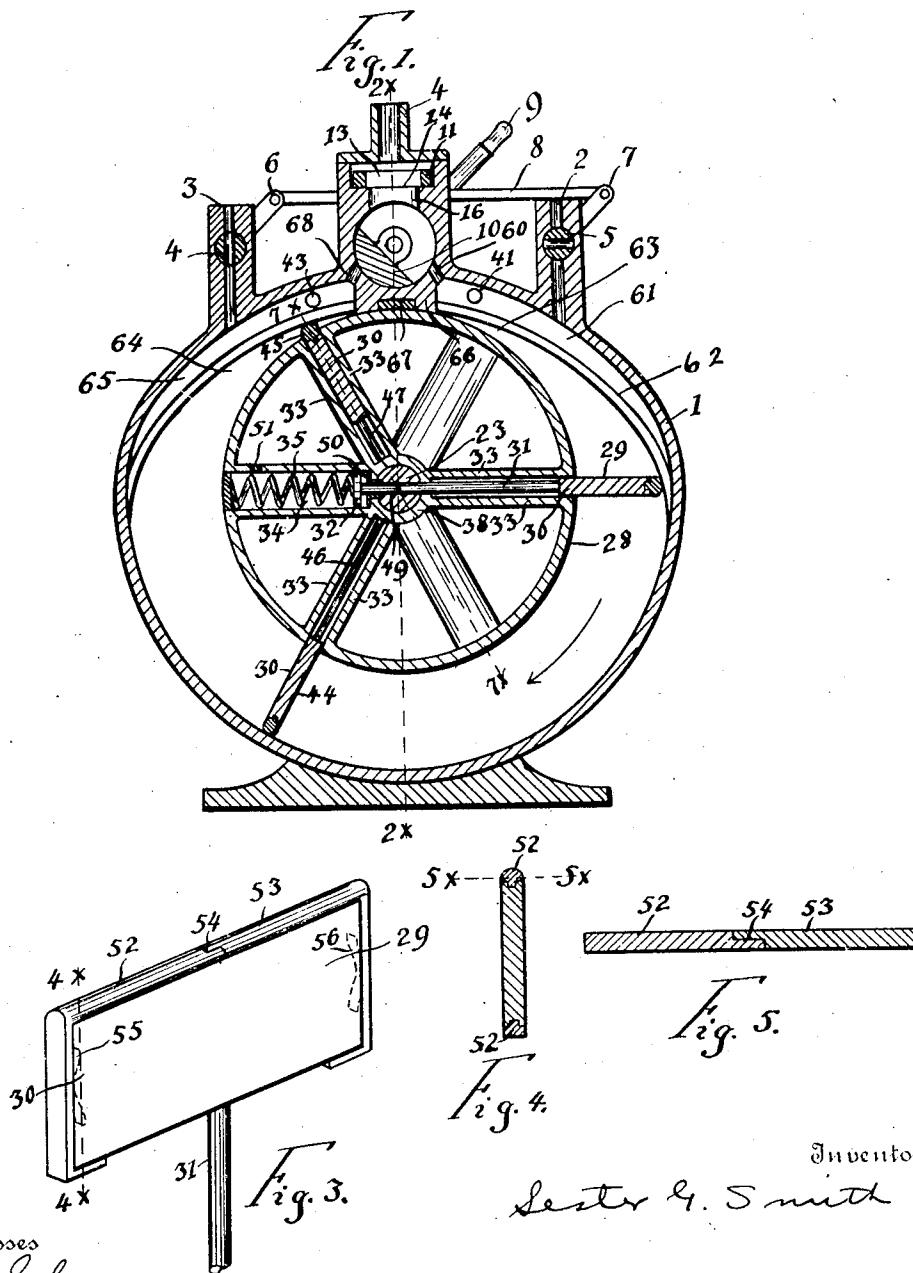


1,062,193.

Patented May 20, 1913.

3 SHEETS-SHEET 1.



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1,062,193.

3 SHEETS--SHEET 2.

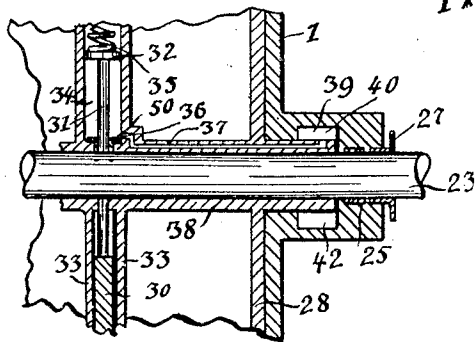
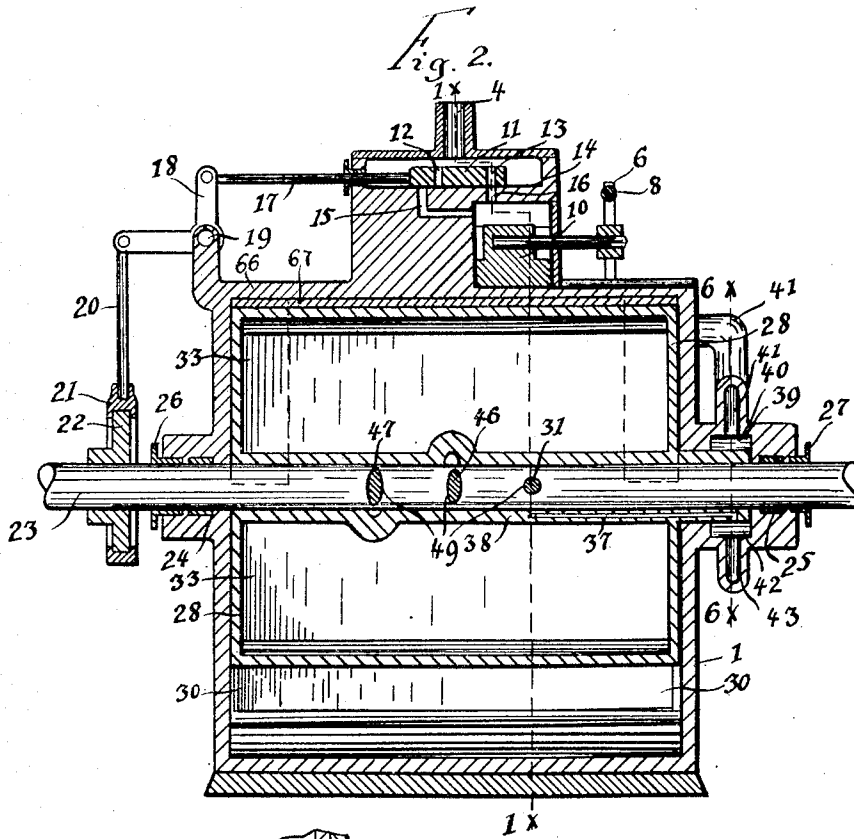


Fig. 7.

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 ROTARY ENGINE.
 APPLICATION FILED MAY 20, 1911.

1,062,193.

Patented May 20, 1913.

3 SHEETS—SHEET 3.

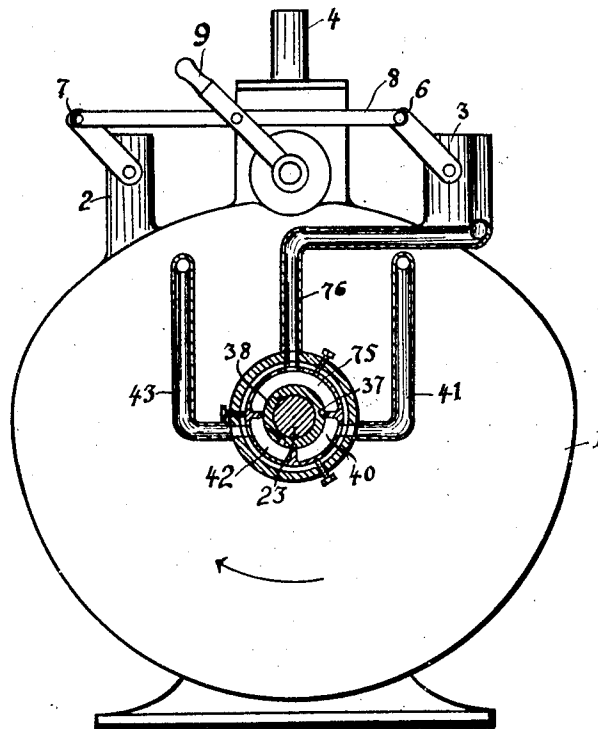


Fig. 6.

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ROTARY ENGINE.

1,062,193.

Specification of Letters Patent.

Patented May 20, 1913.

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To all whom it may concern:

Be it known that I, LESTER G. SMITH, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

One object of this invention is to provide certain improvements in rotary engines that will both improve the construction thereof and keep them compact in size.

Another object of this invention is to provide a cylinder for a rotary engine having piston blades thereon that work in or out as the cylinder and blades rotate, with improved mechanism for operating the blades in and out.

These and other objects of my invention are fully illustrated in the drawings and will be fully described in the specification and pointed out in the claims at the end thereof.

In the accompanying drawings, Figure 1 is a vertical transverse section of my improved engine, the section being taken on the line 1*-1* in Fig. 2. Fig. 2 is a longitudinal vertical section through my improved engine, taken on the line 2*-2* in Fig. 1. Fig. 3 is a perspective view of one of the piston blades of my improved engine. Fig. 4 is a section on the line 4*-4* in Fig. 3. Fig. 5 is a longitudinal section on the line 5*-5* in Fig. 4. Fig. 6 is a section on the line 6*-6* in Fig. 2. Fig. 7 is a section on the line 7*-7* of Fig. 1.

In the accompanying drawings like reference characters refer to like parts.

Reference numeral 1 is the shell or outer casing of the rotary engine, which shell is shown somewhat oval in form. At the top of this shell is provided the exhaust ports 2 and 3 and the intake port 4. In the exhaust ports are placed the valves 4 and 5, which valves are operated by the arms 6 and 7 connected by the rod 8, which rod may in turn be operated by the controlling or reversing lever 9, which lever also operates the reversing intake valve 10 which valve is placed immediately under the intake port 4. Between the intake port 4 and the reversing valve 10 is placed the cut off valve 11, having the ports 12 and 13 therein. This valve slides upon the valve seat 14, which valve seat has the ports 15 and 16 therein. These ports are spaced apart more

than are the ports 12 and 13 in the valve, for a reason that will be explained presently. The valve 11 is connected to and operated by the valve rod 17, which in turn is operated by the bell crank 18 pivoted on the engine frame 19. The free arm of the bell crank 18 is operated by the eccentric rod 20, which in turn is driven by the eccentric strap 21, which eccentric strap is operated by the eccentric 22 on the driving shaft 23 of the engine. The driving shaft 23 is mounted to rotate in the bearings 24 and 25, which bearings are provided with the stuffing boxes 26 and 27.

Mounted on the shaft 23 so as to rotate therewith is the drum 28, which drum carries the piston blades 29, 44 and 45, which blades are illustrated in perspective in Fig. 3. Each of these blades comprises a blade 30 having thereon a piston stem 31. At the opposite end thereof is placed a piston 32. The drum 28 is slotted, having walls 33, 33 thereon which act as guides, between which the piston blade 30 can work in and out, the recess being deep enough to take in the piston blade completely, so that the outer edge thereof will lie flush with the periphery of the drum 28. The piston 32 travels in a cylinder 34 mounted within the drum 28 for that purpose. On one side of the piston is the compression spring 35, against which the piston 32 works, compressing the spring as the piston blade 30 is drawn into the recess between the walls 33, 33. The piston 32 is driven to compress the spring and draw the piston blade 30 into the recess between the walls 33, by means of live steam admitted to the space 36 in the cylinder 34 through a vent 37 provided therefor in the hub 38 of the drum 28. This vent extends outward into a steam chest 39. This steam chest is annular in shape and is shown in cross section in Fig. 6. It has the opening 40 therein in which live steam is admitted through the port 41, and opposite thereto has the opening 42 therein through which live steam is admitted through the port 43. Each of the openings 40 and 42 extends through an arc of about 90 degrees. The steam intake opening 37 revolves with the shaft 23 and as it comes opposite the opening 40, live steam passes through said intake opening and into the steam space 36 in the cylinder 34, causing the piston 32 to advance and compress the spring 35 and draw the piston blade 30 into the recess pro-

vided therefor, it being the intention to draw the piston blade in until the outer edge of it is flush with the periphery of the drum 28. This inward movement of the piston blade occurs when the piston is passing the first half of the eccentric portion of the cylinder. The piston blade must be wholly withdrawn when it passes the center of the eccentric portion of the cylinder, and after the central part of the eccentric portion of the cylinder is passed the piston can then be advanced, keeping it in contact with the eccentric part of the cylinder wall. The piston is advanced by the spring 35. As soon as the piston reaches the central part of the eccentric portion of the cylinder wall, the port 37 comes opposite the opening 42, permitting the exhaust to take place and permitting the piston to recede by reason of the expansion of the spring 35. When the piston is running in the direction shown by the arrow in Fig. 6, live steam will be taken at the opening 40 and the exhaust will take place through the openings 42 and 75. When it is running in the reverse direction live steam will be taken through the opening 42 and the exhaust will take place through the openings 40 and 75. The exhaust port 76 is provided in the opening 75 for this purpose.

In my improved engine three pistons in all are used, each being placed 120 degrees from each other around the periphery of the drum 28, the pistons 44 and 45 being mounted on the stems 46 and 47, each of them being provided with cylinders, pistons, springs and ports similar to those shown in connection with the piston blade 30, each of them operated in succession by the live steam contained in the steam chest 39, by which the withdrawal of the pistons is secured in turn as each of them approaches the top of the engine cylinder, as shown in Fig. 1, each of the pistons being advanced in turn as soon as the top or zenith of the cylinder is passed. Steam is admitted to the steam chest 39 by means of the steam pipes 41 and 43, which steam pipes are connected to the exhaust ports 2 and 3 inside of the valves 5 and 4, as shown in Fig. 1, it being understood that one of these pipes will always be open to receive high pressure steam and the other will be open to receive the exhaust steam, according to the setting of the reversing valve 10. The piston stem 31 passes through a hole 49 in the shaft 23, which is perforated for this purpose and is packed with a stuffing box 50 where it enters the cylinder 34 for the purpose of preventing live steam from entering the cylinder 34 from the main driving cylinder. The cylinder 34 is provided with an air vent 51 through which the air can escape that would otherwise be compressed along with the spring 35. The

piston blade is provided with a packing strip in two pieces 52 and 53, the edges of which are cut away so as to overlap each other, forming a joint 54. The two halves of the packing strip are forced outwardly from the piston blade by means of the bow springs 55 and 56, which bow springs tend to hold the piston blades out firmly against the end walls of the cylinder.

Steam is used expansively in my improved engine, as will now be explained. The slide valve 11 is operated by the eccentric and makes one complete reciprocation for each revolution of the drum 28. In Fig. 2 it is shown in its farthest position to the right and steam is being admitted in that position for the purpose of driving the blade 29, as shown in Fig. 1. Steam passes through the valve 10 and the port opening 60 into the steam space 61, which steam space is separated from the working part of the cylinder by means of the wall 62 through which are provided long slotted openings 63 extending the full length of the wall 62. The valve 11 takes the position shown in Fig. 2 as soon as the piston 29 has passed the opening 63 and may remain open as long as is desired, this being controlled by the speed of the travel of the valve and the size of the port openings 13 and 16. When the valve closes, the steam that is in the steam space 61 and in the cylinder behind the piston 29 and in the opening for the intake valve 10, will expand driving the piston forward. The expansion of the steam ceases when the following piston blade 45 passes the opening 63, after which the steam that is carried between the blades will pass around with them until it reaches the opening 64 into the steam space 65, from which it will pass out through the exhaust port 3. As soon as the piston blade 45 passes the opening 63 the cut off valve 11 moves to the left far enough to permit the opening 12 to register with the opening 15, which will permit the steam to be admitted to drive the piston blade 45 in the same way as has already been described in connection with the piston blade 29. The cut off continues to move to the left, closing the port opening, and to insure the admission of the same amount of steam as would be admitted through the openings 13 and 16, the port openings 12 and 15 should be made correspondingly longer, as the period for which they are open is correspondingly less. When the piston blade 44 passes the opening 63, the valve 11 has begun its movement to the right and brought the port openings 12 and 15 again into register with each other, permitting the admission of steam to drive the blade 44. In this way the cut off valve admits and cuts off the steam separately for each of the piston blades, whether the drum and its pistons are

rotating in one direction or in the other, and the steam is used expansively in driving the engine, as has been described. The bushing 66 and the packing strip 67 separate the live steam on one side thereof from the exhaust steam on the other side thereof. To run the engine in the opposite direction the reversing lever 9 will be thrown over from the position shown in Fig. 1, opening the intake port 68 and closing the intake port 60. This will cause the drum and its pistons to rotate in the opposite direction from that indicated by the arrow in Fig. 1.

I have described my engine as operable by steam pressure only but it will be understood that engines of this type can also be operated equally as well by compressed air or by any other form of compressed gas, and I believe the engine can be operated also by water pressure as well. I believe also that the engine may be driven by power for the purpose of operating in the reverse direction as an air compressor or as a pump, and all of these uses are within the range of my invention.

It will be seen that two or more of my improved engines may be used in series as a compound and that the exhaust may be discharged into a condenser and the same effect secured as though a condenser were used with a reciprocating engine.

Having thus described my invention, what I claim as new and patentable is as follows:

1. The combination in a rotary engine of an engine cylinder, a drum mounted to rotate therein, piston blades mounted to move radially in said drum, stems on said piston blades extending through the axis of the drum, piston heads mounted on said stems, said piston heads working in cylinders carried in said drum, a steam chest for said engine, connections between said steam chest and said cylinders in the drum whereby said piston blades are moved positively in one direction by steam pressure radially in the drum during the operation of the revolution thereof and a spring for moving each of said pistons in the opposite direction.

2. The combination in a rotary engine of an engine cylinder, a drum mounted to rotate therein, piston blades mounted to move radially in said drum, stems on said piston blades extending through the axis of the drum, piston heads mounted on said stems, said piston heads working in cylinders carried in said drum, a steam chest for said engine, connections between said steam chest and said cylinders in the drum whereby said piston blades are moved positively by steam pressure radially in the drum during the op-

eration or the revolution thereof, a compression spring mounted in each of said cylinders for positively moving said piston blade in the reverse direction, the steam pressure operating to draw the blade in radially during the exhaust of the engine, and the spring pressure operating to push the blade out and hold it out during the admission of steam.

3. The combination in a rotary engine of an engine frame and a cylinder therein, a drum and shaft mounted to rotate therein, piston blades moving radially in said drum, a steam cylinder and piston mounted in said drum for operating each of said blades in one direction, a hub for said drum, steam ports passing through said hub parallel to the shaft and communicating with said cylinders at one end, a steam chest mounted at one end of the engine and surrounding said shaft, with which said ports communicate successively on the rotation of said drum.

4. The combination in a rotary engine of a drum and a shaft therefor, piston blades mounted to move radially in said drum on one side of said shaft, cylinders mounted in said drum on the opposite side of said shaft, piston heads mounted to reciprocate in said cylinders and stems connecting said piston heads with said blades, said stems passing through perforations in said shaft, causing said piston heads and said piston blades to reciprocate together, means for admitting steam to said piston head for moving the piston blade toward the axis of the drum when the exhaust begins.

5. The combination in a rotary engine of a drum and a shaft therefor, piston blades mounted to move radially in said drum on one side of said shaft, cylinders mounted in said drum on the opposite side of said shaft, piston heads mounted to reciprocate in said cylinders and stems connecting said piston heads with said blades, said stems passing through perforations in said shaft, causing said piston heads and said piston blades to reciprocate together, steam connections passing along said shaft and communicating with the inner end of said cylinders, admitting steam during a predetermined part of the revolution for causing each of said piston heads to move in one direction and compression springs for causing each of said piston heads to move in the opposite direction.

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

LESTER G. SMITH.

Witnesses:

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ALICE M. JOHANNES.