(No Model.) 3 Sheets—Sheet 1.

C. V. WALLS.

GAS ENGINE.

No. 498,700. Patented May 30, 1893.

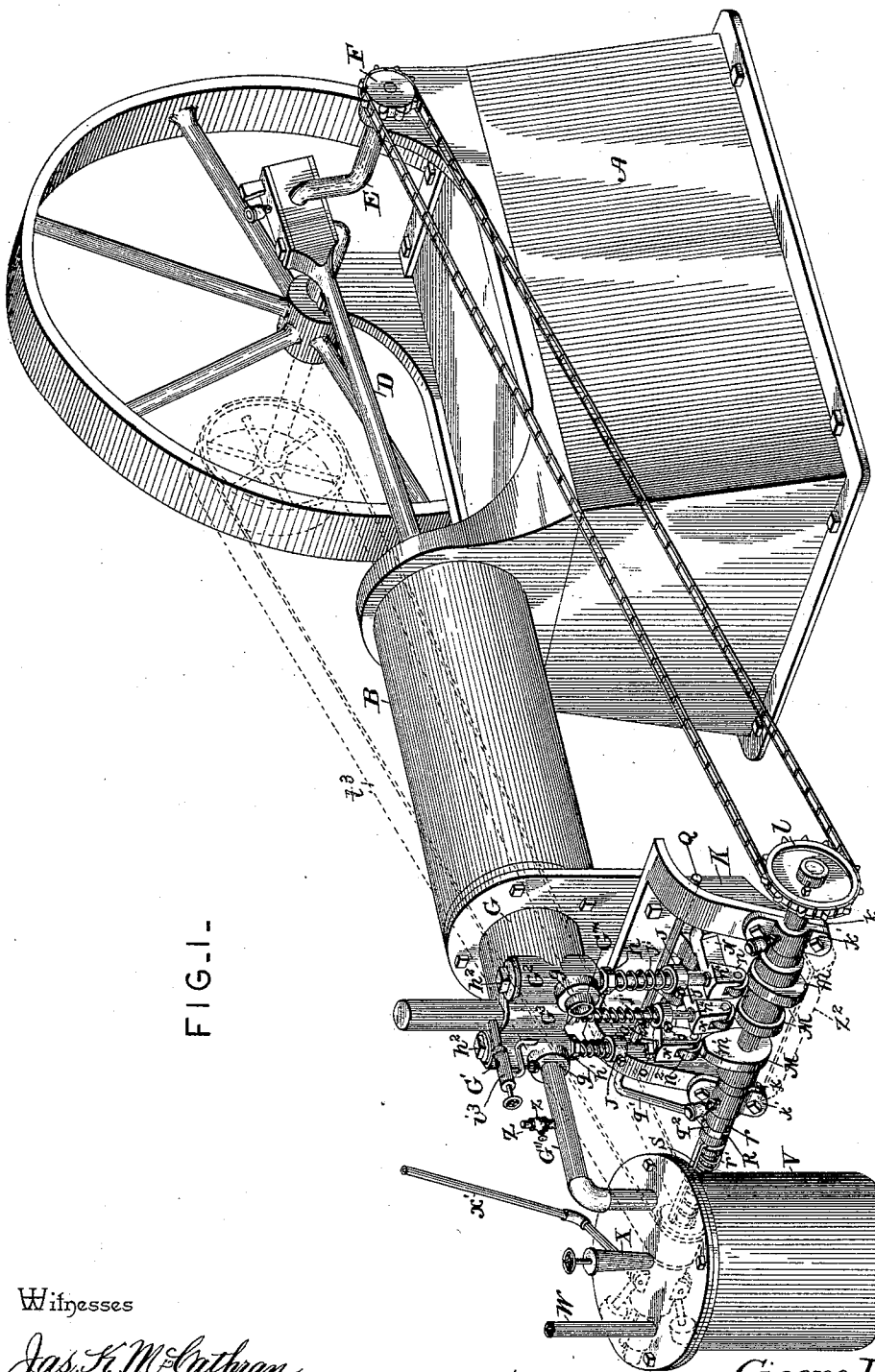

FIG. 1.

Witnesses

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(No Model.) 3 Sheets—Sheet 2.

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FIG. 6.

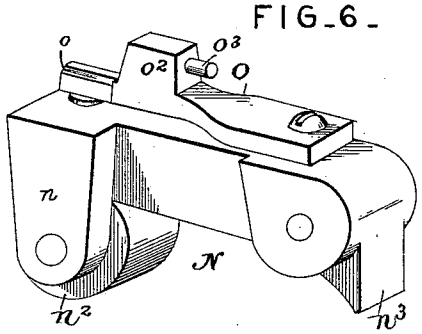

FIG. 2.

FIG. 8.

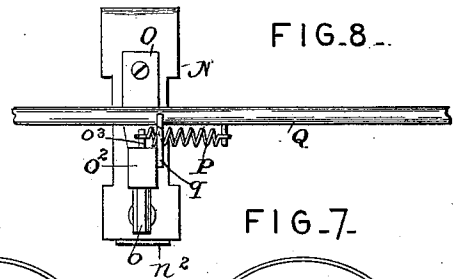

FIG. 7.

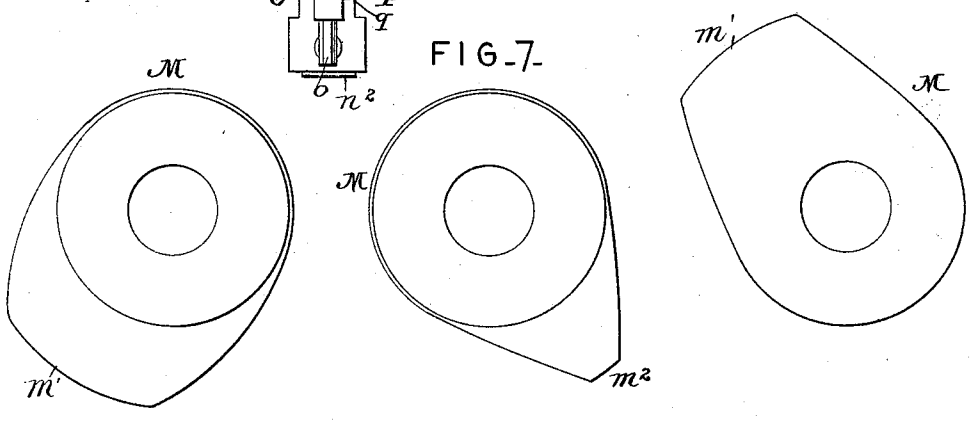

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FIG. 3.

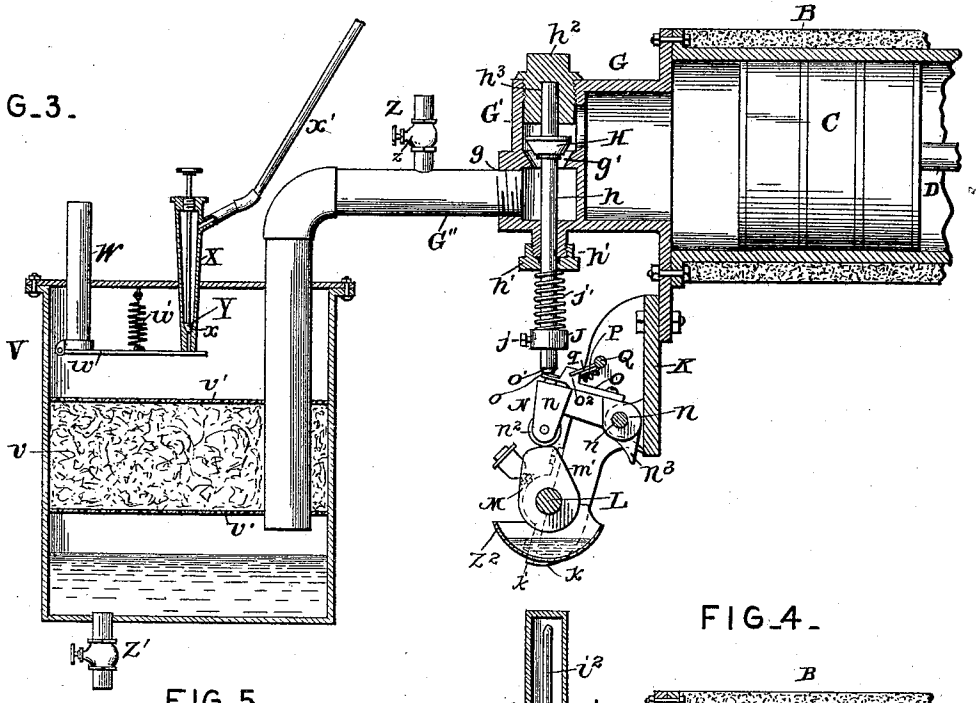


FIG. 4.

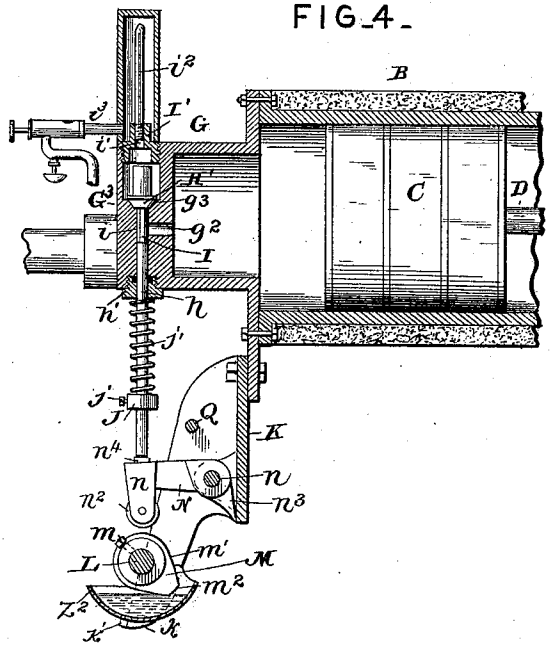
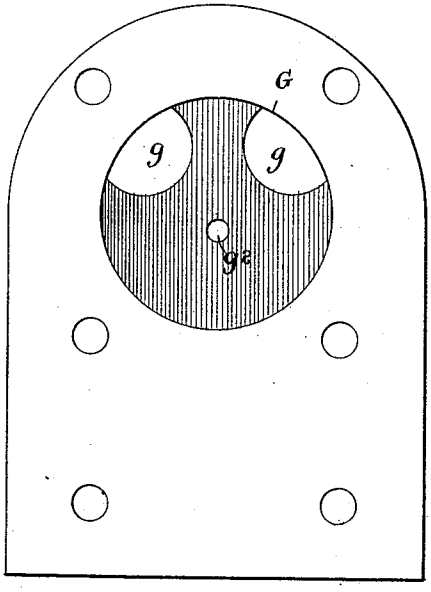


FIG. 5



Witnesses

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D. P. Wolhaupter.

Inventor

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By his Attorneys,

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UNITED STATES PATENT OFFICE.

CICERO V. WALLS, OF ARCOLA, ILLINOIS.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 498,700, dated May 30, 1893.

Application filed March 8, 1892. Serial No. 424,202. (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 an improvement in engines of this class which will not only simplify and render less expensive the construction of such engines, but at the same time will also provide means whereby the valve regulating devices shall be more accurately controlled and also to automatically regulate the speed of the engine under various loads through the valve operating mechanism.

To this end it is my aim to generally improve upon the valve operating and governing devices of such engines.

With these and many other objects in view which will readily appear to those skilled in the art as the nature of the invention is better understood, the same consists in the important improvements hereinafter more fully described, illustrated and claimed.

In the accompanying drawings:—Figure 1 is a perspective view of a gas engine having the improvements as contemplated by my invention. Fig. 2 is a vertical sectional view through the valve chambers. Fig. 3 is a vertical longitudinal sectional view through the supply or exhaust valve chamber. Fig. 4 is a similar view through the ignitor valve chamber. Fig. 5 is a detail plan view looking into the compression and explosion chamber. Fig. 6 is a detail perspective view of one of the valve stem controlling levers. Fig. 7 is a detail in perspective of the operating eccentrics. Fig. 8 is a detail plan view of the governing-lever and operating rod.

Referring to the accompanying drawings:—A represents an ordinary supporting bed or frame, supporting at one end thereof the cylinder B, within which travels the piston C working through the entire length of said cylinder and driving the piston rod D is connected directly to the drive crank shaft E, from which motion is communicated to the machinery to be operated, and which carries at one end thereof the small sprocket or other suitable gear F, the function of which will be presently noted.

At one end and forming the head of the cylinder B is the combined compression and explosion chamber G into which the gas and air is led, compressed and exploded to actuate the piston in the ordinary manner.

Forming an integral part of the combined compression and explosion chamber G, are the opposite supply and exhaust valve chambers G′ and G^2, respectively, while intermediate of the opposite valve chambers G′ and G^2 is the ignitor valve chamber G^3, but it will be readily observed that the location of the several valve chambers may be changed at the option of the manufacturer. Each of the supply and exhaust valve chambers G′ and G^2 are provided with the openings *g*, opening into the compression and explosion chamber, to supply the same with air and gas and to exhaust at the proper moment after explosion. The said supply and exhaust valve chambers G′ and G^2, are provided at a point directly below the openings, therefrom into the compression and explosion chamber, with the beveled valve seats *g*′, over and upon which work the conical valves H. The said valves H are carried by the valve stems *h*, which work through the stuffing boxes *h*′, in the lower ends of said valve chambers, and project a sufficient distance below the same so that they can be readily controlled in the manner to be presently described. The valve stems *h*, also project above the top of the valves H carried thereby, and work into the bearing caps h^2, closing the top ends of the valve chambers. The said caps h^2 are provided with the guiding bores h^3, into which fit the said upper ends of the valve stems, and which serve to guide and steady the valves in their movement. The said caps or plugs are also exteriorly threaded, as illustrated, so as to be removably secured in the upper interiorly threaded ends of the valve chambers, and by such construction it will be readily seen that the said cap plugs not only serve as guides for the valves, but also provide means whereby the said valve chambers can be easily opened for gaining access thereto for cleaning and removal of the valves.

To the supply valve chamber G′, is connected a supply pipe G″, which also supports

the carbureter from which the gas and air is drawn into the compression and explosion chambers, and the construction of which will be hereinafter set forth, while to the adjacent exhaust valve chamber G^2 is connected an exhaust pipe G''' which may be led outside of the building within which the engine is located or to any other suitable point of exhaust.

The ignitor valve chamber G^3 is provided at a point below the opening g, with an opening g^2, communicating with the compression and explosion chamber so that the gases therein can be exploded at the proper time. The said valve chamber G^3 is further provided directly above the opening g^2 with the beveled valve seat g^3, over which works the conical valve H', carried by the valve stem h, similar to the other valve stems previously described, but is further provided below the valve H' with a polygonal flattened guide portion I, which works in the cylindrical guide bore i, located directly below the valve seat and serving to steady and guide the ignitor valve H' in its movement. The ignitor valve stem also projects through the stuffing box h', in the lower end of the chamber G^3 the same distance below the several valve chambers so that it can be accurately controlled at the proper time by the mechanism to be described.

In the upper end of the ignitor valve chamber is removably secured the screw plug I', provided with an opening i' therethrough, and into the upper end of which is fitted the closed igniting tube i^2, which may be heated in any suitable manner by the burner i^3, but it will of course be understood that an ordinary electric spark may be employed for igniting the compressed gases.

To each of the valve stems below the various valve chambers is secured the collars J, adjustably secured to said stems by means of the set screws j passing therethrough and impinging against said stems, whereby, by adjusting said collars in this manner, the tension of the springs j', can be regulated to suit the needs of the engine. The said springs are placed between the said collars and the stuffing boxes of the valve chambers around the valve stems and are of sufficient strength to firmly hold the valves to their seats so that the same can only be raised by the valve actuating mechanism and remain unaffected by gaseous pressure exerted thereupon.

Secured to or integral with the cylinder head is the depending bracket K having the opposite depending bearing arms k standing off from the cylinder head and provided at their lower ends with the boxes k', forming bearings for the horizontal valve controlling shaft L. The valve controlling shaft L carries upon one end thereof the sprocket or other suitable gear l, by means of which the same may be connected by a link or other suitable connecting devices with the crank shaft of the engine. It will of course be observed that the valve operating shaft L may be driven from the crank shaft by any suitable connections, whereby the valve controlling shaft will make one revolution to every two revolutions of the crank shaft E.

Adjustably secured upon the valve controlling shaft L, between the boxes k', and in a line directly under the valve stems are the operating cams or eccentrics M. The said eccentrics or cams are adjusted upon the shaft by means of the set screws m and are so disposed with relation to each other that the valves are controlled in succession one after the other at the proper time, first, the supply valve, then the ignitor valve and finally the exhaust valve, this operation of course being continuous and successive when the governing devices do not interrupt this order of succession. It will be well to observe that the striking portions of the operating cams or eccentrics directly under the supply and exhaust valve stems have a contact portion or face m', of sufficient length so that the inlet and exhaust valves will be held open at the proper moment during the full out or in stroke of the piston, respectively, as will be more specially noted, while on the other hand, the eccentric or cam controlling the ignitor valve is provided with an angular contact point m^2, which provides means for rapidly opening and closing the ignitor valve.

Arranged in a line directly over the several operating eccentrics or cams are the controlling levers N. The several controlling or lifting levers N are suitably pivoted at n to the body of the depending bracket K. The said lifting levers N are bifurcated at their outer ends, and carry the contact rollers n^2, which are engaged by the contact faces and points only, of the several operating cams or eccentrics, while the inner ends of the said lifting levers are provided with the downwardly projecting stops n^3, which project below the point of pivot and are designed to strike or abut against the body of said bracket, and thereby serve to hold said levers in an approximately horizontal position out of contact with the operating eccentrics or cams to prevent wear except when the said eccentrics or cams have reached such a position that the extended contact portions thereof reach the contact rollers and thereby lift the outer ends of the levers. The said lifting levers are further provided at their outer ends with the raised hardened striking bosses n^4, which are designed to bear under and against the extreme lower ends of the valve stems to raise the same at the proper time, it being of course observed that the said bosses serve to prevent undue wear upon the parts at this point. Now it will be observed that when the valve controlling shaft has rotated sufficiently, the eccentric or cam directly under the supply valve stem, will come in contact with the outer end of the lifting lever directly thereover and thereby open the supply valve G', which on account of the contact face or portion of said cam or eccentric, will be

held open during the entire outstroke of the piston. This outstroke of the piston draws the air and gaseous vapors through the supply pipe beforementioned into the cylinder. After the piston has made the full outstroke and upon or at the very instant it starts back, the supply valve closes, and the air and other vapors are compressed to a considerable degree of pressure into the compression and explosion chamber G, by the piston which travels directly up to the head thereof. At this point the angular contact point of the ignitor-valve-controlling eccentric or cam raises the lifting lever directly thereover and sharply and quickly opens and closes the ignitor valve. The short period of time that the ignitor valve is open is sufficient to allow the spark or the heated tube to explode the gas and impel the piston forcibly back in its outstroke. When the piston has reached the limit of its outstroke and commences to return, the exhaust valve operating eccentric or cam has come into play and opened the exhaust valve, through which, and the exhaust pipe, the products of combustion resulting from the explosion are forced by the incoming or returning piston. It will be observed that this cycle of operation is completed once in every two revolutions of the crank shaft and one of the valve controlling shaft, except when interrupted by the governing devices, which I shall now proceed to describe. It may be remarked at this point, although well understood in the art, that the several operating cams or eccentrics open the valves just before the piston has reached the limit of its in or out stroke, as the case may be, in order to give the same the requisite lead.

Pivotally secured to the top of the inlet or supply valve lifting lever N is the governing lever O. Said governing lever O is pivoted near the inner end of the lifting lever and is provided with a beveled contact end o, which is designed to work beneath the lower beveled end o' of the supply valve stem h, and is designed to be regulated as described. The said governing lever O is further provided with the upwardly extending projection o^2, and the rearwardly projecting pin o^3, which receives one end of the spring P, the other end of which is suitably connected with the operating rod Q, at such a point of attachment thereon, so that the contact end of the governing lever will be normally drawn to and under the supply valve stem so that when the lifting lever is raised, the said contact end will engage the lower beveled end of said valve stem and raise the same. The said rod Q pierces the body of the bracket at a suitable point above the several lifting levers and is provided with an operating pin q, which is designed to engage one side of the extended projection o^3 of said governing lever and force the same from under the supply valve stem or sufficiently from under the same so that when the lifting lever is raised the beveled end of the valve stem will clear the said contact end o and will not be operated by the lifting lever so as to allow a fresh charge to be introduced into the engine. This is of course controlled by the speed of the engine as will be readily noted. The said operating rod Q projects beyond one side of the bracket and is provided with a downturned arm q', having a lower bifurcated end q^2, which engages the innermost annular groove R of the grooved collar r, secured to the valve controlling shaft so as to slide thereon on the end thereof, or portion thereof, opposite to the end from which motion is imparted thereto. The said sliding sleeve r, is provided with parallel annular grooves R one of which is engaged by the bifurcated arm of said rod, as already described, while the other and outer groove thereof receives the inner flanged ends of the sliding arms or plates S passing through the governor body T, and controlled as will be described. The said sleeve r is normally pressed toward the bracket by the spring r' mounted over the valve controlling shaft and interposed therebetween and the collars r^2 secured to said shaft at a point away from said sleeve, so that normally the governing lever will be in such a position as to allow the supply valve to be regularly operated.

The governor body T is loosely mounted upon the valve controlling shaft between the collar r^2 and r^3, thereon and is itself provided with a projecting collar or sleeve t, provided with the perforation, t', which may receive the securing pin t^2, which serves to secure the said governor body fixedly to the valve controlling shaft in order that the governor may be controlled by the speed of said shaft when the engine is of sufficient power to cause said shaft to revolve sufficiently rapid to operate the governor, but on the other hand, in slow speed engines it is necessary to operate the governor independently of the valve controlling shaft m, and in such case the pin t^2 is removed so that the governor body can be independently rotated by means of a belt t^3, passing over the belt groove t^4 formed in the valve body and suitably connected with the crank shaft. The governor body T carries the ordinary centrifugal ball governors U, which are suitably pivoted in said body and loosely connected with the sliding plates S so that when the speed demands it, the said sliding plates S are drawn out and thereby cause the sliding sleeve r to draw the rod P sufficiently to move the governor lever out of the way of the supply valve stem so that it will not be operated until the speed of the engine has again sufficiently decreased to allow the governors to retract.

The supply pipe G'', connected with the supply valve chamber G', passes into and supports the carbureting chamber V off from the engine. The said supply pipe G'' extends to a point near the bottom of said carbureting chamber and just below an intermediate stratum v, of porous absorbent material, suit-

ably held in position centrally within the chamber, preferably between the upper and lower perforated metal plates v', thus leaving a space above and below said stratum. An air supply pipe W enters the top of the carburetor and has the lower end thereof normally closed by the hinged valve w hinged thereto and projecting over and beyond the same. The said valve is normally held over said air supply pipe W by means of the coiled spring w', and is designed to also inclose the lower end of the valve casing X, having near the lower end thereof the needle valve seats x and having connected therewith near the upper end the oil supply pipe x'. A needle valve Y works over the needle valve seat x, and accurately regulates the quantity of oil that is to be fed into the carburetor. Now it will be observed that the suction from the outwardly moving piston creates a sufficient vacuum or suction within the carburetor to cause the valve w to open under the air pressure in the pipe W. As the valve w opens it allows the oil to fall from the valve casing X, onto the end of the valve which causes the oil to be sprayed at the same moment the air rushes into the carburetor, and thereby rapidly vaporizes the oil, which also passes through the porous and absorbent stratum, also serving to further vaporize the oil and commingle the air therewith.

When it is found that the commingled gases are too rich, I employ a supplemental air pipe Z having a controlling valve z, by means of which a sufficient quantity of air may be admitted to the supply pipe G'' to render the mixture explosive.

In order to prevent a sufficient quantity of oil to accumulate, so that it would be sucked by the piston, through the supply pipe, I employ a drain cock Z', connected with the bottom of the carburetor so that the surplus oil can be readily drawn off, and so that nothing but the commingled gases can pass into the chamber.

It is now thought that the construction, operation and many advantages of the herein described gas engine are apparent without further description, but it will be well to observe at this point that instead of using the gasoline and vaporizing the same as described, I may connect the carburetor with an ordinary gas main by suitable piping, and in such event substituting said piping for the valve casing X, through which the oil is led into the carburetor, thereby adapting the carburetor for a double function, which is an important point in this class of machines when it is desired to use either gasoline or gas.

Although I have particularly described specific constructions, yet I would have it understood, that I do not wish to confine myself to the exact details specified, but reserve the right to make such changes as are deemed necessary without departing from the spirit of my invention.

To complete the construction herein specified and in order to insure an easy operation of the various parts, I employ a lubricating trough Z^2, which is secured to the depending bracket and arranged below the valve controlling shaft, so that as the said shaft rotates, the cams or eccentrics thereon pass through the lubricant in said trough and are thereby continually lubricated.

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

1. The combination of the supply valve stem having a beveled lower end, the valve controlling shaft carrying an eccentric, a lifting lever located above and operated by said eccentric, a governing lever pivoted horizontally upon said lifting lever and provided with a beveled contact end designed to work beneath the beveled end of said stem and a rearwardly projecting pin, a spring connected with said pin and a suitable point of attachment to normally hold said lever under said valve stem, and means for drawing said lever from beneath the stem, substantially as set forth.

2. The combination with the supply valve carrying stem, the valve controlling shaft carrying an eccentric and a lifting lever operated by said eccentrics; of a governing lever pivoted horizontally upon said lifting lever and provided with a contact end working beneath the lower end of said valve stem, and an upwardly extending projection, a sliding operating rod provided with an operating pin engaging one side of said extended projection to throw the governing lever from under the valve stem, a spring connected to said governing lever and said rod, and a governing device connected with said operating rod, substantially as set forth.

3. The combination with the supply valve-carrying stem, the valve controlling shaft carrying an eccentric and a lifting lever operated by said eccentric; of a governing lever pivotally mounted upon said lifting lever and normally held under the lower end of said valve stem, a sliding sleeve working over said shaft, a sliding operating rod connected with said sliding sleeve and engaging one side of said governing lever, and a centrifugal governor mounted upon said shaft and connected with said sliding sleeve, substantially as set forth.

4. The combination with the supply valve carrying stem, the valve controlling shaft and a lifting lever working directly under said valve stem and over said shaft; of a governing lever pivotally mounted upon said lifting lever and normally held under the lower end of the valve stem, a sliding sleeve working over said shaft, a sliding operating rod connected with said sliding sleeve and engaging one side of said governor lever, and a centrifugal governor mounted upon said shaft and connected with said sliding sleeve, said governor being designed to revolve with or independently of the valve controlling shaft, substantially as set forth.

5. The combination with the supply valve carrying stem, the valve controlling shaft and a lifting lever working directly under said valve stem and controlled by said shaft; of a governing lever pivoted horizontally upon said lifting lever directly under the lower end of the valve stem, a spring-pressed sleeve sliding over one end of said shaft, a sliding operating rod connected with said sliding sleeve and said governing lever, a governor body mounted upon said shaft adjacent to said sleeve and provided with a belt groove and a perforated securing collar, a pin removably engaging said collar and the shaft, flanged operating arms or plates connected with said sleeve and passing through the governor body on the shaft, and ball governors connected with said body and said arms or plates, 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. H. SIGGERS,
H. G. PIERSON.