No. 742,369. PATENTED OCT. 27, 1903.

L. TEAL.

ROTARY ENGINE.

APPLICATION FILED AUG. 16, 1902.

NO MODEL. 5 SHEETS—SHEET 1.

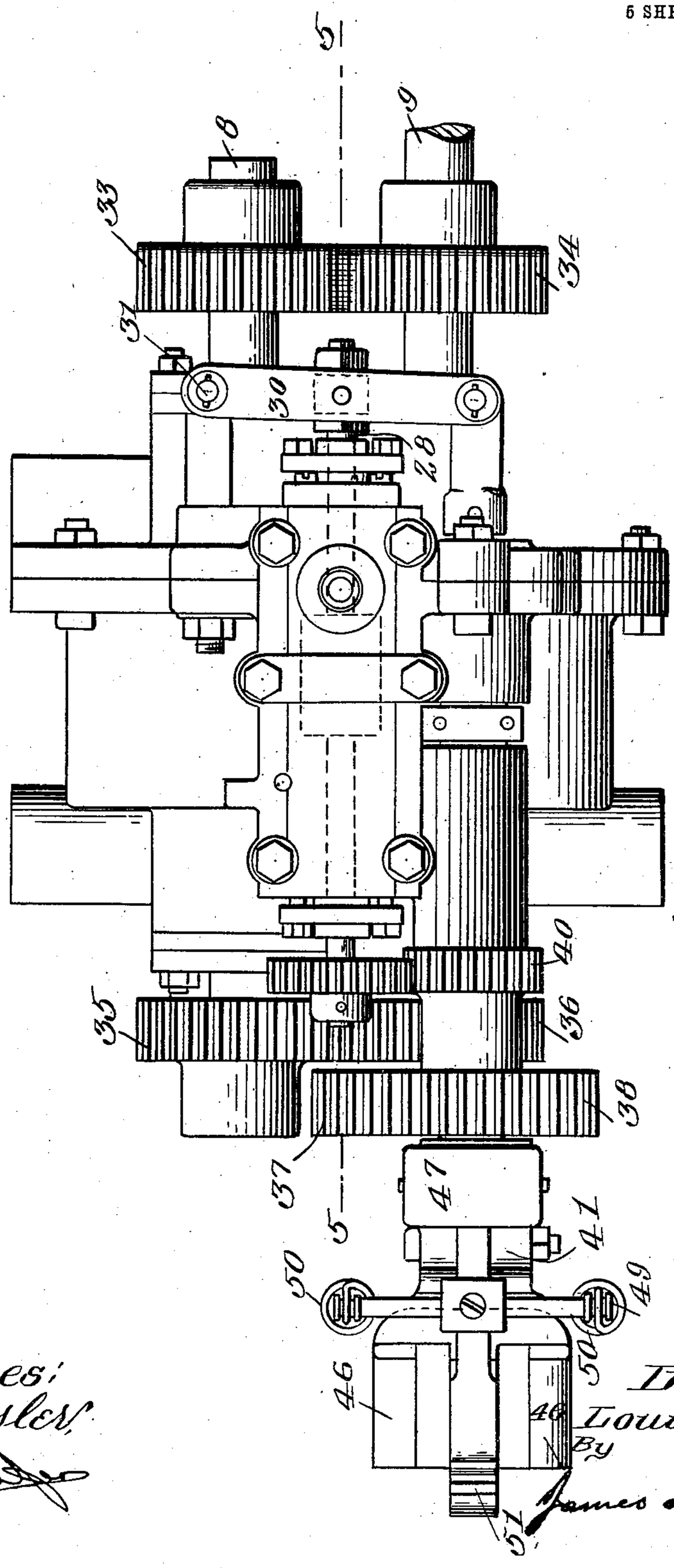

Fig. 1.

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NO MODEL. 5 SHEETS—SHEET 2.

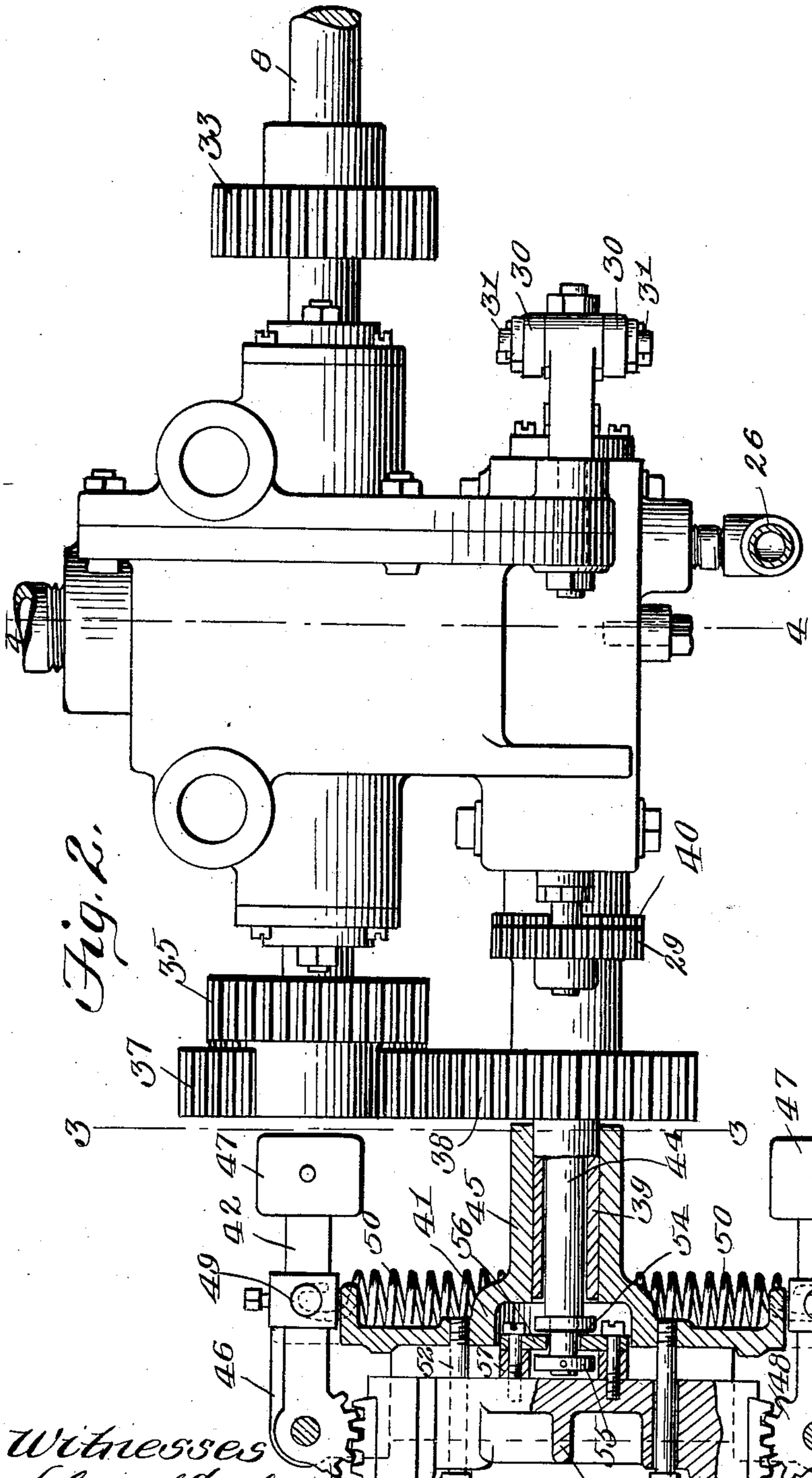

Fig. 2.

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NO MODEL. 5 SHEETS—SHEET 3.

Fig. 3

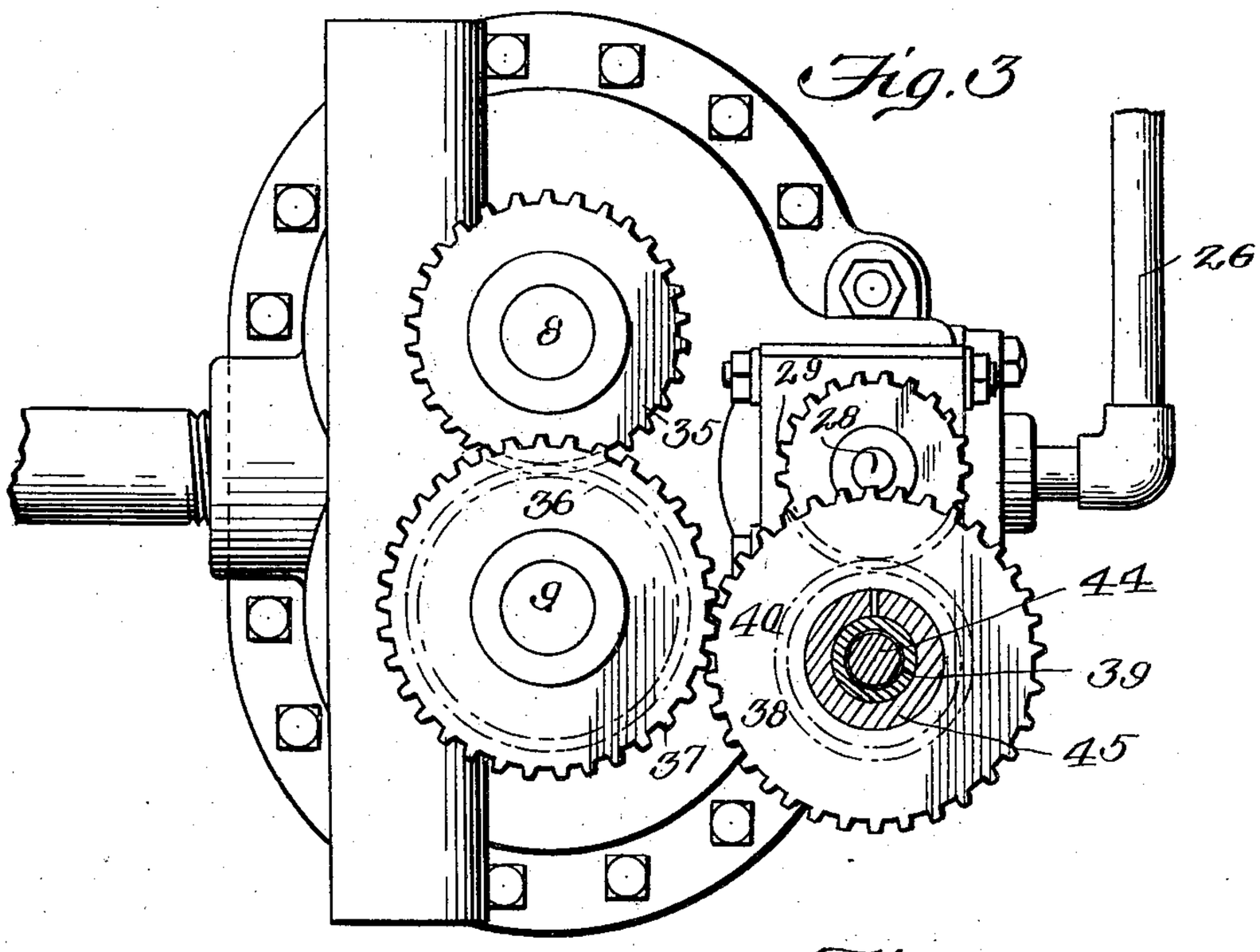
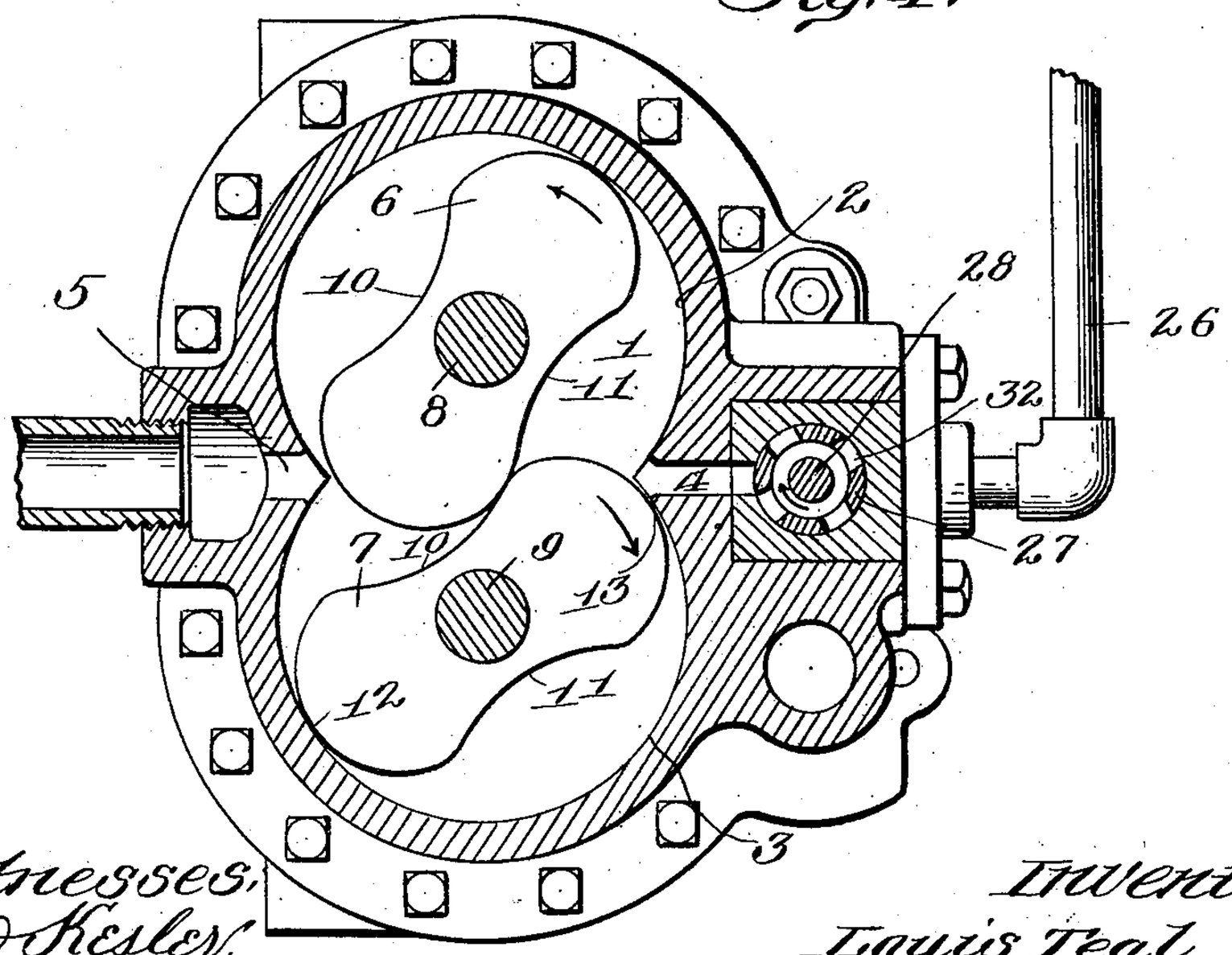


Fig. 4.



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NO MODEL. 5 SHEETS—SHEET 4.

Fig. 5.

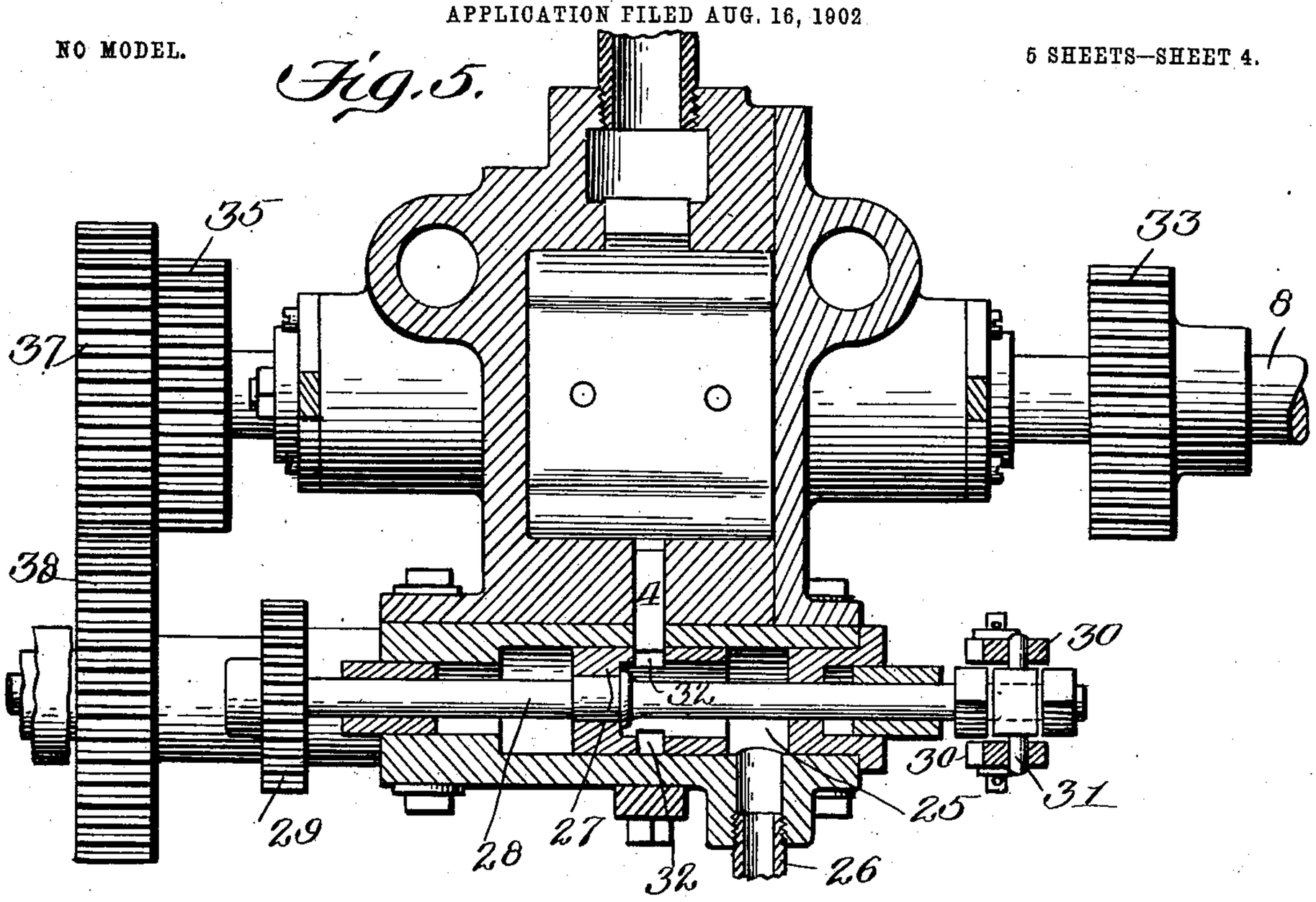


Fig. 7.

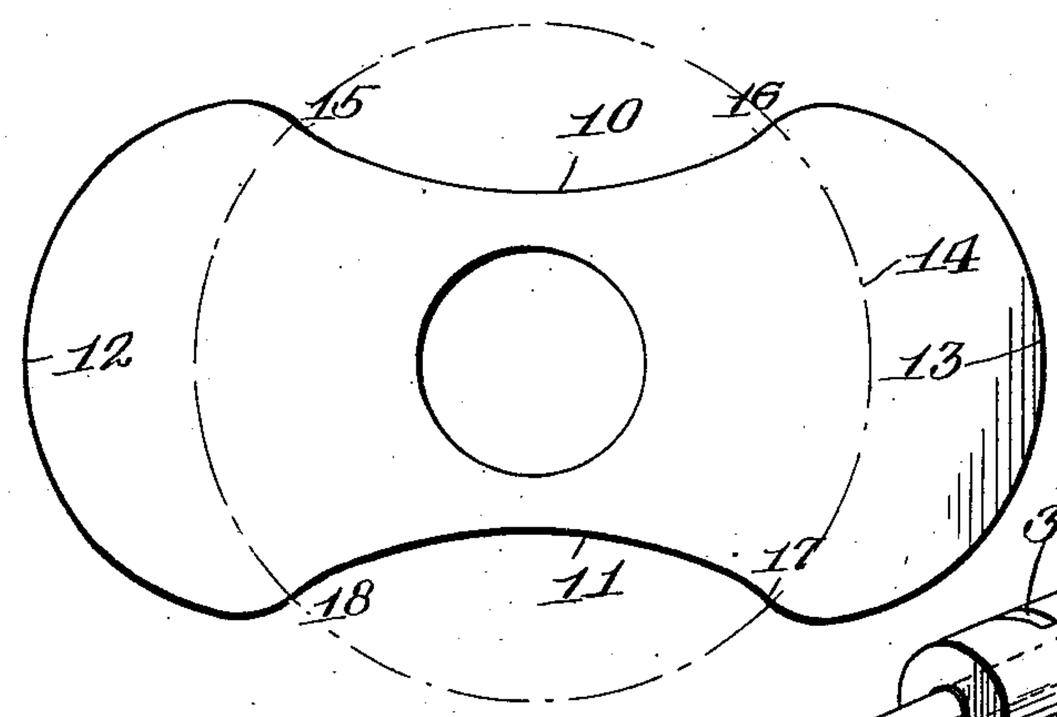
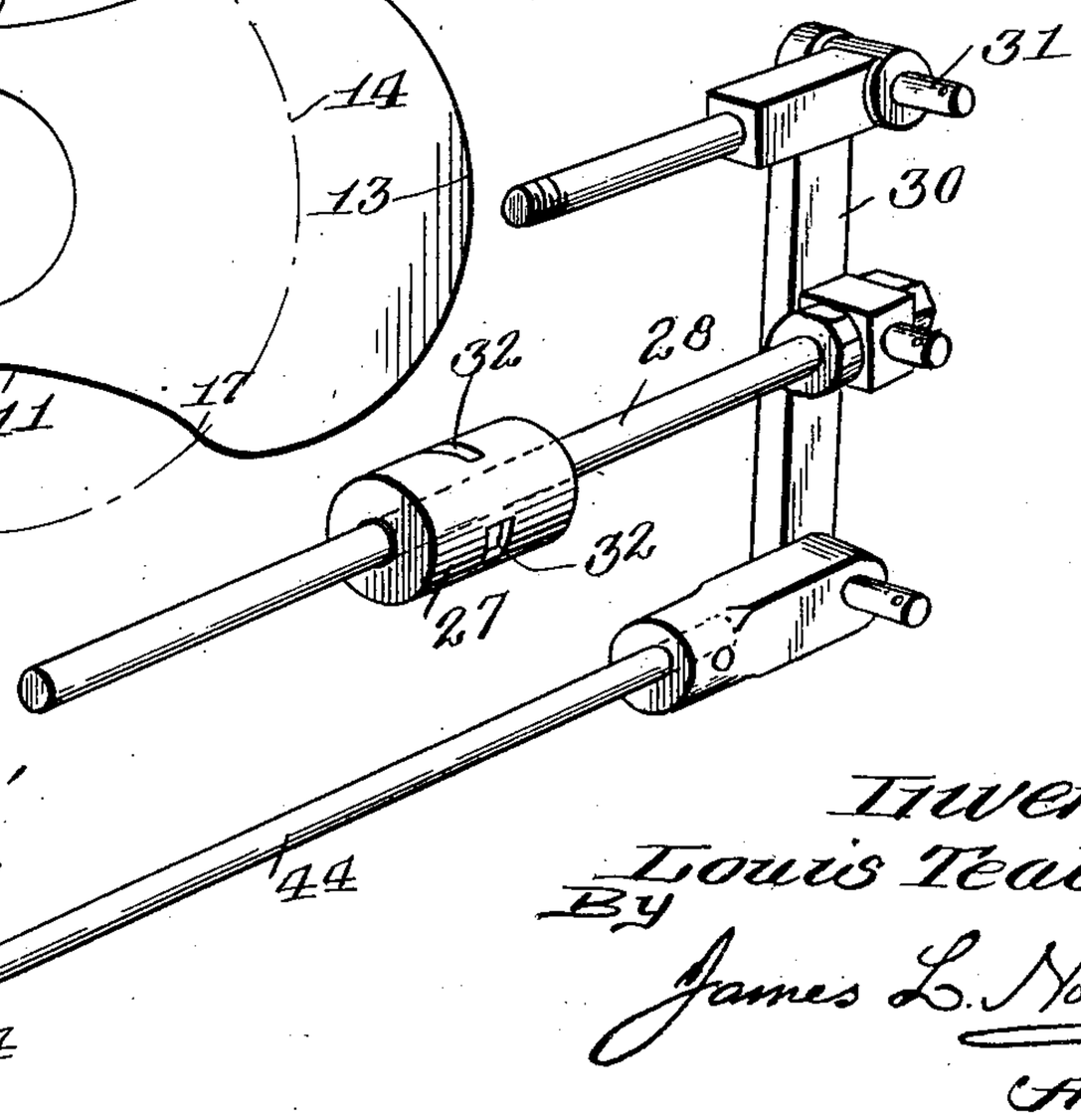


Fig. 6.



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ROTARY ENGINE.

APPLICATION FILED AUG. 16, 1902

NO MODEL. 5 SHEETS—SHEET 5.

Fig. 8.

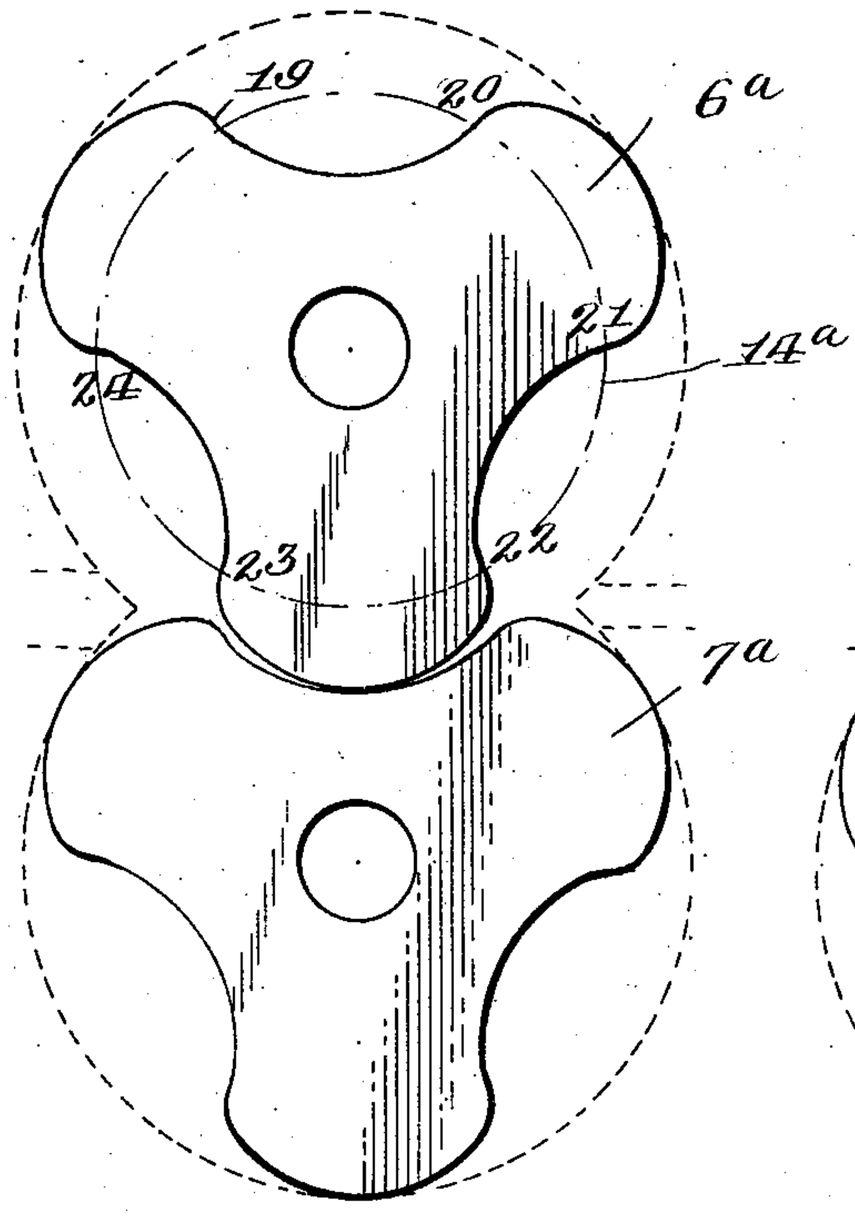
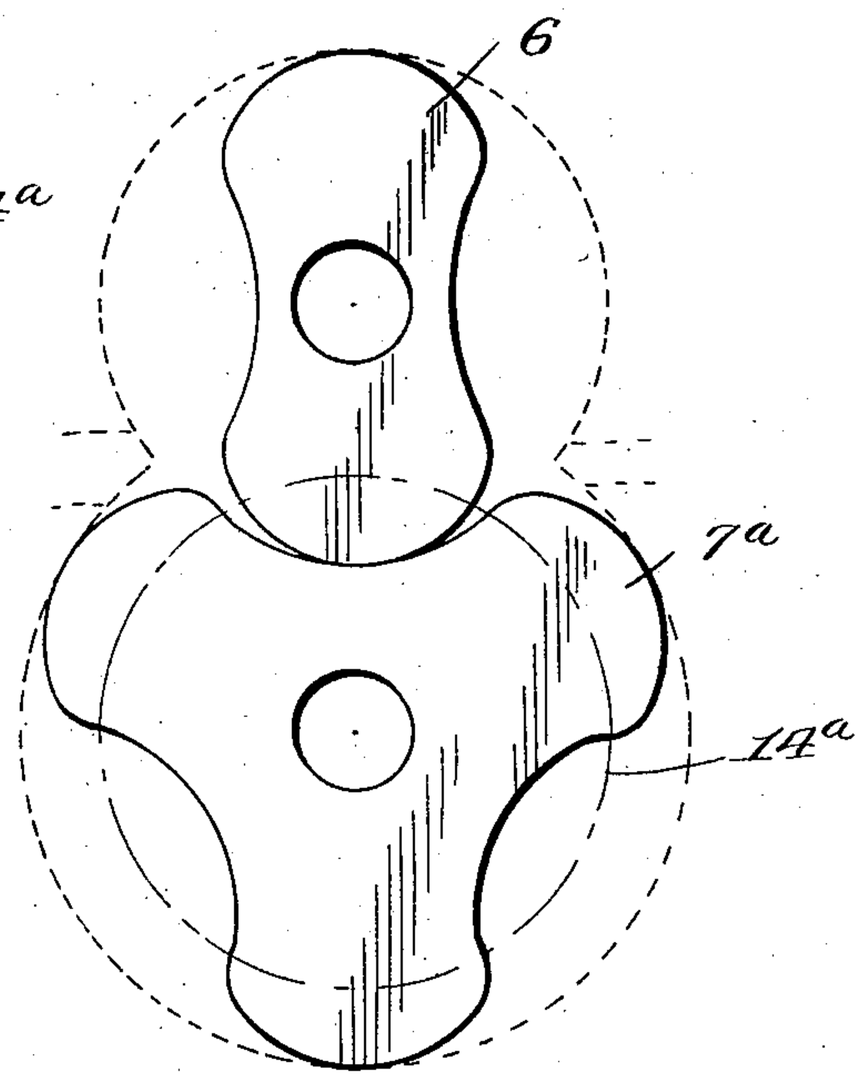


Fig. 9.



Witnesses:
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No. 742,369. Patented October 27, 1903.

UNITED STATES PATENT OFFICE.

LOUIS TEAL, OF CLIFTON HEIGHTS, PENNSYLVANIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 742,369, dated October 27, 1903.

Application filed August 16, 1902. Serial No. 119,919. (No model.)

To all whom it may concern:

Be it known that I, LOUIS TEAL, a citizen of the United States, residing at Clifton Heights, in the county of Delaware and State of Pennsylvania, have invented new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to rotary engines in which steam, gas, vapor, or other expansible substance is employed as the motive agent, the object of the invention being to provide novel means for automatically regulating the admission of steam or other motive agent to the expansion-chamber or cylinder of the engine, according to the speed at which the engine is running.

Other objects of the invention will hereinafter appear, and the novel features thereof will be set forth in the claims.

In the drawings forming part of this specification, Figure 1 is an elevation of an engine constructed in accordance with my invention. Fig. 2 is a plan view of the same with the governor in section. Fig. 3 is a vertical transverse section on the line 3 3 of Fig. 2. Fig. 4 is a similar section on the line 4 4 of Fig. 2. Fig. 5 is a longitudinal section on the line 5 5 of Fig. 1. Fig. 6 is a detail perspective view of the admission-valve and the parts connected therewith for imparting longitudinal movement thereto. Fig. 7 is a detail end view of one of the two-lobed pistons, and Figs. 8 and 9 are diagrammatic views showing modifications of the construction and arrangement of the pistons.

Like reference-numerals indicate like parts in the different views.

The cylinder or expansion-chamber 1 has been shown in the form of two intersecting longitudinally-extending cylindrical recesses 2 3 in the casing, and communicating with said chamber on one side at the intersection of said recesses is an inlet-port 4. Leading from said cylinder or chamber at the point of intersection of the recesses 2 and 3 on the side opposite the inlet-port 4 is an exhaust-port 5. Mounted to revolve within the cylinder or expansion-chamber 1 are the pistons 6 and 7, the same being secured, respectively, to shafts 8 and 9, which extend through the opposite ends of the casing in which said cylinder or expansion-chamber is formed. The shafts 8 and 9 are located, respectively, at the centers of the cylindrical recesses 2 and 3 and are of course separated from each other by a distance less than the mean diameter of said recesses. The pistons 6 and 7 are so constructed and arranged that during their rotation they will move in close contact with each other at all points and in close contact with the inner plane and curved walls of the cylindrical recesses 2 and 3. To provide for the close working contact at all times between the pistons 6 and 7 and the cylindrical recesses 2 and 3, in which they move, and between the opposing faces of said pistons, said pistons are shaped as shown in the drawings.

In Figs. 4 and 7 each piston has been shown as provided with two lobes, produced by forming thereon two oppositely-disposed concave faces 10 and 11 and two oppositely-disposed convex faces 12 and 13. The curvature of each of the faces 12 and 13 is that of a complete epicycloid formed upon the pitch-circle 14, and the curvature of each of the faces 10 and 11 is that of a hypocycloid formed upon the pitch-circle 14. The circular arcs 15 16, 16 17, 17 18, and 18 15 are all equal. The arc 15 16 plus 16 17 and the arc 17 18 plus 18 15 are therefore both equal to one-half circle. I may employ instead of two two-lobed pistons 6 and 7, constructed as above described, two three-lobed pistons 6^a and 7^a or one two-lobed piston 6 and a three-lobed piston 7^a, coöperating therewith. Each of the convex portions of the three-lobed pistons 6^a and 7^a has the curvature of an epicycloid formed upon the pitch-circle 14^a, and each of the concave portions of the pistons 6^a and 7^a has the curvature of a hypocycloid formed upon the pitch-circle 14^a. The circular arcs 19 20, 20 21, 21 22, 22 23, 23 24, and 24 19 are all equal, and the arcs 19 20 21, 21 22 23, and 23 24 19 are all equal to one-third of a circle.

The operation of the modified form and arrangement of pistons above referred to is identical with that of the preferred form of my invention. (Shown in Fig. 4 of the drawings.) In the casing of the device, adjacent to the cylinder or expansion-chamber 1, is a cylindrical valve-chamber 25, with which communicates a pipe 26 for the supply of steam, gas, or other equivalent motive agent to said valve-chamber, the said pipe 26 leading from

a boiler or other source of supply. The inlet-port 4 leads from the valve-chamber 25, as clearly shown in Figs. 4 and 5 of the drawings. Mounted in the valve-chamber 25 is a hollow rotary longitudinally-movable admission-valve 27, the same having secured to it and extending longitudinally in opposite directions therefrom a valve-stem 28. The said stem 28 closes one end of the hollow valve 27 and extends through the opposite ends of the valve-chamber 25. On one of its projecting ends said valve-stem is provided with a gear or pinion 29. At its opposite end said valve-stem has a swivel connection with a pair of levers 30, fulcrumed at their upper ends upon a pin or projection 31, secured to the casing or framework of the device. Through the gear or pinion 29 rotary movement is imparted to the valve 27, and through the levers 30 longitudinal movement is imparted to said valve. The said valve is provided with a series of ports 32, adapted to register successively with the port 4 during the rotation of said valve, so as to admit steam or other fluid under pressure to the cylinder or expansion-chamber 1. When the valve 27 is in its normal position, the ports 32 register throughout their entire lengths with the port 4. When, however, the valve 27 is moved longitudinally, said ports 32 will be partially or wholly cut off by the imperforate portion of the valve-chamber 25, according to the extent or degree of longitudinal movement which is imparted to said valve. It will thus be seen that by moving the valve 27 longitudinally to a greater or less extent the volume of steam or other motive fluid admitted to the cylinder or expansion-chamber 1 through the port 4 may be controlled.

In Fig. 4 of the drawings the pistons 6 and 7 are shown in position to receive steam from the valve-chamber 25 through one of the valve-ports 32 and the admission-port 4, one of the ports 32 in the valve 27 being just at the point of opening. As the steam enters the cylinder or expansion chamber 1 through the port 4 it acts upon the pistons 6 and 7 to rotate the same in the direction of the arrows shown, the end of the piston 7 at this time serving as the abutment. At this time the passage of steam to the cylindrical recess 3 is cut off. When the valve 27 has moved so that the port 32 is just closed, the pistons 6 and 7 will have made a little less than one-fourth of a complete rotation and the space within the cylindrical recess 3 adjacent to the port 4 will be connected with the space adjacent to said port between the piston 6 and the cylindrical recess 2. The steam now acts expansively until the pistons 6 and 7 have moved to complete a one-fourth turn from the point of starting, at which time another one of the ports 32 in the valve 27 reaches its opening position. The steam included between the piston 6 and the cylinder or expansion-chamber 1 is now dead and that included between the piston 7 and said cylinder or expansion-chamber is escaping through the exhaust-port 5. As the next valve-port 32 opens the operation above described is repeated, except that the relative positions of the pistons 6 and 7 are reversed.

The shaft 8 of the piston 6 is provided on one end with a gear or pinion 33, which meshes with a corresponding gear or pinion 34 on the shaft 9 of the piston 7. The opposite end of the shaft 8 is provided with a gear or pinion 35, meshing with a corresponding gear or pinion 36 on the shaft 9. The shafts 8 and 9, and consequently the pistons 6 and 7, are thereby intergeared with each other, so that they rotate in unison simultaneously and in opposite directions. The shaft 9 is also provided adjacent to the gear or pinion 36 thereon with a gear 37, which meshes with a corresponding gear 38, secured to a hollow shaft 39, mounted in suitable bearings beneath the valve-chamber 25. The shaft 39 is also provided with a gear 40, located directly beneath the gear 29 on the valve-stem 28 and meshing therewith. By this construction it will be seen that the motion of the shafts 8 and 9 of the pistons 6 and 7 is transmitted through the gearing described to the valve 27. The said valve is therefore constantly rotated through the operation of the engine to admit steam or other motive fluid from the supply-pipe 26 through the valve-chamber 25 and the ports 32 and 4 to the cylinder or expansion-chamber 1.

The means for automatically controlling the position of the valve 27 in the valve-chamber 25 and for automatically moving said valve longitudinally in said chamber as the speed of the engine increases or decreases consists of a governor made up of a yoke 41, secured to the hollow shaft 39 and rotated thereby, arms 42, pivoted to said yoke and adapted to be thrown outwardly by centrifugal force, a head 43, and a rod 44, the said rod extending through the hollow shaft 39, having a swivel connection with the head 43 and pivotally connected at its opposite end to the levers 30. The yoke 41 has a hub 45, which surrounds the hollow shaft 39 and is secured thereto in any suitable manner. Said yoke is also provided at its opposite ends with ears or projections 46, extending in the direction of the length of the shaft 39 and having pivoted thereto the arms 42. The said ears or projections are arranged in pairs the members of which are separated from each other to provide for the location and movement of the arms 42 between them. The free ends of the arms 42 are provided with weights 47, and the inner ends of said arms adjacent to their pivots are provided with segmental gears 48. Said arms 42 have projecting laterally therefrom the pins 49, to which are connected the springs 50 for resisting the outward movement of said arms and for returning the same to their normal positions. The segmental gears 48 on the arms 42 mesh with the racks 51 on opposite ends of the head 43,

so that when said arms 42 are thrown outwardly by centrifugal force they will serve to move the head 43 longitudinally of the device toward the hollow shaft 39. The head 43 is supported and guided in its movements by the screws 52, which are secured to the yoke 41 and extend through openings in said head. The heads 53 of said screws serve to limit the outward movement of the head 43, whereas the inward movement of said head 43 is limited by its engagement with the body portion or base of the yoke 41. The swivel connection between the rod 44 and the head 43 may be effected in any suitable way. I have, however, shown the collars 54 55 on the rod 44 located on opposite sides of a plate 56, secured to the head 43, but separated therefrom by the spacing-blocks 57 to provide for the location of the collar 55 between said plate 56 and the body of said head. The opening in the plate 56 through which the reduced end of the rod 44 passes is of course of smaller diameter than the collars 54 and 55. The rod 44, as heretofore stated, is pivotally connected at the end opposite the collars 54 55 thereon with the free ends of the levers 30. When, therefore, during the operation of the engine the arms 42 are thrown outwardly by centrifugal force, due to the rapid rotation of the yoke 41, which is connected with the rotary shaft 39, the head 43 of the governor will be moved inwardly toward the shaft 39 and will impart a longitudinal movement to the rod 44. When this is done, the levers 30 will be rocked on their fulcrum 31, and the valve 27, which is connected through its stem 28 to said levers 30, will be moved longitudinally in the valve-chamber 25, in which it operates. The effect of this will be to reduce the effective size of each of the ports 32 or of the port 4 and consequently reduce the quantity of steam or other motive agent which is admitted to the cylinder or expansion-chamber 1 through said port 4. The speed of operation of the engine will then be reduced to the point at which it is desired to maintain the same. If the speed of the engine falls below that at which it is desired to maintain it, the springs 50, acting upon the arms 45, will swing said arms on their pivots, so as to return them to a greater or less extent toward their normal positions. When this is done, the operation of the parts above described will be reversed—that is to say, the head 43 of the governor will be moved outwardly and a corresponding longitudinal movement will be imparted to the rod 44, which is connected therewith. The levers 30 will then be moved on their fulcrum, so as to move the valve 27 in a direction opposite that above described. The effect of this will be to increase the active size of the ports for the admission of steam to the cylinder or expansion-chamber and thereby bring about an increase in the speed of the engine itself.

The governor described thus acts to maintain a constant uniform speed of the engine at all times.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a rotary engine, a valve-chamber, a supply-pipe for a motive agent communicating therewith, a cylinder or expansion-chamber having a port leading therefrom and communicating with said valve-chamber, a rotary valve in said valve-chamber having ports therein adapted to register with the port between said valve-chamber and said cylinder, a hollow shaft rotated by said engine, a governor rotated by said shaft, and a rod connected with the movable part of said governor, extending through said hollow shaft, and operatively connected with said valve for automatically imparting longitudinal movement thereto, as and for the purpose set forth.

2. In a rotary engine, a valve-chamber, a supply-pipe for a motive agent communicating therewith, a cylinder or expansion-chamber having a port leading therefrom and communicating with said valve-chamber, a rotary valve in said valve-chamber having ports therein adapted to register with the port between said valve-chamber and said cylinder, a hollow shaft rotated by said engine, a governor connected with said hollow shaft, rotated thereby, and having a longitudinally-movable head, and a rod extending through said hollow shaft, having a swivel connection with said head and operatively connected with said valve for automatically moving the latter longitudinally, as and for the purpose set forth.

3. In a rotary engine, a valve-chamber, a supply-pipe for a motive agent communicating therewith, a cylinder or expansion-chamber having a port leading therefrom and communicating with said valve-chamber, a rotary valve in said valve-chamber having ports therein adapted to register with the port between said valve-chamber and said cylinder, a hollow shaft rotated by said engine, and a governor connected with said hollow shaft, rotated thereby, and operatively connected with said valve for automatically imparting longitudinal movement thereto, as and for the purpose set forth.

4. In a rotary engine, a valve-chamber, a supply-pipe for a motive agent communicating therewith, a cylinder or expansion-chamber having a port leading therefrom and communicating with said valve-chamber, a rotary valve in said valve-chamber having a port or ports therein adapted to register with the port between said valve-chamber and said cylinder, a hollow shaft rotated by said engine, a governor rotated by said shaft, a rod connected with the movable part of said governor extending through said hollow shaft, and a lever to which said rod is connected, said lever being rotatively connected with said valve.

5. In a rotary engine, a valve-chamber, a supply-pipe for a motive agent communicating therewith, a cylinder or expansion-chamber having a port leading therefrom and communicating with said valve-chamber, a rotary valve in said valve-chamber having ports adapted to register with the port between said valve-chamber and said cylinder, a governor rotated by said engine, a lever rotatively connected between its ends with said valve and fulcrumed at one end, and a rod connected with the other end of said lever and operable by the movable part of the said governor.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LOUIS TEAL.

Witnesses:
WALTER H. JACKSON,
WILLIAM C. POPE.