No. 776,118. PATENTED NOV. 29, 1904.

M. H. DALEY.

SPEED REGULATOR FOR EXPLOSION ENGINES.

APPLICATION FILED SEPT. 30, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

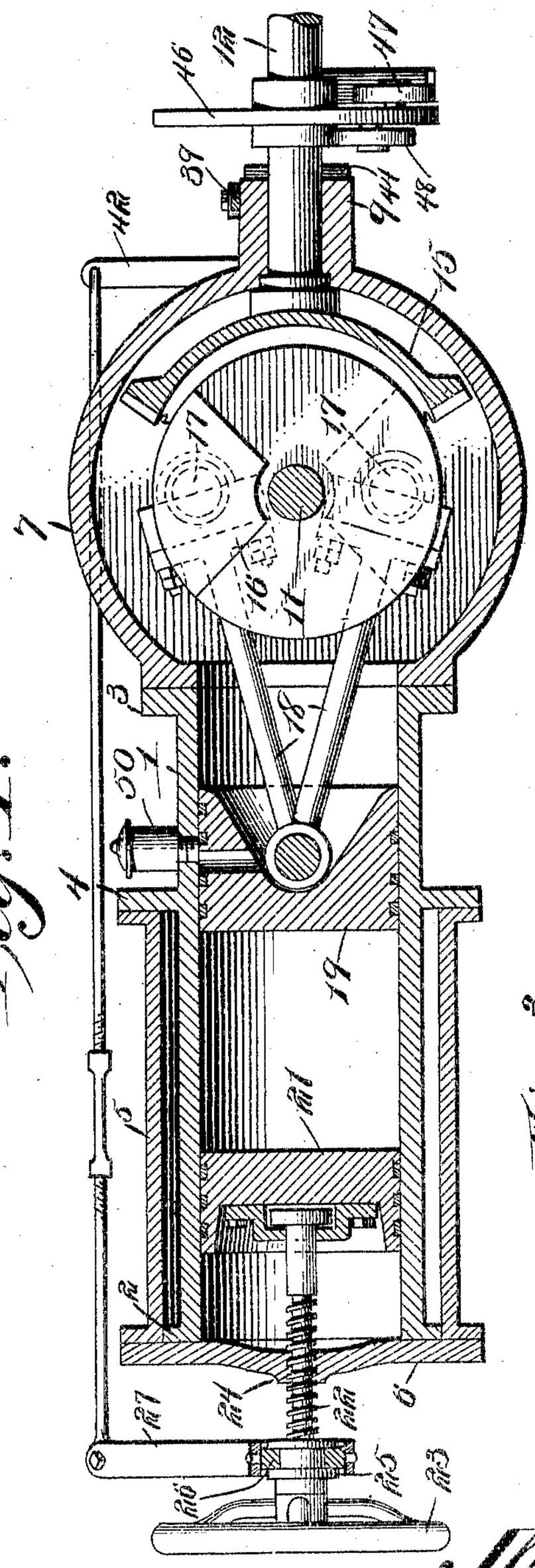

Fig. 1.

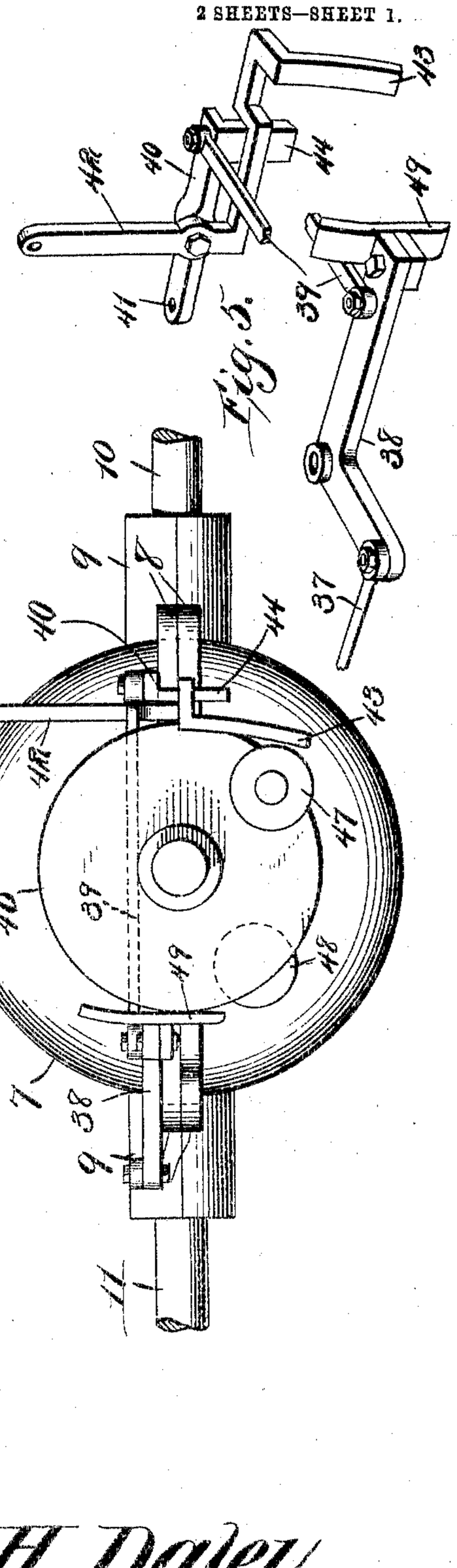

Fig. 2.

Fig. 3.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

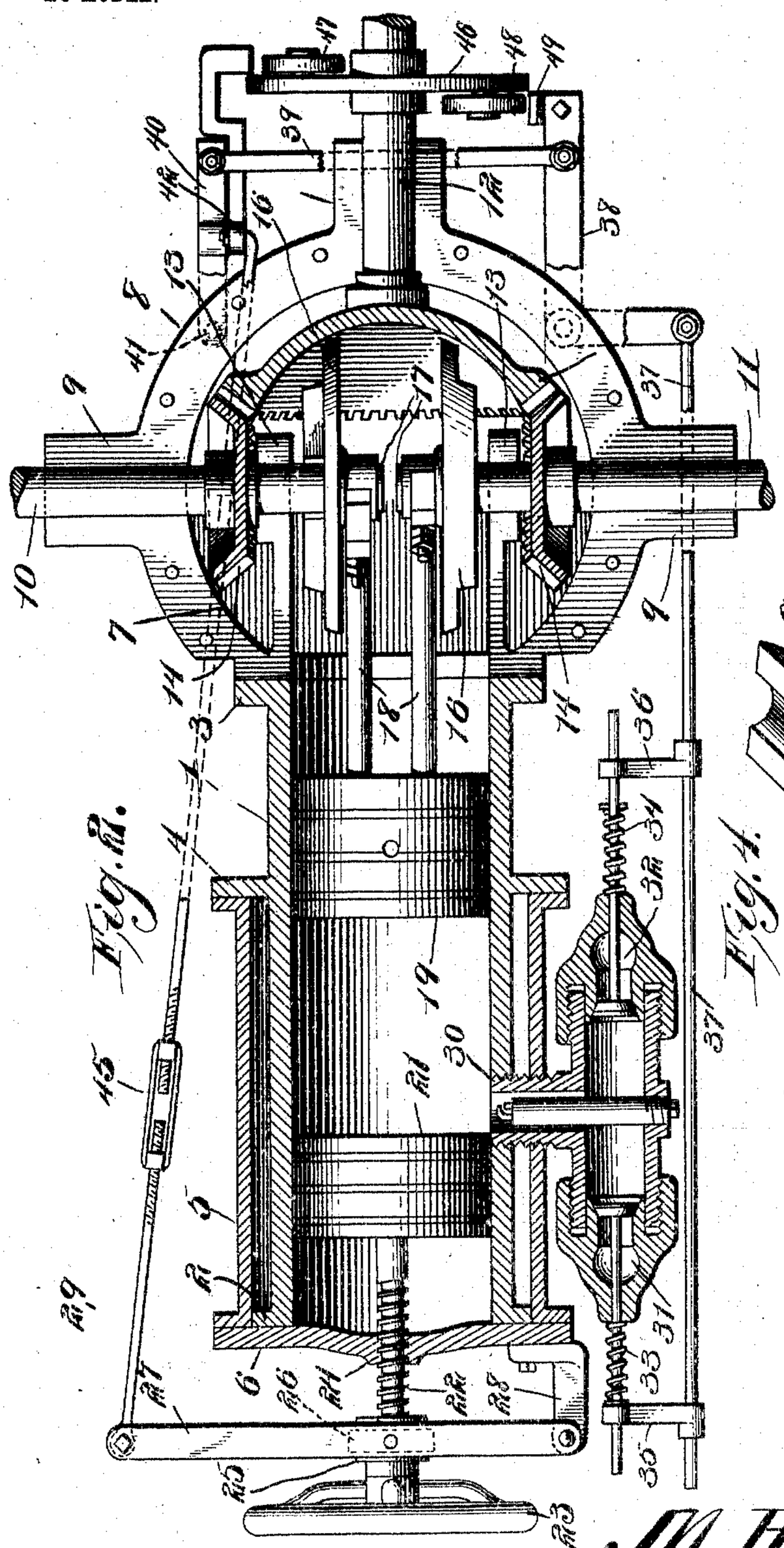
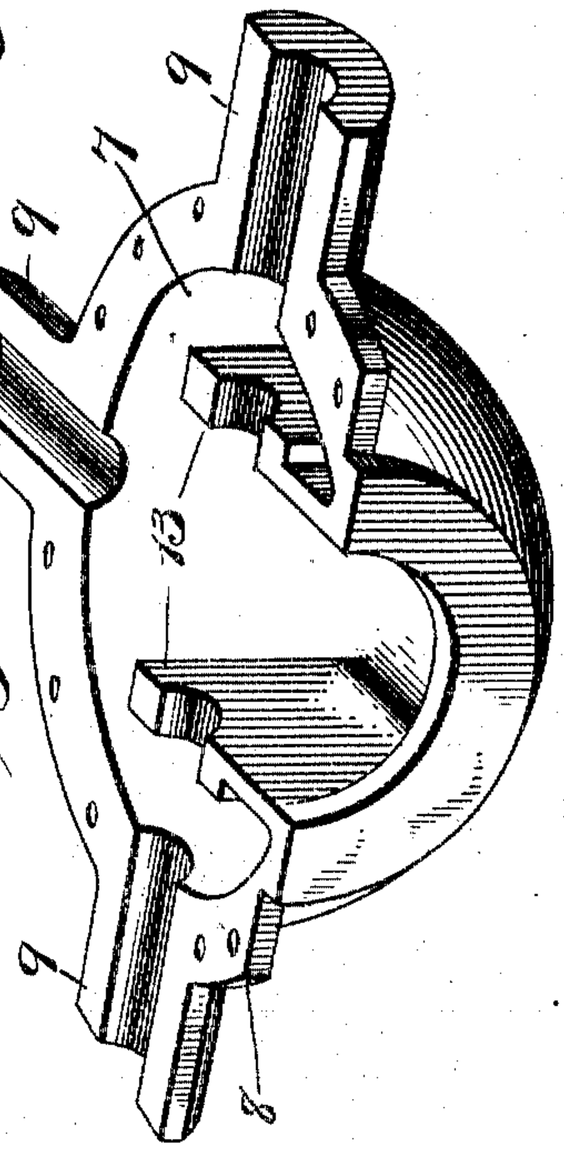


Fig. 4.



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No. 776,118. Patented November 29, 1904.

UNITED STATES PATENT OFFICE.

MICHAEL H. DALEY, OF CHARLES CITY, IOWA.

SPEED-REGULATOR FOR EXPLOSION-ENGINES.

SPECIFICATION forming part of Letters Patent No. 776,118, dated November 29, 1904.

Application filed September 30, 1903. Serial No. 175,218. (No model.)

To all whom it may concern:

Be it known that I, MICHAEL H. DALEY, a citizen of the United States, residing at Charles City, in the county of Floyd and State of Iowa, have invented a new and useful Speed-Regulator for Explosion-Engines, of which the following is a specification.

This invention relates to certain improvements in explosive-engines.

The principal object of the invention is to reduce vibration in engines of that general class employed in automobile work or for the propulsion of small vehicles where it becomes impossible to provide a foundation sufficiently solid to resist or take up the vibratory movement incident to the explosion of the charge and the outward thrust on the piston.

A further object of the invention is to provide a gas-engine in which the horse-power of the engine may be altered to any desired extent by alteration in the size of the explosive-chamber, and a further object in this connection is to provide for an automatic adjustment of the valve-operating mechanism to compensate for increase or decrease in the volume of the explosion-chamber.

A further object of the invention is to provide an explosive-engine in which the amount of gas or explosive compound consumed and the degree of compression will be in direct proportion to the size or volume of the explosion-chamber.

A further object of the invention is to provide a novel form of valve-operating mechanism whereby the opening and closing movements of the inlet and exhaust valves may be properly timed from the main shaft of the engine.

With these and other objects in view, as will hereinafter more fully appear, the invention consists in the novel construction and arrangement of parts hereinafter 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 construction 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 longitudinal sectional elevation of a gas-engine constructed in accordance with the invention. Fig. 2 is a sectional plan view of the same. Fig. 3 is an end elevation of the engine. Fig. 4 is a detail perspective view of a portion of the crank-casing. Fig. 5 is a similar view of a portion of the valve-gear.

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

In the drawings, 1 indicates the cylinder of an explosive-engine constructed in accordance with the invention. The cylinder is provided with opposite end flanges 2 and 3 and an intermediate flange 4, that is of greater diameter than either of the other two. The cylinder is covered by a water-jacket 5, having flanged end portions of which one is bolted to the flange 4, while the other is in a plane parallel with the end flange 2, these two end flanges being faced off in order to receive the main head 6 of the cylinder and to which both flanges are bolted in order that the cylinder and jacket may be properly supported in position.

To the end flange 3 is bolted a substantially spherical crank-casing 7, that is formed in two sections having bolting-flanges 8, and each of the sections have journal-box members 9 for the reception of a plurality of shafts 10, 11, and 12. Two of the journal-box members 9 are arranged in the same plane at a right angle to the axis of the cylinder and serve as supports for the reception of the shafts 10 and 11, respectively, and these shafts are further supported by bearings carried by partitions 13, that form an integral part of the crank-casing, the spaces between these partitions and the wall of the spherical chamber being sufficiently large to receive bevel-gears 14, that are firmly secured to the two shafts 10 and 11. The two shafts 10 and 11 are arranged at a right angle to the shaft 12, and the latter carries a cup-shaped crown-gear 15, that intermeshes with both pinions and insures uniformity of movement. To the inner end of each of the shafts 10 and 11 is secured a counterweighted crank-disk 16, and each disk carries a wrist-pin 17, connected by a rod 18 to the piston 19 of the engine.

During the operation of the engine the two

crank-shafts 10 and 11 revolve at the same speed, but in opposite directions, so that on the outward thrust of the piston the pressure of the latter against the walls of the cylinder will be perfectly balanced and the vibratory movement usually found in single-cylinder engines of this class will not be perceptible. The vibratory movement is for the most part caused by the binding of one portion of the periphery of the piston against the adjacent portion of the inner wall of the cylinder when the wrist-pin is moving forward during the first quarter of its stroke, and when two wrist-pins moving at the same speed in opposite directions are employed the thrust will be equally balanced in the cylinder and this vibratory movement cannot occur.

The gear 15 is preferably of a diameter twice that of each of the bevel-pinions, so that at each rotative movement of the crank-shafts a half-revolution of the main or power shaft 12 will occur, and this power-shaft may thus be conveniently used in the operation of the valves and the sparking circuit.

In engines of this class it is highly desirable from a standpoint of economy that the engine use no more of the explosive compound than is absolutely necessary to produce the required speed and power, and it is also desirable that the speed and power of the engine be under direct control of the operator. To accomplish this, I provide suitable means for altering the area of the explosion-chamber and for correspondingly altering the amount of fuel consumed and the degree of compression of such fuel. The head of the explosive-chamber is formed by a piston 21, that is connected by a screw 22 to a hand-wheel 23 at a point outside the cylinder. The screw is adapted to a stationary nut 24, forming a part of the head 6, and by turning this screw the area of the explosion-chamber may be altered to any desired extent, so that the speed and power may be increased as circumstances require.

To provide for the automatic regulation of a cut-off in accordance with the alteration in size of the explosion-chamber, the screw 22 is provided with a fixed sleeve 25, having a peripheral groove for the reception of pins or segmental blocks 26, carried by a lever 27 that is fulcrumed to a bracket 28, projecting from the cylinder-head 6. The free end of the lever 27 is connected by a rod 29 to a portion of the valve-operating mechanism, and as the movable piston-head is adjusted in or out the valve-operating mechanism receives a corresponding movement in order to alter the point of cut-off in accordance with the capacity of the explosion-chamber. The water-jacket and the cylinder are provided with radially-alining threaded openings for the reception of a nipple 30, and to that portion of the nipple which projects beyond the periphery of the water-jacket are connected an inlet-valve chamber 31 and an exhaust-valve chamber 32, having the usual inlet and exhaust valves that are normally maintained in closed positions by coiled springs 33 and 34, respectively. The valve rods or stems extend to points outside the chambers and are operated upon by tappets 35 and 36, projecting from an operating-rod 37, adapted to suitable bearings or guides carried by the cylinder 1. One end of the rod 37 is connected to one arm of a bell-crank lever 38, pivoted at the point of bifurcation, and the opposite arm of said bell-crank lever is connected by a rod 39 to a bar 40, the inner end of which is pivoted at 41 to the crank-casing. To the bar 40 is pivoted a bell-crank lever 42, the vertical arm of which is pivotally connected to one end of the rod 29, while the opposite or horizontal arm has a depending strip or tongue 43 to be engaged by the inlet-valve operating-cam. The horizontal arm of the bell-crank lever 42 rests against a tongue 44, carried by the arm or bar 40, so that movement imparted to the strip 43 will be imparted to the bar 40 and thence through connecting-bar 39 to bell-crank lever 38 and the valve-operating rod 37. The rod 29 is preferably formed of two sections, having right and left hand screw-threads for the reception of a turn-buckle 45, by which the rod may be lengthened or shortened in order to properly adjust the valve-operating mechanism with respect to the position of the adjustable piston 21.

On the power-shaft 12 is arranged a disk 46, carrying on one side a roller 47 and the other a roller 48. The roller 46 engages the strip 43 at each revolution of the shaft 12 and moves the latter outward with the pin 41 as a pivot-point. This movement is transmitted through the bar 40 and bar 39 to the bell-crank 38 and rod 37 and results in opening the inlet-valve, the length of time for which the valve is open and the quantity of explosive compound admitted being governed by the length of time which the roller 47 is in contact with the strip 43, and as the position of this strip is governed by the position of the adjustable piston or cylinder head it follows that the quantity of explosive compound admitted to the chamber will be in direct proportion to the area of such chamber. The strip 43 is either raised or lowered by adjustment of the bell-crank lever 42, and owing to this tangential adjustment with respect to the cam-disk the operative movement of the latter will continue for a greater or less period of time.

In order to move the rod 37 in the opposite direction and open the exhaust, the bell-crank 38 is provided with a metallic strip 49, engaged by the roller 48 once during each revotion of the power-shaft 12, and the strip makes it possible to maintain the exhaust-valve open for any desired period of time, as distinguished from the quick opening and closing

valves such as are operated by ordinary tappet mechanism. It will be observed, therefore, that the bell-crank lever 42 receives movement in one direction from the roller 47 to open the inlet-valve, while said bell-crank receives movement in the opposite direction from the roller 47 to open the exhaust-valve.

During the operation of the engine the inlet-valve is opened at the commencement of the suction-stroke, and if the capacity of the explosion-chamber has been reduced one-half by proper adjustment of the head 21 the valve will be closed at half the suction-stroke. The compression-stroke then follows, as usual, and then the working stroke. When the piston has completed the working stroke, the gas will be expanded to twice the volume in proportion to initial supply that it would expand if the inlet-valve were held open during all of the suction-stroke, and the waste gases may be exhausted without noise. In this manner the capacity of the explosion-chamber and the quantity of fuel used may be accurately regulated in accordance with the speed and power required and the engine operated without waste of gas and without the usual vibration and the noisy exhaust. The sparking mechanism may be operated in any ordinary manner.

In order to provide for the proper lubrication of all of the movable parts, the water jacket and cylinder are provided with radially-alined openings for connection with a lubricating device in the form of an oil-cup 50, and the movable piston 19 has a radial opening the lower end of which is directly above the pivot-point between the two connecting-rods and the piston. The upper end of this opening comes into alinement with the lower portion of the oil-cup, and oil falling therethrough first strikes and lubricates the pivotal connection between the rods and the piston. The oil will then lubricate the interior of the cylinder and will flow to the crank-casing, where it accumulates and is continuously raised by the teeth of the large gear-wheel, and from thence falls on the wrist-pin connection and lubricates the remaining working parts of the engine.

In use the engine-power may be taken from the shaft 12, or, if desired, one or other or both of the shafts 10 and 11 may be utilized.

When the engine is used on automobiles in which the load and speed is variable, the operator may readily change the force exerted by means of the hand-wheel, which can be geared and placed at the side of the operator regardless of where the engine may be situated. Owing to the proper regulation of the quantity of explosive compound to the capacity of the explosion-chamber, the exploded gases may be allowed to expand and lower to atmospheric pressure or less, so that they may escape without noise, and thus render it unnecessary to employ a muffler or similar device.

Having thus described the invention, what is claimed is—

1. In a gas-engine, an explosion-chamber, an adjustable head for varying the volume of the chamber, means for adjusting the head, an inlet-valve, a valve-operating mechanism including a rocking lever and a revoluble member for engagement with the lever, and means connecting the adjusting mechanism of the head to the rocking lever thereby to alter the position of the latter to an extent proportionate to the degree of adjustment of the head.

2. In a gas-engine, an explosion-chamber, an adjustable head for the chamber, a screw for adjusting the head, an inlet-valve, a revoluble cam, a rocking lever engaged by the cam, a system of levers connecting said rocking lever to the inlet-valve, a bell-crank forming a portion of the rocking lever, a grooved collar carried by the screw, a pivoted lever having a collar-engaging means, and an adjustable connecting-rod extending between the collar-engaging lever and the bell-crank.

3. In a gas-engine, a cylinder, inlet and exhaust valves, a slidable rod having tappets for engaging the stems of the valves and a pair of revoluble cams carried by the engine-shaft, a rocking lever, and a bell-crank lever arranged respectively at opposite sides of the shaft, means for connecting the bell-crank lever to the slidable rod, means for connecting the two levers, and a bar or strip carried by the bell-crank lever for engagement by one of the cams, the opposite cam serving to engage the rocking lever, substantially as specified.

4. In a gas-engine, an adjustable explosion-chamber head, a bell-crank lever connected thereto and having a cam-engaged tongue or strip, a revoluble cam with respect to which said tongue or strip is tangentially adjustable thereby to alter the length of time the two are in contact and the extent of adjustment being dependent on the extent of adjustment of the head, a pivot-bar to which said lever is fulcrumed, a second bell-crank lever, a cam for operating the same, means for connecting the pivot-bar to the second bell-crank lever, an inlet-valve, and means for connecting the inlet-valve to said second bell-crank lever.

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

MICHAEL H. DALEY.

Witnesses:

FRED C. NEHLS,

ROBERT WATERMAN.