No. 644,256. Patented Feb. 27, 1900.

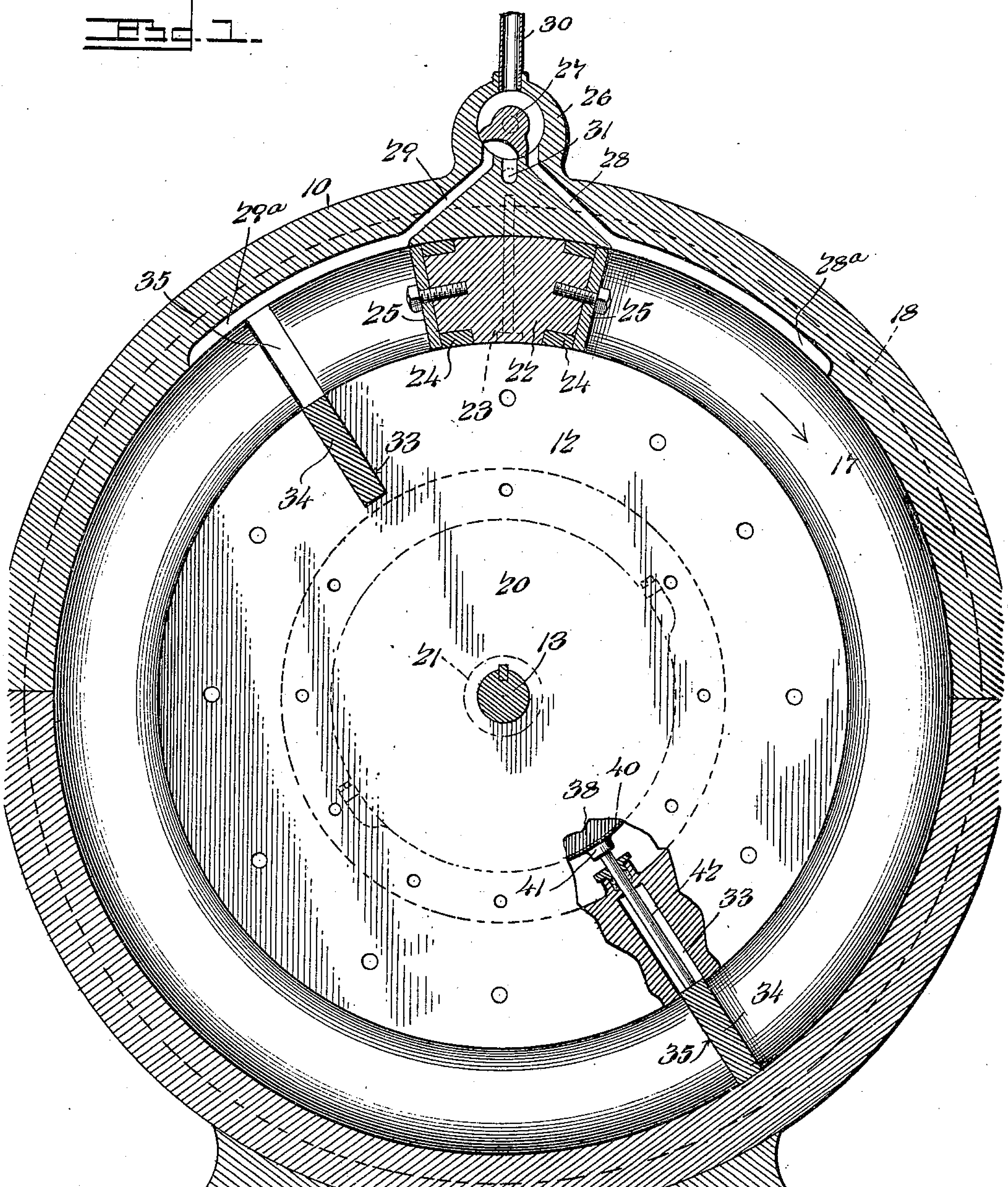
G. W. MONTGOMERY.

ROTARY ENGINE.

(Application filed Apr. 26, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses
E. K. Stewart
[signature]

George W. Montgomery, Inventor
By his Attorneys,
C. A. Snow & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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3 Sheets—Sheet 2.

Fig. 6.

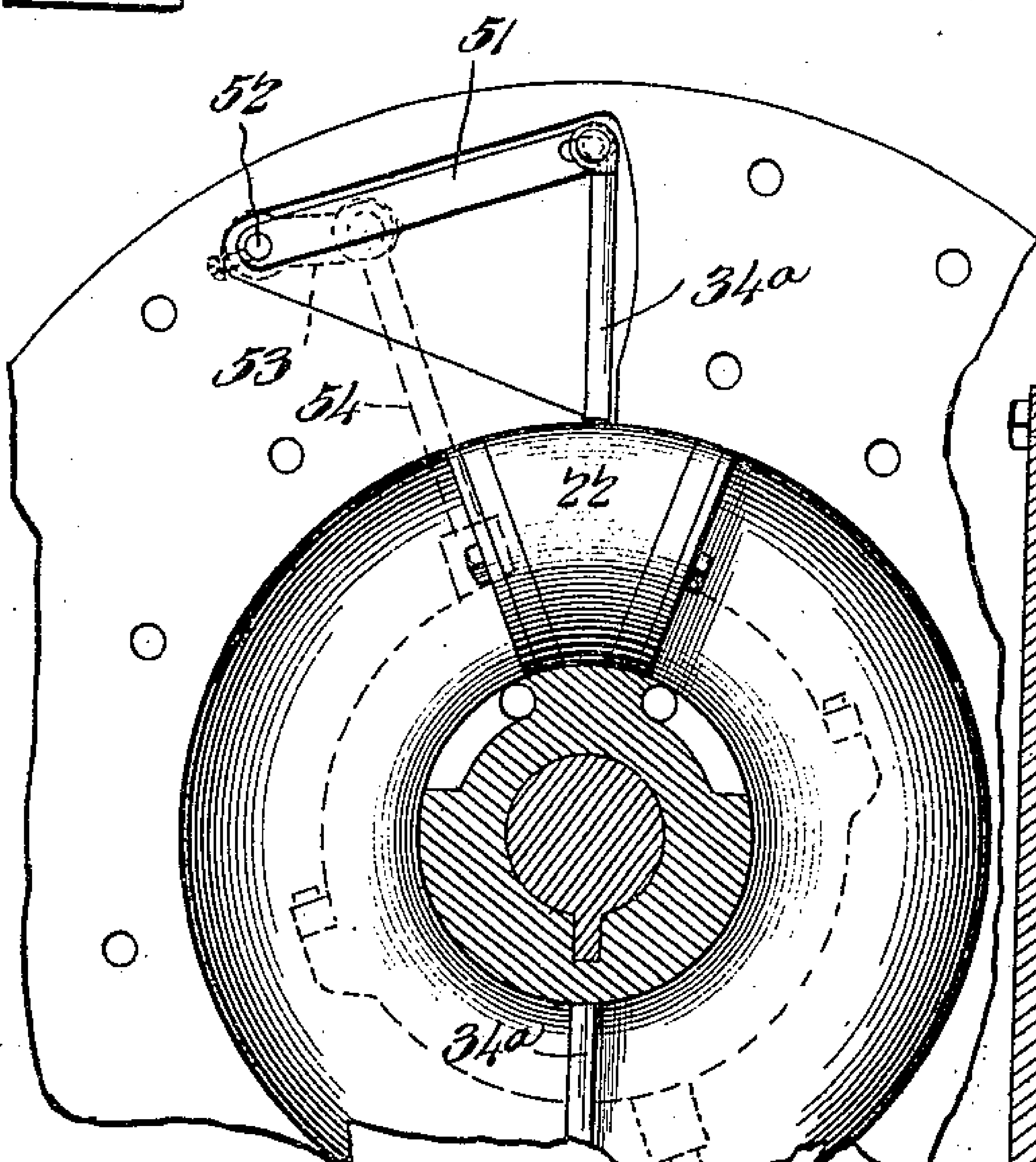
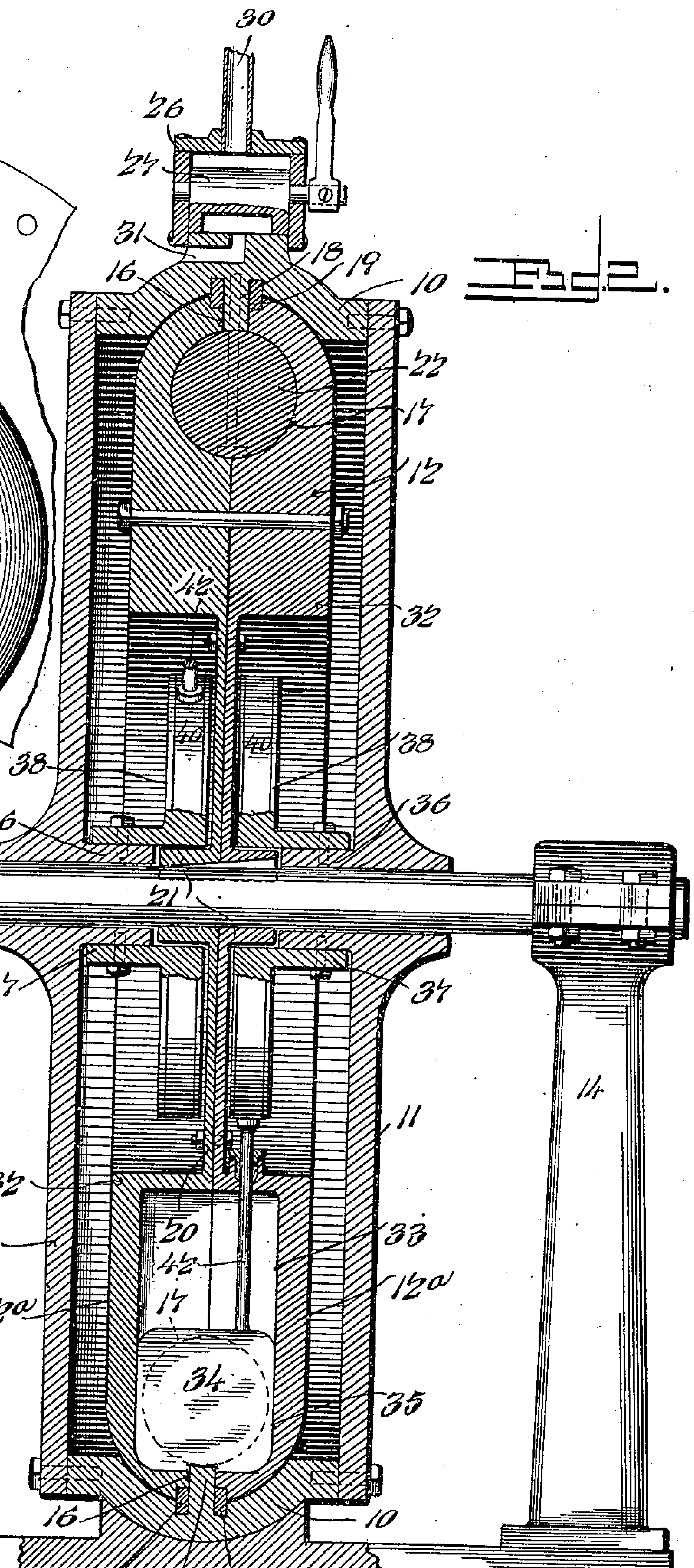


Fig. 2.



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3 Sheets—Sheet 3.

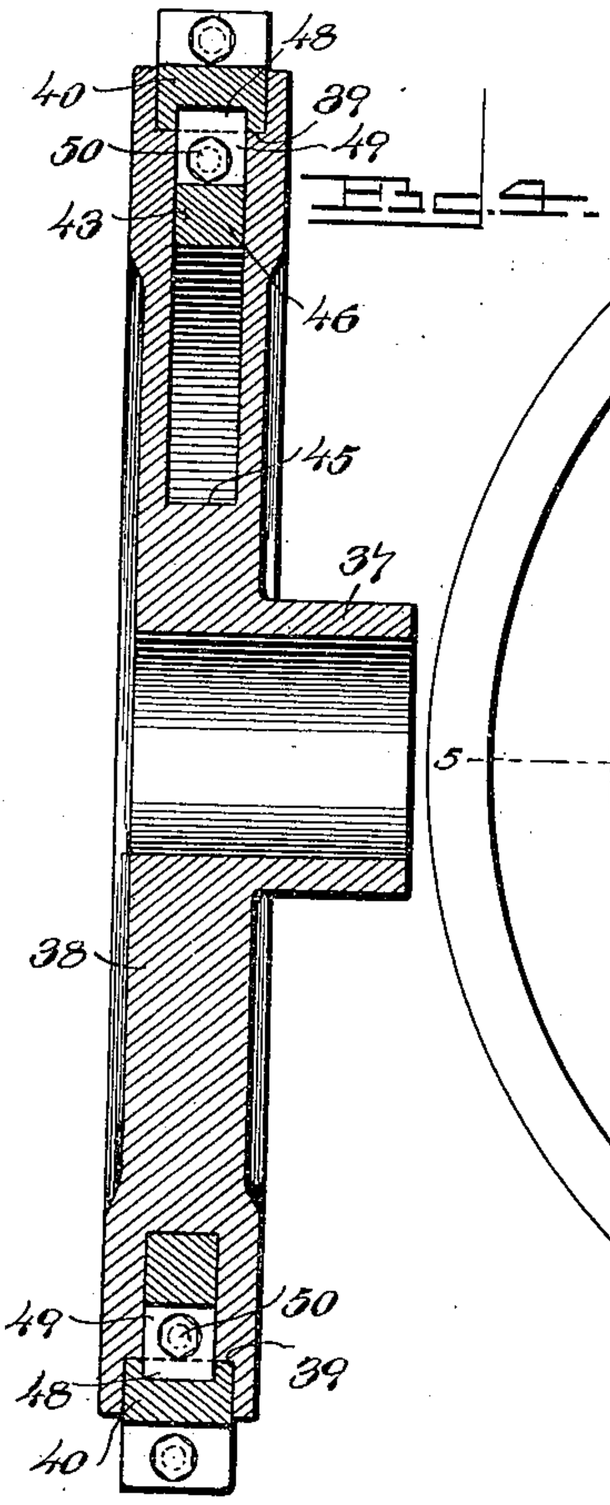
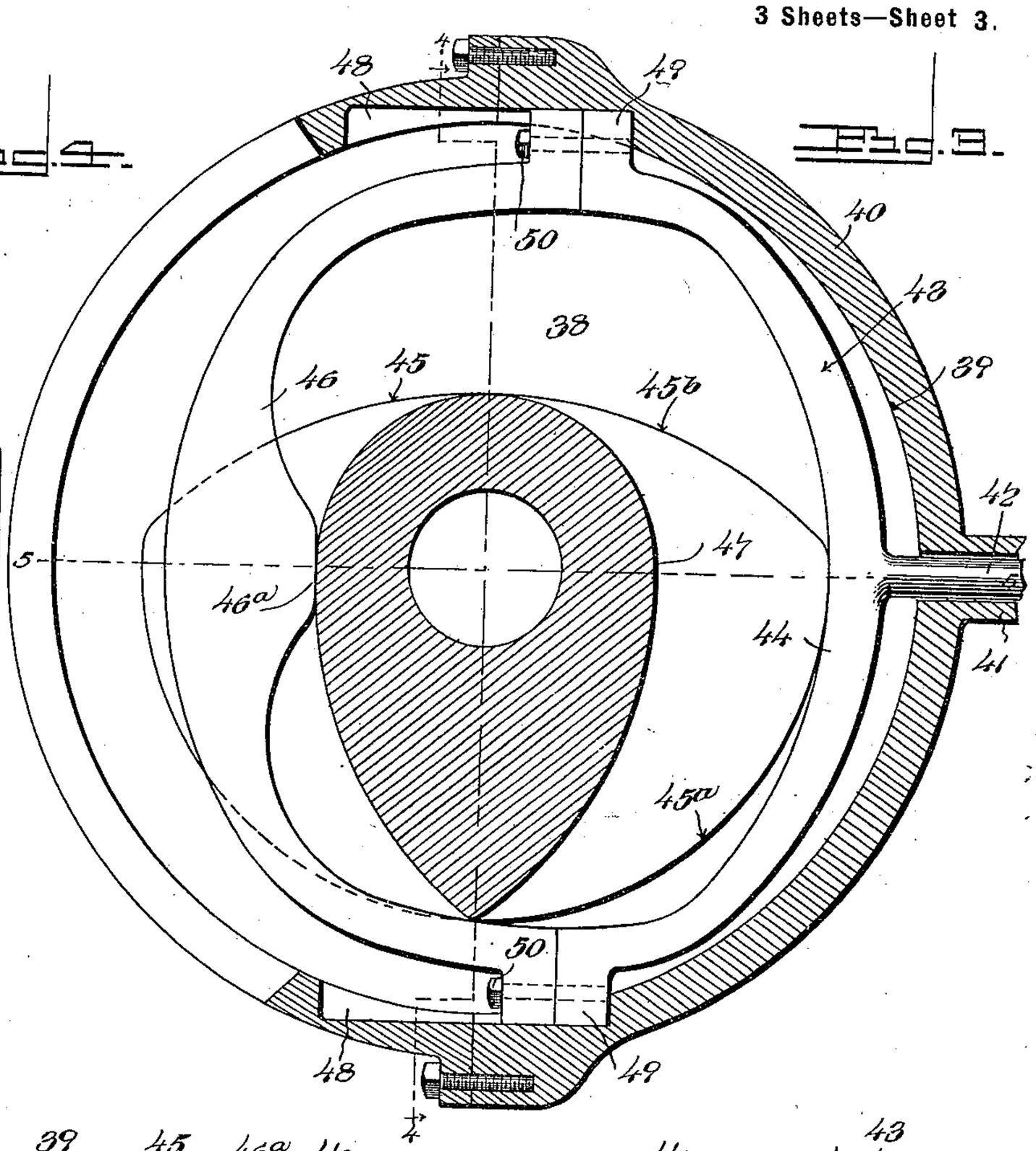


Fig. 4.



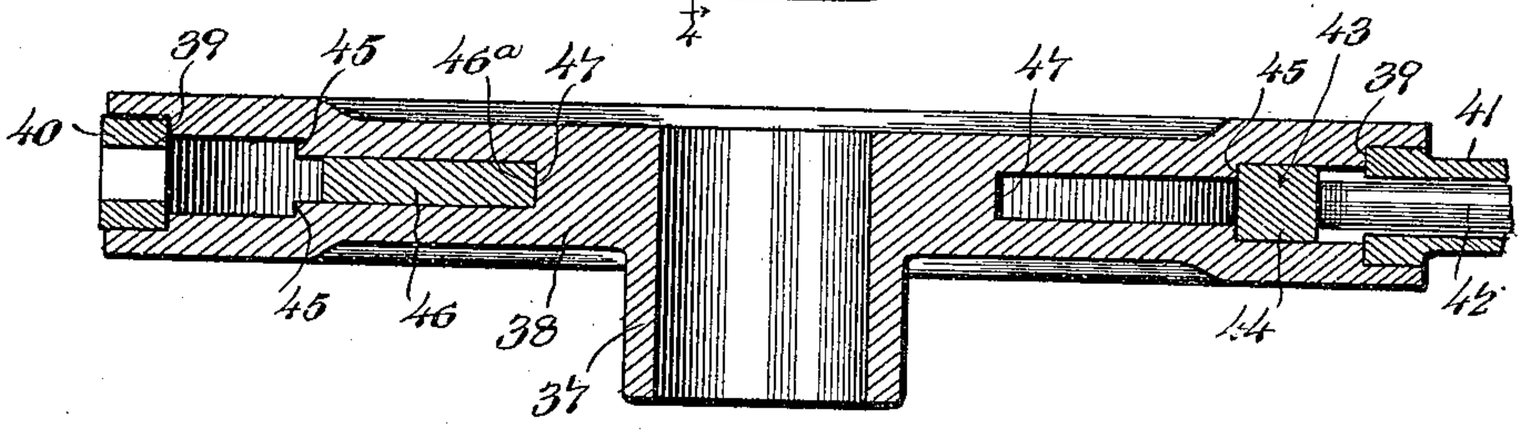


Fig. 5.

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UNITED STATES PATENT OFFICE.

GEORGE W. MONTGOMERY, OF BELLAIRE, OHIO.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 644,256, dated February 27, 1900.

Application filed April 26, 1899. Serial No. 714,567. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. MONTGOMERY, a citizen of the United States, residing at Bellaire, in the county of Belmont and State of Ohio, have invented a new and useful Rotary Engine, of which the following is a specification.

My invention relates to rotary engines of the rotary-cylinder concentric-piston type; and the object in view is to provide a construction adapted for the economical use of the motive agent, which is applied expansively to the movable element, all back pressure due to compression being avoided by exhausting the cylinder before such back pressure can occur, and, furthermore, to reduce frictional resistance to the minimum by exhausting the motive agent prior to the movement of the piston-wings and causing the full extension of the piston-wings before the motive agent is again admitted to actuate the movable element of the mechanism.

The particular object of my invention is to provide an improved construction of mechanism for actuating the piston-wings and, furthermore, to provide a mechanism which is adapted for use in connection with engines of both large and small size.

Further objects and advantages of the invention will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims, it being understood that various changes in the form, proportion, and the minor details of construction within the scope of the appended claims may be resorted to without departing from the spirit or sacrificing any of the advantages of the present invention.

In the accompanying drawings, Figure 1 is a side view of an engine constructed in accordance with my invention, the face-plate of the casing and the front section of the cylinder being omitted. Fig. 2 is a vertical central sectional view of the engine, taken in the plane of the axis of the cylinder. Fig. 3 is a detail sectional view of the wing-operating cam. Figs. 4 and 5 are sectional views, respectively, on the planes indicated by the lines 4 4 and 5 5 of Fig. 3. Fig. 6 is a face view of a portion of an engine, wherein a slightly-different connection between the cam-operating element and the piston-wings is employed.

Similar reference characters denote like and corresponding parts in each of the several figures of the drawings.

Arranged within the exterior casing or housing consisting of an annular wall 10 and opposite face-plates 11, said casing forming a supporting-frame for the engine embodying my invention, is a rotary cylinder 12, fixed to a shaft 13, which extends through suitable central openings in the face-plates 11 and is mounted in bearings on the standards or pedestals 14, any suitable means being employed for communicating motion from this shaft to machinery to be driven, a belt-pulley 15 being illustrated in the drawings for this purpose.

The cylinder is of sectional construction in that it consists of opposite side members 12^a, which are separated at their peripheries to form a channel 16 in communication with the piston-chamber 17, and extending into this channel is a web 18, carried by the cylindrical wall 10 of the casing or frame. Said web is continuous, and a steam-tight contact between the opposite side surfaces thereof and the adjacent edge portions of the cylinder members is formed by means of packing-strips 19 let into suitable grooves in said members. The body portion of the cylinder, which consists of a rim in which the piston-chamber is formed, is connected with the shaft 13 by means of a web 20, which may be of sectional construction, with the members thereof carried respectively by the members of the cylinder, as shown in the drawings, and these web members are provided at their centers with oppositely-extending sleeves or hub members 21, which are keyed to the shaft 13.

The stationary web 18, which projects through the channel formed in the outer side or periphery of the cylinder, carries a fixed abutment 22, which may be secured in place to the web by means of a bolt 23 or its equivalent, and is reduced or cut away at its extremities to receive the expansion packing-rings 24, held in place by cap-plates 25.

Various means may be adopted for admitting motive agent to the piston-chamber of

the cylinder; but in the construction illustrated in Figs. 1 and 2 a throttle-valve chamber 26 is arranged upon the exterior surface of the casing and incloses a valve 27, which controls cylinder-ports 28 and 29 in communication with the piston-chamber respectively at opposite sides of the plane of the fixed abutment.

30 represents the supply-pipe for the steam or other motive agent, and 31 the exhaust-port. In the construction illustrated the cylindrical wall of the casing is concaved to form a seat 10^a, in which the convexed outer surface of the rotary cylinder is fitted, and it will be understood that in practice this seat supplements the inwardly-extending web 18 in maintaining the alinement of the cylinder when in operation.

The rim of the cylinder, in which the piston-chamber is formed, is extended inward to form a portion 32, in which are formed piston-wing seats 33 for the reception of the radially-movable reciprocatory wings 34, and in the walls of the piston-chamber are formed guides 35, in alinement with the seats 33, to receive the edges of the piston-wings when the latter are extended to span the piston-chamber.

Extending inward from the face-plates 11 of the casing or housing are annular bosses or sleeves 36, to which are secured the hub portions 37 of cams 38, of which one is illustrated in detail in Figs. 3, 4, and 5. Each cam is provided with an annular strap-seat 39, which is concentric with the axis of the cylinder or other rotary member of the engine, and in this seat is fitted a strap or guide 40, having at one side a tubular guide 41, through which extends a piston-wing stem 42, attached at one extremity to a piston-wing. Attached to the other or inner end of this stem is a yoke 43, having an inner member 44, which operates in connection with a cam-face 45 on the cam 38, and having an outer member 46, which operates in connection with a countersunk cam-face 47 of said cam, the cam-face 47 being approximately oval in construction and being shown clearly in Fig. 3, while the cam-face 45 is for the greater portion of its length concentric with the axis of rotation, as shown at 45^a, and for a limited distance, as shown at 45^b, is somewhat flattened or is struck from a longer radius than the portion 45^a. The member 46 of the cam-yoke is provided with a bearing-point 46^a, which is adapted to bear upon the cam-face 47 at a point opposite to the point of bearing of the member 43 upon the cam-face 45, and during the movement of the cam-yoke around the axis of the shaft 13 as a center these two opposite points of bearing of the yoke members 43 and 46 are respectively in contact with the cam-faces 45 and 47. Also at the extremities of its major axis the cam-face 47 is flush with the cam-face 45, and this major axis is arranged in such a position that the extension thereof would pass through the center of the fixed abutment 22, said fixed abutment being opposite the center of the flattened portion 45^b of the cam-face 45. Thus in the operation of the mechanism the cam-yoke reciprocates within the strap 40, but is guided positively to traverse a straight line by the guiding thimble or tube 41 and by diametrical guideways 48, in which operate keys 49 at the adjacent sides of the cam-yoke, said keys in the construction illustrated consisting of offset terminal ears of the yoke members and said ears being connected to unite the members of the yoke by means of bolts 50. As the cylinder which carries the piston-wings rotates in the direction indicated by the arrow in Fig. 1, the piston-wings maintain a fully-extended position from the time that the center of the yoke member 43 reaches the point of connection of the cam portion 45^b with the cam portion 45^a until the center of said yoke portion 43 has traversed the cam portion 45^a throughout its length. Before the central point of the member 43, however, begins to ride upon the cam portion 45^b the outer edge of the piston-wing has passed the extremity of the exhaust-groove 29^a, which is formed in the exterior wall of the cylinder and is in communication with the port 29. Hence before radial movement of the piston-wing is initiated all fluid-pressure upon that wing has been removed by the exhaust of the motive agent from the cylinder and fluid-pressure is not again applied to said wing until after it has passed the fixed abutment 22 and has reached its full extension beyond the extremity of the exhaust-channel 28^a at the opposite side of said abutment.

The above-described construction of piston-wing-operating mechanism is such as to provide for a high rate of speed without jar or rattle, owing to the plurality of bearings of the cam-yoke upon the cam-faces and also owing to the use of the strap in which the cam-yoke operates.

One of the modifications of the above-described construction which I have contemplated and tested in practice is shown in Fig. 6, the same being adapted particularly for use in connection with small engines or those of comparatively-low power. In such construction the piston-wings 34^a are withdrawn outwardly from the piston-chamber instead of inwardly, as in the construction illustrated in Figs. 1 and 2, and said piston-wings are connected with arms or levers 51, pivoted, as at 52, to the cylinder, and to these spindles are attached crank-arms 53, connected by pitmen or rods 54 with the cam-yokes. This arrangement of parts locates the piston-chamber adjacent to the axis of rotation of the cylinder and, as before indicated, has particular advantages in connection with small engines wherein a particularly-high rate of speed is desirable. It will be seen that the only essential difference between the two

forms of engines described resides in the fact that in one the piston-chamber is located in the outer and in the other in the inner portion of the cylinder-rim, such reversal necessitating a corresponding reversal in the positions of the piston-wings to cause one to withdraw from the piston-chamber outwardly and the other to withdraw inwardly. The same cam mechanism is employed in both.

Having thus described the invention, what is claimed is—

1. In a rotary engine, the combination with a revoluble member, and radially-reciprocable piston-wings carried thereby, of a cam for each piston-wing having oppositely-convexed outer and inner cam-faces, and a cam-yoke connected with each piston-wing and having diametrically-opposite bearings respectively upon said cam-faces, substantially as specified.

2. In a rotary engine, the combination with a revoluble member, and radially-reciprocable piston-wings carried thereby, of a cam for each piston-wing having oppositely-elongated outer and inner cam-faces, and a cam-yoke connected with each piston-wing and having diametrically-opposite bearings respectively upon their respective cam-faces, substantially as specified.

3. In a rotary engine, the combination with a revoluble member, and radially-reciprocable piston-wings carried thereby, of a cam having outer and inner cam-faces of which the major axes are arranged perpendicularly to each other, and a yoke connected with the piston-wings and having diametrically-opposite bearings upon said cam-faces, substantially as specified.

4. In a rotary engine, the combination with a revoluble member, and radially-reciprocable piston-wings carried thereby, of a cam having an outer cam-face of which the major portion is concentric with the axis of rotation and the remaining portion is flattened, and an inner oval cam-face having its major axis arranged to connect the centers of said concentric and flattened portions of the outer cam-face, and a cam-yoke connected with a piston-wing and having diametrically-opposite bearings respectively upon said cam-faces, substantially as specified.

5. In a rotary engine, the combination with a revoluble member, and radially-reciprocable piston-wings carried thereby, of a cam for each piston-wing having outer and inner cam-faces elongated in planes at right angles to each other and arranged flush with each other at the extremities of the major axis of one of said cam-faces, and a cam-yoke connected with each piston-wing and having diametrically-opposite bearings respectively upon their respective cam-faces, substantially as specified.

6. In a rotary engine, the combination with a revoluble member, and radially-reciprocable piston-wings carried thereby, of a cam having a concentric seat, outer and inner relatively-eccentric cam-faces, a cam-yoke connected with a piston-wing and having diametrically-opposite bearings respectively upon said cam-faces, and a strap mounted upon said concentric seat, and having the cam-yoke arranged therein for reciprocation, substantially as specified.

7. In a rotary engine, the combination with a revoluble member, and radially-reciprocable piston-wings carried thereby, of a cam having a concentric strap-seat, and outer and inner cam-faces having their major axes arranged upon perpendicularly-disposed lines, a strap mounted in said seat and provided with guides, and a cam-yoke connected with a piston-wing, mounted in said strap, and provided with diametrical bearings in contact at diametrically-opposite points respectively with said cam-faces, substantially as specified.

8. In a rotary engine, the combination with a revoluble member, and radially-reciprocable piston-wings carried thereby, of a cam having a concentric strap-seat and outer and inner cam-faces, 45 and 47, of different widths inclosed within said strap-seat, a strap mounted upon said seat and provided with a guide-thimble and diametrically-opposite guideways, a cam-yoke arranged within said strap, provided with keys mounted in the diametrical guideways thereof, and provided with diametrically-opposite bearing-points in contact respectively with said cam-faces, and a piston-wing stem extending through said guide-thimble and connected with the cam-yoke, substantially as specified.

9. In a rotary engine the combination of a supporting-frame having an annular concaved seat, a rotary cylinder fitted at its outer periphery in said seat and provided with a piston-chamber, a continuous annular channel opening into the piston-chamber, an annular web projecting inwardly from said seat and fitting in the channel of the cylinder, a fixed abutment carried by said web, piston-wings mounted for reciprocatory movement in guides in the cylinder, and piston-wing-operating devices, comprising cams having outer and inner faces, of which the major axes are arranged perpendicular to each other, and yokes connected with the piston-wings and having diametrically-opposite bearings upon said cam-faces, substantially as described.

10. In a rotary engine, the combination of a rotary cylinder provided in its outer wall with a continuous channel in communication with its piston-chamber, an abutment-carrying web fitted in said channel and provided with cylinder-ports and communicating exhaust-channels communicating with the piston-chamber at opposite sides of the plane of the fixed abutment, piston-wings mounted in guides in the cylinder, a convexed cam arranged adjacent to the axis of the cylinder,

and a cam-yoke mounted upon the cam and connected with a piston-wing, said cam having a wing-retracting portion of which the extremities are separated a less angular distance than the extremities of said exhaust-channels in the abutment-supporting web, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

GEO. W. MONTGOMERY.

Witnesses:

JOHN H. SIGGERS,

ROBT. E. CRUMP.