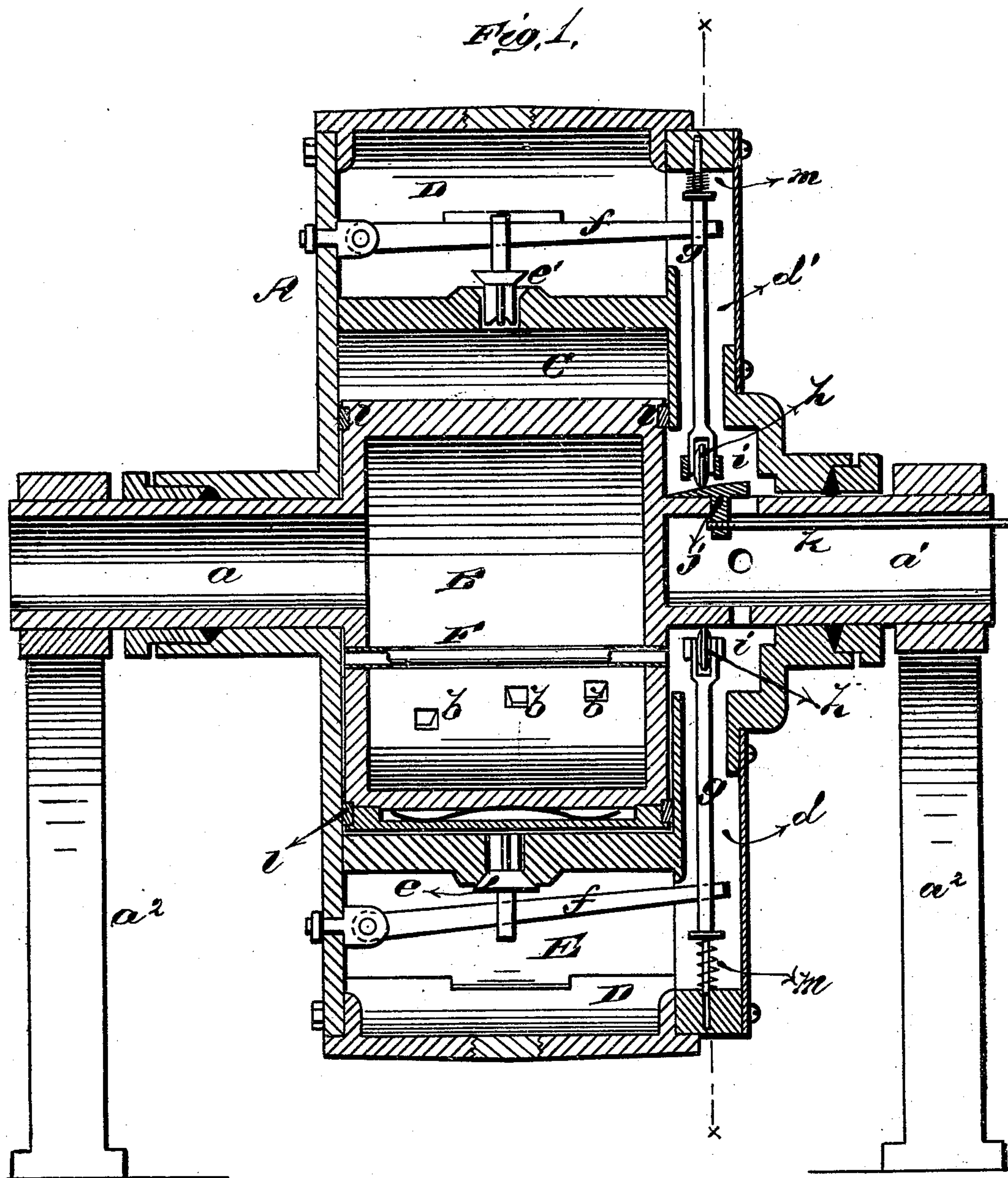


G. C. HALE.  
Rotary Engine.

No. 199,061.

Patented Jan. 8, 1878.



WITNESSES

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*James H. Lange.*

INVENTOR

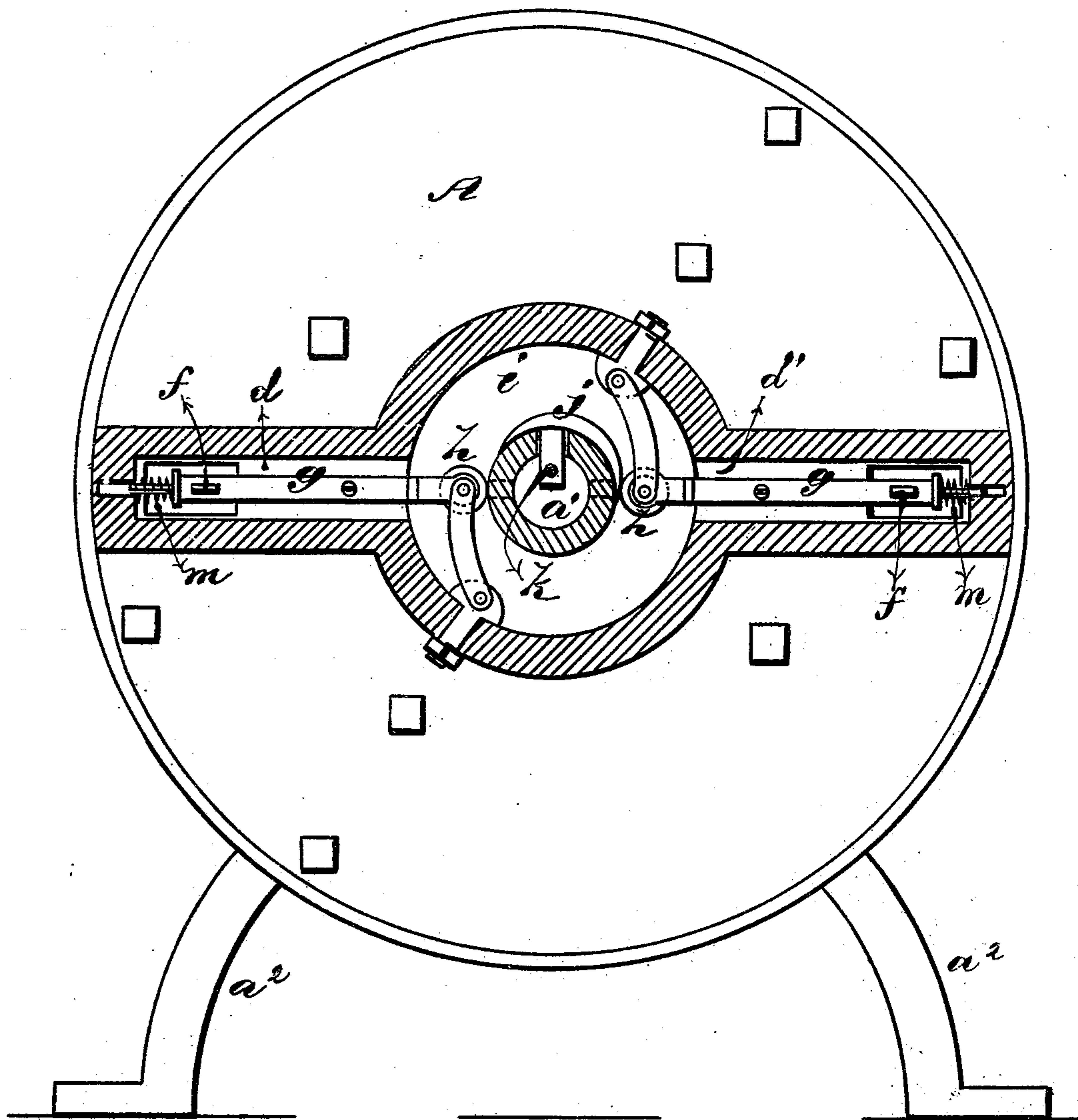
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ATTORNEYS

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Fig. 2.



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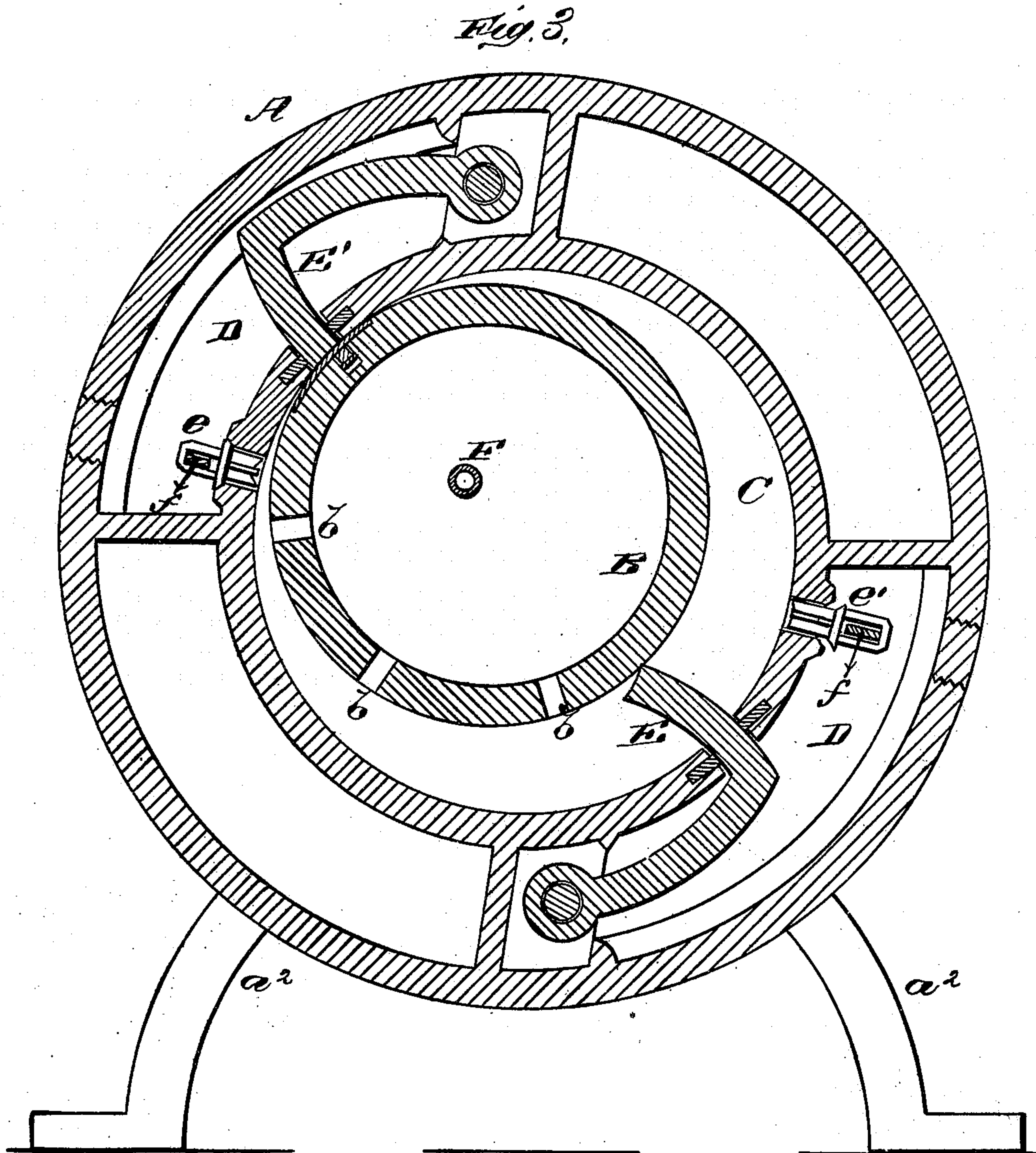
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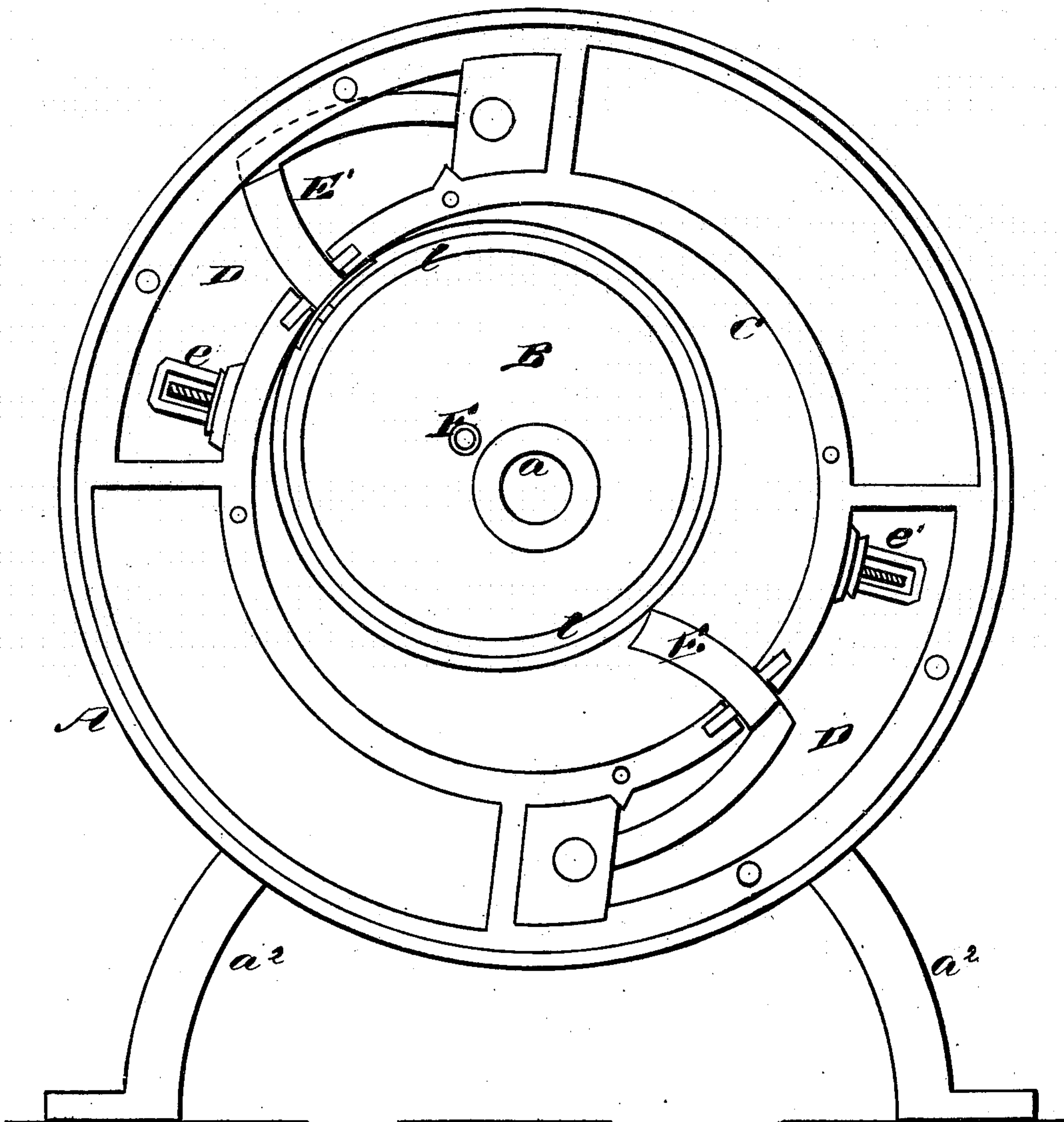
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*Fig. 4.*



WITNESSES

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# UNITED STATES PATENT OFFICE.

GEORGE C. HALE, OF KANSAS CITY, MISSOURI, ASSIGNOR TO HIMSELF  
AND F. C. WHITE, OF SAME PLACE.

## IMPROVEMENT IN ROTARY ENGINES.

Specification forming part of Letters Patent No. **199,061**, dated January 8, 1878; application filed  
December 6, 1877.

*To all whom it may concern:*

Be it known that I, GEORGE C. HALE, of Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification, and in which—

Figure 1, Sheet 1, is a vertical longitudinal section of my improved rotary steam-engine. Fig. 2, Sheet 2, is a section through the dotted line  $x x$  of Fig. 1. Fig. 3, Sheet 3, is a vertical transverse section of my engine; and Fig. 4, Sheet 4, is a side elevation of the same, with one end of the inclosing cylinder or case removed.

Corresponding parts in the several figures are denoted by like letters.

This invention relates to certain improvements in rotary steam-engines; and it consists of the mechanism for opening and closing the puppet-valves, which admit the steam from the steam-chests into the cylinder; and, secondly, of hinged or swinging pistons, hung in the steam-chests, and moving through the shell of the cylinder which receives the steam-pressure that causes them to drive the engine, substantially as hereinafter more particularly set forth.

In the annexed drawings, A refers to an outer cylinder or case, supported upon the tubular trunnions  $a a^1$ , cast or otherwise fixed to the inner eccentric cylinder or chamber B, and resting upon legs or supports  $a^2 a^3$ . The cylinder B is provided with exhaust-ports  $b b$  for the steam from the intermediate cylinder or chamber C.

D D are the steam-chests, to which steam is admitted by the passages  $d d'$  leading from the steam-induction trunnion  $a^1$ .

Steam is admitted from the chests D D to the intermediate cylinder or chamber C by means of the puppet-valves  $e e'$ , alternately opened and closed, as hereinafter set forth. To the stems of the valves  $e e'$  are connected levers  $f f$ , fulcrumed in the side of the case A,

and connected at their free ends to arms or bars  $g g$ , preferably provided with friction-rollers or rotating disks  $h h$ , bearing upon or against the induction-trunnion  $a^1$ . Upon this trunnion, inside of the enlargement  $i i$  of the steam-passages  $d d'$ , is a sliding inclined shoe or cam,  $j$ , projecting through a slot in the said trunnion, and connected to a rod,  $k$ , extending through the trunnion and to a point where it may be conveniently grasped and operated, the object of which will appear hereinafter.

It will be seen that as the shoe or cam is alternately rotated in contact with the bars  $g g$ , or their disks or wheels, the valves  $e e'$  will, in like manner, be opened or closed for the ingress of steam to the chamber C, to drive the pistons.

By moving the rods  $k$  in or out, the shoe or cam will be accordingly affected, and the lifting of the valves be varied to regulate the passage of steam through them.

E E' are the pistons, hung in any suitable manner in the steam-chests, and having their right-angular portions passing, steam-tight, through the cylinder C and into its chamber.

It will be observed that when the piston E is beginning to move away from the eccentric-cylinder B, Fig. 3, the steam in its chest will force it into the chamber of the cylinder C and against the eccentric B, at which time the valve  $e$  will also begin to open and admit steam into the chamber of the cylinder C against the face of the said piston, and thus cause it to rotate or drive the engine. Simultaneously with this action of piston E, the piston E' will have passed the first exhaust-port  $b$ , and the steam admitted to it in the chamber of the cylinder C be partially exhausted, and, as the piston E' continues to move around toward the point where the eccentric and cylinder C meet, become entirely exhausted through the other ports  $b b$  into the chamber of the eccentric B, and be allowed to escape through the induction-trunnion  $a$ . The valves closing after passing the shoe or cam, the admitted steam to the pistons is thus used expansively the remainder of their stroke.

The pistons E E' being held to their seats and against the eccentric B by steam-pressure, they will take up their own wear, and, by



being pivoted or hung at nearly right angles to the direction in which they are acted on by the steam, by which they are subjected to centrifugal force, they are relieved of friction.

F is a tube, communicating with the steam-induction passage *d*, and passing through the eccentric B, for the passage of steam through it to the opposite head of said eccentric, to equalize pressure upon its heads.

The eccentric B is fitted, as at *l l*, steam-tight to the cylinder C.

Springs *m m* are fitted to the lever arms or bars *g g*, to return the valves *e e'* to their seats after the said arms or their rollers have passed the shoe or cam *j*.

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

1. In a rotary steam-engine, the combination, with its puppet-valves, which admit steam to its pistons, of the levers *f f*, spring-arms *g g*, arranged in the steam-passage *d d'*, and the

cam or shoe *j* upon the induction-trunnion, substantially as and for the purpose set forth.

2. In a rotary steam-engine, the swinging pistons E E', hung in the steam-chests, and entering the steam-chamber and resting against the stationary eccentric B, in combination with the valves *e e'*, operated by suitable mechanism, substantially as and for the purpose set forth.

3. The combination of the outer cylinder A, inner cylinder C, forming steam-chests, stationary eccentric B, valves *e e'* and their operating mechanism, pistons E E', and the induction and eduction trunnions *a a'*, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my own I hereunto affix my signature in presence of two witnesses.

GEORGE C. HALE.

Witnesses:

H. FINNEY,  
R. W. HILLIKER.