(No Model.) 2 Sheets—Sheet 1.

J. W. RAYMOND.

GAS ENGINE.

No. 583,508. Patented June 1, 1897.

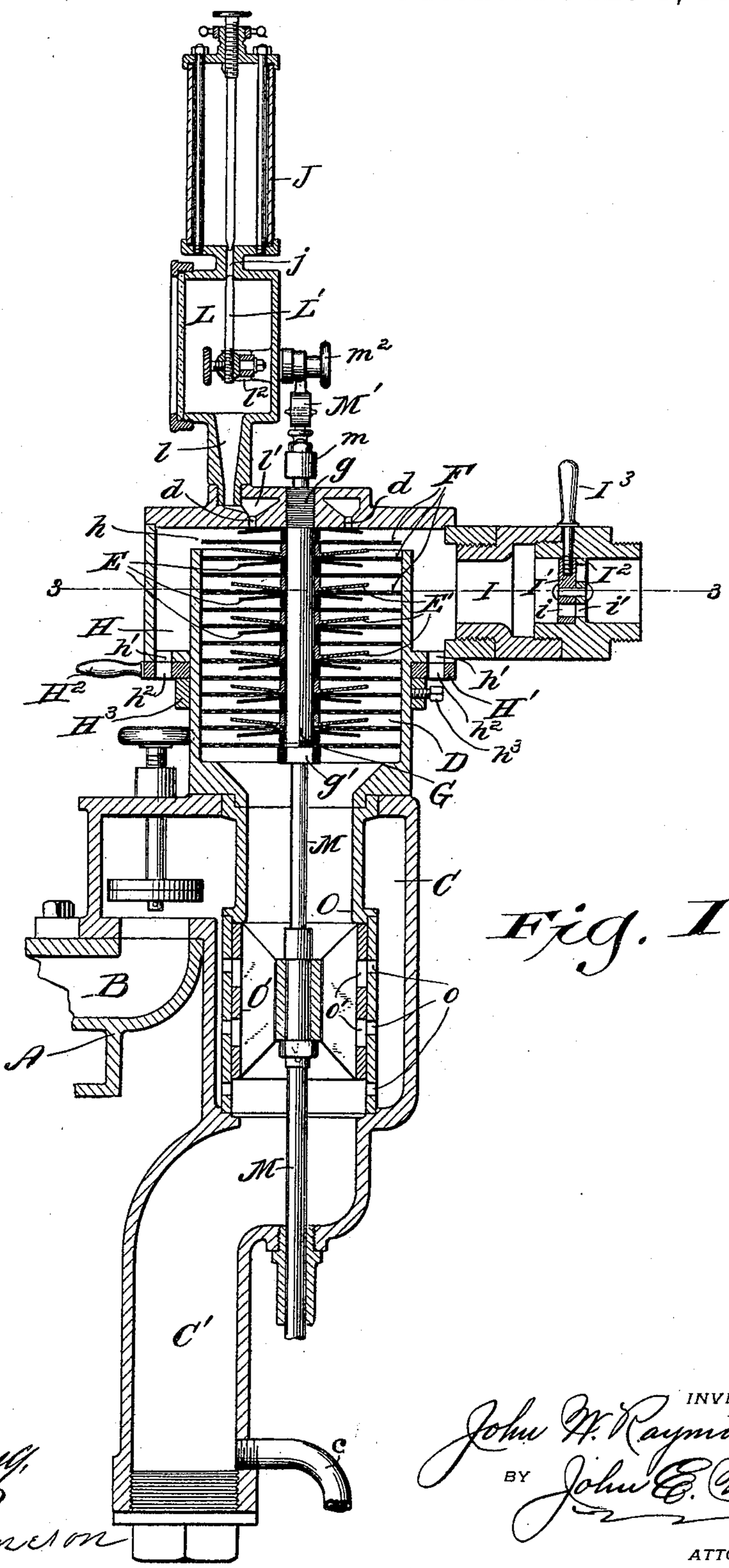

Fig. 1.

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Fig. 3.

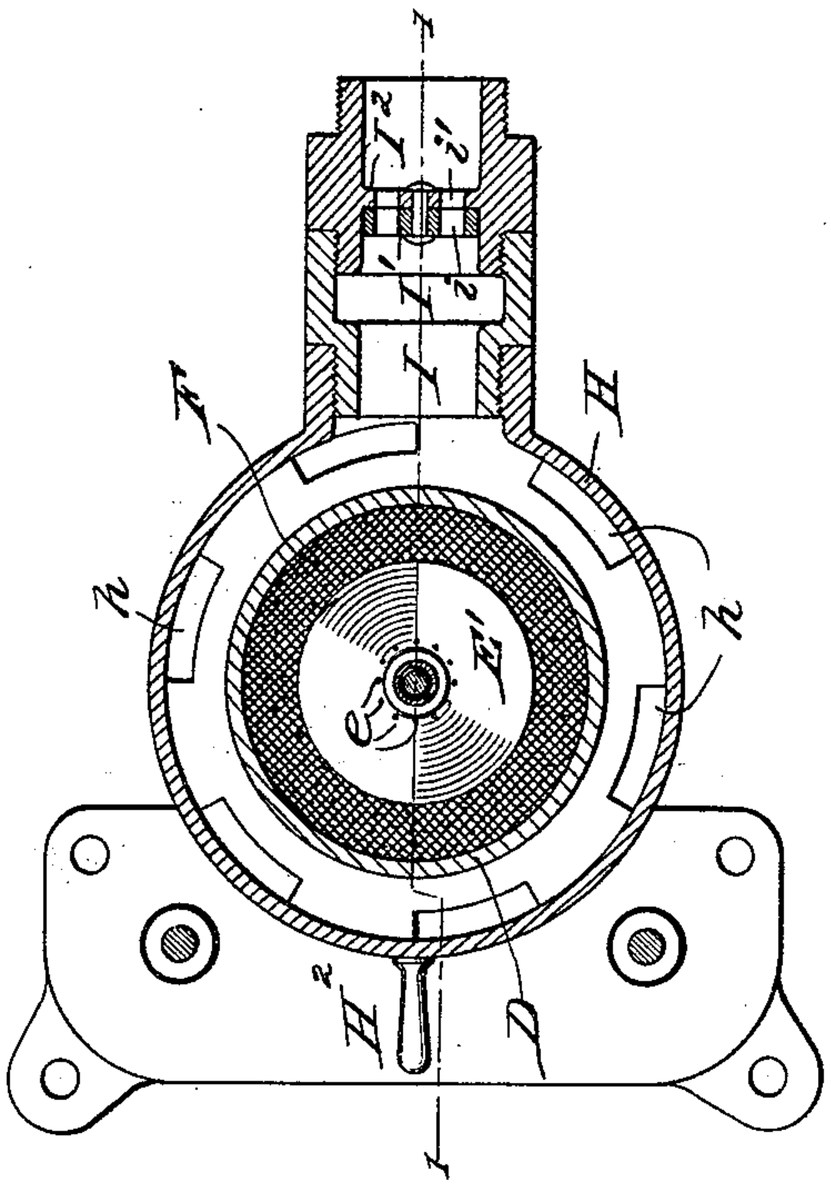
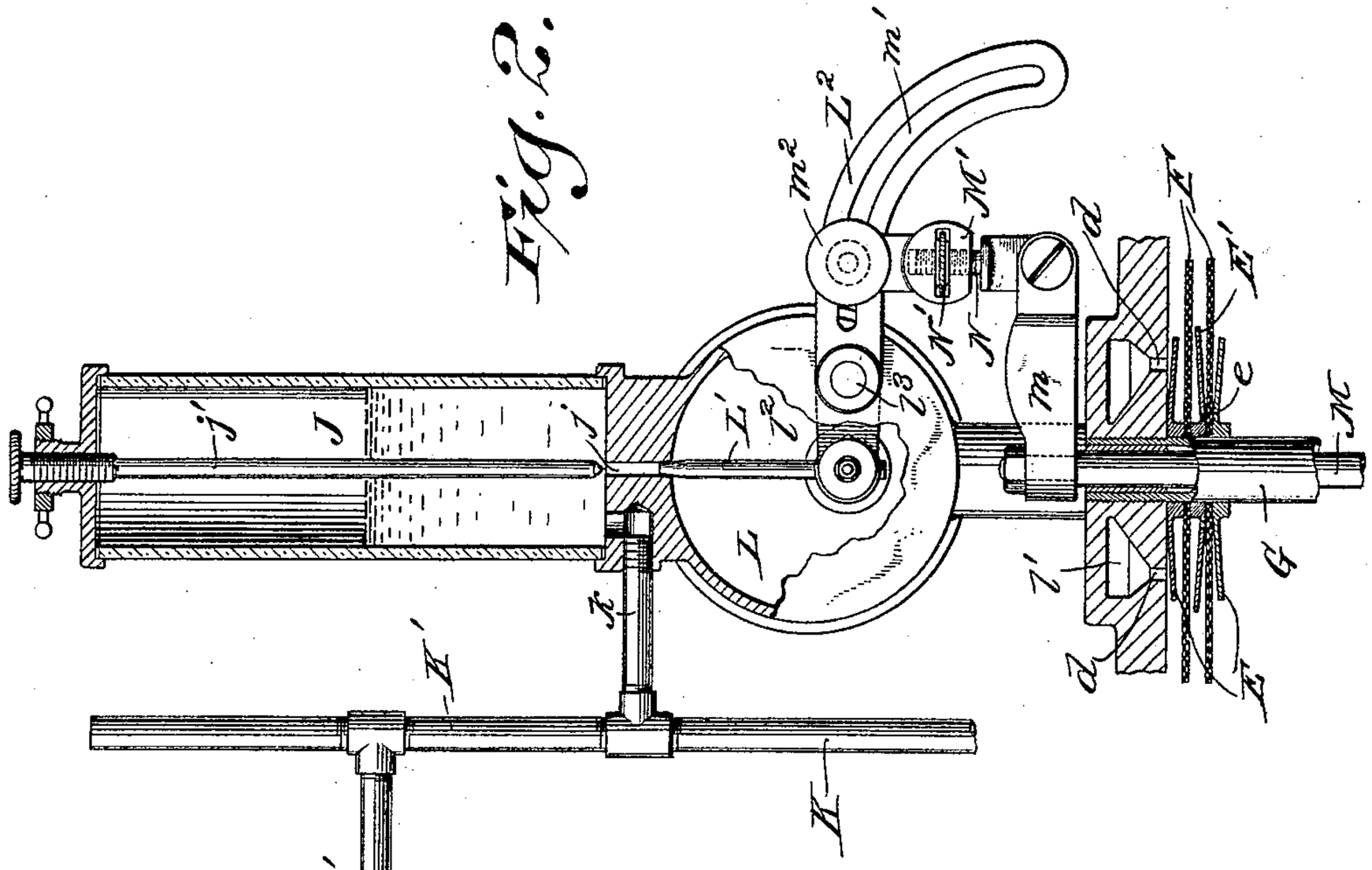


Fig. 2.



WITNESSES

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JOHN W. RAYMOND, OF RACINE, WISCONSIN.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 583,508, dated June 1, 1897.

Application filed January 13, 1896. Serial No. 575,304. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. RAYMOND, a citizen of the United States, residing at Racine, county of Racine, State of Wisconsin, have invented a certain new and useful Improvement in Gas-Engines; and I 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 pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to new and useful improvements in the construction of gas or vapor engines designed for operation by means of an explosive gas or vapor, and relates more particularly to means for accurately controlling the supply of the explosive mixture to the engine-cylinder and to improvements in devices for vaporizing gasolene or other forms of petroleum oils or distillates and regulating the admixture of air therewith.

The various features of my invention will be hereinafter fully described with reference to the accompanying drawings, and set forth in the appended claims.

In said drawings, Figure 1 is a vertical sectional view of my improved device, taken on line 1 1 of Fig. 3, showing the arrangement of the regulating devices and the vaporizing device, together with the supply-chamber, which communicates with the inlet-port of the cylinder. Fig. 2 is an enlarged detail view, partly in section and partly in elevation, showing the means for regulating the supply of gasolene or other petroleum fuel to the vaporizing device. Fig. 3 is a horizontal sectional view taken on line 3 3 of Fig. 1.

In said drawings I have shown in connection with the vaporizing apparatus and the regulating device only so much of the engine as is necessary to a proper understanding of the construction and operation of said device, said device being shown as connected with the engine-casing and connected with the inlet-passage which supplies the explosive medium to the cylinder of the engine.

Referring by letter to said drawings, A designates a part of the engine provided with an inlet passage or port B, which may communicate with any desired part of the cylinder. (Not shown.) A supply-chamber C communicates with the port or passage B and is adapted to receive either an explosive mixture of air and gas or a similar mixture of air and the vapors of petroleum. In practice I find it convenient to provide the supply-chamber C with connections for both air and gas and air and said vapors of petroleum, as in Fig. 1, in which a tubular connection C′, for the mixture of air and gas, communicates with the lower part of said chamber and a vaporizing device communicates with the upper part of said chamber. In practice when the vaporizing device is used and the explosive medium supplied to the cylinder is a mixture of air and petroleum-vapor the tubular connection C′ is closed by means of a plug *c*, screwed into the tapped end of said connection.

My present invention relates more particularly to the construction and arrangement of the vaporizing device and the means for regulating the supply of gasolene or other form of petroleum to the vaporizer and of the explosive mixture to the cylinder, and I will therefore not describe in detail any of the connections or appliances for the use of gas.

I will now describe the construction and operation of the vaporizing device. Said device consists, primarily, of a chamber D communicating with the supply-chamber C, and provided in its upper end with one or more inlet or supply ports or apertures *d d*, through which the gasolene or other form of petroleum is introduced to the interior of said chamber. Within said chamber are conveniently provided a suitable number of deflecting-plates E E and E′ E′, which are conveniently dished more or less and arranged so as to present alternate upwardly and inwardly inclined surfaces for contact with a descending supply of the petroleum liquid. Between said deflecting-plates are conveniently arranged suitable horizontally-disposed perforated screens F F, which preferably extend across the chamber D, the deflecting-plates E E and E′ E′ being of somewhat less width or diameter than said chamber. The upwardly dished or inclined plates E′ E′ are provided adjacent to their centers with apertures or perforations *e e*, as shown more particularly in Fig. 3, through which the liquid to be vaporized is permitted to drip.

As many of the deflecting-plates E E and E′ E′ and the interposed perforated screens F F may be employed as is necessary to provide a desired area of evaporating-surface for contact with the petroleum liquid, and it follows that when said liquid is introduced into the upper part of the chamber D through the apertures *d d* it will drip onto the uppermost deflecting-plate, passing outward to the periphery thereof and dripping from said periphery onto the perforated screen next below, passing through said screen and being received by the upwardly-dished plate below the same, when it will gravitate toward the center of said plate, passing through the apertures or perforations *e e* adjacent to its center, and thence through the screen next below, and so on, until the bottom of the chamber is reached.

The deflecting-plates and the screens may be held in position within the vaporizing-chamber in any desired manner—as, for instance, in the manner shown in the drawings, in which said plates and screens are strung upon a standard G, which is screw-threaded at its opposite ends and is engaged at its upper end in a screw-threaded aperture in the top wall of the chamber, as at *g*, a suitable nut *g′* having a similar engagement with the lower end of said standard to hold the plates and screens in position thereon.

In order to insure the desired vaporization of the petroleum liquid, it is essential to provide suitable means for introducing into the vaporizing-chamber a supply of air and in some instances to regulate the temperature of said air-supply and to bring the air into intimate contact with said liquid, the liquid being at the same time separated or broken up by the deflectors and the screens and distributed over the surfaces thereof so as to be readily taken up by the air. To this end I provide a suitable jacket H outside of the vaporizing-chamber communicating with the upper part of the latter, as at *h*, and provided with one or more ports or openings for the introduction of the air-supply. This jacket may be of any suitable or desirable construction and may be provided with independent connections for the introduction of cold air and warmed or heated air, as shown.

In the particular form of construction shown in the drawings I have shown the lower end of said jacket as provided with a number of segmental ports *h′ h′* and a damper H′, provided with corresponding ports h^2 h^2, adapted to be brought into register with the ports *h′ h′*, said damper being further provided with an operating-handle H^2, by which it may readily be adjusted. A suitable collar H^3 is arranged upon the outside of the vaporizing-chamber and serves to hold the damper H′ in position, said collar being retained in place upon said vaporizing-chamber by one or more set-screws h^3. It follows from this construction that by a movement of the handle H^2 the damper H′ may be adjusted, so as to open or uncover the ports *h′ h′* to a greater or less degree, and thereby permit a desired supply of air to enter said jacket and pass therefrom into the vaporizing-chamber. These ports *h′ h′* are conveniently arranged to communicate with the outside atmosphere and to supply cool air to the vaporizer. I find it convenient also to provide a tubular connection I for supplying heated air to the vaporizing-chamber, and said connection may lead to any source of supply of heated air. Said supply-tube is also provided with a suitable damper or valve I′, provided with ports *i i*, and said damper or valve being seated against a correspondingly-apertured diaphragm or partition I^2. This damper or valve I′ is provided with an operating-handle I^3, conveniently extending outward from the tube and having a screw-threaded engagement at its inner end with said damper, as shown in Fig. 1, and said handle is suitably shouldered at the point where it passes through the wall of the tube, so that by turning said handle said shoulder may be screwed down upon the outside of the tube and thereby serve to lock the valve in its adjusted position. It follows from this construction that by an adjustment of the damper or valve I′ within the tube the ports or apertures *i i* may be uncovered to a greater or less extent, so as to permit a desired supply of air to pass therethrough to the vaporizing-chamber, and that said valve may be readily secured in its adjusted position by tightening said handle in the manner described. It follows from this construction that by adjusting the dampers H′ and I′ the supply of air to the vaporizing-chamber may be accurately regulated as desired, so as to regulate the temperature of the air introduced to a desired degree.

As a further and separate improvement I prefer to provide suitable means for automatically regulating the supply of the petroleum liquid to the vaporizing-chamber, and in practice I find it convenient to employ a construction substantially like that shown in the drawings, in which a suitable reservoir J, preferably of glass, is provided, said reservoir having a feed aperture or duct *j* in its lower end and being preferably provided with a shut-off valve *j′* for controlling said aperture.

A suitable supply-pipe K, leading from any desired source of petroleum liquid, is arranged to communicate, as at *k*, with the interior of said reservoir and is provided with an upwardly-extending branch or stand-pipe K′, having an overflow or vent *k′*, communicating therewith at the level at which it is desired to maintain the supply of petroleum liquid within the reservoir J. Said liquid may be supplied to said pipe K from any suitable source and in any suitable or desired manner, as by gravity-feed or by means of a suitable pump or in any other desired manner, and it follows that by reason of the overflow or vent *k* said liquid will be permitted to rise

within the reservoir J only to the level of said overflow, any excess of said liquid supplied by the pipe K being carried off through overflow-pipe *k'* and conveyed into any suitable receptacle therefor. In this manner a constant and uniform supply of the petroleum liquid may be maintained within the reservoir and is ready for introduction into the vaporizer as rapidly as may be required for use in supplying the engine. I prefer also to employ a suitable means for automatically controlling the feed of the petroleum liquid from the reservoir to the vaporizer, and for this purpose I find it desirable to arrange below said reservoir and in communication with the discharge-aperture thereof a suitable chamber L, conveniently provided with a transparent wall, which in turn is provided with a discharge-passage *l*, leading into an annular chamber or channel *l'* in the top of the vaporizing-chamber, and which chamber or channel supplies the several inlet-apertures *d d*, which communicate with said vaporizing-chamber. A suitable upwardly-closing valve L' is located within the chamber L and has an operative engagement with the lower end of the discharge-passage *j*, which leads from the reservoir J, said valve being operatively engaged with the free end of a rock-arm l^2 within said chamber L, and by movements of which arm said valve may be adjusted so as to open, close, or regulate the communication between the reservoir J and the chamber L.

The arm l^2 is conveniently mounted upon a spindle l^3, which extends outward through the wall of the chamber L and is provided upon its outer end with an operating-lever L^2, by means of which an oscillatory movement may be communicated to said spindle and the arm l^2 connected therewith. It follows from this construction that by the elevation of the outer or free end of the arm or lever L^2 the free end of the crank-arm l^2 within the chamber L will be depressed, thereby lowering the valve L' from its seat and establishing communication between the passage *j* and the interior of the chamber L. It also follows that the degree to which said valve is opened will be determined by the movement of the arm or lever L^2.

In order to enable the valve L' to be automatically adjusted, so as to maintain a supply of petroleum liquid which shall be just sufficient for the use of the engine and variable according to the speed of the engine or the amount of load thereon, I prefer to provide suitable means for operatively connecting the actuating arm or lever L^2 with a governor mechanism, and to this end I find it convenient to extend a suitable actuating-rod M upward through the standard G and out through the top of the vaporizing-chamber, as shown in Figs. 1 and 2, said standard G being made tubular for the passage of said rod. This rod M is adapted for operation in any desired manner by means of any suitable or convenient form of governor mechanism, but inasmuch as any form of governor may be employed and the operation of the same to adjust the rod is the same as many other devices I do not deem it necessary to illustrate or describe said governor mechanism.

The upper end of the rod M has an operative connection with the arm or lever L^2, this connection being conveniently made by means of a suitable link M', having a suitable connection at one end with said arm or lever and at its other end being similarly connected with an angular extension *m* at the upper end of said rod. It follows from this construction that vertical movement of the rod M will be communicated to the arm L^2 and the spindle l^3 and thus to the rock-arm l^2 and the valve L'. In order to accurately adjust said valve with relation to the rod M, I prefer to make the connection between said rod and the actuating lever or arm L^2 adjustable, and for this purpose said arm is conveniently curved, as shown in Fig. 2, and provided with a slot *m'* for adjustable engagement with the upper end of the link M', the latter being provided with a suitable set-screw m^2 for securing the parts together. By this means the throw of the rock-arm l^2, by a predetermined vertical movement of the rod M, may be regulated at will, the opening of the valve being, of course, greater when the adjustable connection between the link M' and the arm or lever L^2 is made nearer to the spindle l^3 and the movement of said valve being correspondingly less when said connection is made farther away from said spindle and nearer the free end of said arm or lever. As a still further means for accurately adjusting the valve, I find it convenient to provide a device by means of which the link *m'* may be lengthened or shortened at will. For this purpose the link M' is conveniently made in two parts, as shown in Fig. 2, and one of said parts is provided with a screw-threaded shank N, extending into a suitable bore or channel in the opposite section, said latter section being provided with an adjusting-nut N', operatively connected with said screw-threaded shank and adapted for operation, so as to adjust said sections and to lengthen or shorten the link in an obvious manner. By this means, after the parts have been connected together, the adjusting-nut N' may be operated so as to lengthen or shorten the link and thereby raise or lower the arm L^2, and consequently adjust the valve L', so as to afford a desired supply of the petroleum liquid, and, when desired, both forms of the devices described may be employed. It follows from this construction that the connection between the governor-rod M and the valve-actuating lever may be varied at will, so as to give a desired adjustment to the valve, and that said adjustment may be very accurately reg-

ulated, so as to insure a very close and accurate regulation of the supply of petroleum liquid to the vaporizer.

It will of course be understood that upon an increase in the speed of the engine the governor will serve to depress said rod M and thereby adjust the lever L^2 to partially or wholly close the valve L′, while by a reverse movement of the governor, due to a decrease in the speed of the engine, an opposite adjustment of the lever and valve will be effected and a greater supply of petroleum liquid admitted. By this construction, therefore, an automatic and very accurate regulation of the supply of petroleum liquid to the vaporizer is effected without the necessity of attention or adjustment of any of the parts, the supply of said liquid being in proportion to the demands of the engine.

The lower end of the vaporizing-chamber communicates directly with a tubular housing or casing O, which is located within the supply-chamber C, and into which the explosive vapor is admitted before passing into said chamber, and said housing or casing is provided with one or more rows or series of apertures or ports *o o* for the passage of said explosive vapor from its interior into said chamber. A suitable regulating-valve O′ is fitted within the casing O and is conveniently mounted upon the governor-rod M, as in Fig. 1, said valve being provided with one or more annular ports or openings *o′ o′*, adapted to be brought into register with the rows of ports or apertures *o o* in said casing.

The valve O′ is so arranged with respect to the apertures or ports in the casing that as the rod M is raised the ports *o o* will be opened to a greater or less extent, and as the rod is depressed said ports will be wholly or partially closed, as the occasion may require, and the annular ports or openings in said valve are preferably arranged to come successively into register with the ports or apertures *o o* in the valve-casing, as is more fully described in a separate application contemporaneous herewith, Serial No. 375,303. It follows from this construction that when the engine demands an increased supply of the explosive vapor the regulating-valve O′ is automatically adjusted, so as to give an increased opening for the passage of said vapor into the chamber C, and the inlet-valve L′ is simultaneously adjusted to give an increased supply of the petroleum liquid to the vaporizer. In this manner I am enabled to automatically and accurately control, by means of the governor mechanism, both the supply of explosive vapor to the cylinder and the supply of petroleum liquid to the vaporizer.

By making the reservoir J of glass the height of the liquid therein may be ascertained at any time by a glance, while by making the chamber L with a transparent wall the feed of the petroleum liquid may be observed from time to time when desired, and the operation of the regulating-valve L′ may also be observed, so that in case an oversupply of liquid is being fed to the vaporizer the valve may be adjusted to satisfactorily limit said supply, and in case of any derangement of the valve or stoppage of either passage the difficulty may be readily ascertained and remedied.

My improved vaporizer and regulating devices may be readily applied to many forms of gas-engines and serve to effectually vaporize petroleum liquid to insure a proper admixture of air at a desired temperature therewith and at the same time to automatically control the supply of the explosive mixture to the engine and of the petroleum liquid to the vaporizer as the demands of the engine may require.

As shown in Fig. 1, I prefer to provide a suitable vent-pipe *c*, which communicates with the lower end of the tubular connection C′ and is adapted to convey any excess of petroleum liquid which may not have been properly vaporized back to a suitable reservoir or receiver and thereby prevent any accumulation of said liquid in said tube.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a gas-engine, a vaporizer for supplying an explosive vapor to the cylinder, the same comprising a suitable vaporizing-chamber provided with a plurality of evaporating-plates, one or more inlets for petroleum liquid, and independent valve-controlled ports for admitting and regulating supplies of cold and of hot air, substantially as described.

2. In a gas-engine, a vaporizer for supplying explosive vapor to the cylinder, the same comprising a suitable chamber provided with one or more inlets for petroleum liquid, and independent valve-controlled ports for admitting cold and hot air, and a plurality of deflecting-plates and interposed perforated screens secured within said chamber between said inlets and the discharge-opening thereof, substantially as described.

3. In a gas-engine a vaporizer comprising a suitable casing having one or more inlets for petroleum liquid at its upper end, and an outlet for vapor at its lower end and one or more valve-controlled ports for admitting air, and a plurality of alternate upwardly and downwardly dished or inclined deflecting-plates and interposed perforated screens, substantially as described.

4. In a gas-engine, a vaporizer for supplying explosive vapor to the cylinder, the same comprising a suitable chamber provided in its upper end with one or more inlets for petroleum liquid, and in its lower end with a discharge or outlet aperture, and further provided with a plurality of deflecting-plates and interposed perforated screens located between said inlets and said discharge-aperture, a jacket surrounding said chamber and communicating therewith, and provided with one

or more valve-controlled ports for the admission of cold air, and an independent valve-controlled connection for supplying hot air to the interior of said jacket, substantially as described.

5. In a gas-engine, the combination with a vaporizer of a chamber for receiving petroleum liquid located above and arranged to convey the same to the vaporizer, a suitable supply for said liquid communicating with said chamber, a valve for regulating the admission of said liquid to the chamber, and an operating-lever for actuating said valve and adapted for operative connection with a governor mechanism, substantially as described.

6. In a gas-engine, the combination with a vaporizer, of a chamber for supplying petroleum liquid thereto, and provided with an inlet-passage, a supply for said liquid communicating with said inlet-passage, a valve for controlling said passage, an actuating-lever for adjusting said valve, and an adjustable connection between said lever and a governor-rod, substantially as described.

7. In a gas-engine, the combination with a vaporizer, of a chamber for supplying petroleum thereto, a reservoir for holding a supply of said liquid, located above said chamber, and having a discharge-passage communicating therewith, means for maintaining a supply of said liquid in the reservoir, a valve for controlling said passage, an actuating-lever for adjusting said valve and an operative connection between said lever and a governor mechanism, substantially as described.

8. In a gas-engine, the combination with a vaporizer of a chamber for supplying petroleum liquid thereto, a reservoir for said liquid communicating with said chamber, means for maintaining a supply of said liquid within said reservoir, an overflow communicating with said reservoir for permitting the escape of an excess of said liquid, a valve for regulating the communication between the said reservoir and the supply-chamber, an actuating-lever for adjusting said valve and an operative connection between said lever and a governor mechanism, substantially as described.

9. In a gas-engine, the combination with a vaporizer of a chamber for supplying petroleum liquid thereto, a reservoir for said liquid communicating with said chamber, a valve for regulating said communication, said valve being mounted upon a rock-arm within said chamber, an arm upon the outside of said chamber and operatively connected with said valve, and an adjustable connection between said arm and a governor mechanism, substantially as described.

10. In a gas-engine, the combination with a vaporizer, a valve-controlled chamber for supplying petroleum liquid thereto, and a regulating-valve for controlling the passage of vapor from the vaporizing-chamber to the cylinder, and suitable means for simultaneously adjusting said regulating-valve and the valve which controls the admission of petroleum liquid to the vaporizer, substantially as described.

11. In a gas-engine, the combination with a vaporizer of a chamber for admitting petroleum liquid thereto, means for supplying said liquid to said chamber, a valve for controlling said supply of liquid, a regulating-valve for controlling the passage of vapor from the vaporizing-chamber to the engine-cylinder, and an actuating-rod adapted for engagement with suitable governor mechanism and having operative connection with said regulating-valve and said supply-valve, and adapted to simultaneously adjust said valves, substantially as described.

12. In a gas-engine, the combination with a vaporizer, a reservoir for supplying petroleum liquid thereto, and an interposed chamber for receiving said liquid from the reservoir and delivering the same to the vaporizer, said chamber being provided with a transparent wall and a regulating-valve for controlling the admission of said liquid to said chamber, said valve being adapted for operative connection with a governor mechanism, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

JOHN W. RAYMOND.

Witnesses:

JOHN E. WILES,

H. J. ROGERS.