No. 760,296. PATENTED MAY 17, 1904.

C. A. ANDERSON & E. A. ERICKSON.

GASOLENE GAS MAKING MACHINE.

APPLICATION FILED FEB. 7, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

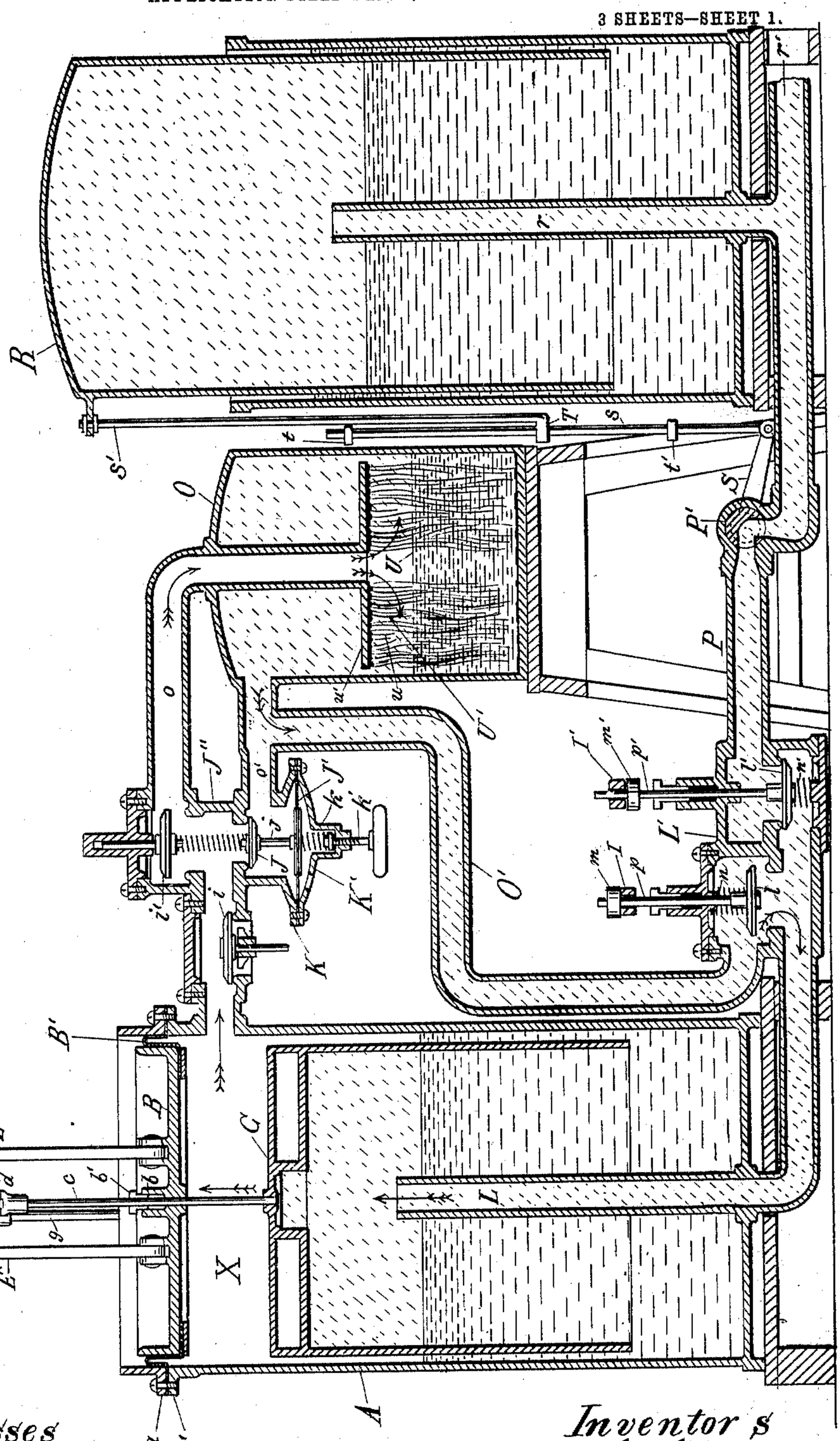

Fig. 1.

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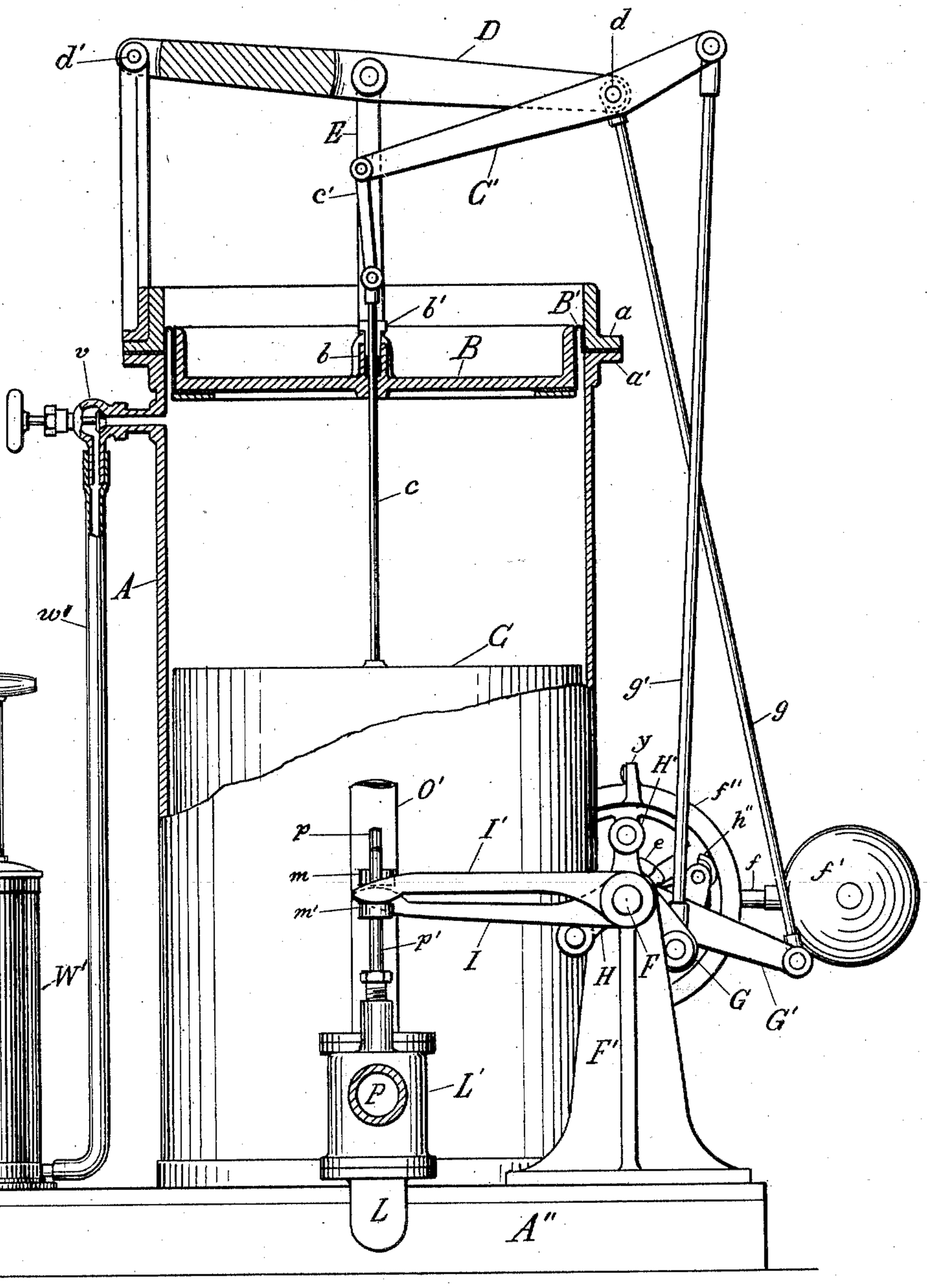
NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.

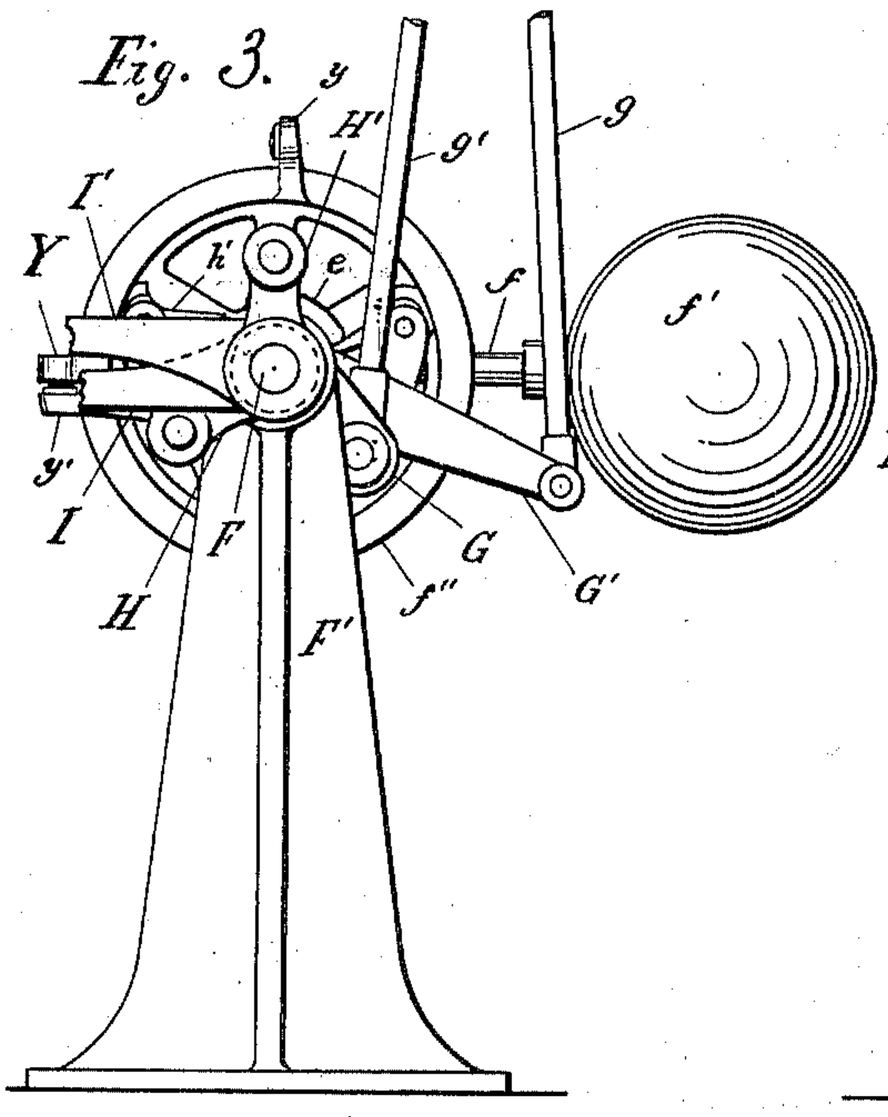


Fig. 4.

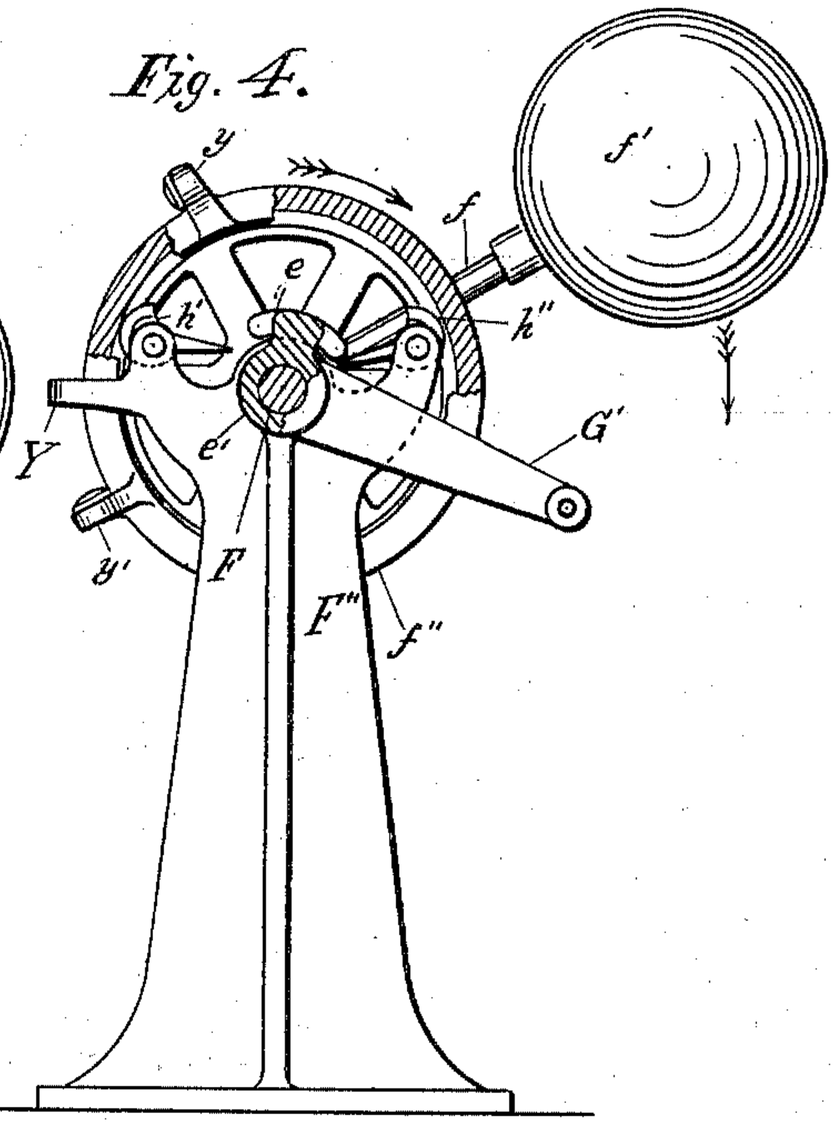


Fig. 6.

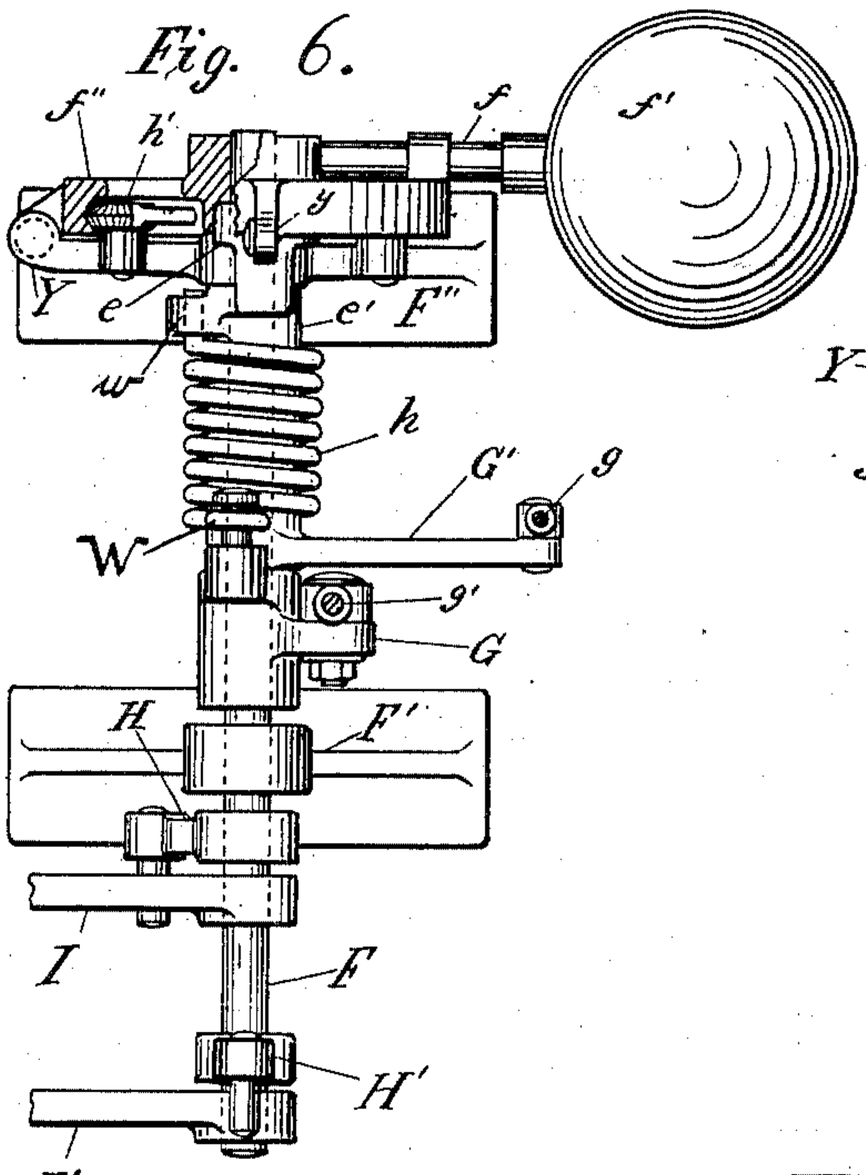
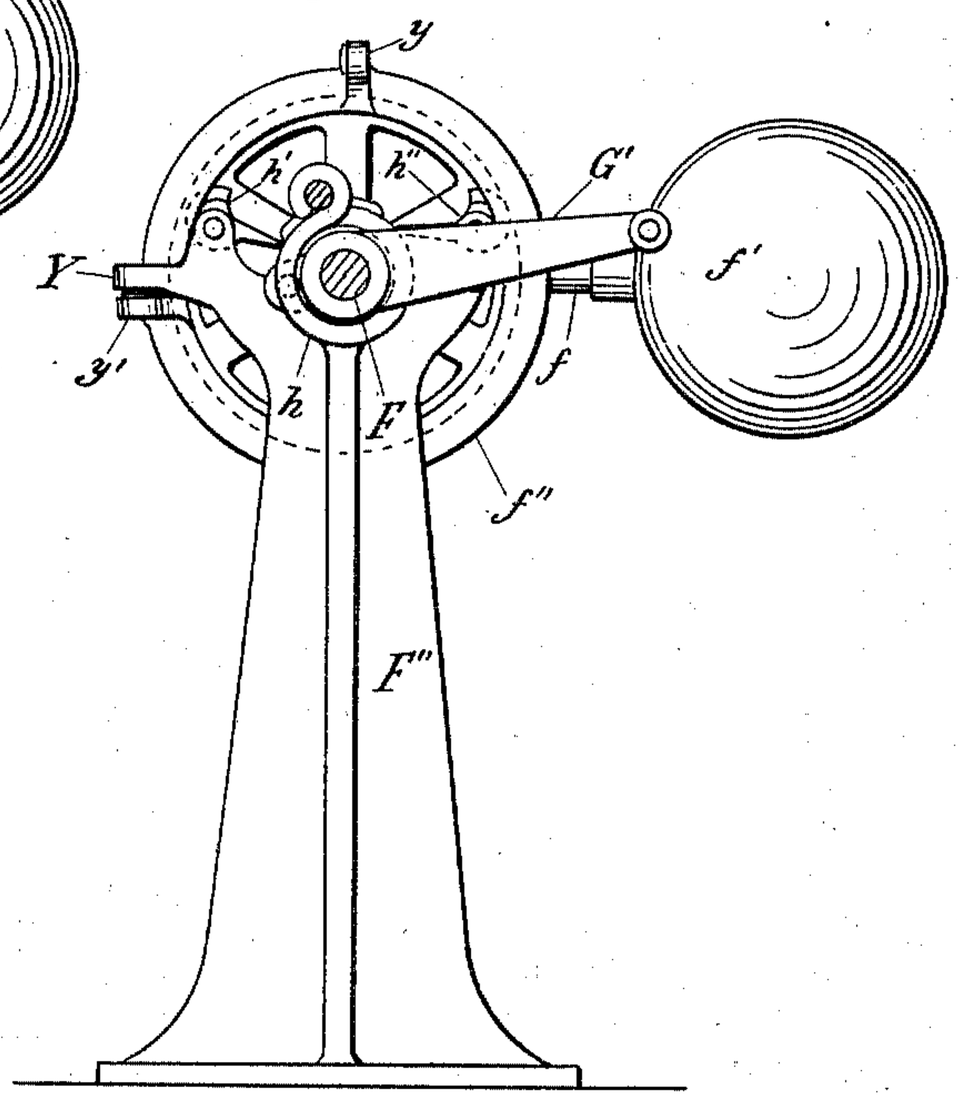


Fig. 5.



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UNITED STATES PATENT OFFICE.

CHARLES A. ANDERSON AND ERICK A. ERICKSON, OF CHICAGO, ILLINOIS.

GASOLENE-GAS-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 760,296, dated May 17, 1904.

Application filed February 7, 1902. Serial No. 93,060. (No model.)

To all whom it may concern:

Be it known that we, CHARLES A. ANDERSON and ERICK A. ERICKSON, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gasolene-Gas-Making Machines, of which the following is a specification.

Our invention relates to that class of machines for making gas by saturating air with gasolene-vapor; and one of its primary objects is to produce a gas of uniform density in which the proportions of air and vapor are constantly maintained.

Another important object of the invention is to utilize whatever expansion may be created in excess of that produced by the predetermined proportions of air and vapor to automatically admit air for mixture with the gas to reduce its density to the degree desired.

A further object is to make the process entirely automatic and utilize the expansion produced by the saturation of the air with the gasolene-vapor to provide the power for operating the machine.

The invention also has other objects in view, which will appear fully in the following detailed description, reference being had to the accompanying drawings, which illustrate one form of machine in which the invention may be embodied, and referring to which—

Figure 1 is a vertical sectional view of a complete machine embodying the invention and connected with a carbureter and gas-holder. Fig. 2 is a side elevation, partly in section, showing the arrangement of the piston and displacer and the mechanism for operating them. Fig. 3 is an end elevation showing the automatic gear. Fig. 4 is a sectional view of the automatic gear, showing the locking and releasing mechanism. Fig. 5 is a similar view showing the shifting spring and the tripping-lever. Fig. 6 is a top plan view of the automatic gear, partly in section.

In the accompanying drawings similar letters of reference designate corresponding parts in all of the figures, and referring thereto, A designates a receptacle of cylindrical form, preferably, and partly filled with liquid, and B is a disk which is arranged to operate like a piston in the upper part of the receptacle. A flexible sleeve-shaped diaphragm B′ is fastened at one edge to the lower side of the disk and at its other edge to the receptacle, being clamped between the flanges *a a′*. The disk is of less diameter than the interior diameter of the receptacle; but the diaphragm B′ constitutes an air-tight connection between the disk and sides of the receptacle, so that the disk may operate freely within the receptacle like a piston and with very little friction.

A displacer-piston C, closed at the top and open at the bottom, is arranged to move freely up and down in the cylinder A and below the power-piston B, the liquid within the cylinder providing an air-tight and almost frictionless packing therefor. This displacer-piston is actuated by the movement of the power-piston and at much greater speed, owing to intermediate multiplying devices. It therefore operates to displace the air in the chamber between itself and the power-piston and force it through the carbureter. As the displacer-piston rises it receives the gas from the carbureter with initself above the water-level, and when it descends it expels and forces the gas through to the gas-holder. Therefore the displacer-piston operates to force the air to the carbureter on its upward movement and force the gas to the gas-holder on its downward movement and is actuated by the power-piston, but at greater speed.

A rod *c* is connected to the displacer and passes through an aperture *b* in the power-piston B and a packing-gland *b′* and is connected at its upper end by a link *c′* to the lever C′. The lever C′ is fulcrumed on the pivot-pin *d* at one end of a forked lever D, which is pivoted at its other end to a stationary support *d′* on the cylinder A and is connected by links E and E′ to the piston B, Fig. 1. A rod *g′* connects the outer end of lever C′ to a radial arm G, Fig. 6, rigidly secured on the shaft F, journaled in brackets F′ F″, and another rod *g* is connected at one end to the pivot-pin *d* and at its other end to the trip-lever G′, which is carried by a sleeve *e′*, arranged loosely on the shaft F. A spiral spring *h* is arranged on the sleeve *e′* and has one end W fastened to the rigid arm G and its other

end engaged under a lug *w* on the sleeve for a purpose hereinafter described. A wheel *f''* is rigidly mounted on the end of the shaft F, and two pawls *h' h''*, Figs. 4, 5, are supported on the bracket F'' and arranged to alternately engage the inner face of the wheel and lock the wheel and shaft, these pawls being released from locking engagement by an extension *e* on the sleeve *e'*. An arm *f*, carrying a weight *f'*, is also rigidly secured on the shaft F.

A valve-chamber J'', Fig. 1, is connected with the upper part of the cylinder A, and it contains the air-inlet valve *i* and outlet-valve *i'* and the regulating-valve J. The valves *i* and *i'* may consist of any suitable form of check-valve; but the regulating-valve J is controlled by the flexible diaphragm J', to which it is connected by means of the stem *j*. This diaphragm is secured at its outer edge between the flange K and the cover K', and a compression-spring *k* is interposed between the diaphragm and the cover, the tension of which can be regulated by means of the screw-plug *k'*. The valve-chamber J'' and the carbureter O are connected by a pipe *o*, and the carbureter is connected by a pipe O' to a pipe L, which extends up in the receptacle above the level of the liquid therein and within the displacer-piston.

The carbureter may be of any suitable form and is shown to comprise a plate *u'*, from which cotton wicking or other fibrous material *u* is suspended in the gasolene U, the wicking serving by capillary action to draw the liquid gasolene up into the carbureting-space U', through which the air admitted from the passage *o* must pass before escaping to the outlet-passage O'. The regulating-valve J is arranged to admit air for reducing excessive density of the gas, and we have shown this valve connected by a short passage *o'* with the gas-passage O' adjacent to the carbureter.

A pipe P is connected with a pipe *r* within the gas-holder R, and the other end of this pipe P connects with a valve-chamber L', to which the pipes L and O' are also connected. Puppet-valves *l l'* are arranged in this valve-chamber L' and provided with springs *n n'* to assist in holding them against their seats and having stems *p p'*, carrying collars *m m'*. These valves are mechanically operated by the shaft F through the medium of the levers H H', Fig. 6, rigid on said shaft, which engage and operate the levers I I', loosely mounted on the shaft F and having their outer ends apertured to receive the valve-stems *p* and *p'*, the lever I being arranged beneath the collar *m* on stem *p* and the lever I' being arranged above the collar *i* on stem *p'*.

r' is a distributing-pipe, and P' is a valve in the pipe P, which is adapted to be operated by the gas-holder, a rod *s'* being connected to the gas-holder and provided with a collar T, operating on a rod *s* between the collars *t* and *t'*. The rod *s* is connected to a lever S, rigid with the valve P', and it will be readily understood that the valve P' will be automatically closed by the gas-holder as the latter fills with gas and opened as the gas-holder empties.

An air-compressing pump W 'of any suitable kind is connected by a pipe *w'*, having a valve *v*, with the air-chamber X.

The operation of our machine is as follows: The carbureter is first supplied with the required amount of gasolene, and the valve *v* is then opened and an initial pressure of about two pounds per square inch, for example, is produced in the chamber X by means of the air-pump. The valve *v* is then closed, and the pressure within the receptacle will cause the power-piston to rise and raise the displacer-piston through its connections therewith, the movement of the displacer-piston, however, being about six times as great as that of the power-piston by reason of the arrangement of the levers. The valve *l* is held open mechanically at this time, and the differential movement of the pistons will create a corresponding difference of pressure in the chamber X and in the gas-receiving space within the displacer-piston which causes the check-valve *i''* to open and induces a flow of air from the chamber X through the pipe *o* and carbureter and the pipe O' to the displacer-piston. In its passage through the carbureter the air absorbs the vapor of the gasolene and increases in volume, which supplies the power to operate the pumping apparatus and the machine. As the air increases in volume in the carbureter by absorbing the gasolene-vapor, the space for receiving the gas from the carbureter must be greater than the space containing the air which is supplied to the carbureter. In our machine the volume of the air and gas spaces is correctly proportioned by the operation of the power and displacer pistons. The increase in the volume of gas over the volume of air supplied to the carbureter varies according to the quality of gasolene used, its temperature, and other conditions, and it has been found that when the carbureter contains a fresh supply of high-grade gasolene a greater volume of vapor is produced and the air will become excessively saturated therewith and of greater density than desired. To avoid this result, we provide for admitting a supply of fresh air direct from the air-chamber to mix with the gas, and thus reduce its density. As the volume of air delivered to the carbureter and the space for receiving the gas from the carbureter are in a fixed ratio, therefore should the air absorb more vapor than is contemplated by this ratio the pressure of the gas will increase and operate on the diaphragm J' to open the valve J. This permits a supply of air to enter through the passage *o'*, and as this air does not pass through the carbureter or absorb any vapor it will decrease the volume of gas and the

pressure and reduce the surcharged gas to its proper density. It is apparent that when the vapor absorbed by the air is not excessive the valve J will remain seated. In this way we utilize the pressure of the expansion of the carbureting process in excess of the fixed ratio between the air delivered to and the gas received from the carbureter to reduce the density of the gas and maintain the ratio. As the displacer-piston moves upward the trip-lever G′ is raised and the sleeve *e′* turned on the shaft to produce a tension in the shifting spring *h*, and when the displacer-piston has approached the power-piston so close as to almost touch it the extension *e* on the sleeve will engage and release the pawl *h′* from engagement with the wheel and unlock the shaft F. The pressure of the gas confined by the displacer-piston will force that piston upward, compressing the air in chamber X and through the medium thereof forcing up the power-piston, and this movement of the power-piston, aided by the shifting spring now at tension, will turn the shaft now unlocked thereby, closing the valve *l* and raising the weight *f*, thus utilizing the expansive force of the gas confined by the displacer-piston to effect the reversal movement of the piston. During this operation the pistons will move upward at a uniform speed until the lug *y* on the wheel *f″* engages with the projection Y on the bracket F″, at which time the valve *l′* is open and the shaft is locked by the pawl *h″*, engaging the wheel *f″*, with the weight in elevated position. The weight of the pistons and their associated parts causes the pistons to descend, and the gas collected in the displacer-piston is forced out through the passage L, the valve *l′*, and the passages P and *r* into the gas-holder. While the displacer-piston is descending at a rate of speed about six times as great as the power-piston it will create a partial vacuum in chamber X, causing valve *i* to open and drawing in air from outside the machine. When the displacer-piston has about reached the limit of its downward movement, the extension *e* on the sleeve will engage and release the pawl *h″* to unlock the shaft, which is thereupon turned back by means of the weight and closes the valve *l′* through the medium of the arm H′ and lever I′. At the same time the power-piston is pulled down, thereby compressing the air in chamber X and producing an initial pressure therein greater than the pressure in the carbureter and sufficient to open the valve *i′*. Just before the weight reaches its lowest position the valve *l* will be opened through the levers H and I, thereby establishing communication between the carbureter and the displacer and enabling the gas to repeat the operation in the manner hereinbefore described.

If the consumption of gas is less than the volume produced, the gas-holder R will rise until the collar T on the rod S′ engages with the collar *t* on the rod *s* and raises the lever S to close the valve P′, and thereby stop the operation of the machine by shutting off the outlet for the gas. When the gas-holder descends, the collar T will engage the collar *t′* and shift the lever S to open the valve P′, which again enables the gas to escape and the machine to resume operation. It is apparent that the machine will always stop working during that part of the operation in which it delivers the gas to the gas-holder, and therefore after the valve P′ is opened and the machine is once started it will continue to operate automatically as long as there is a sufficient quantity of gasolene in the carbureter.

From the foregoing description it will be understood that we utilize the expansion obtained in the carbureting process to furnish the power for operating the machine and regulate the mixing of air and vapor, the air being delivered to the curbureter and the gas received therefrom in measured quantities and in fixed ratio to each other. Excess expansion due to the air taking up too much vapor is made use of by us to automatically introduce air to mix with the gas and reduce its density to the predetermined degree, so that the machine will operate automatically to keep the gas at a uniform density at all times.

Our invention consists, broadly, in regulating the mixture in the carbureting process and utilizing the expansion power derived from this process to operate the machine and supply the air and pressure required without restriction to the particular character of the machine for accomplishing these results, and we reserve the right to make any and all changes in the construction of the machine which fall within the spirit and scope of the invention.

When the supply of gasolene is wholly or about exhausted or when a poor quality of gasolene is used or when it becomes cooled down by excessive evaporation, the machine will come to rest because of insufficient expansion, and in this way our machine is perfectly safe and avoids the production of an explosive mixture.

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

1. The combination with a carbureter having an air-inlet passage and a gas-outlet passage and means for inducing a flow of air through the inlet-passage to the carbureter, of a regulating-valve connected with both the air-inlet and the gas-outlet passages and adapted to be operated by the expansive pressure of the gas produced in the carbureter in excess of a fixed ratio between the air delivered to and the gas received from the carbureter to admit air to the gas-outlet passage for reducing the density of the gas.

2. The combination with a carbureter, of an air and gas pumping apparatus, an air-pas-

sage between said apparatus and the carbureter, a gas-passage between the pumping apparatus and the carbureter, a connection between said passages, and a regulating-valve in said connection adapted to be operated by the expansive pressure of the gas produced in the carbureter in excess of a fixed ratio between the air delivered to and the gas received from the carbureter to admit air for reducing the density of the gas.

3. The combination with a carbureter, of an air and gas pumping apparatus comprising a chamber to receive the gas, an air-passage connecting the pumping apparatus with the carbureter, a gas-passage connected to the carbureter and discharging into said gas-chamber, a connection between said air and gas passages, and a valve in said connection adapted to be operated by the expansive pressure of the gas produced in the carbureter in excess of a fixed ratio between the air delivered to and the gas received from the carbureter to admit air through said connection to the gas-passage for reducing the density of the gas.

4. The combination with a carbureter, of an air and gas pumping apparatus provided with a chamber to receive the gas, an air-passage connecting the pumping apparatus with the carbureter, a valved gas-passage connected with the carbureter and discharging into said chamber, a cut-off passage connecting the air and gas passages, a valve in said cut-off passage adapted to be operated by the expansive pressure of the gas produced in the carbureter in excess of a fixed ratio between the air delivered to and the gas received from the carbureter to admit air for reducing the density of the gas, a gas-holder, and a valved passage leading from the gas-holder to the gas-passage.

5. The combination with a carbureter, of a pumping apparatus for forcing air through the carbureter, and means for actuating said pumping apparatus by expansion due to carburetion in the carbureter.

6. The combination with a carbureter, of a cylinder, a pumping apparatus operating in said cylinder and comprising a piston provided with a chamber to receive the gas from the carbureter, said piston operating to force the air between itself and the top of the cylinder to the carbureter and receive the gas in said chamber from the carbureter on its upward stroke, and to receive the air between itself and the top of the cylinder and force the gas in the chamber to a distributing-point on its downward stroke.

7. The combination with a carbureter, of a pumping apparatus for supplying air to the carbureter and comprising a power-piston, a displacing-piston for receiving gas from the carbureter and forcing it to a distributing-point, and means for moving the displacing-piston at greater relative speed than the power-piston.

8. The combination with a carbureter, of a pumping apparatus for supplying air to the carbureter and comprising a power-piston and a displacing-piston, and means for moving the pistons in the same directions and at different speed.

9. The combination with a carbureter, of a cylinder connected therewith and partly filled with liquid, a power-piston operating in the cylinder, a hollow displacing-piston also operating in the cylinder and connected with the carbureter and sealed by the liquid in the cylinder, and means for moving said pistons in the same direction and at different speed to force air from between them into the carbureter and for receiving gas from the carbureter in the hollow displacing-piston, and means for reversing the movement of the piston to expel the gas in the hollow displacing-piston and take in a fresh supply of air between the pistons.

10. The combination with a carbureter, of an apparatus for alternately pumping air and gas and comprising a hollow piston adapted to displace air on one side thereof and receive gas on its other side while moving in one direction, and expelling the gas and receiving air on the other side while moving in the other direction, and means for automatically reversing the operation of the pumping apparatus.

11. The combination with a carbureter, of a receptacle, a piston operating therein, a flexible air-tight connection between the receptacle and piston, a displacer-piston operating in the receptacle and containing a chamber to receive the gas from the carbureter, and connections between said pistons.

12. The combination with a carbureter, of a receptacle, a piston operating therein, a displacer-piston operating in the receptacle and containing a chamber to receive gas from the carbureter, a pipe connecting the carbureter with the receptacle at a point between the pistons, and connections between said pistons.

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