No. 859,474. PATENTED JULY 9, 1907.

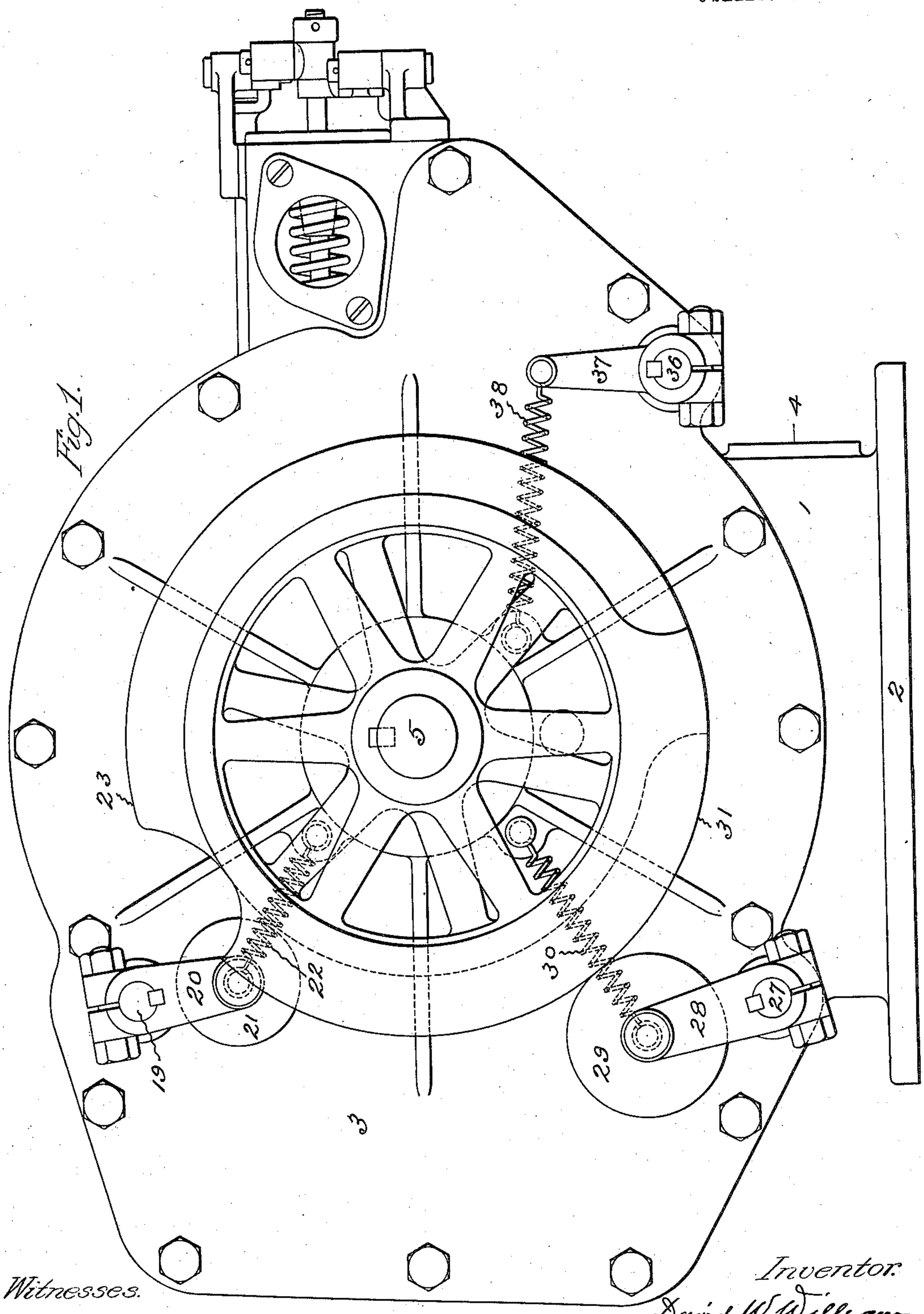
D. W. WILLIAMS.

ROTARY GAS ENGINE.

APPLICATION FILED JUNE 29, 1905.

5 SHEETS—SHEET 1.

Fig. 1.



Witnesses.

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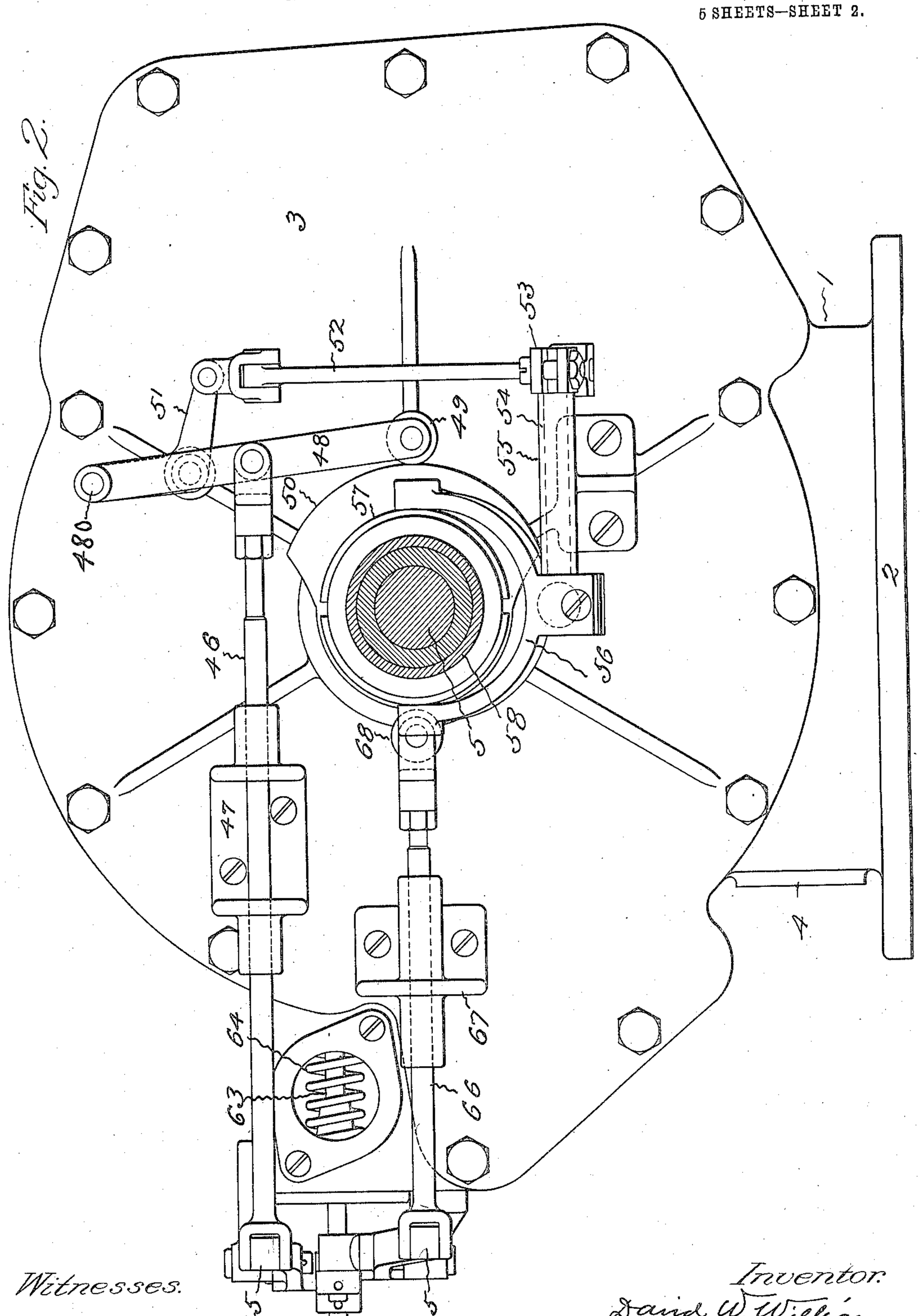
5 SHEETS—SHEET 2.

Fig. 2.



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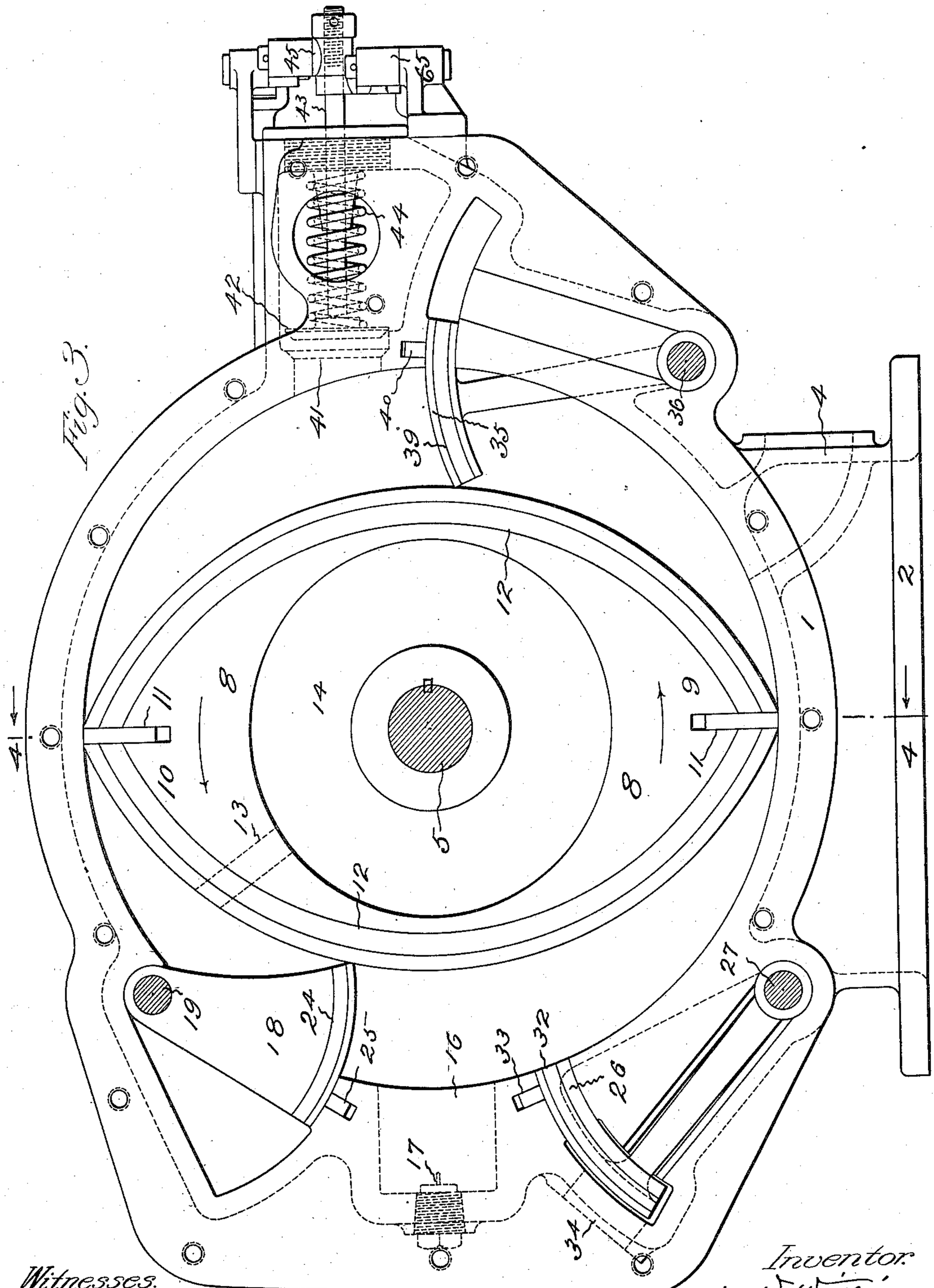
5 SHEETS—SHEET 3.

Fig. 3.



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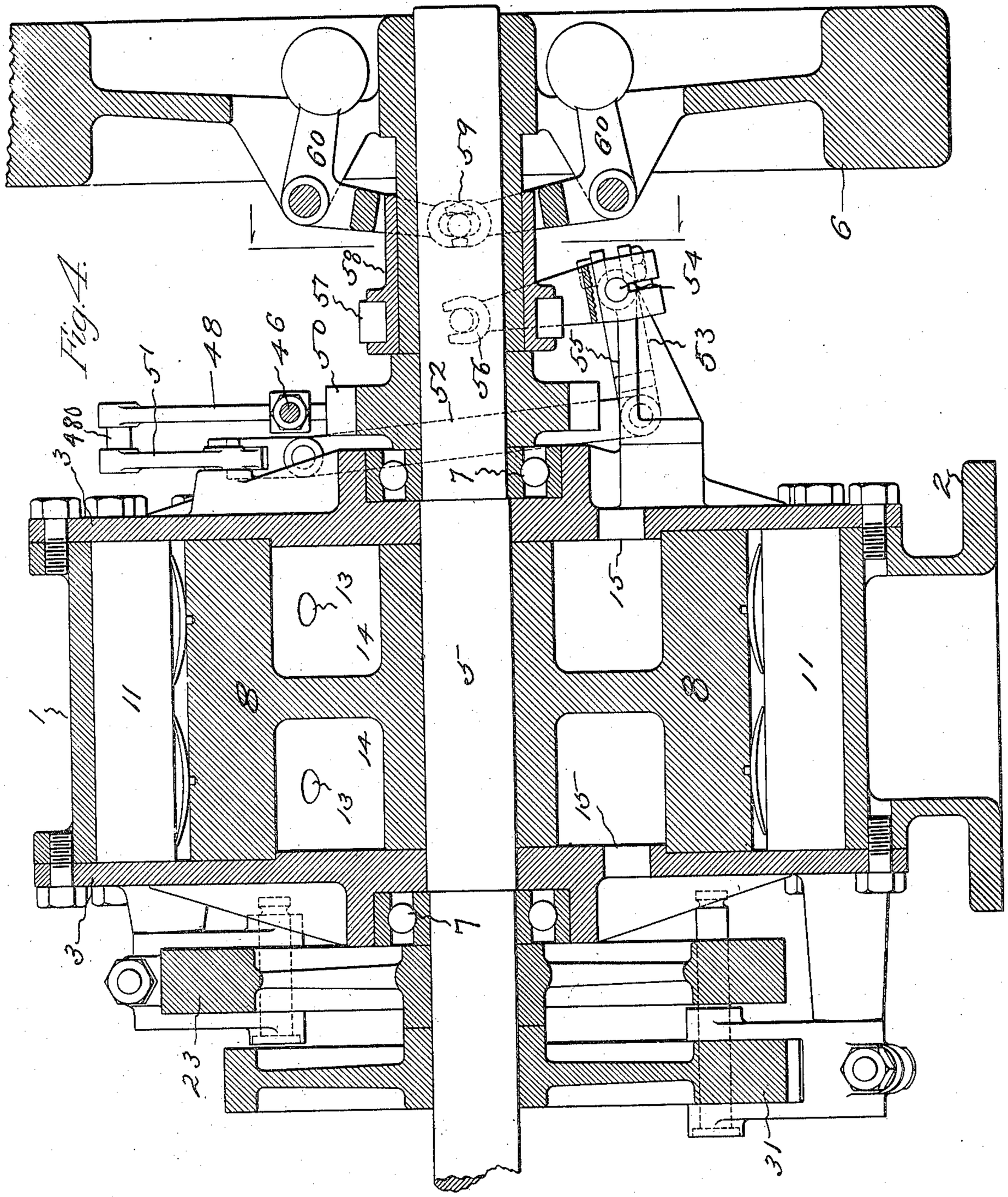
5 SHEETS—SHEET 4.

Fig. 4.



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5 SHEETS—SHEET 5.

Fig. 7.

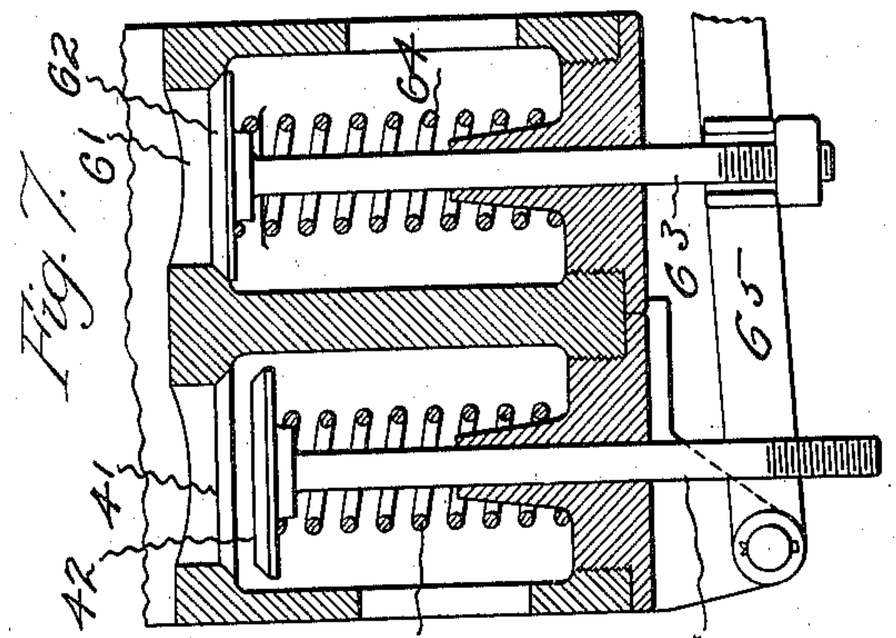


Fig. 6.

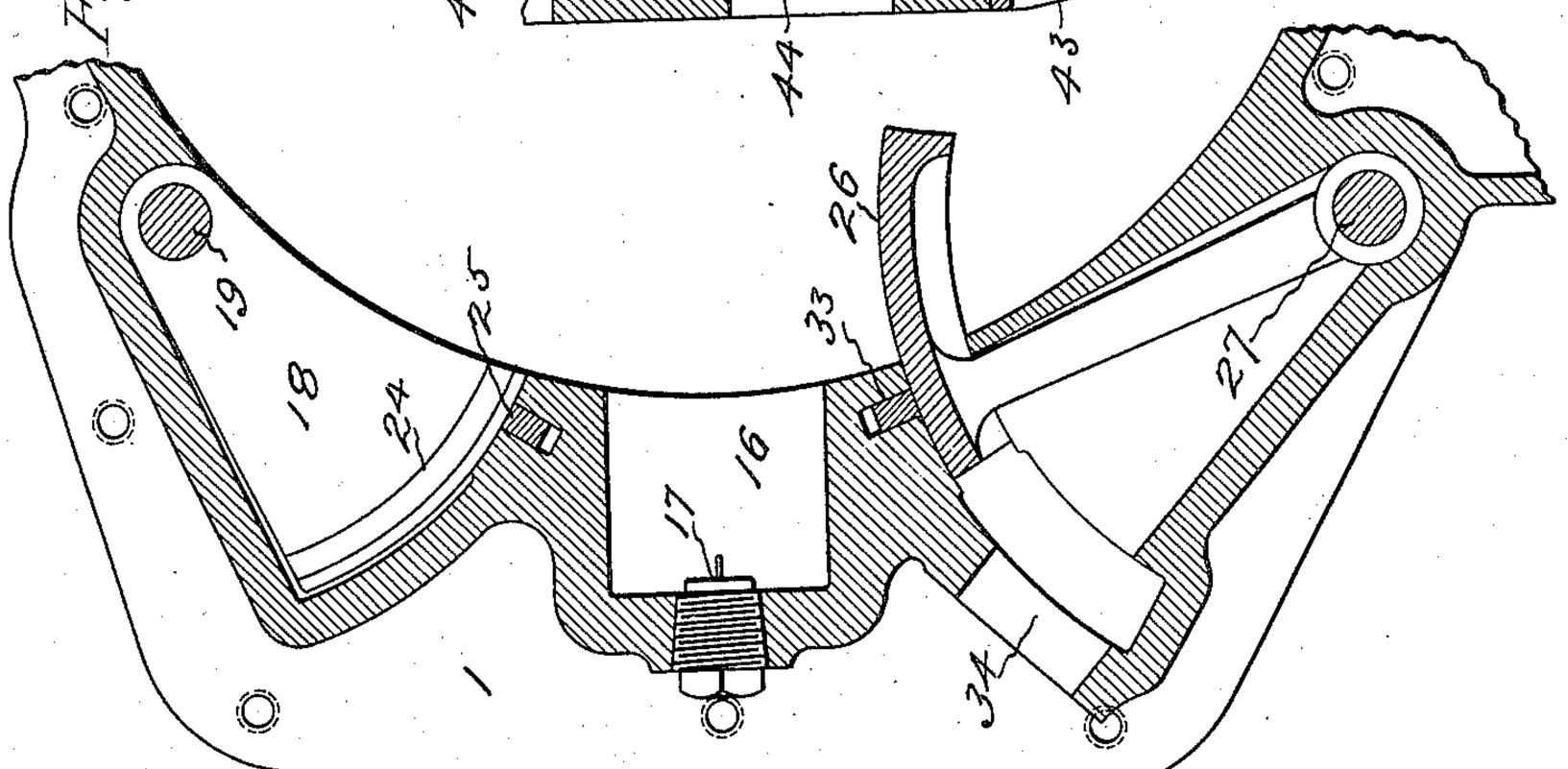
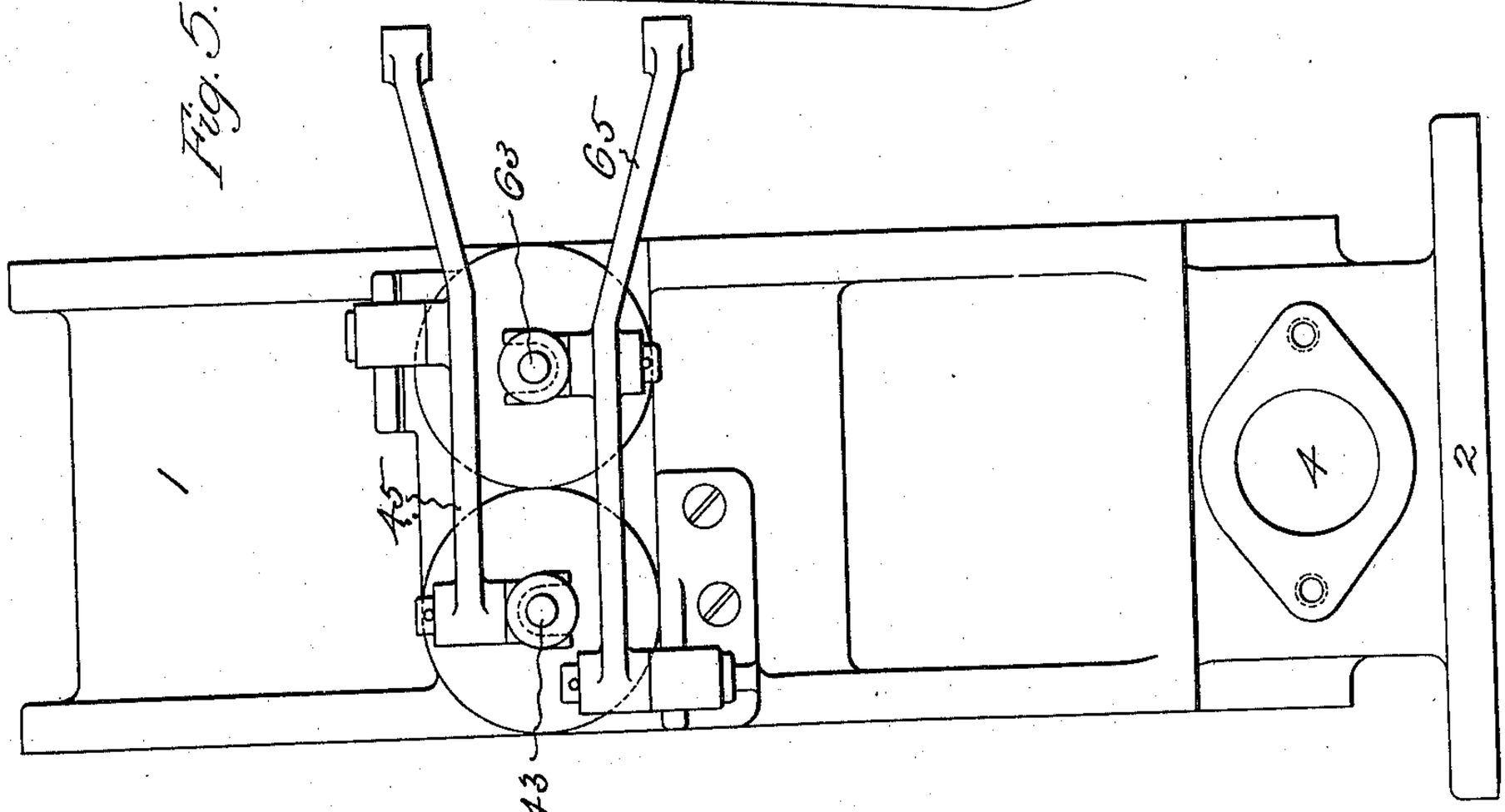


Fig. 5.



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UNITED STATES PATENT OFFICE.

DAVID W. WILLIAMS, OF GLASTONBURY, CONNECTICUT.

ROTARY GAS-ENGINE.

No. 859,474. Specification of Letters Patent. Patented July 9, 1907.

Application filed June 29, 1905. Serial No. 267,640.

To all whom it may concern:

Be it known that I, DAVID W. WILLIAMS, a citizen of the United States, residing at Glastonbury, in the county of Hartford and State of Connecticut, have invented a new and useful Rotary Gas-Engine, of which the following is a specification.

This invention relates to an engine in which the explosion of gasolene, naphtha, kerosene or other light hydrocarbon fluid properly mixed and volatilized is utilized to drive a rotatory piston.

The object of this invention is to provide a simple, compact and efficient engine in which gas is exploded against a rotatory piston which is arranged to cause the inflow and compression of the gas before explosion and the outflow of the spent gas after explosion, and to effect the opening and closing of swinging compression and explosion abutments whereby the gas may be compressed and the explosion directed against the piston, and the opening and closing of the valves which permit the inflow of the explosive gas and of the vitalizing and cooling air.

The engine which is illustrated has a casing with a cylindrical piston chamber containing a piston and a pair of oppositely facing swinging abutments which move into and out of the piston chamber in co-operation with the piston, one abutment holding the gas while it is being compressed by the rotation of the piston and the other abutment retaining the gas under compression and receiving the shock of explosion in such manner that the maximum explosive energy of the gas is exerted against the piston. The rotatory piston is elliptical, its periphery being shaped to co-operate smoothly with the abutments which bear against it and its major diameter being such that the ends closely fit the peripheral wall of the piston chamber. The gas is drawn in back of the cleaning end of the piston and compressed in front of the explosion end of the piston and the fresh or vitalizing air is drawn in back of the explosion end of the piston and driven out with the spent gas after the explosive effect has been utilized in front of the cleaning end of the piston.

The engine shown has one explosion chamber and is only designed to have one explosion during each rotation of the piston but of course the explosion chambers could be multiplied and there could be more than one explosion during each rotation of the piston without departing from the invention.

Figure 1 of the accompanying drawings shows an elevation looking at one side of an engine that embodies the invention. Fig. 2 shows an elevation of the same engine looking at the other side with the fly wheel and the governor omitted. Fig. 3 shows an elevation with the face plate removed in order to show the interior. Fig. 4 shows a vertical section through the center of the engine taken on the plane 4—4 looking in the direction indicated by the arrows on Fig. 3. Fig. 5 shows a view looking at one edge of the engine with the face plates omitted. Fig. 6 is a section showing the swinging explosion and compression abutments. And Fig. 7 is a section showing the air and gas valves.

The casing 1 may have any desired contour and may be mounted on any suitable form of base 2. Face plates 3 are fastened to the sides of the casing so as to inclose the cylindrical piston chamber and the valve pockets. An exhaust opening 4 is made through the casing above the base to permit the outflow of gas from the piston chamber.

The shaft 5 having an ordinary fly wheel 6 is preferably supported by ball bearings 7 arranged in recesses in hubs formed on the face plates.

The piston 8 which is elliptical is keyed to the shaft. The ends 9 and 10 of the major diameter of the piston travel close to the peripheral wall of the cylindrical piston chamber and the side surfaces of the piston travel close to the inner sides of the face plates which form the side walls of the piston chamber. The ends of the piston are preferably provided with packings 11 which keep tight the joints between the piston and the peripheral wall of the piston chamber, and packing strips 12 are preferably arranged in the side faces of the piston in order to insure tight joints between those faces and the side walls of the piston chamber. Passages 13 are made through one wall of the piston to permit communication between the piston chamber and the annular chambers 14 in the piston. Openings 15 are made through the face plates to provide communication between the central chambers in the piston and the outer atmosphere.

At one side of and opening into the piston chamber is an explosion chamber 16. In this chamber is a gas igniter, preferably a common electric spark plug 17, by means of which the gas under pressure is exploded at the proper time for driving the piston.

Above the explosion chamber in the form of engine shown and movable into and out of the piston chamber is the explosion abutment 18. This is preferably an oscillatory abutment mounted on a spindle 19 that extends through the face plate and on the outside is provided with an arm 20 carrying a roll 21. A spring 22 holds the arm with the roll against the edge of a cam 23. This cam is mounted upon the shaft and its rotation causes the explosion abutment at the proper time to be drawn back out of the piston chamber into its pocket, the spring normally tending to draw the abutment out of the pocket so that its edge rests against the periphery of the piston. The inner face of this abutment is

formed on an arc of the same circle as the periphery of the piston chamber so that when the abutment is drawn back into its pocket the inner face will form a part of the cylindrical wall of the piston chamber, and the lower face is formed on the arc of a circle the center of which is coincident with the axis of the spindle. Packing strips 24 are arranged on the side faces of this abutment to insure tight joints between the face plates and the side faces of the abutment and a packing 25 is arranged in the casing to insure a tight joint between the casing and the lower face of this abutment.

Below the explosion chamber is the compression abutment 26 which moves in and out of a pocket in the casing. This abutment is preferably oscillatory and is fastened to a spindle 27 which extends through the face plate and on the outside has an arm 28 which bears a roll 29 that is by a spring 30 held against the edge of a cam 31. This cam is mounted on the shaft and its rotation draws this abutment at the proper time back into its pocket. The spring tends to draw the abutment out of the pocket so that its edge will rest against the periphery of the piston. Packing strips 32 are arranged on the side faces of this abutment to form tight joints between the face plates and the side faces of the abutment and a packing 33 is arranged in the casing to form a tight joint between the upper curved face of this abutment and the casing. The inner end of this abutment is so shaped that when the abutment is drawn back into its pocket the pocket is entirely shut off from the piston chamber but when the abutment is moved out of its pocket, as shown in Fig. 6, air can pass back of the abutment around the stem, from the pocket into the piston chamber. An opening 34 is left in the casing for the free flow of air into and out of this pocket.

On the other side of the casing and movable into and out of the piston chamber is the check abutment 35. This abutment is preferably oscillatory and is attached to a spindle 36 that extends through the face plate and on the outside has an arm 37 that is drawn toward the center by a spring 38. This spring tends to keep the abutment closed with its inner edge resting against the periphery of the piston. Packing strips 39 are arranged on the side faces of this abutment to insure tight joints between the face plates and the side faces of the abutment and a packing 40 is arranged in the casing to insure a tight joint between the curved upper end of the abutment and the casing.

Gas is admitted to the piston chamber through the port 41 that is closed by a valve 42 attached to a spindle 43 about which is a spring 44 that tends to keep the valve closed (Fig. 7). The gas valve spindle extends through the casing and is connected with a lever 45 which is hinged to one end of a rod 46 that is supported by a bracket 47 attached to the face plate. The other end of this rod is jointed to a link 48 that at one end bears a roll 49 that runs in contact with the edge of a cam 50 on the shaft. The other end of this link is pivotally connected by a pin 480 with an angle lever 51 that by a link 52 is connected with an arm 53 on one end of a shaft 54 that is supported by a bracket 55 fastened to the face plate. Attached to the other end of the shaft 54 is a yoke 56 which embraces and is loosely connected with a collar 57 that is movable on the sleeve 58 on the hub of the fly wheel. Engaged with this sleeve are the forks 59 of the weighted governor levers 60. (Figs. 2, 4.)

The rotation of the cam 50 oscillates the link 48 and through the rod 46 and lever 45 at the proper time opens the valve which controls the gas inlet. If the fly wheel is rotating too fast and too much gas is being admitted the weighted governor levers draw out the sleeve and this through the yoke, shaft, arm, link, and lever rocks the link 48 on the joint which connects it with the rod 46 so that its roll will be moved away from the cam. When this link is in this position the cam does not open the valve which controls the gas inlet and thus the flow of gas will be cut off until the speed of the fly wheel drops to normal.

Air is admitted to the piston chamber through the port 61 which is controlled by the valve 62 on the stem 63 of which is a spring 64 which tends to keep the valve closed. This valve stem extends through the casing and on the outside is connected with a lever 65 which is jointed to the outer end of a rod 66 that is supported by a bracket 67 fastened to the face plate. The inner end of this rod bears a roll 68 which runs in contact with the cam 50. As the rolls connected with the gas and air valves are diametrically opposite the shaft and run against the same cam the gas valve and air valve are operated to open and close their respective ports alternately (Figs. 2, 7).

The cams are so timed and the valve connections so made in the engine shown in the drawings, that the gas valve is opened at about the time the explosion end 9 of the piston reaches the compression abutment 26 and remains open until just before the explosion end reaches the gas inlet port, at which time the gas valve closes. During this interval the forward movement of the cleaning end 10 of the piston draws gas back of it into the piston chamber. After the gas valve is closed the forward movement of the explosion end 9 of the piston causes a compression of the gas in the piston chamber between the front face of the explosion end of the piston and the face of the compression abutment 26 which moves in against the periphery of the piston just before the cleaning end reaches it so that no gas can escape past it. This compression continues until the explosion end of the piston reaches the explosion chamber and then as the explosion end passes the explosion chamber, the gas which is compressed between the front face of this end of the piston and the compression abutment escapes around this end of the piston to the back side of the piston. The gas is still compressed back of this end of the piston for the explosion abutment 18 closes against the periphery of the explosion end of the piston just as it passes and prevents the escape of any gas backward. As the explosion end of the piston reaches the compression abutment and is at practically the same point at which the gas valve is opened the explosion takes place and the impact of the explosion in the explosion chamber and against the lower face of the explosion abutment and the back face of the explosion end of the piston drives the piston forwardly. The forward movement of the piston now causes another charge of gas to be drawn in for the following explosion. The explosive force of the gas is exerted against the back side of the explosion

end of the piston until the piston passes the exhaust opening. During this time the compression abutment is held back in its pocket and the explosion abutment is held against the periphery of the piston. As the explosion end of the piston passes the exhaust outlet the spent gases are driven out by the forward movement of the cleaning end of the piston. When the explosion end passes the exhaust outlet the explosion abutment is raised and held raised until the explosion end again passes it. As the cleaning end reaches the compression abutment that abutment is brought down into contact with the periphery of the piston so as to insure the compression of the following charge which is drawn in back of the cleaning end of the piston and compressed by the forward face of the explosion end. The compression abutment as stated, remains down until after the following explosion.

The air valve is opened shortly after the explosion end of the piston passes the air inlet port. Then the forward movement of the explosion end draws fresh air in back of this end so as to vitalize and reduce the temperature of the gases in the piston chamber. The air valve is closed just before the cleaning end of the piston reaches the air inlet port.

The check abutment 35 is always held against the periphery of the piston and prevents any backward flow toward the exhaust outlet of gas or air when the gas or air valves are open. Air is not compressed between the forward side of the cleaning end and the explosion abutment as the cleaning end moves around for it may flow through the passages 13 in the wall of the piston to the central chambers 14 and from thence through the openings in the face plates to the outer atmosphere. These passages also prevent the compression of air between the front of the cleaning end and the back of the check abutment 35 below the gas and air inlets. When the compression abutment is closed against the piston a vacuum will not form under it for air can flow in through the opening 34 around the abutment stem into the piston chamber below the abutment.

During the rotation of the piston gas is drawn in during nearly half a revolution back of the cleaning end of the piston and then is compressed by the front of the explosion end of the piston. While gas is being drawn in back of the cleaning end of the piston and that gas is being compressed by the front of the explosion end of the piston the spent gases of the previous explosion are being driven out in front of the cleaning end and fresh air is being drawn in back of the explosion end of the piston. Thus the rotation of the piston draws in gas, compresses it, drives out the spent gas and draws in fresh air for vitalizing the air in the interior and cooling the parts.

The invention claimed is:-

1. A rotary explosive engine having a casing with a cylindrical piston chamber, an explosion chamber, a gas inlet and an exhaust outlet, a rotatory piston in the piston chamber, a swinging abutment on each side of the explosion chamber and movable into and out of the piston chamber, and means for igniting gas in the explosion chamber, substantially as specified.

2. A rotary explosive engine having a casing with a cylindrical piston chamber, an explosion chamber, a gas inlet, an air inlet, and an exhaust outlet, a rotatory piston in the piston chamber, a swinging abutment on each side of the explosion chamber and movable into and out of the piston chamber, and means for igniting gas in the explosion chamber, substantially as specified.

3. A rotary explosive engine having a casing with a cylindrical piston chamber, an explosion chamber, and a gas inlet, a rotatory piston in the piston chamber and having an exhaust outlet through the piston, an abutment on each side of the explosion chamber and movable into and out of the piston chamber, and means for igniting gas in the explosion chamber, substantially as specified.

4. A rotary explosive engine having a casing with a cylindrical piston chamber, an explosion chamber, a gas inlet and an exhaust outlet, a rotatory piston having an explosion end and a cleaning end in the piston chamber, a swinging abutment on each side of the explosion chamber and movable into and out of the piston chamber, and means for igniting gas in the explosion chamber, substantially as specified.

5. A rotary explosive engine having a casing with a cylindrical piston chamber, an explosion chamber, a gas inlet, and an exhaust outlet, a rotatory piston in the piston chamber, an abutment on each side of the explosion chamber and movable into and out of the piston chamber, an abutment back of the gas inlet and movable into and out of the piston chamber, and means for igniting gas in the explosion chamber, substantially as specified.

6. A rotary explosive engine having a casing with a cylindrical piston chamber, an explosion chamber, a gas inlet and an exhaust outlet, an elliptical rotatory piston with the ends of its major axis in contact with the cylindrical wall of the piston chamber, an oscillatory abutment on each side of the explosion chamber and movable into and out of the piston chamber, and means for igniting gas in the explosion chamber, substantially as specified.

7. A rotary explosive engine having a casing with a cylindrical piston chamber, an explosion chamber, a gas inlet and an exhaust outlet, a rotatory piston in the piston chamber, an abutment on each side of the explosion chamber and movable into and out of the piston chamber, springs arranged to move the abutments into engagement with the periphery of the piston, cams arranged to move the abutments away from the periphery of the piston, and means for igniting gas in the explosion chamber, substantially as specified.

8. A rotary explosive engine having a casing with a cylindrical piston chamber, a gas inlet and an exhaust outlet, a rotatory piston having an explosion end and a cleaning end in the piston chamber, a swinging compression abutment movable into and out of the piston chamber, a swinging explosion abutment movable into and out of the piston chamber, and means for igniting gas located between the compression abutment and the explosion abutment, substantially as specified.

9. A rotary explosive engine having a casing with a piston chamber, an explosion chamber, a gas inlet, an air inlet, and an exhaust outlet, a rotatory piston in the piston chamber, a compression abutment movable into and out of the piston chamber, means for moving the compression abutment toward the periphery of the piston, means for holding the compression abutment away from the periphery of the piston, an explosion abutment movable into and out of the piston chamber, means for moving the explosion abutment toward the periphery of the piston, means for holding the explosion abutment away from the periphery of the piston, means for igniting gas between the compression abutment and the explosion abutment, a valve controlling the gas inlet, a valve controlling the air inlet, means for closing the gas and air valves, and means for opening the gas and air valves, substantially as specified.

10. A rotary explosive engine having a casing with a cylindrical piston chamber, a gas inlet and an exhaust outlet, a rotatory piston having an explosion end and a cleaning end in the piston chamber, a swinging abutment movable into and out of the piston chamber and adapted

to engage the periphery of the piston and prevent the forward flow of unexploded gas as the piston rotates, a swinging abutment movable into and out of the piston chamber and adapted to engage the periphery of the piston and prevent the backward flow of fresh gas as the piston rotates, and means for igniting gas between these abutments, substantially as specified.

11. A rotary explosive engine having a casing with a cylindrical piston chamber, an explosion chamber, a gas inlet and an exhaust outlet, a rotatory piston in the piston chamber and having annular recesses communicating with openings through the casing and with passages through the periphery of the piston a swinging abutment on each side of the explosion chamber and movable into and out of the piston chamber, and means for igniting gas in the explosion chamber, substantially as specified.

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