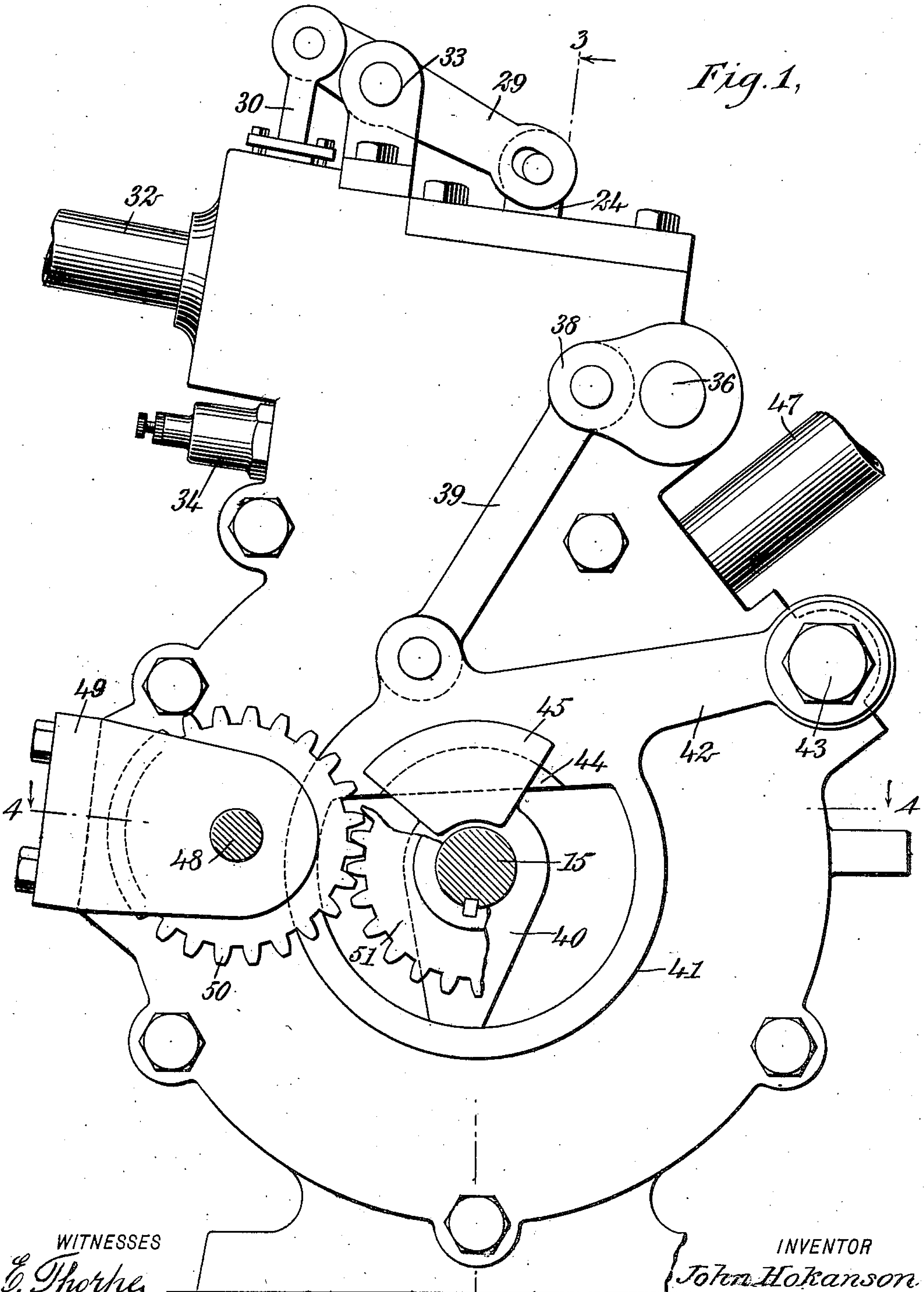
No. 880,453. PATENTED FEB. 25, 1908.

J. HOKANSON.

ROTARY INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 7, 1907.

4 SHEETS—SHEET 1.



WITNESSES

E. Thorpe.

C. W. Fairbank

INVENTOR

John Hokanson.

BY Munn & Co.

ATTORNEYS.

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Fig. 2.

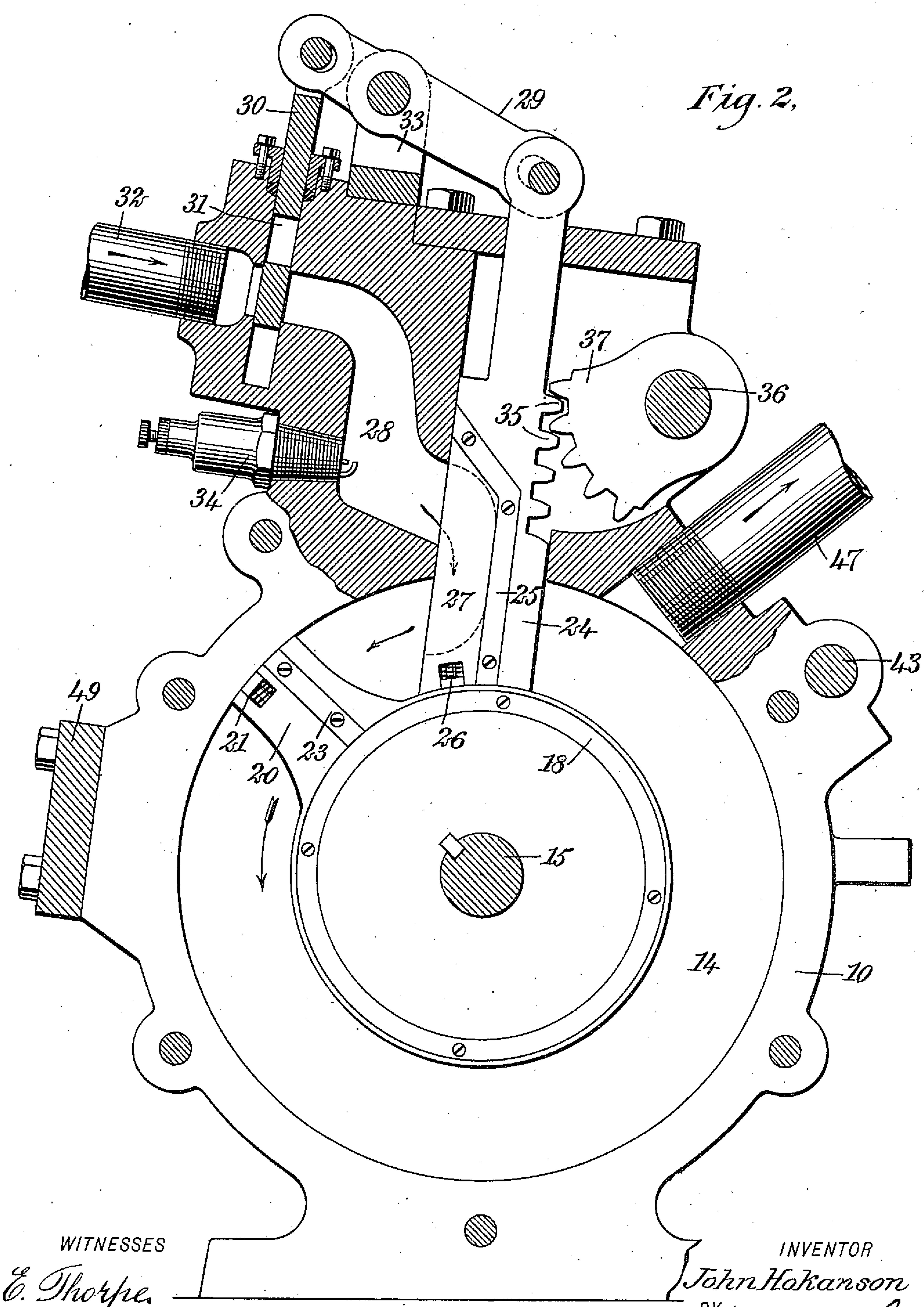

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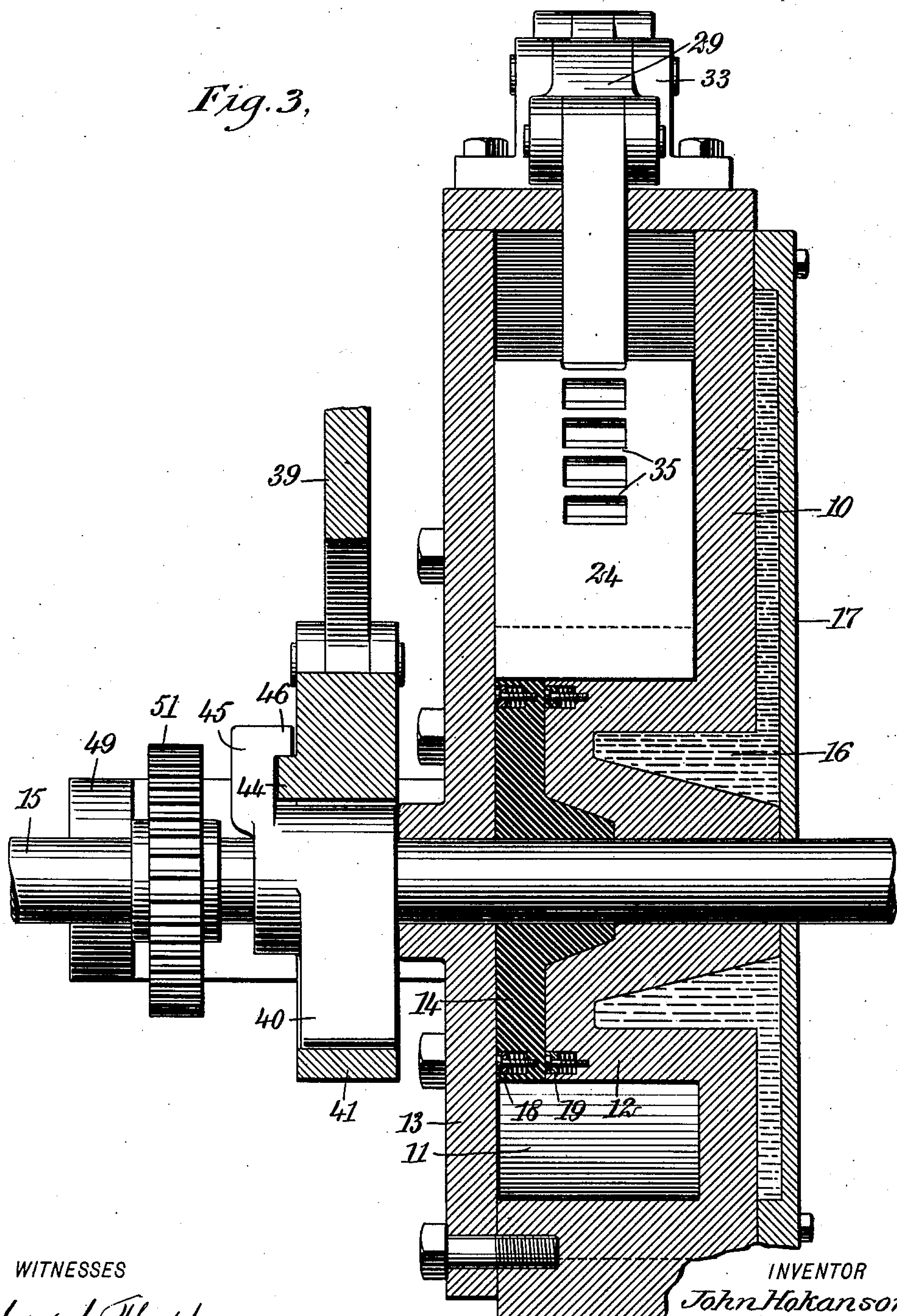
Fig. 3.



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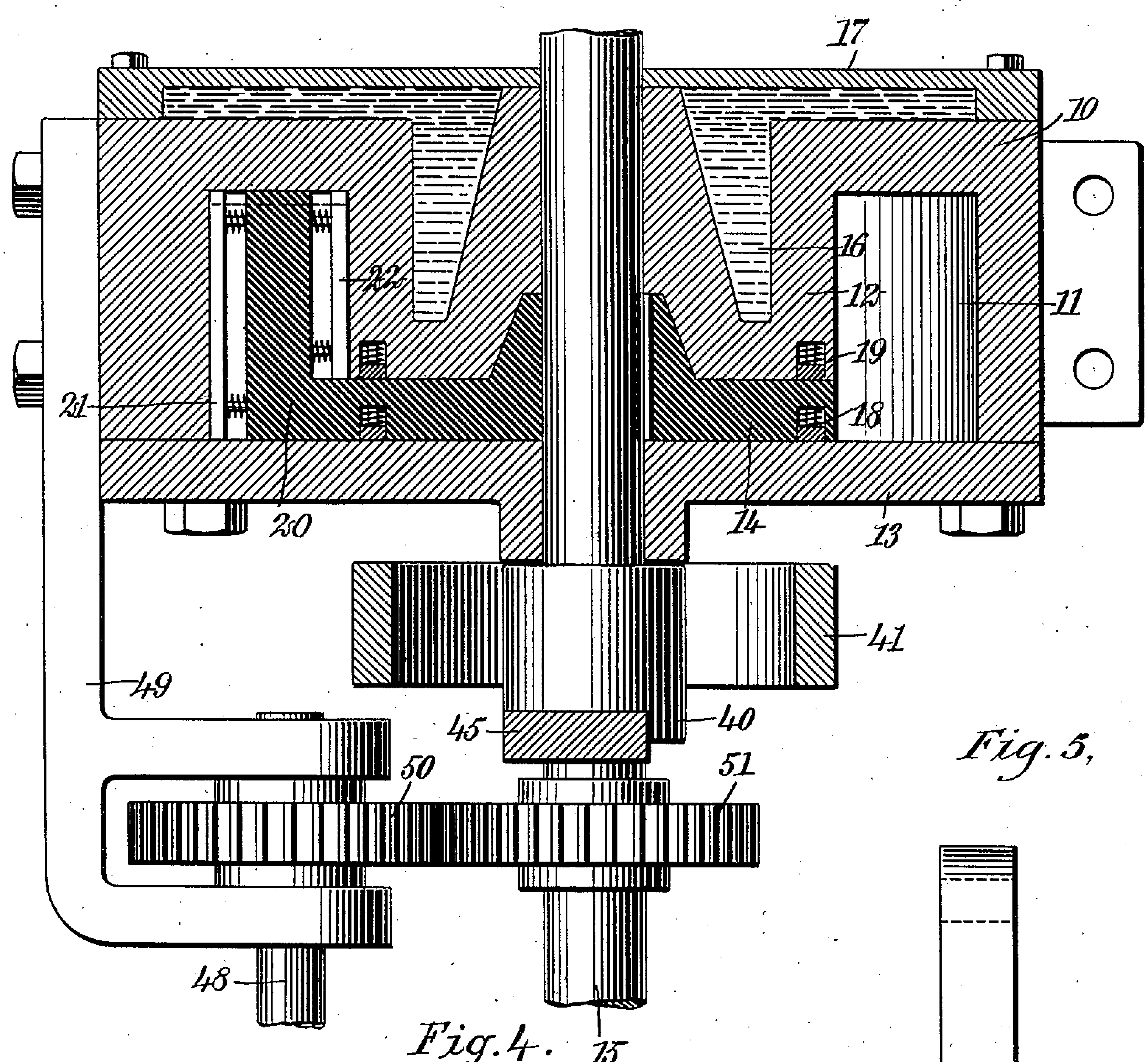


Fig. 4.

Fig. 5.

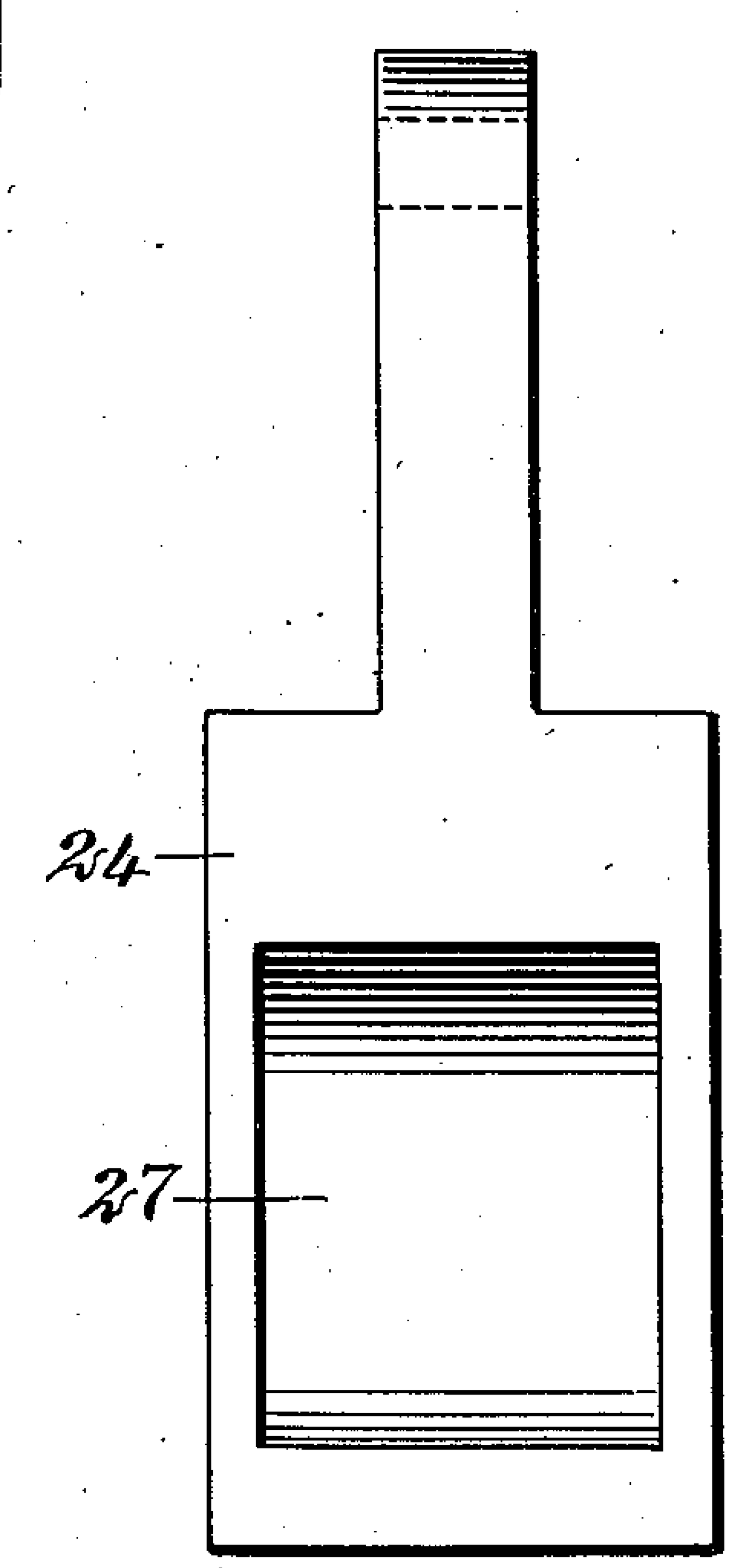
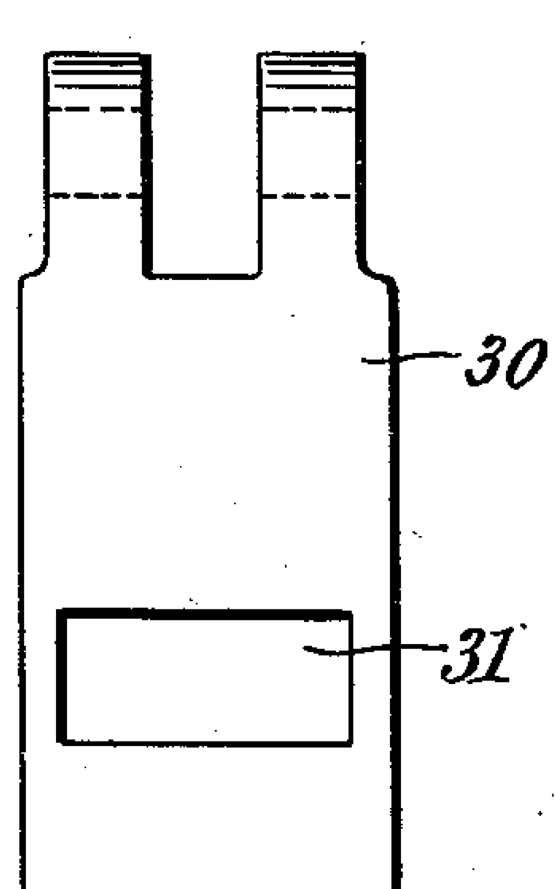


Fig. 6.



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C. W. Fairbank

INVENTOR

John Hokanson

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

JOHN HOKANSON, OF NEWARK, NEW JERSEY.

ROTARY INTERNAL-COMBUSTION ENGINE.

No. 880,453. Specification of Letters Patent. Patented Feb. 25, 1908.

Application filed May 7, 1907. Serial No. 372,384.

To all whom it may concern:

Be it known that I, JOHN HOKANSON, a citizen of the United States, and a resident of Newark, in the county of Essex and State of New Jersey, have invented a new and Improved Rotary Internal-Combustion Engine, of which the following is a full, clear, and exact description.

This invention relates to certain improvements in rotary internal combustion engines, and more particularly to that type of engine in which a separate explosion chamber is provided into which the fuel charge is compressed and from which it is admitted into the annular cylinder to expand against the piston therein upon the ignition of the charge.

One object of the invention is to provide an improved construction, whereby the sliding abutment also constitutes a valve for controlling the admission of the gas to the annular cylinder, and whereby the operation of this sliding abutment causes a simultaneous operation of a second valve controlling the admission of the explosive charge to the ignition chamber. Thus, the ignition chamber is normally out of communication with the supply and in communication with the interior of the engine, but the communication is established with the supply and is shut off from the engine at the time the piston is passing the sliding abutment.

A further object of the invention is to so construct the sliding abutment that the lateral pressure exerted thereon at the time of the explosion serves to more effectively seal the joint between said abutment and the rotating piston.

Other objects of the invention will be hereinafter set forth, and the specific construction of one embodiment of my invention described in detail.

The invention consists in certain features of construction and combination of parts, all of which will be fully set forth hereinafter and particularly 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 figures, and in which

Figure 1 is an end elevation of an engine embodying my invention; Fig. 2 is a view similar to Fig. 1, the end plate being removed and a portion of the main casing being broken away; Fig. 3 is a section on the line 3—3 of Fig. 1; Fig. 4 is a transverse section on the line 4—4 of Fig. 1; Fig. 5 is an elevation showing the combined abutment and inlet valve; and Fig. 6 is an elevation showing the inlet valve for the ignition chamber.

In my improved engine there is provided a suitable casing formed preferably of cast metal, and provided with an annular chamber hereinafter referred to as the "cylinder". Within the casing is a rotary member carrying a piston traveling within the cylinder and caused to move by the ignition of an explosive mixture intermediate the piston and a sliding abutment. This sliding abutment is also mounted upon the main frame or casing, and is provided with a passage whereby an ignition chamber may be placed in communication with the cylinder. As illustrated, the main frame or casing 10 is provided with an annular chamber 11 constituting the cylinder and extending inwardly from one open side of the casing. The portion of the casing within the annular member and forming the inner wall thereof, constitutes a cylindrical projection 12 of a depth somewhat less than the depth of the annular chamber 11, whereby when the chamber is closed by a face plate 13, a space is left for the piston-supporting wheel 14. This wheel is keyed or otherwise rigidly secured to a main shaft 15 journaled in the face plate 13 and in the central projecting portion 12 of the casing, as is most clearly illustrated in Figs. 3 and 4. The projection 12 forming the inner wall of the annular chamber or cylinder is preferably provided with an annular recess 16 upon the outer side thereof, which recess serves for the reception of cooling water. The outer wall of the casing is closed by a suitable plate 17 spaced from the casing save adjacent the edges of the plate, whereby water may be circulated in contact with approximately the entire wall of the casing.

Within the casing the annular chamber or cylinder is of considerably greater width than is the space between the central projection 12 and the plate 13, whereby not only the wall forming the end of the casing, but also the wall forming the inner surface thereof, may be cooled. The piston wheel 14 completely fills the space between the projection 12 and the face plate 13, and either the piston wheel or the walls adjacent the same are provided with packing rings to prevent the escape of the gases from the cylinder. As illustrated, the piston wheel 14 is provided with a packing ring 18 bearing against the face plate 13, while the projection 12 is provided with a packing ring 19 bearing against the piston wheel on the opposite side thereof from the packing 18. The piston wheel 14 is provided with a piston 20 which may be either integral therewith or rigidly secured thereto. The piston is preferably of greater thickness adjacent its connection to the wheel 14 than at its outer end, so as to materially strengthen and reinforce the same. The piston 20 carries a plurality of packing rings bearing against the walls of the cylinder. Two of these packings rings, 21 and 22, are oppositely disposed to each other and bear against the outer wall; a third packing ring 23 bears against the end wall of the casing.

At the upper portion of the casing and closely fitting therein, I provide a sliding abutment 24 movable into and out of the annular chamber to sub-divide the same into two compartments. This abutment does not extend radially in respect to the annular chamber or cylinder, but is set at a slight angle thereto, as illustrated in Fig. 2. The abutment carries packings 25 upon opposite edges thereof, which engage with the walls of the casing, and carries a suitable packing 26 engaging with the projection 12 forming the inner wall of the cylinder. The abutment is provided with a recess 27 in one face thereof, said recess serving to form a passage by which the ignition chamber 28 in the upper portion of the casing may be placed in communication with the cylinder. The recess is upon the side of the abutment which is off center to the greatest extent, whereby the gas pressure after having been admitted to the cylinder through the passage in the abutment and while tending to force the abutment laterally, brings the end of said abutment into more firm engagement with the wall of the cylinder and of the piston wheel 14.

The outer end of the abutment extends to the outside of the casing, and is connected to a link 29 serving to operate a second valve 30 which controls the admission of the explosive mixture to the ignition chamber 28. The valve 30 preferably comprises a sliding plate having a passage 31, through which the explosive mixture may pass from the supply conduit 32 to the ignition chamber 28. The link 29 is pivotally connected to the upper end of the valve plate 30 and to the upper end of the sliding abutment, and is mounted upon a suitable fulcrum 33 upon the upper end of the casing, whereby as the abutment 24 is moved outward the valve plate 30 is moved downward. The recess in the sliding abutment does not extend to the lower end thereof but terminates a short distance therefrom, whereby the lower end of the abutment serves to completely close the passage from the ignition chamber to the cylinder. When the abutment is in its outermost position, the valve 30 is moved to its inner position and the explosive mixture under pressure may pass into the chamber 28; while when the abutment is in its innermost position, as illustrated in Fig. 2, the valve plate 30 is in its outermost position, and the explosive mixture within the ignition chamber 28 may when ignited expand against the piston 20 to move the same. Any suitable means may be provided for igniting the mixture while in the ignition chamber 28, the specific means illustrated comprising a simple spark plug 34, although I preferably employ two such spark plugs which may either operate simultaneously, or one serve as a reserve in case either fails to operate. As the valve plate 30 and the abutment 24 move in substantially parallel planes, it is evident that sliding connection must be made with the ends of the link 29, such sliding connection being preferably formed by slots within which the pivots may move.

For operating the abutment, I preferably provide mechanism connected to the main drive shaft 15, and so constructed as to hold the abutment in engagement with the piston wheel during the larger portion of the revolution of said wheel, but to move the abutment out of the cylinder and to permit the passage of the piston when said piston approaches the abutment. As illustrated, I provide the side of the abutment 24 opposite to the recess or passage 27, with a series of gear teeth 35, whereby the rear side of said abutment constitutes a rack bar. Adjacent this rack bar, I provide a short shaft 36 rotatably mounted within the walls of the casing and having a gear wheel rigidly secured thereto and intermeshing with the rack bar. In the specific form illustrated, the shaft 36 cannot rotate through a complete revolution; therefore, it is only necessary to provide a curved segment 37 instead of a complete gear wheel. For oscillating the shaft, I secure thereto an arm 38 connected by a link 39 to mechanism operated by a cam 40 on the main drive shaft 15. This mechanism preferably comprises an annular member 41 surrounding the shaft 15 and cam 40, and adapted to be raised and lowered by the rotation of said shaft and cam, the annular member being held from rotation therewith by an arm 42 mounted on a pivot bolt 43 at one side of the casing. The annular member is preferably cylindrical in form, except at one side thereof which is flattened, the extent of the flattened portion being dependent upon the degree to which it is necessary to elevate the abutment and the length of time which said abutment remains open. The flattened side of the annular member is at the top thereof and the cam remains stationary during the major portion of each revolution of the shaft and cam, but when the outer portion of the cam which has been traveling along the curved surface reaches the flattened portion, the member is raised and the movement thus produced is imparted to the abutment to raise the same out of the cylinder. For more securely holding the annular member in its lowered position and to thus hold the abutment in engagement with the inner wall of the cylinder, I provide an outwardly extending lug 44 upon the annular member at the flattened side thereof and having a curved outer surface. Integral with the member forming the lug 40, I provide an arm 45 having an inwardly directed flange 46 adapted to engage with the outer surface of the projection 44 to normally prevent the annular member 41 from moving vertically. The flange becomes disengaged from the projection just before the lug engages with the flattened portion, thus liberating the annular member and permitting it to be raised to raise the abutment.

In the operation of my improved engine, a fuel charge is supplied under pressure through the conduit 32 to the ignition chamber 28 at the time that the valve plate 30 is lowered and the abutment raised. The lower end of the abutment closes the communication between the ignition chamber and the cylinder, and the charge may be forced into the ignition chamber at as great a pressure as may be desired. As soon as the piston reaches approximately the position indicated in Fig. 2, the cam 40 passes out of engagement with the flattened portion of the annular member 41, and the abutment is lowered and the valve plate 30 raised to place the ignition chamber in open communication with the cylinder. At this time, the explosive charge is ignited and the gases of combustion in pressing against the piston and the abutment, cause the rotation of the former.

Adjacent the abutment and upon the opposite side from the ignition chamber 28 there is provided an exhaust conduit 47, which preferably remains open at all times. The gas resulting from one explosion is forced outward through the exhaust conduit by the piston upon the next succeeding revolution. The speed of the engine may be controlled by controlling the timing of the spark, the maximum speed being attained when the gas is ignited as soon as possible after the abutment returns into engagement with the inner wall of the cylinder. Any suitable form of timer may be employed for controlling the sparking, such timer being preferably mounted upon a shaft 48 supported in a bracket 49 carried by the main frame. This shaft is provided with a gear wheel 50 intermeshing with a gear wheel 51 upon the main shaft, the gear wheels being of the same size, whereby the shaft 48 and the main engine shaft 15 rotate at the same speed.

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

1. A rotary engine, having an annular chamber, a piston operating therein, an explosion chamber, means for supplying a fuel charge thereto, an igniter within said explosion chamber, and a sliding abutment movable into said annular chamber and having a passage therethrough establishing communication between said annular chamber and said explosion chamber.

2. A rotary engine, having an annular chamber, a piston operating therein, an explosion chamber, an igniter mounted therein, and a sliding abutment movable into said annular chamber, said abutment having a recess in one face thereof to permit the passage of gas from the explosion chamber into the annular chamber when the abutment is in its innermost one of two limiting positions.

3. In a rotary engine, the combination of a casing having a curved working chamber, a rotatable piston operating therein, an explosion chamber, having an igniter therein, a conduit for supplying a fuel charge thereto, a sliding abutment movable into said working chamber, and means for simultaneously withdrawing said abutment and opening communication between said conduit and said explosion chamber.

4. In a rotary engine, the combination of a casing having a curved working chamber, a rotatable piston operating therein, a sliding abutment movable into said working chamber, an explosion chamber, an igniter therein, a sliding valve controlling the admission of fuel charge to said explosion chamber, and means for simultaneously withdrawing said abutment from the working chamber and opening said sliding valve.

5. In a rotary engine, the combination of a casing having a curved working chamber, a rotatable piston operating therein, a sliding abutment movable into said chamber, an explosion chamber, a slide valve controlling the admission of fuel charge thereto, a link connecting said abutment and said slide valve whereby the slide valve is opened upon the withdrawal of the abutment, and means operatively connected to the engine for moving said abutment.

6. In a rotary engine, the combination of a casing having a curved working chamber, a main shaft, a piston carried thereby and movable within said working chamber, a sliding abutment movable into said chamber and carrying a series of teeth upon one side thereof, a gear wheel in engagement with said teeth, and means operatively connected

to said shaft for oscillating said gear wheel to bring the abutment into and out of said chamber.

7. In a rotary engine, the combination of a casing having a curved working chamber, a shaft, a piston carried thereby and operating within said chamber, a sliding abutment having a rack bar carried thereby, a gear wheel in engagement with said rack bar, and means operatively connected to the shaft of the engine for oscillating said gear wheel.

8. In a rotary engine, the combination of a casing having a curved working chamber, a piston operating therein, a sliding abutment movably mounted in said chamber, an explosion chamber adjacent the working chamber, said sliding abutment having a recess in one side thereof adapted to establish communication between said chambers when said abutment is in its innermost position, and a rack bar upon the opposite side of said abutment from said recess for operating the abutment.

9. In a rotary engine, the combination of a casing having a curved working chamber, a piston movable therein, a sliding abutment extending into said working chamber and having packings upon opposite sides thereof, a recess in one face thereof, and a rack bar upon the opposite face, said recess adapted to serve as an inlet passage to said chamber, and means in engagement with said rack bar for moving said abutment longitudinally.

10. In a rotary engine, the combination of a main shaft, a casing having a curved working chamber, a piston operating therein, a sliding abutment having a rack bar carried thereby, a gear wheel in engagement with said rack bar, a cam upon the main shaft of the engine, and means operated by said cam for intermittently rotating said gear wheel in opposite directions.

11. In a rotary engine, the combination of a casing having a curved working chamber, a piston operating therein, a main shaft, a sliding abutment and means operated by said shaft for intermittently moving said abutment, said means comprising a cam carried by said main shaft, an annular member surrounding said cam and having a curved surface and a flattened surface, a pivoted arm secured to said annular member and adapted to prevent the rotation thereof, a link connecting the said annular member and operating means in engagement with said sliding abutment and adapted to be oscillated by said link.

12. In a rotary engine the combination of a casing having a curved working chamber, a piston operating therein, a main shaft, a sliding abutment and means operated by said shaft for intermittently moving said abutment, said means comprising a cam carried by said main shaft, an annular member surrounding said cam and adapted to be intermittently raised thereby, a locking means carried by said cam for normally preventing the raising of said annular member, and means secured to said member and in engagement with said sliding abutment for intermittently raising the latter.

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

JOHN HOKANSON.

Witnesses:
CLAIR W. FAIRBANK,
EVERARD B. MARSHALL.