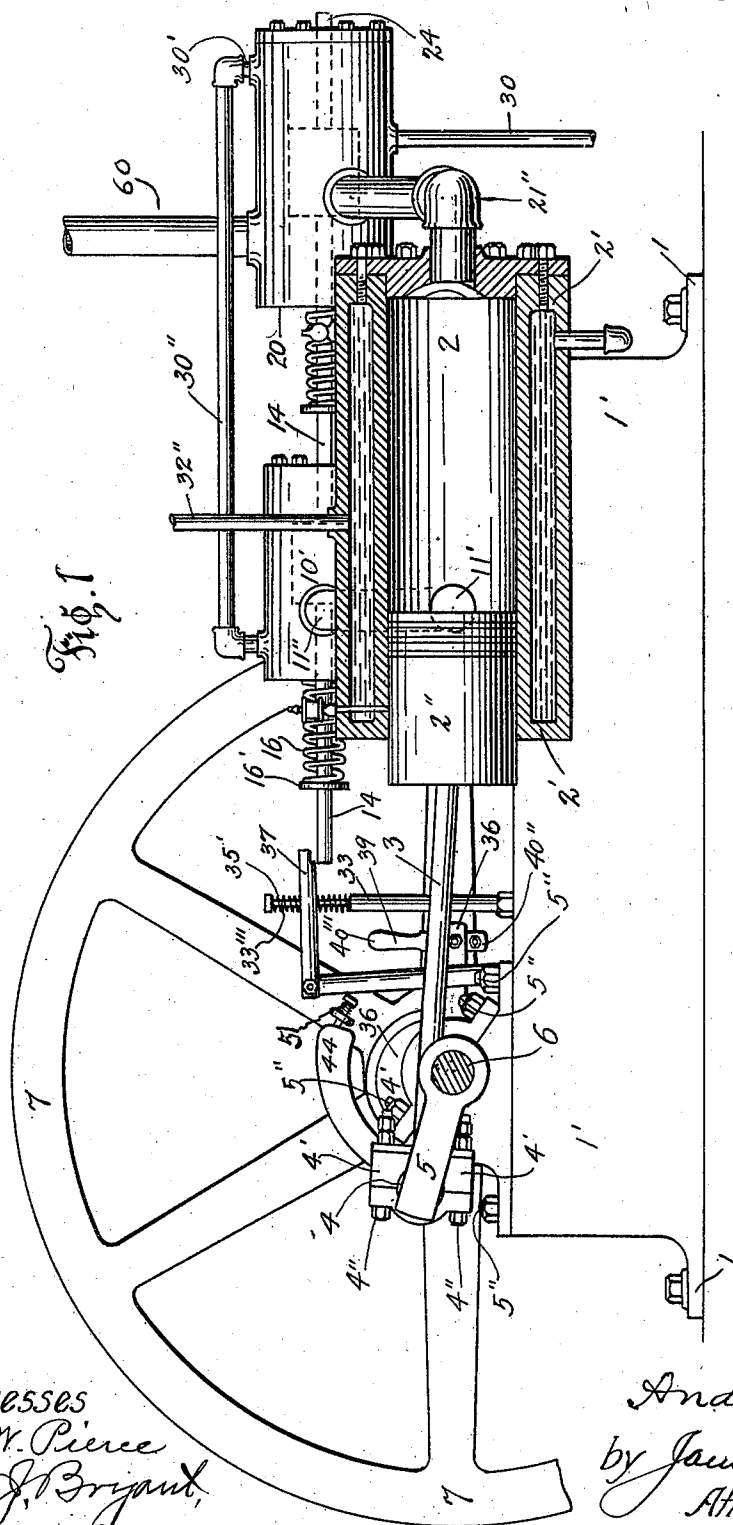


GAS ENGINE HAVING AUTOMATIC EXHAUST OPENINGS THEREIN.

Patented Dec. 6, 1910.

4 SHEETS—SHEET 1.

977,667.



Witnesses
B. W. Pierce
M. J. Bryant,

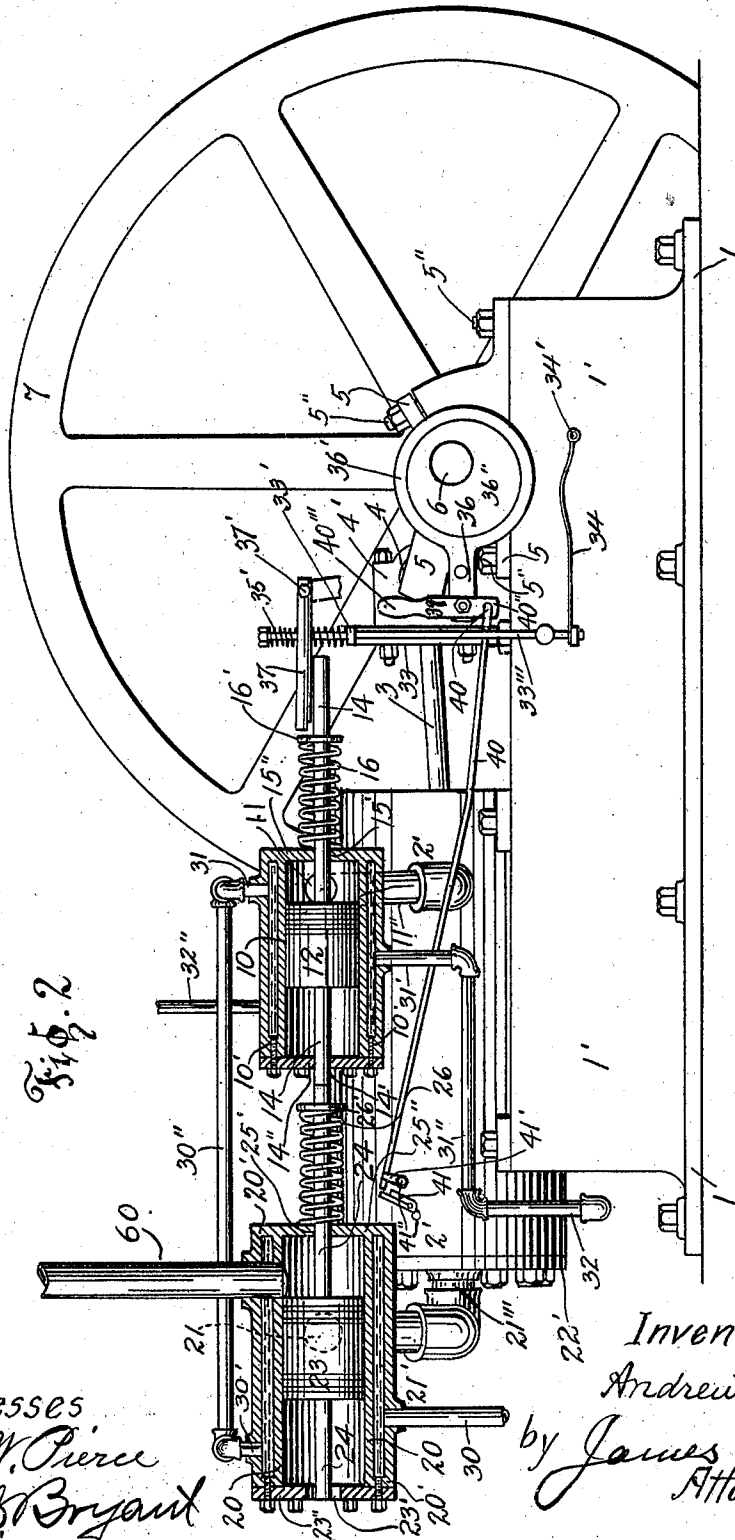
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4 SHEETS—SHEET 2.



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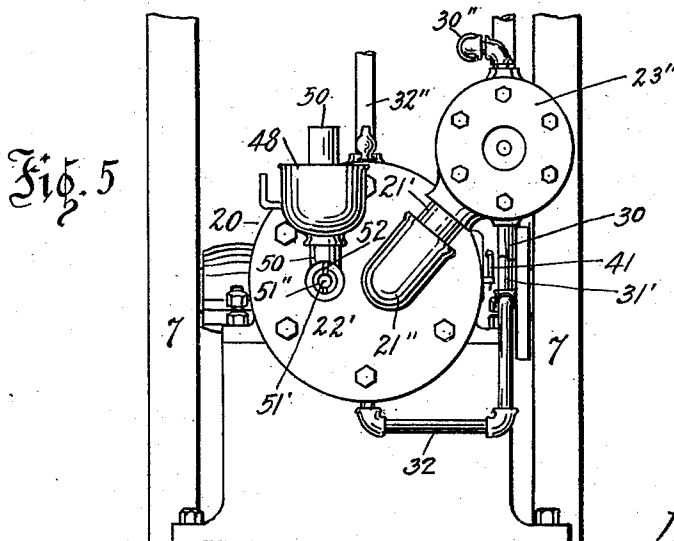
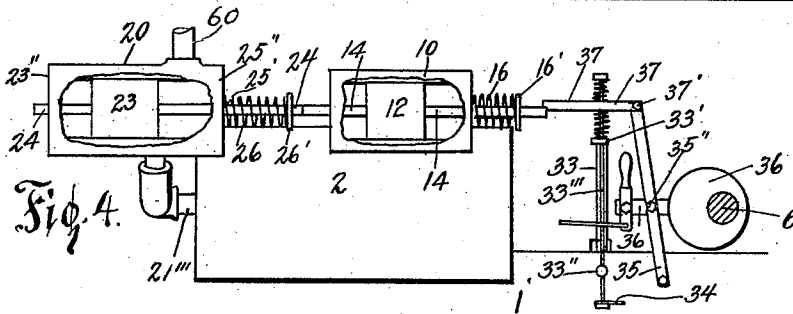
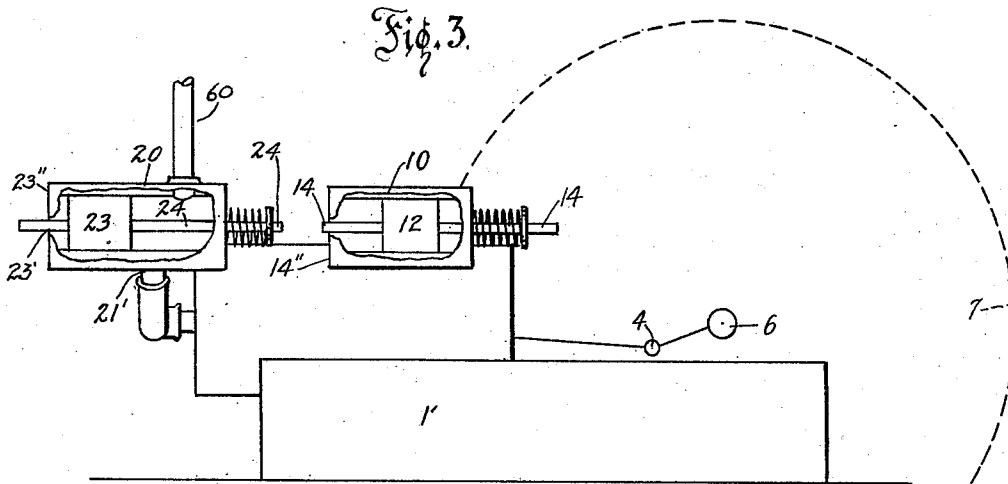
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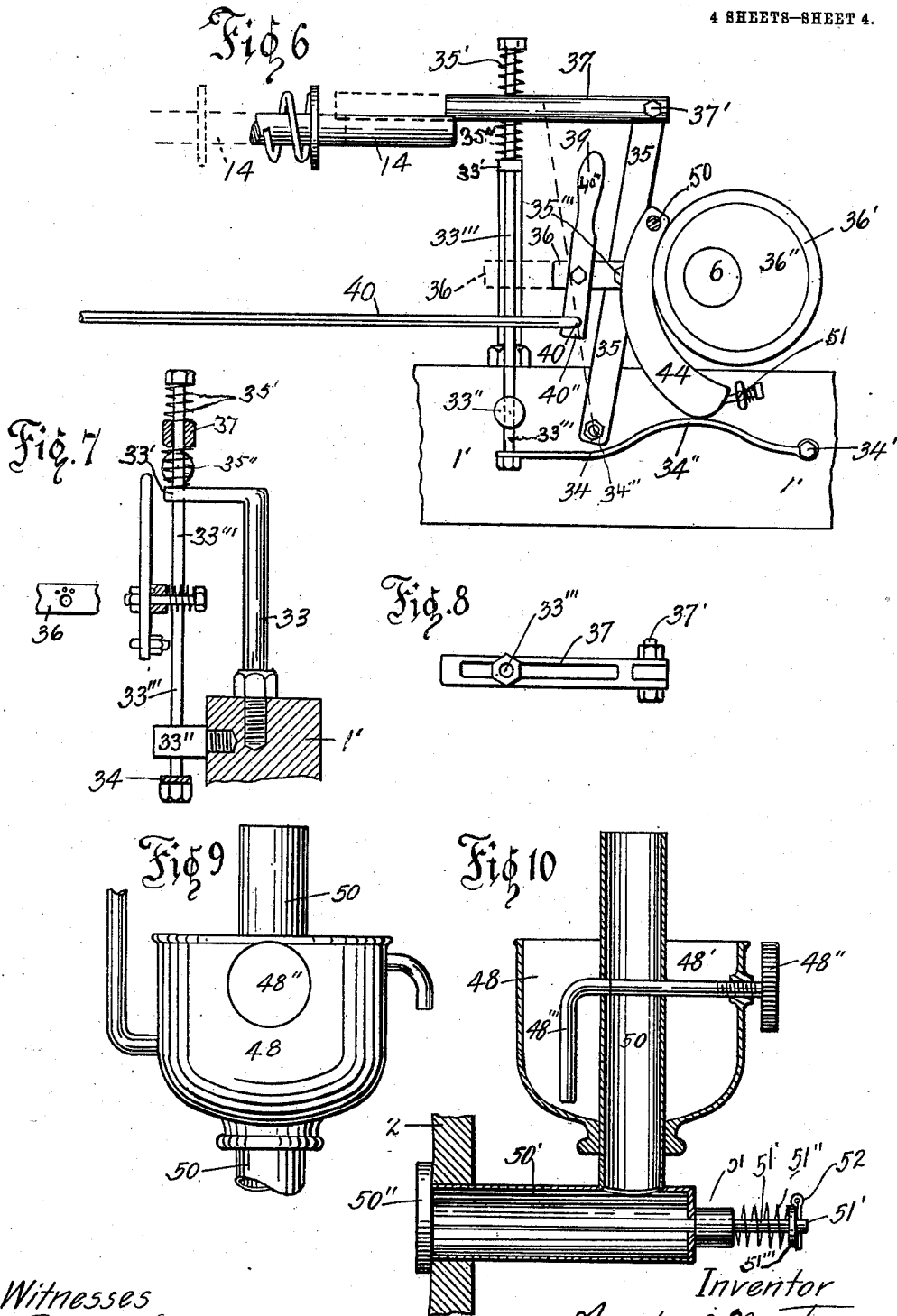
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UNITED STATES PATENT OFFICE.

ANDREW MATSON, OF LOS ANGELES, CALIFORNIA.

GAS-ENGINE HAVING AUTOMATIC EXHAUST-OPENINGS THEREIN.

977,667.

Specification of Letters Patent.

Patented Dec. 6, 1910.

Application filed August 23, 1909. Serial No. 514,277.

To all whom it may concern:

Be it known that I, ANDREW MATSON, a citizen of the United States, residing at Los Angeles, county of Los Angeles, State of California, have invented and discovered a new and useful Improvement in Gas-Engines Having Automatic Exhaust-Openings Therein, set forth in the annexed specification; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in gas engines having automatic exhaust openings; and the objects of my improvement are to provide an engine simple in construction, more efficient and powerful in operation than gas engines heretofore placed upon the market.

The invention consists essentially in the construction, combination and arrangement of the several parts as will be hereinafter fully described in the specification, shown upon the drawings appended hereto, and specifically pointed out in the claims made a part hereof.

I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view of the main driving cylinder, of the water jacket surrounding the same and a cross sectional view of the crank shaft; and a view in elevation of the piston and the piston rod for operating said piston within the said cylinder; other portions of the engine shown in elevation and parts thereof broken away; Fig. 2 are longitudinal sectional views of the primary-supplemental cylinder and the final exhaust cylinder each having a water-cooling jacket surrounding the same; and a view in elevation of the pistons and piston rods for operating respectively the pistons within the said cylinders; the main driving cylinder and other portions of the engine shown in elevation, and parts of the operating devices broken away; Fig. 3 are views in elevation of the primary-supplemental cylinder and the final exhaust cylinder portions of each of the said cylinders broken away showing the piston in elevation within said cylinders, respectively, the piston rods for operating the said pistons; the main driving cylinder, bed plate, driving shaft and crank shaft shown in elevation and other

parts of the engine illustrated diagrammatically; Fig. 4 are views in elevation of the primary-supplemental cylinder and the final-exhaust cylinder portions of each of the said cylinders broken away illustrating the piston in each of said cylinders, respectively, the piston rods for operating the said pistons in juxtaposition; the main driving cylinder and other portions in elevation; the driving shaft shown in cross section and portions of the engine broken away and parts thereof removed; Fig. 5 is a rear end view of the machine showing in elevation the rear ends of the main driving cylinder, the final-exhaust cylinder, pipes for connecting the water-cooling jackets surrounding the said cylinders and the fuel vaporizing receptacle and portions of the devices connecting the said receptacle and the main driving cylinder; other portions of the engine shown in elevation and parts thereof broken away; Fig. 6 are views in elevation of a portion of the bed plate of the machine, the governor, main driving shaft with the eccentric thereon, devices for operating the governor, a portion of the sparker rod and handle for operating the same; the governor-push-rod and portions of the piston rod for operating the said piston within the said primary-supplemental cylinder and other devices connected therewith shown in full and dotted lines; Fig. 7 are views in elevation of portions of the devices for supporting and operating the governor and sparker rod; portions of the bed plate, the governor-push-rod and other parts of the device shown in sections; Fig. 8 is a top plan view of the slotted governor-push-rod showing the end rocker arm to which it is pivoted at one end and guide rod in the slot and nut on the end thereof; Fig. 9 is a view in elevation of the fuel vaporizing receptacle and the pipes connected therewith for regulating the fuel therein, and the air pipe extending through said receptacle; and Fig. 10 is a sectional view of the fuel vaporizing receptacle, the air pipe in section extending through the same, the fuel valve casing and a portion of the main driving cylinder also in section; the fuel valve, the valve stem and means for regulating the valve stem, illustrated in elevation.

Similar numerals, letters and characters refer to like parts throughout the several views of the drawings.

The reference numeral 1 denotes the bed

plate of the machine having vertical upright portions 1' preferably made integral with the said bed plate. The numeral 2 indicates the main driving cylinder having
 5 a water-cooling jacket 2' surrounding the same; 2'' the piston operating within the said driving cylinder and 3 the piston rod for operating the piston 2'' connected at one end to the said piston and at the opposite end to the crank shaft 4 by means of
 10 the bearing 4' and headed bolts 4'' shown upon Figs. 1 and 2 of the drawings. The reference numeral 5 denotes the crank arms secured to the driving shaft 6 by means
 15 of the bearing 5' and the headed screw bolts 5''. The numeral 77 represents the fly-wheels upon the ends of the main driving shaft 6 without the said vertical portions 1' of the bed plate 1 as shown upon Figs. 1 and
 20 2 of the drawings.

The reference numeral 10 refers to the primary-supplemental cylinder having the water-cooling jacket 10' surrounding the same; the numeral 11 an opening in the side
 25 of the said primary-supplemental cylinder adjacent to the main driving cylinder 2 adapted to be connected with the opening 11' therein as shown upon Figs. 1 and 2 of the drawings, by means of the pipe 11''.
 30 12 denotes the piston operating within the said primary-supplemental cylinder 10, and 14 the piston rod for operating the said piston 12 connected to and extending through the said piston 12, the rear end of
 35 the said piston rod 14 adapted to reciprocate through openings 14' in the rear head 14'' and through an opening 15' in the front head 15'' of the said primary-supplemental cylinder 10, the front projecting end of the
 40 said piston rod 14 is secured thereon to the coil cushion spring 16 and the collar 16'; the rear end of the said piston rod 14 is adapted to abut against the front end of the piston rod of the piston within the final
 45 exhaust cylinder hereinafter described and shown upon Figs. 1, 2, 3 and 4 of the drawings.

The numeral 20 indicates the final-exhaust cylinder of my improved engine provided with a water-cooling jacket 20' surrounding the same; the numeral 21 refers to an opening in the side of the final-exhaust cylinder 20 adjacent to the main driving cylinder 2, the said opening 21 is connected
 50 with the said main driving cylinder 2 by means of the pipe 21', couplings 21'' and pipe 21''', the latter extending through the rear head 22' of the said main driving cylinder 2 as illustrated upon Figs. 1, 2, 3 and
 55 4 of the drawings. The numeral 23 denotes the piston adapted to operate within the said final-exhaust cylinder 20, and 24 the piston rod for operating the said piston 23 connected to and extending through the said
 60 piston 23, the rear end of the said piston

rod 24 adapted to reciprocate through an opening 23' of the rear head 23'' and through an opening 25' in the front head 25'' of the said final-exhaust cylinder 20. The front projecting end of the piston rod 24 has secured thereon the coil cushion
 70 spring 26 and the collar 26', the said front projecting end of the piston rod 24 is arranged in line with the reciprocating piston rod 14 hereinbefore mentioned, and is adapted to abut against the rear end thereof,
 75 as shown upon Figs. 1, 2, 3 and 4 of the drawings.

The numeral 30 refers to the water pipe for conveying water from any suitable
 80 street main where my improved engine may be located, to the water-cooling jacket 20' surrounding the cylinder 20.

The numeral 30' denotes the pipe for conveying water from the said water-cooling
 85 jacket 20' through the pipe 30'', into the pipe 31 leading to the water-cooling jacket 10' surrounding the cylinder 10 hereinbefore referred to, and by means of the pipe 31' the water from the said water-cooling jacket
 90 10' is carried through the pipes 31'' and 32 into the water-cooling jacket 2' hereinbefore mentioned surrounding the cylinder 2, as shown upon Figs. 1 and 4 of the drawings, and by means of the pipe 32'' shown upon
 95 Fig. 1 of the drawings, the water is finally carried from my improved engine, and flows into any suitable receptacle not necessary to be shown.

The numeral 33 denotes the support
 100 screwed or otherwise fastened to the upper edge of one of the vertical upright portions 1' of the bed plate 1, shown upon Figs. 1, 2, 6 and 7 of the drawings, the said support 33 having an angular portion 33' for guid-
 105 ing the vertically reciprocating rod 33''' at its upper portion, and a bracket 33'' for guiding the said vertically reciprocating rod 33''' at its lower portion, the said vertically reciprocating rod 33''' having secured
 110 upon the lower end thereof the flat upwardly-curved spring 34, fastened at one end to the said vertical upright portion 1' of the bed plate 1 by means of the headed
 115 bolt 34'. The said vertically reciprocating rod 33''' is adapted to carry the free end of the curved flat spring 34, upwardly by means of the stronger coiled spring 35'' below the push rod 37, its lower end resting
 120 upon the angular projection 33' of the said support 33, against the tension of the weaker coiled spring 35' upon the said vertically reciprocating rod 33''', the lower end of the weaker coiled spring 35' resting upon
 125 the upper surface of the push rod 37 as shown upon Figs. 1, 2, 4, 6 and 7 of the drawings.

The numeral 35 designates the rocker arm shown upon Figs. 4 and 6 of the drawings, swiveled upon the pin 34''' to the upright
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portion 1' of the bed plate 1. The upper end of the said rocker arm 35 being movably fastened by the headed bolt 37' to the slotted governor push rod 37, as illustrated upon Figs.

1, 2, 4, 6, 7 and 8 of the drawings. The said slotted governor push rod 37 is adapted to be disconnected from the front end of the piston rod 14 as shown in full lines upon Figs. 1, 2 and 4 of the drawings, and in dotted lines upon Fig. 6 of the drawings, and when the said slotted governor push rod 37 is disconnected from the front end of the piston rod 14 as hereinbefore stated, the piston 12 of the primary-supplemental cylinder, and the piston 23 of the exhaust cylinder cease to reciprocate within the respective cylinders 10 and 20 hereinbefore referred to.

The numeral 40 indicates the sparker rod secured at 40' to the shorter end 40'' of the operating handle 39. The longer end 40''' of the handle 39 is adapted to be grasped by the hand of the operator to move the sparker rod 40 backward and forward against the electrical contact 41 secured in any suitable manner upon the outer surface of the water-cooling jacket 2' upon the cylinder 2 hereinbefore referred to, the rear end of the sparker rod 40 being secured in the movable support 41', the said support being fastened upon the headed bolt 41'', as illustrated upon Fig. 2 of the drawings.

The numeral 44 designates the governor shown upon Figs. 1 and 6 of the drawings pivotally secured to the fly wheel 7 at 50 at one end thereof, and loosely connected at the opposite end at 51. When the push rod 37 is in alinement and in contact with the piston rod 14 as shown upon Fig. 4 of the drawings, the opening 11' in the main driving cylinder 2 and the opening 11 in the primary-supplemental cylinder 10 communicate with each other; the exploded gases from said cylinders pass freely from one to the other as the pistons 2'' and 12 reciprocate respectively in the said cylinders 2 and 10.

The numeral 48 denotes the receptacle for the evaporating fluid employed to drive the engine; 48' refers to the valve stem, and 48'' the milled head for operating the said valve stem; 48''' denotes the bent pipe for conveying the volatile fluid to the bottom of the receptacle 48.

The numeral 50 refers to the tube for conveying air into the air chamber 50'; 50'' indicates the valve adapted to open and close the opening in the end of the main cylinder 2 of the engine, as the piston 2'' reciprocates back and forth in said cylinder 2.

51 refers to the valve stem casing; 51' indicates the valve stem of the valve 50''; 51'' the coil spring upon the projecting end of the valve stem 51'; 51''' the collar upon the projecting end of the valve stem 51';

and 52 the split pin for retaining the said coil spring 51'' and the collar 51''' upon the end of the valve stem 51', as shown upon Fig. 1 of the drawings.

From the foregoing description taken in connection with the accompanying drawings the mode of operation and advantages of the invention will be readily apparent without requiring an extended explanation thereof.

To start the engine the hand of the operator is first applied to one or both of the fly wheels 7 and simultaneously with the force applied to the said fly wheels 7 the piston 2'' being at the opposite end of the cylinder 2 from that shown upon Fig. 1 of the drawings, the pressure occasioned by the first explosion presses against the inner end of the said piston 2'' and forces the piston into the position shown upon Fig. 1 of the drawings until the inner end of the said piston 2'' passes beyond the opening 11' permitting the discharge to pass into the cylinder 10 through the pipe 11'' shown in dotted lines upon Fig. 1 and in full and dotted lines upon Fig. 2 of the drawings. The pressure from the said first discharge being equal in the main driving cylinder 2, in the said pipe 11'' and in the primary supplemental cylinder 10 forces the said piston 12 carrying the piston rod 14, shown upon Fig. 3 of the drawings to abut against the end of the piston rod 24 carried by the piston 23 in the exhaust cylinder 20 from the opening 21 in the said exhaust cylinder 20 of the pipes 21' and 21''' connecting the said cylinder 2 and the said cylinder 20 whereby the said exhaust of the said first explosion is carried into the outer air through the pipe 60 shown upon Figs. 1, 2, 3 and 4 of the drawings. The above mentioned steps of the operation are repeated whenever the engine is in operation.

I claim:

1. A gas engine comprising a main driving cylinder, a primary supplemental cylinder each of said cylinders provided with a piston and with means for reciprocating each of said pistons respectively within said cylinders, each of said cylinders having an opening therein and a pipe for connecting the said opening for re-conveying gases from the said primary supplemental cylinder into the said main driving cylinder, an exhaust cylinder having a piston and means for reciprocating the said piston within the exhaust cylinder, the said exhaust cylinder provided with an opening, the main driving cylinder provided with an opening in the end thereof, a pipe connecting the said opening in the main driving cylinder and the said opening in the exhaust cylinder, a pipe connecting the opening in the exhaust cylinder with the said opening in the end of the main driving cylinder, the said piston in the

said exhaust cylinder adapted to open and close the said opening in the exhaust cylinder and to force the waste products of combustion from the said exhaust cylinder into the
 5 open air and to expel the products of combustion from the said exhaust cylinder.

2. A gas engine comprising a main driving cylinder, a piston adapted to reciprocate within said cylinder, a primary supplemental cylinder having a piston adapted to reciprocate therein, each of said cylinders having
 10 openings therein, a pipe connected with each of said openings for re-conveying gases from the said primary supplemental cylinder into the main driving cylinder, an exhaust
 15 cylinder having a piston adapted to reciprocate therein, the said exhaust cylinder provided with a pipe leading to the said main driving cylinder, the said main driving cylinder provided with an opening in the end
 20 thereof the said pipe connecting the said opening in the exhaust cylinder and the main driving cylinder, the piston in the said exhaust cylinder adapted to open and close
 25 the opening in said exhaust cylinder, the said exhaust cylinder provided with a pipe leading therefrom for conveying the products of combustion from the said exhaust cylinder into the outer atmosphere.

30 3. A gas engine comprising a main driving cylinder, a piston adapted to reciprocate in said cylinder, and means for operating the said piston, a primary supplemental cylinder provided with a piston adapted to reciprocate therein, and means for operating the
 35

said piston in said primary supplemental cylinder, each of said cylinders having an opening therein and a pipe connecting each of said openings for re-conveying heated and expanded gases from the said primary supplemental cylinder back into the said main driving cylinder, an exhaust cylinder having a piston adapted to reciprocate therein and means for operating said piston in said exhaust cylinder, the said exhaust cylinder
 45 provided with an opening therein, the said main driving cylinder having an opening therein, a pipe connecting the said opening in the exhaust cylinder with the opening in the end of the said main driving cylinder, the piston in the said exhaust cylinder adapted to open and close the said opening in the
 50 said exhaust cylinder, the said exhaust cylinder provided with a pipe leading therefrom into the open air whereby the waste products of combustion are carried from
 55 said exhaust cylinder, the said piston in the exhaust cylinder adapted to open and close the opening in said exhaust cylinder and the piston adapted to reciprocate in the said
 60 main driving cylinder adapted to open and close the said opening in the end of the said main driving cylinder.

In testimony whereof, I have signed my name to this specification in the presence of
 65 two subscribing witnesses.

ANDREW MATSON.

Witnesses:

W. J. BRYANT,
 JAMES R. ROGERS.