No. 619,129. Patented Feb. 7, 1899.

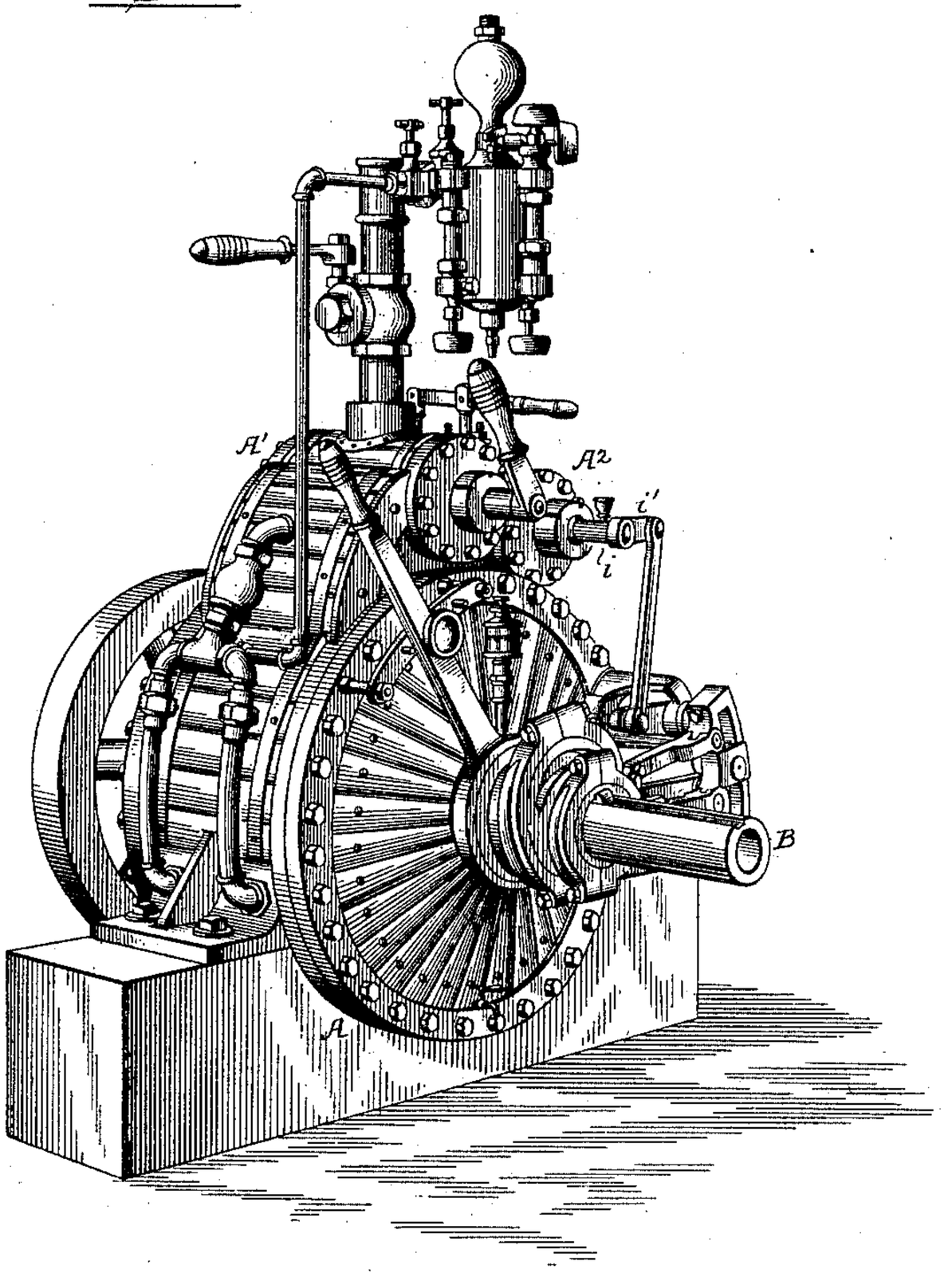
M. J. BRETHERTON.

ROTARY ENGINE.

(Application filed June 23, 1898.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.



Witnesses:-
Louis M. Whitehead.
Wm. A. Barr.

Inventor:-
Montague J. Bretherton.
by his Attorneys.
Howson & Howson

No. 619,129. Patented Feb. 7, 1899.

M. J. BRETHERTON.

ROTARY ENGINE.

(Application filed June 23, 1898.)

(No Model.) 5 Sheets—Sheet 2.

FIG. 2.

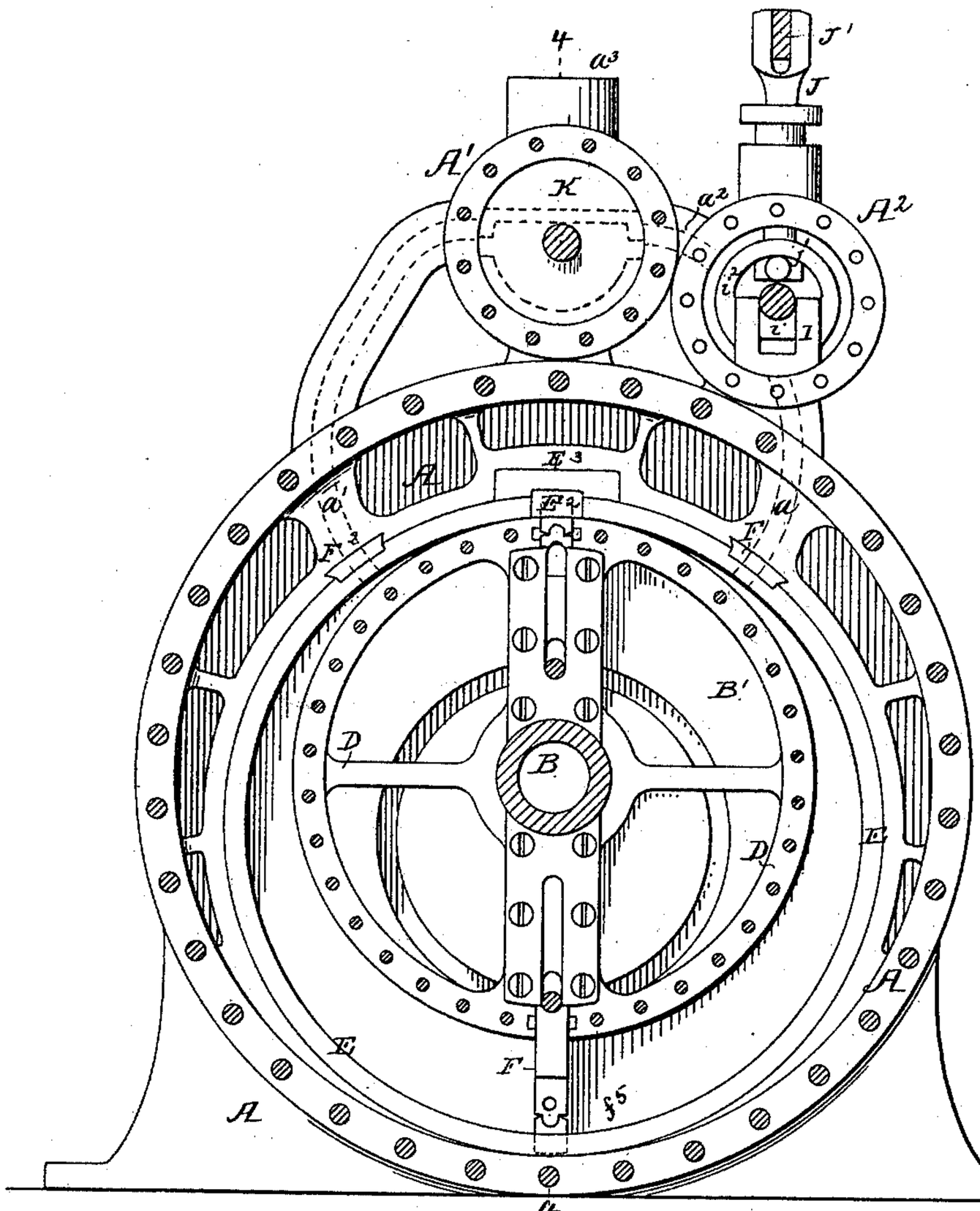
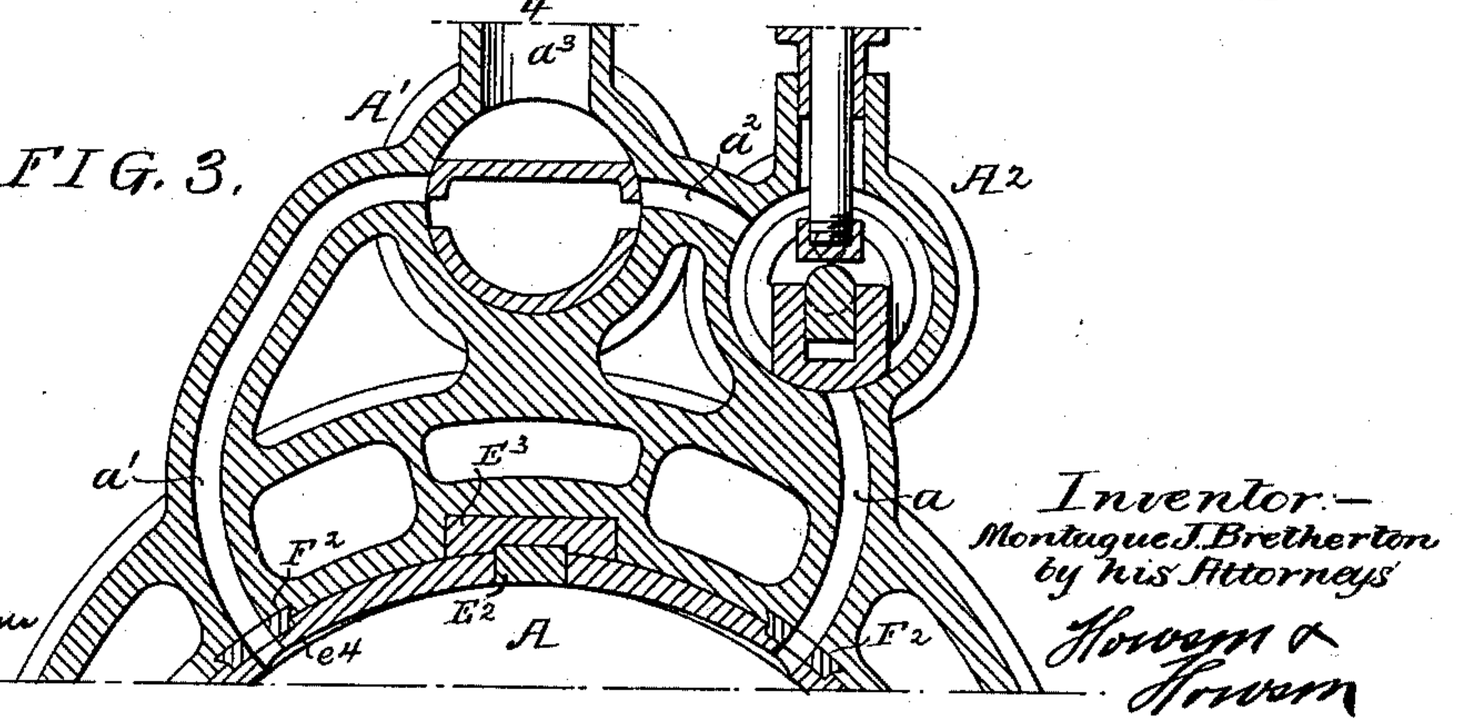


FIG. 3.



Witnesses:—
James C. Krayer.
Frank H. Graham

Inventor:—
Montague J. Bretherton
by his Attorneys
Howson & Howson

No. 619,129. Patented Feb. 7, 1899.

M. J. BRETHERTON.

ROTARY ENGINE.

(Application filed June 23, 1898.)

(No Model.) 5 Sheets—Sheet 3.

FIG. 4.

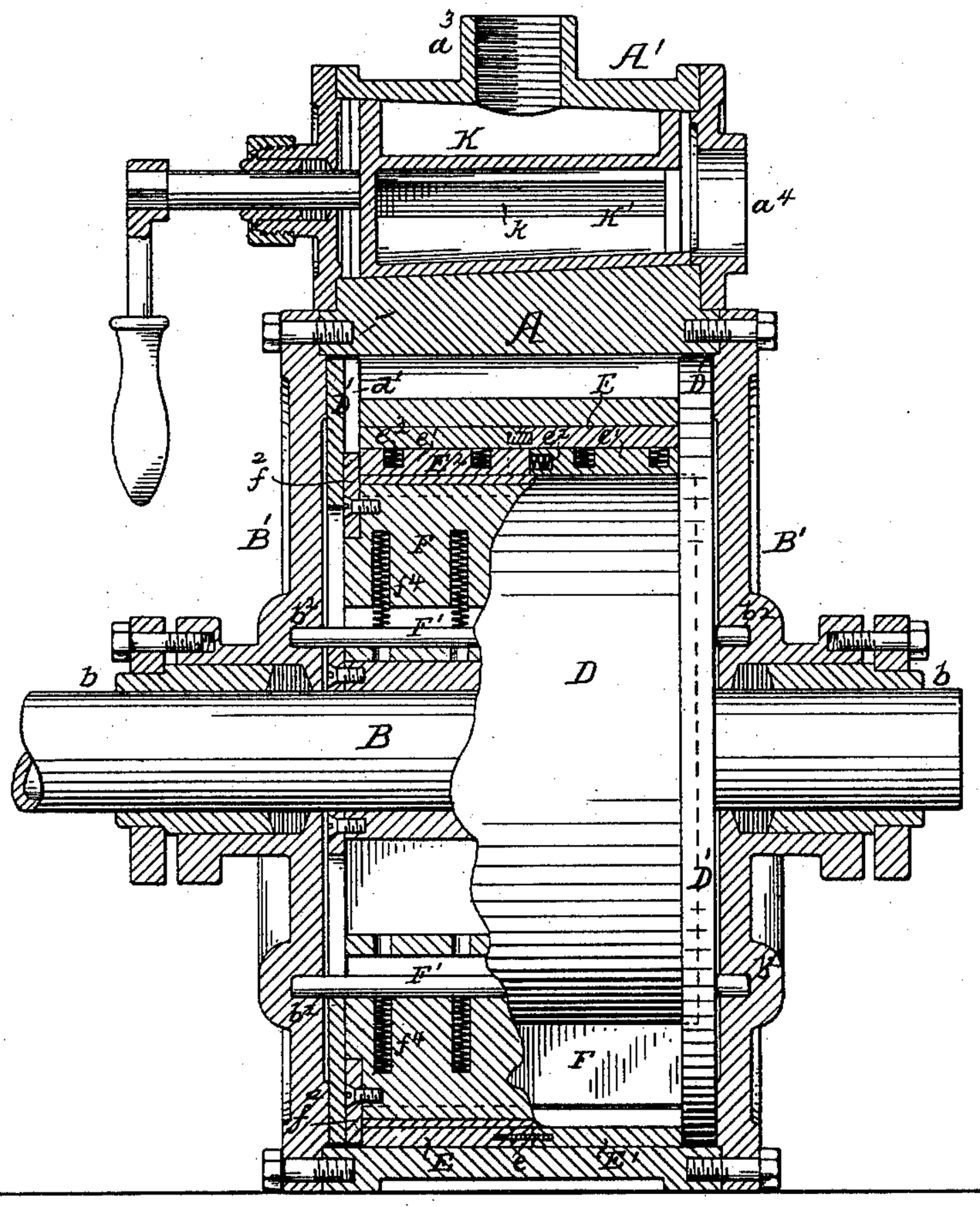


FIG. 9.

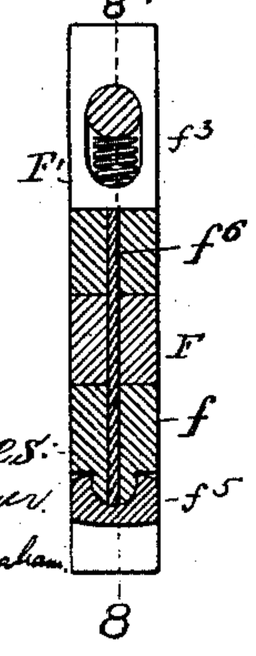
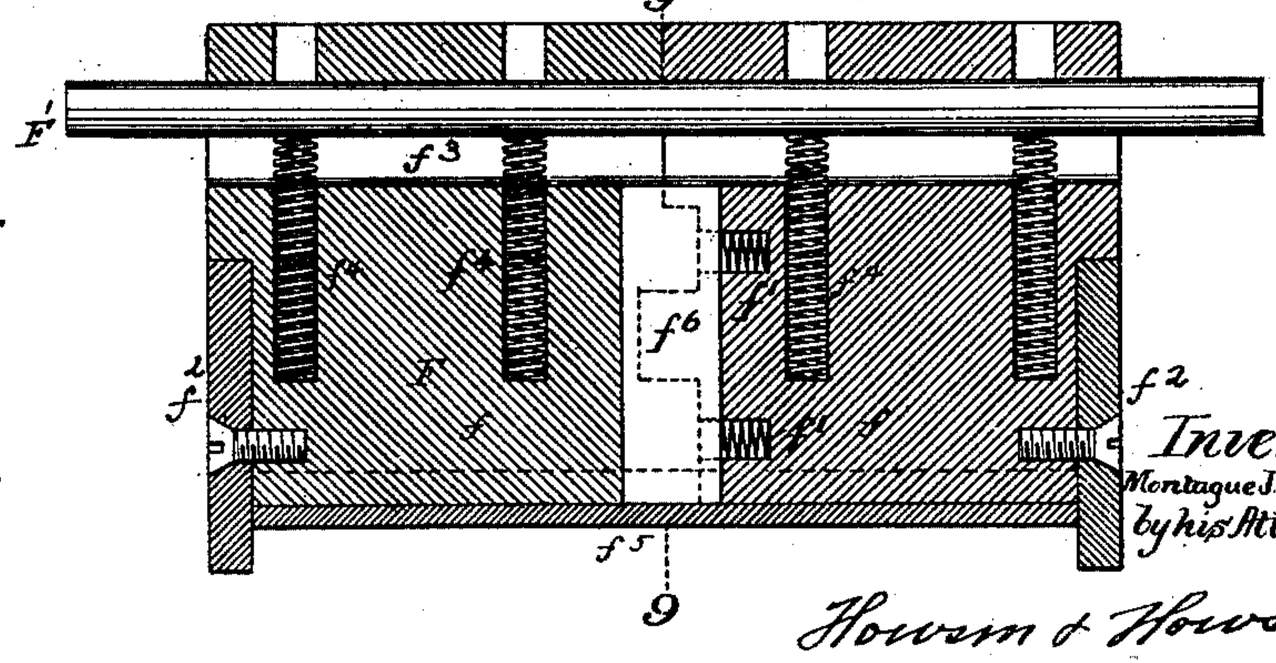


FIG. 8.



Witnesses:
James L. Frazer.
Frank K. Graham.

Inventor:
Montague J. Bretherton
by his Attorneys
Howson & Howson

No. 619,129. Patented Feb. 7, 1899.

M. J. BRETHERTON.

ROTARY ENGINE.

(Application filed June 23, 1898.)

(No Model.) 5 Sheets—Sheet 4.

FIG. 11.

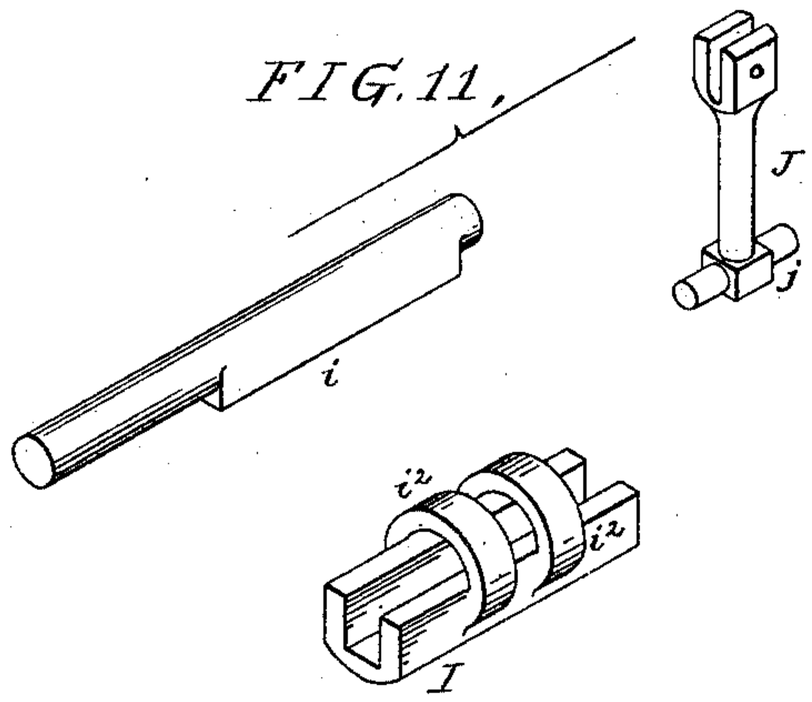
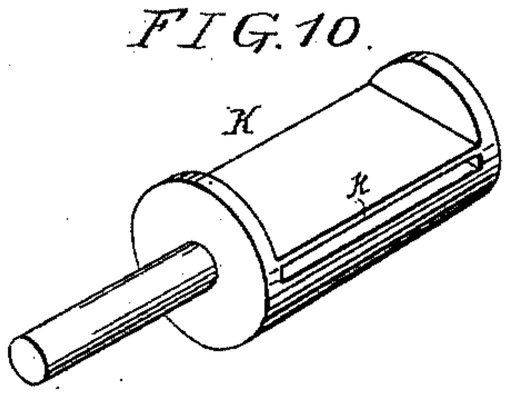


FIG. 10.



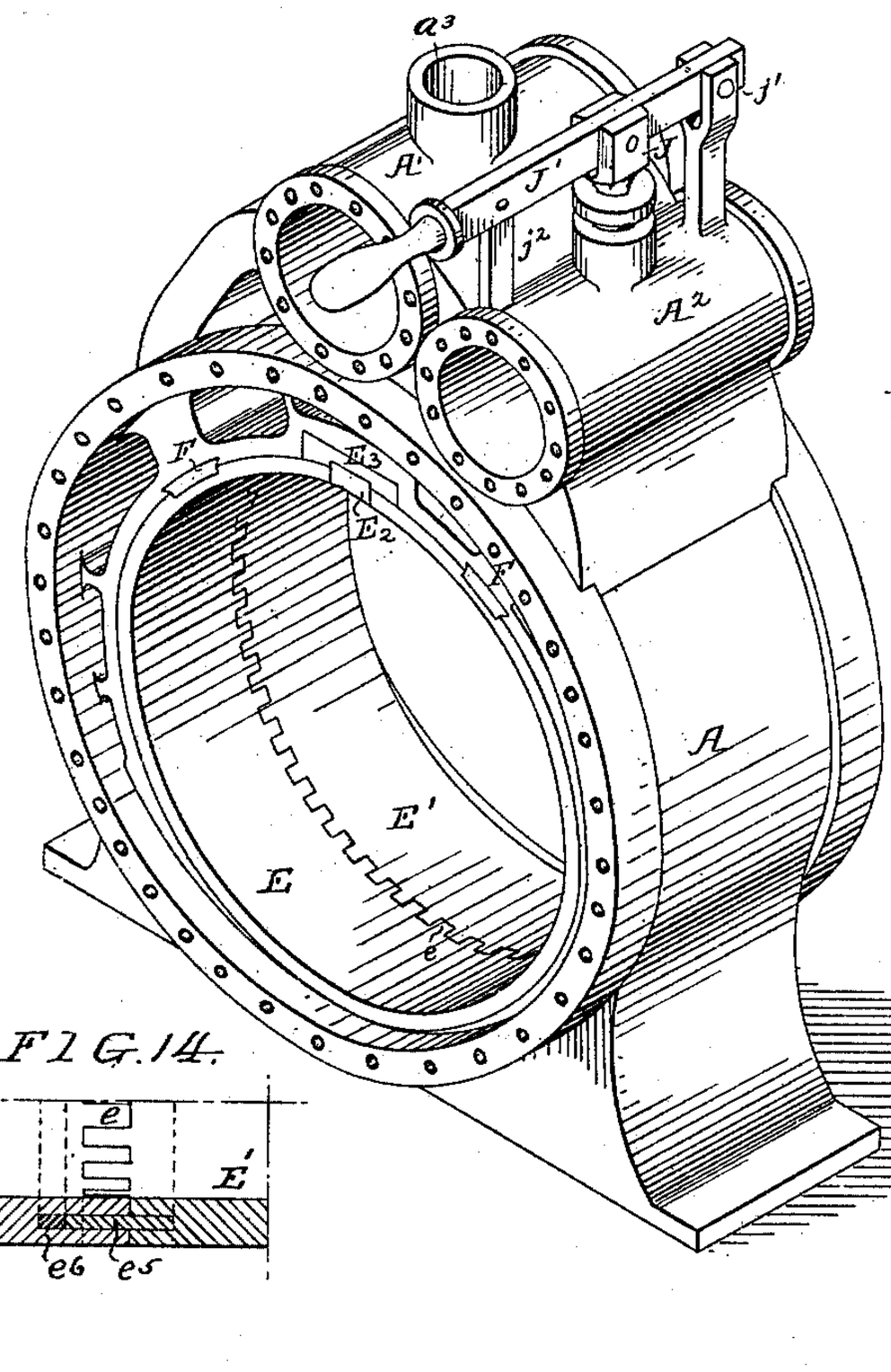


FIG. 5.

FIG. 14.

Witnesses:-
James C. Krayer.
Frank F. A. Graham

Inventor:-
Montague J. Bretherton
by his Attorneys.
Howson & Howson

No. 619,129. Patented Feb. 7, 1899.

M. J. BRETHERTON.

ROTARY ENGINE.

(Application filed June 23, 1898.)

(No Model.) 5 Sheets—Sheet 5.

FIG. 12.

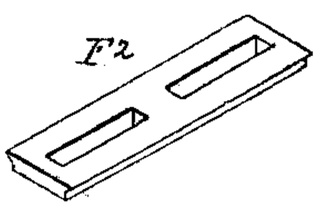


FIG. 6.

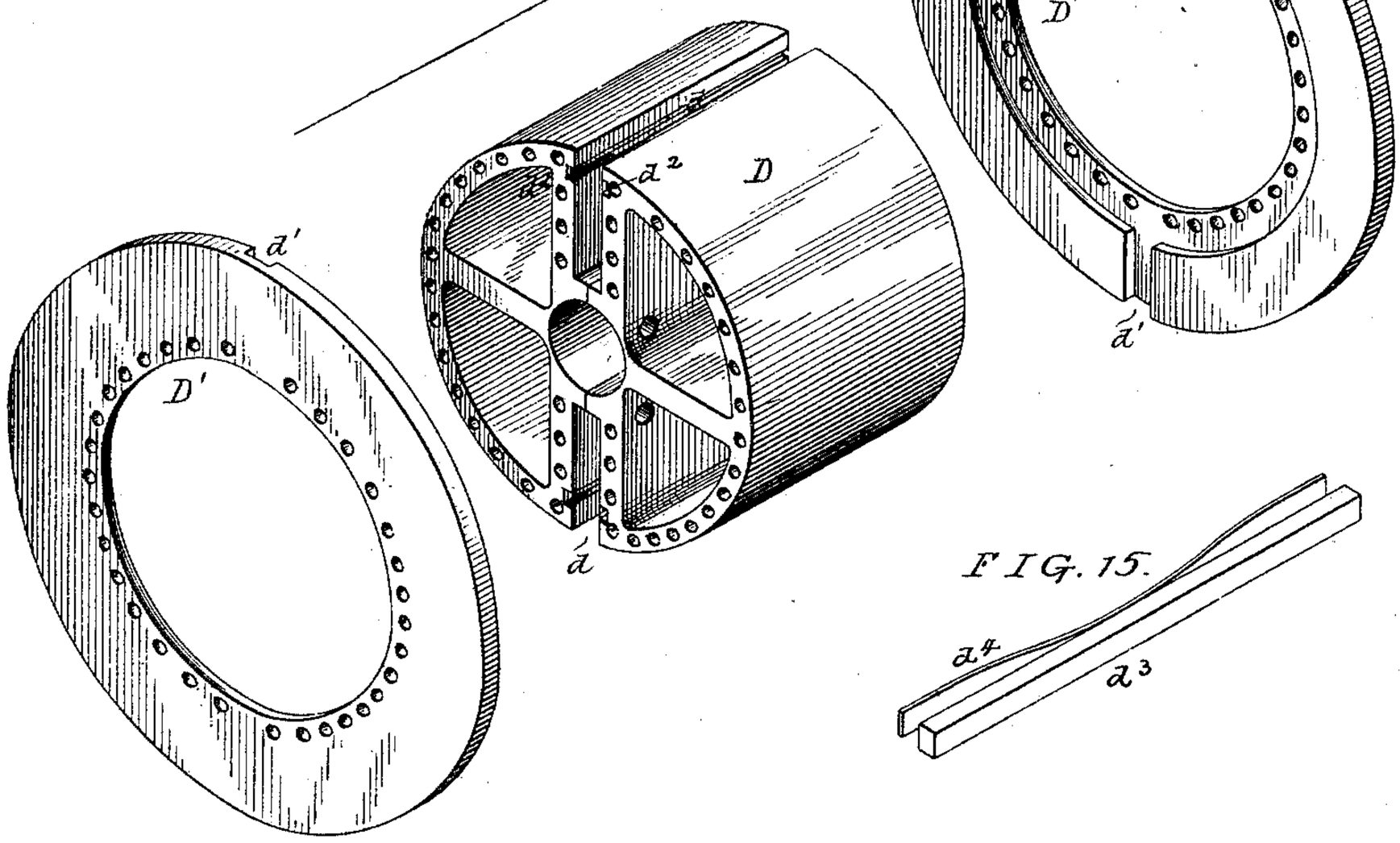


FIG. 15.

FIG. 13.

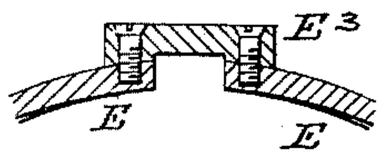
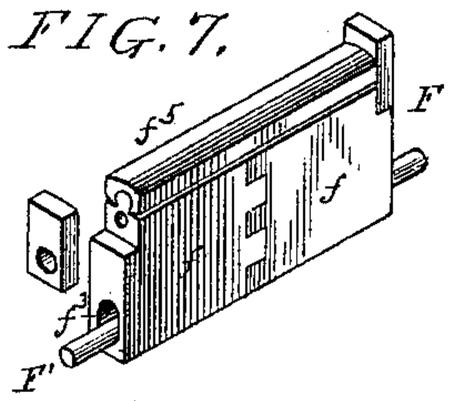


FIG. 7.



Witnesses:—
James C. Krayer
Frank H. Graham

Inventor:
Montague J. Bretherton
by his Attorneys.
Howson & Howson

UNITED STATES PATENT OFFICE.

MONTAGUE JAMES BRETHERTON, OF PHILADELPHIA, PENNSYLVANIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 619,129, dated February 7, 1899.

Application filed June 23, 1898. Serial No. 684,240. (No model.)

To all whom it may concern:

Be it known that I, MONTAGUE JAMES BRETHERTON, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Rotary Engines, of which the following is a specification.

The main object of my invention is to so construct a rotary steam-engine that it will be steam-tight at all times and that the wear will be automatically taken up without increasing the friction to a greater extent than in the ordinary reciprocating engine.

A further object of the invention is to so construct the valve mechanism that it can be readily reversed even at full speed and to throw into or out of action the cut-off; and a still further object of the invention is to so construct the engine that there will be no dead-centers.

In the accompanying drawings, Figure 1 is a perspective view illustrating my improved rotary engine provided with link-motion. Fig. 2 is a side view of my improved engine with the caps removed. Fig. 3 is a sectional view. Fig. 4 is a section on the line 4 4, Fig. 2. Fig. 5 is a perspective view of the engine-casing. Fig. 6 is a perspective view of the piston-wheel and flanges detached. Fig. 7 is a perspective view of one of the sliding pistons. Fig. 8 is a longitudinal sectional view of one of the pistons. Fig. 9 is a transverse sectional view of the same. Fig. 10 is a detached perspective view of the reversing-valve. Fig. 11 is a detached perspective view of the cut-off valve. Fig. 12 is a perspective view of one of the port-plates. Figs. 13 and 14 are enlarged detached views showing details of the cylinder-rings, and Fig. 15 is a detached perspective view of one of the packing-strips for the piston.

A is the casing of my improved rotary engine. This casing has an extension A′, forming the reversing-valve chamber, and an extension A^2, forming the cut-off-valve chamber. The cut-off-valve chamber is connected to the cylinder by a passage a and the reversing-valve chamber is connected to the cylinder by a passage a', and the two chambers A′ A^2 are connected together by a passage a^2.

a^3 is the steam-inlet into the reversing-valve chamber and is coupled onto the steam-supply pipe, which is provided with the usual throttle-valve.

a^4 is the exhaust, in the present instance in the rear cap of the reversing-valve chamber.

B is the shaft of the engine, which is mounted in suitable bearings b b on the heads B′ B′, secured to the cylinder-casing A. These heads form the side walls of the chamber in which rotates the piston-wheel. The bearings are in the form of glands, and steam is prevented from escaping between the bearings and the shaft by suitable packing, so that while the shaft is free to revolve within its bearings the steam cannot escape at the bearings.

Secured to the shaft B is a piston-wheel D, in the present instance made in two sections and secured together by bolts; but in some instances this wheel may be made in one or more pieces, as desired. It will be noticed that the shaft is eccentric to the bore of the cylinder and the piston-wheel is so proportioned that it will snugly fit against the upper portion of the cylinder, as indicated in Fig. 2, and the passages a a' are arranged, respectively, on either side of this point of contact, and when the engine is running forward the passage a is the steam-inlet passage and the passage a' is the steam-outlet passage, and at the point where the piston-wheel comes in contact with the cylinder is the abutment-block E^2. Lining the cylinder are two rings or bushings E E′. These rings snugly fit the cylinder-casing, and each ring has a series of projections e, which fit in the recesses of the other ring, so as to form a dovetailed or staggered joint, as shown in Fig. 14. There is an annular groove cut in the projections e, and in the groove in each head is inserted a lead strip e^5, which is secured to one section and is free in the other. Between the lead strip and the bottom of the groove in the ring to which the lead strip is not attached is placed a gum-core packing-ring e^6. The tendency of the ring e^6 is to force the rings apart and against the flanges of the piston-wheel. On the piston-wheel are flanges D′, which are of such a depth as to extend beyond the rings or bushings E E′ of the casing, so that the rings as they are forced out by the packing above mentioned

will bear against the inner surfaces of these flanges of the piston-wheel, and as the edges of the rings, as well as the flanges, are ground a steam-tight joint is thus formed, and as the parts wear the rings are kept in contact by the pressure of the packing. It will be understood that springs may be inserted between the two sections of the rings to accomplish this purpose; but I prefer the method described. The abutment E^2 is made in two pieces e', one being tongued into the other, and in one of these sections is a cavity for the reception of a coiled spring e^2, which tends to keep the end of the sections against the flanges of the piston-wheel, and in the upper portion of the abutment-block are cavities for the reception of coiled springs e^3, which tend to keep the block in contact with the periphery of the piston-wheel. The abutment-block is adapted to a connecting-block E^3, set in the cylinder-casting and secured to the ends of the rings E E'.

It will be noticed that the ports a a' are some little distance from the abutment-block, and each extends through a tapered plate F^2, which is undercut, as shown in the perspective view Fig. 12, and is adapted to seat itself partly in the casing and partly in the recess in the rings E E'. This tapered plate is driven into place in the casing, but it fits freely in the recess in the rings, so as to allow for the free lateral movement of the rings. These plates have openings to allow for the passage of the steam to and from the cylinder, and the object of inserting the plates at the point indicated is to make a steam-tight joint at the ports.

I prefer to make the flanges of the piston-wheel separate from the wheel itself and secure the flanges rigidly to the wheel by screws or bolts. The flanges are in the form of rings reduced in thickness, so that they will extend over the edges of the rings and form a good joint, and they are also grooved at d' in line with the radial slots d in the piston-wheel in which the piston-blades F F slide. These blades therefore are not only guided by the hub portion of the piston-wheel, but are also guided by the flanges, so that the strain is more evenly divided than where the piston-blades are simply guided by the hub.

The piston-blades F F are made in two sections f f and preferably have their abutting edges notched in the same manner as the rings E E' of the cylinder, with stopping-plates f^6 extending across the joints, so as to break joints and in order to allow for the free lateral movement of the sections. I place in transverse cavities in the piston-sections f f springs f', which tend to force the pistons out against the flanges of the piston-wheel, and I preferably secure to the outer end of each section hardened bearing-plates f^2, which fit snugly in the grooves of the flanges.

The back portion of each piston-blade is slotted at f^3, and adapted to the slot is a rod F', the ends of which rest in grooves b^2 in the heads B'. These grooves are shaped as shown, so that the rods tend to force the piston-blades out in contact with the rings of the cylinder. Springs f^4, however, are placed within recesses in sections of the piston-blades, and the pressure is applied through these springs to the blades, so that they will readily yield, but will always be in contact with the surface of the rings.

I preferably provide a shoe f^5 for each piston-blade. This shoe is slipped on the undercut semicircular projection, so that it will have free movement to seat itself properly on the ring; but its movement is limited so that it cannot possibly move out of place. It is kept longitudinally in place by the hard-metal bearing-pieces f^2. In some instances this shoe may be dispensed with; but I prefer to use it on engines of large size.

Resting in recesses d^2 at each side of each piston-blade are blocks d^3, which are pressed against the surface of the piston-blades by flat springs d^4. This prevents leakage of steam past the piston, Fig. 15.

The piston-wheel is made in two parts, as shown, so that the slideways for the piston-blades can be readily cut out, formed, and finished, as well as the recesses for the packing-strips.

As shown in Fig. 3, I preferably form grooves e^4 between the ports and the abutment-blocks in the rings E E', so as to prevent the shaft remaining on a dead-center. If, for instance, one of the pistons should stand between the port and the abutment-block, the engine would not start without the shaft was first turned; but by making the grooves in the rings as indicated steam passes back of the piston and the engine will move forward as soon as steam is admitted.

I preferably arrange a cut-off valve in the steam-port, and this valve can be raised off its seat, so that the steam will be admitted to the cylinder during the full stroke of the piston. If the valve is on its seat, then the steam is cut off at a certain portion of the stroke, according to the amount desired and the shape of the valve.

The valve I is adapted to its casing A^2 and has a groove throughout its length, in which is mounted the operating-spindle i, which has a crank i' at its outer end connected to an eccentric on the shaft of the engine, or it may be connected to link-motion—for instance, as shown in Fig. 1—without departing from the essential feature of the invention.

The slot in the valve is of such a depth that the valve can be raised off its seat. To accomplish this, I form two arches i^2 on the valve and extend the stem J down through an opening in the valve-casing A^2. This stem has a T-head j, the arms of which extend under the loops of the valve. The upper end of this stem is connected to a lever J', pivoted at j' to a standard, and has a movable locking-arm j^2, which when down holds the

lever up and also holds the valve off its seat, thus allowing the steam to flow into the cylinder the full stroke of the engine; but by simply releasing this lever the valve will be locked to its seat and will again cut off the steam in the manner described above.

Adapted to the valve-casing A′ is a reversing-valve K, flat on top, as shown in the perspective view, and hollow, as shown in the sectional view. The valve has ports *k*, leading to the central chamber K′, so that when the valve is shifted in one position the engine will take steam over the top of the valve through the passage a^2, valve-chamber A^2, and passage *a*, and it will exhaust through the passage *a′* and the interior of the reversing-valve to the exhaust-pipe. By moving the valve in the opposite direction the direction of the steam will be reversed, and consequently the engine will be reversed; but when reversed the cut-off mechanism cannot be used without a duplicate cut-off valve is provided in the passage *a′*.

I claim as my invention—

1. The combination in a rotary engine, of a flanged piston-wheel, a casing, two bushing-rings adapted to the casing and resting against the flanges of the piston-wheel, substantially as described.

2. The combination of a casing, a flanged piston-wheel, two bushing-rings adapted to the casing, with means for separating the rings and pressing them against the inner surfaces of the flanges of the piston-wheel, substantially as described.

3. The combination of a casing, a piston-wheel, flanges thereon, with two rings mounted within the casing and notched on their inner edges, the notches of one ring adapted to the recesses of the other, each ring having an annular recess in its inner edge, with a narrow ring, and packing adapted to the recesses, so as to form a yielding steam-tight joint, substantially as described.

4. The combination in a rotary engine, of the casing, a flanged piston-wheel, slots in said wheel, piston-blades mounted within the slots, said blades being made in two sections, with means for separating the sections laterally so that they will press against the flanges of the piston-wheel, substantially as described.

5. The combination of a casing, two bushing-rings mounted within the casing, said rings being laterally movable, a two-part piston-wheel slotted to receive piston-blades, rings secured to each end of the piston-wheel and forming flanges, grooves in the said flanges in line with the slots in the piston-wheel, piston-blades, said piston-blades being made in two parts, with means for laterally moving the said parts, and means for positively moving the blades radially, substantially as described.

6. The combination in a rotary engine, of the cylinder, inlet and outlet ports therein, an abutment between the ports, two bushing-rings mounted within the cylinder, the said rings being grooved from one of the ports to a point near the abutment, with a piston-wheel and pistons, substantially as and for the purpose set forth.

7. The combination in a rotary engine, of the cylinder, piston-wheel and pistons therein, a valve-casing, a cut-off valve, means for oscillating the same, with means for raising the valve off its seat so as to allow steam to enter the cylinder during the full stroke, substantially as described.

8. The combination in a rotary engine, of the cylinder, pistons therein, a valve-casing, a cut-off valve therein, said valve being slotted, an operating-rod adapted to the slot and means for rocking said rod and oscillating the said valve over the valve-port to the engine, a yoke on the valve, a rod having a T-head adapted to the yoke and means for moving the said rod so as to elevate the valve off its seat, substantially as described.

9. The combination in a rotary engine, of the casing, laterally-movable rings mounted within the casing, a flanged piston-wheel, a shaft on which the piston-wheel is mounted, the flanges of said wheel overlapping the rings of the casing so as to make a steam-tight joint, sliding pistons mounted within the piston-wheel, each of said pistons being made in two parts and laterally movable, a shoe mounted on the end of each piston so as to snugly fit the casing, a tie-block mounted in the casing and secured to the two rings, an abutment-block made in two sections and adapted to the tie-block of the rings, said block being laterally movable so as to make a steam-tight joint at the edges, substantially as described.

10. In a rotary engine, the cylinder having closed ends, and the bushing-ring having endwise-movable sections in combination with the rotary piston-wheels carrying pistons and having fixed thereto flanges contiguous to the edges of said bushing-ring and also to the edges of the pistons and overlapping the joint between the pistons and ring, said parts inclosing two or more steam-spaces, substantially as described.

11. In a rotary engine, the cylinder having closed ends, a bushing-ring and an abutment and tie-block within the cylinder, a rotating piston-wheel provided with pistons and with fixed flanges overlapping the edges of the pistons, said ring, abutment and block being made in sections movable endwise of the cylinder, substantially as described.

12. In a rotary engine, the cylinder having closed ends and a steam-inlet, an expansible sectional bushing-ring fitting the cylinder circumferentially and a rotating piston-wheel provided with pistons and with fixed flanges overlapping the edges of the ring, said wheel, flanges, ring and piston inclosing a tight steam-chamber, substantially as described.

13. In a rotary engine, a cylinder, a piston made with meshing toothed sections movable endwise, springs to press the sections apart, and a steam-stopping plate extending across

the joint from one section to the other, endwise of the meshing teeth and cutting the same, substantially as described.

14. In a rotary engine, a cylinder, a piston made with meshing toothed sections movable endwise, springs to press the sections apart and a steam-stopping plate extending across the joint from one section to the other, endwise of the meshing teeth and cutting the same, said springs pressing on the sections and on the edges of the plate, substantially as described.

15. The combination in a rotary engine, of a flanged piston-wheel, sliding piston-blades therein, said blades made in sections, springs separating the sections, and spring-bars mounted in the wheel and adapted to rest against each face of the piston-blades, substantially as described.

16. The combination in a rotary engine, of a casing, guide-slots in the casing, a piston-wheel, a blade therein, said blade being slotted longitudinally, a bar passing through said slot and extending into the guide-slots of the casing, and springs within the blades and bearing against one side of the bar and tending to force the blade out, substantially as described.

17. The combination in a rotary engine, of a casing, two bushing-rings mounted within the casing, a two-part tie-block mounted in the casing and secured to the two rings, said block being recessed, a two-part abutment in said recess, springs tending to separate the two parts of the abutment, a piston-wheel and springs mounted between the abutment and the tie-block and tending to force the abutment against the piston-wheel, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MONTAGUE JAMES BRETHERTON.

Witnesses:

WILL. A. BARR,

JOS. H. KLEIN.