(No Model.) 2 Sheets—Sheet 1.

C. V. WALLS.

GAS ENGINE.

No. 537,370. Patented Apr. 9, 1895.

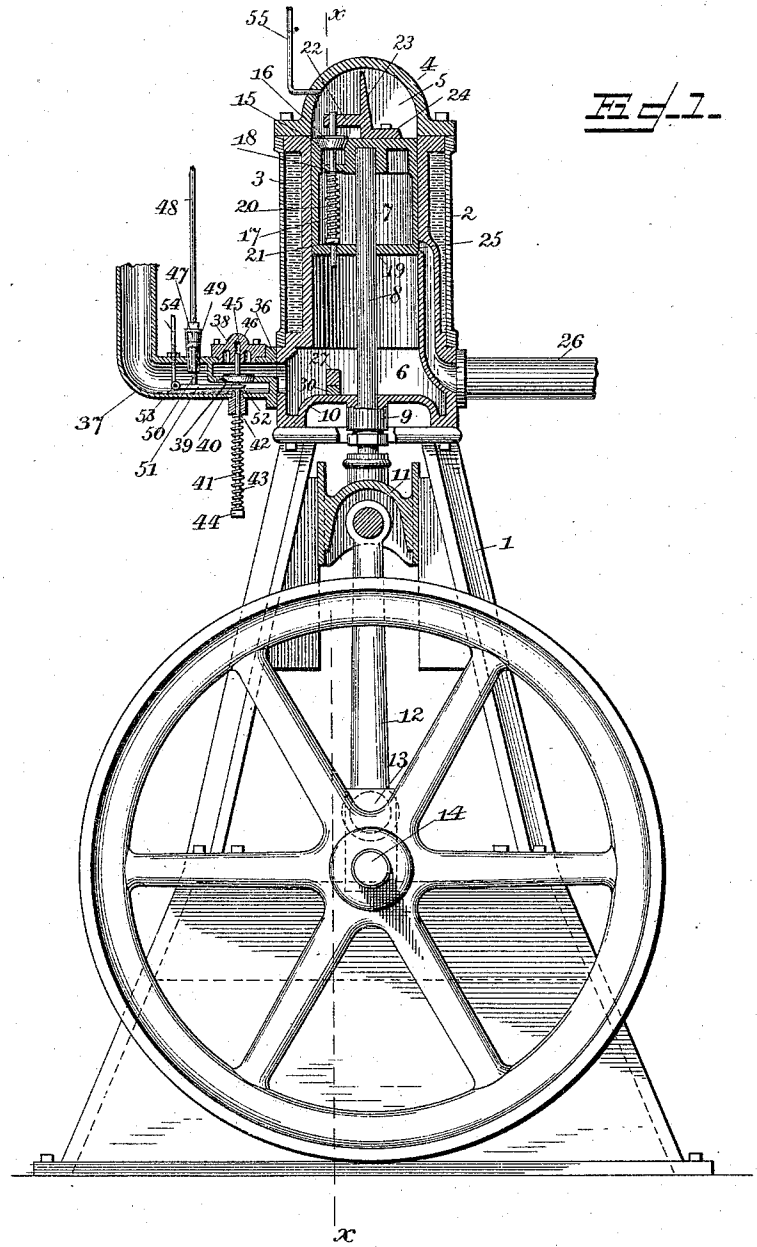

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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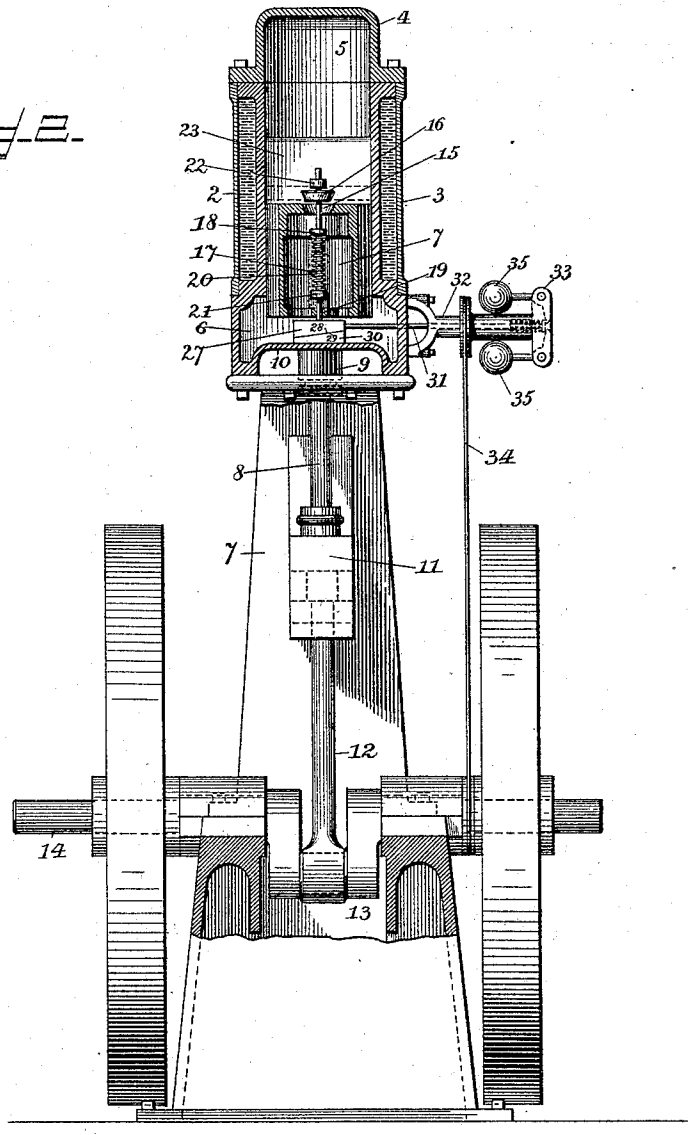
Fig. 2.



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UNITED STATES PATENT OFFICE.

CICERO V. WALLS, OF ARCOLA, ILLINOIS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 537,370, dated April 9, 1895.

Application filed June 14, 1894. Serial No. 514,586. (No model.)

To all whom it may concern:

Be it known that I, CICERO V. WALLS, a citizen of the United States, residing at Arcola, in the county of Douglas and State of Illinois, have invented a new and useful Gas-Engine, of which the following is a specification.

This invention relates to gas engines; and it has for its object to provide certain improvements in engines of this character which while simple in construction shall be efficient and powerful in operation.

To this end the main and primary object of the invention contemplates a gas engine operated by gasoline or other explosive hydrocarbon, and which shall be constructed of comparatively few working parts that provide for an explosion of the gas and air at every revolution of the shaft driven by the piston of the engine, thereby securing an increase in power over engines of that type in which the explosion of the explosive mixture is made at every other revolution of the shaft.

With these and other objects in view, which will readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

In the accompanying drawings:—Figure 1 is a central vertical sectional view of a gas engine constructed in accordance with this invention. Fig. 2 is a vertical sectional view on the line *x*—*x* of Fig. 1.

Referring to the accompanying drawings, 1 designates a suitable engine stand on which is mounted the upright engine cylinder 2. The engine cylinder 2, is made in suitable sizes according to the power of the engine to be manufactured, and in the present invention is surrounded by a water jacket 3, in which a circulation of cold water is maintained during the operation of the engine to prevent overheating of the cylinder, and said cylinder is inclosed at its upper end by the rounded cap 4, that forms at the upper end of the cylinder an explosion chamber 5, and at its corresponding lower end the said cylinder is widened out into the enlarged supply and compression chamber 6 which chamber avoids making the cylinder too long, and at the same time accommodates the mixture of gas and air that is to be fed into the chamber 5, for explosion, and also prevents a too great compression of the explosive mixture on the descent of the hollow piston 7.

The hollow piston 7, is arranged to reciprocate within the cylinder 2, between the chambers 5 and 6, and is securely mounted on the inner end of the piston rod 8, which works through the stuffing box 9, on the lower cylinder head 10, which incloses in the lower end of the cylinder and the chamber 6, formed at such end. The lower outer end of the piston rod 8, is suitably connected with the sliding cross heads 11, working within the stand 1, and to which is pivotally connected the upper end of the crank pitman 12, the lower end of which is connected to the crank 13, of the drive shaft 14, mounted in suitable bearings on the stand 1, and as motion is given to the piston 7, within the cylinder, the same will transmit its motion through the connections noted to the drive shaft, from which motion can be communicated to any suitable machinery in the ordinary manner.

The hollow piston 7, has a stroke within the cylinder proportionate to the length thereof in order to secure a steady and uniform motion and said hollow piston is provided in the closed upper end thereof with the beveled valve opening 15, that provides communication between the lower and upper portions of the cylinder, or in other words between the supply and explosion chambers 6, and 5, respectively, and said valve opening 15, is made as large as the space between the piston rod and the walls of the piston will admit, inasmuch as it is necessary for the charge of gas and air to pass very quickly through the valve opening into the upper part of the cylinder when the piston is at the bottom of the cylinder.

The beveled valve opening 15 in the upper closed end of the piston 7, is adapted to accommodate therein the beveled piston valve 16, that is mounted on the vertically movable valve stem 17. The vertically movable valve stem 17, is guided to move below the valve 16, through the perforated guide lug 18, and the transverse guide bar 19, extending across the lower open end of the piston, and between the lug 18 and the guide bar 19, the said bar

17, accommodates thereon the valve closing spring 20, the upper end of which bears under the lug 18, and the lower end of which bears against the adjusting collar or nut 21, adjustably mounted on the stem 17, to provide for maintaining the spring at the proper tension in order to normally hold the valve 16, closed onto its seat within the opening 15. The valve stem 17 extends above the valve 16, and is adapted to have its upper extremity guided through a perforation or opening in the upper perforated guide lug, 22, arranged above the valve and the upper closed end of the piston. The guide lug 22, provides means for guiding the valve 16, squarely to its seat and is projected from one side of the upwardly extending baffle plate 23. The baffle plate 23, is provided with a lower flanged end 24, secured on top of the piston 7, at one side of the opening 15, therein, and said baffle plate 23, extends transversely across the top of the piston 7, and meets the opposite side of the cylinder, in order that the supply of unexploded gas and air which passes upwardly through the valve opening 15 will be deflected or guided straight up into the explosion chamber 5, and will thereby be prevented from passing off through the side exhaust port 25, when the piston is at the bottom of its stroke. The said exhaust port 25, is formed in one of the walls of the cylinder and opens thereinto at a point intermediate of its ends so as to be uncovered by the piston when it passes to its lowest limit of movement and to be covered by the piston during the rest of its movement, the stroke of the piston being so adjusted that it will not uncover the port 25, at its upper limit of movement. The port 25, has fitted to the outer end thereof an exhaust pipe 26, for carrying off the products of combustion.

The vertically movable valve stem 17, extends below the lower transverse guide bar 19, and is adapted to have the lower end thereof come in contact with the wedge shaped automatically adjustable tappet block 27. The automatically adjustable tappet block 27, is provided with a lower beveled side 28, that is adapted to register with and slide on the correspondingly beveled side 29, of the fixed wedge shaped supporting block 30, mounted within the lower end of the cylinder on the lower head 10, thereof at one side of the piston rod 8. The tappet block 27, is fitted to the inner end of the longitudinally movable adjusting rod 31, which projects through the cylinder at one side thereof and works in the off-standing bearing bracket 32, mounted at one side of the cylinder. The said bearing bracket 32, accommodates on the outer end thereof an ordinary ball-governor 33, that is rotated by means of a suitable belt connection 34, with the drive shaft 14, and the bell crank ball arms 35, of said ball governor are adapted to suitably connect with the outer extremity of the rod 31, so that the same can be moved in and out according to the speed of the engine and thereby shift or adjust the position of the block 27 on the block 30, so as to regulate the opening of the valve 16, whereby the supply of gas and air admitted into the explosion chamber 5, may also be regulated according to the requirements of the engine.

The cylinder 2, is provided at one side and at the lower end thereof with the inlet opening 36, to which leads the air supply pipe 37. The air supply pipe 37, is provided at a point near its connection with the opening 36, with a valve casing 38, having therein a horizontal valve seat 39, to accommodate the inlet valve 40. The valve 40, is mounted on a valve stem 41, that works through a bottom guide opening 42, in the lower side of the valve casing and accommodates thereon a closing spring 43, the tension of which is properly adjusted by means of the adjusting collar or nut 44, adjustably mounted on the lower extremity of the said stem. The valve stem 41, extends above the valve 40, and works into the guide socket 45, of the guide cap 46, fitted to the top of the valve casing 38. At one side of the valve seat 39, the air supply pipe 37, has fitted thereinto the valve casing 47, to which is connected the gasoline or other hydrocarbon supply pipe 48, and within which is arranged to work the supply valve 49, the stem 50, of which projects below the casing 47, into the pipe 37. The lower end of the valve stem 50, impinges on top of the valve lever 51, loosely connected at one end as at 52, to the valve stem 41, below the valve 40 and pivoted at its other end at 53, to the inner end of the adjustable pivot post 54, adjustably supported within the air supply pipe 37.

Fitted to the upper rounded cylinder cap 4, is an ordinary incandescent igniting tube 55, which provides means for igniting the explosive mixture contained within the chamber 5, but which may be substituted by an electrical or any other suitable igniting device.

From the above it is thought that the operation and many advantages of there hereindescribed gas engine will be readily apparent to those skilled in the art. When the piston ascends within the cylinder to the highest point illustrated in Fig. 1, the explosive mixture of gas and air is compressed within the chamber 5, where it is exploded so as to force the piston downward, and while rising within the cylinder the said piston opens the valve 40, the opening of which, through the valve lever connection with the stem 50, will cause the valve 49, to open so as to admit a supply of gasoline or other hydrocarbon into the pipe 37, where such gasoline or other hydrocarbon will be vaporized and absorbed by the current of air that is drawn into the supply chamber 6, at the lower end of the cylinder. Upon the descent of the piston the stem 17, of the valve 16, comes in contact with the tappet block 27, and opens the said valve 16, immediately after the piston has passed and uncovered the exhaust port 25. Immediately

upon the opening of the valve 16, the mixture of gas and air contained in the bottom supply chamber 6, rushes through the valve opening of the piston to the space above it, and this supply of gas and air that passes above the piston has a tendency to drive out the burned products of the previous explosion without any appreciable quantity of unexploded gas and air passing out with the burned gases through the exhaust port. As the piston starts again on the up-stroke, the valve 16, closes, and the piston closes the exhaust support and commences to compress the charge of gas and air within the chamber 5, until, reaching the limit of its up-stroke, the explosive mixture is ignited and the explosion drives the piston to the bottom of the cylinder, which operation is repeated as the engine continues to work.

It will of course be understood that the adjustment of the pivot post 54, provides for regulating the supply of gasoline or other hydrocarbon to suit the demands of the engine, and any changes in the form, proportion and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described the invention, what is claimed, and desired to be secured by Letters Patent, is—

1. In a gas engine, the upright cylinder provided at its lower end with an enlarged supply and compression chamber, an explosion chamber at its upper end, and an intermediate exhaust port, the hollow piston provided with a valve opening, a normally closed valve working within said valve opening, and means for automatically and variably opening the valve at the limit of the down stroke of the piston, substantially as set forth.

2. In a gas engine, the upright cylinder having supply and explosion chambers at its opposite ends and an intermediate exhaust port, a hollow piston provided with a valve opening, perforated guide lugs above and below the valve opening, and a transverse guide bar extending across the lower open end thereof, a vertically movable valve stem arranged to work in the guide lugs and guide bar, said valve stem carrying a valve working within the valve opening of the piston, a spring adjustably mounted on the valve stem to hold the valve normally closed on its seat and means for automatically and variably moving the valve stem to open the valve at the limit of the down-stroke of the piston, substantially as set forth.

3. In a gas engine, the upright cylinder provided with supply and explosion chambers at its opposite ends and an intermediate exhaust port, the hollow piston having a valve opening, a normally closed valve working within the valve opening and having its stem projecting below the piston, and an automatically adjusted tappet block supported within the cylinder at the lower end thereof and adapted to be engaged by the lower end of said valve stem, substantially as set forth.

4. In a gas engine, the upright cylinder provided with enlarged supply and explosion chambers at opposite ends and an intermediate exhaust port, the hollow piston having a valve opening, a normally closed valve working in the valve opening and having its stem projecting below the piston, a wedge shaped supporting block fitted into the lower end of the cylinder, a correspondingly shaped tappet block arranged on said supporting block in a line with the disposition of said valve stem, and a governor-operated adjusting rod connected with said tappet block, substantially as set forth.

5. In a gas engine, the combination of the cylinder having supply and explosion chambers at its opposite ends and an intermediate exhaust port, the valved piston, the air supply pipe connected with the supply chamber of the cylinder, a normally closed inlet valve arranged within the line of the air supply pipe, a valved hydrocarbon supply pipe connected with said air supply pipe, and an adjustable lever connection between the inlet valve and the valve of the hydrocarbon supply pipe, substantially as set forth.

6. In a gas engine, the combination of the cylinder having supply and explosion chambers at its opposite ends and an intermediate exhaust port, the valved piston, the air supply pipe connected with the supply chamber of the cylinder, an inlet valve arranged within the line of the air supply pipe and having a stem extending below the pipe, a spring adjustably arranged on the valve stem to normally close the valve on its seat, a hydrocarbon supply pipe having a valve casing fitted into the air supply pipe, a supply valve working within said valve casing and having its stem extended into said air supply pipe, a pivot post adjustably supported in the air supply pipe, and a valve lever arranged to work below the valve stem of the supply valve, said valve lever being pivoted at one end to said pivot post and loosely connected at its other end to the valve stem of the inlet valve, substantially as set forth.

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

CICERO V. WALLS.

Witnesses:
J. R. BEGGS,
H. W. POTTER.