the piston and the face of the slot 11 in the movement of the former through the latter. There is no side pressure to the piston other than the force exerted upon it by the guideways in transferring it from one side to the other of the carrier, the only resistance to this movement being the friction of the packing within the slot 11, which friction is only great enough to preserve a steam-tight joint. It will also be noticed that while the greater part of the piston is at all times exposed to the force of the steam not more than one-half of its perimeter is in frictional contact with the casing.

By making the web of the piston-carrier narrow and concave and extending the convex portion of the guideway inward until it abuts against the carrier almost the full area of the piston is exposed to the steam in the opposite chamber as it passes the abutment-point, while at other points in its revolution the piston is only shielded from the steam by the width of the carrier-web.

Any suitable valve arrangement may be employed for controlling the admission of steam and the exhaust. As shown in the drawings, a cylindrical valve-casing 32 is set into each side of the engine opposite the inlet and exhaust ports, and within this casing is arranged a rotatable valve 33, operated by gearing 34, connected with the shaft. A reversing-valve 36 is interposed between the inlet and exhaust ports and the rotatable valve. As the arrangement of the valves forms no part of my invention, a more detailed description is unnecessary.

The form of the piston may vary from a true circle, the grooves in the casing and carrier being arranged to correspond; but I prefer the circular form as affording the greatest area with a minimum amount of friction. The terms "concave" and "convex" in this specification are not to be taken as meaning merely the true arc of a circle.

From the foregoing description the operation of the engine will be readily understood by those familiar with the art. Assuming the piston to be traveling from the observer in Fig. 2, after it has moved past the inlet-port 23 into the position indicated in Fig. 6 steam will be admitted to the groove 21 behind the piston, and when it has completed a revolution the steam will exhaust through the port on the opposite side of the abutment. Similarly after the engine has made half a revolution and the piston commences to enter the guide-groove 20 steam will be admitted to said groove and will exhaust from the port 24.

Having described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a rotary engine, the combination with a casing and a shaft, of a piston-carrier mounted upon the shaft within the casing, and having an opening in its web, a piston within said opening, guideways in the casing inclined to the plane of the carrier and varying in section from convex to concave, and packing-rings extending along the edges of said guideways, substantially as described.

2. In a rotary engine, the combination with a casing and a shaft, of a piston-carrier mounted upon the shaft within the casing and having an opening in its web, a piston pivoted at its inner portion to the carrier and adapted to oscillate through the opening, and guideways in the casing inclined to the plane of the carrier, and varying in section from convex to concave, substantially as described.

3. In a rotary engine, the combination with the casing and shaft of the piston-carrier upon the shaft provided with a radial opening, a piston mounted upon trunions within the hub of the carrier and adapted to oscillate through the opening and guideways for said piston inclined to the plane of the carrier, substantially as described.

4. In a rotary engine the combination with a casing and a shaft of a piston-carrier secured to the shaft and having a double-concave web and an opening through said web, a piston pivoted to said carrier and movable through the opening, and annular guideways for said piston, said guideways being inclined to the plane of the carrier, and each guideway varying in cross-section from convex to concave.

5. In a rotary engine, the combination with a casing and a shaft of a piston-carrier secured to the shaft, and having a double-concave web, and an opening through said web, a circular piston movable through the opening, and annular guideways in the casing opposing the said concave web, said guideways being inclined to the plane of the carrier, and

each guideway varying in cross-section from convex to concave.

6. In a rotary engine, the combination with a casing and a shaft of a piston-carrier secured to the shaft and having a double-concave web, and an opening through said web, a circular piston movable through the opening, annular guideways for said piston, said guideways being inclined to the plane of the carrier, and each guideway varying in cross-section from convex to concave, and having packing-rings which meet at the convex portion and extend around the edges of the concave portion.

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

CHARLES E. MILLER.

Witnesses:
ROBERT WATSON,
R. LOUIS GRAMBS.