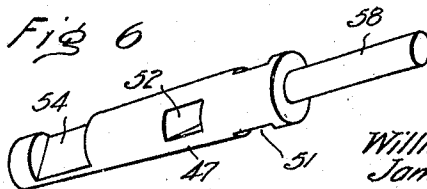
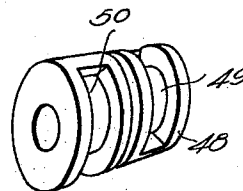
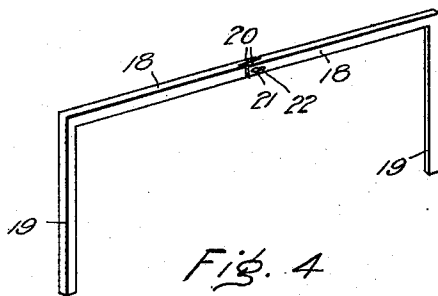
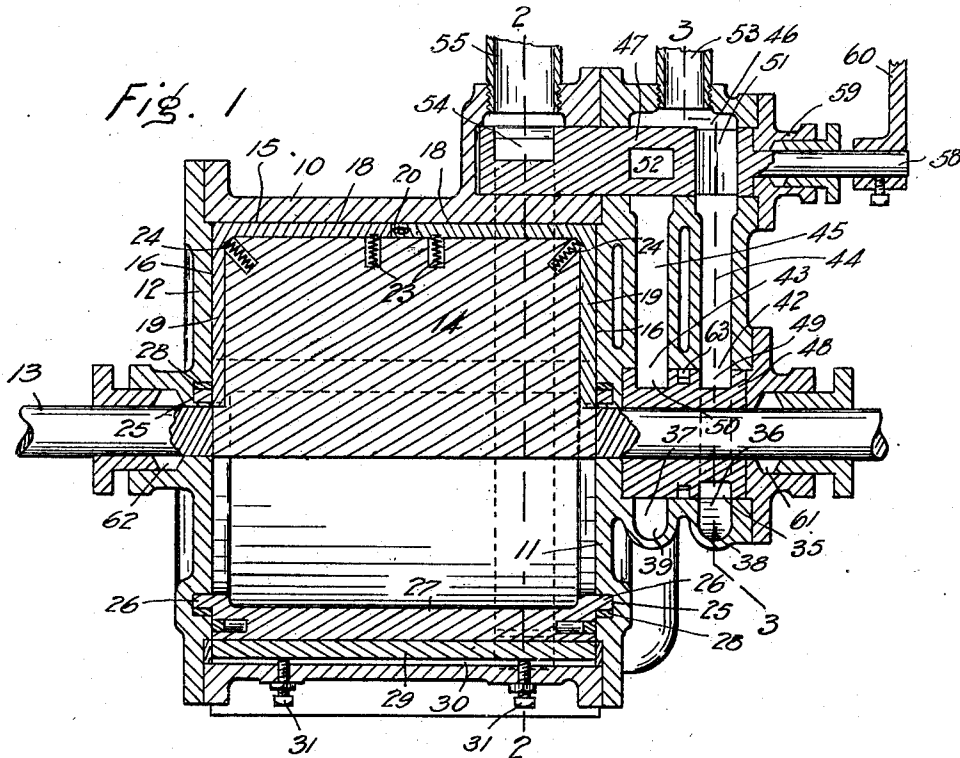


980,402.

W. & J. BIRRELL.
 ROTARY ENGINE.
 APPLICATION FILED AUG. 10, 1909.

Patented Jan. 3, 1911.

2 SHEETS—SHEET 1.



WITNESSES:

H. Barnes
 A. H. Shoemaker

INVENTORS:

William Birrell and
 James Birrell

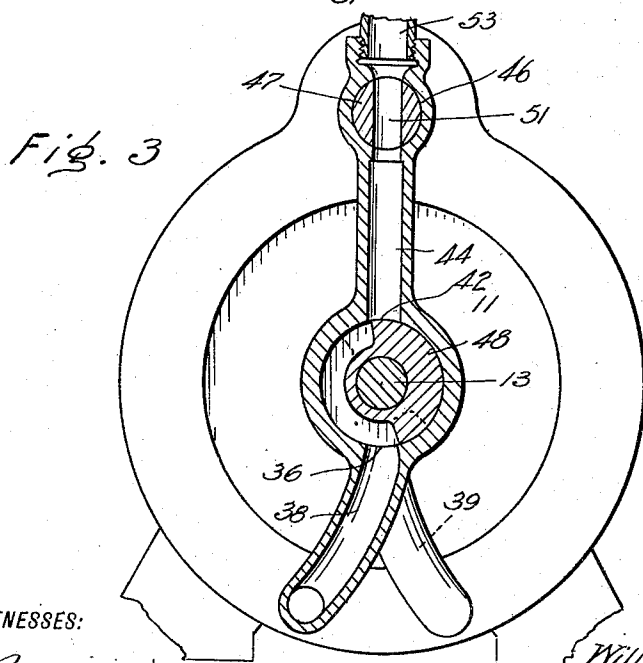
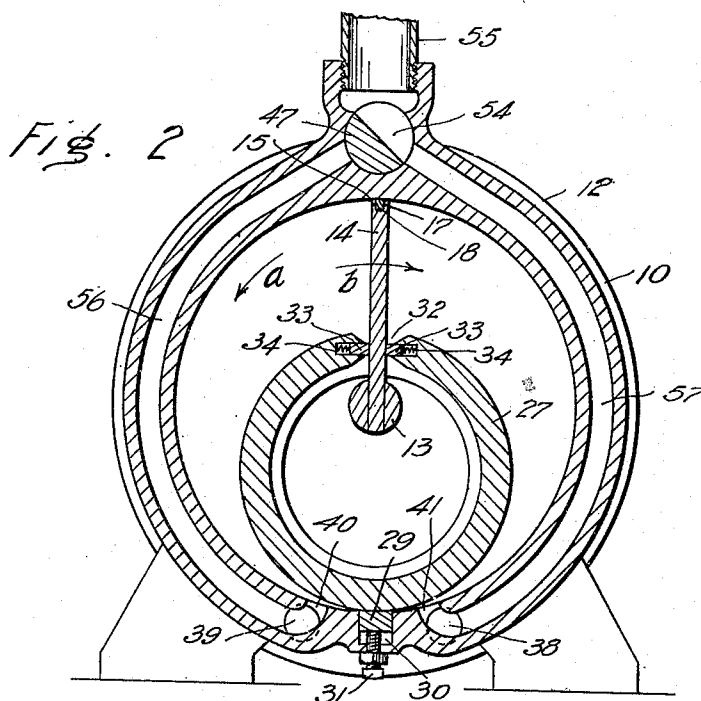
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 2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

WILLIAM BIRRELL AND JAMES BIRRELL, OF CARBONADO, WASHINGTON.

ROTARY ENGINE.

980,402.

Specification of Letters Patent.

Patented Jan. 3, 1911.

Application filed August 10, 1909. Serial No. 512,139.

To all whom it may concern:

Be it known that we, WILLIAM BIRRELL and JAMES BIRRELL, citizens of the United States, residing at Carbonado, in the county of Pierce and State of Washington, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

The object of this invention is the improvement in the efficiency of rotary engines.

The invention consists in the novel construction, adaptation and combination of parts as will be hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a longitudinal vertical section of an engine embodying our invention. Figs. 2 and 3 are cross sectional views respectively taken through 2—2 and 3—3 of Fig. 1. Fig. 4 is a perspective view of the piston packing strips. Fig. 5 is a perspective view of the main steam valve. Fig. 6 is a like view of the supplemental or reversing valve.

The reference numeral 10 designates the engine cylinder which is provided, as shown, with removable heads 11 and 12. Extending axially through the cylinder bore and said heads is a power shaft 13 whereupon is carried a piston-wing 14 which is arranged radially of the shaft and of a width and length to allow of its revolving within the cylinder. About the edges 15 and 16 of said wing is a groove 17 for the reception of a two-part packing strip, which is shown detached in Fig. 4. Each part of the packing strip is formed with two rectangularly directed limbs 18 and 19 and with the adjoining ends of the aligned limbs 18 of the two parts formed with overlapping portions 20 which are connected for end-wise movement by a pin 21 extending through a longitudinal slot, such as 22, in the respective limbs 18. To afford contact of said packing strip with the periphery of the cylinder and the inner faces of the heads, we employ springs such as 23 and 24. The former are located in proximity to the joint of the strip parts and are arranged rectangularly to the shaft and tend to press the packing strip radially outward; while the others, 24, are disposed at the corners and inclined so as to serve to urge the strip parts diagonally outward for causing the limbs of the affected parts to respectively bear against the pe-

riphery of the cylinder and the inner faces of the heads. Provided in each of the heads is an annular recess 25 arranged eccentrically of the shaft 13 to house correspondingly shaped flanges or extensions 26 provided at the ends of a drum 27 and of a size to also accommodate a packing ring 28 in each recess. The axis of the recesses is located in the same vertical plane with and below the axis of the shaft. The external diameter of the drum is such that it will contact, or nearly so, with the inner periphery of the cylinder at the bottom. In order, however, to prevent the passage of steam between the drum and the cylinder a longitudinally disposed packing piece 29 is provided within a groove 30 of the cylinder and is adjusted by means of take-up screws 31 extending through correspondingly threaded holes in the cylinder. Intermediate the drum extensions 26 is a longitudinal slot 32 through which the aforesaid wing 14 extends and upon opposite sides of the wing spring pressed packing pieces 33 are provided in slots 34 of the drum structure, as illustrated in Fig. 2.

In the cylinder head 11 is a cylinder valve-chamber 35 having at its under side two ports 36 and 37, Fig. 1, which are arranged in longitudinal alinement with each other and are communicatively connected through passages 38 and 39 with openings 40 and 41 provided in the cylinder upon opposite sides of and in proximity to the packing piece 29, Fig. 2. Said valve chamber is provided with ports 42 and 43 which are respectively arranged diametrically opposite the ports 36 and 37 and are communicatively connected by passages 44 and 45 with the chamber 46 of a reversing valve 47. The valve 48, which controls the flow of steam through the chamber 35 is comprised of a cylindrical body fixedly secured to the shaft 13 for rotation therewith, and is formed in its circumferential surface with two arc-shaped cavities 49 and 50. The cavity 49 of the valve is arranged to register with the valve ports 36 and 42 to establish communication therebetween in each rotation of the valve. The cavity 50 is arranged to similarly make communication between the valve ports 37 and 43.

The reversing valve 47 is of a cylindrical shape and is provided with two passages 51

and 52 which extend diametrically there-through but at right angles from each other. These passages are disposed so that the valve when suitably turned will afford communication between a steam supply pipe 53 and either of the passages 44 and 45. Said reversing valve is also adapted to regulate the engine exhaust, and is accordingly cut away, as at 54, to provide a communication between the discharge pipe 55 and the passages 56 and 57 which are respectively connected with the passages 36 and 37. 58 represents the stem of the valve 47 extending through a stuffing box 59 and provided near its outer end with a handle 60 whereby the valve is manually controlled. 61 and 62 are stuffing-boxes in the heads for preventing the leakage of steam about the shaft 13, and a packing ring 63 is advantageously inserted in the valve 48 and between the cavities 49 and 50 of the same.

The operation of the invention is as follows: When the reversing valve 47 is in the position in which it is represented in Figs. 1 and 3, the steam is admitted from the supply pipe 53 and is conducted through the valve passage 51 to the passage 44 whence the steam is delivered through the cavity 49 of the valve 48 as it revolves by the ports 42 and 36, into passage 38 to flow into the cylinder through the opening 41 thereof. The steam acting against the wing 14 causes the same to revolve in the direction indicated by the arrow *a* in Fig. 2, whereupon the steam employed in the previous cycle of operation is exhausted through the passage 56 and the discharge pipe 55 when the valve 47 is properly set to establish communication therebetween through cavity 54 of the valve. To reverse the engine, the valve 47 is given a partial rotation to have the valve passage 52 brought into position to admit steam through the passage 45, through the valve cavity 50, and the passage 38 to the cylinder and in so doing the valve 47, as represented in Fig. 2, is adjusted to provide an exit for the exhaust steam through the passage 57 with a consequent rotation of the engine shaft in the direction of the arrow *b*.

From an inspection of the drawings, it is obvious that the wing 14 is progressively protruded from the drum during the first half of each revolution and then is gradually retracted until it is entirely shrouded when passing the packing strip 29.

What we claim as our invention, is—

1. In a rotary engine, a cylinder, a drum eccentric to the cylinder and mounted for rotation in annular grooves provided in the cylinder heads, a shaft concentric to the cylinder, a piston-wing rigid with the shaft and extending through a slot in said drum, a valve mounted upon the shaft and provided with two spaced recesses, a chamber for said valve, said chamber being provided with two

pair of spaced ports, one pair of said ports being respectively connected by passages with openings provided in the cylinder at opposite sides of the drum axis, a second valve provided with a cavity and two passages which extend diametrically there-through, said valve passages being arranged at right angles from each other, a chamber for the second valve having communicative connections with the first named passages and also with the ports in the other chamber which are extraneous to such passages, openings in the second named chamber for the supply and exhaust of steam, and means whereby the second named valve may be adjusted to cause the flow of steam into the cylinder through either of the recesses of the first named valve in the rotation of the latter with the shaft.

2. In a rotary engine, a cylinder, a drum eccentric to the cylinder and mounted for rotation in annular grooves provided in the cylinder heads, a shaft concentric to the cylinder, a packing strip seated in a groove in the cylinder, means for adjusting the packing strip and maintaining the same in contact with said drum, a piston-wing rigid with the shaft and extending through a slot in said drum, a valve mounted upon the shaft and provided with two spaced recesses, a chamber provided in one of the cylinder heads for said valve, said chamber being provided with two pair of spaced ports, one pair of said ports being respectively connected by passages with openings provided in the cylinder at opposite sides of said packing strip, a second valve provided with a cavity and two passages which extend diametrically therethrough, said valve passages being arranged at right angles from each other, a chamber for the second named valve having communicative connections with the first named passages and also with the ports in the other chamber which are extraneous to such passages, openings in the second named chamber for the supply and exhaust of steam, and means whereby the second named valve may be adjusted to cause the flow of steam into the cylinder through either of the recesses of the first named valve in the rotation of the latter with the shaft.

3. In a rotary engine, a cylinder, a drum eccentric to the cylinder and mounted for rotation in annular grooves provided in the cylinder heads, a shaft concentric to the cylinder, a packing strip seated in a groove in the cylinder, means for adjusting the packing strip and maintaining the same in contact with said drum, a piston-wing rigid with the shaft and extending through a slot in said drum, a valve mounted upon the shaft and provided with two spaced recesses, a chamber provided in one of the cylinder heads for said valve, said chamber being provided with two pairs of diametrically

opposite spaced ports, the ports on one side of the valve being respectively connected by passages with openings provided in the cylinder at opposite sides of said packing strip, a second valve provided with a cavity and two passages which extend diametrically therethrough, said valve passages being arranged at right angles from each other, a chamber for the second named valve having communicative connections with the first named passages and also with the ports in the other chamber which are opposite such passages, openings in the second named chamber for the supply and exhaust of steam, and means whereby the second named valve may be adjusted to cause the flow of steam into the cylinder through either of the recesses of the first named valve in the rotation of the latter with the shaft.

4. In a rotary engine, a cylinder, a drum eccentric to the cylinder and mounted for rotation in annular grooves provided in the cylinder heads, a shaft concentric to the cylinder, a packing strip seated in a groove in the cylinder, means for adjusting the packing strip and maintaining the same in contact with said drum, a piston-wing rigid with the shaft and extending through a slot in said drum, a two-part packing piece seated in grooves provided in the outer edges of the wing, the parts of said packing piece being each formed with two rectangularly disposed limbs and with a limb of one part adapted to overlie the corresponding limb of the other part, springs tending to urge the respective parts of said packing piece radially outward and asunder, a valve mounted upon the shaft and provided with two spaced recesses, a chamber for said valve, said chamber being provided with two pair of spaced ports, one pair of said ports being respectively connected by passages with openings provided in the cylinder at opposite sides of the packing strip, a second valve provided with a cavity and two passages which extend diametrically therethrough, said valve passages being arranged at right angles from each other, a chamber for the second valve having communicative connections with the first named passages and also with the ports in the other chamber which are extraneous to such passages, openings in the second named chamber for the supply and exhaust of steam, and means whereby the second named valve may be adjusted to cause the flow of steam into the cylinder through either of the recesses of the first named valve in the rotation of the latter with the shaft.

5. In a rotary engine, a cylinder, a drum eccentric to the cylinder and mounted for rotation in annular grooves provided in the cylinder heads, a shaft concentric to the cylinder, a packing strip seated in a groove in the cylinder, means for adjusting the packing strip and maintaining the same in

contact with said drum, a piston-wing rigid with the shaft and extending through a slot in said drum, a two-part packing piece seated in grooves provided in the outer edges of the wing, the parts of said packing piece being each formed with two rectangularly disposed limbs and with a limb of one part adapted to overlie the corresponding limb of the other part, springs tending to urge the respective parts of said packing piece radially outward and asunder, a valve mounted upon the shaft and provided with two spaced recesses, a chamber provided in one of the cylinder heads for said valve, said chamber being provided with two pairs of diametrically opposite spaced ports, the ports on one side of the valve being respectively connected by passages with openings provided in the cylinder at opposite sides of said packing strip, a second valve provided with a cavity and two passages which extend diametrically therethrough, said valve passages being arranged at right angles from each other, a chamber for the second named valve having communicative connections with the first named passages and also with the ports in the other chamber which are opposite such passages, openings in the second named chamber for the supply and exhaust of steam, and means whereby the second named valve may be adjusted to cause the flow of steam into the cylinder through either of the recesses of the first named valve in the rotation of the latter with the cylinder.

6. In a rotary engine, a cylinder, a drum eccentric to the cylinder and mounted for rotation therein, a shaft concentric to the cylinder, a piston-wing carried by the shaft and extending through a slot provided in the drum, a valve mounted upon the shaft and provided with two spaced recesses, a chamber for said valve and provided with spaced ports which are respectively connected with openings provided in the cylinder at opposite sides of the drum axis, a second valve provided with passages extending therethrough, a chamber for the second valve and communicatively connected with said cylinder openings and with the aforesaid valve chamber, openings in the second named chamber for the supply and exhaust of steam, and means for adjusting the second named valve to selectively cause steam to flow into the cylinder through either of the recesses of the first named valve as the latter is rotated with the shaft.

7. In a rotary engine, a cylinder, a drum eccentric to the cylinder and mounted for rotation therein, a shaft concentric to the cylinder, a piston-wing carried by the shaft and extending through a slot provided in the drum, a valve mounted upon the shaft and provided with two spaced recesses, and a chamber for said valve and provided with spaced ports which are respectively connect-

ed with openings provided in the cylinder
at opposite sides of the drum axis, in com-
bination with a reversing valve for supply-
ing steam to said chamber whereby the steam
is selectively delivered through one or the
5 other of the recesses of the first named valve
and the respective cylinder openings to pre-

determinately effect the rotation of the shaft
in one direction or the other.

WILLIAM BIRRELL.
JAMES BIRRELL.

Witnesses:

HENRY REIMER,
WM. ROSS.