(No Model.) 2 Sheets—Sheet 1.

F. C. MORTON.

ROTARY ENGINE.

No. 310,843. Patented Jan. 13, 1885.

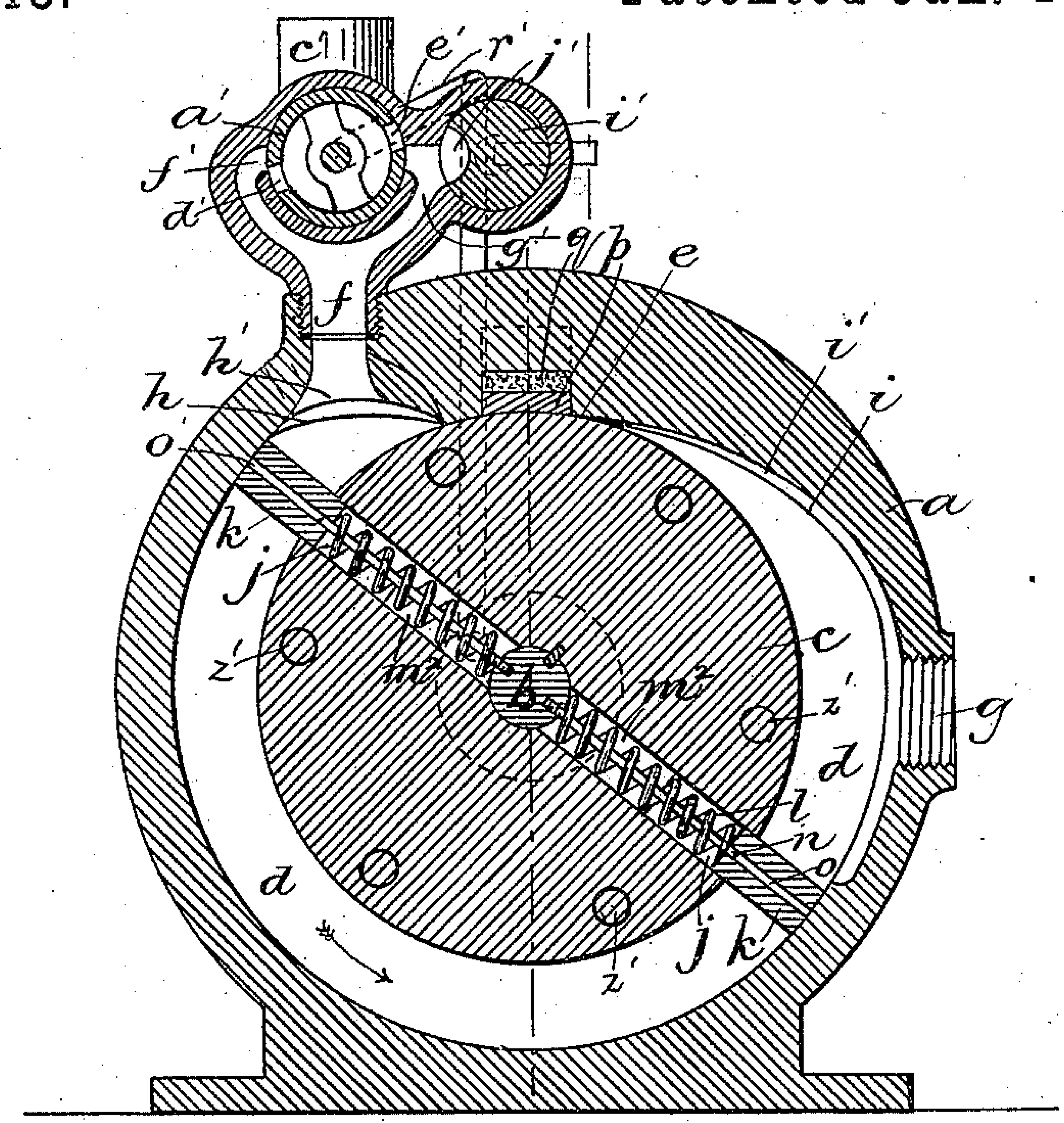

Fig. 1.

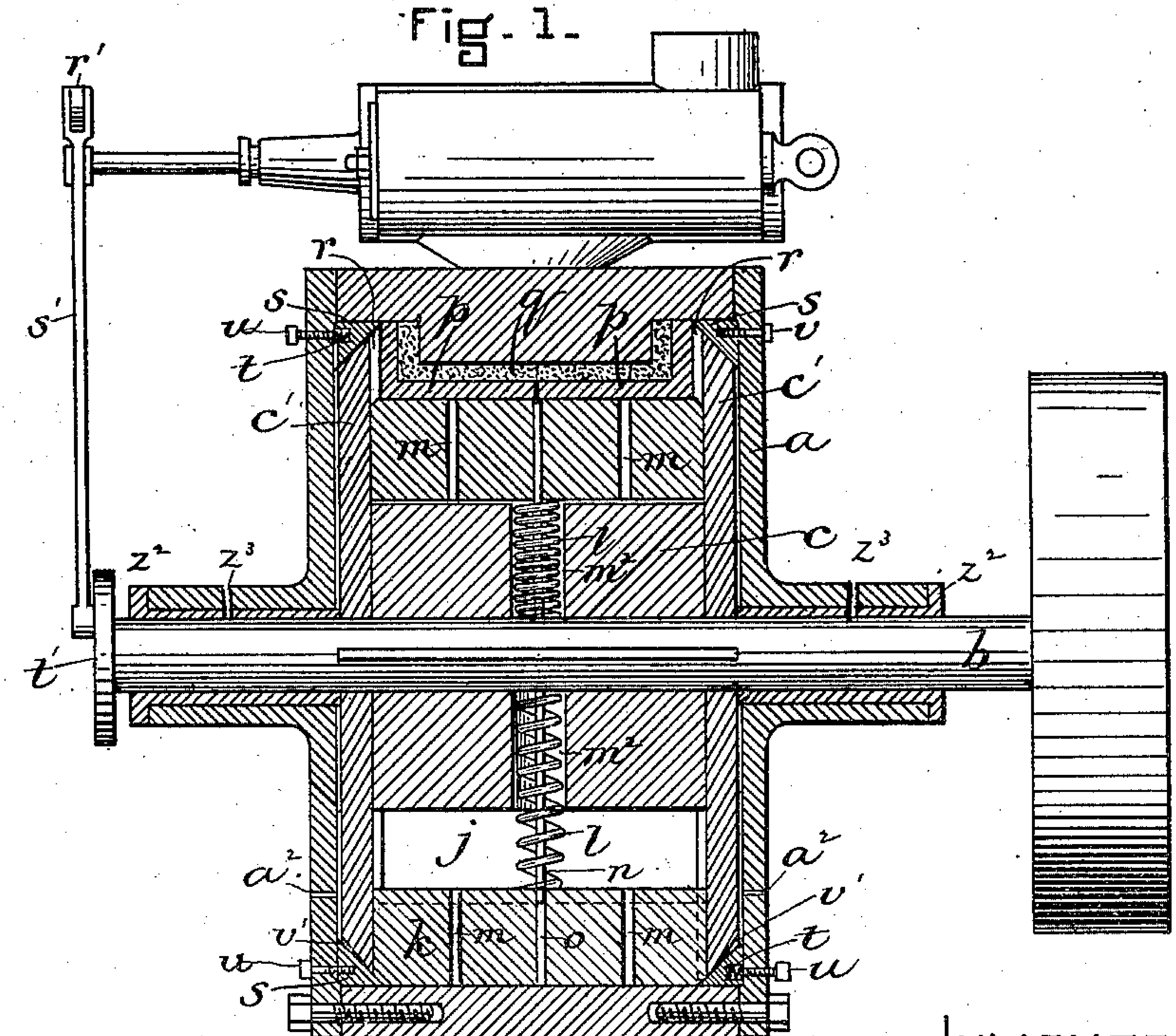

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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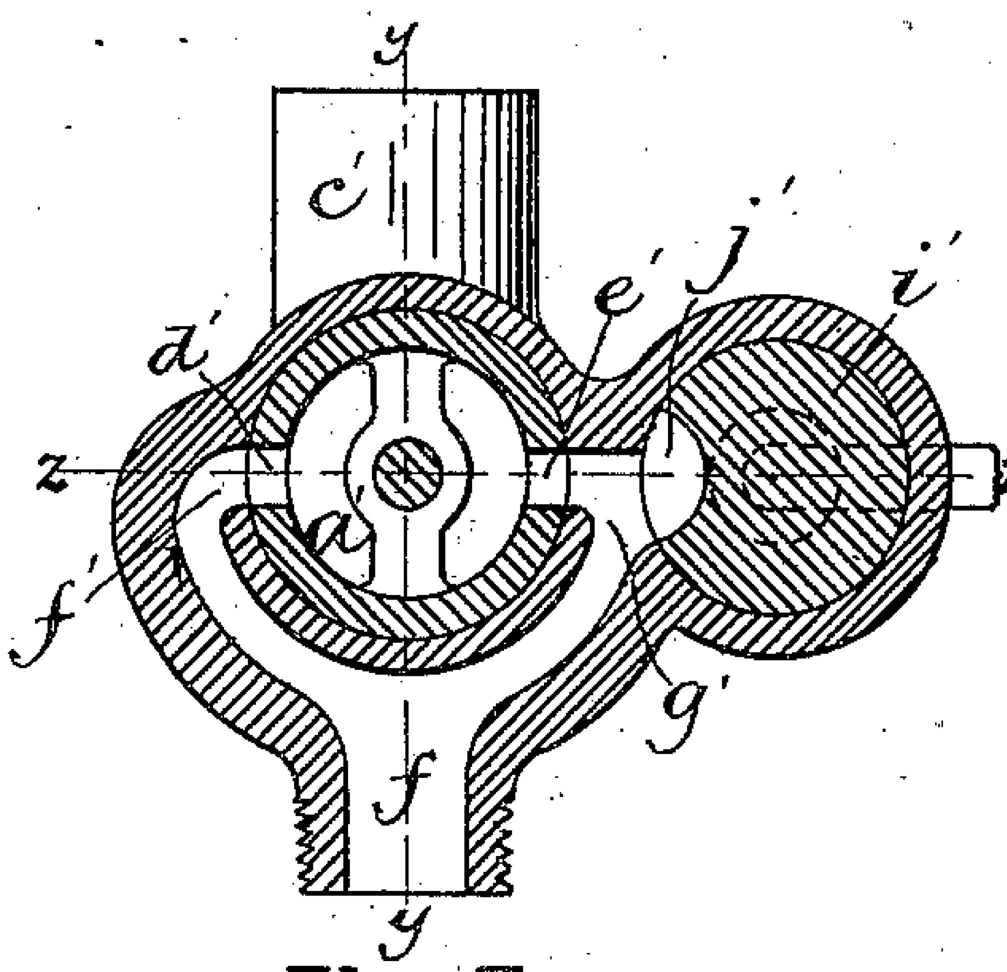

Fig. 3.

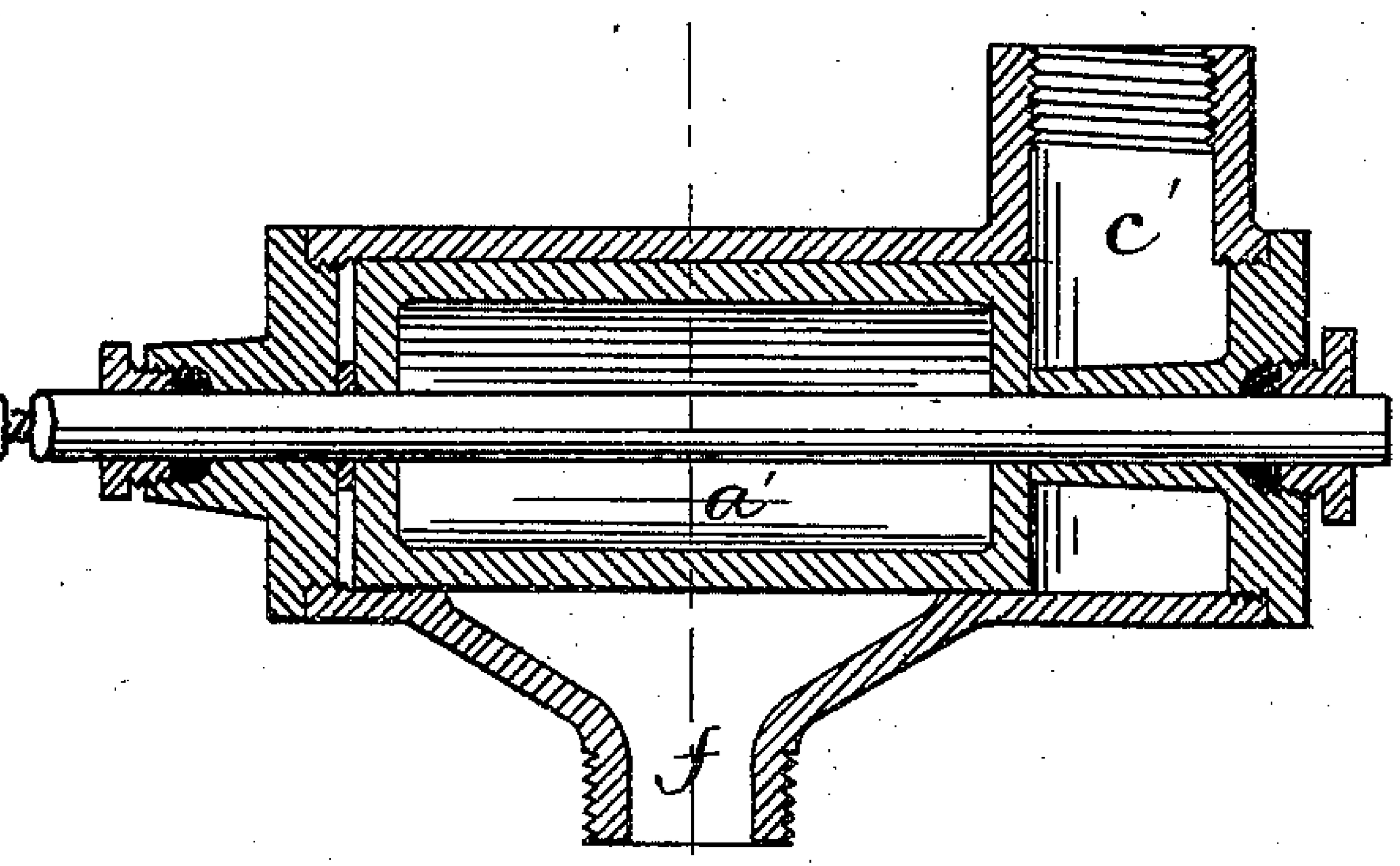

Fig. 4.

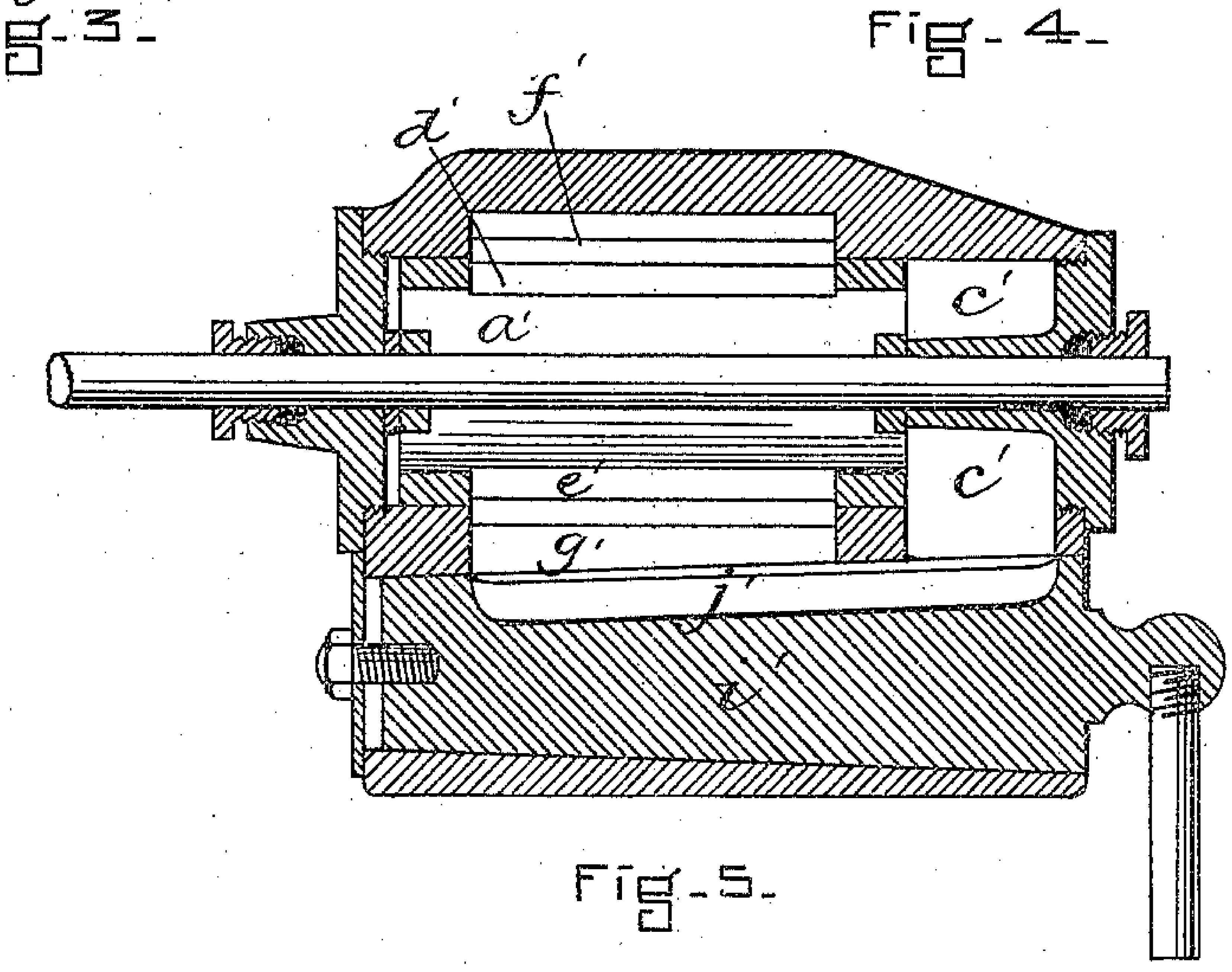

Fig. 5.

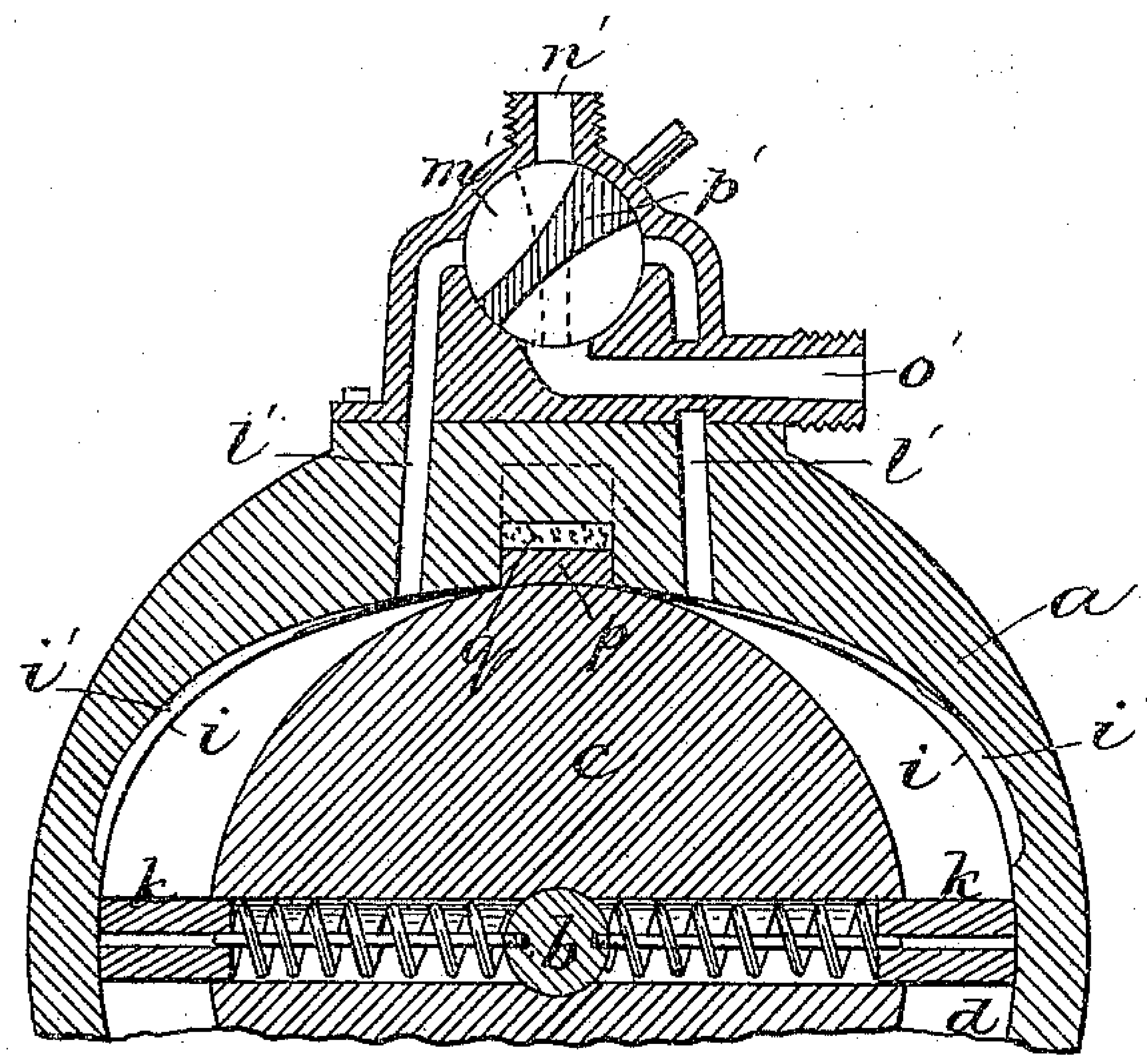

Fig. 6.

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UNITED STATES PATENT OFFICE.

FREDERIC CHAUNCEY MORTON, OF CHELSEA, MASSACHUSETTS.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 310,843, dated January 13, 1885.

Application filed February 25, 1884. (No model.)

To all whom it may concern:

Be it known that I, FREDERIC C. MORTON, of Chelsea, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Rotary Engines, of which the following is a specification.

This invention relates to that class of rotary engines having pistons which are alternately forced into and out of a rotating hub, and caused while forced into the hub to pass an abutment or point where the hub and casing are always in contact.

The invention has for its object to provide certain improvements in this class of engines whereby the pistons are more perfectly balanced and enabled to operate with less friction than heretofore.

The invention also has for its object to provide improved packing devices, an improved valve, and other details of construction.

To these ends my invention consists in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a vertical transverse central section of a rotary engine embodying my invention. Fig. 2 represents a longitudinal vertical section showing the hub and its pistons in a different position from that shown in Fig. 1. Fig. 3 represents a transverse vertical section of the valve. Fig. 4 represents a longitudinal vertical section on line *y y*, Fig. 3. Fig. 5 represents a horizontal section on line *z z*, Fig. 3. Fig. 6 represents a transverse section of a modification.

The same letters of reference indicate the same parts in all the figures.

Referring to Figs. 1, 2, 3, 4, and 5, *a* represents the cylindrical casing.

b represents the shaft journaled in bearings at the ends of the casing, and provided within the casing with a hub or enlargement, *c*, keyed or otherwise rigidly secured to the shaft. The hub is provided with end plates or flanges, *c′ c′*, of greater diameter than the hub, and bolted thereto by bolts *z′*. The chamber in the casing which contains the hub *c* is of sufficient diameter to receive the flanges *c′*, and forms a steam-space, *d*, between said flanges, extending partly around the hub, the continuity of said space being broken by an abutment, *e*, formed by extending the inner wall of the space *d* inwardly between the flanges *c′* until it meets the hub between the induction-port *f* and the eduction or exhaust port *g*. The outer wall of the chamber *d* is concentric with the hub, excepting at said abutment and at the opposite ends thereof, where two curved inclines, *h i*, connect the abutment with the concentric portions of the outer wall of the chamber. In the hub are formed two radial chambers or cavities, *j j*, extending in diametrically-opposite directions.

k k represent pistons adapted to slide in said cavities, and normally pressed outwardly against the outer wall of the chamber *d* by springs *l l*, which extend into orifices *m* in the hub. The pistons *k* are formed to extend across the space between the hub and the outer wall of the chamber, as shown in Fig. 1, and also to extend from one flange *c′* to the other, as shown in Fig. 2. It will be seen that when the engine is in operation each piston, as it approaches the abutment, (the hub rotating in the direction indicated by the arrow in Fig 1,) will be gradually forced inwardly by the incline *i* against the pressure of the spring until the piston passes the abutment, and will then be forced out by its spring while passing along the incline *h*. The incline *i*, whereby the pistons are pushed inwardly, is more gradual than the other incline, *h*, so that the friction caused by the inward pressure of the pistons is made as light as possible. The shortness of the incline *h* enables each piston to be quickly forced out to contact with the concentric portion of the wall of the chamber *d* after passing the abutment, so that only short clearance is required, and the steam can be cut off very soon after the piston passes the induction-port. The clearance, however, is not exhausted. The outer wall of the chamber *d* is provided with grooves *h′ i′*, extending along the inclines *h i* and permitting steam to pass around the outer ends of the pistons. Thus when a piston has passed the exhaust-port and is being pressed inwardly by the incline *i*, the groove *i′* in said incline permits the steam between the piston and the abutment to escape over the end of the piston before the latter is entirely retracted. The induction-port *f* opens into the groove *h′*, and the incoming steam passes into said groove, and is enabled thereby to gain access to the space between the abutment and piston when the outer end of the piston is directly opposite the induction-port. Each piston is provided with orifices *m* extending from its outer to its inner end, and permitting steam to pass into the cavity *j* of the hub behind the piston, when the outer end of the latter coincides with the induction-port, or with any portion of the groove *h'*. The piston is thus perfectly balanced, the steam being prevented from exerting its entire pressure inwardly on the end of the piston, and by gaining access to the rear and inner sides of the piston so equalizes the pressure that the action of the spring *l* in pushing the piston outwardly is not impeded. The spring of each piston is supported by a rod, *n*, which is screwed into the shaft *b* at its inner end, and projects outwardly, its outer end entering an orifice, *o*, in the piston. The springs are thus firmly supported and prevented from being displaced laterally to a sufficient extent to make them liable to be caught between the pistons and the outer ends of the orifices in the hub which receive said springs. The abutment *e* is recessed to receive a packing composed of two L-shaped metallic pieces or plates, *p p*, adapted to bear at the same time against the hub, and against the inner faces of the flanges *c'* thereof. The plates *p* are backed by expansible material *q*, such as felt in a compressed condition, which presses the plates inwardly against the hub and laterally against the flanges, and thus insures steam-tight joints at the abutment. The perimeters of the flanges *c'* are beveled, as shown in Fig. 2, and their inner sides have grooves *r*, which receive the ends of the pistons, and support said pistons when they are pressed outwardly. When the pistons are in their working position, as shown in Fig. 1, the pressure of steam on their rear sides presses their front sides against the corresponding surfaces of the recesses *j* and grooves *r r*, and thus prevents steam from passing between the pistons and the surfaces against which they bear. The ends or corners of the pistons are beveled, so that when pressed outwardly to the fullest extent the corners of the pistons will form continuations of the beveled perimeters of the flanges, as shown at the lower portion of Fig. 2. *s s* represent packing-rings, each of which is a right-angled triangle in cross-section, the hypotenuses of the triangles fitting the beveled perimeters of the flanges *c'*, while the right-angled sides bear against the casing, as shown in Fig. 2. The rings *s* are pressed against the beveled perimeters of the flanges *c'* by springs *t*, interposed between the backs of the rings and adjustable screws *u*, inserted in the casing. The screws may be adjusted to regulate the pressure of the packing-rings, or to compensate for wear of the bearing-surfaces of the rings. Pins *v*, inserted in the casing and projecting into orifices in the packing-rings, prevent said rings from rotating with the flanges, but do not prevent the described adjustment of the rings. The triangular form of the packing-rings, the beveled form of the perimeters of the flanges, and the provision of means for adjusting the rings enable said rings to be used until they are nearly worn out, the wear experienced by the rings being uniform and effecting no change in the form of the wearing-surfaces of the rings with relation to the perimeters of the flanges *c'*. The beveled perimeters of the flanges *c'* are provided preferably with file cuts or grooves *v'*, extending partly but not wholly across said perimeters. These cuts enable oil poured between the casing and the outer surfaces of the flanges *c'* to find its way between the bearing-surfaces of the flanges and the packing-rings, and thus keep said surfaces lubricated. The oil may be inserted through holes a^2 drilled in the casing. (See Fig. 2.)

a' represents the valve, which is of the oscillating or rocking form, and is oscillated by means of a crank-arm, *r'*, attached to one end of the valve-rod, and a connecting-rod, *s'*, eccentrically pivoted to a disk, *t'*, on the shaft *b* of the engine. The valve is a hollow cylinder open at both ends, as shown in Fig. 5, so as to receive steam at one end from a steam-pipe, and permit the steam to bear against the end of the casing at the other end of the valve, thus preventing endwise pressure on the valve. From the interior of the valve the steam passes to the induction-port *f* alternately through ports *d' e'*, formed at diametrically-opposite points in the periphery of the valve and corresponding fixed ports, *f' g'*, in the casing. Steam is therefore always present in the interior of the valve and bears against the outer surface of the valve at two diametrically-opposite points—viz., at the ports *f' g'*—when the valve is turned to wholly or partly cut off the steam, so that the valve is balanced and enabled to rock freely.

The valve-operating devices above described are so adjusted that the valve begins to open and admit steam to the induction-port just after each piston has passed the incline *h* and is in position to form a space for the entering steam between the abutment and rear side. After the hub has made a partial rotation the steam is cut off until the next piston reaches the same point, the steam admitted working expansively after the cut-off. The valve may be timed, however, to cut off and admit the steam at any desired stages in the rotation of the hub and its pistons.

i represents a valve located in an offset portion of the casing of the valve *a'*, and provided with a longitudinal port, *j'*, adapted to connect the steam-pipe with the port *g'* leading to induction-port *f*, and thus admit steam to start the engine. This valve is intended for use only in starting the engine when the valve *a'* is not in position to admit steam to the induction-port. When the engine is in motion, the valve *i'* is turned to disconnect its port from the port *g'*.

Fig. 6 shows a sectional view of a reversible engine provided with my improvements, excepting the valve arrangement above described.

In the modification the casing is provided with two ports, l' l', at equal distances from the abutment, but at opposite sides thereof. The inclines whereby the pistons are pressed inwardly have the same inclination, each being substantially like the incline i, (shown in Fig. 1,) and each having a groove, i', to permit passage of steam over the ends of the pistons. The ports l' l' communicate with a valve casing or chamber, m', having an induction-port, n', and an exhaust-port, o'. An oscillating valve, p', in said chamber is adapted to connect either of the ports l' with the induction or with the exhaust port of the casing, and thus make either port l' an induction or an exhaust port. The valve p' is wider at one of its bearing-surfaces than at the other, and is adapted to cover the induction-port with its wider surface, while its narrower surface stands over the exhaust-port, but leaves an open space at each side, as shown by dotted lines in Fig. 6. The valve is turned to this position when the engine has stopped. The steam remaining in the engine is thus allowed to escape through both ports l' and the exhaust-port.

I am aware that it is not new to make the casing of a rotary engine with a long incline on the eduction side and a short incline on the induction side of the rotating piston, and such I do not claim broadly.

I claim—

1. In a rotary engine, the combination of the rotary hub having the outwardly-impelled radially-movable spring-impelled pistons, and the chambered casing having a portion (more than half) of its inner surface concentric with the axis of the hub, and separated from the surface of the hub, and the remaining portions composed of the concave abutment having an elongated bearing on the hub, the curved incline i, tangential both to the separated concentric surface and the concave abutment, and arranged mainly between the eduction-port and the abutment, whereby the pistons are forced in gradually with the minimum of friction after the steam has mainly exhausted, and the shorter incline h connecting the abutment with the separated concentric surface, whereby the pistons, after passing the abutment, are enabled to quickly reach their operative position and receive the pressure of the entering steam, as set forth.

2. The casing having the abutment, grooved inclines, and ports, relatively arranged as described, combined with the recessed hub having the spring-impelled pistons, the latter having apertures for the admission of steam into the recesses of the hub, as set forth.

3. The combination, with the casing having the abutment, grooved inclines, and ports, relatively arranged as described, of the recessed hub having grooved end plates or flanges, and the spring-impelled pistons adapted to slide in the recesses of the hub and in the grooves of the flanges, as set forth.

4. The hub having the piston-receiving recesses, the rods n, affixed to the hub and projecting into said recesses, the pistons k, adapted to slide in said recesses, and provided with orifices receiving the rods n, and with passages m, whereby steam is admitted to the recesses to balance the pistons, and the springs surrounding the rods n and adapted to force the pistons outwardly, as set forth.

5. The hub having the spring-impelled pistons and end plates or flanges, combined with the casing having the ports, inclines, and abutments, and the L-shaped packing-plates supported by expansible backings, and bearing simultaneously against the hub and its flanges, as set forth.

6. The hub having disk-shaped end plates, c', with beveled edges, the flat-ended casing inclosing the same, the triangular packing-rings surrounding and bearing against the beveled portions of the end plates, and mechanism, substantially as described, whereby the rings may be adjusted, all combined and operating substantially as described.

7. The combination of the casing, the triangular packing-rings, and the hub having the beveled flanges bearing against the packing-rings, and provided with grooves for the admission of oil to lubricate the bearing-surfaces of the flanges and rings, as set forth.

8. The combination of the oscillating hollow valve a', open at both ends, and having side ports, d' e', and the casing having corresponding ports, f' g', with the casing of a rotary engine having a port communicating with said ports, f' g', and a rotating hub and piston, as described, substantially as set forth.

9. The combination, with the casing of a rotary engine having rotating hub and pistons, as described, of the oscillating hollow valve a', having ports at opposite sides, the induction-ports in the casing to correspond therewith, and the starting-valve i' in a casing, and adapted to make connection with the induction-port, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 21st day of February, 1884.

FREDERIC CHAUNCEY MORTON.

Witnesses:
FREDERICK A. FOSTER,
NORMAN MORTON.