(No Model.)

J. H. EICHLER.

ROTARY GAS ENGINE.

No. 442,963. Patented Dec. 16, 1890.

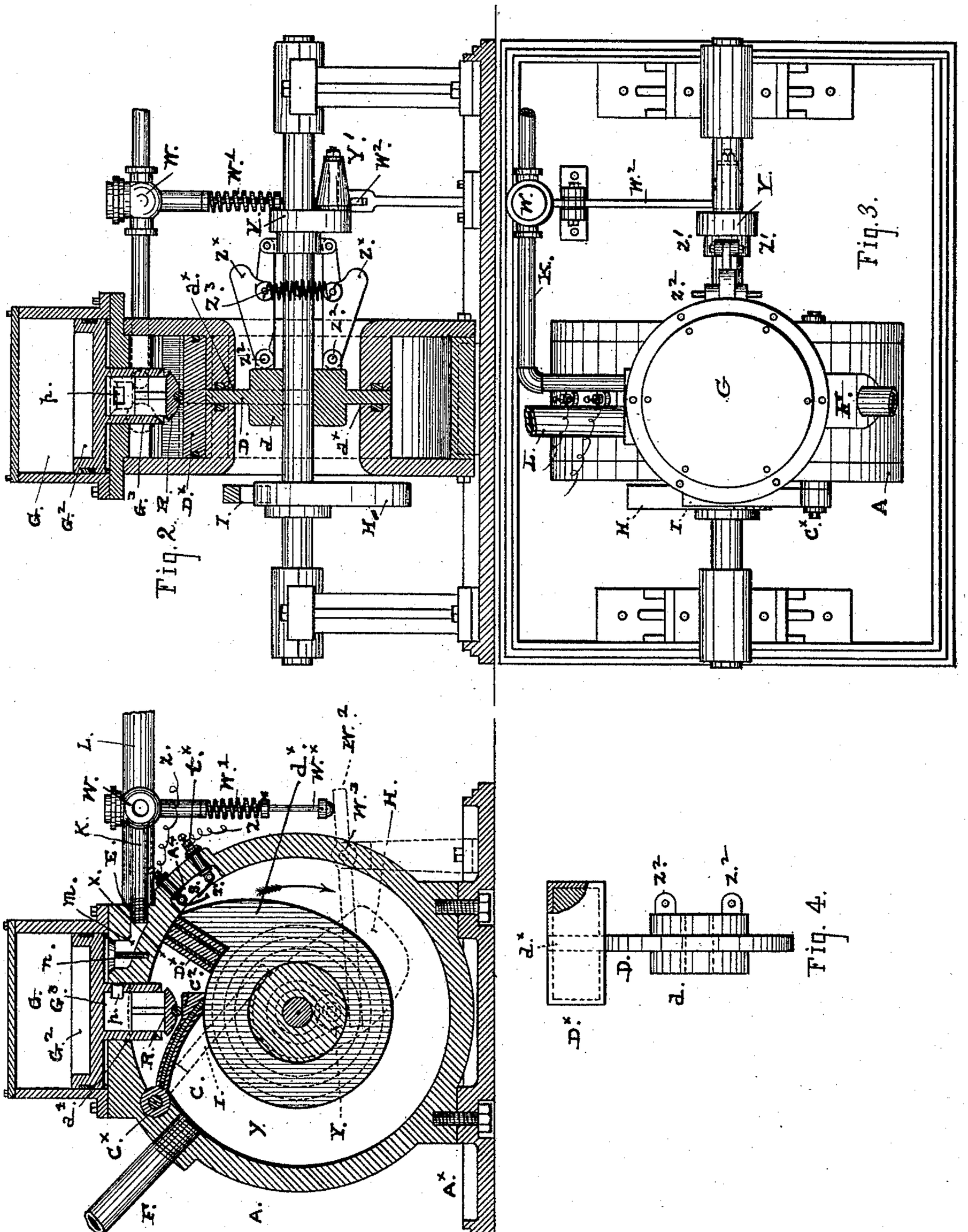

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 1.

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ROTARY GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 442,963, dated December 16, 1890.

Application filed June 4, 1890. Serial No. 354,269. (No model.)

To all whom it may concern:

Be it known that I, JOHN HENRY EICHLER, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Rotary Gas-Engines, of which the following is a specification.

This invention relates to engines or motors of that class in which the motion of the piston is caused by the explosion of a mixture of gas and atmospheric air in the cylinder; and it has for its object, mainly, the production of a rotary engine to be run with such kind of motive power.

To this end and purpose the invention consists in certain novel parts and combination of parts and mechanism, as hereinafter explained, producing a rotary engine specially adapted to work with an explosive mixture of gas and air.

The accompanying drawings, forming a part of this specification, represent my improved engine.

Figure 1 is an elevation in longitudinal section through the engine-cylinder and parts. Fig. 2 is a transverse section. Fig. 3 is a top view, and Fig. 4 is a detail view, of the piston.

The cylinder A is a cylindrical case fixed on a suitable bed-plate $A^{\times}$ and constructed with an annular space, preferably of rectangular form in cross-section, and the piston-head $D^{\times}$, of corresponding rectangular form, is fixed on a thin circular plate or disk that is keyed on the engine-shaft and works in a slot through the inner wall of the annular space. The engine-shaft sets through the center of the stationary case, which is open for that purpose, and the piston-disk is fixed on the shaft within this opening by its hub *d* to run smoothly in the slot $a^{\times}$ through the circular inner wall of the case, the edges of this opening being suitably packed to make a gas-tight joint. On one side of its center the disk is increased in breadth to extend across the cylinder-space, as shown at $d^{\times}$, for an abutment against which the piston-head $D^{\times}$ is fixed; but at all other points around the rim the disk is cut down to nearly the surface of the inner wall of the case, so that while filling the circular slot $a^{\times}$ the rim of the disk is about flush with the inner wall and leaves a clear cylinder-space of substantially rectangular form in cross-section.

C is a partition attached at $C^{\times}$ by a hinge-joint to the outer wall and resting at the lower edge on the inner wall, thereby dividing the annular space into the pressure side *x* and exhaust side *y*. The edges of this partition are suitably packed to produce gas-tight joints.

E is the gas-inlet, and F is the exhaust, the partition C dividing the pressure from the exhaust side. That portion of the casing directly over the partition in front of the hinge is recessed to let in the partition flush with the outer wall when raised up for the piston-head to pass, and the lower face of the partition is shaped to correspond with the curvature of the wall when set up into this recess. The lower end of the partition rests upon and forms a close joint with the lower surface of the piston-chamber, and excepting when it is raised to let the piston-head pass the partition separates the inlet from the exhaust. The partition is moved in time with the revolutions of the piston by a face-cam H, fast on the engine-shaft, and an arm I, fast on the end of the hinge-pin $C^{\times}$ outside the case and resting on the cam at the outer end. The edge of the broader portion of the piston-disk extending from the concentric portion to the top or outer edge of the piston-head is carried in a continuous curve to bring the point of first contact between the disk and the partition at the outer end of the partition, so that in case of accident, as when the lifting mechanism fails to work, this curved edge of the disk itself will raise and hold up the partition. The gas-inlet, being controlled by the same means, is opened at the upward movement of the partition and is closed after the piston has cleared it and the charge of gas has been taken into the cylinder.

The gas-chamber G, of suitable capacity to furnish the proper quantity of explosive mixture for a charge, is located on the top of the casing directly over the inlet E, and connection between it and the gas and air supply is made by pipes K L, the former carrying the gas and the latter supplying the required proportion of air. Both pipes set through the end of the casing below the gas-chamber and terminate in a common passage *m*, that opens

into the chamber and is fitted with an upwardly-acting check-valve *n*. The piston G^2 of the gas-chamber has a tubular stem G^3, fitting closely an aperture a^1 of corresponding shape in the top of the casing and having a port *p* in the side that opens into the chamber when the piston is raised, but is shut off from it when the piston is set at rest at the bottom of its chamber. The end of this tubular stem is lifted with a drop-valve R, that is normally open and leaves the passage clear, but is closed at the upward movement of the piston to shut off the gas-chamber from the cylinder and cause the piston to draw in by suction a charge of gas and air through the check-valve. The piston is raised by the hinged partition in its upward throw against the stem and descends by virtue of its own weight after the partition has dropped into place behind the piston, or by the assistance of a spring, if necessary, to accelerate the expulsion of the gas from the chamber G into the cylinder. The end of the partition sets directly under the tubular stem, and has a ledge or flat surface C^2 for the bottom of the drop-valve to rest in. There is suitable space left between this ledge C^2 and the end of the tubular stem for the valve to drop and uncover the opening in the end of the stem when the piston is down. Thus at every revolution of the engine-piston in the annular space after it has passed the exhaust-port F the partition is thrown up by the cam on the engine-shaft, and in that movement the stop-valve is first pressed up to its seat on the end of the tubular stem, thereby closing the opening, and then the piston G^2 is raised to the top of its chamber and held until the engine-piston has passed beyond the gas-inlet into the pressure side of the cylinder. At the upward movement of the piston G^2 the charge of gas and air is drawn in through the passage by suction, and as the piston is released it expels this charge into the engine-cylinder through the port *p* and the tubular stem.

The charge is fired by an electric spark generated by two electrodes and working either in an open or a closed circuit. In the present construction I have arranged two electrodes S T in an open circuit in a recess A^4 in the outer wall of the cylinder, with their contact-points overlapping and in line with the outer edge of the piston-head $D^\times$ in such position that one contact-point will be pressed against the other by the piston-head, and then as the piston passes that point the two electrodes will move apart by virtue of their elasticity and break the circuit, thereby producing a spark just as the edge of the piston-head passes by the point of the inner spring. Each electrode is formed of a metal tongue fixed on the inner end of an insulated plug $t^\times$, to which the conductor *z* from the battery is attached by a binding-screw on the outer end. Arranged in this manner with an open circuit there is less waste of battery, and the ignitor is operated directly by the piston, without requiring special actuating mechanism. For such reasons the open circuit appears to me to be the more practical arrangement and application of the electric current to explode the charge. Other forms of electric ignitors arranged to be worked mechanically from the engine-shaft could also be used. The charges in the cylinder-space could be fired by a flame in a chamber at one side of the case communicating with the cylinder, as in some of the present types of gas-engines. The form of ignitor which I have applied as above described is both simple and efficient. The supply of gas for such charge is let on and cut off automatically by an upwardly-acting gas-valve W in the pipe, held normally closed by a spring W′ and raised by the action of an arm or disk Y, with a projecting stud Y′ on the engine-shaft, and the lever W^2, pivoted at W^3 and setting under the valve-stem $W^\times$, the opposite end of the lever projecting in the path of the revolving arm Y.

Variation of the lift of the valve to increase or diminish the area of the gas-inlet is produced by using a stud of conical form and shifting the arm on disk Y′ longitudinally on the engine-shaft, so that the end of the stud will clear the valve-lever when the arm is drawn back to the limit of movement in one direction or the largest diameter of the stud will be set over against the lever when the arm sets to the opposite limit upon the shaft. Different positions between these two extremes will produce different lengths of stroke in the valve-lever, and consequently will vary the lift of the valve. By attaching to this movable arm a centrifugal governor of some kind actuated from the engine-shaft the movement of the arm Y will be regulated by the variations in speed of the engine.

In the present construction I have attached to the piston-hub *d* centrifugal arms $Z^\times$ $Z^\times$ by joints Z′ and connected to the outer ends of the arm by link Z^2 the collar y^2 of the revolving arm Y. The arms are arranged to be thrown outward by centrifugal force and to be drawn in by a spring Z^3. As the speed of the engine increases, the arms act to draw back the conical stud away from the valve-lever, while a reduction in speed causes the stud to be set forward, as will be understood from Fig. 2 of the drawings.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of the stationary casing having an annular cylinder-space and an open center, a disk-piston carrying a piston and working through a slot in the inner wall of the case, the hinged partition, gas-chamber connected with cylinder-space on one side of said partition through an inlet controlled by a drop-valve, gas-inlet, passage in said chamber connecting with gas-supply outside and having a check-valve, a pressure-piston in said gas-chamber adapted to control the connect-

ing-passage between chamber and cylinder, and an exhaust-outlet on the opposite side of the partition, substantially as hereinbefore described.

2. In a rotary gas-engine, the combination of the piston, annular cylinder having its space divided into pressure and exhaust sides by a hinged partition, and the gas-chamber mounted on said cylinder, having an upwardly-acting head or piston, a gas-inlet passage connecting the cylinder-space on the pressure side with the gas-chamber, a valve controlling said passage and adapted to be opened and closed by the gas-chamber piston, and a passage connecting said chamber with a gas-supply outside, having a check-valve, substantially as hereinbefore described.

3. In a rotary gas-engine, the combination, with an annular cylinder having an open center, of a disk-piston fast on a piston-shaft in said open center and working through a slot in said chamber, a piston-head fast on said disk, adapted to rotate continually in the cylinder, the hinged partition *c*, and mechanism actuated from the engine-shaft to raise said partition in time with the movement of the piston, the gas-inlet E, controlling-valve W, valve-stem $W^{\times}$, spring W′, arm Y, carrying conical projection $Y^{\times}$ and lever W^{2}, and the exhaust F, substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand and seal.

JOHN HENRY EICHLER. [L. S.]

Witnesses:

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