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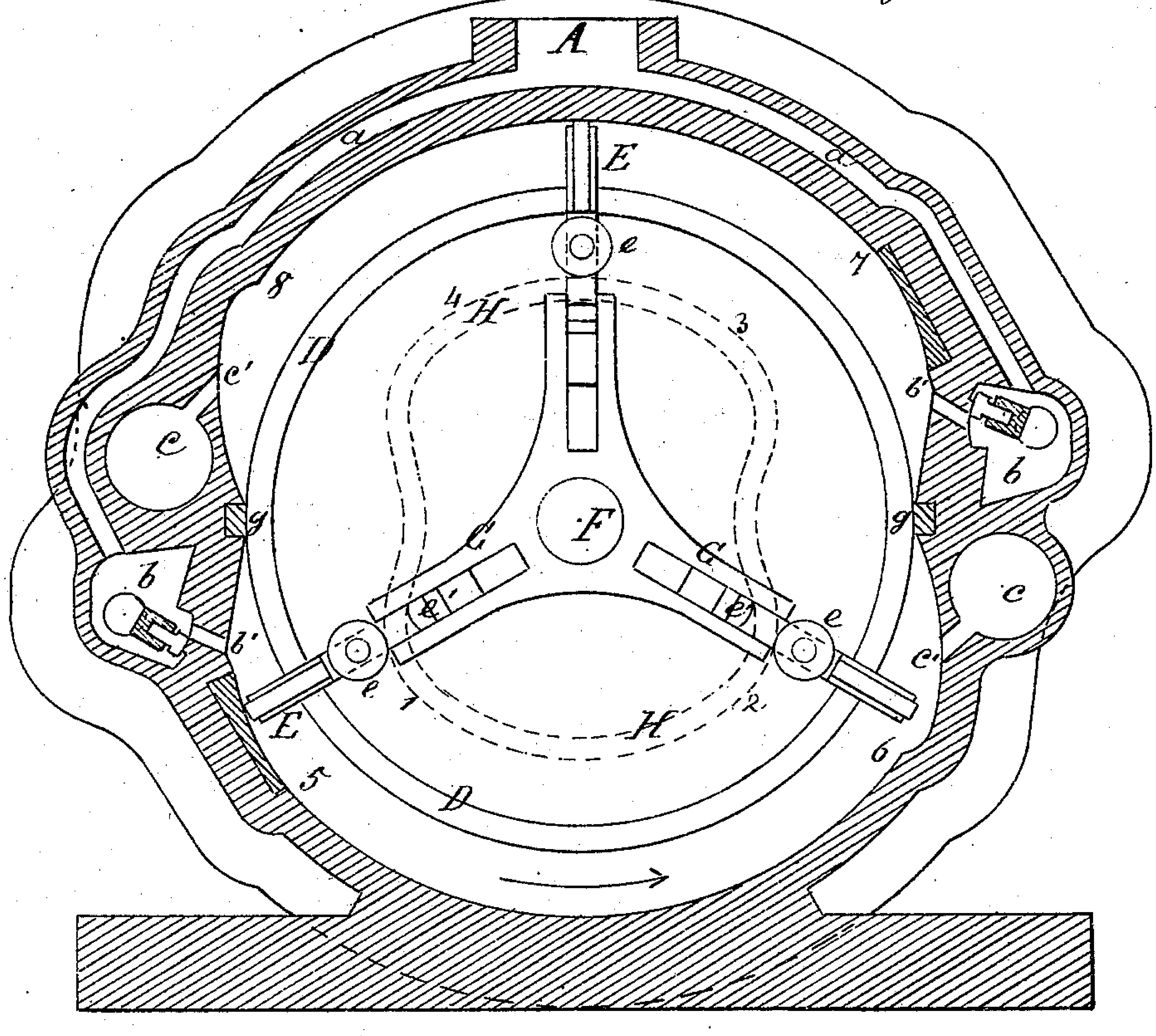
O. ADAMS
Rotary-Engines.

No. 158,664. Patented Jan. 12, 1875.

Fig 1



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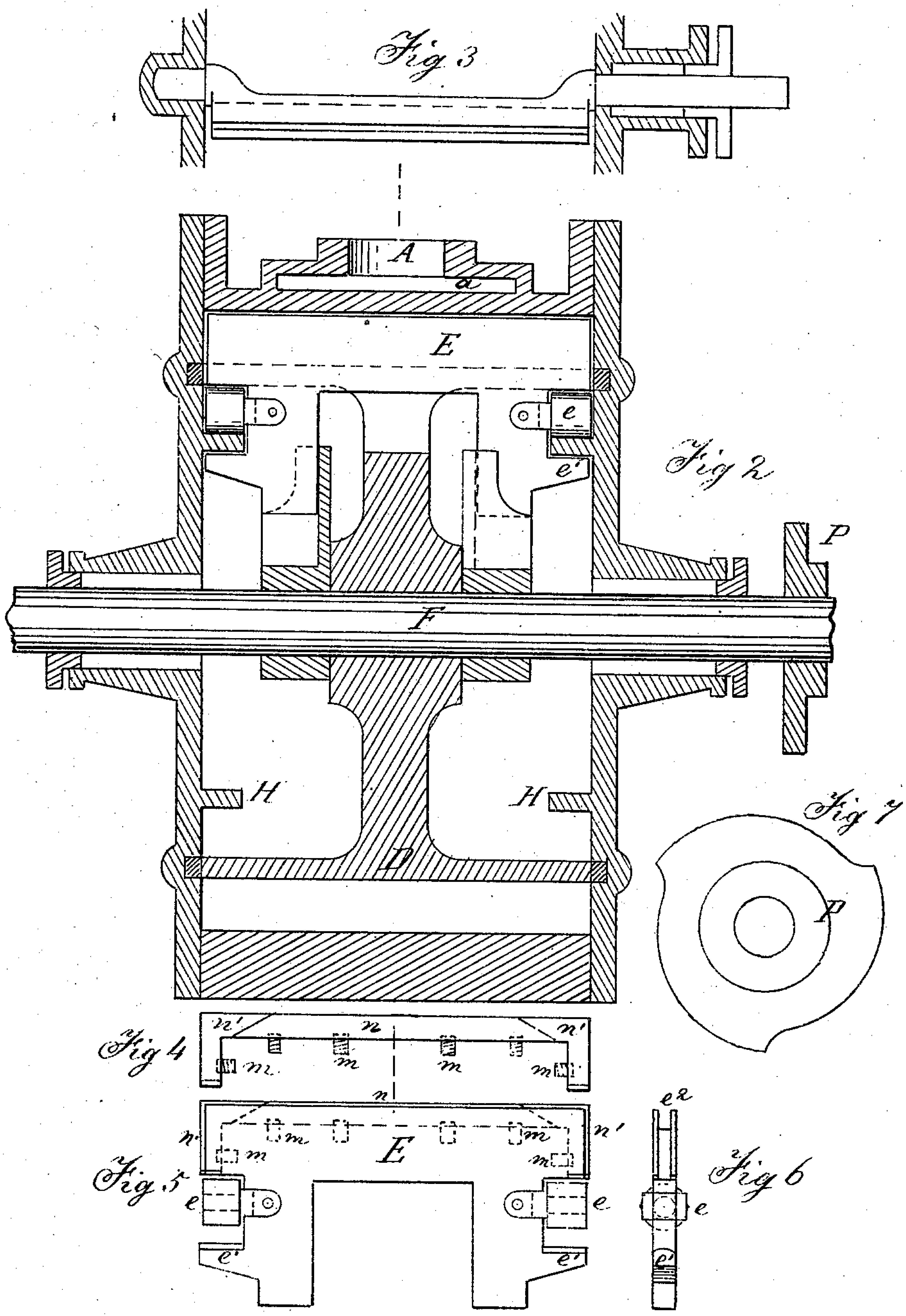

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Fig 9

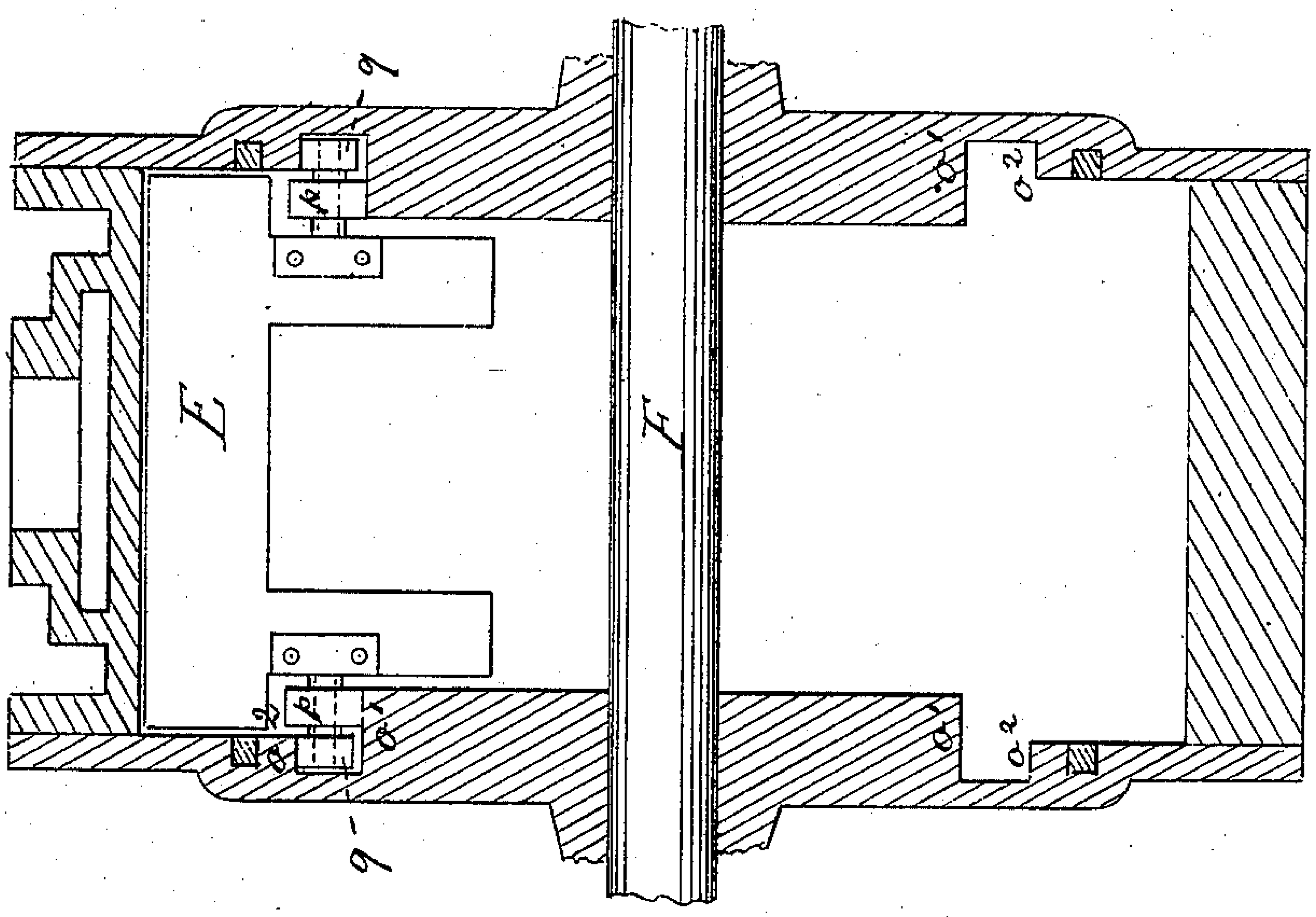


Fig 10

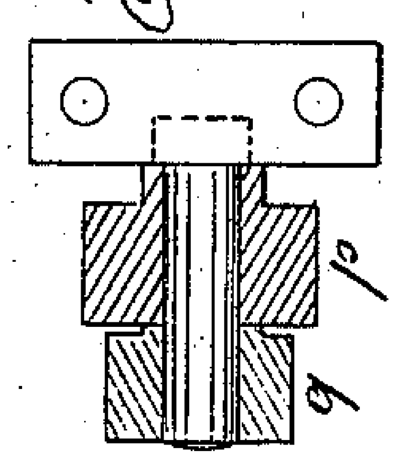
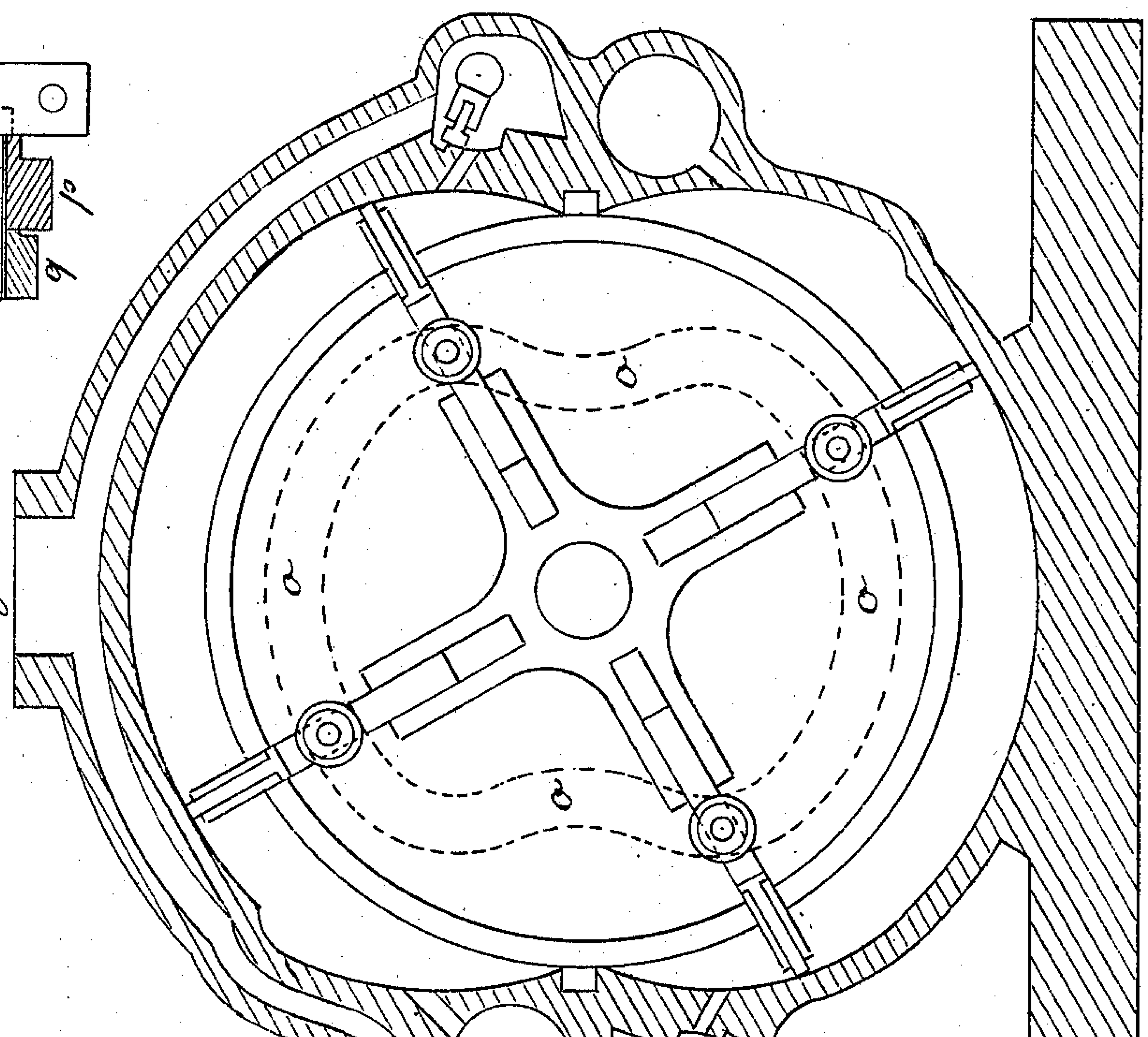


Fig 8



Witnesses.

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UNITED STATES PATENT OFFICE.

ORWIN ADAMS, OF BATTLE CREEK, MICHIGAN.

IMPROVEMENT IN ROTARY ENGINES.

Specification forming part of Letters Patent No. **158,664**, dated January 12, 1875; application filed June 11, 1874.

To all whom it may concern:

Be it known that I, ORWIN ADAMS, of Battle Creek, State of Michigan, have invented an Improved Rotary Engine, of which the following is a specification:

The object of the invention is to arrange grooved cams on each side of the piston-drum, to guide the pistons in and out, and a double roller on each end of the pistons, to obviate rapid wear of those working parts. A second object of the invention is to provide rectangular pistons, such as are used in my engine, with a more perfect edge-packing than was heretofore used in any engine.

The accompanying drawings show the principal parts of a non-reversible rotary engine, the valve-gear being omitted, as that will be substantially the same as that heretofore patented by me August 19, 1873, which patent is numbered 141,909.

In these drawings, Figure 1 represents a vertical longitudinal section in line *x x* of Fig. 2 of the cylinder, and a full view of the drum arranged with three pistons, the guiding-cams for the pistons being shown in dotted lines. Fig. 2 is a vertical transverse section through the center of the engine. Fig. 3 is a front view of the rocking valve and a portion of each of the two cylinder-heads. Fig. 4 is a front view of the pieces constituting the edge-packing of the pistons. Fig. 5 is a front view of one of the pistons detached. Fig. 6 is an end view of the piston, the packing being removed. Fig. 7 is a front view of the cam, which operates the valve-gear of a three-piston engine. Fig. 8 is a vertical longitudinal section of a four-piston engine, in which the pistons are guided in and out by grooved cams attached to the heads of the cylinder, the shape of the said cams being shown in dotted lines. Fig. 9 is a vertical transverse section of the four-piston engine represented in Fig. 8. Fig. 10 is a sectional view of the double rollers and the pin on which they run, shown on a larger scale than the other figures.

Letter A represents the induction, and *a a* are the channels which lead the steam around the cylinder to the two steam-chests *b b*, which are located at opposite sides of the cylinder. *b′ b′* are the steam-ports, by which the steam enters the interior of the cylinder. *c c* are exhaust-receivers, which communicate with the interior of the cylinder by the exhaust-ports *c′ c′*. D is the revolving drum, which carries the pistons E. The drum is fastened upon a center shaft, F, which has its bearings in the heads of the cylinder. The pistons E slide in and out in slits made in the periphery of the drum, and are also guided in the arms of the spiders G, one on each side of the hub of the drum, the arms of these spiders being furnished with radiating grooves, to receive and guide the legs of the pistons. Each piston is provided with two rollers, *e*, and two projections, *e′*. The rollers travel upon the outer surface of a guiding-flange, H, and the projections upon the inner surfaces. The guiding flanges or cams H are attached to the inner sides of the cylinder-heads, and serve to guide the pistons in and out. Their shape is part of a circle from 1 to 2 and from 3 to 4, (see Fig. 1,) and contracted or depressed toward the center from 1 to 4 and from 2 to 3; and the interior of the cylinder is also a portion of a circle from 5 to 6 and from 7 to 8, and both the cylinder as well as the flanges are made concentric with the drum at those places. While the pistons travel upon the circular portions of the flange H, their edge-packing is in contact with the circular portions of the cylinder. In about the center, between the steam and exhaust ports, the interior surface of the cylinder is contracted toward the drum, and there is a metallic packing, *g*, which bears against the drum D, and prevents communication between the steam and exhaust ports. The rocking valves close and open the steam-ports *b′ b′*, being operated by the cam P, which must be a three-folded cam for a three-piston engine, as shown in Fig. 7, and a four-folded cam for a four-piston engine.

The valve-gear is not shown in the drawings, as the said gear may be substantially the same as that described and claimed in the aforesaid Letters Patent No. 141,909, except that it must be made suitable to operate two valves instead of one.

A modified plan of the means of guiding the pistons in and out is shown in Figs. 8, 9, 10. It consists in making the cylinder-heads with a continuous grooved cam, *o*, (shown in dotted lines in Fig. 8,) and furnishing the ends of the pistons with two rollers each, p and q, the rollers p traveling upon the inner surface, o^1, of the groove-cam o without touching the outer surface, o^2, of the said cam, and the rollers q traveling on the outer surface, o^2, of the groove-cam without touching its inner surface, o^1, both rollers running on the same pin. In order to accomplish this, the roller q may be made of smaller diameter than the roller p, and the inner surface, o^1, of the cam-groove o may project horizontally beyond the outer surface, o^2, of the said groove as much as the larger roller p is wide, as is clearly shown in Figs. 9 and 10. This is preferable to having a single roller running in a groove-cam, as a single roller could not be made to fit the groove tightly; otherwise it would not revolve in traveling around the groove, and, if made to have a play between the sides of the groove, the single roller is obliged to change its contact from one side of the groove-cam to the other, and also its direction of revolving motion, (four times in going once around the cam,) which would expose the roller and the sides of the cam each time to a blow, and, in the rapid motion of the engine, to considerable wear, while the two rollers p and q, as arranged by me, can be so fitted to the width of the groove-cam as to keep one of them (p) constantly in close contact with the inner surface, o^1, and the other roller (q) constantly in contact with the outer surface, o^2, of the groove.

It will be readily seen that the rollers p and q, thus arranged and fitted in between the sides of the groove, will never be obliged to reverse their motion, nor receive any blows.

It is evident that the same device may be applied with success to any grooved cam requiring a rapid motion and exposed to wear.

The edge-packing of the pistons is of the following construction: The blade is made with a groove, e^2, running along its outer edge and down its end edges, as shown in Fig. 6, and the three packing-pieces n n' n' are fitted into these grooves, projecting slightly beyond the edges of the blade. n' n', being the corner packing-pieces, are fitted beveling against the ends of the center piece, n, and there are spiral springs m m let into the blade, which tend to hold these pieces n n' n' out and in close contact with the cylinder and its heads.

The object of fitting the end pieces, n' n', beveling or angular against the ends of the center piece, n, in the manner as shown in the drawings, (see Fig. 4,) is to retain a steam-tight joint between the three packing-pieces when the edges of these packing-pieces wear away, the ends of the center piece, n, keeping all the time in close contact with the inner ends of the end pieces, n'.

Among the advantages obtained by this rotary engine are the following:

First, the incoming piston cuts off all steam back of it; thus there is no steam exhausted back of the piston.

Second, there are no dead-points in the engine; two of the pistons are all the time taking steam.

Third, in the four-piston engine there is no one-sided pressure on the main journals of the shaft, caused by the steam-pressure on the drum, and in a three-piston engine this one-sided pressure is counterbalanced to a great extent.

Fourth, a perfect edge-packing is obtained for a rectangular piston.

Fifth, there is no material friction on any moving part of the engine caused by the pressure of the steam.

Sixth, the valves are opened at about one-fifteenth of the stroke of each piston. Thus the pistons may have boiler-pressure for almost the whole length of their stroke, unless the engine is made to cut off.

Seventh, the cut-off can be arranged from one-fifteenth to two-thirds of the stroke, thus enabling the engine to be governed by the cut-off.

Eighth, the area of the ports being about one-quarter of that of the pistons, the steam in the ports is not obliged to travel more than seventy-five feet per second, while the piston speed may be one thousand feet per minute.

Ninth, on account of the great speed of the piston, the loss of steam by radiation and leakage is proportionally small.

It is obvious that the herein-described plan is also applicable to the construction of rotary pumps, in which case the rocking valves should be dispensed with.

What I claim as my invention is—

1. The stationary cams o^1 and o^2, the surface of o^1 projecting beyond the surface of o^2, in combination with the rollers p and q, turning on the same pin, substantially as specified.

2. The metallic packing of a rectangular piston, consisting of the combinations of the packing-pieces n n' n', the adjoining ends of each piece being beveled to form close contact, and the springs m, substantially as and for the purpose specified.

ORWIN ADAMS.

Witnesses:

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E. R. MORRISON.