No. 619,801.

Patented Feb. 21, 1899.

F. R. STRUNK.

ROTARY ENGINE.

(Application filed Nov. 13, 1897.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

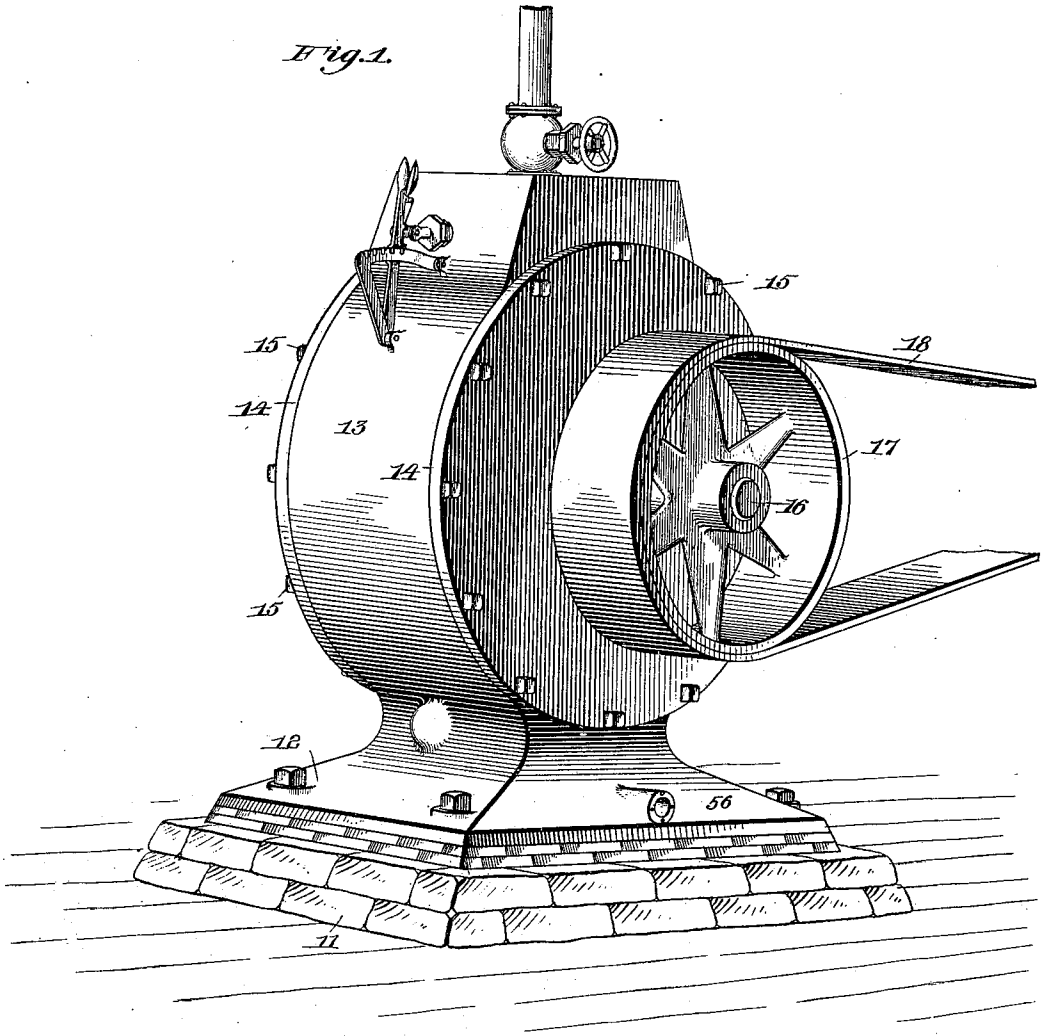


Fig. 6.

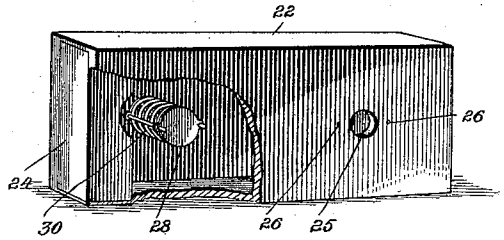


Fig. 7.

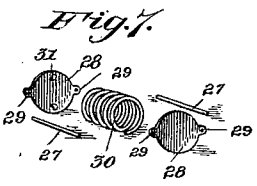
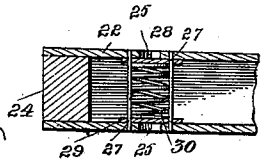


Fig. 8.



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No. 619,801. Patented Feb. 21, 1899.

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(Application filed Nov. 13, 1897.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

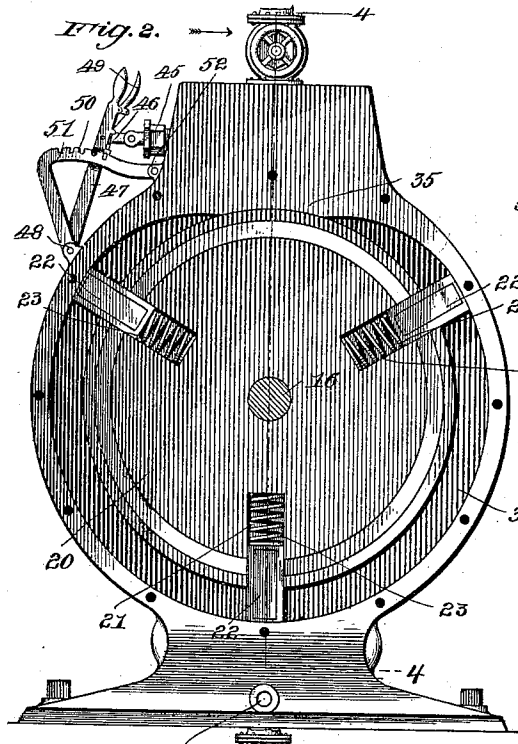


Fig. 3.

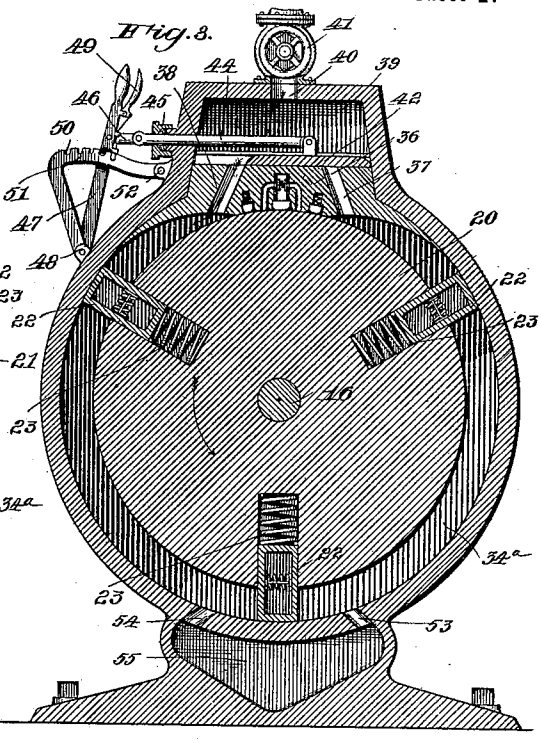


Fig. 4.

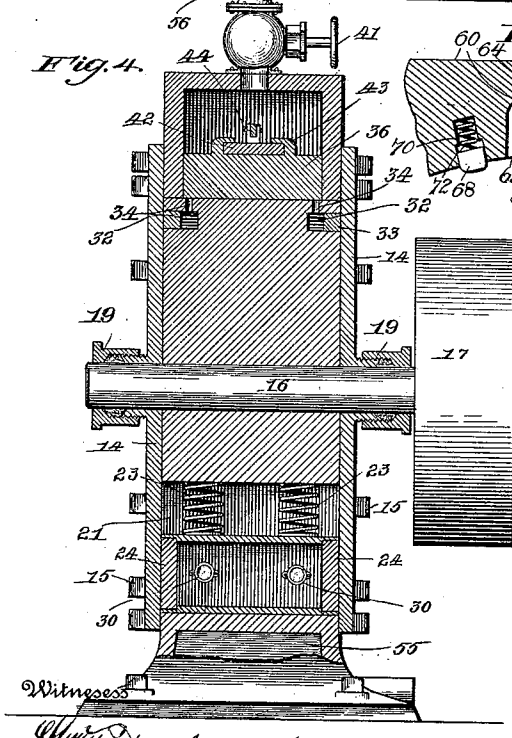


Fig. 9.

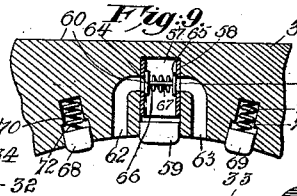
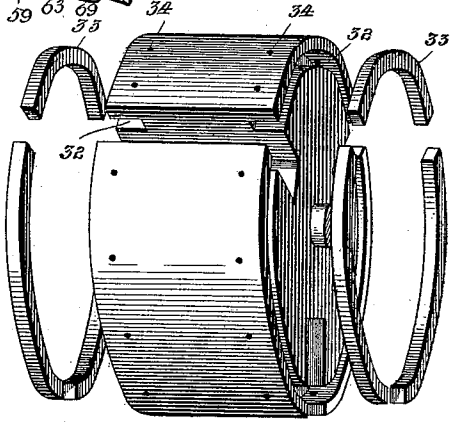


Fig. 5.



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UNITED STATES PATENT OFFICE.

FRANK R. STRUNK, OF SPRINGFIELD, MISSOURI.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 619,801, dated February 21, 1899.

Application filed November 13, 1897. Serial No. 658,447. (No model.)

To all whom it may concern:

Be it known that I, FRANK R. STRUNK, a citizen of the United States, residing at Springfield, in the county of Greene and State of Missouri, have invented a new and useful Rotary Engine, of which the following is a specification.

My invention is in the nature of a steam-engine of the class known as "rotary" engines, in which the steam is directly applied to pistons inclosed in a cylinder and mounted upon a piston-head secured upon a shaft journaled in the cylinder-heads at the central axial line of both piston-head and cylinder, the effect of this application of the steam being to cause the rotation of the piston, piston-heads, and shaft without the necessity of converting rectilinear motion to rotary motion by means of cranks and pitmen, as in the ordinary reciprocating piston-engines.

The object of my invention is to generally improve the construction and operation of this class of engines, a special object being to provide means whereby the ends of the pistons will be kept closely in contact with the inner surface of the cylinder-heads by means of the pressure of the steam admitted within the cylinder.

A further object of my invention is to provide means whereby a close steam-tight joint is maintained between the ends of the piston-heads and the cylinder-heads by the pressure of the steam admitted into the cylinder.

With these objects in view my invention consists in the improved construction, arrangement, and combination of parts hereinafter fully described, and afterward specifically pointed out in the appended claim.

In order to enable others skilled in the art to which my invention most nearly appertains to make and use the same, I will now proceed to describe its construction and operation, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a perspective view of a rotary engine constructed in accordance with my invention in position for practical operation. Fig. 2 is an end elevation thereof with the cylinder-head removed and the shaft shown in section. Fig. 3 is a vertical section on a plane cutting diametrically through the shaft. Fig. 4 is a central vertical section on a plane cutting longitudinally through the shaft on the line 4 4 of Fig. 2. Fig. 5 is a detail perspective view of the piston-head with the sectional bearing-rings detached in position ready for insertion into the grooves. Fig. 6 is a detail perspective view illustrating one of the pistons detached from the piston-head, a portion being broken away to show the valve in the interior. Fig. 7 is a detail perspective view of the various parts of one of the piston-valves detached from each other, but in their proper relative positions. Fig. 8 is a fragmentary detail longitudinal sectional view partially through one of the pistons. Fig. 9 is a fragmentary detail view, on an enlarged scale, on the same plane as Fig. 3.

Like numerals of reference mark the same parts wherever they occur in the various figures of the drawings.

Referring to the drawings by numerals, 11 indicates a foundation of any suitable material or design, upon which is secured the base 12 of a cylinder 13, provided with the ordinary heads 14, secured thereto by bolts 15 in the usual manner. A shaft 16, carrying a pulley 17, which drives a belt 18, is journaled in the cylinder-heads, the journals being rendered steam-tight by suitable stuffing-boxes 19. Upon the shaft 16, within the cylinder, is mounted a piston-head 20, concentric with the cylinder and having a plurality of radial grooves 21 extending from end to end. In each of these grooves a sliding piston 22 is mounted and is held normally in its outer position, with its outer surface in contact with the inner surface of the cylinder, by means of springs 23, located in the bottom of its grooves and bearing outward against its inner edge. The pistons 22 are formed hollow, with open ends, in which are located slidable blocks 24, the ends of said blocks resting in grooves formed in the interior surface of the inner and outer edges or sides of the piston.

In each side of the piston are two openings 25, one near each end, the openings in one side being directly opposite those in the other, as clearly shown in Fig. 8. Adjacent to each of the openings 25 are small openings 26, in which are supported the ends of rods 27, upon which are mounted valve-disks 28, the rods passing through openings in lugs 29 at the

sides of said disks, whereby the disks are slidable upon the rods. A spring 30 is engaged at each end with hooks 31 on the inside of the disks and serves to normally press the disks outward, so as to close the openings 25.

The ends of the piston-head between the radial grooves 21 are provided with grooves 32 parallel with the periphery of the cylinder and forming parts of an annular groove interrupted by the radial groove. In the grooves 32 are fitted curved bars 33, and openings 34 lead from the periphery of the cylinder into the grooves 32 behind these curved bars.

The piston-head is of less diameter than the cylinder, leaving a steam-space 34^a, and the cylinder has cut-off projections 35 on each side at the top reaching in to the circumference of the piston-head. Between these projections 35 in the bottom of the steam-chest is seated a block 36, the bottom of which also rests in contact with the circumference of the piston-head, steam-inlet ports 37 and 38 being formed therein, opening into the steam-space 34^a on each side of that portion of the block in contact with the piston-head.

Steam is admitted into the steam-chest 39 through a steam-pipe 40, provided with the usual valve 41. A valve-gate 42 rests upon the upper surface of the block 36 and is of a proper length to cover only one of the inlet-ports at a time, said gate being mounted to slide between ways 43, formed on top of the block 36.

A rod 44, connected with the valve-gate, passes through a stuffing-box 45 in the end of the steam-chest and is connected by a link 46 with a hand-lever 47, pivoted at 48 outside of the cylinder and provided with a pawl mechanism 49, engaging in the notches 50 of a curved rack 51, secured at 48 and 52 to the outside of the cylinder. Exhaust-ports 53 and 54 lead from the lower portion of the steam-space 34^a of the cylinder into a chamber 55, from which an exhaust-pipe 56 communicates with the open air.

The block 36 is chambered at 57, and a box or casing 58 is inserted in the chamber. Below the casing 58 is a plate 59, extending entirely across the block. Openings 60 and 61 lead from casing 58 to channels 62 and 63, which lead into the cylinder. A double spring-valve constructed similarly to those in the pistons, consisting of plates 64 and 65, spring 66, and bars 67, serve to alternately open and close the openings 60 and 61 as steam is admitted through channels 62 and 63, which steam, passing into chamber 57, serves to maintain plate 59 in close contact with the periphery of the piston-head.

Contact bars or plates 68 and 69 are seated in chambers 70 and 71 in the block 36 on each side of chamber 57 and are normally held outward by springs 72 and 73. By means of this arrangement any steam which might escape under plate 68 by reason of wear or a bad fit between the circumference of the piston-head and the inner surface of the block 36 will pass into and through channel 62 and opening 60 into casing 58 in the rear of the plate 59, forcing it into close contact with the circumference of the piston-head, thus insuring a close fit and a reliable cut-off at all times. When the piston-head is rotated in the opposite direction, plate 69, channel 63, and opening 61 will perform the same functions with the same result.

The operation of my invention may be described as follows: Presuming the parts to be in the positions illustrated in Figs. 2 and 3, steam admitted into the steam-chest through the pipe 40 will pass through the steam-port 38 into the steam-space 34^a and, pressing against the first piston on the left-hand side, will cause the piston-head and shaft to be rotated in that direction, such rotation bringing the several pistons in succession into a position to receive the impact of the steam in the same manner, whereby the movement is continued as long as the position of the valve is unaltered. About the time one piston reaches a position to be acted upon by the steam the piston-head in advance of it passes the exhaust-port 54, whereby the steam between those two pistons is exhausted. This exhausting operation is continuous as long as the engine is run in that direction. By shifting the lever 47 and engaging its pawl in the middle notch of the rack 51 the valve-gate will be moved to the left far enough to cover up and close both of the inlet-ports 37 and 38, which will cut off the steam and stop the engine. The further movement to the left of the shifting lever to a position in which its pawl will engage the outer notch of the curved rack will open the inlet-port 39, which will admit the steam to the opposite side of the cylinder and reverse the movement of the pistons and piston-head. When steam is admitted into the steam-chamber, as before stated, to start the engine, a portion thereof will pass through the openings 34 in the periphery of the piston-head into the bottom of the grooves 32 and will exert an outward pressure upon the curved bars 33, causing them to form a steam-tight joint against the cylinder-heads, while another portion of the steam will be admitted through the openings 25 in the side of the piston into the interior thereof, which will force the end blocks 24 of the pistons into steam-tight contact with the head of the cylinder. When the steam enters the opening 25, it will force one of the valve-disks 28 away from the opening in order to admit the steam and its force will be exerted against the inside of the other valve-disk 28 to hold the opening in the opposite side of the piston-head closed and prevent the escape of steam therefrom, so that its force must be exerted against the end blocks. It will be obvious also that a close fit between the cut-off block 36 and the outer surface of the piston-head will be maintained by the pressure of steam which might pass under plate 68 or 69 in the manner before explained, thus compensating

for any misfit between the piston-head and cut-off block.

It will of course be understood that the springs will always press the pistons outward and hold them in contact with the inner periphery of the cylinder.

From the foregoing description it will be seen that I have provided a rotary engine in which all the objects of my invention are accomplished. With the cylinder, the pistons, and the curved end bars properly lubricated, so as to reduce the friction between the parts to a minimum, proper steam-tight joints will be maintained between the contacting moving surfaces, and the means for maintaining such joints as described will preserve the steam-tight contact until the parts are entirely worn out.

While I have illustrated and described what I believe to be the best means for carrying out my invention, I do not wish to be understood as limiting myself to the exact construction and arrangement shown and described, but hold that such slight changes and variations as might suggest themselves to the ordinary mechanic would properly fall within the limit and scope of my invention.

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

The combination with the cylinder and piston-head, of the block 36 provided with chamber 57, the casing 58 in said chamber, the plate 59 extending across the block, openings 60, 61 and channels 62 and 63 being provided leading from casing 58 into the cylinder, and a double spring-valve consisting of plates 64 and 65 at openings 60 and 61, bars 67 between said plates, and spring 66 supported on the bars 67 and bearing against plates, all substantially as described.

FRANK R. STRUNK.

Witnesses:
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