No. 882,428. PATENTED MAR. 17, 1908.

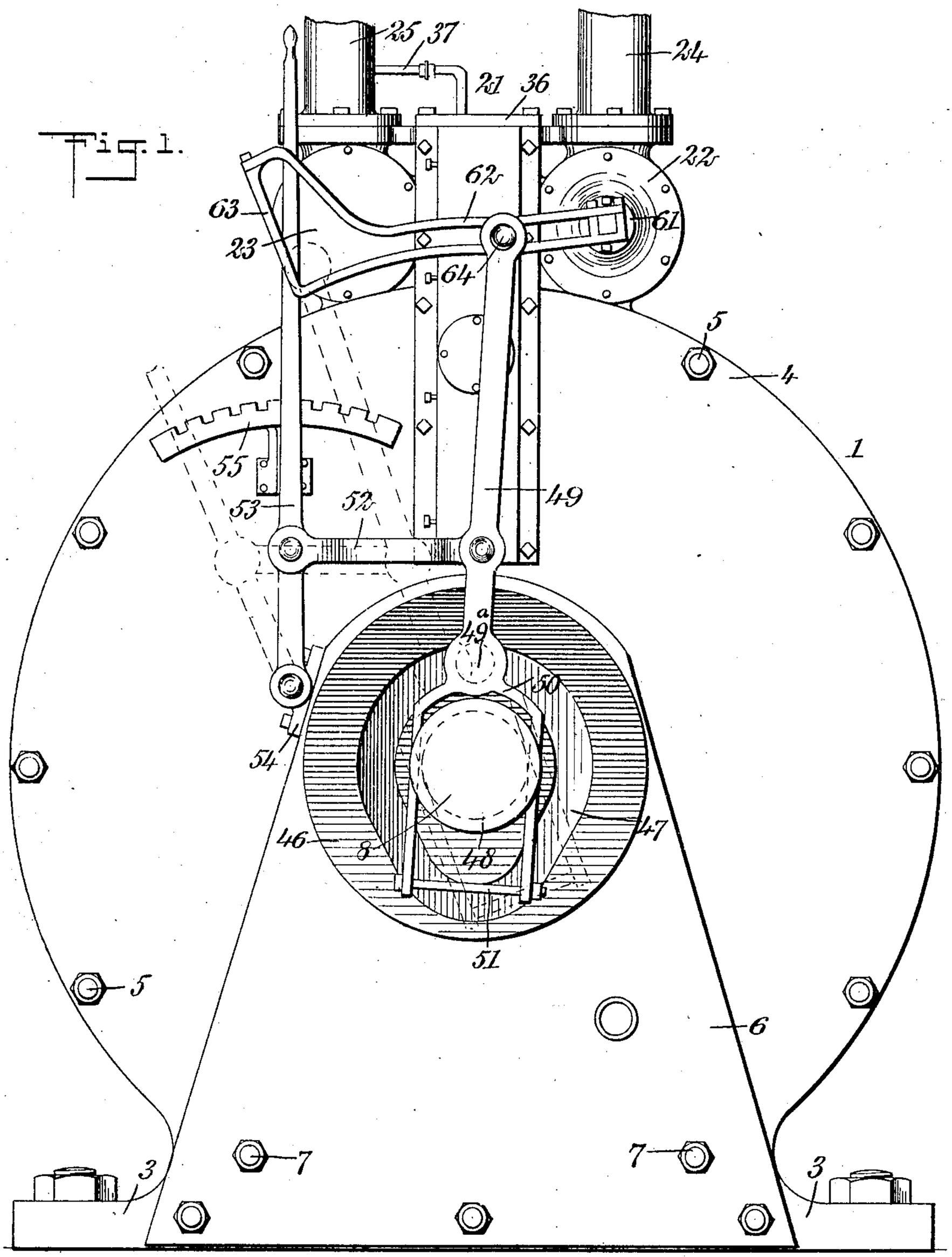
C. O. SHERMAN.

ROTARY ENGINE.

APPLICATION FILED JULY 12, 1907.

4 SHEETS—SHEET 1.

Fig. 1.



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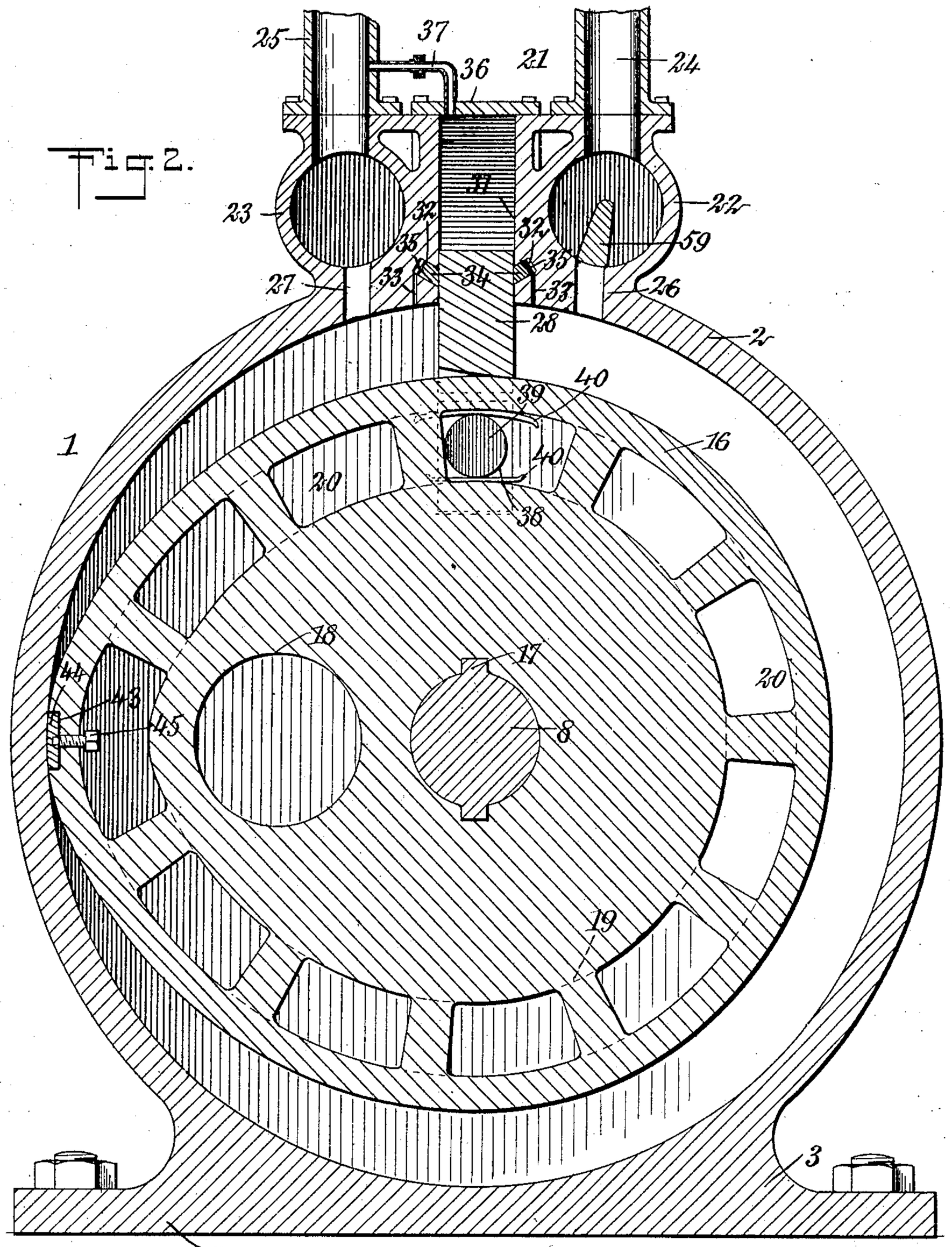
4 SHEETS—SHEET 2.

Fig. 2.



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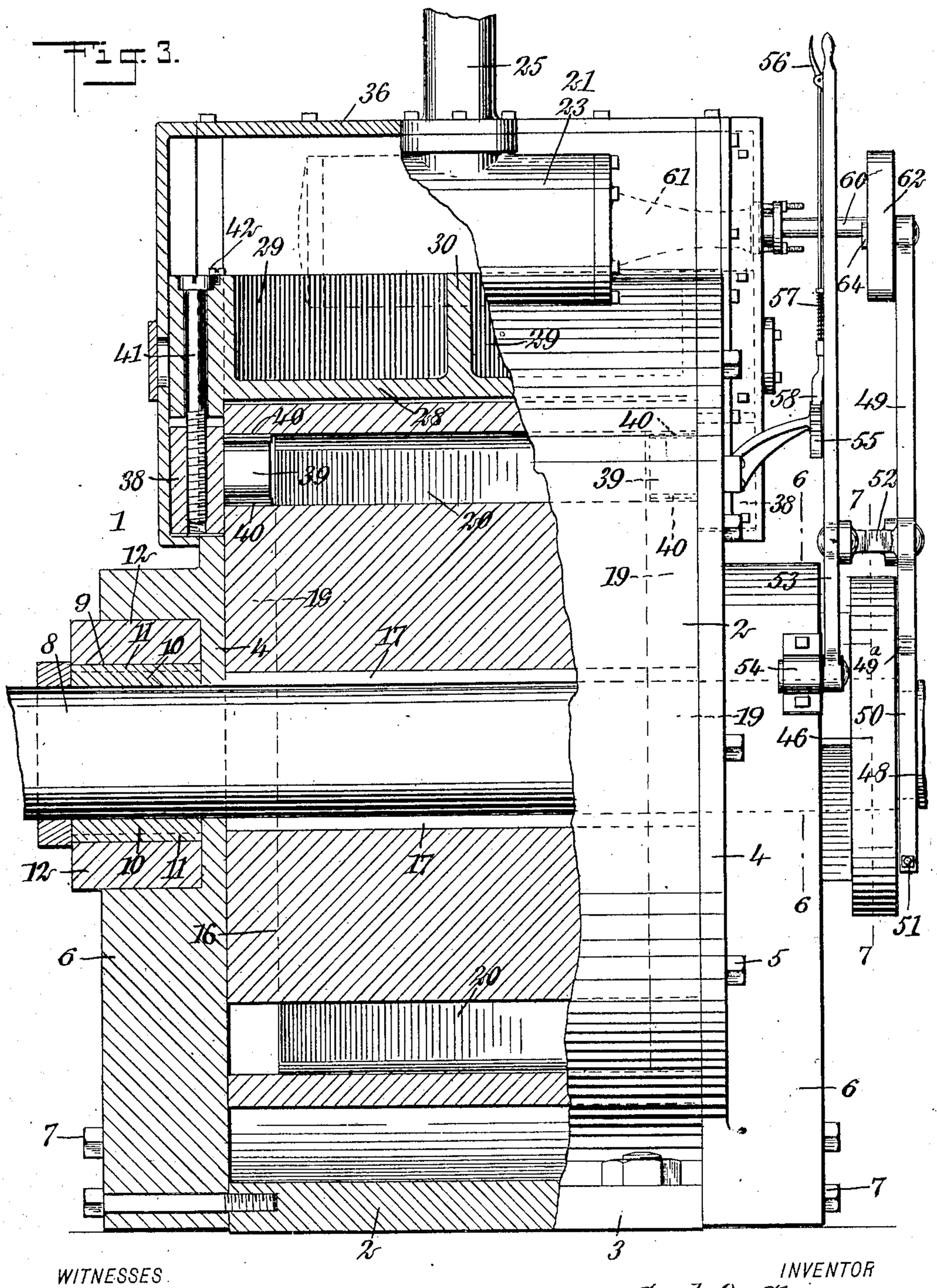
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 4.

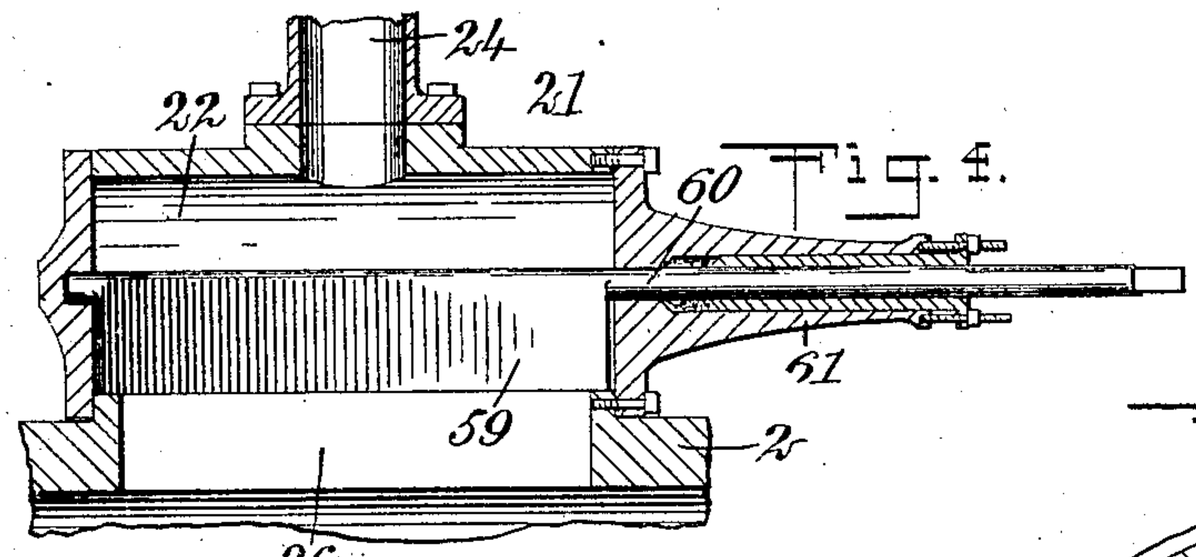


Fig. 5.

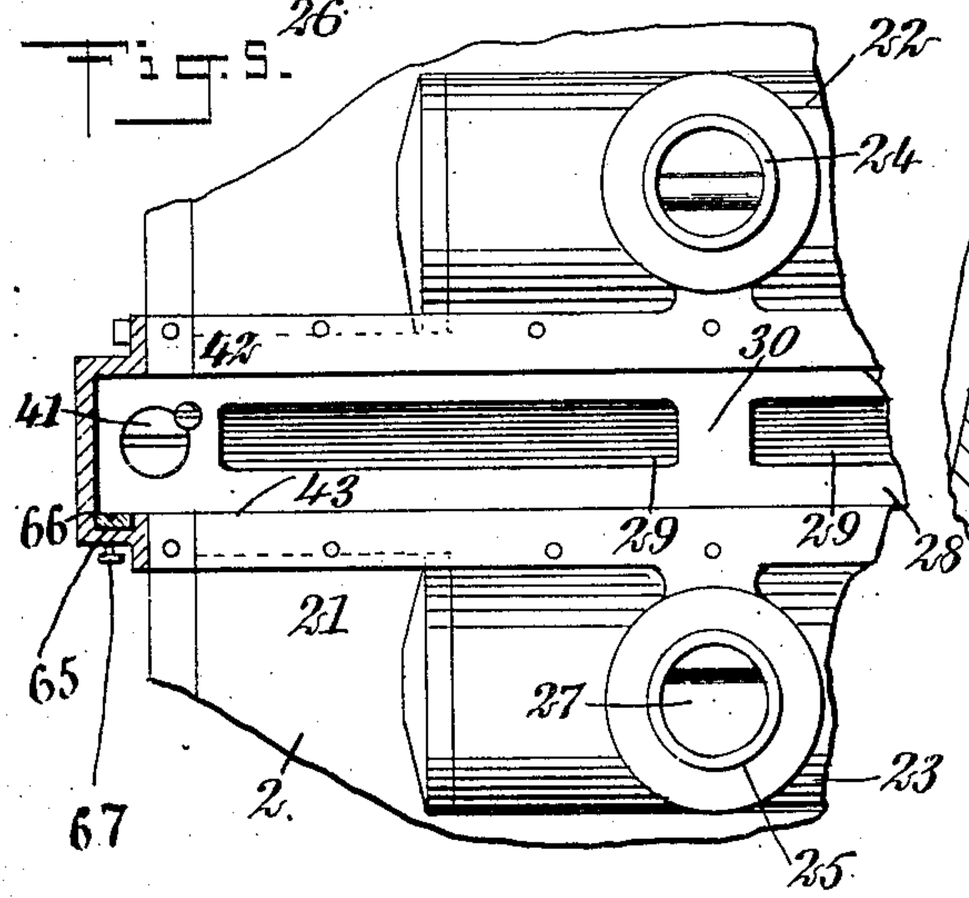


Fig. 6.

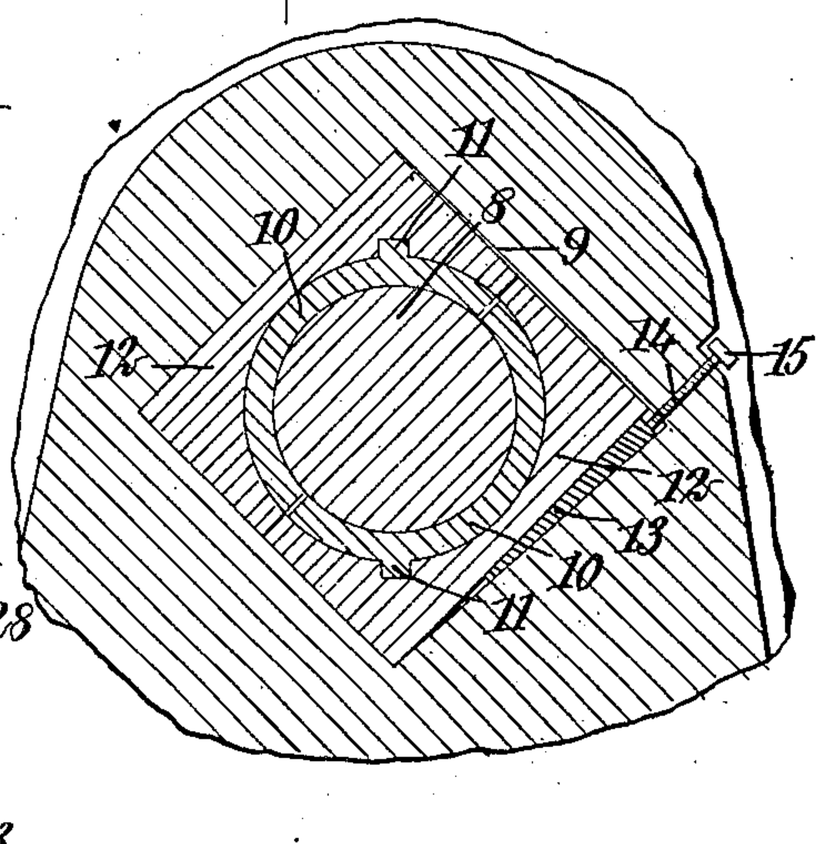


Fig. 7.

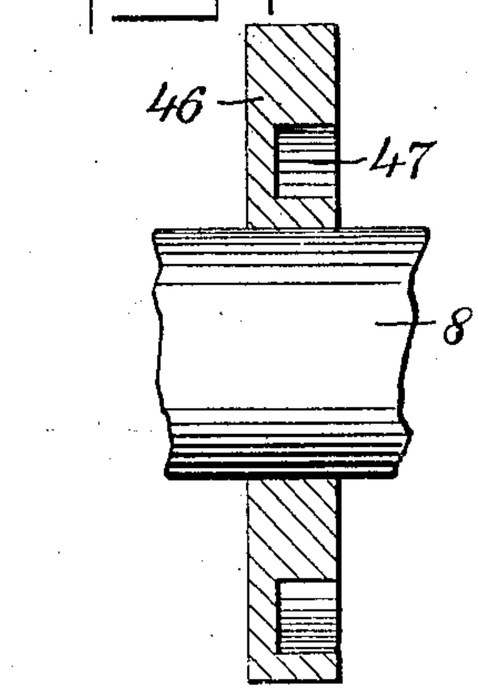


Fig. 8.

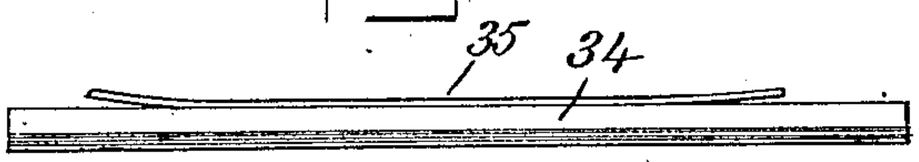
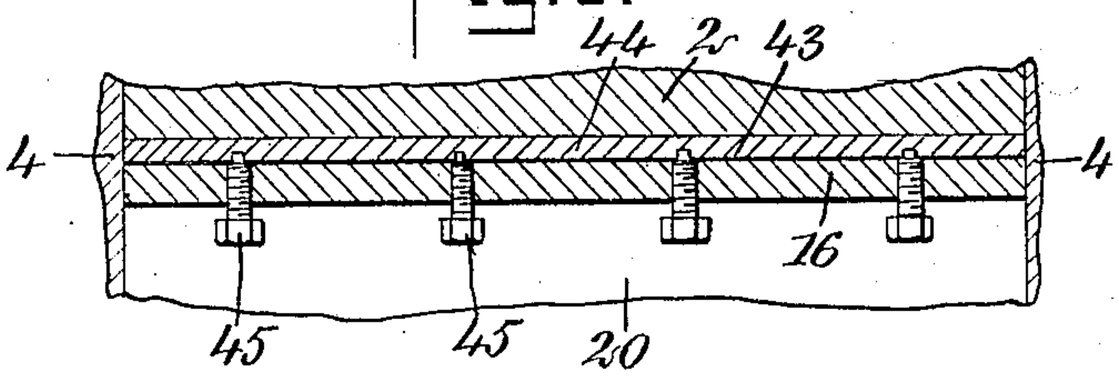


Fig. 9.



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UNITED STATES PATENT OFFICE.

CARL OLOF SHERMAN, OF RUTLAND, VERMONT.

ROTARY ENGINE.

No. 882,428. Specification of Letters Patent. Patented March 17, 1908.

Application filed July 12, 1907. Serial No. 383,455.

To all whom it may concern:

Be it known that I, CARL OLOF SHERMAN, a citizen of the United States, and a resident of Rutland, in the county of Rutland and State of Vermont, have invented a new and Improved Rotary Engine, of which the following is a full, clear, and exact description.

This invention relates to rotary engines, and more particularly to that class of rotary engines adapted to be actuated by steam, gas under pressure, or other suitable fluid media.

The object of the invention is to provide a simple, strong and efficient rotary engine having means for adjusting the inlet opening for the actuating fluid, whereby the quantity of fluid admitted to the engine at each revolution can be regulated.

A further object of the invention is to provide a rotary engine particularly well suited to the use of steam, compressed air and similar motive fluids, and so constructed that the inlet is closed during a part of each revolution, whereby the expansive force of the motive fluid is employed in driving the engine during that part of the revolution.

The invention consists in the construction and combination of parts to be more particularly described hereinafter and fully pointed out in the claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views, and in which

Figure 1 is an end elevation of my rotary engine; Fig. 2 is a vertical section of the engine; Fig. 3 is a partly longitudinal section showing portions broken away; Fig. 4 is a longitudinal section of the motive fluid chest showing the inlet valve cylinder and valve; Fig. 5 is a plan view showing a part removed and parts broken away; Fig. 6 is a vertical section of a portion of the engine, on the line 6—6 of Fig. 3; Fig. 7 is a vertical section on the line 7—7 of Fig. 3; Fig. 8 is a plan view of a detail showing a packing strip; and Fig. 9 is a longitudinal section showing a packing strip carried by the rotor of the engine.

Before proceeding to a more detailed explanation of my invention it should be understood that the engine consists essentially of a casing or stator preferably cylindrical in form and having mounted within the same a rotor of eccentric form. Transversely, the rotor is concentric with the stator for half its periphery or circumference, and is laterally extended and eccentric with the stator for the other half of the periphery. The rotor extends to the inner wall of the stator at the line of greatest eccentricity of the rotor; thus as the rotor rotates within the stator it is in constant engagement along an element of its surface with the inner wall of the stator. A sliding abutment suitably mounted in an abutment chamber, is operated and controlled by the moving rotor and slides into the chamber and out of the same once during each revolution. The inlet for the motive fluid is arranged at one side of the sliding abutment and the outlet at the other. The motive fluid exerts its pressure to drive the engine against a piston area presented by the rotor, substantially equal to an area equivalent in length to the length of the rotor and in width to the difference between the shortest radius of the rotor and the radius of the cylindrical casing or stator. The effective piston area of the rotor is presented at a quarter of its periphery from the point of greatest radius to that of smallest radius of the rotor. The inlet valve is controlled by an eccentric, and is so operated that the motive fluid is permitted to enter the casing for three-quarters of each revolution, and thereafter for the remaining quarter of the revolution the inlet is closed to permit the motive fluid to exert the pressure due to its expansion, upon the rotor. Needless to say, by thus utilizing the expansive force of the motive fluid the efficiency of the operation is increased, while the fuel consumption of the engine is diminished. Furthermore, I provide means for so regulating the valve mechanism that the inlet can be adjusted as desired, and thereby the amount of motive fluid admitted to the casing can be easily controlled to regulate the speed and operation of the engine.

Referring more particularly to the drawings, 1 represents the stator, comprising a preferably cylindrical casing 2 mounted upon a suitable bed-plate 3. The ends of the cylindrical casing are closed by means of casing heads 4 mounted upon the casing in the usual manner by means of bolts 5. At each end of the stator are supports or uprights 6, suitably secured to the casing heads and the bed-plate by means of bolts 7 or in any other preferred manner. A drive shaft 8 is arranged within the casing, centrally thereof, and is carried in stuffing-box bearings 9 of the up-

rights or supports 6. The bearings 9 comprise preferably, semi-annular members 10 of suitable bearing metal such as brass or the like, and presenting keys 11 arranged in suitable key-ways of rectangular blocks 12 provided with curved recesses conforming to the members 10 which are arranged therein. The blocks 12 are carried in suitably formed openings of the supports 6. Between a wall of the opening of the support and one of the blocks 12, is located a wedge 13 controlled by a screw 14 mounted in a correspondingly threaded opening of the support and having a head 15 located in a recess at the side of the support. The opening of each support in which the blocks 12 are mounted is so formed that three sides thereof correspond to the three adjacent sides of the blocks 12, and the wedge is of such shape that when inserted between the fourth side of the opening and the corresponding side of the adjacent block 12 and forced therebetween, the blocks 12 are approached evenly and thereby tighten the bearing members 10, forcing the same against the shaft 8. In this way the drive shaft bearings can be adjusted and leakage from the stator through the bearings is thereby minimized.

The rotor 16 is mounted upon the shaft 8 by means of keys 17 of the latter which fit in suitable key-ways of the rotor. One-half of its periphery is semicylindrical and is concentric with the cylindrical stator; the other half of the rotor is eccentric with the stator casing and is extended symmetrically to the inner wall of the same, the element of the rotor at its point of greatest eccentricity engaging the cylindrical stator casing at an element of the latter. The rotor is balanced by means of a longitudinal opening 18 therethrough at the eccentric side and in this way the masses of metal on each side of the shaft are made equal. At each end the rotor has a guide-groove 19 corresponding in form to the peripheral outline of the rotor and adjacent to the edge thereof. The guide-grooves 19 are joined by a plurality of longitudinal openings 20 extending from end to end of the rotor.

At the top, the stator carries a motive fluid chest 21 comprising similar symmetrically arranged valve cylinders 22 and 23. The cylinder 22 is an inlet cylinder, while the cylinder 23 is an exhaust cylinder. Inlet and exhaust pipes 24 and 25 are suitably mounted upon the motive fluid chest and communicate with corresponding openings of the cylinders 22 and 23, respectively. An inlet opening 26 effects communication between the cylinder 22 and the interior of the stator, while a similar exhaust opening 27 joins the interior of the stator and the cylinder 23. An abutment chamber 31 is formed in the chest 21 between the cylinders 22 and 23, and has slidably arranged therewithin a sliding radial abutment 28 having the face adjacent to the rotor beveled to permit sliding engagement with the rotor. The abutment 28 is provided with recesses 29 separated by a strengthening web 30. The recesses 29 open upwardly. At the opposite sides of the abutment chamber 31 are inclined longitudinal grooves 32 having vents 33 communicating with the stator interior, and having loosely mounted therein packing strips 34 held in position by springs 35 between the bottoms of the grooves and the packing strips. The packing strips are normally projected from the grooves by the springs, and engage the sliding abutment to prevent leakage of motive fluid from the stator interior to the abutment chamber. The abutment chamber is closed by a cover 36, suitably mounted thereupon and provided with a pipe 37, which effects communication between the chamber and the exhaust pipe 25, to permit the escape of any of the motive fluid which has leaked past the abutment into the abutment chamber. The chest 21 is extended beyond the end of the stator and is downwardly disposed at the ends thereof adjacent to the abutment and the abutment chamber, and has openings at the casing heads 4 communicating with the stator interior. Slide blocks 38 are mounted in the downwardly disposed parts of the motive fluid chamber and have integral pin projections 39 extending into the stator and engaging the guide grooves 19 at the ends of the rotor. Spring shoes 40 are arranged between the projections 39 and the walls of the guide-grooves 19. The blocks 38 are secured to the sliding abutment at the ends thereof by means of screw pins 41, arranged in suitable openings of the abutment ends and engaging threaded openings of the blocks 38. By means of the screw pins 41 the relative positions of the sliding abutment and the rotor can be easily adjusted. A set-screw 42 is provided at each end of the abutment and engages the screw-pin to lock the same against accidental movement. It will be understood that as the rotor rotates within the stator, it engages the sliding abutment and moves the same upwardly within the abutment chamber until the point of greatest eccentricity of the rotor is passed, when the sliding abutment returns, the latter remaining in constant engagement with the periphery of the rotor.

To prevent excessive wear of the rotor there is formed therein along the element of greatest eccentricity, an elongated recess 43, in which is mounted a packing strip 44, held in position by set-screws 45 having the heads arranged in the adjacent opening 20 of the rotor. The packing strip 44 can be easily replaced as it wears and can be adjusted from time to time by means of the set-screws. As the engagement of the rotor with the

sliding abutment 28 necessitates considerable wear, it is of advantage to operate the abutment independently of its peripheral engagement with the rotor. To accomplish this purpose I provide the guide-grooves 19 and the blocks 38 with their extensions 39 engaging the guide-grooves. As the rotor moves within the stator, the extensions 39 are moved upward and downward with the movement of the eccentric guide-grooves 19, for it will be remembered that the latter conform to the shape of the rotor. Thus by means of the screw-pins 41 the sliding abutment can be so adjusted that it substantially engages the periphery of the rotor, but closely enough, merely, to prevent the escape of motive fluid from one side to the other of the abutment without entailing the excessive wear of the parts usual when the abutment engages the rotor operatively. The blocks 38 with their extensions 39 can be easily replaced if worn, and the mounting of the blocks to the sliding abutment by means of the screw-pins 41, permits of excessive adjustment and close regulation of the relative positions of the parts.

At one side, near the ends, the abutment chamber has substantially vertical grooves 65 in which are adjustably mounted adjusting plates or shoes 66 held in position by means of set-screws 67. The plates 66 engage the sliding abutment and take up the wear of the moving parts.

Suitably mounted at one end of the drive shaft 8 at the outside of the casing is an eccentric plate 46, having an eccentric cam groove 47. An eccentric rod 49 having a yoke 50 is mounted upon a head 48 rigid with the cam plate. The yoke 50 has a cross-bar 51. The eccentric rod 49 has an eccentric pin 49^a located in the eccentric groove 47. As the plate 46 revolves, the eccentric rod is actuated by the eccentric groove 47 which co-acts with the pin 49^a, moving the eccentric rod in a substantially vertical direction. A link 52 is pivoted at one end to the rod 49, and at the other end to a lever 53 which is pivotally held upon a bracket 54 carried by one of the supports 6. At the opposite end, the lever 53 has a handle by means of which it can be manually operated. A spring catch 56 is slidably arranged upon the lever 53, and has a spring 57 holding a finger 58 in normal engagement with a notched segment 55 mounted upon the stator casing. By means of the spring catch the lever can be held in a plurality of positions. Within the inlet cylinder 22 is pivotally mounted a valve 59 arranged to swing transversely of the inlet opening 26 and having a shaft 60 extending through a suitable stuffing-box 61. The shaft 60 carries at its outer end a slotted link or arm 62, curved in the arc of a circle and having its center at the center of the shaft 8 and being upwardly extended at the outer end. The eccentric rod 49 at the upper extremity carries a slide pin 64 mounted to move in the slotted arm 62.

As the eccentric rod is moved upward and downward it swings the slotted arm 62 and the shaft 60 of the valve 59. As the arm 62 is rigid with the shaft the valve 59 is actuated and moves transversely of the inlet opening, permitting the entrance of the motive fluid to the stator when displaced from the opening, or preventing the inlet of the motive fluid when covering the opening. The movement or swing of the valve depends upon the point of engagement of the eccentric rod with the slotted arm. The closer to the shaft 60 that the slide pin 64 engages the arm 62 the wider will be the movement of the valve. The point of engagement of the eccentric rod with the arm 62 can be regulated and adjusted by means of the lever 53. As the lever is moved away from the valve cylinder 22 it moves the eccentric rod 49 in the same direction by means of the link 52, and the nearer the eccentric rod approaches the end of the slotted arm the smaller will be the swing of the rod 59. When the rod 59 reaches the end of the slotted arm 62, it will move upward and downward in the extended portions 63 of the slotted arm and thus becomes inoperative, the valve 59 remaining in a closed position. By means of the valve and adjusting mechanism, the amount of motive fluid permitted to enter the stator can be closely regulated and the speed of the engine governed thereby.

It will be understood that as the stator is cylindrical and the rotor is semi-cylindrical with an eccentrically extended portion, the engagement of the rotor with the stator will be along an element, the element of engagement of the rotor being that of greatest eccentricity. In using the word "element" in the specification and claims reference is had, not to a part of the mechanism, but to a line of generation.

In the structure illustrated in the drawings and described above the arrangement of the parts is such that the steam is allowed to expand for substantially a quarter of each revolution. It should be noted that the expansion of the steam can be adjusted as desired by providing an eccentric plate suitably formed for the purpose. It will be understood that the form of the cam groove controlling the operation of the inlet valve and this groove can be so shaped as to cut off the inlet steam at any desired point of the revolution.

Having thus described my invention I claim as new, and desire to secure by Letters Patent:

1. In a rotary engine, in combination, a cylindrical stator, an eccentric rotor there-

within, a sliding abutment movable into said stator, said rotor having at one end a guide groove conforming to the periphery of said rotor, and a movable member operatively arranged outside of said stator and having an extension projecting into said stator and engaging said guide groove, said movable member controlling said abutment.

2. In a rotary engine, in combination, a cylindrical stator, a rotor therewithin, a sliding abutment movable radially into said stator, said rotor having substantially one-half of the periphery concentric with said stator and the other half of the periphery eccentrically extended and engaging the stator along an element thereof at the element of greatest eccentricity of said rotor, said rotor having at each end a guide groove conforming to the periphery of said rotor, and movable members arranged at the outside of said stator and having extensions projecting into said stator and each located in one of said guide grooves, said members controlling said abutment.

3. In a rotary engine, in combination, a cylindrical stator, an eccentric rotor therewithin, a sliding abutment movable radially into said stator, said rotor having substantially one-half of the periphery concentric with said stator and the other half of the periphery eccentrically extended and engaging the stator along an element thereof at the element of greatest eccentricity of said rotor, said rotor having at each end a guide groove conforming to the periphery of said rotor, said rotor further having openings therethrough connecting said guide grooves, movable members at the sides of said stator and having extensions projecting thereinto, each of said extensions being located in one of said guide grooves and having shoes engaging the walls of said grooves, and adjustable means for securing said members to said abutment.

4. In a rotary engine, in combination, a cylindrical stator, an eccentric rotor therewithin, a sliding abutment movable into said stator, said rotor having a portion of the periphery concentric with said stator and the remainder of the periphery eccentrically extended and engaging the rotor along an element thereof at the element of greatest eccentricity of said rotor, said rotor having at each end a guide groove conforming to the periphery of said rotor, guide chambers arranged at the sides of said stator and communicating interiorly therewith, movable members in said chambers and having extensions projecting into said stator, each of said extensions being located in one of said guide grooves and controlling said abutment, and adjustable means for securing said members to said abutment.

5. In a rotary engine, in combination, a cylindrical stator, an eccentric rotor therewithin, a sliding abutment movable radially into said stator, said rotor having at each end a guide groove conforming to the periphery of said stator, said rotor further having openings therethrough connecting said guide grooves, guide chambers arranged at the sides of said stator and communicating interiorly therewith, movable members arranged in said chambers and having extensions projecting therefrom, each of said extensions being located in one of said guide grooves, and adjustable means for securing said members to said abutment.

6. In a rotary engine, in combination, a cylindrical stator, an eccentric rotor therewithin, a sliding abutment movable into said stator, said rotor being eccentrically extended and engaging the stator at the element of greatest eccentricity of the rotor, said rotor having at one end a guide groove, a movable member at the side of said stator and having an extension projecting into said stator and engaging said guide groove, said abutment having an opening therethrough, a screw-pin located in said opening and adjustably engaging said member, and means for locking said screw-pin against accidental displacement.

7. In a rotary engine, in combination, a cylindrical stator, an eccentric rotor therewithin, a sliding abutment movable into said stator, said rotor being eccentrically extended and engaging said stator at the element of greatest eccentricity of said rotor, said rotor having at one end a guide groove, a guide chamber arranged at the side of said stator and communicating interiorly therewith, a movable member arranged in said guide chamber and having an extension projecting into said stator and engaging said guide groove, said abutment having an opening therethrough, a holding member located in said opening and adjustably engaging said movable member, and means for locking said holding member against accidental displacement.

8. In a rotary engine, in combination, a stator having an inlet opening, an eccentric rotor within said stator, a slidable abutment controlled by said rotor, a valve adapted to obstruct said opening, means for reciprocating said valve, and means controlled by said rotor for operating said valve to obstruct said opening for a part of each revolution said last means being inoperative in one position with respect to said valve.

9. In a rotary engine, in combination, a stator having an inlet opening, an eccentric rotor within said stator, a slidable abutment controlled by said rotor, a valve adapted to obstruct said opening and movable across the same, an arm rigid with said valve, a rod adapted to engage said arm at a plurality of points and controlled by said rotor, and means for holding said rod in engagement with said acm at a plurality of points of the

latter said arm being formed at one point to permit the inoperative engagement therewith of said rod.

10. In a rotary engine, in combination, a stator having an inlet opening, a rotor mounted within said stator, a slidable abutment controlled by said rotor, a valve for obstructing said opening and mounted to swing across the same, an arm rigid with said valve, an eccentric rigid with said rotor and having the point of greatest eccentricity at substantially right angles with the point of greatest eccentricity of the rotor, and a rod controlled by said eccentric and engaging said arm said arm being formed at one point to permit the inoperative engagement therewith of said rod.

11. In a rotary engine, in combination, a stator having an inlet opening, a rotor within said stator, a slidable abutment controlled by said rotor, a slotted arm rigid with said valve and presenting a laterally disposed extension, an eccentric rigid with said rotor and having the greatest radius at substantially right angles to the greatest radius of said rotor, a rod controlled by said eccentric and having an end removably carried by said slotted arm to operate the latter, and means for holding said rod in engagement with said arm at a plurality of points of said arm, said laterally extended part of said arm being adapted to engage said end of said rod inoperatively.

12. In a rotary engine, in combination, a stator, a valve cylinder mounted thereupon and having an opening communicating with said stator, a rotor within said stator, a sliding abutment controlled by said rotor, a valve within said valve cylinder and mounted to swing across said opening, a slotted arm rigid with said valve and having a laterally extended portion, an eccentric plate rigid with said rotor and presenting a cam groove, an eccentric rod engaging said cam groove and having an end removably carried by said slotted arm, means for adjusting said rod to bring the end thereof in engagement with said arm at different points of the latter, and means for holding said rod in engagement with said arm at a plurality of points, said extended portion of said arm being adapted to engage the end of said rod inoperatively.

13. In a rotary engine, in combination, a stator, a valve cylinder mounted thereupon and having an opening communicating with said stator, an eccentric rotor in said stator, a sliding abutment controlled by said rotor, a valve within said valve cylinder and mounted to swing across said opening, a slotted arm rigid with said valve and having a laterally extended portion, an eccentric plate having a cam groove, an eccentric rod having a slide pin in engagement with said groove and an end movably carried at the slot of said arm, a lever adapted to be manually operated, a link connecting said rod and said lever, and means for holding said lever in a plurality of positions, said cam groove having substantially half the periphery circular and the remainder of the periphery eccentrically extended, the greatest radius of said cam groove being at substantially right angles to the greatest radius of said rotor, said extended portion of said arm being adapted to engage said end of said rod inoperatively.

14. In a rotary engine, in combination, a cylindrical stator having an abutment chamber, an eccentric rotor within said stator, a sliding abutment in said chamber movable into said stator, recesses at the sides of said abutment chamber, and packing members within said recesses, said recesses communicating at the back of said packing members, interiorly, with said stator, said stator having an exhaust outlet, said abutment chamber communicating with said exhaust outlet.

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

CARL OLOF SHERMAN.

Witnesses:
B. A. THOMPSON,
GEO. B. THOMPSON.