(No Model.) 2 Sheets—Sheet 1.

K. A. EKMAN.

ROTARY ENGINE.

No. 342,079. Patented May 18, 1886.

Fig. 2.

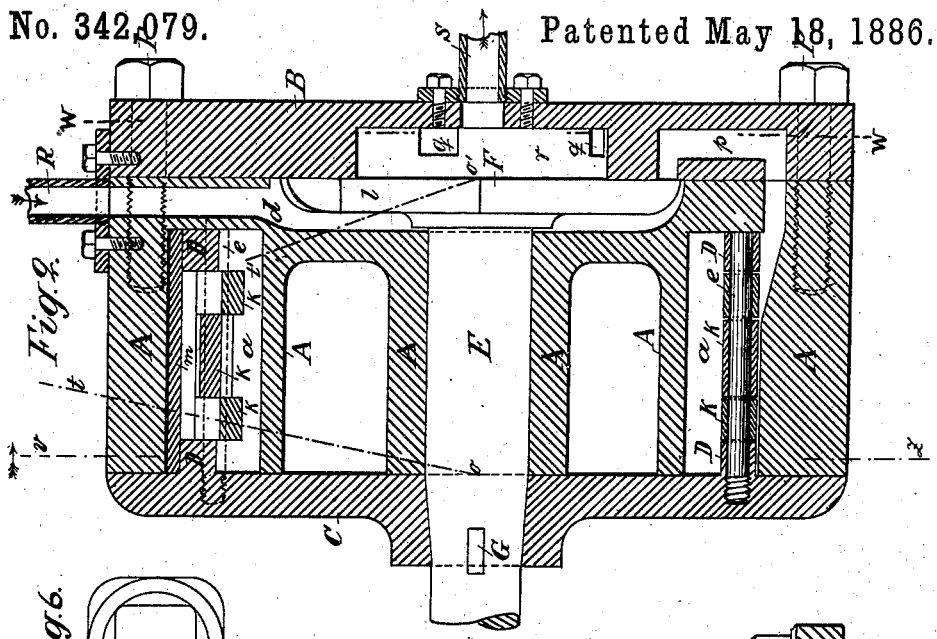

Fig. 6.

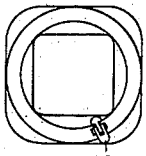

Fig. 7.

Fig. 1.

Fig. 5.

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(No Model.)

2 Sheets—Sheet 2.

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Fig. 4.

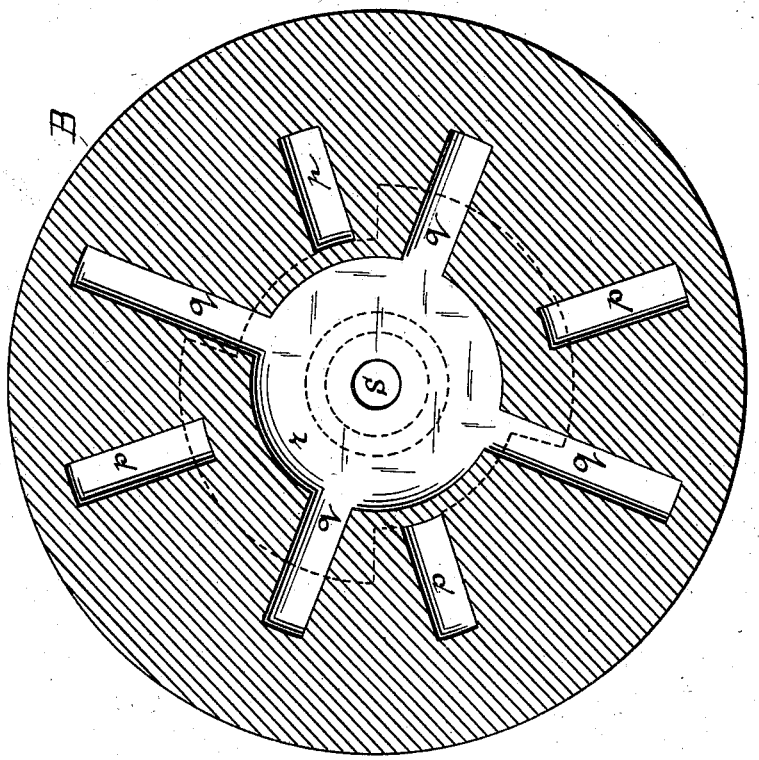
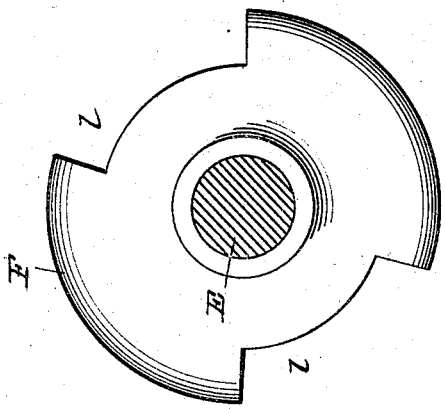


Fig. 3.



WITNESSES:

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E. Sedgwick

INVENTOR:

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ATTORNEYS.

UNITED STATES PATENT OFFICE.

KARL AUGUST EKMAN, OF BOFORS, SWEDEN.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 342,079, dated May 18, 1886.

Application filed April 8, 1886. Serial No. 198,170. (No model.) Patented in Sweden January 29, 1886, No. 257.

To all whom it may concern:

Be it known that I, KARL AUGUST EKMAN, of Bofors, Sweden, have invented a new and Improved Rotary Engine, of which the following is a full, clear, and exact description.

The object of my invention is to provide a new and improved rotary steam-engine capable of running at a very high rate of speed.

The invention consists of a cylinder-body having an elliptical groove in which operate pistons fulcrumed on the revolving cylinder-head, which is attached to the main shaft carrying a disk-valve, and of a fixed cylinder-head provided with inlet and outlet ports and with an exhaust.

The invention also consists of various parts and details and combinations of the same, as will be fully described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional elevation of my improvement on the line *v z*, Fig. 2. Fig. 2 is a longitudinal cross-section of the same on the line *x o y*, Fig. 1. Fig. 3 is a detail face view of the disk-valve. Fig. 4 is a sectional face view of the fixed cylinder-head on the line *w w*, Fig. 2. Figs. 5, 6, and 7 represent modifications hereinafter more fully described.

The engine cylinder or casing A is provided with a base-plate on which the engine rests, and with an elliptical groove or recess, *a*, and a central hub, forming a bearing for the shaft E, on which is secured a cylinder-head, C, by means of a key, G. The cylinder-head B is rigidly attached by the bolts P to the cylinder or casing A, and is provided with a circular recess, *r*, from which radiate the exhaust-channels *q*, and which recess has the radial inlet-ports *p*. The exhaust-pipe S leads centrally to the recess *r*.

The movable cylinder-head C covers the elliptical recess or groove *a* in the cylinder A, and is provided with the annular offset or projection D, which has two or more transverse recesses in which are mounted the pistons K, each piston being attached to an arm which is fulcrumed on the bolt or shaft *e*, secured in the annular projection D of the cylinder-head C.

The pistons K are each made in two parts, which fit tightly in the elliptical recess or groove *a*, and are held in close contact with the same by small spiral springs pressing the two parts of the piston outward. Against the circular surfaces of the pistons K press the pads *n*, placed in grooves formed in the annular projection D, and held in contact with the pistons K by spiral springs.

The annular projection D touches the cylinder or casing A in four or more places, and the cylinder A is provided at each of these contact places with a recess, in which is placed a packing-strip, *m*, pressed outward into contact with the annular projection D by a spiral spring.

On the inner end of the shaft E is secured a disk-valve, F, placed in the steam-chest *d*, formed between the cylinder A and the cylinder-head B. The steam inlet-pipe R opens into the steam-chest *d*, and the disk-valve F is provided with two ports, *l*.

The operation is as follows: The steam enters through the steam inlet-pipe R into the steam-chest *d*, and its pressure forces the disk-valve F to seat itself against the inner face of the fixed cylinder-head B. The ports *l* of the disk-valve F connect alternately with the radial inlet-ports *p*, thereby admitting steam into the elliptical groove or recess *a* of the cylinder A, which steam also exerts a pressure against the cylinder-head C, whereby the valve-disk F is counterbalanced, and as both the cylinder-head C and the valve-disk F are mounted on the shaft E only a longitudinal tension is exerted against the said shaft. The steam entering the elliptical groove *a* also exerts its pressure against the pistons K, which are pushed forward in the direction of the arrow *a'*, and cause the cylinder-head C, the shaft E, and its valve-disk F to rotate. As the pistons K are fulcrumed at *e*, they swing so as to conform to the shape of the elliptical groove *a*, in which they travel. As soon as the pistons K have passed the outlet-ports *q* the steam behind the pistons enters the outlet-ports *q* and the recess *r*, from which it escapes into the exhaust-pipe S. The pistons K receive a secondary impulse from the steam as soon as they have passed the next inlet-port, *p*, the valve-disk F establishing the necessary

communication between the elliptical groove *a* and the port *p*. As the outlet-ports *q* are always open, the steam can escape freely.

The cylinder-head C and the valve-disk F may be conical in shape, as indicated by the dotted lines *o t* and *o' t'*, the contact-surfaces of the cylinder A and the head B being shaped correspondingly. The eccentricity of the elliptical groove *a* and the number of pistons K may be varied from the simple elongated recess *a*, with two pistons, as shown in Figs. 1 and 2, to the form where the annular projection D is supported at three or six places, as shown in Fig. 5, with three pistons, or to the form where the annular projection has four contact-places, as shown in Fig. 6, with four pistons.

Instead of having the pistons K pivoted on pins *e*, they may be constructed of two parts, as shown in Fig. 7, of which one part telescopes the other, and the two parts are pressed outward from each other by a spiral spring. In case the latter form of piston is used, the engine may be reversed by making the now fixed cylinder-head B movable on its center, so that the head B is turned to an angle equal to the distance between the next inlet and outlet ports, the outlet-openings *q* become inlet-ports, and vice versa.

In order to save space, the steam-inlet ports may be made annular and formed in the inner edge of the annular projection D at each side, as shown by the construction-lines at *c* in Fig. 1. In the bottom of the grooves in the surface covered by the annular projection elongated recesses are then formed, which correspond to the recesses in the annular projection, which recesses communicate with the steam-chest. More grooves may be used—one outside of the other—which will then be covered by a common cylinder-head, so that the pistons of one groove are placed in an intermediate position to those of the other grooves, the pressure on the cylinder-head varying less from one to the other, so as to make an outer tightening between the movable and stationary parts of the engine without incurring a great surplus of pressure on the valve-disk in the steam-chest.

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

1. In a rotary steam-engine, a cylinder having an elliptical groove and a fixed cylinder-head having inlet and outlet ports, in combination with the main shaft having its bearing on the cylinder, a cylinder-head attached to the said shaft and having an annular projection, pistons fulcrumed on the said annular projection and operating in the elliptical groove of the cylinder, and a valve-disk provided with ports, substantially as shown and described.

2. In a rotary steam-engine, a cylinder having an elliptical groove, in combination with a movable cylinder-head having an annular projection, and pistons fulcrumed on the said annular projection and traveling in the elliptical groove of the cylinder, substantially as shown and described.

3. In a rotary steam-engine, a cylinder having an elliptical groove, a fixed cylinder-head having inlet and outlet ports and forming a steam-chest between the cylinder and the cylinder-head, in combination with a movable cylinder-head having an annular projection, pistons fulcrumed on the annular projection and traveling in the elliptical groove, and a valve-disk provided with ports and attached to the main shaft, to which is secured the movable cylinder-head, substantially as shown and described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

KARL AUGUST EKMAN.

Witnesses:
ALB. JUDERSON,
FRANS PETTERSSON.