No. 871,322. PATENTED NOV. 19, 1907.

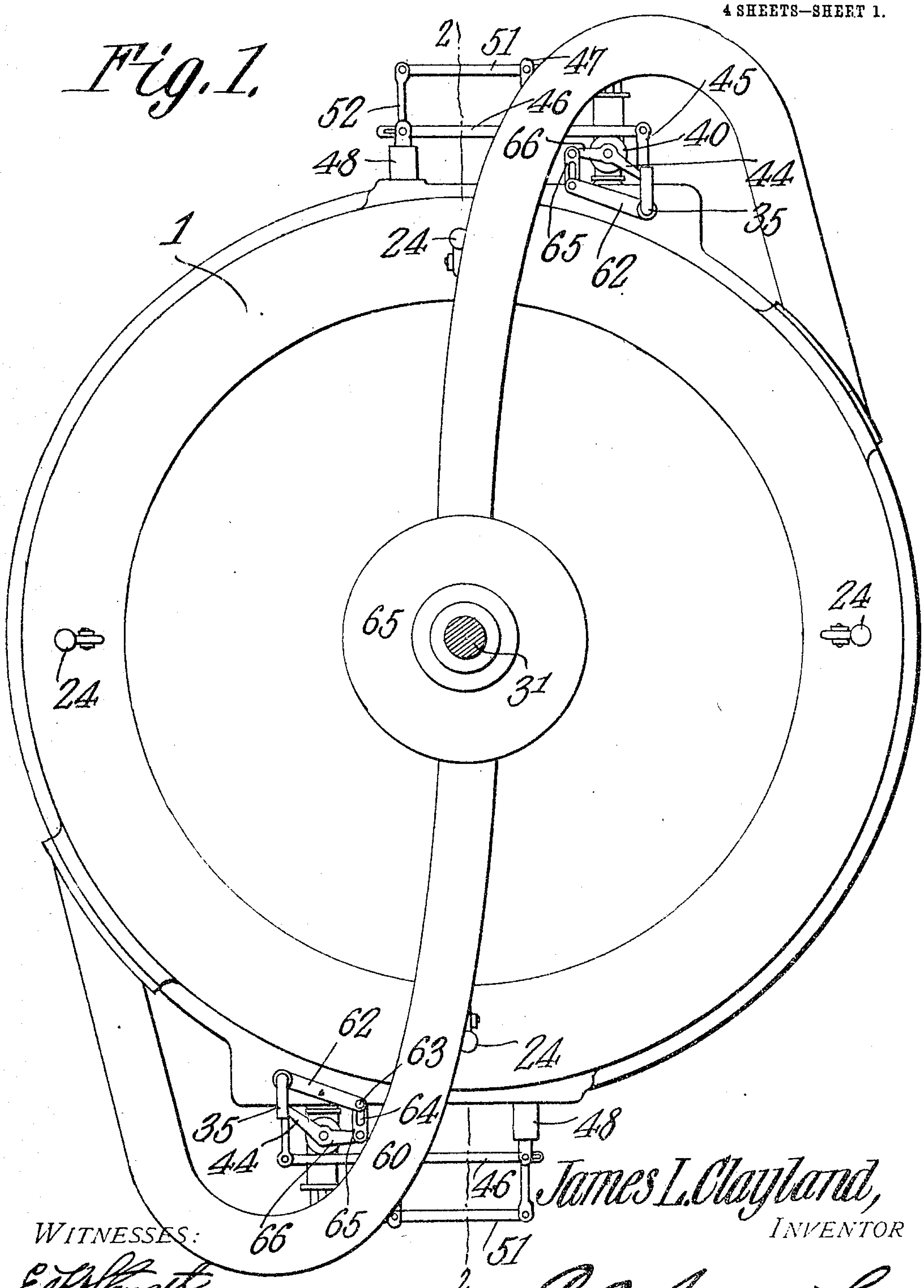
J. L. CLAYLAND.

ROTARY ENGINE.

APPLICATION FILED APR. 5, 1907.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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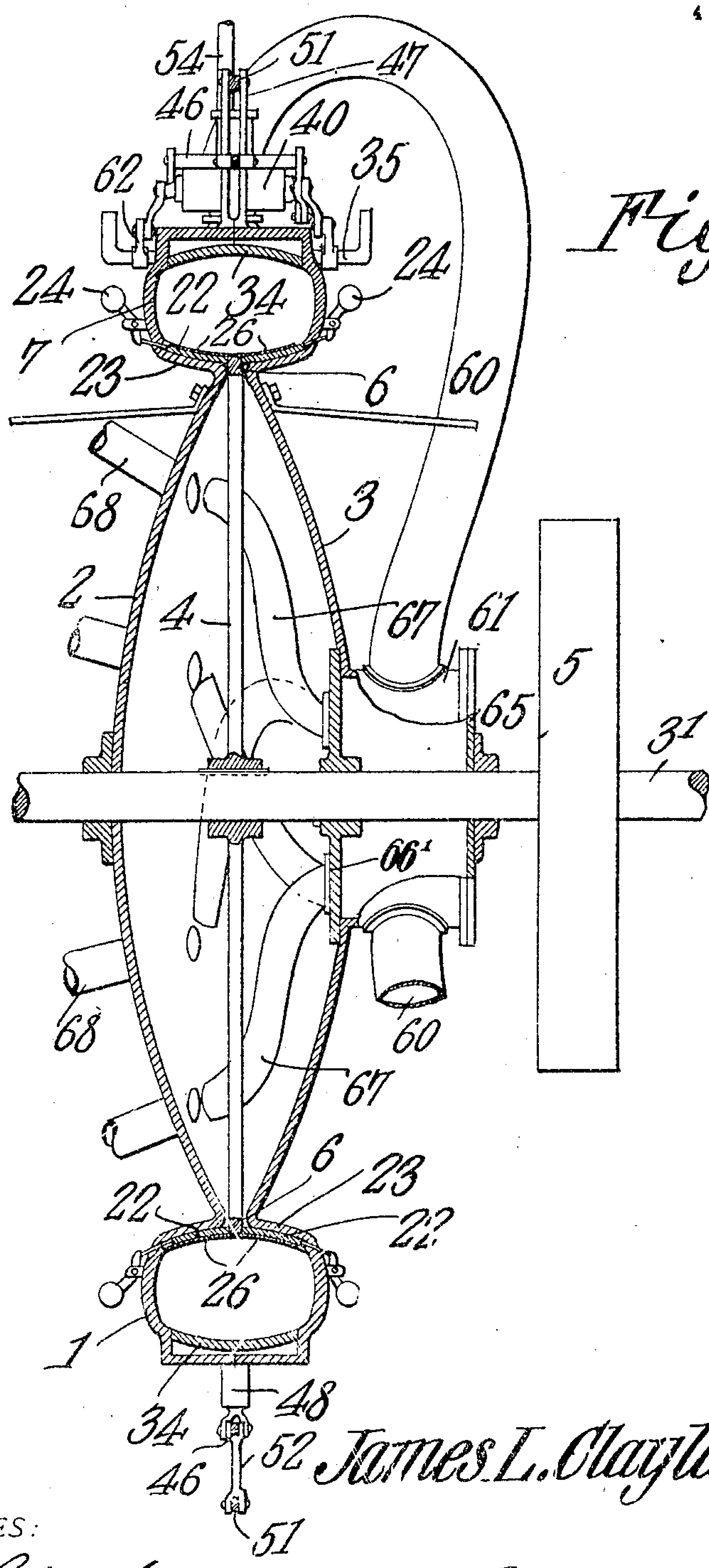
Fig. 2.



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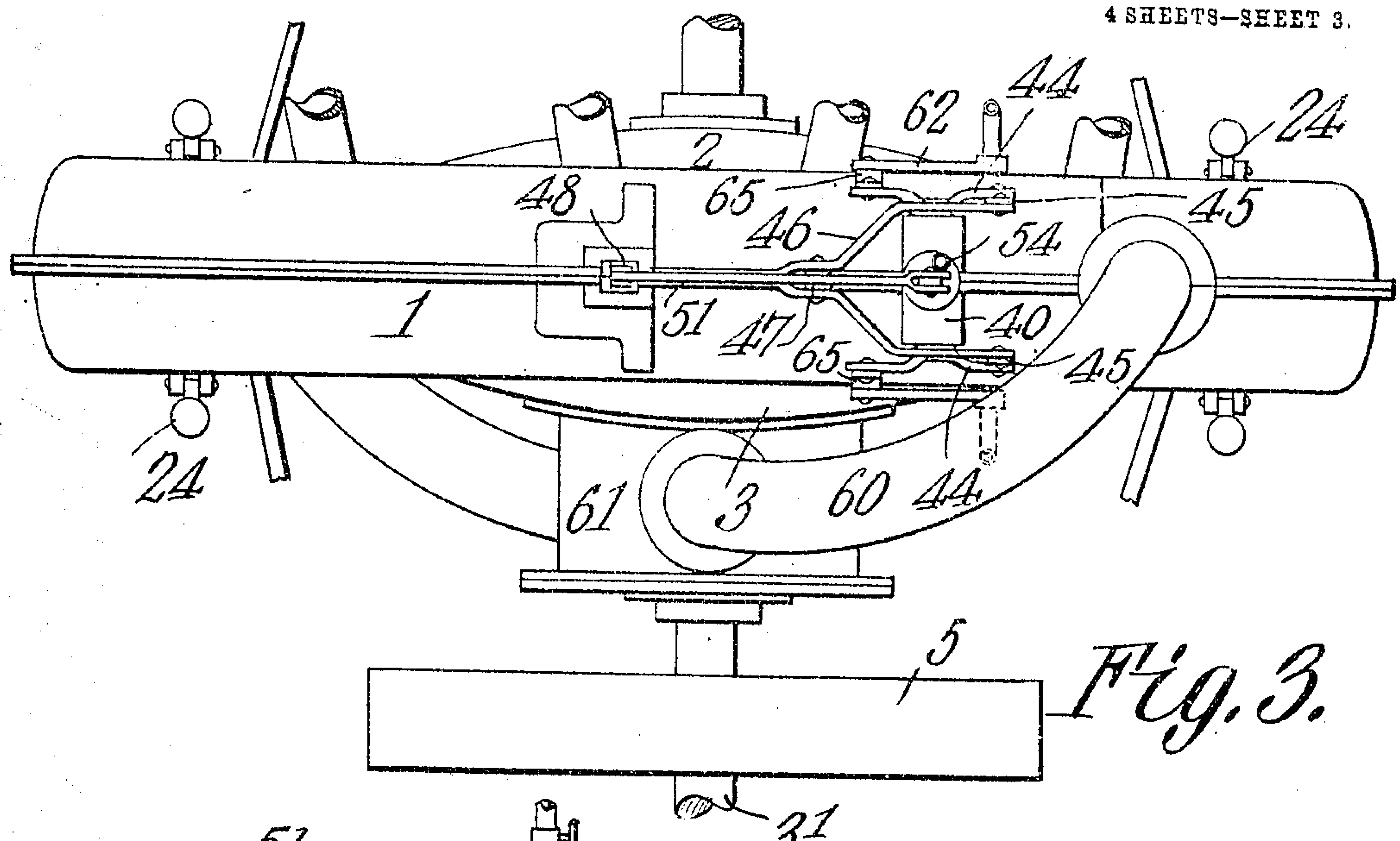


Fig. 3.

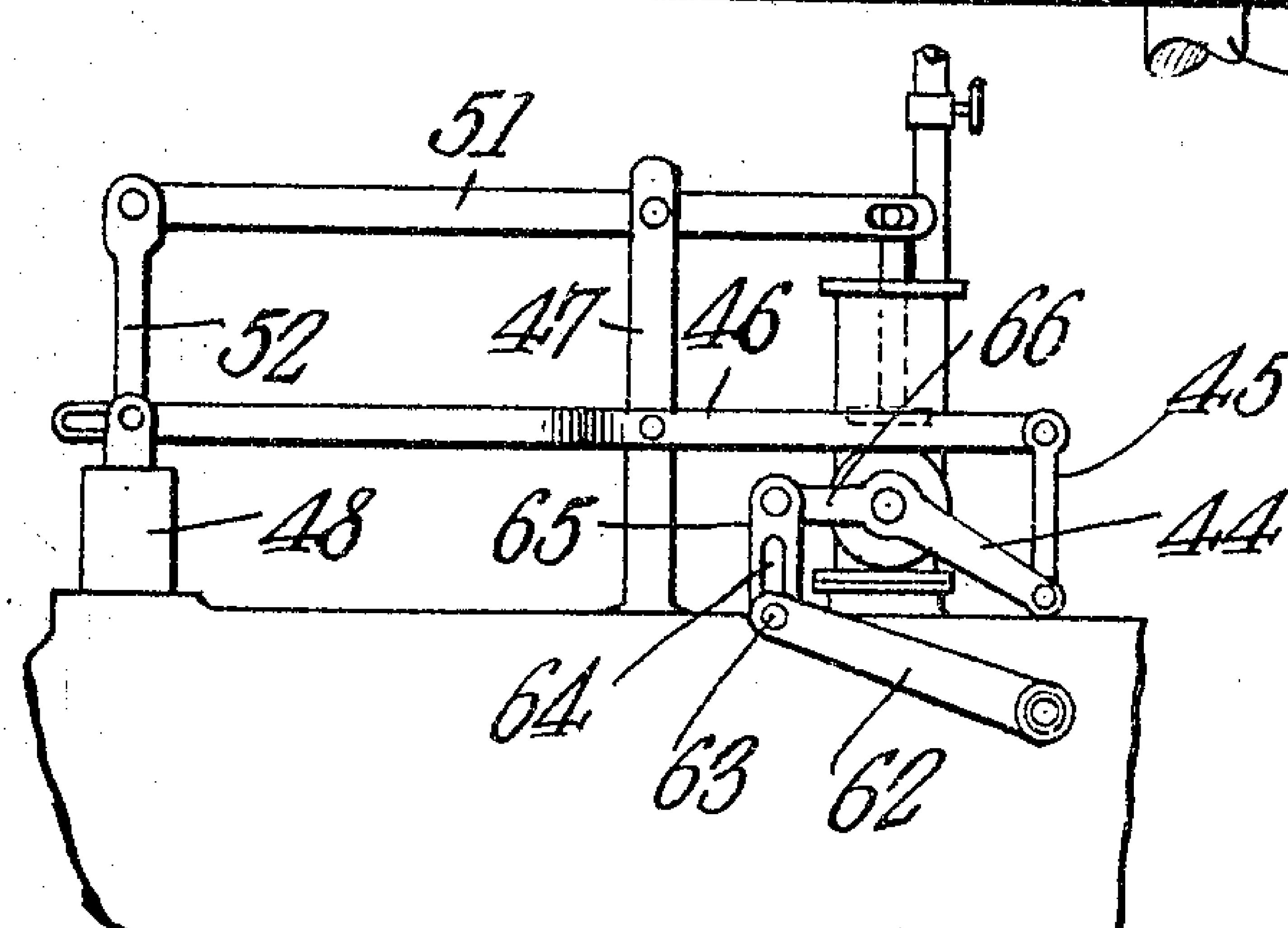
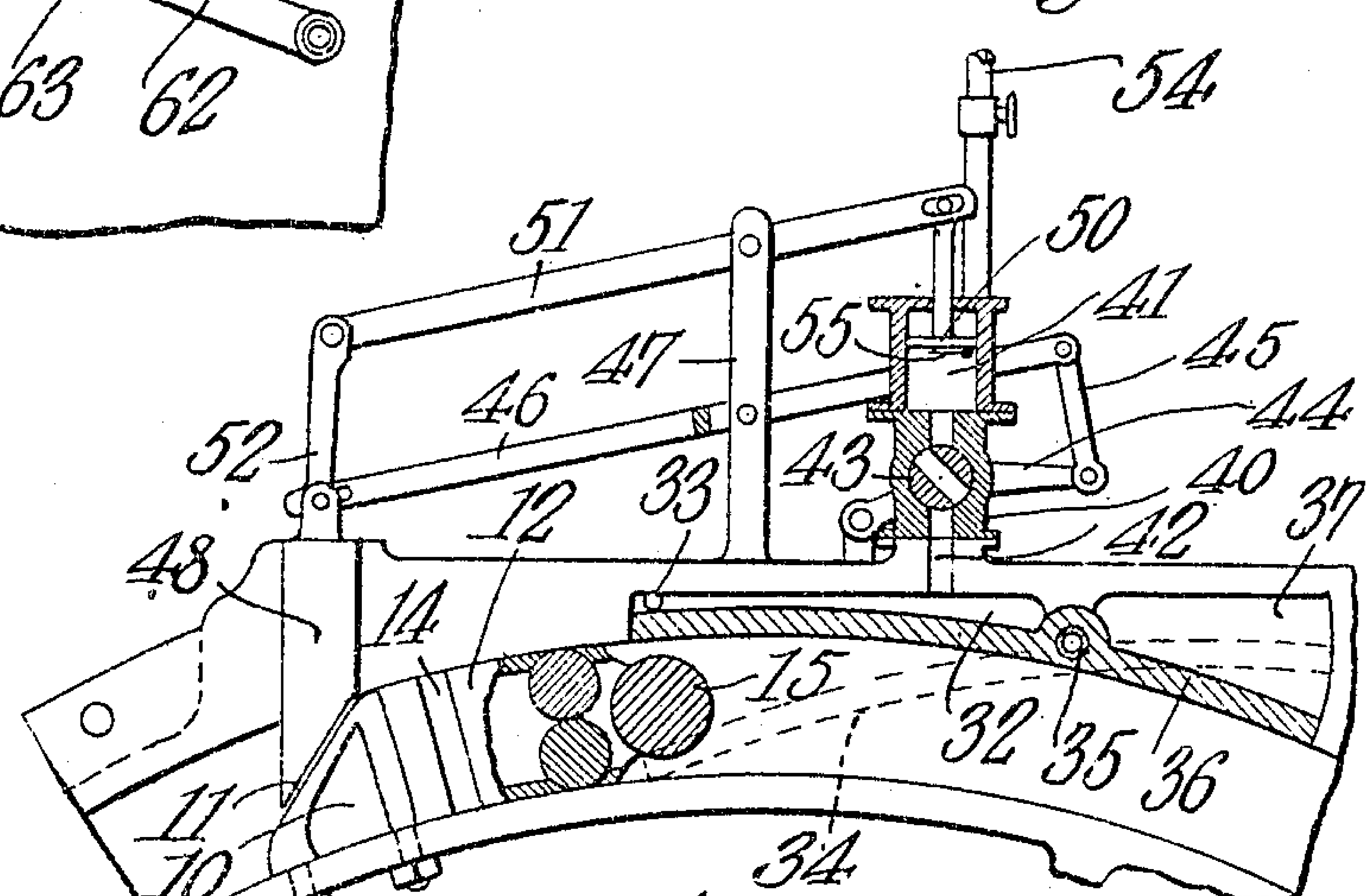


Fig. 4.

Fig. 5.



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4 SHEETS—SHEET 4.

Fig. 6.

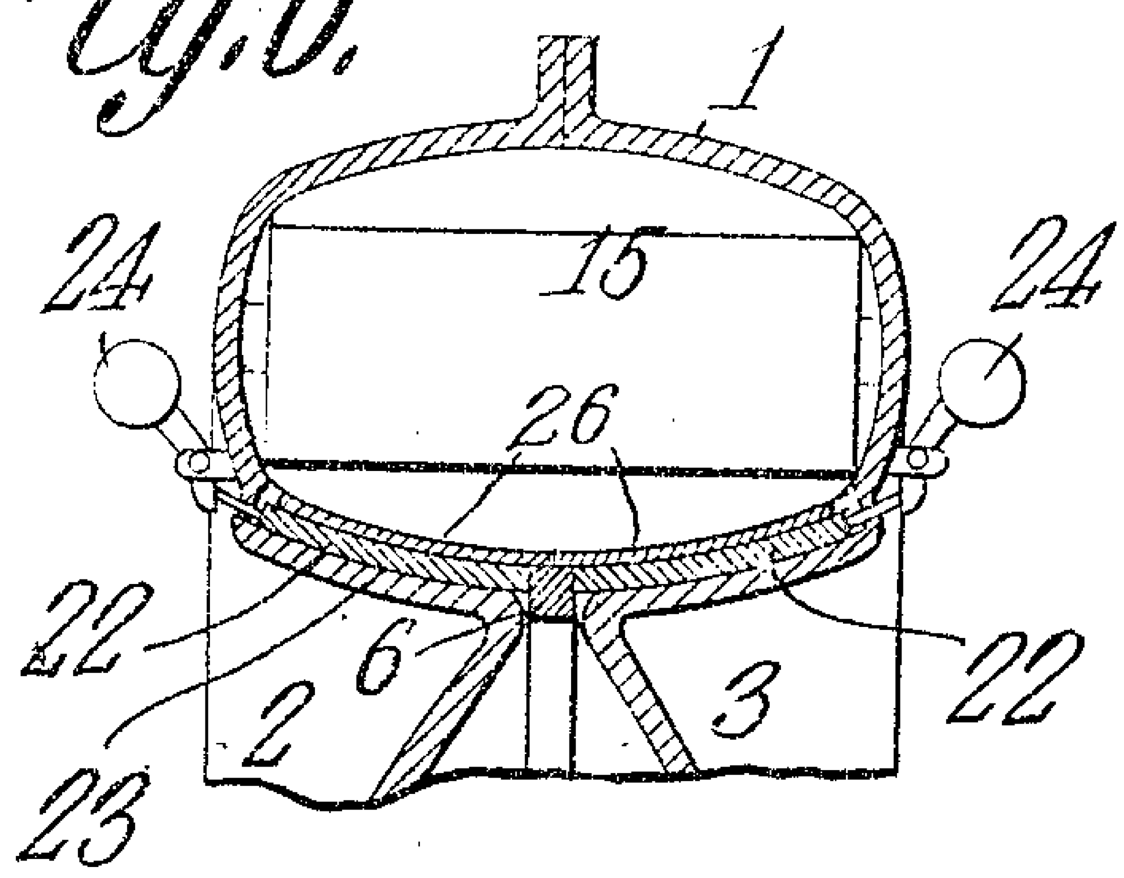
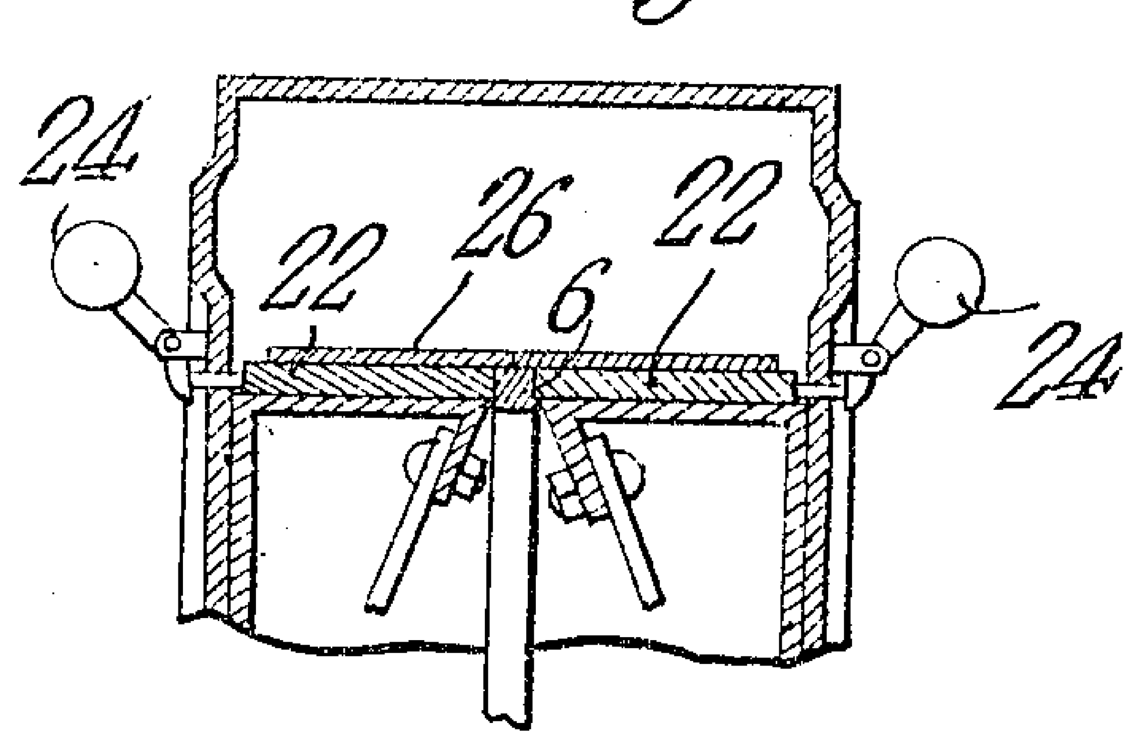


Fig. 7.



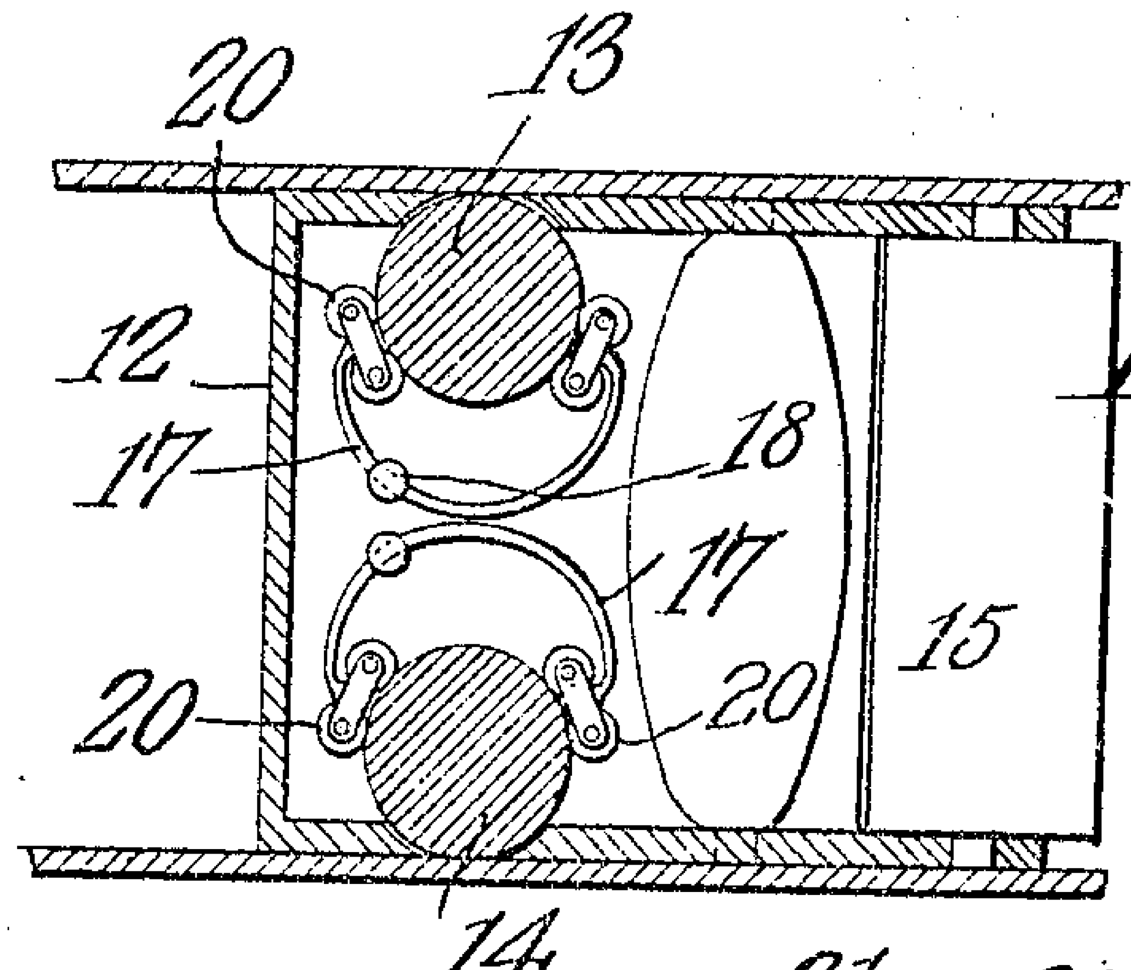


Fig. 8.

Fig. 9.

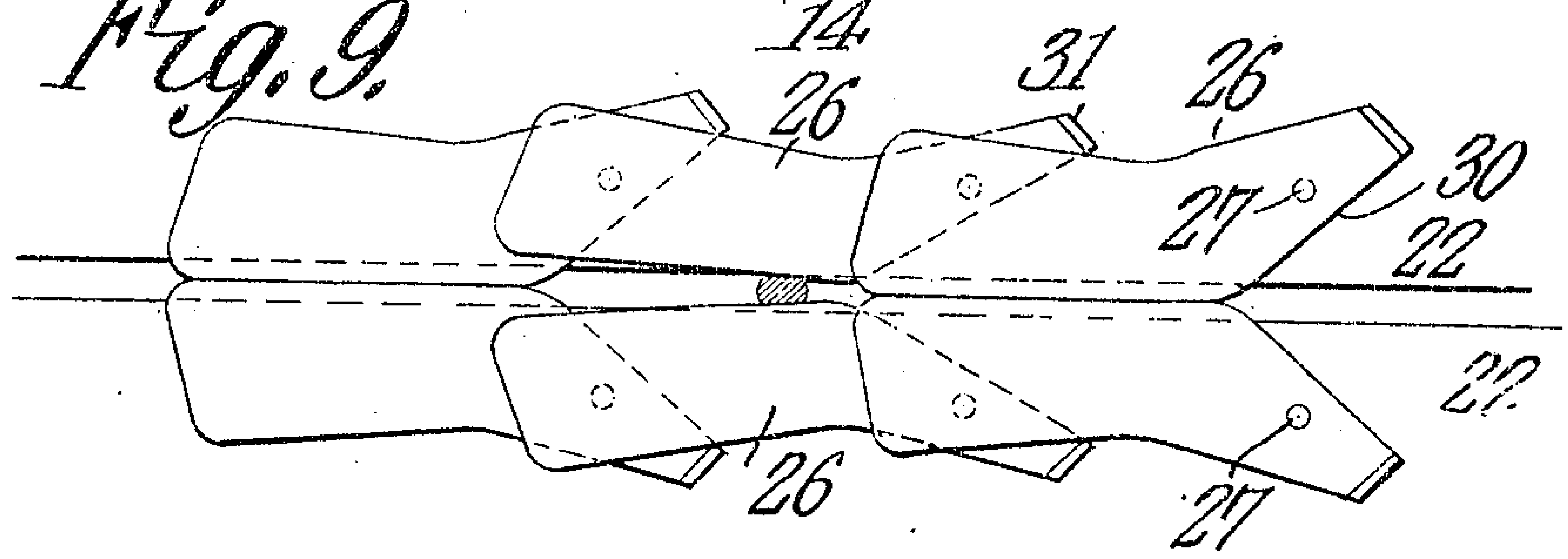
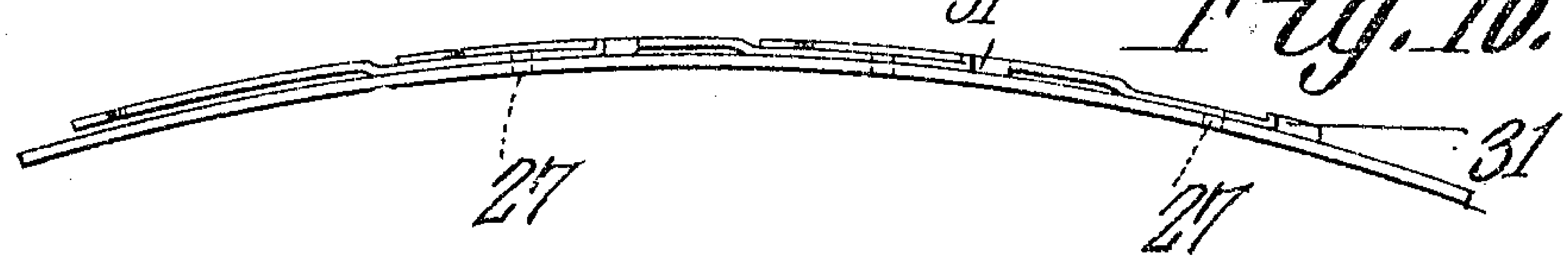


Fig. 10.



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UNITED STATES PATENT OFFICE.

JAMES LAMBERT CLAYLAND, OF FORT SMITH, ARKANSAS.

ROTARY ENGINE.

No. 871,322. Specification of Letters Patent. Patented Nov. 19, 1907.

Application filed April 5, 1907. Serial No. 366,585.

To all whom it may concern:

Be it known that I, JAMES LAMBERT CLAYLAND, a citizen of the United States, residing at Fort Smith, in the county of Sebastian and State of Arkansas, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to rotary engines which ay be operated by an explosive compound or an expansible fluid of any nature, and is designed principally for use as a rotary explosive motor especially adapted for marine propulsion, power house service, and generally for work requiring great motive power.

A further object of the invention is to improve and simplify the construction and operation of prime motors of this character, so as to be highly efficient, thoroughly reliable, and having a high out put.

A further object of the invention is the provision of a rotary engine having one or more devices for discharging explosive gases upon the piston to rotate the same, the supply of the explosive gas being controlled by a valve mechanism operated automatically by a rotatable element of the engine.

A still further object of the invention is to provide a novel form of explosion chamber arranged on the casing of the engine to discharge approximately tangentially against the blades of the piston, and means adjacent the explosion chamber for preventing the liquid fuel from passing directly into the exhaust pipe before doing useful work on the piston.

A still further object of the invention is to provide a rotary engine in which a movable abutment supported by the stationary cylinder or casing of the engine is acted upon by the explosive charge in such manner as to be forced into contact with the piston blade or blades acting to push the same forward, after which the expansive force of the charge is utilized for the further propulsion of the piston wing or blade.

A still further object of the invention is to provide a device of this class in which a measured charge of explosive compound is forced under pressure into the explosion chamber through the agency of a rotatable member of the engine.

A still further object of the invention is to provide an engine in which the exploded gases after exercising direct pressure on the rotatable piston wings or blades are directed through discharge pipes or outlets which are so arranged that the force of the streams of products of combustion issuing from said pipes and impacting against the air or a part of the wall of the cylinder will assist the rotative movement of the piston.

A still further object of the invention is to provide a novel form of piston and piston wing or blade, in the latter of which rollers are utilized for engagement with the walls of the expansion or working chamber, in order to reduce friction.

A still further object of the invention is to provide an improved means for preventing the escape of any material portion of the operating fluid from the expansion chamber until after its work has been accomplished.

With these and other objects in view, as will more fully hereinafter appear, the invention consists in certain novel features of construction and arrangement of parts, hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings:—Figure 1 is a side elevation of a rotary engine constructed in accordance with the invention. Fig. 2 is a transverse sectional view of the same on the line 2—2 of Fig. 1. Fig. 3 is a plan view of the engine. Fig. 4 is a side elevation of a portion of the same drawn to an enlarged scale, and showing the mechanism for controlling the inflow of the explosive charge. Fig. 5 is a detail sectional view of the mechanism shown in Fig. 4, illustrating, also, the explosion chamber, and one of the piston wings or blades. Fig. 6 is a transverse sectional view of a portion of the working or expansion chamber drawn to an enlarged scale. Fig. 7 is a similar view illustrating a chamber of slightly modified contour in cross section. Fig. 8 is a plan view of the preferred form of piston member. Fig. 9 is a detail plan view of a portion of the devices for preventing the escape of the gases or explosive fluid from the working chamber. Fig. 10 is a detail elevation of the mechanism shown in Fig. 9.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

Referring to the drawings, 1 indicates the cylindrical casing or shell, and 2 and 3 the heads thereof through which extends a shaft 3′ carrying the rotating piston 4, and at a point outside the cylinder is mounted a balance or belt wheel 5 of any ordinary construction.

The two cylinder heads 2 and 3 are concaved and at their margins are brought together forming a comparatively narrow annular passage through which extends a solid rim 6 of the piston member, the body of the piston being preferably formed of a plurality of spokes and a central hub.

The piston member carries a plurality of wings or blades, which work in an annular space 7 that is preferably of the approximate elliptic shape shown in Figs. 2 and 6, although it may be rectangular, as shown in Fig. 7, or of any other desired form, and while any number of blades or wings may be used, it is found that two are sufficient for ordinary purposes, these being preferably disposed at points diametrically opposite each other.

Each piston wing is secured to the rim 6 by a forward brace 10 having an angular cam face 11, which is used for the purpose of opening the valves that control the supply of the explosive mixture to the engine. Extending rearward from this brace is a frame 12 in which are mounted a number of rollers 13, 14 and 15 and in the present instance but three rollers are shown, although the number may be increased or diminished as desired. The rollers 13 and 14 are mounted loosely in the frame which forms the body of the piston wing and are held outward by bowed springs 17 pivoted on studs 18 and carrying at their free ends small antifriction rollers 20 that engage with the inner portions of the rollers. The structure is such that the rollers 13 or 14 are yieldably held and are maintained in practically fluid proof contact with the vertical or approximately vertical walls of the expansive space, but owing to the way in which the holding springs are pivoted, considerable stress is exerted by said springs in forcing the rollers outward. The rearmost roller 15 is shaped to conform to the upper and lower walls of the expansion space, and when the construction shown in Fig. 6 is employed, the roller has a rounded face tapering gradually from the middle toward both ends. If necessary, an additional number of rollers may be employed, the rollers in all cases being so journaled or mounted as to break joint and prevent, or to a material extent limit, the passage of the expansive fluid employed for propelling purposes.

In order to prevent the escape of any of the operating fluid from the expansion or working space of the cylinder into that space bounded by the central portions of the heads 2 and 3, a pair of rings 22 are employed, these rings being mounted on the outwardly extending flanges 23 of the heads, and being forced inward into engagement with the opposite sides of the piston rim 6 by means of a plurality of pivotally mounted weighted levers 24, as clearly shown in Figs. 6 and 7. This construction, however, is not sufficient to prevent the escape of some portions of the volume of operating fluid, and for this reason additional closing plates 26 of the character shown in Figs. 9 and 10 are employed.

The plates 26 are mounted in opposing pairs on the rings 22, each plate being pivoted on a stud 27, and the edges of the plates of each pair being arranged to spring into and from engagement with each other during the passage of the brace or carrier 10 of the piston wing. It will be seen on reference to Fig. 9 that the plates are provided with cam faces 30, which, when engaged by the brace 10, will result in the spreading of the plates, while those plates immediately preceding will be swung to closed position by lugs 31 disposed at the ends of the cam faces and engage such preceding plates, so that during the whole course of travel of the piston wing only a single set of plates will be spread, the edges of the remaining pair of plates being in close contact with each other, and serving in connection with the main rings 22 to prevent the leakage of the expansive fluid from the working space of the cylinder.

In the wall of the cylinder are arranged explosion chambers 32, two of which are shown in the present instance, although the number may be increased, if desired, and at one end of the explosion chamber is an igniter 33 which may take the form of an igniting tube, sparking device, or any other suitable apparatus. The lower wall of the explosion chamber is formed of an abutment 34 which is movable between the dotted and the full line positions shown in Fig. 5, as the result of the ignition of an explosive charge, and when moved to the full line position the abutment serves the function of the abutment of an ordinary form of rotary engine, that is to say, the stationary wall of the expansion chamber, the piston wing forming the opposite or movable wall of such chamber. The abutment is mounted on a hollow stem 35 through which water may be circulated for cooling purposes, and projecting beyond the pivot is a wing 36 that is arranged to move into a dash pot or cushioning space 37 which is intended merely for the purpose of preventing abrupt movement of the abutment and possible breakage of the same from violent contact with the inner wall of the expansion chamber as said abutment is drawn inward under the influence of an explosive charge.

Above the explosion chamber is a valve casing 40, the upper end of which communicates with a measuring chamber in the form of a cylinder 41, and from the lower end of the casing leads a port 42 to the explosion chamber. In this casing is mounted a ported valve 43, to the stem of which is secured a pair of arms 44, that are connected by links 45 to the bifurcated end of a lever 46 that is pivoted on a standard 47. The opposite end of the lever 46 has a pin and slot connection with a slidable cam block 48, the inner end of which is inclined, and is disposed in the path of movement of the cam shaped face 11 of the bracket 10, so that when the bracket comes into engagement with the block, the latter will be moved out of the cylinder, and the valve will be moved through the described connections to place the measuring chamber 41 in communication with the explosion chamber 32.

Arranged in the measuring chamber 41 is a piston 50 that is connected to one end of a lever 51 fulcrumed on the standard 47. The opposite end of the lever 51 has a linked connection 52 with the block 48, and as said block moves outward, the piston will be depressed and the explosive charge previously introduced into the measuring chamber will be forced out of said chamber through the valve casing and into the explosion chamber.

The supply of explosive compound in the nature of gas, carbureted air, or any form of hydrocarbon, alcohol, or the like, enters the measuring chamber 41 through a valved pipe 54, and the supply is drawn into the chamber during the descending movement of the piston. As the piston rises, a flap valve 55 in its lower face will open, allowing the charge to flow through a port in the piston to the lower end of the measuring chamber, so that a fresh charge will be in readiness to be injected.

The products of combustion or other operating fluid escape through exhaust pipes 60 to a stationary casing 61 at the hub of the head 3 of the cylinder, and are subsequently issued to assist in propelling the piston.

The abutment 34 is free to rise when it is engaged by the cam 11 of the bracket 10, the pivot 35 of said abutment carrying an arm 62 at the outer end of which is a pin 63, said pin entering a slot 64 in a link 65 that is hung from an arm 66 that forms a part of the lever 44, the pin and slot connection permitting movement of the abutment from the full line to the dotted line position shown in Fig. 5 without effecting any movement of the valve, but if the valve has been moved to open position the linked connection will hold the abutment up after the piston has passed to such position as to no longer form a support.

In the operation of the parts as thus far described, the projecting piston wing will engage the abutment 34, while the latter is in the full line position shown in Fig. 5 and will move the same up to the dotted line position in Fig. 5. Then as the piston wing continues to travel, the cam 11 will engage the block 48 and shift the position of the valve 43, opening the latter and causing the piston 50 to descend, so that the measured charge of explosive compound is forced into the now closed explosion chamber. At this time the extreme rear end of the piston wing represented by the rear face of the roller 15 has not passed wholly beyond the free end of the abutment, and as soon as the explosion occurs, the abutment will be forced down very rapidly, and its free edge will engage against the periphery of the roller, forcing the same forward, and after this purely mechanical thrust, the abutment moves down into engagement with the inner wall of the working space of the cylinder. During this movement of the abutment, the wing 36 is cushioned in the dash pot 37, and any abrupt movement, such as would tend to destroy the abutment, is prevented. The piston wing has now passed a slight distance away from the forward edge of the abutment, and the exploded charge confined between the wing and the abutment will expand, and in expanding will force the piston to continue its course, the products of combustion finally escaping through the pipe 60.

All of the products of combustion are conducted to the stationary casing 16, said casing being substantially cylindrical in form and having a stationary head 65 which may be provided with a stuffing box for the passage of the shaft 3′. The opposite head 66′ of this casing is keyed or otherwise rigidly secured to, and rotates with the shaft, and projecting from this head or disk 66 are a number of pipes 67 which cross the plane of the piston 4, and are arranged in such manner as to form a reaction engine, the products of combustion impinging against the air within the hollow cylinder body, and to a considerable extent assisting in imparting rotative movement to the piston.

As there is some danger of the body of air within the central portion of the cylinder being set into motion, and, therefore, minimizing the effect of the escaping gases, the cylinder head 2 is provided with a large number of escape ports 68, and these are arranged at such an angle to the discharge ends of the pipes 67 that as the gases issue from said pipes 67 they will impinge against the ends of the escape ports or pipes, and the working force will be increased to a considerable extent.

As before observed, the number of explosion chambers, piston wings, and abutments may be increased to any desired extent, and the number of rollers employed on the piston wings may be altered, or the precise contour of the working space of the cylinder may be changed without departing from the invention.

I claim:—

1. In a rotary explosion engine, a cylinder, a piston arranged therein and provided with a projecting wing, a movable abutment, and means for introducing and discharging an explosive charge outside the abutment, the latter acting by impact on the projecting piston wing to effect rotative movement of the piston.

2. In a rotary explosion engine, a cylinder having an explosion space or chamber, in one wall thereof, a swinging abutment movable into and from the chamber, a revoluble piston having a projecting wing, on which the abutment acts by impact, and means for introducing an explosive charge into such chamber.

3. In a rotary explosion engine, a cylinder having an explosion chamber in one wall thereof, a swinging abutment movable into such chamber, a revoluble piston, and a piston wing including a roller on which the abutment acts by impact to effect rotative movement of the piston.

4. In a rotary explosion engine, a cylinder having an explosion chamber, and provided with an annular expansion or working space, a swinging abutment movable into and from the chamber, and a revoluble piston having a projecting wing against which the abutment acts by impact on the initial explosion, the abutment thereafter serving as the stationary wall of the expansion space.

5. In a rotary explosion engine, a cylinder having an explosion chamber, a swinging abutment movable into and from said chamber, said abutment having a projecting wing, a dash pot pocket into which said wing may move, a revoluble piston, and a wing carried by the piston and against which the abutment acts on its initial movement, the abutment thereafter serving as the stationary wall of an expansion space.

6. In a rotary explosion engine, a cylinder having an explosion chamber, and an expansion space, a pivotally mounted abutment movable between said chamber and expansion space, a revoluble piston, a piston wing carried thereby and having a cam shaped forward end, a cam block against which the piston wing acts, and an inlet valve for the explosive charge, said valve being connected to said cam block.

7. In a rotary explosion engine, a cylinder having an explosion chamber and an annular expansion space, a pivotally mounted abutment movable between the chamber and the explosion space, a revoluble piston, a piston wing carried thereby and having a cam shaped forward end, a cam block on which the piston wing acts, and a pumping means for forcing the explosive charge into the chamber, said pumping means being operatively connected to said cam block.

8. In a rotary explosion engine, a cylinder having an explosion chamber, and an annular expansion space, an abutment movable between said chamber and expansion space, a revoluble piston, a piston wing supported thereby and having a cam shaped forward end, a cam block on which the wing acts, a measuring chamber for the explosive charge, a piston for forcing the charge from the measuring chamber to the explosion chamber, a valve between the two chambers, and means operatively connecting both the piston and the valve to the cam block.

9. In a rotary explosion engine, a cylinder having an explosion chamber, a pivotally mounted abutment movable between the chamber and the expansion space, a revoluble piston, a piston wing carried thereby, a cam block with which the piston wing engages, a measuring chamber for the explosive charge, a piston arranged in the measuring chamber, a valve between the measuring chamber and explosion chamber, a series of levers and link connections between the piston, the valve, and the cam block, and a loose connection arranged between the valve and the pivoted abutment.

10. In a rotary engine, a hollow cylinder member having a plurality of exhaust ports formed in one head thereof, a revoluble piston, a piston wing, means for directing an operating fluid against the piston wing, an exhaust receiving chamber to which the exhaust fluid is conducted, one of the heads of said chamber being revoluble with the piston, and a plurality of exhaust pipes carried by the head and arranged to direct the streams of exhaust fluid against said exhaust ports.

11. In a rotary engine, a cylinder having an annular expansion space, a revoluble piston having a rim projecting into such expansion space, a piston wing carried by said rim, a pair of packing rings forming the inner wall of the expansion space, and means for forcing said packing rings into engagement with the opposite sides of the piston rim.

12. The combination with a cylinder having an annular expansion space and provided with a narrow circumferential slot connecting the interior of the cylinder with the expansion space, a revoluble piston having its rim fitting within said slot, and packing rings arranged in said expansion space and engaging the opposite sides of said rim.

13. In a rotary engine, a cylinder having an annular expansion space, a revoluble piston having a piston wing, a brace or carrier connecting the piston to the wing, and a plu-

rality of pairs of overlapping cam plates with which such brace consecutively engages, said plates serving to cut off communication between the expansion space and the interior of the cylinder both in advance and in the rear of the piston wing.

14. In a rotary engine, a cylinder having an annular expansion space, a piston, a piston wing, a brace or carrier connecting the piston to the wing, the cylinder having a narrow annular slot through which said brace extends, and a plurality of overlapping cam plates arranged in a continuous annular series within the expansion space, said plates serving to cut off communication between the expansion space and the interior of the cylinder both in advance and in the rear of the piston wing.

15. In a rotary engine, a cylinder having an annular expansion space, a revoluble piston, and a piston wing carried thereby, said piston wing including a plurality of rollers arranged to engage the walls of the expansion space, and yieldable supports on which said rollers are mounted.

16. In piston wing construction, a frame, a plurality of rollers, the axes of which are disposed at angles to each other, said rollers being arranged to engage with the walls of the expansion space, and spring mounted rollers serving as anti-friction supports for those piston rollers which engage with the side walls of the expansion space.

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

JAMES LAMBERT CLAYLAND.

Witnesses:

VICTOR ANDERSON,
JOHN P. KENNEDY.