No. 686,089. Patented Nov. 5, 1901.

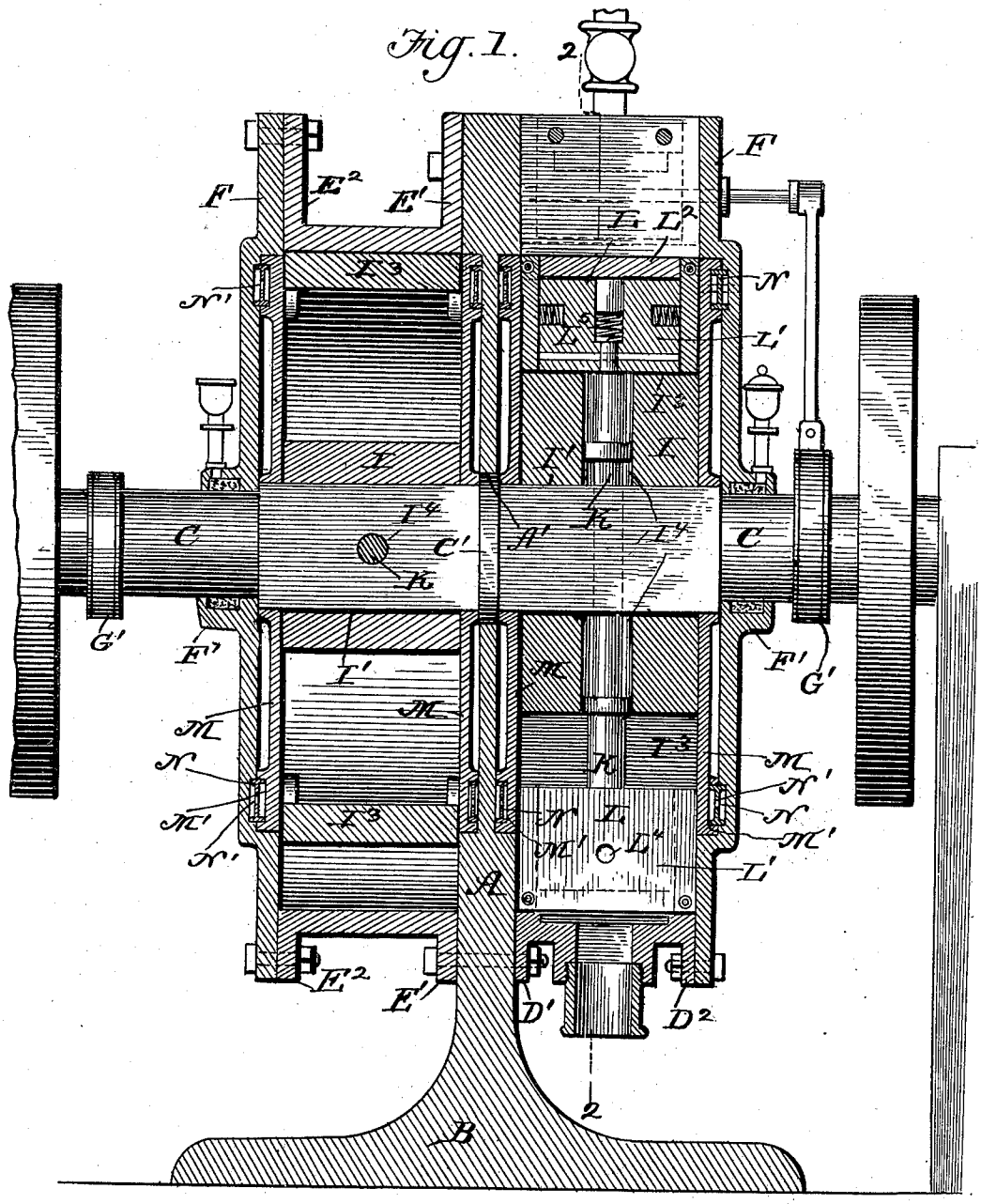
S. E. KOCHENDARFER.

ROTARY ENGINE.

(Application filed Mar. 18, 1901.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

Fig. 2.

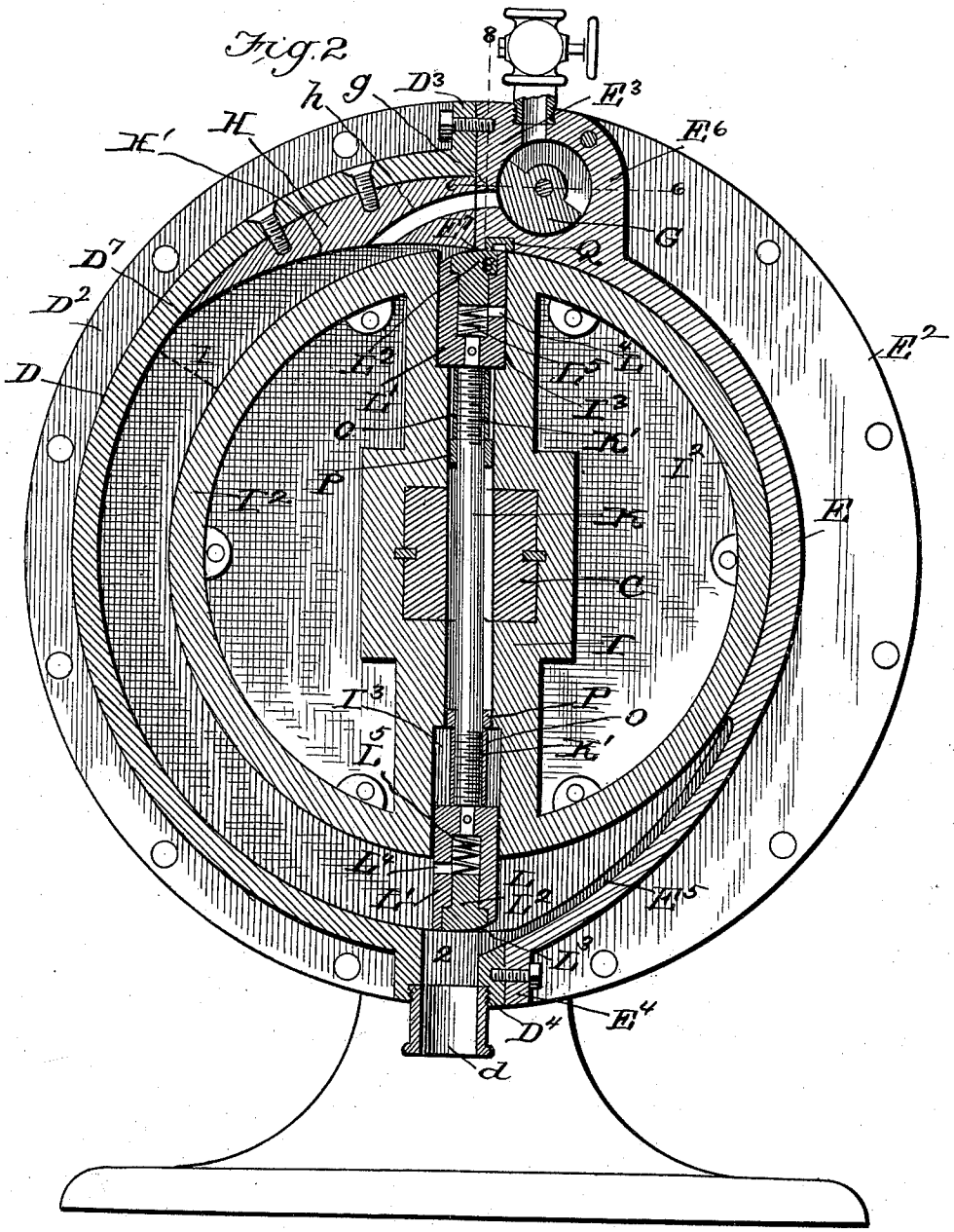

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Fig. 3

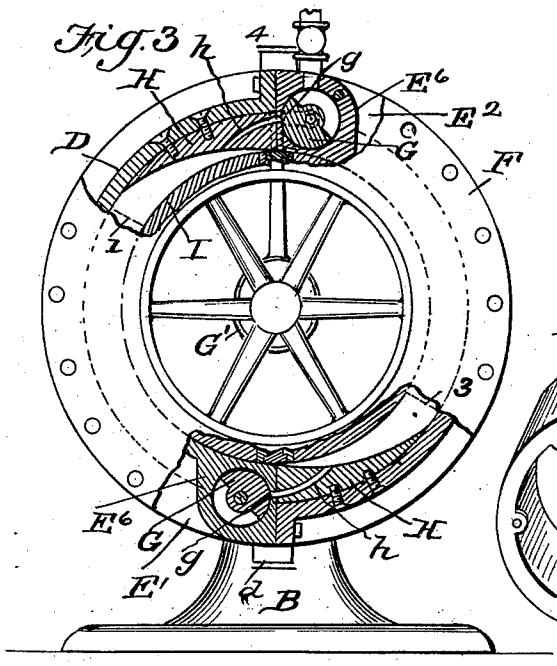


Fig. 4

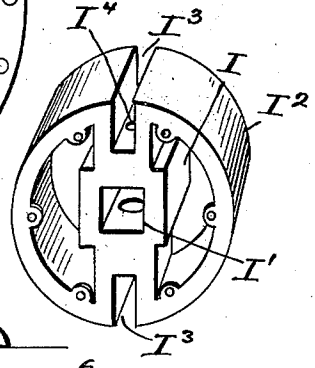


Fig. 5.

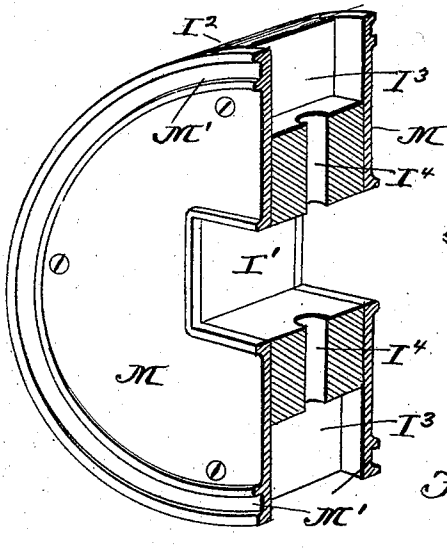


Fig. 6

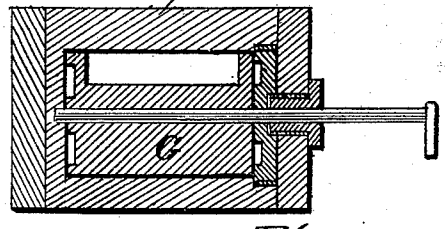


Fig. 8.

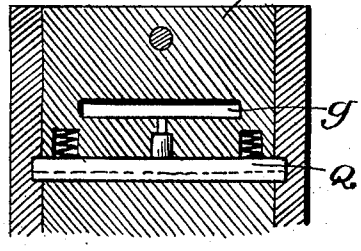
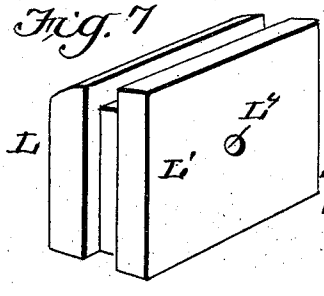


Fig. 7



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UNITED STATES PATENT OFFICE.

SIRUS E. KOCHENDARFER, OF HOLLIDAYSBURG, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO OSMOND W. GARDNER, OF HOLLIDAYSBURG, PENNSYLVANIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 686,089, dated November 5, 1901.

Application filed March 18, 1901. Serial No. 51,657. (No model.)

To all whom it may concern:

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

This invention is an improvement in rotary engines, and particularly in that class of such engines in which the pistons are provided with sliding blades, which operate within the cylinders; and the invention has for its objects to provide certain improvements in the structure of the cylinders and in that of the piston and other improvements in the general and detail construction of the engine, as will be more fully described.

The invention consists in certain novel constructions and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In the drawings, Figure 1 is a longitudinal section of the engine drawn alongside the shaft. Fig. 2 is a cross-section on about line 2 2 of Fig. 1. Fig. 3 is an end view of the engine, partly broken away to show the relative location of the valve-chambers of the two cylinders. Fig. 4 is a detail perspective view of the body portion of one of the pistons. Fig. 5 is a detail perspective view of a section of one of the pistons, showing the piston in section as if cut through the center. Fig. 6 is a detail sectional view on about line 6 6 of Fig. 2. Fig. 7 is a detail perspective view of the body portion of one of the blades, and Fig. 8 is a detail sectional view on about line 8 8 of Fig. 2.

In carrying out my invention I provide the cylinders on opposite sides of a central division-plate A, which is provided on the base or support B, which operates as a stand for the engine. This plate A is provided at its center with an opening A′, which forms a bearing for the circular portion C′ of the shaft C, on which shaft are supported the pistons which operate in the cylinders, lying on opposite sides of the division-plate A, as shown in Fig. 1. The cylinders are composed each of two segmental sections D and E, which are provided at their side edges with outwardly-projecting flanges D′ and E′ and D^2 and E^2. The inner flanges D′ and E′ are lapped against and secured by bolts or otherwise securely to the central division-plate A, while the outer flanges D^2 and E^2 are lapped against and secured to the inner faces of the heads F of the cylinders, which heads are provided at their centers with suitable bearings F′ for the shaft C, which bearings may be packed in any suitable manner. At its ends each section D is provided with a flange D^3 and a flange D^4, which abut and are bolted to flanges E^3 and E^4 of the complementary section E, the two sections D and E completing the circle of the cylinder. Adjacent to the ends D^4 and E^4 of the cylinder-sections the section D is provided with the exhaust-port *d*, and the end of the section E adjacent to said exhaust is provided with a groove or channel E^5, which extends for a considerable distance along the inner face of the section E and to a point where the surface of the piston coincides with that of the cylinder, such passage E^5 leading to the exhaust *d* and permitting the escape of any steam that may be in advance of the piston after the latter passes the exhaust. The section E is provided at its end opposite to that which connects with the exhaust with the valve-chamber E^6, in which operates the rocking valve G, which may be actuated by an eccentric G′ on the shaft C or in other well-known manner. The feed-port *g* leads from the valve-chamber to the adjacent end of the section D and communicates with a port *h* in the abutment-block H, carried by the section D and having its surface H′ curving gradually from the surface of the section E at E^7 to the inner surface of the section D at D^7. The block H is preferably made separate from the section D and is bolted or otherwise secured thereto, as shown in Fig. 2, as such construction permits of the accurate boring out of the inner surface of the section D on the arc of a true circle, as is desired.

By preference I arrange the valve-chambers E^6 of the adjacent cylinders at diametric-

ally opposite points, as shown in Fig. 3. By this means I am able to arrange the pistons to receive steam consecutively and avoid the wear and tear incident to operating the engine on one side only. Thus, it will be seen, the piston on the right in Fig. 1 takes the steam at the dotted line marked 1 in Fig. 2 and will be freed of steam when it reaches the exhaust position, (shown at 2 in the said figure,) whereas the piston in the cylinder (shown at the left in Fig. 1) will take steam at the point indicated by dotted lines 3 in Fig. 3 and will begin to exhaust at the point indicated at 4 in the said Fig. 3. It will be seen, therefore, that the steam is operating upon the engine continuously and on opposite sides thereof in such manner as to secure an even operation of the engine to avoid all unnecessary wear and tear.

The pistons are each constructed with a body portion I, which may be cast integral and formed, as shown in Fig. 1, with the central opening I′ for the shaft C, with the rim portion I^2, and with the diametrically opposite chambers I^3 for the blades, openings at I^4 being provided for the passage of the blade-carrying rod K. This rod is passed through the opening in the head and supports the blades L on its opposite ends, as shown in Fig. 2. The ends of the body I are closed by the head-plates M, which are suitably secured and are provided near their outer edges with grooves M′ for the packing-rings N.

The blades L are composed of a body portion L′ and a packing-strip L^2, seated in the outer edge of the body L′ and having its outer surface L^3 inclined, as shown, to ease the motion of the blade. This packing-strip L^2 is pressed outwardly by the spring L^5, causing it to bear closely against the inner side of the cylinder, and a port L^4 is arranged to admit steam to further press the said packing-strip outwardly when steam is operating upon the piston. This will be clearly understood from Fig. 2 of the drawings. The blades are carried on the outer ends of the rod K, and said rod is threaded at K′ to receive a collar O, which operates to secure in place a disk P, which fits within the opening in the body I of the head and slides therein during the reciprocal movement of the blade-carrying rod in the operation of the engine. This construction is shown in Fig. 2 of the drawings and will be understood from said figure and the foregoing description.

A packing-strip Q is arranged in advance of the point where the piston receives steam and operates to prevent any pressure of the steam in the reverse direction. This strip may be actuated by the springs, as shown in Fig. 8, or by steam, or by both, as will be understood from the said figure. The construction of the engine is such that it can be economically made, readily assembled, and will operate efficiently, evenly, and with the minimum of friction and wear, as is desired.

The packing-rings N operate in the grooves M′ of the head-plates M, and said packing-rings are channeled, forming steam-passages in their inner and outer faces, and have their webs perforated at N′ to permit the passage of steam between the inner and outer sides of said ring in order to avoid any operation of the said rings by steam in case steam should leak to the said rings.

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

1. The improvement in rotary engines herein described consisting of the base or support having the central division-plate provided with a bearing for the shaft, the segmental cylinder-sections provided at their sides with the outwardly-projecting flanges for connection with the central division-plate and with the head-plates, and provided at their ends with outwardly-projecting flanges whereby the sections may be connected together, the head secured to the outer side of the cylinder-section, one of the sections of each cylinder being provided with a valve-casing and valve and the other section with the cam-block having a steam-port and secured to its supporting-section, the valve-chambers of the adjoining cylinders being arranged to admit steam to their respective pistons at different points, the valves and their operating devices, and the pistons composed each of the body portion made integral and having at its center an opening to fit on the shaft and provided with the blade-chambers, the blade-carrying rod, and the blades on said rod and provided in their outer edges with the spring-actuated packing-strips and having means whereby steam may be admitted to aid in packing the said strips, the end plates fixed to the said piston-body, and the shaft all arranged and adapted for use substantially as set forth.

2. The combination in a rotary engine of the central division-plate, the cylinders arranged on opposite sides thereof and composed of segmental sections connected together at their ends and provided with side flanges secured to the central division-plate and with opposite side flanges for connection with the heads, the heads secured to said flanges, the abutment-blocks secured in one of the sections of each of the cylinders, the valve-chamber on the other section of said cylinder, the valves and their operating devices, and the pistons substantially as set forth.

3. In a rotary engine a piston composed of the integral body portion having the blade-passages whose base-walls are provided with the guide-openings for the blade-supporting devices, and whose ends are open, the separate heads secured to the ends of said body, and closing the ends of the blade-passages, the blades, and their supporting device or carrier and the cylinder substantially as set forth.

4. In a rotary engine a cylinder composed

of two segmental sections united at their ends, one of the said sections being provided at one end with an abutment-block and at its other end with an exhaust and the other section being provided at its end adjacent to the abutment-block of the other section with the valve-chamber and the piston operating in said cylinder substantially as set forth.

5. In a rotary engine the combination of the cylinder the piston-body having the passages for the blade, of the blades, the rod carrying said blades and having the threaded portions, the collars on said threaded portions, and the disks held by said collars and sliding in bearings in the piston-body substantially as set forth.

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