

No. 832,480.

PATENTED OCT. 2, 1906.

P. H. HENDRICKSON.

ROTARY ENGINE.

APPLICATION FILED JULY 18, 1906.

3 SHEETS—SHEET 1.

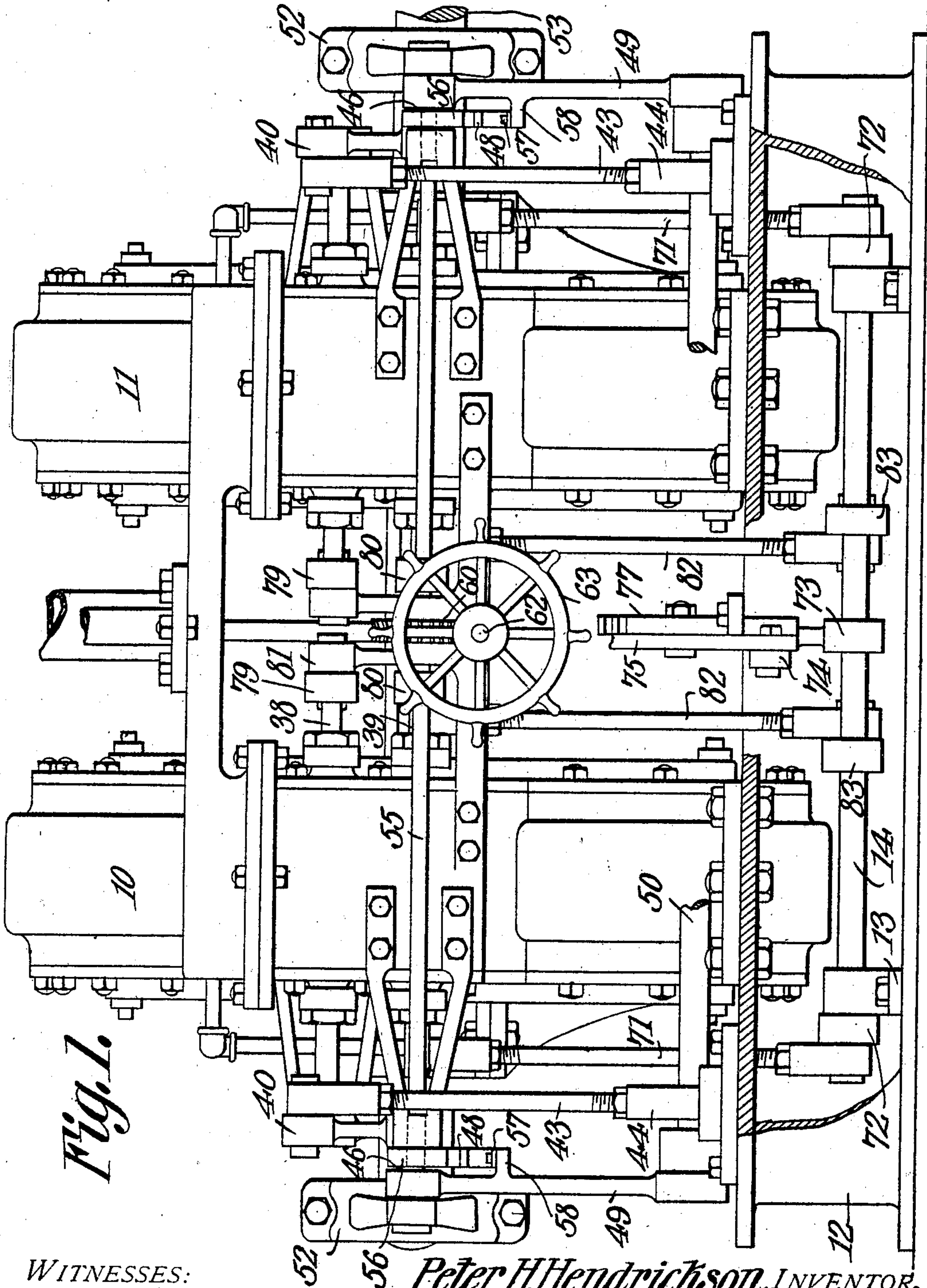


Fig. 1.

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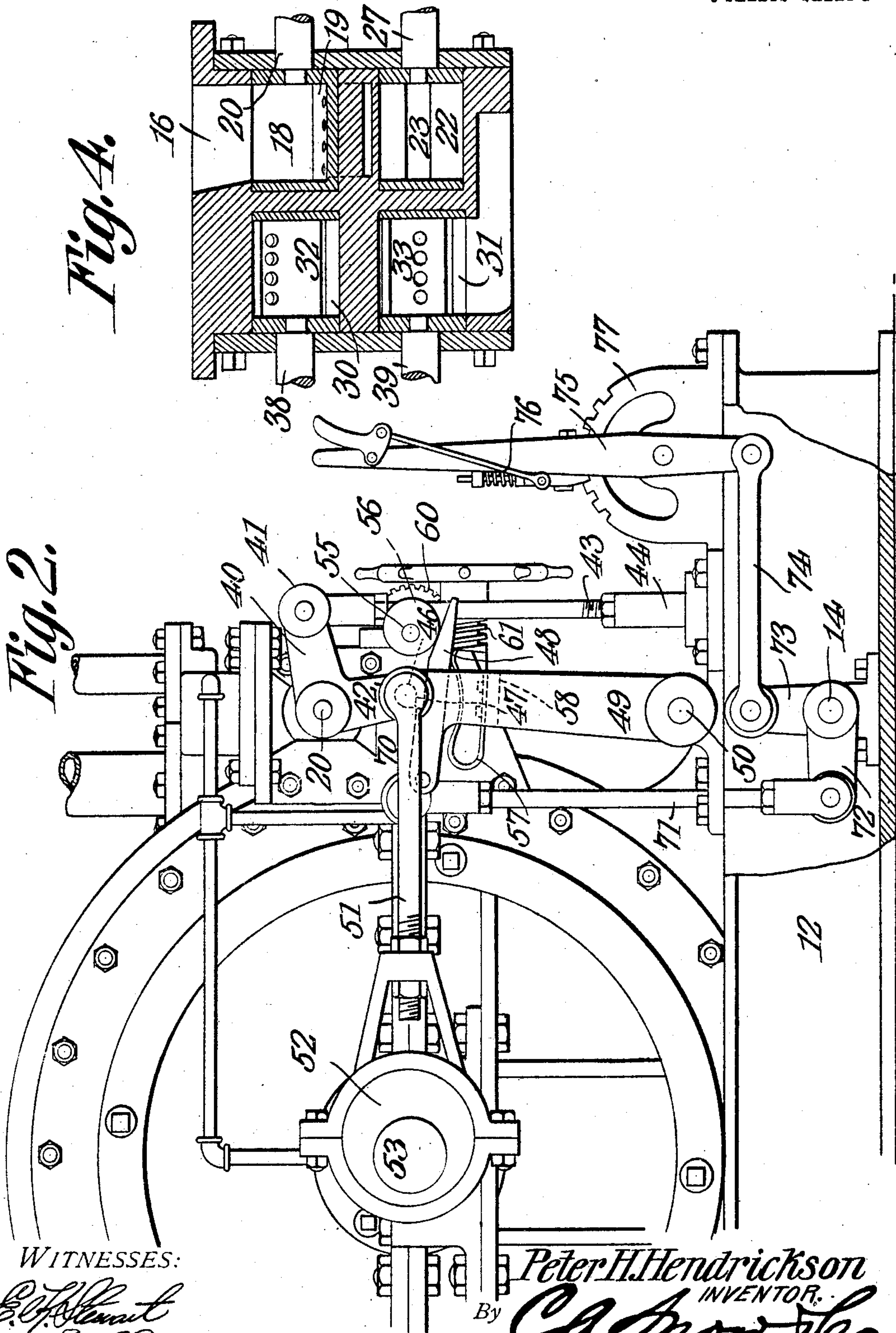
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3 SHEETS—SHEET 3.

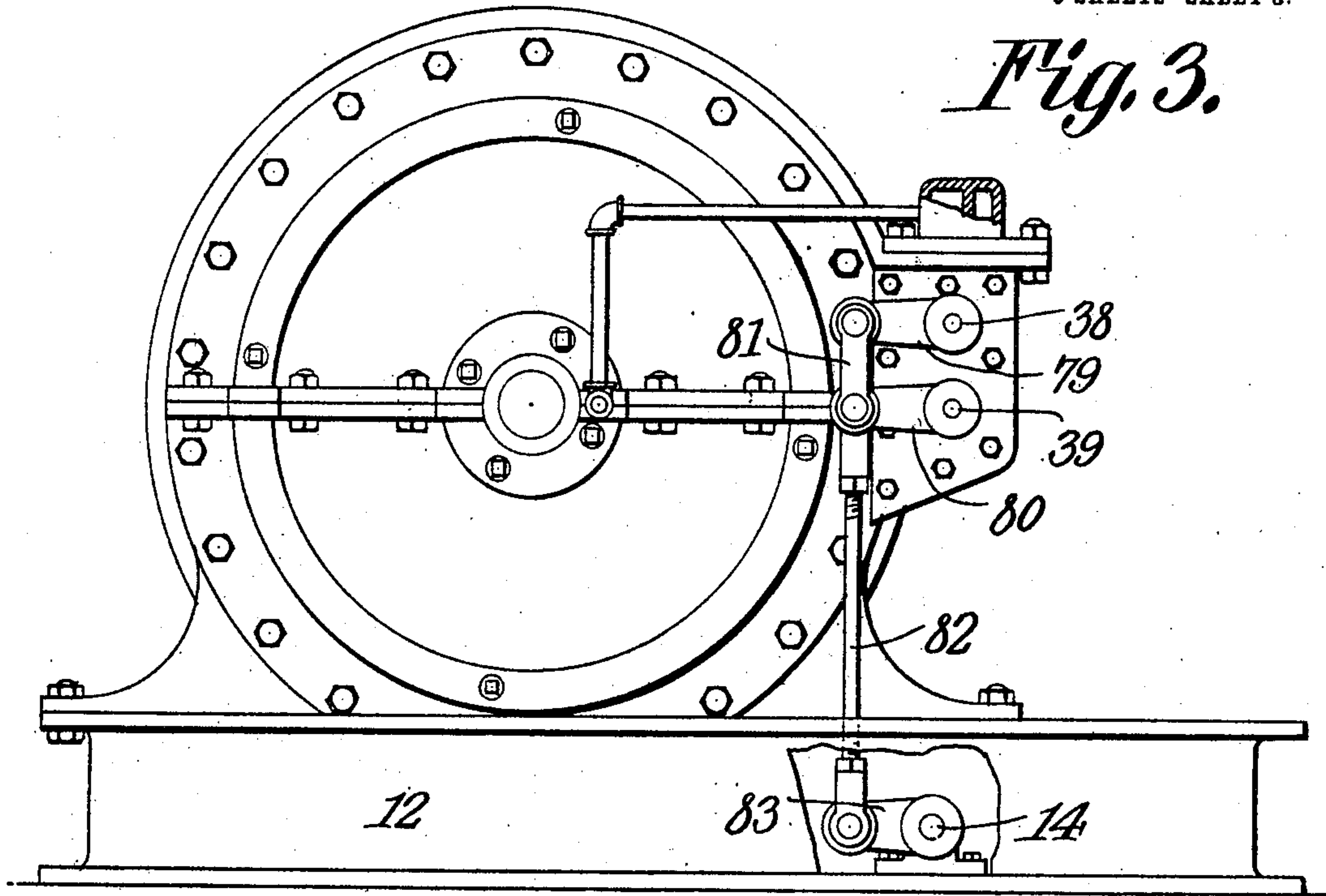


Fig. 3.

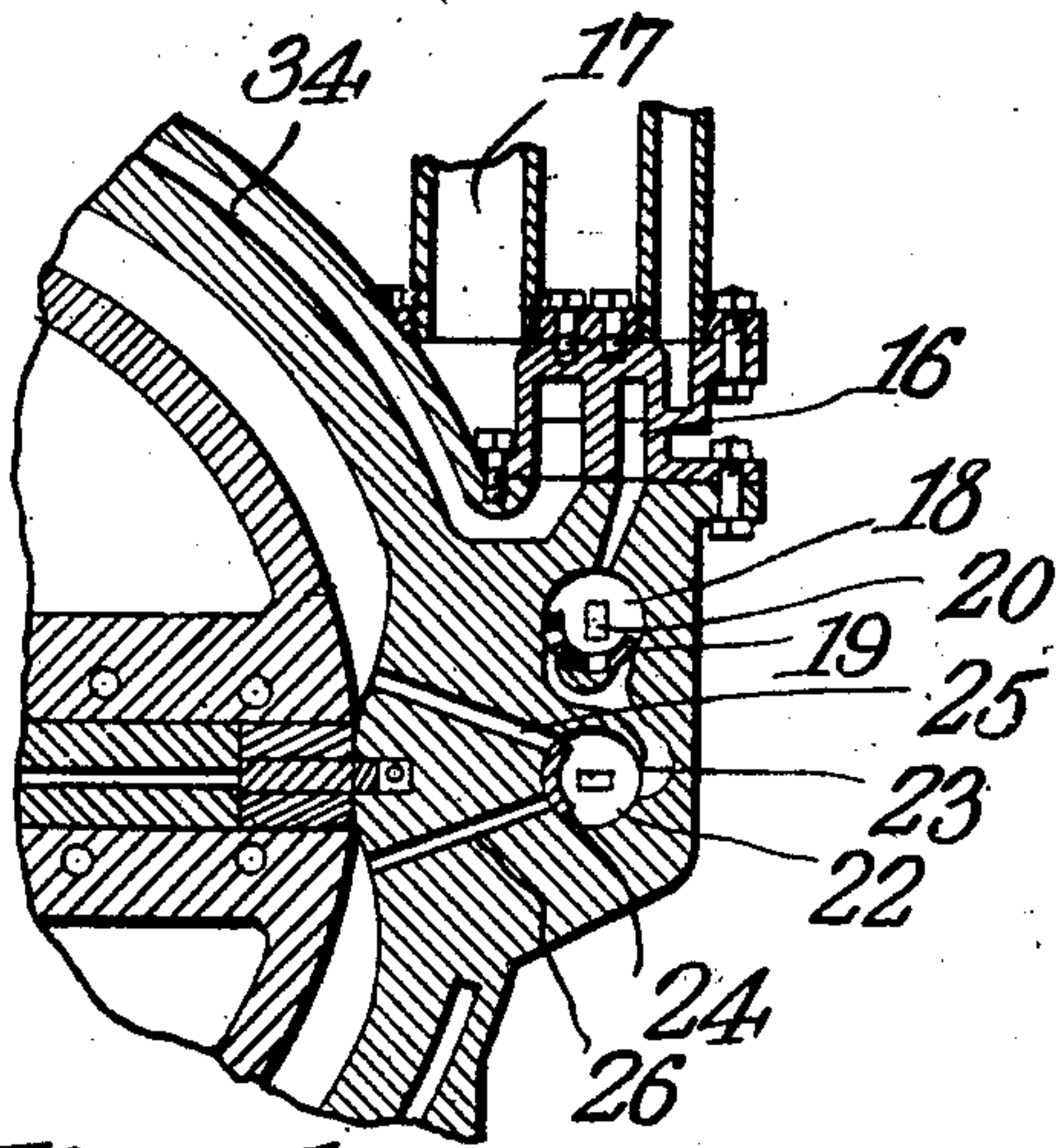


Fig. 5.

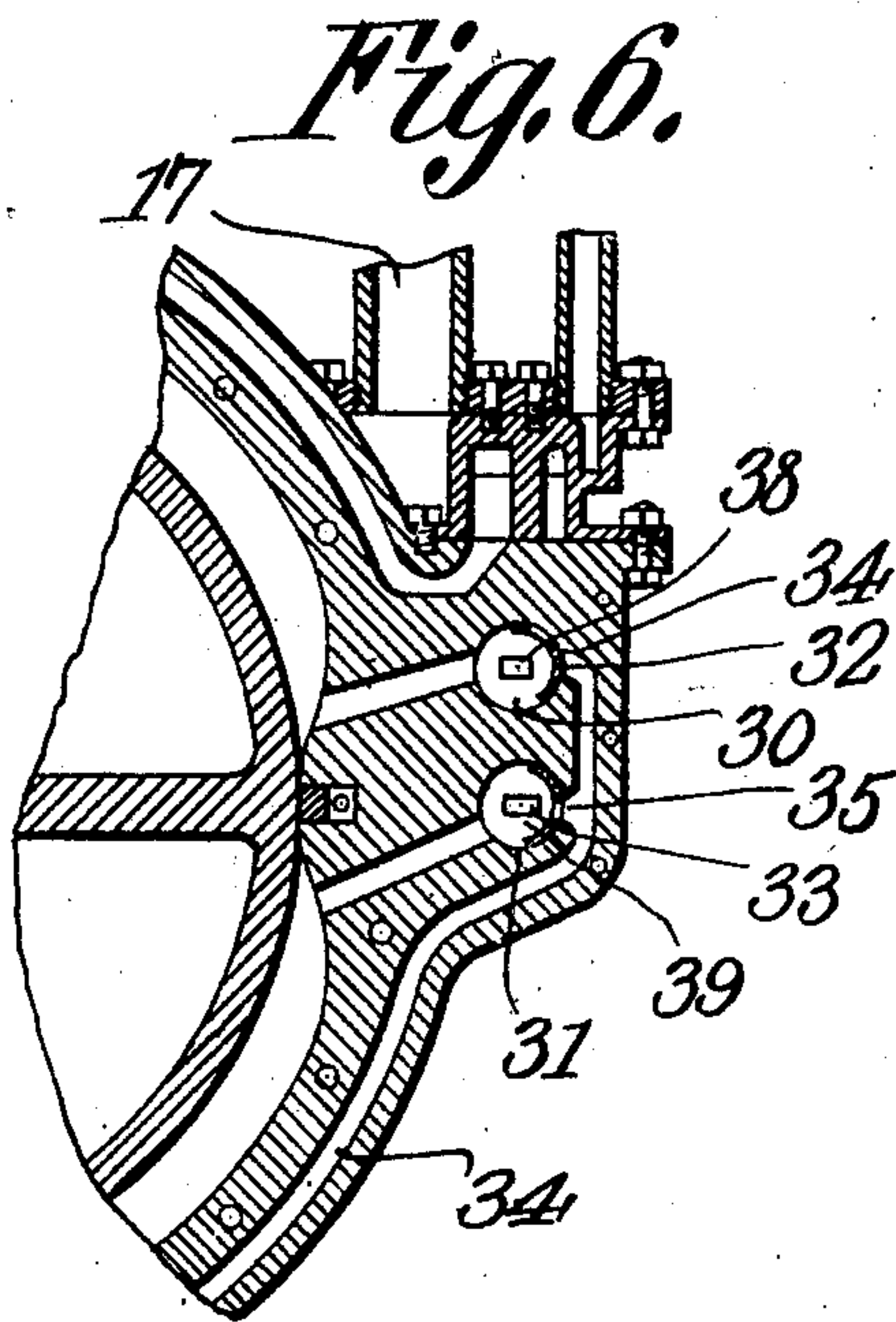


Fig. 6.

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UNITED STATES PATENT OFFICE.

PETER H. HENDRICKSON, OF SKIBO, MINNESOTA.

ROTARY ENGINE.

No. 832,480.

Specification of Letters Patent.

Patented Oct. 2, 1906.

Application filed July 18, 1906. Serial No. 326,771.

To all whom it may concern:

Be it known that I, PETER H. HENDRICKSON, a citizen of the United States, residing at Skibo, in the county of St. Louis and State of Minnesota, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to rotary engines, and has for its principal object to provide a novel form of valve-operating gear by which the opening and closing of the inlet-valves may be accurately controlled, the parts being so arranged as to permit a comparatively wide range of adjustment of the point of cut-off.

A further object of the invention is to provide a valve-gear of compact construction which may be readily adjusted and which will permit the ready reversal of the direction of rotation of the engine.

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 herein after 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 front elevation of a two-cylinder rotary engine constructed in accordance with the invention. Fig. 2 is an end elevation of a portion of the same. Fig. 3 is a detail view showing more particularly the arrangement of the reversing apparatus and its connections. Fig. 4 is a detail sectional view taken in the vertical plane of the inlet and exhaust valve stems. Figs. 5 and 6 are detail sectional views taken in vertical planes at right angles to the plane of Fig. 4 and respectively through the inlet and exhaust valve chambers.

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

The two cylinders 10 and 11 are mounted on a suitable bed-plate 12, which preferably is in the form of a hollow casting and is provided with bearings 13 for the reception of a reversing-shaft 14. Each of the cylinders is provided with a steam-inlet port 16 and a

steam-exhaust port 17, the inlet-port communicating with a chamber 18, containing a cut-off valve 19, that is provided with a spindle 20, extending to the outside of the cylinder. Below the inlet-valve chamber is a reversing-valve chamber 22, that is in constant communication with the inlet-valve chamber through a port 23. In the chamber 22 is a reversing-valve 24, this valve controlling two ports 25 and 26, through either of which the steam under pressure may be directed for the purpose of operating the revoluble piston, the other port remaining closed. This reversing-valve is provided with an operating-stem 27, that also extends to a point outside the cylinder.

Arranged in alinement with the inlet and reversing valve chambers are two exhaust-chambers 30 and 31, containing valves 32 and 33, respectively, each valve being preferably in the form of an arcuate plate having a plurality of openings through which the steam may pass to an exhaust-channel 34, which preferably extends completely around the circular walls of the cylinder and is connected at its opposite end to the steam discharge or exhaust 17. These two exhaust-valves control the outflow of steam from the cylinder through ports 34 and 35, and when one of the valves is moved to open position the other is moved to closed position and will be retained in this closed position by the working pressure of steam within the cylinder. These valves are provided with connecting-stems 38 and 39, respectively, the stems extending to a point outside the wall of the cylinder.

Keyed to the outer end of each cut-off-valve stem 20 is secured a bell-crank lever 40, having two arms 41 and 42, the approximately horizontal arm 41 being connected by an adjustable rod 43 to the piston or plunger of a dash-pot 44, the function of which is to turn the valve to closed position after each opening movement. The approximately vertical arm 42 of the bell-crank lever carries a projecting pin 46, having an annular edge 47, which may engage with the shoulder of an operating-pawl 48. This pawl is carried by a rocker-arm 49, that is carried by a rock-shaft 50, mounted in suitable bearings on the bed-plate. Each of the rocker-arms 49 is adjustably connected by a rod 51 to the strap of an eccentric 52, mounted on the main shaft 53 of the engine, and during each out-

stroke of the eccentric—that is to say, during movement toward the position shown in Fig. 2—the pawl 48 will engage the pin 46 and will rock the bell-crank lever and the valve-stem, thereby moving the inlet-valve 20 to the open position.

Extending transversely across the front of the engine is a cam-shaft 55, held in suitable bearings on the engine or its frame and carrying a pair of cams 56, one cam for each of the pawls 48. The pawls are inclined at their inner ends and are normally held up in operative position by small springs 57, that are carried by flanges 58, projecting from the rocker-arm 49. The inclined forward end of each pawl will engage with its cam 56 and in so doing will be gradually depressed, being moved downward until its shoulder is out of engagement with the pin 46, whereupon the dash-pot is free to move the valve back to the closed position. By turning the cams the point of cut-off may be accurately adjusted, the cam acting sooner or later to effect disengagement of the pawls in the manner described.

At a point about midway of the length of the cam-shaft 55 is a worm-wheel 60, which is engaged by a worm 61, the latter being carried by a small shaft 62, having at its outer end a hand-wheel 63, which may be turned for the purpose of adjusting the position of the cams and so adjusting the point of cut-off.

The stem 27 of the reversing-valve carries a rocker-arm 70, which is connected by a rod 71 to a rocker-arm 72 on the reversing-shaft 14, and at a point about midway of the length of the shaft 14 is an arm 73, that is connected by a link 74 to a lever 75, the latter being provided with a locking-bolt 76 of the ordinary type for engagement with a notched segment 77. By moving this lever in one direction or the other the position of the reversing-valve may be shifted and the direction of rotation of the engine reversed.

Where the reversing-valve is shifted, it is also necessary to shift the positions of the two exhaust-valves, and for this purpose the stems 38 and 39 of said valves are provided with rocker-arms 79 and 80, respectively, the outer ends of these arms being coupled by a link 81. The arm 80 is connected by a link 92 to a rocker-arm 83 on the reversing-shaft, and when the latter is turned for the purpose of reversing directions of rotation of the engine the exhaust-valves are also shifted in order that the exhaust-steam may pass from the cylinder at the proper side of the abutment.

I claim—

1. The combination with a rotary engine, having an oscillatory cut-off valve, of a rocker-arm, an eccentric to which the arm is connected, a shouldered pawl carried by the arm, said pawl having an inclined face at its free end, a valve-stem, a rocker-arm carried thereby, a pin or lug projecting from the rocker-arm, and in the path of the shouldered pawl, and an adjustable cut-off-controlling pin arranged to be engaged by the inclined end portion of said pawl.

2. The combination with an oscillatory cut-off valve, of a stem carrying the same, a rocker-arm on the stem, a lug projecting from the stem, a shouldered pawl arranged to engage said lug and provided with an inclined face on its free end, a pawl-carrying rocker-arm, means for operating the same, a cam-shaft, a cam mounted thereon and disposed in the path of movement of the inclined face of the pawl and means for turning the cam-shaft to adjust the position of the cam with respect to the pawl and thus determine the point of cut-off.

3. The combination with an oscillatory cut-off valve, of a stem carrying the same, a bell-crank lever on the stem, a lug projecting from one arm of the lever, a rocker-arm, means for adjusting the same, a pawl carried by the rocker-arm and having a shoulder for engaging the lug, the free end of said pawl having an inclined face, a cam-shaft, a worm-wheel thereon, a worm engaging said worm-wheel, means for controlling the worm, a cam carried by the shaft and disposed in the path of movement of the inclined surface of the pawl, a lug projecting from the rocker-arm, a spring carried by said lug and tending to hold the pawl in operative position, and a dash-pot, the plunger of which is connected to the second arm of said bell-crank lever.

4. In a rotary engine, a cylinder, a piston therein, a cut-off valve, means for controlling the same, a reversing-valve, a pair of exhaust-valves, the cylinder having independent chambers for the several valves, a rock-shaft, rocker-arms carried thereby, and means for connecting the rocker-arm to the reversing-valve and to both of the exhaust-valves.

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

PETER H. HENDRICKSON.

Witnesses:

EDWARD M. GAYLORD,
GEORGE N. GILMAN.