J. A. MAXAM.

ROTARY ENGINE.

APPLICATION FILED JAN. 28, 1918.

1,304,497.

Patented May 20, 1919.

6 SHEETS—SHEET 1.

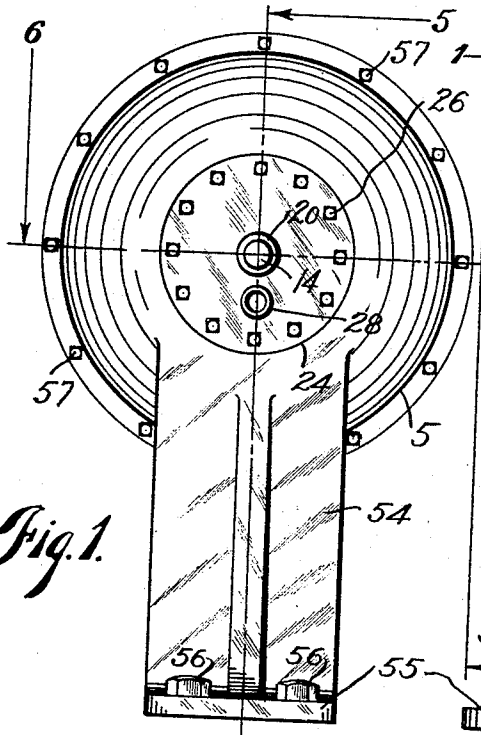


Fig. 1.

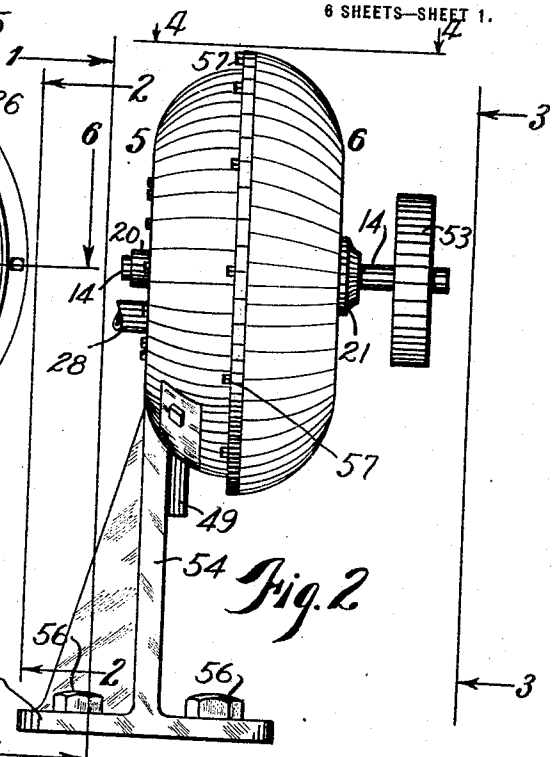


Fig. 2.

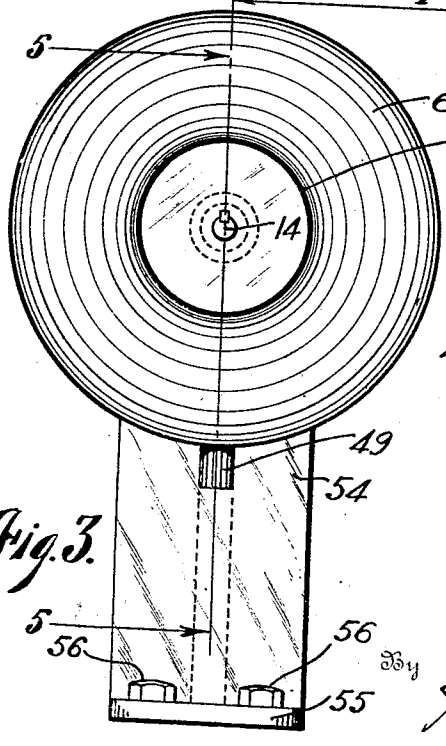


Fig. 3.

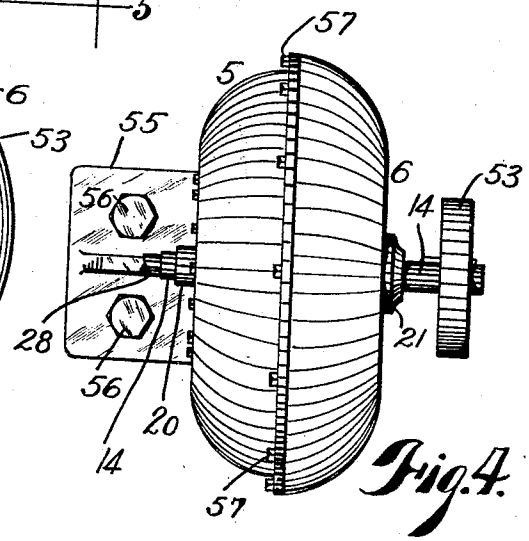


Fig. 4.

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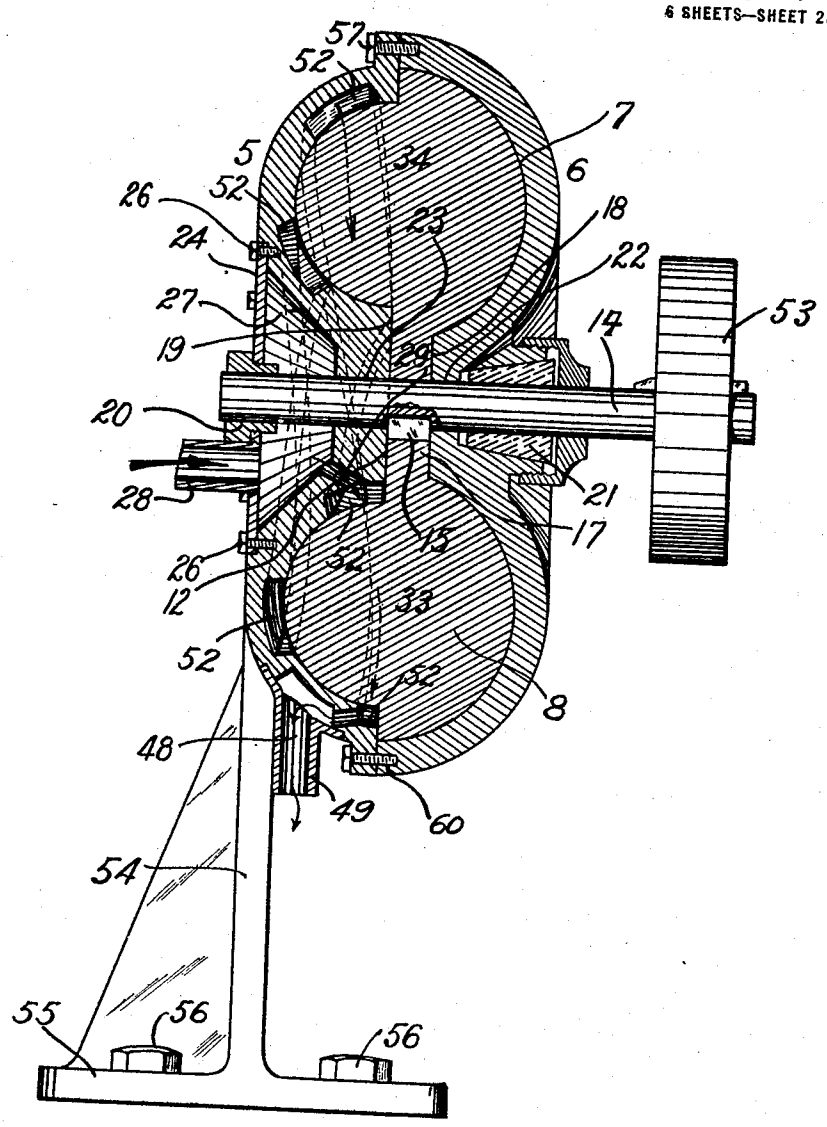


Fig. 5.

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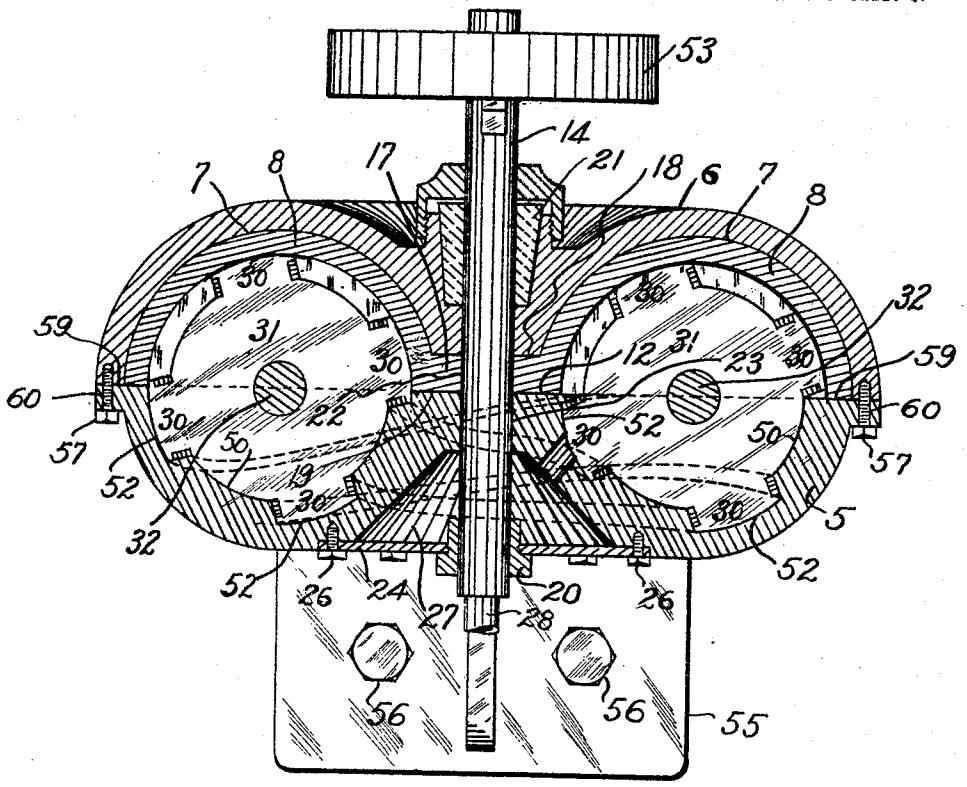


Fig. 6.

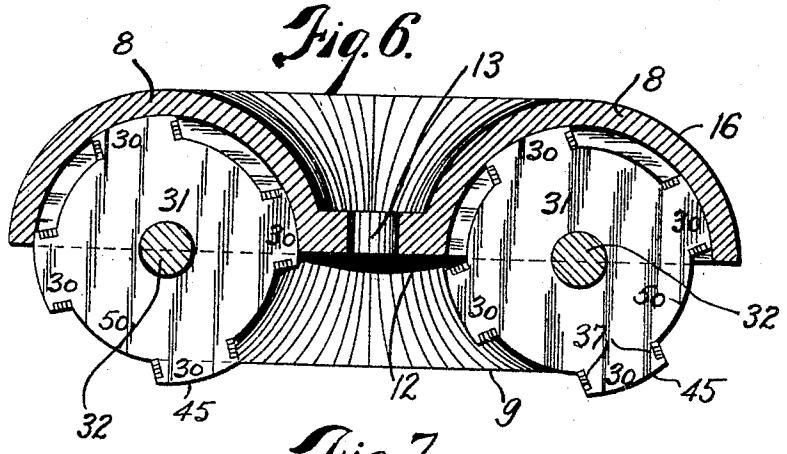


Fig. 7.

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6 SHEETS—SHEET 4.

Fig. 8.

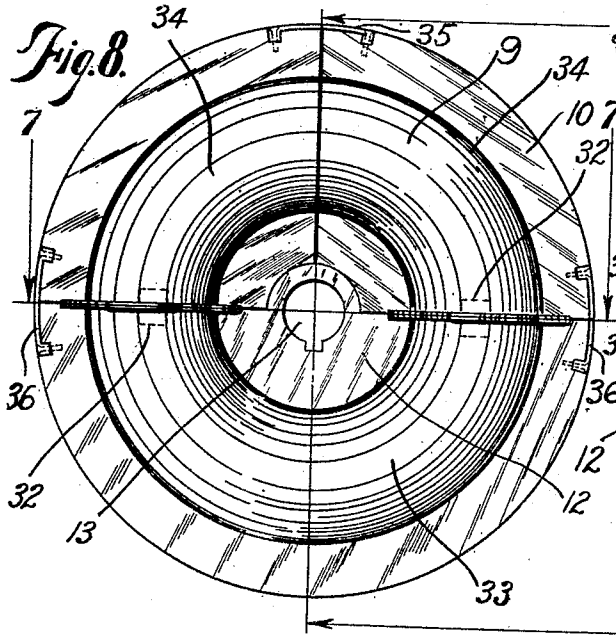


Fig. 9.

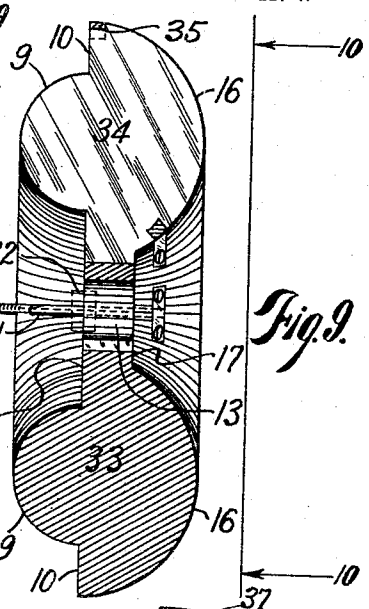
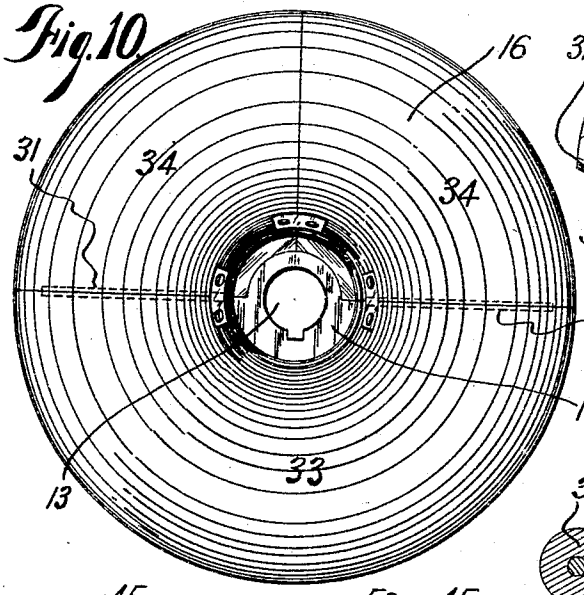


Fig. 10.



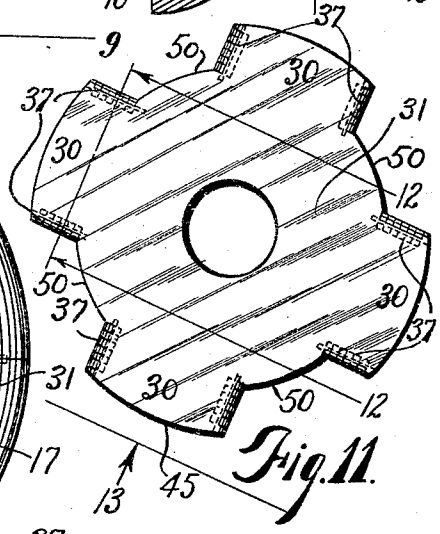


Fig. 11.

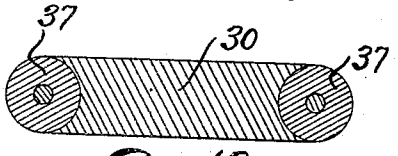


Fig. 12.

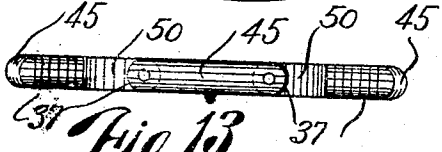


Fig. 13.

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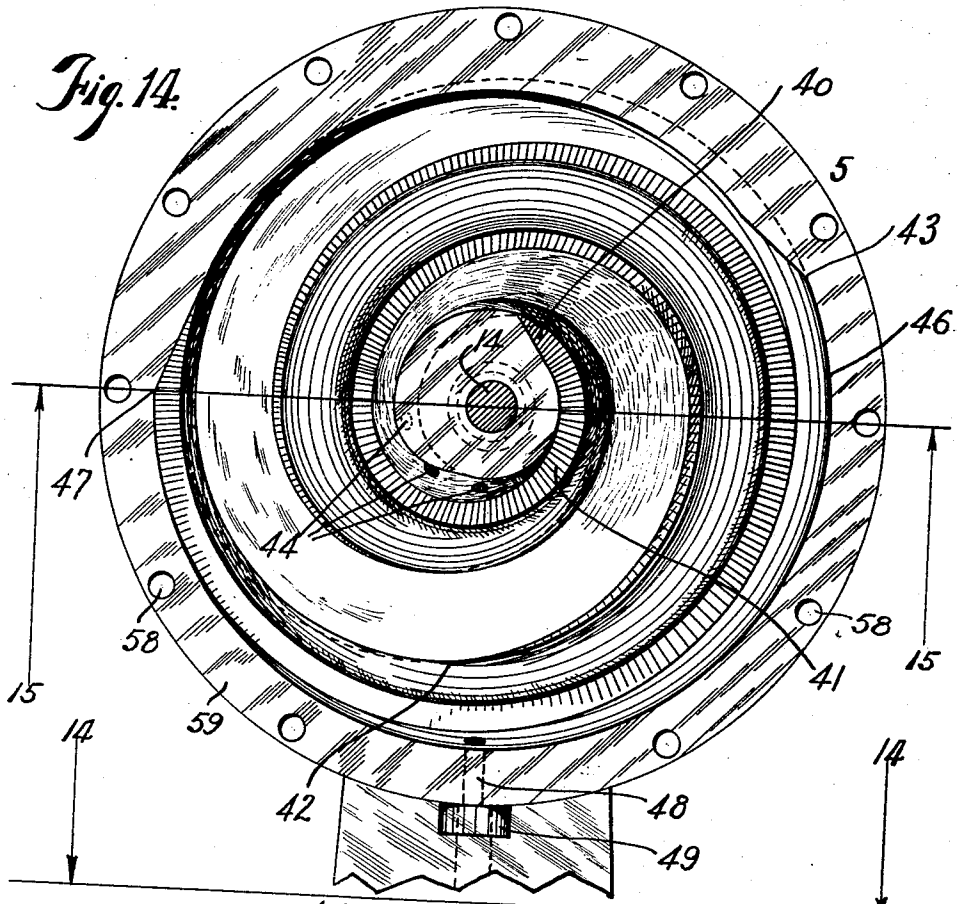
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6 SHEETS—SHEET 5.

Fig. 14.



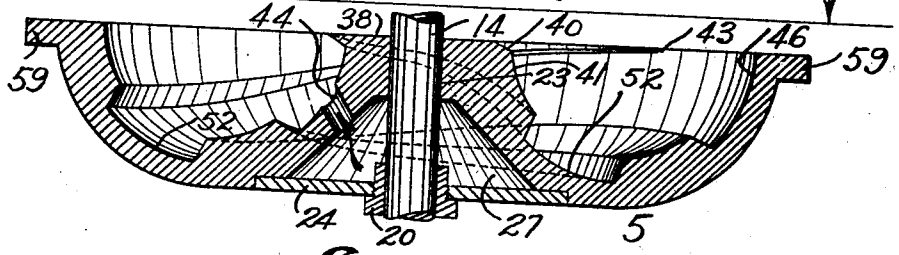


Fig. 15.

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6 SHEETS—SHEET 6.

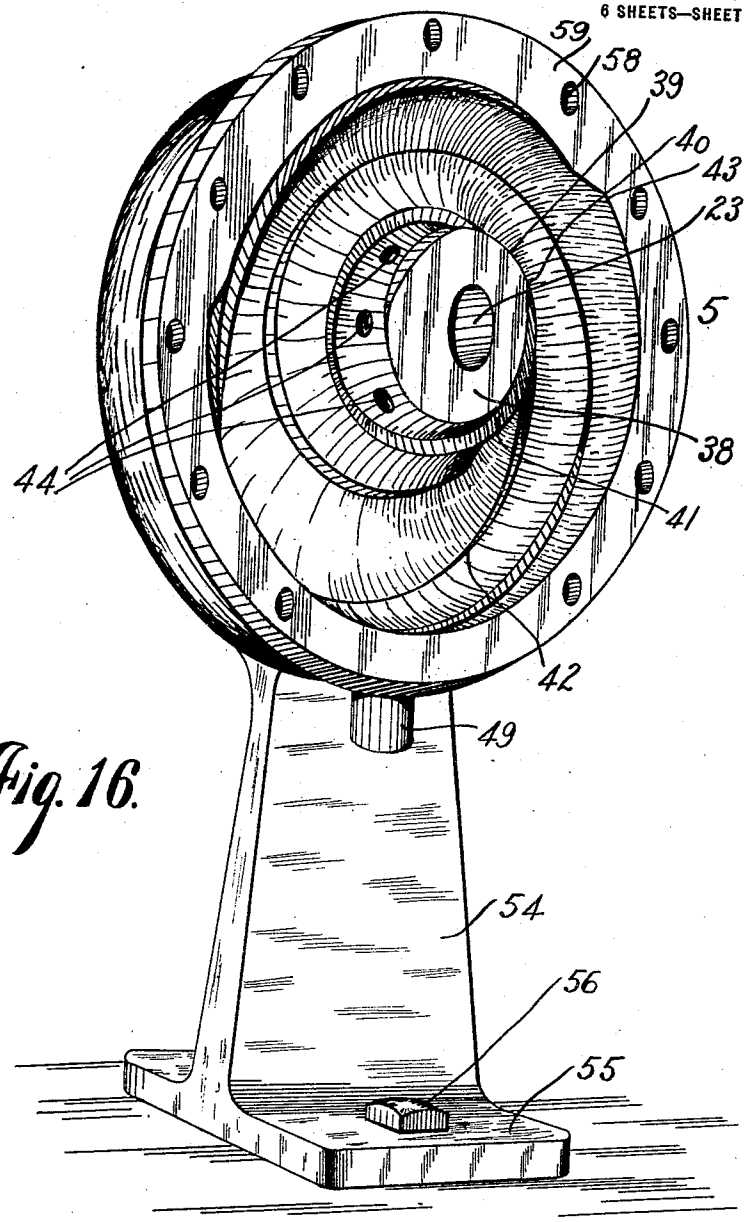


Fig. 16.

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By A. L. [illegible]

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UNITED STATES PATENT OFFICE.

JOEL A. MAXAM, OF DENVER, COLORADO.

ROTARY ENGINE.

1,304,497. Specification of Letters Patent. Patented May 20, 1919.

Application filed January 23, 1918. Serial No. 214,197.

To all whom it may concern:

Be it known that I, JOEL A. MAXAM, citizen of the United States, residing at the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Rotary Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rotary engines or motors, my object being to provide a construction of this class adapted to be operated by a motive fluid, as steam or compressed air, in such a manner as to give a high degree of efficiency.

In my improvement I employ a casing, one half of which contains a spiral groove or helix. In this casing is located a rotor carrying a pair of rotary disks, each having a number of projections extending beyond the circle of its periphery, these projections being adapted to engage the spiral groove or helix, formed in one side of the casing, the opposite side of the casing being smooth and curved to fit the rotor. This rotor in its entirety is a circular member having a convex zone on both sides surrounded by an outer flange, and an inner flat central member perforated to receive an operating shaft through which movement to the rotor is transmitted, the shaft being equipped with a pulley or other suitable device to facilitate the transmission of the power from the engine or motor.

The disks which are carried by the rotor are placed in slots formed in the convex portions thereof, the projections of the disks extending beyond the rotor on the side adjacent the spiral groove, whereby these projections are adapted to engage the groove into which the motive fluid is introduced and acts upon the projections of the disks to actuate the rotor. Each disk while mounted to rotate on its own axis which extends at right angles to the axis of the rotor, has a very slow movement, being that imparted by the winding of the groove and by virtue of the fact that the groove is constantly changing its depth, whereby any projection in following the groove from its inner to its outer extremity produces slow movement of the disk on its individual axis, the projections of the disks being acted on by the motive fluid to actuate the rotor on the axis of the latter.

The motive fluid is introduced at the inner extremity of the spiral groove and exhausts at its outer extremity. As illustrated in the drawing this groove makes two distinct circuits commencing at the center of the casing member and gradually moving outwardly away from the axis of the rotor and also in the direction of such axis, until a maximum depth is reached, after which the spiral reverses its previous travel in the direction of the axis of the rotor. In this way, the power for actuating the rotor is developed within one half of the rotor casing, while the other half is smooth as heretofore indicated. The rotary disks containing the projections which enter the spiral groove or helix are exposed on one side of the rotor only, namely, on the side adjacent the casing member provided with the spiral groove.

Having briefly outlined my improvement I will proceed to describe the same in detail, reference being made to the accompanying drawing in which is illustrated an embodiment thereof. In this drawing:

Figure 1 is an end elevation of my improved rotary engine, showing the same mounted on a suitable stationary support.

Fig. 2 is a side elevation of the same, or a view looking in the direction of the arrows 2, Fig. 1.

Fig. 3 is an end elevation, the reverse of that shown in Fig. 1, being a view looking in the direction of the arrows 3, Fig. 2, while Fig. 1 is a view looking in the direction of arrows 1, Fig. 2.

Fig. 4 is a top plan view of the rotor, or a view looking in the direction of arrows 4, Fig. 2.

Fig. 5 is a section taken on the line 5—5, Figs. 1 and 3, being a view looking in the direction of arrows 5, Fig. 1 and in the direction of arrows 5, Fig. 3.

Fig. 6 is a horizontal section taken on the line 6—6, Fig. 1 looking downwardly or in the direction of arrows 6.

Fig. 7 is a section taken on the line 7—7, Fig. 8, viewed in the direction of the arrows 7.

Fig. 8 is a detail view of the rotor.

Fig. 9 is a section taken on the line 9—9, Fig. 8 looking toward the left.

Fig. 10 is an elevation of the rotor or a view taken from the side opposite that of Fig. 8. It is also a view looking in the direction of arrows 10, Fig. 9.

Fig. 11 is a detail view of one of the rotary disks carried by the rotor, the same being shown on a larger scale than in the other views.

Fig. 12 is a section taken through one of the projections of one of the rotary disks, being a view taken on the line 12—12, Fig. 11, the parts being shown on a larger scale.

Fig. 13 is an edge view of one of the disks, being a view looking in the direction of arrow 13, Fig. 11.

Fig. 14 is an elevation of the member of the casing provided with the spiral or helical groove looking into the grooved concavity of the said casing member. In this view the supporting pedestal which is preferably cast integral with this member is largely broken away.

Fig. 15 is a section taken on the line 15—15, Fig. 14, looking in the direction of the arrows 15.

Fig. 16 is a perspective view of the casing member provided with the helical groove, viewed when occupying a position at an angle of approximately 45° to that shown in Fig. 14.

The same reference characters indicate the same parts in all the views.

Let the numerals 5 and 6 respectively designate two casing members forming a chamber 7 in which is located a rotor 8, the latter being circular in shape when viewed, as shown in Figs. 8 and 10, in which the two sides of the rotor are respectively seen. This rotor on one side has a convex zone 9 arranged between an exterior flange 10 and an inner flat part 12 which is perforated, as shown at 13, to receive an operating shaft 14 which is keyed to the rotor, as shown at 15. The face or side of said rotor opposite that shown in Fig. 8 is convex at the entire distance from its periphery inwardly, as shown at 16, being centrally provided, however, with a flat part 17 in which the perforation 13 is formed. The two flat faces 12 and 17 of the rotor are of different areas and respectively engage adjacent flat faces 18 and 19 of the two casing members 5 and 6. The shaft passes through bearings 20 and 21 extending beyond perforations 22 and 23 formed in the respective casing members, these bearings being of such character that tight joints are formed where the operating shaft passes through the structure. The bearing 20 is threaded into a central perforation formed in a plate 24 which is secured to the casing member 5 by fastening devices 26, forming a chamber 27 into which the motive fluid, as compressed air or steam, is introduced by way of a pipe 28 from which this fluid passes through perforations 29 into the rotor chamber, where it acts upon projections 30 formed on two disks 31 which are mounted in the rotor, the projections 30 extending beyond the body of the rotor in the direction of the casing member 5, while the slots in the rotor in which the disks 31 are located are closed on the side of the rotor adjacent the casing member 6. These disks 31 are mounted to rotate on their individual axes arranged within the rotor and consisting of short shafts or journals 32 which are mounted in the rotor, as best illustrated in Fig. 8 where they are indicated by dotted lines.

In order to make it practicable to mount the disks 31 in the rotor, or at least to facilitate such mounting, the rotor is composed of three parts, one of said parts, namely that designated 33, constituting one half of the rotor, being the part below the line 7—7, in Fig. 8. The other half of the rotor is composed of two approximately twin parts 34 which are divided on the line 9—9, in Figs. 8 and 10. The two parts 34 are connected by a key 35 while the part 33 is connected with the two parts 34 by similar keys 36. Each projection 30 of each disk 31 is preferably provided on its opposite parallel edges with anti-frictional rollers 37. These projections 30 extend into a spiral groove or helix formed in the casing member 5 and commencing at the flat face 38 of a projecting hub part 39 in which the perforation 23 for the shaft 14 is formed. This groove begins to wind around the hub part 39 and at the same time extends outwardly in the direction of the axis of the rotor and its casing. This groove commences in the face of the hub part at a point or line designated 40, referring more particularly to Figs. 14 and 16 of the drawing. From this point or line the groove extends downwardly and outwardly, as shown at 41, its distance from the axis of the operating shaft continually increasing, one wall of this groove or the part indicated by the shade lines in Fig. 14, also continually changing its surface, being approximately flat at the beginning but gradually tilting to such an inclination that its visible area in Fig. 14 gradually diminishes until in this view it disappears altogether at a point 42, the wall from this point being indicated by dotted lines which terminate at a point 43. It may be assumed that this wall at its beginning or at the point 40, is engaged by one of the roller bearing edges 37 of a disk 31 at the time the engine is started, while a similar edge of the other disk 31 of the rotor engages this wall of the groove at a diametrically opposite point or line, being considerably farther downward or in the direction of the axis of the operating shaft. Between these two projections of the two disks of the rotor, a number of perforations 44 communicate with the

groove, as illustrated in both Figs. 14 and 16. The motive fluid, as compressed air or steam, enters these perforations and acts on the projection 30 of the disk farther from the point 40 of the groove, and as a greater area of this projection is exposed to the motive fluid than the area of the projection 30 at the beginning of the groove, the motive fluid will act on the projection whose greater area is exposed thereto to start the motor which will be kept in motion, as there is always a larger area of the projections 30 of the disks 31 acted on in a direction to rotate the rotor than is acted on by the back pressure which would have a tendency to retard the rotor's movement. In this way, the rotor is continuously driven in the desired direction, the spiral groove or helix being so shaped that the two disks 31 are slowly rotated in the rotor as the latter rotates on its axis. For instance, the roller bearing edge 37 of the disk, which engages the wall 41 of the groove at the point or line 40 at the beginning of the groove, emerges from engagement with this wall at the point 43 and passes into the closed part of the slot in the rotor in which the disk rotates. As illustrated in the drawing, the spiral or helix of the part 5 of the casing makes two complete circuits or approximately two circuits. After the roller edge 37 leaves the wall 41 of the spiral groove or path, the edge 45 of the same projection 30 engages a wall 46 of the groove which gradually diminishes in area until a point 47 approximately is reached when the edge 44 of this particular projection passes into the concealed portion of the slot in which the disk is located, having passed into the part of the rotor whose disk slots are closed by the convex wall 16.

It will be understood, that as one projection of a disk 31 passes out of the spiral groove or helix of the casing member 5 and into the portion of the rotor where the disk slot is concealed by the closed side 16, other projections 30 occupy portions of the groove through which the emerged projection has already passed and these projections are acted on by the motive fluid to keep the rotor in action. As one of the projections emerges from the spiral groove into the side of the rotor where the slots for the disks are concealed. the motive fluid, between the emerging projection and the corresponding projection of the other disk in the rear exhausts through an outlet port 48 into an exhaust tube 49.

From this explanation it is believed the operation of my improved rotary engine or motor will be understood, at least sufficiently for the purposes of this specification. From this explanation it should be understood that from the time the roller carrying edge 37 of the projection 30 of the disk leaves the point or line 40 of the groove the area exposed to the motive fluid continually increases until a point is reached where the entire area of the projection is exposed to the motive fluid, this position being just beyond or approximately a short distance beyond the foremost motive fluid inlet perforation 44, and the entire area of this projection will be acted on by the motive fluid until one of the roller bearing edges of this projection passes the point 43 and begins to enter the closed part of the rotor slot in which the disk is located. It will be understood, however, as this projection begins to emerge from the groove and from the path of the motive fluid, another projection of the same disk is in another convolution or part of the spiral and is also acted on by the motive fluid to drive the rotor. It should also be explained that both convex surfaces 9 and 16 of the rotor closely engage the adjacent walls of the casing, this engagement being over the entire area of the inner surface of the casing member 6, but only such areas or walls of the casing member 5 as are between the parts of the convolutions of the spiral which are engaged by the projections 30 and which correspond to the edges 50 of the disk between the projections 30 which are in the spiral groove in such relation as to be acted on by the motive fluid. By virtue of this construction and arrangement the groove or spiral path which the motive fluid enters, is completely closed except as to the portions thereof which are engaged by the projections 30 of the disks. In other words, the motive fluid enters the spiral groove or helix through the inlet conduit 28, passes thence into the cavity 27, and thence through the perforations 44 into the spiral groove which I will designate in its entirety and for convenience of explanation by the numeral 52. This motive fluid, by reason of the fact that the spiral groove or helix is closed on the side toward the rotor by the latter, cannot escape until it reaches the exhaust port 48 and passes out of the machine through the exhaust pipe or conduit 49. Between the induction ports and the exhaust port, the fluid acts effectively upon the rotor, by virtue of its engagement with the areas of the projections 30 of the disks 31, whereby the motive fluid is efficiently utilized for power purposes, the power being taken from the engine by means of a pulley 53 or other suitable element connected with the operating shaft 14, which pulley or other device may be connected with the machine to be operated by means of a belt or other suitable connection.

As illustrated in the drawing, the engine or motor is supported by means of a pedestal 54 which is cast integral with the casing member 5 and is expanded at the base, as shown at 55, to give the necessary supporting area, the base being preferably secured to the floor or other surface where the en-

gine is located by suitable fastening devices 56.

The two parts 5 and 6 of the casing are connected by stud bolts 57 which pass through perforations 58 formed in a flange 59 of the casing member 5, into threaded openings 60 formed in the flange-abutting edge of the casing member 6.

It will be understood that any suitable or desirable provision may be made for forming tight joints between the casing parts and also between the engaging surfaces of the rotor and casing members in order to prevent leakage of the motive fluid and in order that the same may be properly confined within the spiral groove or helix for the performance of its rotor actuating function.

Having thus described my invention, what I claim is:

1. The combination of a rotor having rotary disks mounted therein, projections on said disks extending from the rotor, roller bearings on the edges of said projections, and a casing in which said rotor operates having a groove in which said projections travel and against the walls of which said bearings work.

2. The combination of a rotor having an exteriorly convex zone surrounding its central portion, said zone on one side of a plane passed centrally through the rotor vertically to its axis having a smooth unbroken face, rotary disks mounted in the rotor having projections extending from the other face of said zone and a stator in which said rotor is mounted having grooves to receive said projections.

3. The combination of a rotor having an exteriorly convex zone surrounding its central portion, said zone on one side of a plane passed centrally through the rotor vertically to its axis having a smooth unbroken face, rotary disks mounted in the rotor having projections extending from the other face of said zone, said smooth face being formed on a larger radius than the other face and a stator in which said rotor is mounted having grooves to receive said projections.

4. A rotary engine or motor comprising a casing centrally perforated, an operating shaft passing through said perforation, a rotor mounted in the casing and having an exteriorly convex zone surrounding its central portion, the latter being apertured to receive said shaft, one side of the casing having a spiral groove or helical cavity, the rotor carrying disks rotatably mounted and having projections extending beyond the body of the rotor and entering the said groove, said rotor being imperforate except for the mountings for said disks, and ports extending through said casing to said groove for introducing motive fluid and exhausting it from the said groove of the casing.

5. A rotary engine or motor comprising a casing, one side of which is provided with a spiral groove or helical cavity, the casing having induction and exhaust ports extending through said casing directly into said cavity, a rotor mounted in said casing and carrying disks rotatably mounted and having projections extending into the casing on the side having the groove, the latter being shaped to impart rotary movement to the disks as the projections travel in the groove during the operation of the rotor.

6. A rotary engine comprising a casing having inlet and exhaust ports, a rotor mounted therein, the casing having a spiral groove formed on one side of a plane passed centrally through the casing at right angles to the rotor axis, the other side of the casing having a smooth interior and the adjacent side of the rotor being smooth to fit and rotate within said smooth interior, disks rotatably mounted on said rotor and having projections extending therefrom on the side of the casing where the said grooves is located, the groove being shaped to rotate the disks as their projections travel in the groove in response to the force of a motive fluid, the said ports being in communication with the groove.

7. A rotary engine comprising a casing having an interiorly located convoluted groove formed in one side thereof, and a piston mounted to rotate in the casing and carrying disks rotatably mounted in the piston and provided with parts projecting from the body of the piston into said groove which is so shaped as to impart rotation to the disks as their projections travel therein, the other side of the casing having a smooth interior and the adjacent face of the piston being smooth to fit and move within said smooth interior.

In testimony whereof I affix my signature.

JOEL A. MAXAM.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."