

(No Model.)

L. G. LJUNGSTRÖM.  
ROTARY STEAM ENGINE.

No. 571,381.

Patented Nov. 17, 1896.

Fig. 2.

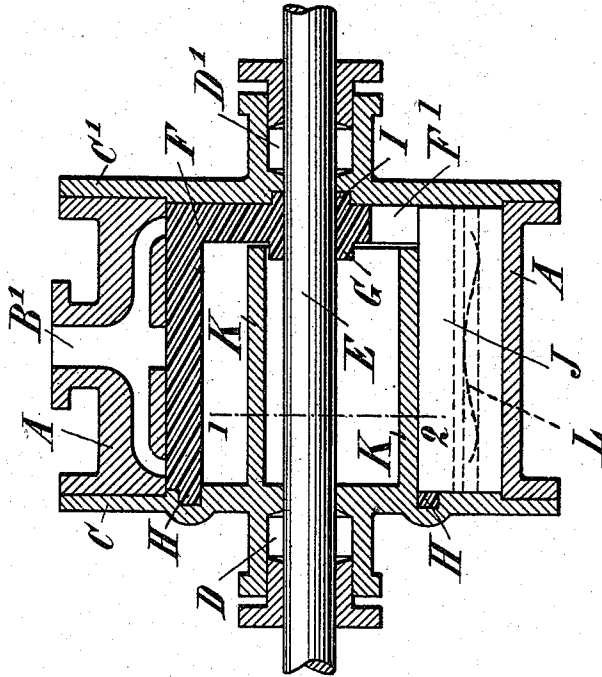
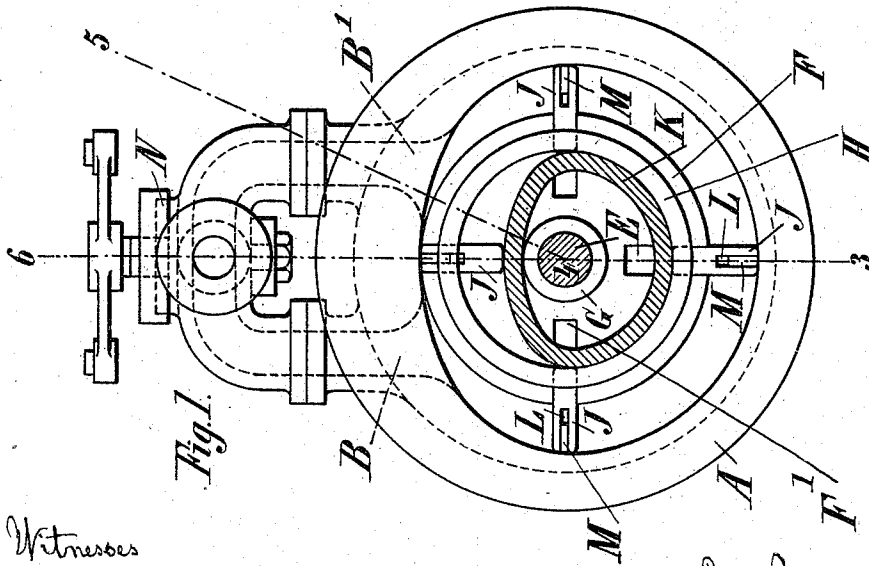


Fig. 1.



Witnesses

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# UNITED STATES PATENT OFFICE.

LARS GUSTAF LJUNGSTRÖM, OF STOCKHOLM, SWEDEN, ASSIGNOR OF ONE-HALF TO WILHELM GEORG CHRISTOFF HARMSSEN, OF SAME PLACE.

## ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 571,381, dated November 17, 1896.

Application filed November 9, 1895. Serial No. 568,480. (No model.)

*To all whom it may concern:*

Be it known that I, LARS GUSTAF LJUNGSTRÖM, a subject of the King of Sweden and Norway, and a resident of Stockholm, in the Kingdom of Sweden, have invented certain new and useful Improvements in Rotary Steam-Engines, of which the following is a specification.

This invention relates to improvements in rotary steam-engines, especially of that class in which a piston-wheel fixed on the engine-shaft and provided with movable pistons or wings rotates or revolves in a stationary steam-chamber and in which the movable wings of the said piston-wheel are operated by means of a separate steering-cylinder concentrically with the steam-chamber.

The invention consists in giving to the steam-chamber and consequently also to the concentric steering-cylinder a cross-section showing the form of a semicircle and of a semiellipse, the major axis of which latter being equal to the diameter of the semicircle, so that the steam-chamber as well as the steering-cylinder may be considered as composed each of two halves, one of which has the form of a semicylinder and the other of a semicylindroid. The axes or center lines of these halves and of the piston-wheel on the engine-shaft, respectively, coincide with one another. The invention further consists in providing a reliable bearing for the open end of the piston-wheel; and the objects of the said improvements are, first, to produce an even path without sharp or abrupt angles or curves for the piston-wings in order to obviate jerking and chocking of the pistons and piston-wheel and to secure a noiseless working of the engine, particularly when running at a high speed, and, second, to secure a steam-tight bearing and reliable guide of the piston-wheel, so that the latter is prevented from vibrating or from giving way in any lateral or radial direction. These objects are attained by the means illustrated in the accompanying drawings, in which—

Figure 1 is an end elevation of the improved rotary steam-engine, partly in section, on the line 1 2, Fig. 2, and as it appears after the removal of the steam-chamber cover; and

Fig. 2, a vertical longitudinal section on the line 3 4 5, Fig. 1.

Similar letters refer to similar parts throughout both views.

The stationary steam-chamber A, which has the function of a steam-cylinder and in which rotates the piston-wheel F, keyed or fixed on the engine or main shaft E, shows, as it will clearly be seen from Fig. 1, an annular circular elliptical cross-section, the major axis of the elliptical part being equal to the diameter of the circular part. The steam-chamber A may be likewise considered as being formed partly by a semicylinder and partly by a semicylindroid, so that the two halves of the steam-chamber at the right and at the left hand of the vertical middle line 3 4 6, Fig. 1, are exactly symmetrical (*i. e.*, similar and equal in form and size) and pass over from one to another in a smooth or even path or curve without any sharp or abrupt angles at the points of union.

The cylindro-elliptical steam-chamber A, provided with suitable admission and escape ports B or B', respectively, which are governed or controlled by a convenient two-way cock or valve N, is closed at its extremities by means of suitable covers C and C', in which the main shaft E is journaled by means of stuffing-boxes D and D', so that the longitudinal axis of the said shaft coincides with that of the cylindro-elliptical steam-chamber A. (See Fig. 2.)

The can or drum shaped piston-wheel F, having its outer diameter equal to the minor axis of the elliptical part of the steam-chamber A, is concentrically fixed on the main shaft E and revolves with the latter in the said steam-chamber. In order to give the piston-wheel F a proper guide during its revolution, the ends of the said piston-wheel are arranged to slide in suitable grooves of the covers C and C' of the steam-chamber A. For this purpose the annular face of the open end of the piston-wheel is provided with an annular rib H, adapted to engage with and bearing in an annular groove in the cover C, while at the other end a shoulder I of the boss or hub G is bearing and revolving in a suitable annular recess of the cover C', so that any vi-

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brating and lateral motion of the piston-wheel F in the cylindro-elliptical steam-chamber A is reliably obviated.

The piston-wheel or drum F is moreover provided with a series of movable pistons or wings J, preferably four, which are capable of sliding to and fro in radial slots F' of the can-shaped piston-wheel. The said radial slots F', however, do not intersect the annular rib H, the latter being thereby enabled to form a continuous reliable journal of the piston-wheel, as already described above.

The movable wings J are operated or forced to slide outwardly in order to traverse the steam-space between the piston-wheel F and the outer steam-chamber by means of a steering-cylinder K, projecting into the can-shaped piston-wheel and acting upon the inner edges of the wings J when the said piston-wheel revolves, and will be withdrawn or forced in again by contact with the interior surface of the cylindro-elliptical steam-chamber A. The said steering-cylinder K being concentrically arranged within the cylindro-elliptical steam-chamber A is proportionally of exactly the same form as the latter, and all that is said about the said cylindro-elliptical steam-chamber is applicable also to the steering-cylinder, which may be made in one piece with the steam-chamber cover C.

The wings or pistons J are provided at their outer edges with longitudinal grooves adapted to receive packing plates or rails M, which accommodate themselves by means of suitable springs L to the interior surface of the steam-chamber A, in order to secure a steam-tight contact and to avoid leakage.

The operation of the described rotary engine is as follows: The steam admitted from the inlet-port B passes into the steam-space of the steam-chamber A in the rear of the left-hand wing J, Fig. 1, so that by the pressure exerted on the said wing, which is fully forced out of the piston-wheel, a rotation of the latter is caused. As soon as the following wing, being at that time in its withdrawn position, (see upper wing J of Fig. 1,) passes the inlet-port B it is forced radially outward by the steering-cylinder, thus offering to the admitted steam a new working surface, whereby further motion is imparted to the piston-wheel, and so on. The steam inclosed between two wings and carried around with

the same escapes as soon as the wing in front passes the outlet-port B'. As the wings approach the upper part of their rotation they are successively forced inward into their respective slots of the piston-wheel by the contact with the interior surface of the steam-chamber and the elliptical form of the steering-cylinder until they reach their innermost position, in which their outer edges are flush with the periphery of the piston-wheel, whereupon on further rotation of the latter the said wings will be forced outward again by the sloping other half of the cylindro-elliptical steering-cylinder in order to be acted upon by the admitted steam, as already stated above. The inward and outward motions of the wings are effected, due to the cylindro-elliptical form of the steam-chamber and steering-cylinder, in a proportionally short time, so that the full width of the wings is exposed to the action of the steam shortly after the wings have passed the steam-inlet port.

The improved rotary steam-engine is capable of running in either direction and may be reversed by changing the functions of the admission and escape ports accordingly.

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

In combination the cylinder with its shaft and with the eccentric space about said shaft, the cylinder-head having the integral inwardly-projecting cam extending along the shaft, said head having also an annular groove in its inner face at a distance from the shaft, and a rotary piston having sliding abutments with spring-pressed portions M tending constantly outward, the said piston being cup-shaped with its edges fitting in the internal groove of the cylinder-head and its bottom or head portion fitting between the edge of the cam and the other cylinder-head, said head having a recess directly about the shaft for the reception of the boss on the cup-shaped piston, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 21st day of October, 1895.

LARS GUSTAF LJUNGSTRÖM.

Witnesses:

CARL P. GERELL,  
GUSTAF M. BARTHOLDI.