No. 797,621. PATENTED AUG. 22, 1905.

N. H. SMITH.

ROTARY ENGINE.

APPLICATION FILED DEC. 28, 1904.

3 SHEETS—SHEET 1.

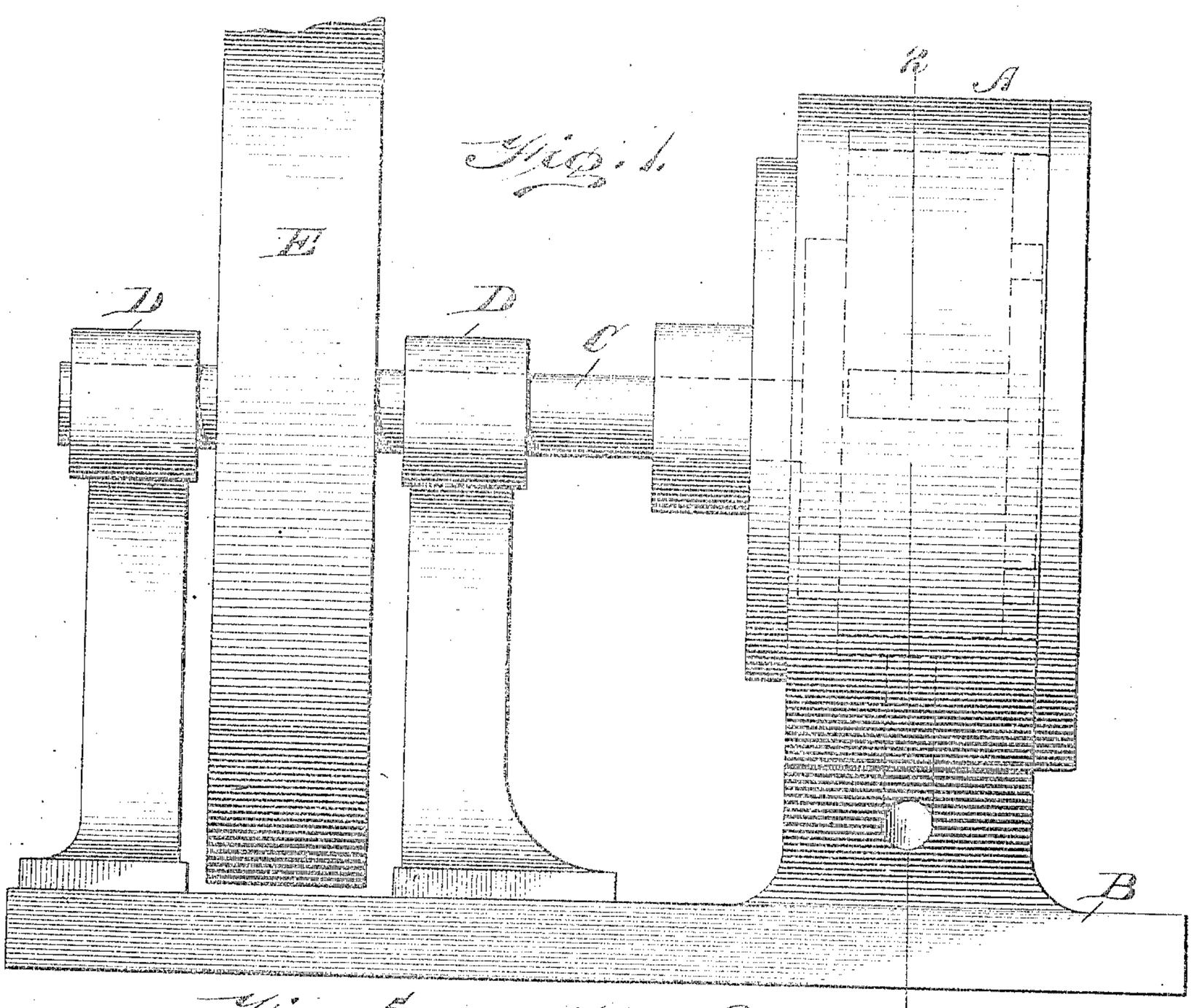

Fig. 1.

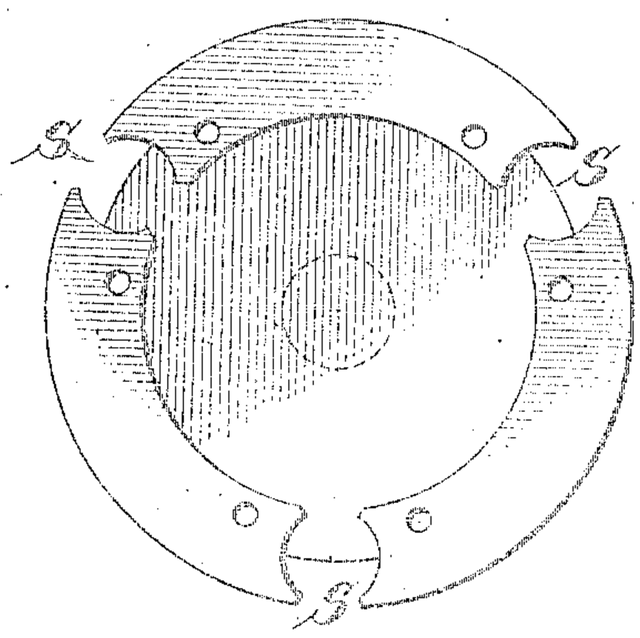

Fig. 5.

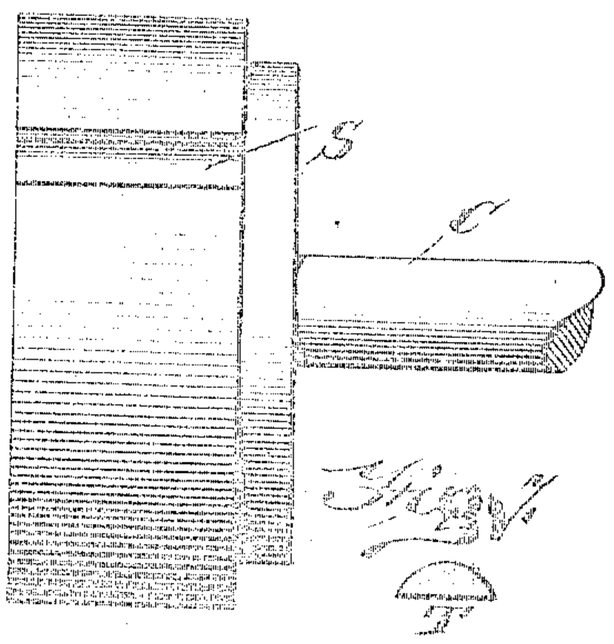

Fig. 6.

Fig. 7.

F

Fig. 8.

F

Witnesses:
H. E. Dieterich
W. Wirth

Inventor:
Newton H. Smith
by Knight Bros
Attorneys.

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3 SHEETS—SHEET 2.

Fig. 2.

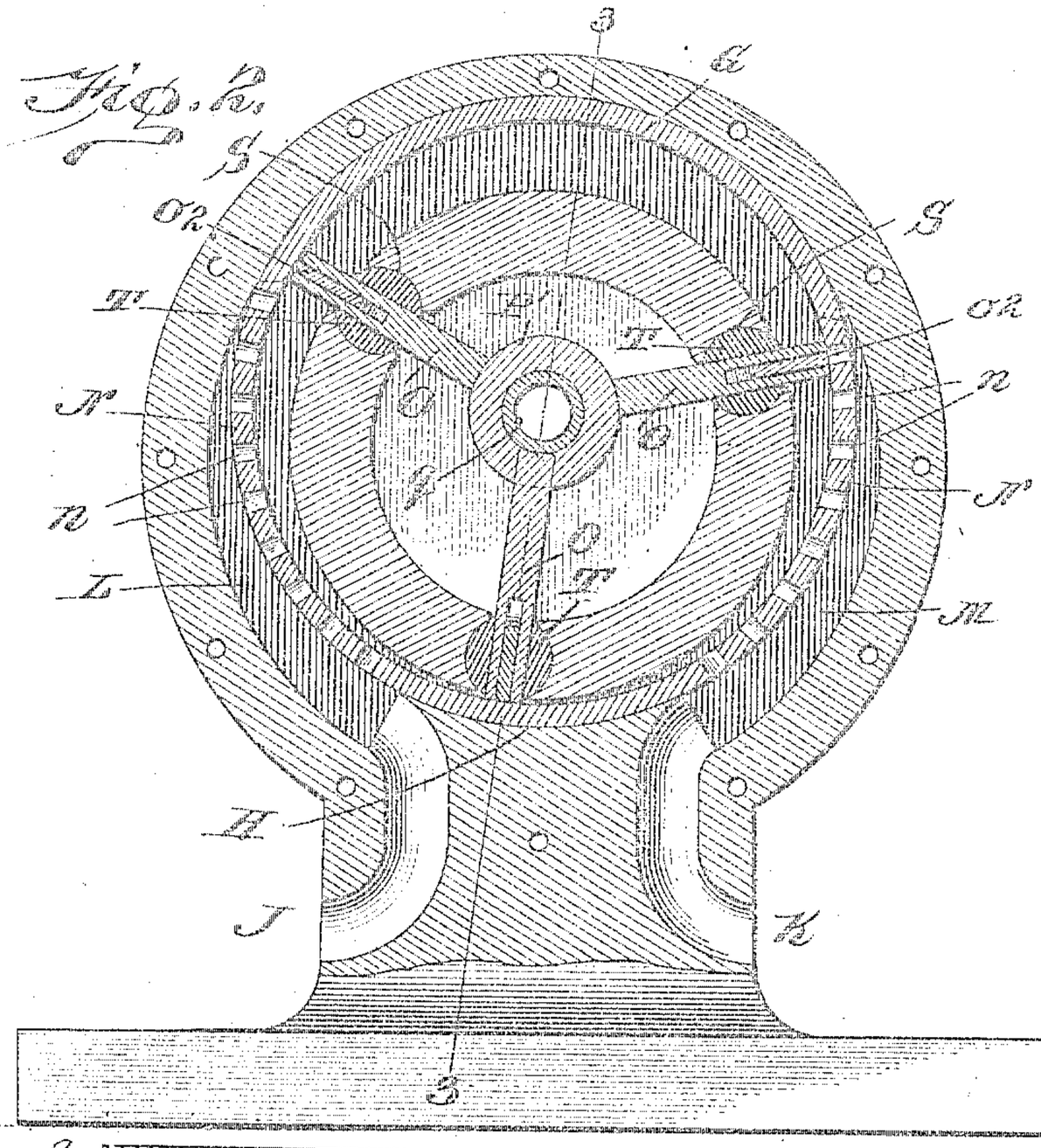


Fig. 3.

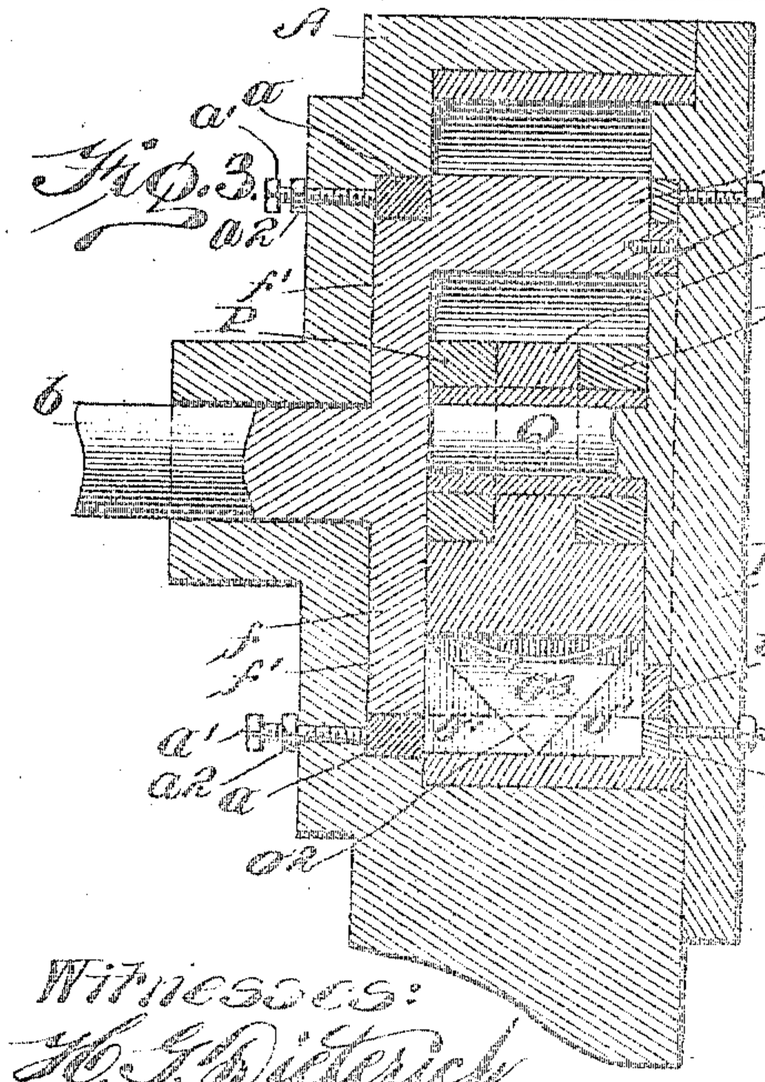
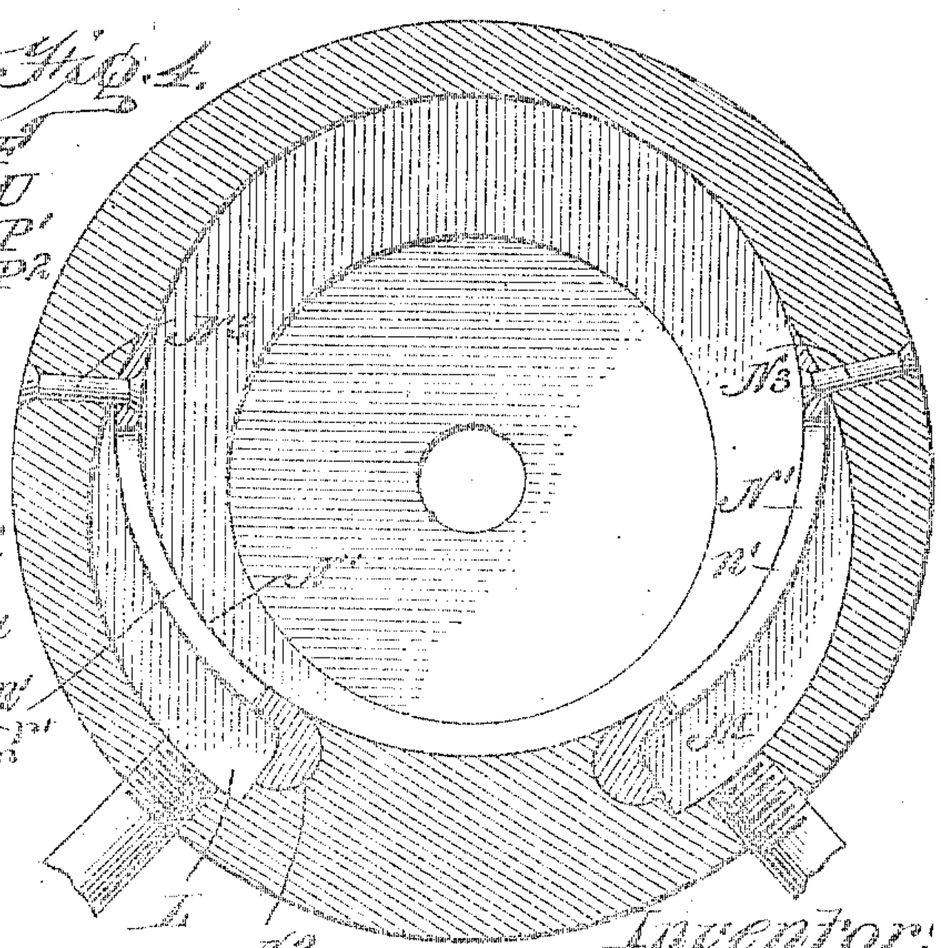


Fig. 4.



Witnesses:
H. E. Dittrich
J. V. Whitt.

Inventor:
Newton H. Smith
Knight Bros
Attorneys.

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3 SHEETS—SHEET 3.

Fig. 9.

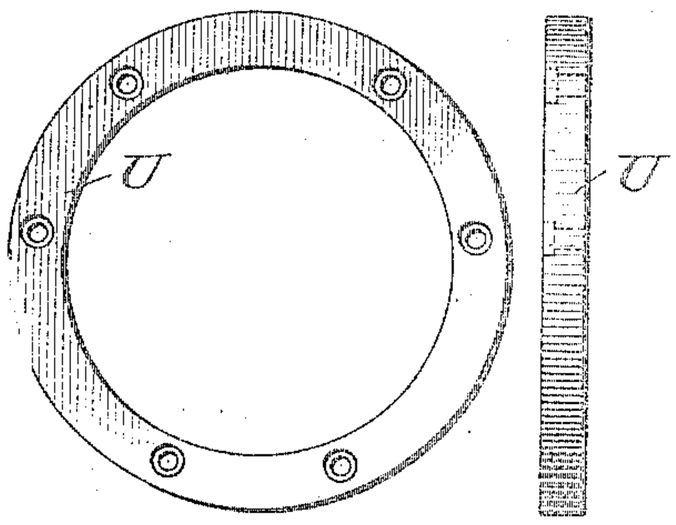


Fig. 10.

Fig. 11

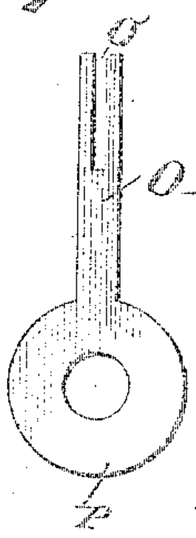


Fig. 12

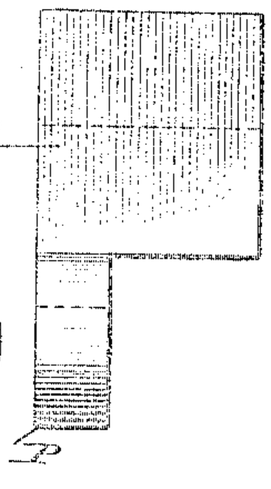


Fig. 13.

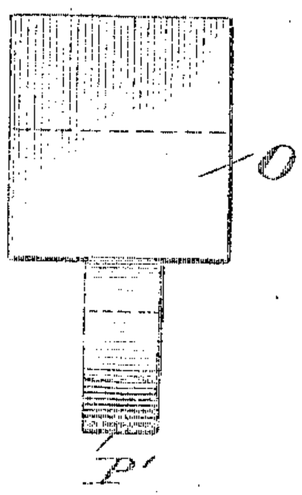


Fig. 15.

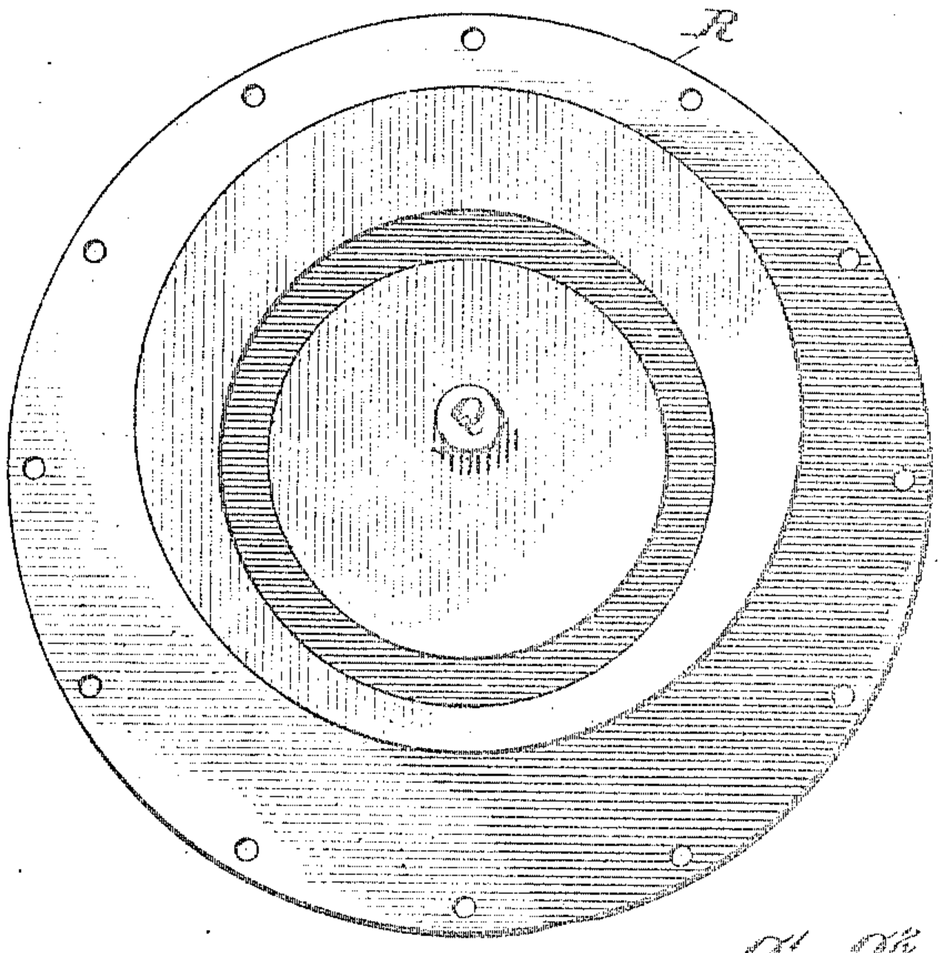


Fig. 16.

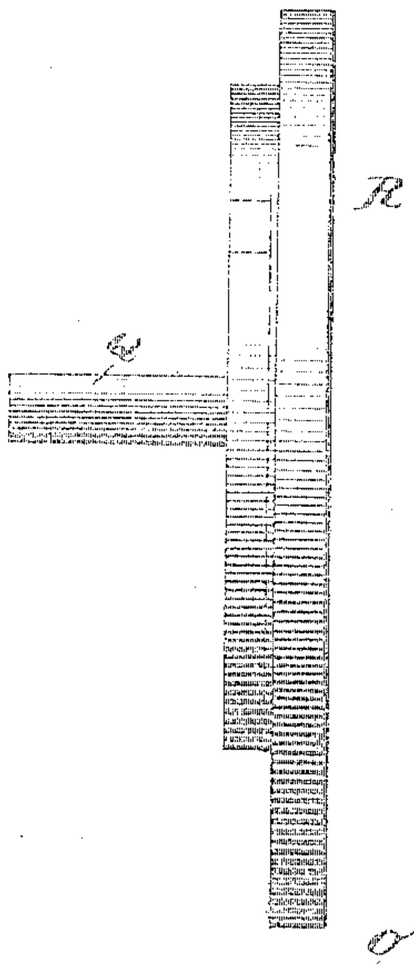
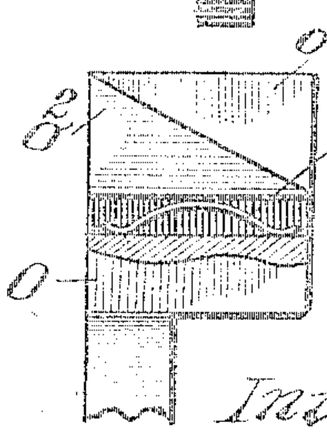


Fig. 14.

Fig. 14a.



Witnesses:
H. E. Dieterich
J. Wolik.

Inventor
Newton H. Smith
By Knight Bros
Attorneys:

UNITED STATES PATENT OFFICE.

NEWTON H. SMITH, OF KEOKUK, IOWA.

ROTARY ENGINE.

No. 797,691. Specification of Letters Patent. Patented Aug. 22, 1905.

Application filed December 23, 1904. Serial No. 238,617.

To all whom it may concern:

Be it known that I, NEWTON H. SMITH, a citizen of the United States, and a resident of Keokuk, in the county of Lee and State of Iowa, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to that type of rotary engines embodying fixed and rotating cylinders fitted one eccentrically within the other, so as to produce a crescent-shaped pressure-chamber with a neutral point between the ends thereof, supply and exhaust ports being provided on opposite sides of such neutral point and wings being projected through the inner cylinder to provide pistons against which pressure is exerted in the pressure-chamber and withdrawn within said cylinder in passing the neutral point.

My invention consists in certain novel features of construction in such an engine, which will be hereinafter fully described, and particularly pointed out in the claims, reference being made to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a side elevation of an engine embodying my invention. Fig. 2 is a vertical transverse section on the line 2 2, Fig. 1. Fig. 3 is a longitudinal section on the line 3 3, Fig. 2, showing the two cylinders, one of the wings or pistons, and the three hub-sections, which carry the wings or pistons. Fig. 4 is a view similar to Fig. 3, but showing only the outer cylinder in a slightly-modified form. Figs. 5 and 6 are respectively an end and a side view of the inner cylinder and drive-shaft with the wings or pistons and their securing-ring removed. Figs. 7 and 8 are respectively an end and a side view of one of the packings, which make steam-tight connection between the inner cylinder and its wings or pistons while permitting relative radial and angular movement between these parts. Figs. 9 and 10 are respectively an edge view and a face view of the ring for securing the wings in the inner cylinder. Figs. 11 and 12 are respectively an end view and a face view of one of the two wings or pistons which are carried by an end hub-section. Fig. 13 is a face view of that one of the wings or pistons carried by the intermediate hub-section. Fig. 14 is a view similar to Fig. 12 with one wall of the packing-groove broken away to disclose the expanding packing within. Fig. 14ª is a view similar to Fig. 14, showing a modified embodiment of that feature of my invention which relates to the packing. Figs. 15 and 16 are respectively a face and an edge view of the removable head of the outer cylinder.

A represents the outer cylinder, which is fixed on a suitable base B, and C represents the main driving-shaft, which may, if desired, be provided with external bearings D and equipped to transmit power in any suitable manner—as, for instance, by a pulley E.

F represents the inner cylinder, fitted eccentrically within the cylinder A, so as to leave a crescent-shaped pressure-chamber G and to approximately contact with the outer cylinder at H to form a neutral point between opposite ends of the pressure-chamber.

I and K represent passages through which steam may be supplied to and exhausted from the chamber G, and these passages communicate with said chamber through the medium of chests L M, separated from the chamber by cylindrical walls N, having openings or ports. These ports may be of any desired shape, provided they afford communication between the chests and the pressure-chamber throughout the greater portion of the length of the chests. I have shown them as a plurality of small bores *n* in Fig. 2 and as elongated slots *n'* in Fig. 4.

The inner rotary cylinder F is hollow and is provided with three wings O, which project through its cylindrical wall at equal circumferential distances apart and provide pistons against which pressure is exerted in the chamber G. In order that these wings or pistons may remain in contact with the inner surface of the outer cylinder during the revolution of the engine, thereby projecting beyond the inner cylinder during their travel through the pressure-chamber and withdrawing within said cylinder as they pass the neutral point H, each wing is carried by a hub-section P P' P", so formed that said sections will fit together and make a complete hub, corresponding in axial dimension with the interior of the inner cylinder, and said hub is caused to rotate on a fixed spindle Q, projecting inwardly from the removable head R of the outer cylinder and coaxially with the pressure-chamber of said outer cylinder.

The eccentricity of the inner cylinder with relation to the outer cylinder and the central position of the axial spindle Q cause the wings O to move in both an angular and approximately radial direction relatively to the inner cylinder. To permit these movements and still maintain a substantially steam-tight

joint, the cylindrical wall of the inner cylinder is provided with longitudinal cylindrical bores S of such diameter that they intersect the outer and inner surfaces of said wall and provided radial openings for the wings O, while within these bores on opposite sides of the wings are fitted segmental packing-pieces T, having flat faces fitting against the faces of the wings and cylindrical surfaces fitting the walls of the bores S. The wings O and packings T are introduced longitudinally into the bores S and secured therein mainly by the head of the outer cylinder, although they are also prevented from displacement during assembling of the parts by means of a ring U, fixed over the open ends of the bores by countersunk screws or other suitable means.

The ring U forms an annular projection on the end of the inner cylinder that fits in a corresponding groove *u* in the removable cylinder-head R, and this being concentric with the main driving-shaft C forms a rotary bearing for the driven member or inner cylinder of the engine. The opposite end of the inner cylinder is likewise provided with a cylindrical portion of a diameter less than the main diameter of the inner cylinder, and this reduced portion has rotary bearing in a depression *f'* in the outer cylinder and serves as an additional centering means for the driven member. Surrounding the cylindrical extensions *f* and U and abutting against the ends of the main part of the inner cylinder F are packing-rings *a* and *r*, adapted to be set up into impingement with said cylinder by means of set-screws *a'* and *r'*, which are fixed in their adjustment by jam-nuts a^2. The bores S extend entirely through the main portion of the inner cylinder and the wings abut against the packings *a r*, so that the spaces between the fixed and rotating members, as well as between the fixed member and the wings, and consequently the sides of the pressure-chamber, are in this manner made sufficiently steam-tight to maintain the efficiency of the engine.

To pack the pistons O, they are provided with grooves *o* in their outer ends parallel with the axis of their hub, and in these grooves are placed two or three part packings, consisting of outer packing-plates *o'*, the outer edges of which conform to the outer edges of the pistons, and inner wedge-shaped spreading-plates o^2, forced outwardly by spring o^3 and serving to hold the outer plates *o'* in close contact with the cylindrical and end walls of the pressure-chamber and against the packing-rings. As shown in Fig. 14, each packing may consist of two outer plates with one inner spreading-plate, or, as shown in Fig. 14^a, each packing may have but one outer plate with an inner plate impinging one outer plate through their diagonal faces, the inner plate in this case also forming one end of the packing, while the outer plate forms the other end and the outer face.

In practice the inner revolving cylinder, together with the inner head to which the main shaft is keyed or otherwise attached, is preferably cast in one integral piece. This greatly increases the strength and stability of the inner cylinder.

As will be understood on reference to Fig. 4, the cylindrical wall or lining *n* (shown in Fig. 2) may be replaced by shorter walls *n'*, set into the outer cylinder n^2, extending across the chests L, so as to provide necessary surface at these parts for the travel of the pistons, and having their upper ends secured by rivets n^3 or other similar means. The continuous ring N (shown in Fig. 2) forms a complete lining which can be removed and replaced when worn, which fact, together with the replaceability of all wearing parts of the engine, add greatly to its durability and economy in use. The short walls *n'* may likewise be replaced when worn. With either the continuous lining or the shorter bridging-walls the machining or cutting out of the chests L M is greatly facilitated.

For a continuous-running engine supplied with some known form of external reversing mechanism in its transmitting-gear one of the chests L M would be selected as the supply and the other as the exhaust. If the steam connections of the engine are provided with some suitable reversing-valve, then the chests would serve reciprocally for supply and exhaust according to the direction of running.

Having thus described my invention, what I claim is—

1. A rotary engine comprising a fixed outer cylinder constructed with heads and the rotary inner cylinder mounted eccentrically within the outer cylinder; the inner cylinder having a main portion fitting between the outer cylinder-heads and two extensions of less diameter than the said main portion, fitted in rotary bearings within said cylinder-heads and said heads carrying packing-rings which abut against said extensions and the ends of the main portion of the rotary cylinder.

2. A rotary engine comprising a fixed outer cylinder constructed with heads and the rotary inner cylinder mounted eccentrically within the outer cylinder; the inner cylinder having a main portion fitting between the outer cylinder-heads and two extensions of less diameter than the said main portion, fitted in rotary bearings within said cylinder-heads and said heads carrying packing-rings which abut against the ends of the main portion of the rotary cylinder and surrounding the reduced extensions and forming bearings therefor.

3. In a rotary engine, the combination of the outer cylinder, the inner cylinder eccentric thereto, constructed with longitudinal bores within its cylindrical wall intersecting the outer and inner surfaces thereof to pro-

vide radial openings, wings or pistons working in said radial openings, segmental packing-pieces fitting between the faces of the wings or pistons and the cylindrical walls of the bores, and a ring secured to the end of the inner cylinder having a bearing in the head of the outer cylinder and forming a turning-bearing for said inner cylinder.

4. In a rotary engine, the combination of the outer cylinder, the inner cylinder eccentric thereto, constructed with longitudinal bores within its cylindrical wall intersecting the outer and inner surfaces thereof to provide radial openings, wings or pistons working in said radial openings, segmental packing-pieces fitting between the faces of the wings or pistons and the cylindrical walls of the bores, and a ring detachably secured to the inner cylinder to form a reduced extension thereon and having a rotary bearing in one of the heads of the outer cylinder.

5. In a rotary engine, the combination of the outer cylinder, the inner cylinder eccentric thereto, constructed with longitudinal bores within its cylindrical wall intersecting the outer and inner surfaces thereof to provide radial openings, wings or pistons working in said radial openings, segmental packing-pieces fitting between the faces of the wings or pistons and the cylindrical walls of the bores, and a ring fitting in a groove formed in the head of the outer cylinder concentrically with the inner cylinder and providing a rotary bearing for the inner cylinder.

6. In a rotary engine, the combination of the outer cylinder, a piston working in said cylinder and having a longitudinal slot extending to the end and sides of the piston and a packing in said slot comprising a plurality of plates having inclined abutting faces and a spring interposed between the bottom of the slot and said packing, forcing the plates outwardly against the cylindrical wall and by the wedging action of their inclined faces, spreading them against the end walls of the cylinder.

7. In a rotary engine, the combination of the outer and inner cylinders, pistons projecting through the cylindrical wall of the inner cylinder and having a longitudinal slot therein extending to the outer end of the piston, and a packing in said slot; said packing consisting of a pair of outer plates in contact with the side and end walls of the pressure-chamber of the engine, and a spring-actuated wedge-shaped spreading-plate entering between the outer plates to force them against the walls of the pressure-chamber.

8. The combination of the inner and outer cylinders, the shaft projecting from the inner cylinder through the end of the outer cylinder, a head tightly closing the other end of the outer cylinder and the adjustable packing-ring located between the cylinders at the end, from which the shaft projects.

9. In a rotary engine, the combination of the outer cylinder, the inner cylinder having an end boss fitting a rotary bearing in the end of the outer cylinder, and a shaft projecting centrally from said boss through said cylinder end, and the adjustable packing-ring fitting an offset in said cylinder end, surrounding the boss and abutting the end of the inner cylinder.

The foregoing specification signed at Keokuk, Lee county, Iowa, this 19th day of November, 1904.

NEWTON H. SMITH.

In presence of—
W. C. HOWELL,
A. SCHONTEN.