

No. 821,449.

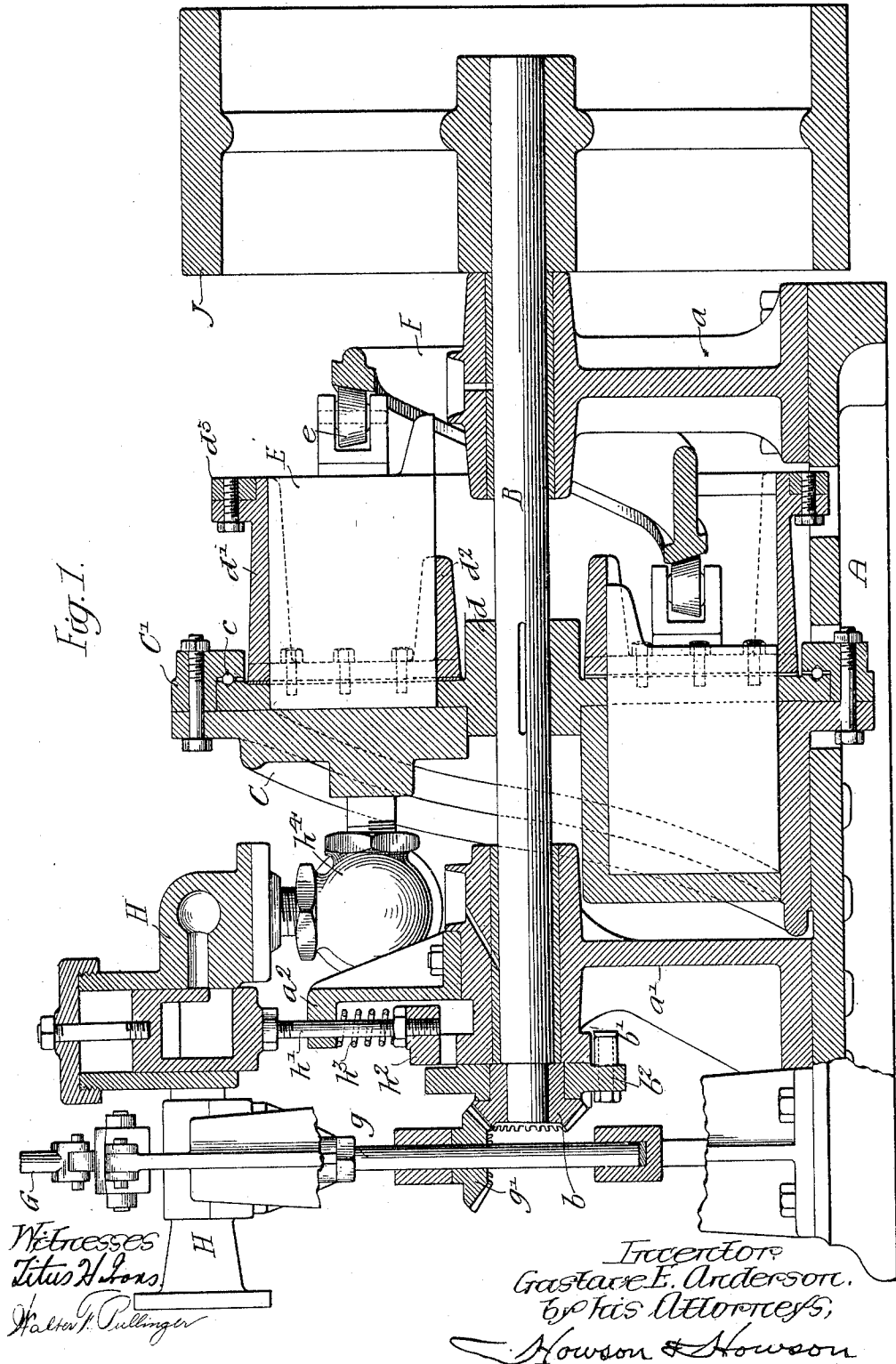
PATENTED MAY 22, 1906.

G. E. ANDERSON.

ROTARY ENGINE.

APPLICATION FILED AUG. 9, 1905.

4 SHEETS—SHEET 1.

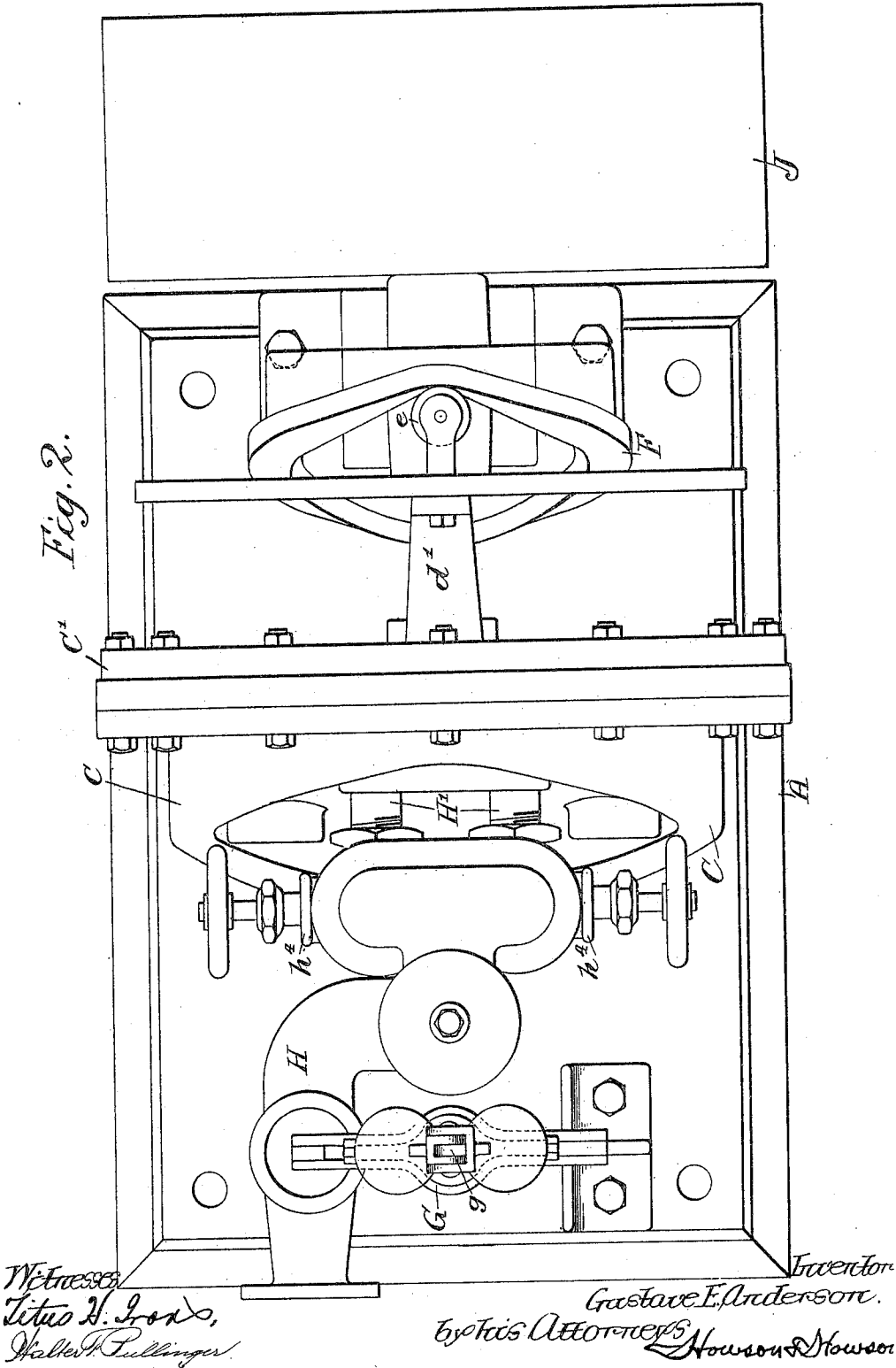


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4 SHEETS—SHEET 2.



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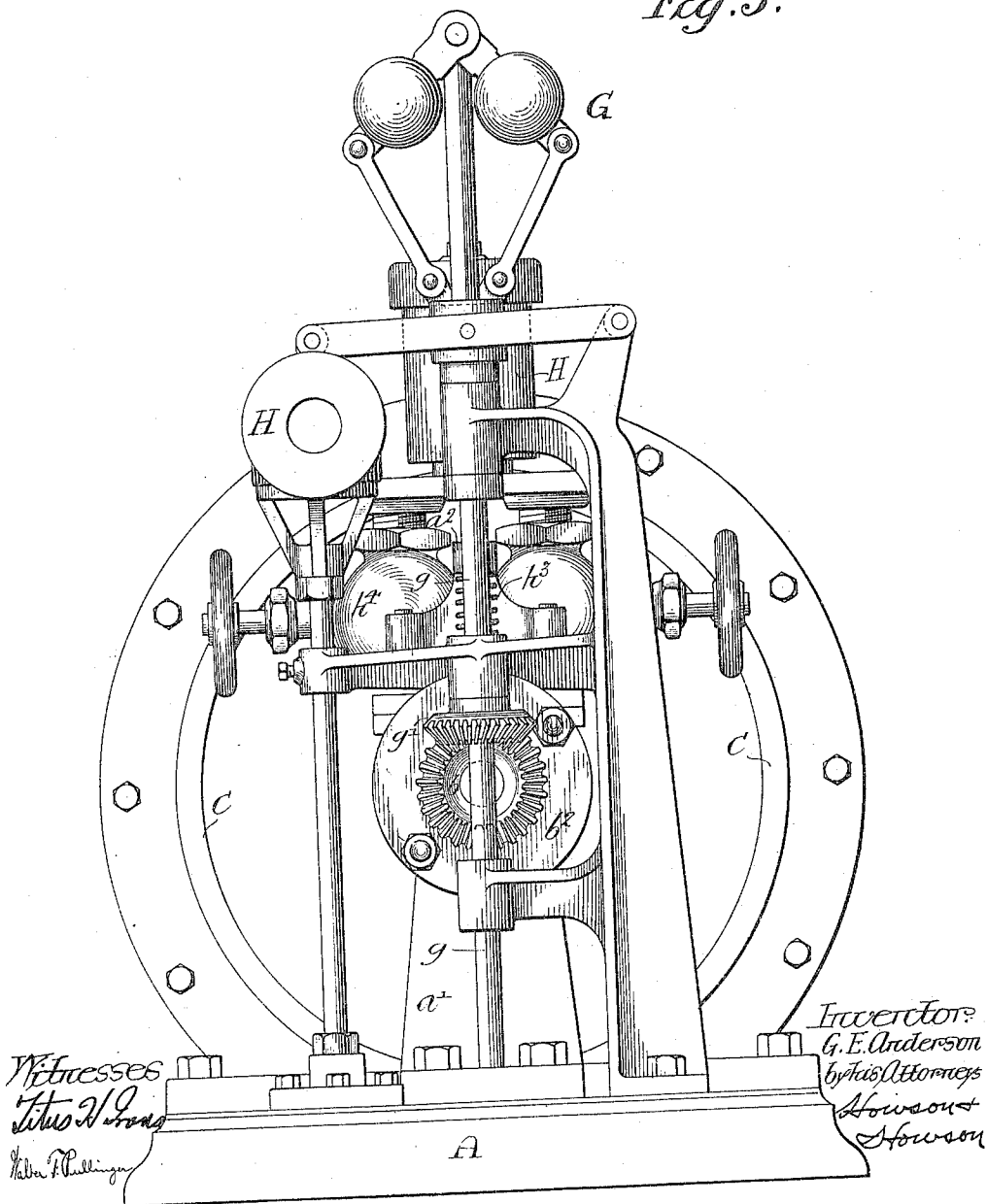
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4 SHEETS—SHEET 3.

Fig. 3.



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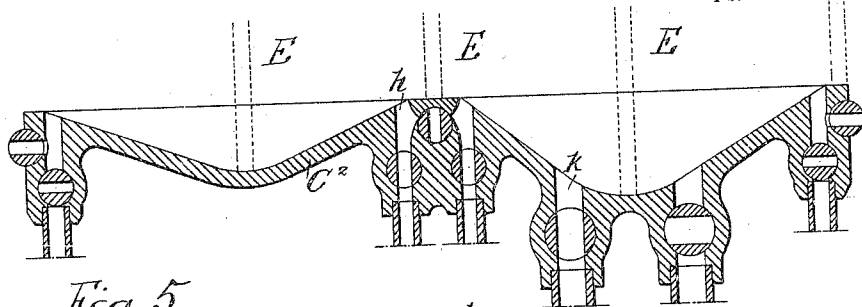


Fig. 5.

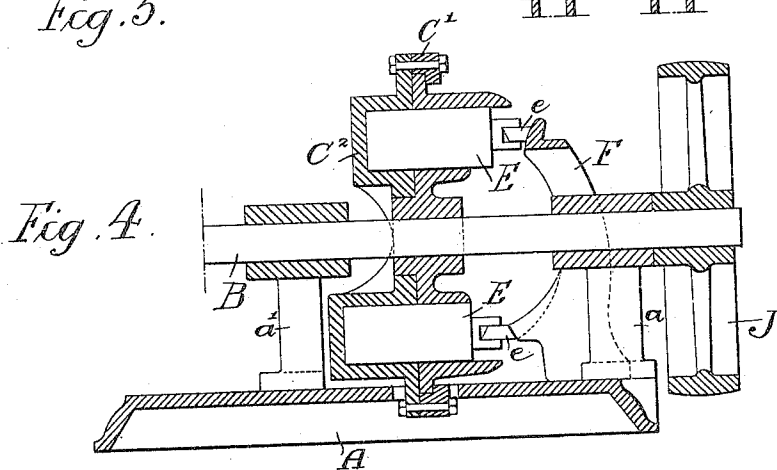


Fig. 4.

Fig. 10.

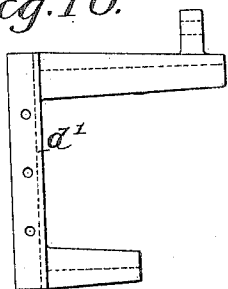


Fig. 9.

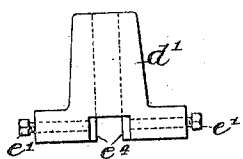


Fig. 8.

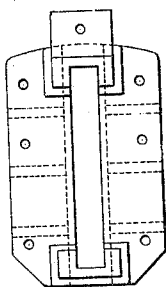


Fig. 7.

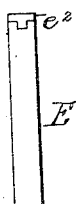
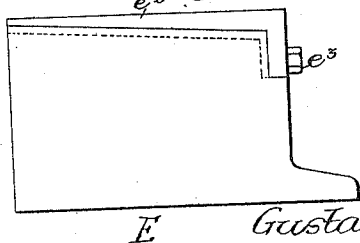


Fig. 6.



Witnesses:

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UNITED STATES PATENT OFFICE.

GUSTAVE E. ANDERSON, OF ALLEGHENY, PENNSYLVANIA.

ROTARY ENGINE.

No. 821,449.

Specification of Letters Patent.

Patented May 22, 1906.

Application filed August 9, 1905. Serial No. 273,432.

To all whom it may concern:

Be it known that I, GUSTAVE E. ANDERSON, a citizen of the United States, residing in Allegheny, Pennsylvania, have invented certain Improvements in Rotary Engines, of which the following is a specification.

My invention consists of a novel form of rotary engine which while having but few moving parts and being of relatively simple construction shall be powerful and efficient and of a construction such that it occupies but a comparatively small space for a given capacity. It is further desired to provide a reversible engine having the above-noted characteristics which shall at the same time have its parts so arranged that it shall have no dead-centers. These objects I attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional elevation taken through the main shaft of an engine constructed according to my invention and illustrating the detail construction thereof. Fig. 2 is a plan view of the engine shown in Fig. 1. Fig. 3 is an end elevation of the engine shown in Fig. 1. Fig. 4 is a vertical section of a compound engine constructed according to my invention. Fig. 5 is a view illustrating in diagram the development of the portion of the engine which I shall refer to as the "cylinder" or "cylinders," the view particularly illustrating that form of the invention shown in Fig. 4; and Figs. 6 to 10, inclusive, are detail views of certain of the parts of the engine.

In the above drawings, A is the foundation or framework of my engine, which is provided with two standards *a* and *a'*, carrying bearings for the main shaft B. Concentric with said shaft and supported upon the framework A is a casting C, which may be described as an annular container or operating-chamber having a helically-curved bottom, the elements of whose surfaces are at right angles to the line of the shaft B. The end of said chamber opposite this helical surface is closed by a disk D, having a hub *d* keyed to the main shaft B and revoluble with said shaft relatively to the chamber-casting C. In order that these parts may retain their proper relative positions, I provide a flanged ring C', bolted to the chamber-casting C and overhanging the disk D in such manner that ball-bearings *c* or antifriction-ring bearings may be carried in properly-constructed races be-

tween the flange of said ring C' and the adjacent face of the cover-plate D.

Bolted to the exterior face of the cover-plate D are two pairs of guides, each pair *d'* and *d''* being preferably formed as a single casting, as shown in Figs. 8 to 10, and the two pairs being bolted to the cover-plate D at points substantially one hundred and eighty degrees apart. Operating in each pair of guides and extending through the cover-plate D into the operating-chamber of the casting C (which I shall hereinafter refer to as the "cylinder") is a flat piston E, free to move in a line parallel with the shaft B and, since it is carried by the cover-plate D, also movable about said shaft as an axis. There are two of these pistons E, and it will be understood that their inner ends engage and are always in contact with the helical surface of the cylinder, being pressed thereto by means of a cam-ring F, fixed to the foundation or frame A and engaged by suitable bevel-rollers *e*, respectively carried by the pistons E. An elastic packing may be placed between the bevel-roller brackets and the piston, such packing being of rubber or other resilient material, or it may consist of springs.

In order to control the flow of motive fluid of the engine, I provide a throttling-governor G, whose spindle *g* is driven from the main shaft B by means of a pair of bevel-gears *g'* and *b*. This governor controls the flow of motive fluid through the main supply-pipe H to the engine in a manner so well known that it will not be further described. In order, however, that the motive fluid may be admitted to the engine at the proper times and amounts, I provide mechanism including a slide-valve *h*, operating in the main supply-pipe to the engine and having a spindle *h'*, periodically acted upon by a cam *b'*, carried upon a disk *b''*, actuated by the shaft B. The spindle *h'* is provided with a head *h''*, which is designed to be engaged by the cam *b'*, as noted. There is also upon said spindle, between its head and a guiding portion *a''*, carried by the bearing *a'*, a spring *a''*, whereby the valve *h* is maintained in its cut-off position, as shown in Fig. 1, at all times when it is not displaced from such position to an open position by the cam *b'*. Cut-off valves *h'* are placed between the admission-valve *h* and the cylinder C, and in the present instance I have so arranged the piping H that it enters the cylinder at two points equidistant from

that portion of the helical surface of the cylinder which is nearest the cover-plate B. This construction is adopted, and a cut-off valve is placed in each of the branches H' in order that the engine may be reversible, as it will turn the shaft B in either direction, according as to which of said valves is open.

Under operating conditions it will be seen that steam or other motive fluid is periodically admitted to and cut off from the cylinder C by means of the valve *h*, and inasmuch as there are two pistons E the cam *b'* must be so made or operated as to cause two admissions of motive fluid to the cylinder for each revolution of the shaft B. Said fluid acts upon the side or one face of one of the pistons E, and thereby causes this, together with the cover-plate D and the shaft B, to revolve, driving whatever mechanism or other load may be connected to the pulley J on said shaft. By the time that the cover-plate D has turned through one hundred and eighty degrees from the position shown in Fig. 1 steam is again admitted and caused to act upon the second piston E, while shortly thereafter the first piston uncovers an exhaust-port *k* and permits the motive fluid, which has acted expansively upon the piston, to escape. The continued revolution of the shaft B brings the first piston to a position such that the motive fluid is again admitted to it, while shortly thereafter the second piston uncovers an exhaust-port, and so allows the escape of the motive fluid which has been acting on it.

If desired, my improved engine may be made in such form as to permit of the motive fluid being expanded in a plurality of stages, and in Fig. 4 I have shown the main portions of a compound engine constructed according to my invention. In this form of the device the engine-cylinder C² is so made that instead of its helical surface approaching the cover-plate but once in the three hundred and sixty degrees of its annular lengths said surface approaches adjacent to said cover-plate twice in such length, thereby dividing the annular operating-chamber into two distinct cavities, of which one is of greater volume than the other by an amount fixed by engineering practice in the matter of compound engines. In this case there are four of the pistons E, placed upon the cover-plate D ninety degrees apart and kept in constant engagement with the helical surfaces of the cylinder by means of a corresponding curved cam F', supported from the frame A in such manner as to engage the rollers *e*, carried by the pistons. The proportions of the cylinders, together with the relative placing of the pistons, are indicated in the digrammatic development of the helical surfaces of said cylinders, as illustrated in Fig. 5.

In order to take up whatever wear may occur between the pistons and their guides, I provide side wearing-strips *e'*, fitted in suit-

able recesses in said guides and bearing against the faces of their respective pistons. The positions of these strips may be adjusted by means of screws *e'* so placed as to force said strips toward the piston-faces. Whatever wear may occur on the outside edges of the pistons from their outward pressure, due to centrifugal force, is taken up by means of tongued tapered wedges *e''*, fitted to such outer edge. These wedge-strips may be moved in or out at will by means of a bolt *e'''*, with which each of them is provided.

I claim as my invention—

1. An engine having an annular operating-chamber provided with a helically-formed surface substantially continuous throughout the three hundred and sixty degrees of its extent, two pistons having portions in engagement with said surface, and a cam structure for maintaining the pistons in engagement with said surface, one of the parts comprised by the pistons and the operating-chamber being revoluble relative to the other, there being an inlet for motive fluid and an exhaust-port placed to allow escape of motive fluid from the chamber when the volume of the space between the pistons has reached a maximum, substantially as described.

2. The combination of a structure formed as an operating-chamber, one of whose ends has its surface curved throughout the three hundred and sixty degrees of its extent, a cover for said chamber opposite said surface, a plurality of pistons having portions in engagement with the curved surface and movable through said cover-plate, means for revolvably supporting one of the members comprised by the cover-plate and the chamber structure, and means for maintaining the pistons in engagement with the curved surface during the revolution of said member, there being an inlet for motive fluid and a port placed to permit exhaust of the motive fluid when the plate has been moved to the point at which the motive fluid between the pistons has attained its maximum expansion, substantially as described.

3. The combination of a frame, a structure thereon formed as an annular operating-chamber, a shaft extending through said chamber concentric therewith, a plate carried by said shaft and forming a cover for the chamber, pistons carried by and movable through said cover into engagement with one end of the chamber, the surface of said end being curved throughout its extent, and means for causing movement of the pistons through said cover when the shaft is revolved, said pistons being one hundred and eighty degrees apart and there being inlet and exhaust ports two hundred and seventy degrees apart, substantially as described.

4. The combination of a frame, a structure thereon formed as an annular operating-chamber, a shaft extending through said

chamber concentric therewith, a plate carried by said shaft and forming a cover for the chamber, a piston carried by and movable through said cover into the chamber, and means for causing movement of the piston through said cover when the shaft is revolved, with means for taking up wear between the piston and the cover, substantially as described.

5. The combination of a frame, a structure thereon formed as an annular operating-chamber, a shaft extending through said chamber concentric therewith, a plate carried by said shaft and forming a cover for the chamber, a piston carried by and movable through said cover into the chamber, and means for causing movement of the piston through said cover when the shaft is revolved, with a strip carried by the cover in engagement with the piston, and means for moving the strip toward the piston to take up wear thereof, substantially as described.

6. The combination of a frame, a structure thereon formed as an annular operating-chamber, a shaft extending through said chamber concentric therewith, a plate carried by said shaft and forming a cover for the chamber, a piston carried by and movable through said cover into the chamber, and means for causing movement of the piston through said cover when the shaft is revolved, with means for taking up the wear between the outer edge of the piston and the side of the chamber, substantially as described.

7. The combination of a frame, a structure thereon formed as an annular operating-chamber, a shaft extending through said chamber concentric therewith, a plate carried by said shaft and forming a cover for the chamber, a piston carried by and movable through said cover into the chamber, and means for causing movement of the piston through said cover when the shaft is revolved, with a wedge-shaped piece carried by the piston upon its outer edge having means whereby it may be moved to take up the wear between the piston and the side of the operating-chamber, substantially as described.

8. The combination of a frame provided with bearings, a shaft carried in said bearings, an annular structure on the frame concentric with the shaft, said structure having an operating-chamber open at one end and having a continuous helically-curved interior surface at its other end, a cover carried by the shaft and closing the open end of the operating-chamber, flat plates movable through said cover in lines parallel with the shaft, with means for pressing one edge of said plates in engagement with the curved interior surface of the end of the operating-

chamber, there being inlet and exhaust ports to the operating-chamber so placed as to permit exhaust of motive fluid when the space between the plates in which it is contained has reached its greatest volume, substantially as described.

9. The combination of a supporting-frame, a structure carried thereon and formed as an annular operating-chamber, one end of said chamber being open, and the other being helically curved throughout the three hundred and sixty degrees of its extent, with its elements at right angles to the axis of the chamber, a flanged ring carried by said structure, a cover for the end of the structure opposite that having the helical curve, said cover being held in place by said ring, ball-bearings between the cover and the ring, a plurality of pistons formed as plates movable through said cover, and means for maintaining one edge of these plates in engagement with the helical surface of the operating-chamber, substantially as described.

10. An engine including a supporting-frame, a shaft revolubly carried thereon, a disk carried by said shaft, an annular structure concentric with the shaft and having an operating-chamber of which said disk forms the cover, the end of said chamber opposite said disk being curved so as to be of varying distances from said cover, guides on the cover, a plate movable in said guides and extending through the cover so as to engage the opposite ends of the operating-chamber, an annular cam for maintaining said piston in engagement with said end, and means for permitting revolution of one of the elements comprised by the shaft and the structure having the operating-chamber relatively to the other, substantially as described.

11. An engine including an annular structure formed as an operating-chamber, a shaft extending through said structure, a plate thereon serving as a cover for the operating-chamber, the end of the chamber opposite said cover being curved helically with reference to the shaft and approaching said cover a plurality of times in the three hundred and sixty degrees of the angular length of the operating-chamber, a flat plate forming a piston movable through the cover, and a cam structure engaging said piston for maintaining one edge of the same in engagement with the helical surface of the operating-chamber, substantially as described.

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

GUSTAVE E. ANDERSON.

Witnesses:

CHAS. A. LOCK,
W. MURRAY.