S. E. KOCHENDARFER.

ROTARY ENGINE.

APPLICATION FILED APR. 25, 1917.

1,302,930.

Patented May 6, 1919.

3 SHEETS—SHEET 1.

Fig. 1.

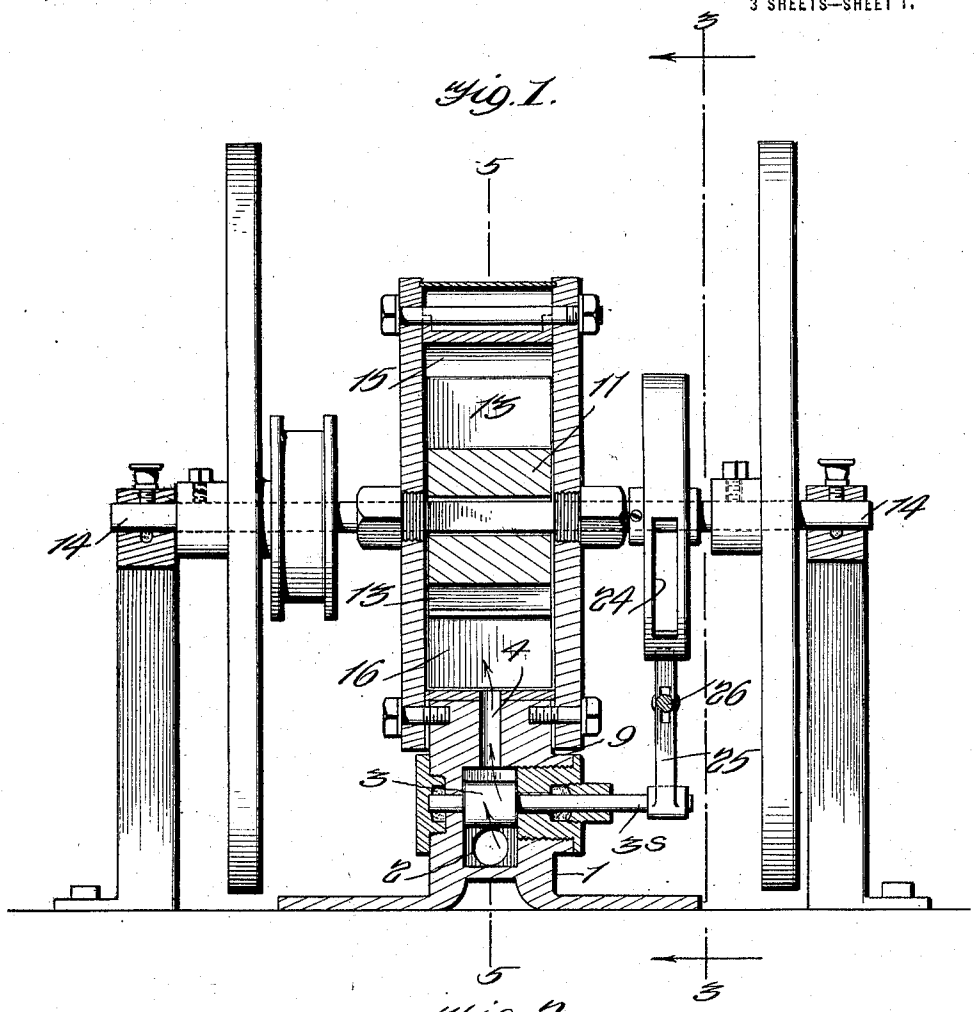
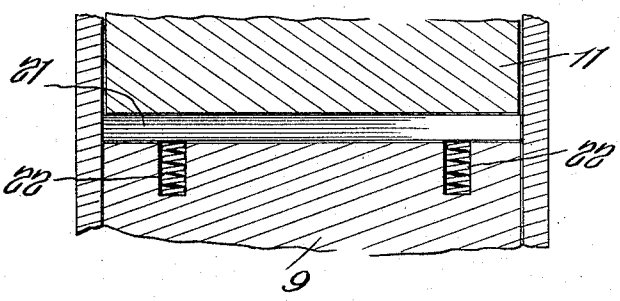


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

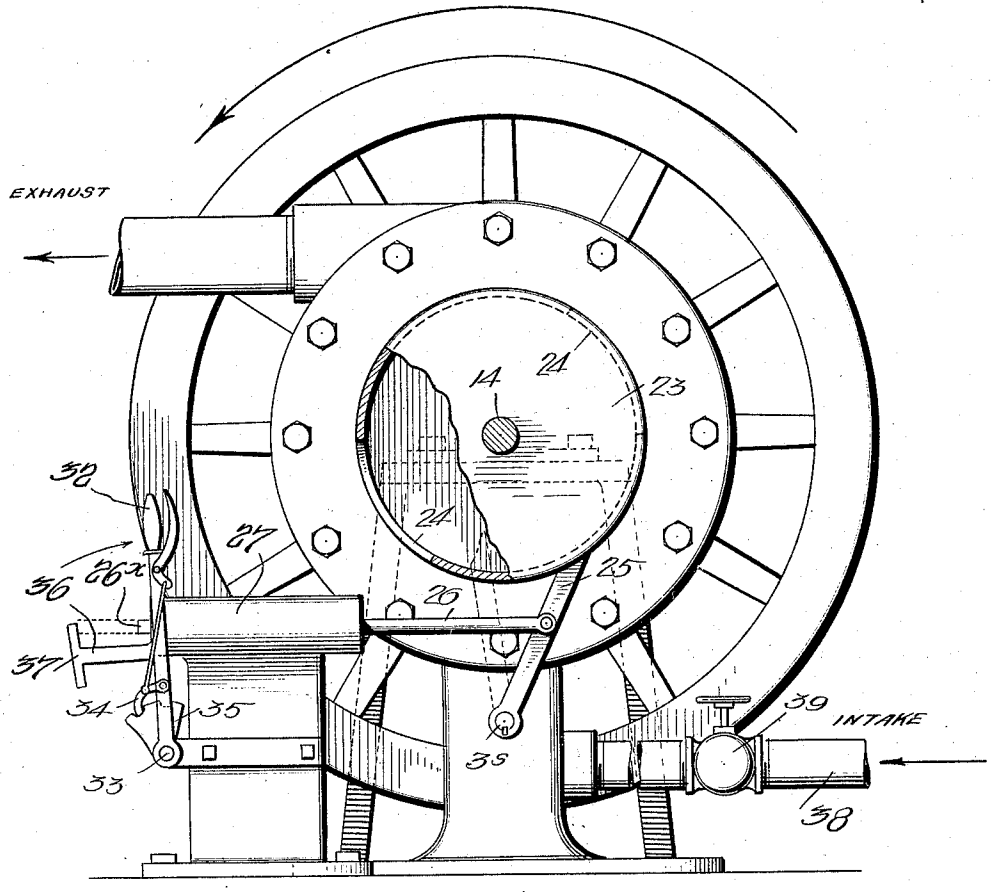
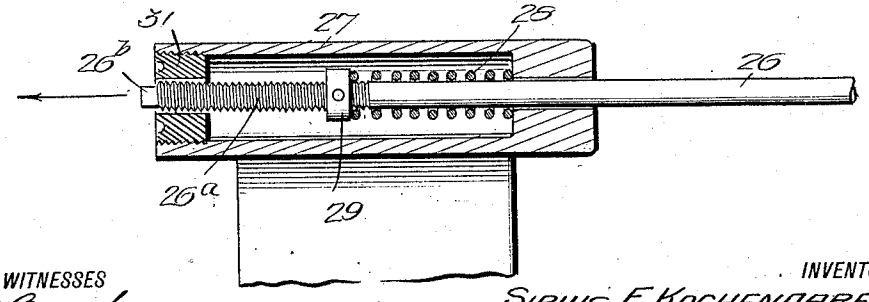


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

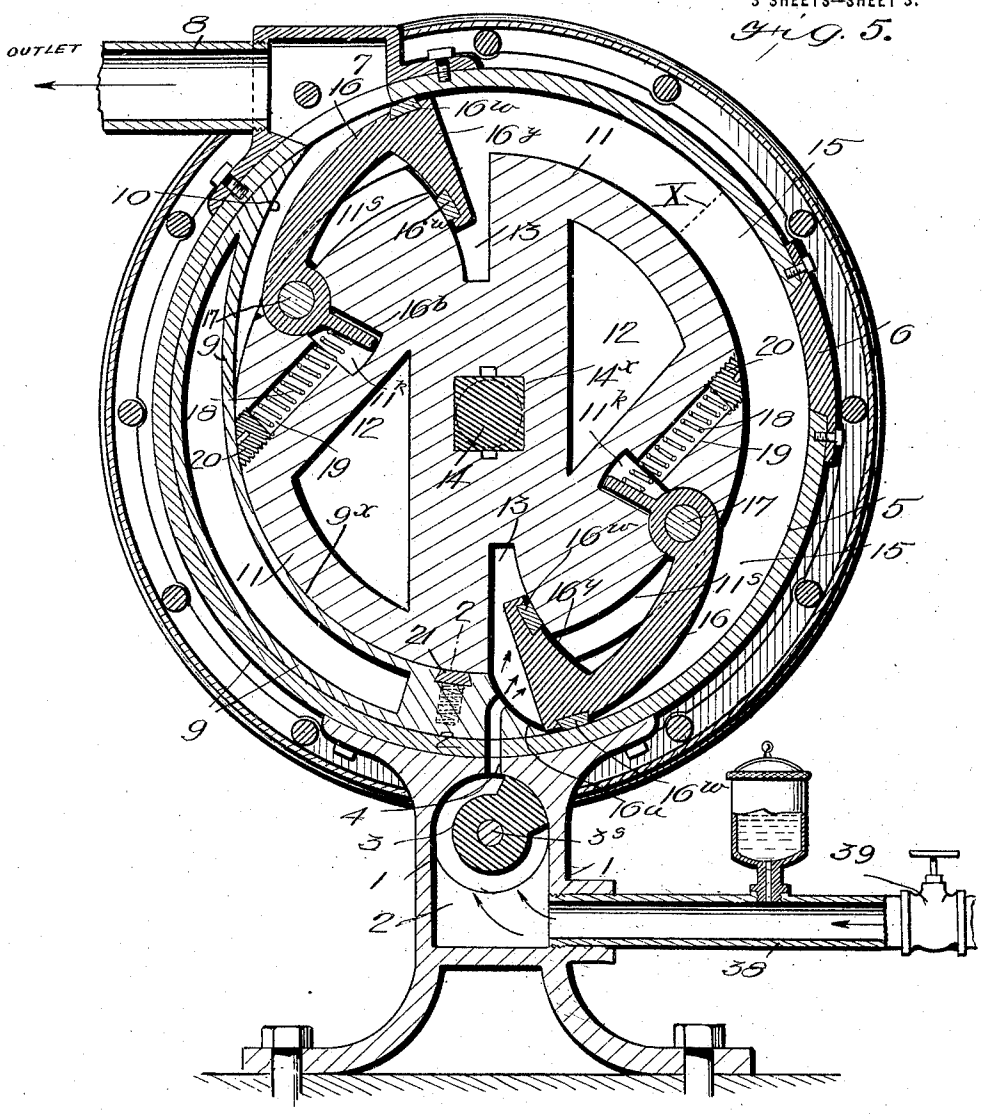
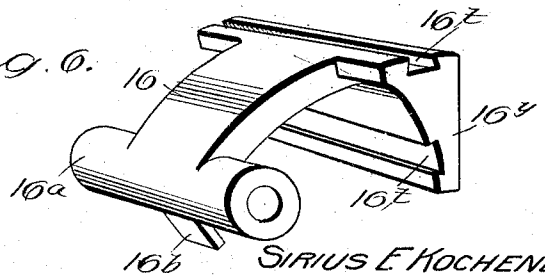


Fig. 6.



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ROTARY ENGINE.

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To all whom it may concern:

Be it known that I, SIRIUS E. KOCHENDARFER, a citizen of the United States, and a resident of Washington, in the county of Washington and State of Pennsylvania, have made certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to improvements in rotary engines, and it consists in the combinations, constructions and arrangements herein described and claimed.

An object of my invention is to provide a rotary engine having no dead center, thus permitting the engine to start up and run, no matter where the oscillatory pistons happen to be with respect to the steam chamber.

A further object of my invention is to provide a rotary engine having spring pressed oscillatory pistons which are normally held in operative position by means of the springs, but which are forced inwardly by a long cam surface having a gradual slope on the engine casing, thus obviating sudden impact and reducing to a great extent the noise which might otherwise be present.

A further object of my invention is to provide novel means for rendering the device steam tight, that is to say, for preventing the passage of steam between the edges of the oscillatory piston and the walls of the steam chamber, when the pistons are in operative position.

A further object of my invention is to provide a valve mechanism by means of which steam may be cut off at any given instant during the movement of the rotor, or by which a continuous supply of live steam may be admitted to the engine.

Other objects and advantages will appear in the following specification, and the novel features of the invention will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming part of this application, in which:—

Figure 1 is a central vertical section through the device.

Fig. 2 is a section along the line 2—2 of Fig. 5.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged section through a portion of the valve operating mechanism.

Fig. 5 is a section along the line 5—5 of Fig. 1.

Fig. 6 is a perspective view of one of the oscillatory pistons.

In carrying out my invention I provide a base 1 which contains a valve chamber 2 having a valve 3. The latter is preferably of the rotary type, and controls the steam inlet passage 4. The base 1 supports the engine casing 5. The latter is in the form of a cylinder, and is provided with a removable plate 6 by means of which access may be had to the interior. At another portion of the casing is secured an exhaust chamber 7, which communicates with an exhaust pipe 8. On the inside of the casing 5 between the exhaust chamber 7 and the intake port 4 is disposed a casting 9, which is made hollow for the sake of lightness and economy in material. The inner surface of this casting 9 is curved on a circular arc, as shown at 9^x. That portion of the casting 9 near the exhaust chamber 7 is curved to form a cam surface 10.

The rotor is shown at 11. It consists of a cylinder having cut-away portions 12 to lighten the cylinder and being provided with recesses 13. The cylinder is mounted on the squared portion 14^x of the shaft 14. The cylinder is of such a diameter as to closely contact with the curved surfaces 9^x of the casting 9. This leaves a steam or expansion chamber 15 on the opposite side of the shaft.

The oscillatory pistons are like that shown in Fig. 6. In this figure it will be observed that the piston has a central portion 16, having a sleeve 16^a at one end and an abutment blade 16^y at the other, both the sleeve and the blade being wider than the body portion 16.

Recesses 16^t are provided for the insertion of packing 16^w. At 17 I have shown pivot pins which pass through the sleeve 16. The latter are disposed in cylindrical recesses in the rotor 11, to oscillate about the pins 17. Slots 11^s are provided in the periphery of the rotor for receiving the body portion 16 of each of the pistons, while the recesses 13 receive the blades 16^y.

Each sleeve 16^a has an arm 16^b arranged to enter a recess 11^k in the rotor. Springs 18 are disposed in bores 19 in the rotor, the ends of the bores being closed by screw plugs 20. The springs 18 bear at one end of the screw plugs and at the other end of the arms

11^k, thus tending to force the pistons outwardly against the wall of the casing 5. It will be observed that the blades 16^y of the pistons are curved on an arc, the center of which is the axis of the pivot pin 17, and that the recess 13 has a contact wall which is curved on a similar arc.

In Fig. 2 I have shown a section through a portion of the casting 9 and the rotor 11. It will be observed that there is a packing member 21, which is held by springs 22 against the surface of the rotor. The packing members 16^w are also designed to be kept in close contact with the abutting surfaces by means of springs, not shown, (but precisely like those shown in Fig. 2, in connection with the packing 21) when the pistons are in operative position.

In order to time the valve 3 I provide a valve operating mechanism shown in Figs. 1, 3 and 4. This consists of a cam wheel 23, which has openings 24. The wheel is mounted on the shaft 14 to turn with the latter. The valve stem 3^s has an arm 25, which is pivotally connected with a rod 26, see Fig. 2. The latter enters a cylinder 27 having a spring 28, which surrounds the rod, and which is provided with an adjusting nut 29 on the threaded portion 26^a of the rod 26. A screw plug 31 closes the end of the cylinder 27. A handle 32 is pivoted at 33, and is provided with a spring actuated locking dog 34 arranged to engage the notches of a locking segment 35. The handle has an extension 36 having an arm 37 arranged to engage the projecting end 26^b of the shaft 26, so as to force the latter inwardly against the tension of the spring 28, when desired.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood.

Steam is admitted into the inlet pipe 38 by means of the valve 39 or by any other suitable means, and passes into the valve casing 2 through the inlet 3, and into the recess 13, see Fig. 5, where it exerts pressure on the piston blade. The latter being carried by the rotor this pressure is transmitted to the rotor, which turns, thus turning the shaft 14. The steam continues to force the piston around until it passes the exhaust chamber 7 when the steam is allowed to escape. Under normal conditions the cut off of the steam should take place at about the dotted line marked "X" in Fig. 5, and this may be regulated by means of the valve mechanism just described. As long as the arm 25 is on the outside of the cam wheel 23, the valve is open, but when under the influence of the spring 28, the arm drops into the opening 24 in the cam wheel, then the steam is cut off. As soon as the piston engages the cam surface 10, see Fig. 5, it is forced inwardly, into the recess 13 and 11^s, and at the same time the spring 18 is compressed. Contact with the surface 9^x of the casting 9 keeps the piston in its inner position, until it clears the end of the casting which is just adjacent to the inlet port 4. Having cleared this casting, the piston under the influence of the spring 18 immediately springs outwardly. It will be observed that there is an inclined portion 10^a at the end of the casting 9, down which the end of the piston will slide, but this inclined portion is more abrupt than the inclined portion 10 at the opposite end of the casting 9, which closes the piston. The provision of the packing members 16^w insures the close contact of the piston with the wall of the casing, and also with the curved portion of the rotor against which the piston bears. It is not possible for the steam to escape past the piston when the latter is in its operative position. It will be noted that the recesses 11^s tend to form an air cushion for the pistons 16, thus reducing the noise and vibration.

I desire to call particular attention to the fact that steam is always acting on one of the pistons, so that the engine has no dead center, for it will be observed that in Fig. 5 the upper piston has not yet reached the exhaust port, while the lower piston is in position to be acted on by the steam pressure. Prior to the springing into position of the lower piston, the upper piston was being pushed forward by the expansion of the steam, if the steam had been previously cut off, or by the live steam if the steam had not been cut off, so that before one piston stops acting, the other piston is brought into play. The elimination of the dead center of the engine constitutes a valuable feature of the invention.

Another point where an advance is made in the art is the fact that both the contacting surfaces of the pistons and the cam surface 10 are curved on arcs which provide a gradual and not an abrupt inclination to the wall of the casing 5. The result is that the closing of the pistons or their movement into the recesses of the rotor is comparatively gradual, thus doing away with the power absorbing impact which is often found in rotary engines, and furthermore rendering the engine much less noisy.

When it is desired to drive the engine continuously with live steam, that is to say, not to cut off the steam at any point during rotation, it is only necessary to move the handle 32 into such position that the arm 37 will engage the end 26^x of the arm 26, thus holding the rod against the tension of the spring 28, so that the arm 25 will remain in its outer position, thus keeping the valve 3 open. The entrance of the steam may be controlled by any suitable means, such as the valve 39, so that live steam may be continuously admitted to the engine. The retrac-

tion of the handle 32 will bring the cut off mechanism again into play when desired.

I claim:—

1. In a rotary engine, a rotor provided with recesses in its periphery, a plurality of L-shaped oscillatory pistons pivotally carried by said rotor and adapted to be moved into said recesses, each of said pistons being cushioned by steam during such movement into the recess, an extension carried by each of said pistons and disposed in one of said recesses, a spring disposed in another recess and arranged to bear on said extension for normally forcing the piston outwardly, and a removable screw plug arranged to be engaged by the opposite end of the spring.

2. In a rotary engine, a cylindrical casing, a rotor disposed within said cylindrical casing and having recesses in its periphery, a plurality of L-shaped oscillatory pistons pivotally carried by said rotor and adapted to be moved into said recesses, each of said pistons having a packing on one side thereof arranged to continuously engage a portion of the wall of the rotor during its movement into and out of said recess, and being provided on the opposite side with packing arranged to engage the inner wall of the casing when the piston is in its outer position.

3. In a rotary engine, a casing, a rotor disposed within said casing and having recesses, a plurality of L-shaped oscillatory pistons pivotally carried by said rotor and adapted to move into said recesses, each of said pistons being pivoted at the extreme end of the longer arm of the L, the shorter arm of the L being provided with packing arranged to continuously engage the wall of the rotor during the movement of the piston into and out of the recess, the surface of the piston facing the casing being provided with packing near the junction of the longer and shorter arms, an extension carried by said piston, and a spring disposed within the body of the rotor and arranged to bear on said extension for normally forcing the piston outwardly in contact with the inner wall of the casing.

4. In a rotary engine, a casing having inlet and exhaust ports, a rotor disposed within the casing, a plurality of oscillatory spring pressed pistons carried by said rotor, means for admitting steam into operative relation with said pistons and for cutting off the steam from the pistons at a predetermined point, said means comprising a rotary valve, a cam wheel on the main shaft, an arm secured to the valve stem and arranged to be engaged by the cam wheel, a spring for normally holding said arm to said cam wheel, and means for throwing the spring out of commission, and for maintaining the valve in its open position, said last-named means comprising a cylinder, a rod pivotally connected to said arm and arranged to extend through said cylinder and spring within the cylinder for exerting tension on the rod and means for holding the rod rigidly when the arm is in its outer position and the valve is in its open position.

SIRIUS E. KOCHENDARFER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."