P. A. & I. S. KNAPP.

ROTARY ENGINE.

No. 187,539. Patented Feb. 20, 1877.

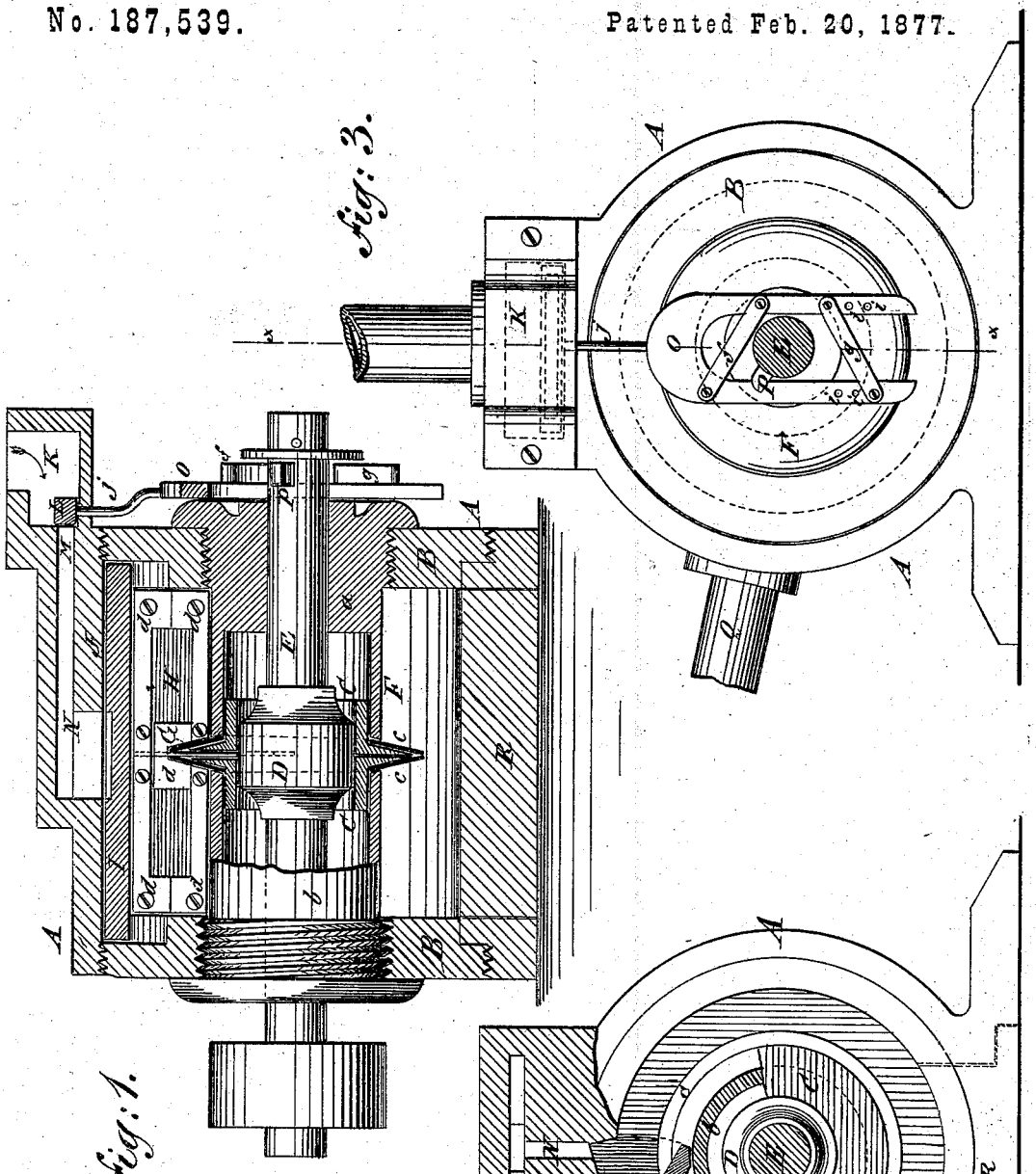

Fig: 1.

Fig: 2.

Fig: 3.

WITNESSES:

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PHILO A. KNAPP AND IRA S. KNAPP, OF DANBURY, CONNECTICUT.

IMPROVEMENT IN ROTARY ENGINES.

Specification forming part of Letters Patent No. **187,539**, dated February 20, 1877; application filed December 23, 1876.

To all whom it may concern:

Be it known that we, PHILO A. KNAPP and IRA S. KNAPP, of Danbury, in the county of Fairfield and State of Connecticut, have invented a new and Improved Rotary Engine, of which the following is a specification:

Figure 1 is a central longitudinal section of our improved rotary engine, taken on line *x x* in Fig. 3. Fig. 2 is an end elevation, in part section, showing the internal construction of the engine. Fig. 3 is an end elevation, showing the device for moving the valve.

Similar letters of reference indicate corresponding parts.

Our invention consists of a cylinder having an annular space, in which a rotating piston is placed, and a shaft running through the central portion or core of the cylinder, and connected with the said piston by a thin arm, which passes between annular spring-plates, secured in the center of the core of the cylinder, the said plates forming a packing, which permits the piston-arm to rotate, but closes together after the arm passes, preventing the steam from coming into contact with the shaft.

Referring to the drawing, A is the cylinder of the engine, in the ends of which heads B are screwed. A hollow core, F, consisting of the parts *a b*, is secured centrally in the cylinder by screwing them into the heads B. The inner ends of the parts *a b* are separated a small distance, and beveled, and to this surface the annular spring-plates *c c* are attached. These plates are beveled or dished, so that their peripheries meet. C C are flanged bushings, fitted to the ends of the parts *a b* that assist in holding the plates *c c*, and form a bearing for the hub D, formed on the center of the shaft E. The shaft E is journaled centrally in the outer ends of the parts *a b* of the core F, and to the hub D a thin arm, G, is secured, which passes between the spring-plates *c*, and is also attached to the piston H. The piston H fits the annular space between the core F and the interior surface of the cylinder A, and is notched to receive the plates *c c*. Adjustable packing-pieces *d* are attached to the face of the piston H, by means of which it is made to fit steam-tight in the cylinder. The advancing side of the piston is beveled or reduced in thickness, so that it may readily pass under the abutment. I is a movable abutment, that is longer than the annular steam-space of the cylinder, and is retained in place by recesses formed in the cylinder-heads to which it is fitted. A recess, J, is also formed in the side of the cylinder, which is of sufficient depth to receive the abutment, so as to allow the piston to pass. The side of the abutment that forms the pivot upon which it turns is rounded, and fits a rounded groove, *e*, at one side of the recess J. K is a steam-chest containing the valve L, which is capable of opening or closing the supply-port M. N is a passage leading from the port M, and communicating with the space at the back of the abutment I. A valve-rod, *j*, projects downward from the valve through the lower portion of the steam-chest, and is attached to a fork, O, that straddles the end of the shaft E, and to which the inclined bars *f g* are attached. P is a cam-lug, that projects from the shaft E, and is capable of engaging alternately with the bars *f g*. The bar *f* is permanently attached to the fork O, and when it is engaged by the cam-lug P the valve L opens the port M, and admits steam to the cylinder as the piston H passes the abutment I.

When the cam-lug P strikes the bar *g*, the slide-valve L closes the port M, cutting off the steam. The point of cut-off may be varied by adjusting the bar *g* on the face of the fork O by changing the bolts that hold it in place in the holes *i i*, &c.

Q is the exhaust-opening, through which steam escapes when the piston passes it.

The operation of our improved engine is obvious. Steam being admitted to the steam-chest K, the cam-lug P strikes the bar *f*, and opens the valve L, allowing steam to pass into the cylinder after the piston has passed the abutment. The steam, acting on the piston, causes it to rotate, and when it nears the exhaust-opening the cam-lug strikes the bar *g*, and cuts the steam off. The steam exhausts as the piston passes the opening Q, and the momentum of the movable parts carries the piston forward until it has raised and passed the abutment, when steam is again admitted, and the operation is repeated.

A removable portion, R, is fitted to the lower portion of the cylinder, which is bored out

when the cylinder is made, and forms a part of it. It is designed for convenience in constructing and repairing the engine.

The engine may be made from materials commonly used for the purpose. The heads being screwed, it should be made of brass or composition metal, so that they will not corrode.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The spring-plate *c*, in combination with the piston-arm G, for excluding steam from the shaft while permitting the rotation of the arm, substantially as herein shown and described.

2. The combination of the cylinder A, the core F, shaft E, arm G, piston H, and spring-plates *c c*, substantially as herein shown and described.

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Witnesses:
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