J. SHAW.

ROTARY ENGINE.

APPLICATION FILED FEB. 28, 1913.

1,078,170.

Patented Nov. 11, 1913.

3 SHEETS—SHEET 1.

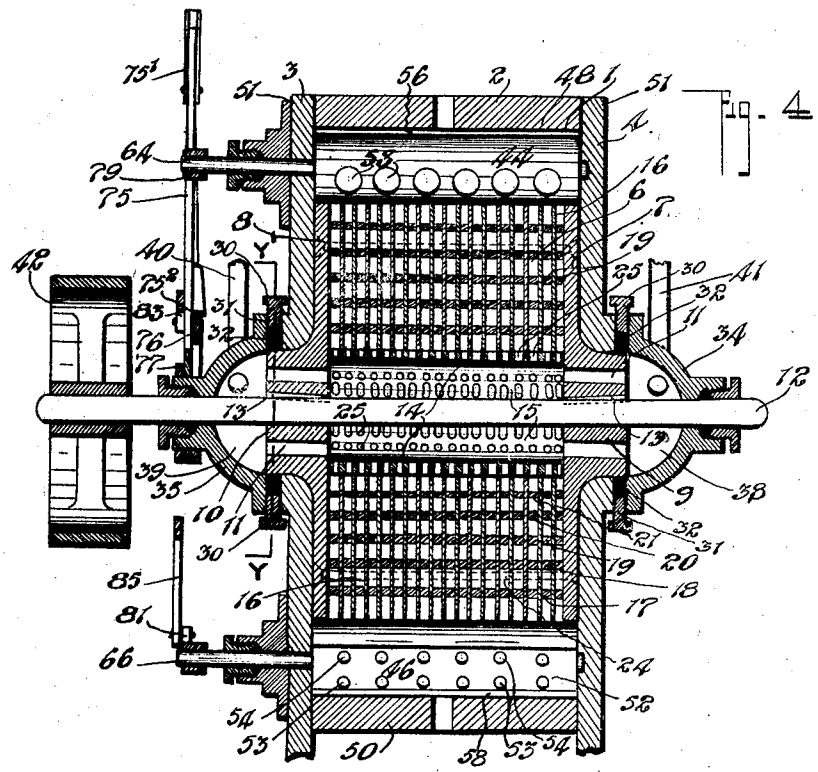


Fig. 4.

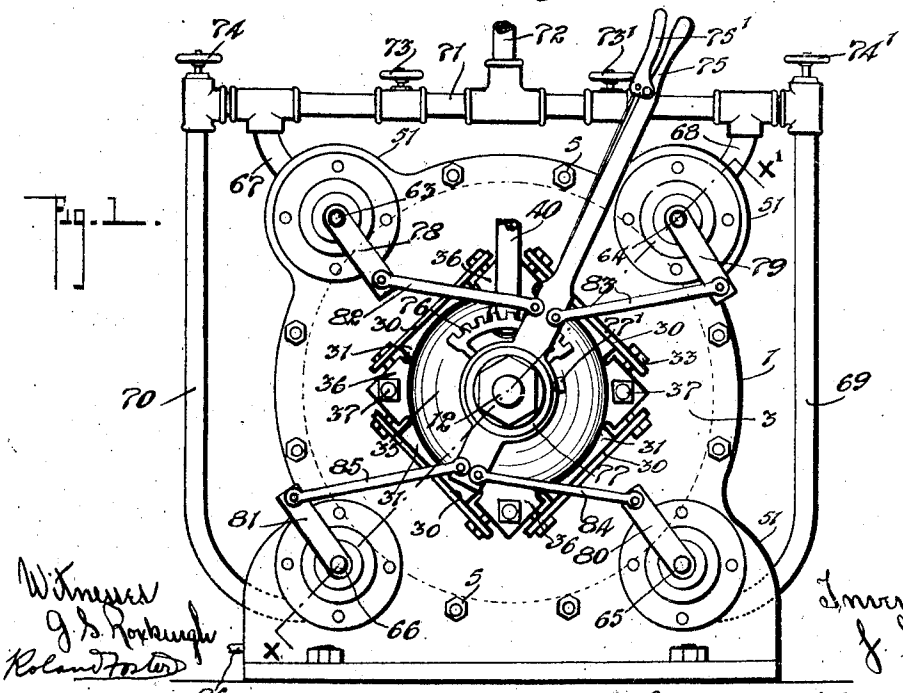


Fig. 1.

Witnesses
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3 SHEETS—SHEET 2.

Fig. 3.

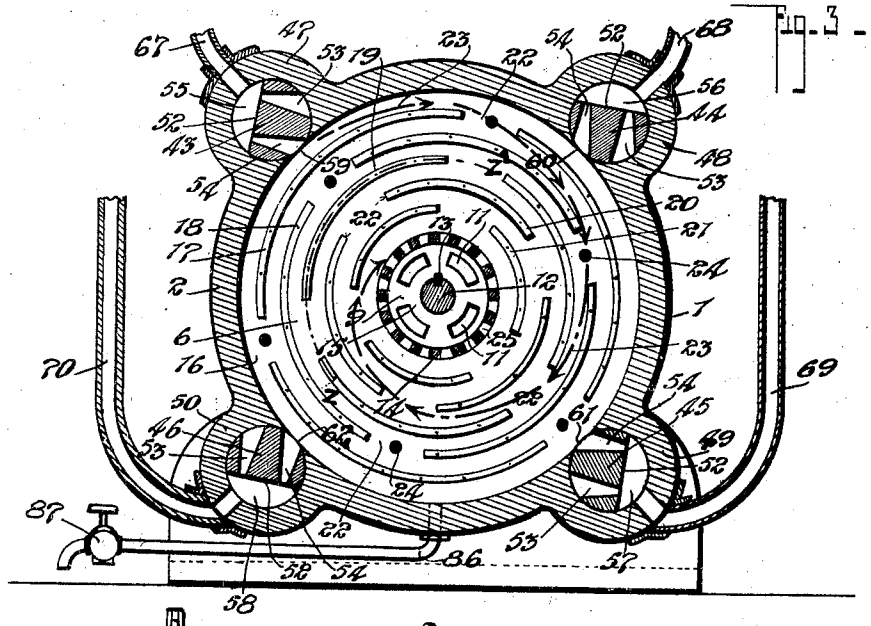
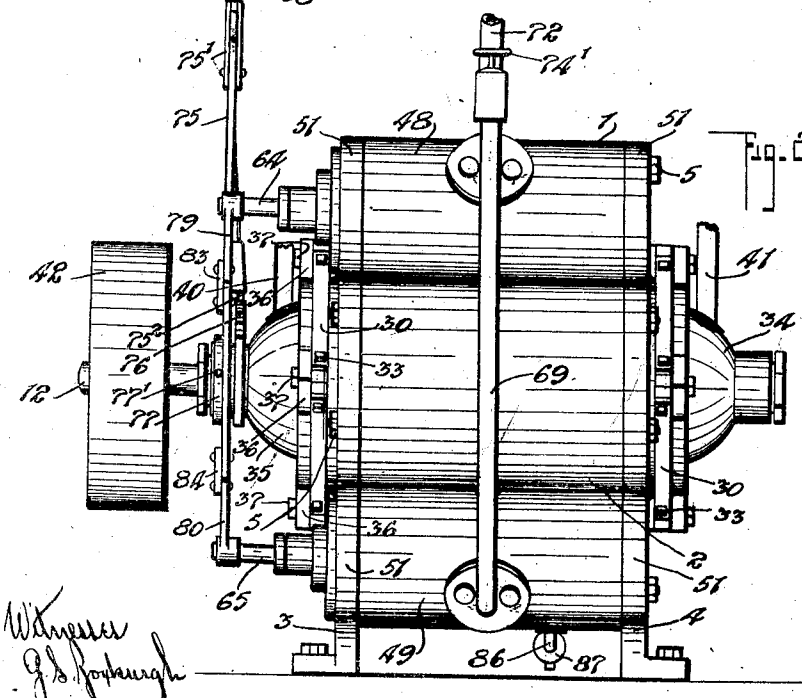


Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 5.

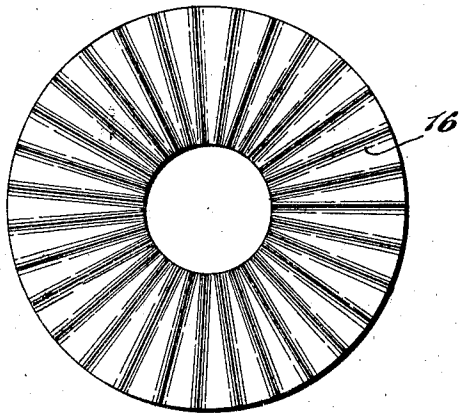




Fig. 6.

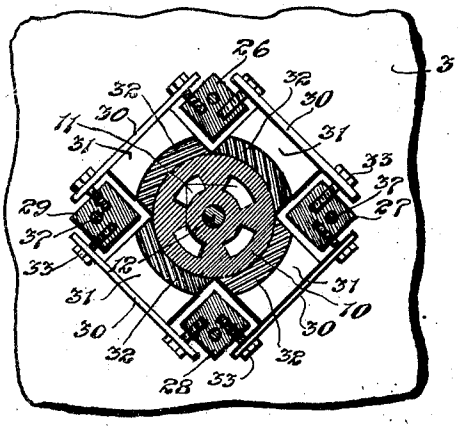


Fig. 7

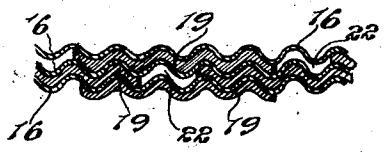


Fig. 8.

Witnesses
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UNITED STATES PATENT OFFICE.

JAMES SHAW, OF DAUPHIN, MANITOBA, CANADA.

ROTARY ENGINE.

1,078,170. Specification of Letters Patent. Patented Nov. 11, 1913.

Application filed February 28, 1913. Serial No. 751,224.

To all whom it may concern:

Be it known that I, JAMES SHAW, of the town of Dauphin, in the Province of Manitoba, Canada, have invented certain new and useful Improvements in Rotary Engines, of which the following is the specification.

The invention relates to an improvement in rotary engines and the object of the invention is to provide an easily assembled, efficient steam engine of the rotary type wherein the steam is fully expanded in spiral paths formed in a suitably incased rotatably mounted rotor.

A further object of the invention is, in an engine of the above type to construct the rotor in an inexpensive and durable manner and arrange it so that a large impinging surface is exposed in the spiral paths above mentioned in which the steam travels prior to exhausting.

A still further object of the invention is to provide an improved form of valve for admitting the steam to the rotor, the particular feature of the valve being that it is of the rotary type and that it is supplied with sets of nozzles for reversing purposes.

With the above objects in view the invention consists essentially in a stator, or casing, a rotor suitably mounted in the casing and presenting a plurality of disks spaced in a particular manner to provide spiral paths between them, a rotatably mounted drive shaft keyed to the rotor, a plurality of valves for admitting live steam between the disks at the circumference thereof, means for controlling the valves and means for releasing the exhaust steam from the centers of the disks to the exterior of the stator, the parts being arranged and constructed as hereinafter more particularly described and later pointed out in the appended claims.

Figure 1 represents an end view of a complete engine. Fig. 2 represents a side view of the same. Fig. 3 represents a vertical cross sectional view centrally through the engine. Fig. 4 represents a longitudinal sectional view through the engine, the section being taken in the plane denoted by the line X—X′ Fig. 1 certain parts being shown in side elevation. Fig. 5 represents a face view of one of the disks. Fig. 6 represents a side view of one of the disks. Fig. 7 is a vertical sectional view through parts of the rotor and stator, the section being taken in the plane denoted by the line Y—Y′ Fig. 4. Fig. 8 is a sectional view through a portion of the rotor, the section being taken in the plane denoted by the line Z—Z′ Fig. 3.

In the drawings like characters of reference indicate corresponding parts in each figure.

1 represents a stator, or inclosing casing which comprises a body piece 2 to which I have attached head plates 3 and 4 by suitably located bolts 5. Within the casing I have mounted a rotor 6, the construction of which is now described in detail.

7 and 8 are circular similar end plates fitted centrally with similar bosses 9 and 10 rotatably mounted in the head plates. The bosses are fitted with exhaust slots 11 arranged concentrically around a drive shaft 12 permanently fastened to the end plates by keys 13.

14 is a hollow tube located between the end plates 7 and 8 and surrounding the shaft, which tube forms an exhaust chamber 15 which communicates with the slots already mentioned.

16 are similar circular disks mounted on the tube 14 and located between the end plates, the disks being of the same diameter as the end plates. Each disk is corrugated as best shown in Figs. 5, 6 and 8 of the drawings and they are spaced apart by sets of spacing bars 17, 18, 19, 20 and 21 secured to the disks and arranged at different radii to the center of the disks.

The bars are all serpentine in form so as to fit between the corrugations of adjoining disks when the disks with attached bars are threaded on the tube. They are also bent concentric to the shaft. The bars comprising each set are arranged so that an opening is reserved at 22 between the adjacent ends of the bars in each set. These bars are spaced to provide virtually a series of spiral paths for the steam between the disks, one of these paths being shown in Fig. 3 of the drawings by a dotted line 23 which it will be noticed passes more or less in a spiral manner from the circumference of the disk to the center thereof.

When the end plates 7 and 8, tube 14 and disks with attached spacing bars have been assembled they are fastened permanently together by tie rods 24 passing through the disks and into the end plates.

The central tube 14 is perforated at 25

to allow the steam admitted between the disks to escape through the tube to the exhaust chamber 15. The rotor, it will be noticed is rotatably mounted in the stator, the outer edges of the disks and end plates making a frictional contact with the body piece 2.

The head plates 3 and 4 are cast with four projecting spaced studs 26, 27, 28 and 29 arranged concentric to the shaft 12, which studs are made substantially square in cross section (see Fig. 7) to carry follower bars 30 of a T-shaped section having the webs 31 thereof extending between the studs and bearing continuously on the backs of segmental bushings 32 which receive the protruding ends of the bosses 9 and 10. The follower bars are held to the studs by adjustable set screws 33. As the bushings wear the set screws can be tightened up which action will draw the follower bars in toward the bosses.

34 and 35 are stuffing boxes receiving rotatably the extending ends of the shaft 12. These stuffing boxes bear against the outer faces of the follower bars and bushings and are cast with four projecting lugs 36 (see Figs. 1 and 2) which are fastened by bolts 37 to the studs 26, 27, 28 and 29. It is here to be noticed that the stuffing boxes are designed to provide auxiliary exhaust chambers 38 and 39 which communicate continuously with the outer ends of the slots 11 in the bosses.

40 and 41 are exhaust pipes carried by the stuffing boxes and communicating with the auxiliary exhaust chambers.

The shaft 12 is supplied with a pulley 42 for driving purposes.

43, 44, 45 and 46 are similar rotary valves rotatably mounted in suitable cylindrical valve casings 47, 48, 49 and 50 cast integral with the body piece 2 and having their ends closed by the head plates which are provided with projecting portions 51 supplied for this purpose.

Although I have supplied the engine in the present case with four valves it will be understood that this number can be increased or diminished according to requirements. The valve in each case is in the form of a solid cylinder having a flattened face 52 and provided throughout its length with pairs of nozzles 53 and 54, the nozzles being cone-shaped and passing from the flattened face of the valve to the opposite face thereof. By so flattening the valves I provide steam chests 55, 56, 57 and 58 respectively between the flattened faces of the valves and the opposing inner walls of the valve casings.

The large ends of the nozzles are directed normally toward the rotor and the body piece 2 is provided with entry ports 59, 60, 61 and 62 designed to register with the inner ends of the nozzles and admit steam to the rotor between the disks. It will here be noticed that if the entry ports, which are the same size as the inner ends of the nozzles, be made with a diameter slightly greater than the distance between the disks, they will admit steam between several of the disks as the rotor rotates owing to the corrugated construction of the disks.

The valves are fitted with spindles 63, 64, 65, 66 which extend through suitable stuffing boxes carried by the head plate 3.

67, 68, 69 and 70 are steam pipes opening to the respective steam chests. These pipes are connected to a horizontally disposed feed pipe 71 in turn communicating with a main steam pipe 72.

73 and 73′ are valves located in the pipes 71 at opposite sides of the main pipe 72 and 74 and 74′ are further valves located in the pipes 69 and 70. These valves control the passage of steam from the main pipe to the respective chests as will be readily understood.

75 is a lever rotatably mounted on the stuffing box 35 which lever is provided with the usual hand latch 75′ and detent 75², the detent operating over a quadrant 76 permanently mounted on the stuffing box at the inner side of the lever.

77 is a collar mounted on the stuffing box at the outer side of the lever and fastened to said stuffing box by a set screw 77′.

78, 79, 80 and 81 are cranks permanently secured to the spindles 63, 64, 65 and 66 respectively in a set position to the nozzles. The cranks 78 and 79 are connected by links 82 and 83 to the lever 75 at a point above the shaft while the cranks 80 and 81 are connected to the lever by links 84 and 85 fastened to said lever at points below the shaft.

86 is a drip pipe opening to the interior of the casing at the bottom, the said pipe being supplied with a suitable drip cock 87.

In the drawings I have shown the lever and valves in the position in which they appear when the engine is running in a forward or clockwise direction. It will be seen that the steam admitted through the feed pipes to the chests 55, 56, 57 and 58 is freed through the nozzles 54 and entry ports to the opening between the disks, the said nozzles being arranged to inject the steam in a direction more or less tangential to the disks. The steam upon being admitted in this manner impinges the disks striking the presented corrugations thereof, which owing to their construction are disposed at an angle to the normal path of the admitted steam.

In expanding in the rotor the steam is not only deflected by the corrugation of the disks but it is compelled by virtue of the openings 22 to find its way to the exhaust chamber 15 in a series of spiral paths

such as that 23 indicated. In this way I obtain an efficient expansion of the steam in the rotor and also provide a large impinging surface for the steam when passing through the rotor in the spiral paths prior to exhausting.

To stop the engine it is only necessary to throw the lever to the upright position, which action is designed to turn the valves through the links to a position wherein the entry ports 59, 60, 61 and 62 are closed by the faces of the respective valves, a sufficient distance being reserved on the face of each valve between the inner ends of the nozzles to permit of this.

To reverse the engine the lever is swung until the nozzles 53 register with the entry ports 59, 60, 61 and 62 and it is also to be noticed that the said nozzles are designed so as to inject the steam between the disks in a direction more or less tangential to the disks.

By manipulating the valves 73, 73′, 74 and 74′ one can run the engine with one, two, three or four of the valves admitting steam to the rotor as desired.

What I claim as my invention is:—

1. The combination comprising a stator, a pair of similar opposed end plates rotatably mounted within the stator, a centrally disposed drive shaft carried by the end plates, there being exhaust slots in the end plates adjoining the shaft, a perforated tube surrounding the shafts and between the end plates, said tube inclosing an exhaust chamber communicating with the exhaust slots, a plurality of similar spaced disks mounted on the tube and permanently secured to the end plates, the openings appearing between the disks communicating through the perforations in the tube with the exhaust chamber and means for admitting live steam between the disks at the circumference thereof, as and for the purpose specified.

2. The combination comprising a stator or inclosing casing, an opposing pair of circular end plates located in the casing at opposite sides thereof, a drive shaft passing centrally through the end plates and keyed to the same, there being exhaust slots in the end plates adjoining the shaft, a perforated tube located between the disks and surrounding the shaft, said tube forming an exhaust chamber communicating continuously with the exhaust slots, a plurality of similar spaced disks mounted on the tube and contacting frictionally with the inner wall of the casing, the spaces between the disks communicating through the perforations in the tube with the exhaust chamber and a plurality of valves carried by the casing and disposed around the circumference of the disks, said valves being designed to admit live steam between the disks in a direction tangential to the disks, as and for the purpose specified.

3. The combination comprising a stator or inclosing casing, an opposing pair of circular end plates located in the casing at opposite sides thereof, a drive shaft passing centrally through the end plates and keyed to the same, there being exhaust slots in the end plates adjoining the shaft, a perforated tube located between the disks and surrounding the shaft, said tube forming an exhaust chamber communicating continuously with the exhaust slots, a plurality of similar disks mounted on the tube, sets of spacing bars interposed between the disks and arranged concentric with the shaft, the bars in each set having the ends spaced apart to provide openings, and a plurality of valves disposed around the circumference of the disks designed to admit live steam between the disks and in a direction tangential to the same, as and for the purpose specified.

4. In a rotary engine, a rotor comprising a centrally disposed shaft, a pair of similar opposing end plates keyed on the shaft and provided with exhaust slots adjoining the shaft, a perforated tube between the plates and surrounding the shaft, said tube forming a central exhaust chamber communicating with the exhaust slots and a plurality of spaced circular disks mounted on the tube between the end plates and having the spaces between the disks communicating through the perforations in the tube with the exhaust chamber, as and for the purpose specified.

5. In a rotary engine, a rotor comprising a centrally disposed shaft, a pair of similar opposing end plates keyed on the shaft and provided with exhaust slots adjoining the shaft, a perforated tube between the plates and surrounding the shaft, said tube forming a central exhaust chamber communicating with the exhaust slots, a plurality of spaced corrugated disks mounted on the tube between the end plates and having the space between the disks communicating through the perforations in the tube with the exhaust chamber, as and for the purpose specified.

6. In a rotary engine, a rotor comprising a centrally disposed shaft, a pair of similar opposing end plates keyed on the shaft and provided with exhaust slots adjoining the shaft, a perforated tube between the plates and surrounding the shaft, said tube forming a central exhaust chamber communicating with the exhaust slots, a plurality of similar corrugated disks mounted on the tube and sets of spacing bars inserted between the disks, the spaces so reserved between the disks communicating through the perforations in the tube with the exhaust chamber, as and for the purpose specified.

7. In a rotary engine, a rotor comprising a centrally disposed shaft, a pair of similar opposing end plates keyed on the shaft and provided with exhaust slots adjoining the shaft, a perforated tube between the plates and surrounding the shaft, said tube forming a central exhaust chamber communicating with the exhaust slots, a plurality of similar corrugated disks mounted on the tube, sets of spacing bars disposed between the disks, the bars in each set being located at different radii from the center of the shaft and having the ends of the bars of each set spaced apart to present openings, the openings between the ends of the respective sets of bars being staggered in relation to each other, as and for the purpose specified.

8. In a rotary engine the combination with a stator and a rotor presenting a plurality of similar spaced circular disks, of a plurality of suitably incased rotary valves mounted in the stator and at the circumference of the disks, and provided with cone-shaped nozzles and means for adjusting the valves, as and for the purpose specified.

9. In a rotary engine the combination with a plurality of similar spaced circular disks and a stator inclosing the rotor and providing a plurality of valve casings disposed around the rotor and opening through suitable inlet ports to the edges of the disks, of similar cylindrical valves rotatably mounted in the valve casings and provided throughout their length with pairs of cone-shaped nozzles designed to register with the inlet ports and means for manipulating the valves, as and for the purpose specified.

10. In a rotary engine the combination with a plurality of similar spaced circular disks and a stator inclosing the rotor and providing a plurality of valve casings disposed around the rotor and opening through suitable inlet ports to the edges of the disks, of similar cylindrical valves rotatably mounted in the casing and having each a flattened face providing in each instance a steam chest between said flattened face and the opposing wall of the valve casing and supplied further throughout their length with pairs of cone-shaped nozzles having the contracted ends of the nozzles communicating continuously with the steam chest in each instance and the enlarged ends of the nozzles designed to register with the inlet ports aforesaid and means for simultaneously shifting the valves, as and for the purpose specified.

Signed at Winnipeg this 6 day of February, 1913.

JAMES SHAW.

In the presence of—
G. S. ROXBURGH,
L. GOULD.