No. 751,913. PATENTED FEB. 9, 1904.

E. HAYNES & E. APPERSON.

CARBURETING DEVICE FOR EXPLOSIVE ENGINES.

APPLICATION FILED JAN. 26, 1901.

NO MODEL.

Fig 1

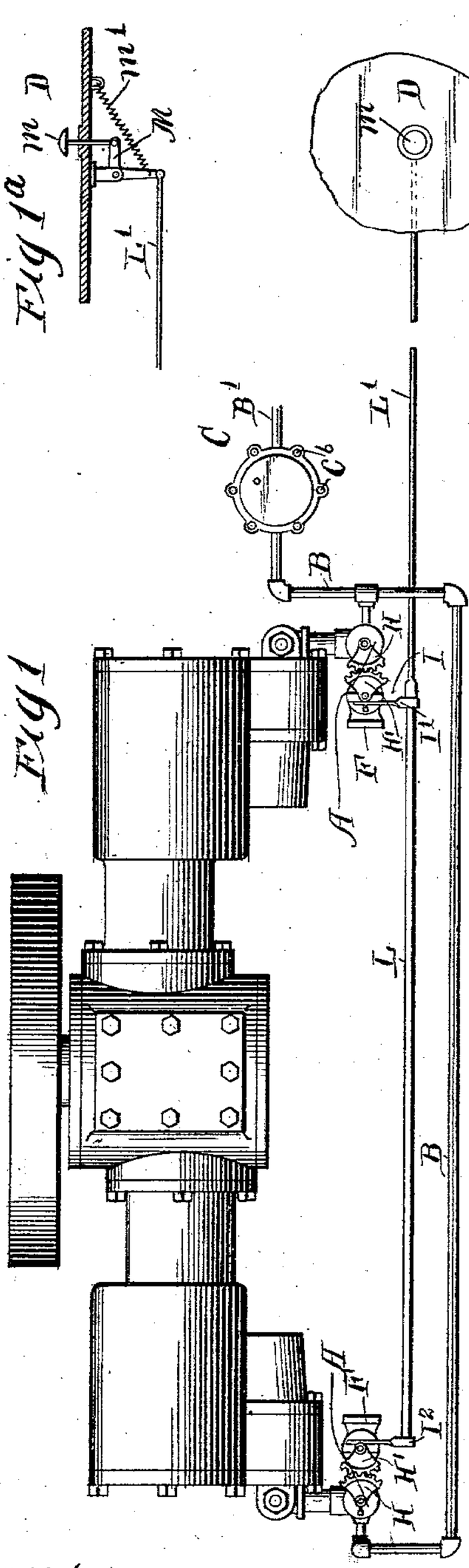

Fig 1a

Fig 2

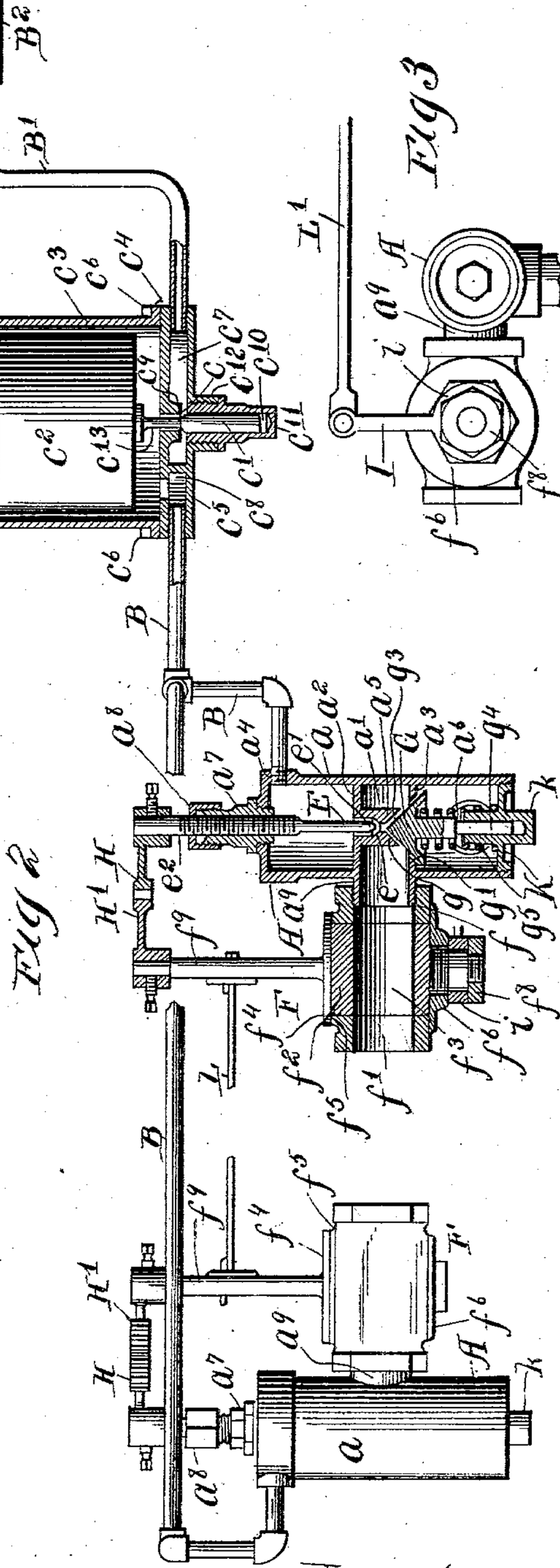

Fig 3

Witnesses:
Carl H. Crawford
Clement P. Stickney.

Inventors:
Elwood Haynes
Elmer Apperson
by Poole & Brown
their Attorneys

No. 751,913. Patented February 9, 1904.

UNITED STATES PATENT OFFICE.

ELWOOD HAYNES AND ELMER APPERSON, OF KOKOMO, INDIANA.

CARBURETING DEVICE FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 751,913, dated February 9, 1904.

Application filed January 26, 1901. Serial No. 44,819. (No model.)

To all whom it may concern:

Be it known that we, ELWOOD HAYNES and ELMER APPERSON, residents of the city of Kokomo, in the county of Howard and State of Indiana, have invented certain new and useful Improvements in Carbureting Devices for Explosive-Engines; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in feed-controlling devices for explosive-engines of the Otto cycle type whereby the charge admitted to the cylinder can be varied at the will of the operator to suit varying requirements of load and speed.

The invention relates to the matters hereinafter set forth, and more particularly pointed out in the appended claims.

The salient features of the invention comprise, in general terms, a vaporizer, a valve for automatically providing a constant head of fuel, such as gasolene or other volatile liquid hydrocarbon, to the vaporizer, and a controlling mechanism for the vaporizer by which the operator may vary the supply of fuel and air to the vaporizer at will, the proper relative proportions of fuel and air to be supplied to the vaporizer being kept constant under all circumstances.

Referring to the drawings, Figure 1 represents a device embodying the main features of the invention operatively connected with the cylinders of coupled engines designed for use in connection with a motor-vehicle. Fig. 1^a is a view in detail of one form of controlling-lever adapted for use when the device shown is applied to motor-vehicles. Fig. 2 is a view showing a vaporizer, as herein described, in elevation and a corresponding vaporizer coupled thereto, in section, together with a view, in section, of a pressure-valve. Fig. 3 is a view of the lower end of a vaporizer, showing the throttle-lever.

In the drawings, A indicates as a whole a vaporizer of a type embodying some of the features of this invention. Said vaporizer A is supplied with liquid hydrocarbon, such as gasolene, by a pipe B, connected thereto and leading from an automatic feed-controlling valve C. Said valve C is connected with a feed-pipe B′, which conducts the fuel from a suitable source of supply, such as a tank B^2, to the valve, the tank and the vaporizer being so disposed as to furnish a gravity feed or "head" to the fuel from the tank to the vaporizer. A pressure-tank may be used instead of utilizing gravity for feeding.

D represents one form of controlling mechanism by which the operator may throttle the supply of air and fuel to the vaporizer from any desired point.

Referring now to the vaporizer, said vaporizer A, as shown herein, comprises a hollow casing *a*, cylindrical in general form and provided with a vaporizing or mixing chamber *a′* therein, a valve-closure E for controlling the admission of fuel to the chamber, an air-valve F for admitting air to the chamber, and a check-valve closure G, opening automatically under the vacuum caused by the outstroke of the piston to allow the passage of the carbureted air to the engine from the vaporizer and acting to automatically and simultaneously cut off the supply of fuel to the vaporizer and the explosive admixture from the engine-cylinder when the charge is being compressed during the expansion of the gases after explosion and in the back or exhaust stroke of the piston. Said casing *a* is interiorly divided into three compartments by two cross-walls *a*^{2} and *a*^{3}. The central or intermediate compartment constitutes a vaporizing or mixing chamber *a′* and is connected with the casing of the air-valve F. One of the end compartments is connected with the feed-pipe B′ and is herein called the "receiving-chamber," and the other end compartment is connected with the engine-cylinder and is herein called the "delivery-chamber." An aperture *a*^{4}, extending through the side wall of the casing *a* into the receiving-chamber, is provided with screw-threads, whereby one end of the feed-pipe B is conveniently attached to the vaporizer. A boss *a*^{5} projects into the central compartment from the cross-wall *a*^{2}, said boss being centrally apertured and provided with a valve-seat *e*, facing toward the receiving-chamber, and a valve-

seat g at the inner end of the aperture facing the central compartment. The cross-wall a^3 is provided with an aperture having a valve-seat g' facing the delivery-chamber in axial alinement with the valve-seat g. A lateral aperture a^6, interiorly screw-threaded, leads from the delivery-chamber, said aperture being screw-threaded as a convenient means of attaching the vaporizer by the usual coupling to an engine-cylinder, as shown.

The closure E is shaped at its lower end e' to engage the valve-seat e and its outer end extends without the casing and forms a stem e^2. Said closure E is held in axial alinement over its seat e by a bushing a^7, said bushing being secured by screw-threads or other suitable means in the end wall of the casing a. Said closure has screw-threaded engagement with said bushing, so that its revolution therein gives it longitudinal movement toward and from its seat e. To secure a tight joint between the bushing and closure a cap a^8, centrally apertured to allow the passage of the stem, is adjustably secured over the outer end of the bushing a^7 by screw-threads, forming a gland which is packed in the usual manner.

A lateral hollow nipple a^9, preferably of an interior diameter equal to the distance between the cross-walls a^2 and a^3, projects from the central compartment of the casing a and has screw-threaded connection with the casing f of the air-valve F. Said air-valve F has a lateral duct f' leading from the connecting-nipple a^9 through a cylindrical valve-seat and opening to the air. A closure or plug f^2 rotates in said seat, said plug having the usual port f^3, which may be brought into more or less complete register with the duct f' by the rotation of the plug. Said plug is held longitudinally in position between a flange f^4 on one end bearing against a suitable shoulder f^5 of the casing and a collar f^6 on the other end bearing against a similar shoulder and clamped in place by a nut f^8. From the flanged end of the plug a stem f^9 extends in axial alinement therewith and parallel to the stem e^2 of the closure E. Said stems f^9 and e^2 are connected at their outer ends, so that the turning of one gives rotary movement to the other. Obviously, this connection may be made in any suitable manner. Preferably and as herein shown a segmental gear H is secured to the end of the stem e^2, meshing with a segmental gear H', secured in substantially the same plane therewith on the stem f^9. The shifting of the gear H through the longitudinal movement of the stem e^2 is so slight that the gears do not get out of mesh. An arm I is secured at one end i to either of the closures. As herein shown, it is secured between the nut f^8 and collar f^6 to the plug f^2. The controlling connections D, hereinafter described, form a convenient means of transmitting the desired movement to the valves from any desired point or place. The gears H and H' are so proportioned that the ports of each valve will be opened to allow the desired relative quantities of hydrocarbon and air into the central or vaporizing chamber of the valve A. Thus a proportionate supply of air and of fuel may be admitted to the vaporizer in any required amount by a single movement of the arm I, so long as a constant pressure or head of the fuel be maintained at the vaporizer, this constant factor leaving the proportions dependent entirely on the relative size of the two valve-openings.

The valve-closure G, which forms the moving member of the automatically-acting check or vacuum valve, comprises a conical head g^3 and a stem g^4. Said closure is held in axial alinement with the valve-seats g and g' by the sliding engagement of the stem g^4 in a guide-aperture, closed at the outer end, which is formed in a boss k of a screw-cap K, which closes the outer end of the delivery-chamber of the casing a. A spiral spring g^5 encircles the stem g^4 and bears against the inner face of the cap K and the base of the conical head g^3, so that it holds the closure G in spring-pressed contact with the seat g of the fuel-aperture in the cross-wall a^2 and also with the seat g' in the cross-wall a^3, the head and valve seats being so proportioned and dimensioned as to afford such simultaneous seating.

The operation of the vaporizer as a whole is as follows: On turning the arm I the fuel and air enter the central compartment of the casing, and the gasolene is free to pass through the aperture in the cross-wall a^2 upon the unseating of the closure G. This happens when the outstroke of the piston forms a vacuum behind the closure, which under the atmospheric pressure produces compression of the spring g^5 and recedes from its seat g and g'. The stream of gasolene under the head or pressure flows through the aperture of the seat E, impinges against the apex of the conical head g^3 of the closure G, and is distributed in a fine film over the surface thereof. As it passes over the cone it is volatilized and is drawn with the air which comes in through the lateral aperture of the valve F through the valve-seat g' and the duct into the engine-cylinder. When the inward or charge-compressing stroke of the piston begins, the valve-closure G is at once closed upon the seats g and g' by the spring g^5, thereby simultaneously cutting off the air, fuel, and vapor from the engine-cylinder.

It is clear that when the engine and fuel tanks are at fixed relative levels the fluid in the tank will have a varying head as the tank is gradually emptied. This involves a varying rate of flow through the valves, other conditions being constant. In addition to this, if the engine and tank are in a boat or vehicle the bodily movements thereof may result in abrupt changes in the head. Similarly if the supply-tank is placed under air-pressure the

pressure therein will be lessened as the tank is emptied. To maintain a constant pressure at the vaporizer under all conditions, the feed-regulating valve C, referred to before, is connected to the pipe B and to the tank-pipe B′. Said pressure-valve comprises in general terms a valve-seat c and a closure therefor, c', controlled by a float c^2, contained in a closed casing c^3. Preferably said parts of said pressure-valve are formed and disposed as follows:

The closed casing c^3 is a shell with cylindric side walls closed at its upper end and having at its lower open end an outwardly-projecting flange c^4. A base c^5 for said casing c^2, circular in shape, is secured to the shell-flange by a plurality of bolts or screws c^6, which engage said flange and suitable lugs in said base. Said base has a duct c^8 projecting radially inward from its margin to a point between its circumference and center, where it turns upward into the float-chamber formed by the casing c^3. Said duct is interiorly screw-threaded at its outer end to receive the screw-threaded end of the pipe B, leading to the vaporizer A. Said base is also provided with a duct c^7, which leads to the valve-seat c therein located and which communicates through said valve-seat with the float-chamber. Said duct c^7 is provided with interior screw-threads at its outer end for engaging the screw-threaded end of the pipe B′, leading from the fuel-tank. Said valve-seat c is formed in the outer end of a boss c^9, which projects into the horizontal portion of the duct c^7. The valve-closure c' has a shoulder, which is adapted to close upon the valve-seat c, and a stem c^{13}, considerably smaller in diameter than the valve-seat c, extending through said valve-seat into the float-chamber. To hold said closure c' in alinement over the seat, its lower cylindrical end slides in a guide-aperture c^{10}, which is in axial alinement with the valve-stem, and is formed in a closed nipple or cap c^{11}. Said nipple is secured by screw-threads in the aperture of a boss c^{12}, which depends from the base c^5. The end of the valve-stem c^{13}, which projects into the float-chamber, is secured by screw-threads or other suitable means to the float c^2, contained in said float-chamber.

The operation of the feed-regulating valve is as follows: The gasolene from the tank passes through the duct c^7 into the float-chamber through the valve-seat c and rises in the float-chamber, so as to maintain a body of liquid therein. If no gasolene is flowing from the float-chamber to the vaporizer, the float will be lifted by the inflowing gasolene until the valve is closed and the inflow is stopped. When the gasolene is permitted to flow to the vaporizer, the level of the liquid in the float-chamber will be lowered and the valve will be thereby opened, and the valve will continue to remain open to a greater or less extent, according to the rate of consumption of the gasolene in the motor, the valve moving toward or from its seat according to variations in the rate of supply and consumption, so as to maintain any required supply to the motor at a constant pressure. Thus the gasolene or other liquid hydrocarbon is supplied to the vaporizer at a constant head or pressure, although varying conditions of pressure or head exist between the supply-tank and vaporizer and the gasolene is used more or less rapidly in the motor. Consequently the proportion of air and gasolene admitted to the vaporizer is dependent solely on the relative size of the passages afforded by the air and fuel valves. Each of the vaporizer-closures can therefore be set so that the desired explosive mixture may be obtained, and as the said closures are connected so as to open and close in unison, as hereinbefore described, the amount or size of charge to be admitted to the cylinder at any particular moment can be regulated at the will of the operator without varying the proportions of the constituents of such charge. As a plurality of engines are frequently coupled to the same shaft, the vaporizers for each engine may be likewise coupled. A convenient method of so doing is illustrated in Fig. 1, wherein A A are two vaporizers of the type herein described connected to coupled engines and operatively connected by a rod L, which has pivoted connection with the stem-arms I′ and I².

The controlling device D, as herein shown, is especially adapted for motor-vehicles. It comprises a rod L′, connecting the stem-arm I of a vaporizer with one arm of a bell-crank lever M, said bell-crank lever being pivotally secured beneath the floor of the vehicle and having a foot-piece m, connected to its horizontal arm, extending through the floor. The depression of said foot-piece by the foot of the driver opens the valves of the vaporizer, a spiral spring m' being attached to the lever L and the vehicle-body, so as to return the lever and shut off the vaporizer when the foot-piece is liberated. The operator is therefore able to vary the charge for the engine at any particular moment at will without leaving his post and is therefore able to procure greater or less driving power to suit varying requirements by varying the working charge delivered to the engine.

We do not restrict ourselves to the special forms or features of construction herein shown, except as set forth in the appended claims.

We claim as our invention—

1. The combination with the power-cylinder of an explosive-engine, of a vaporizer connected with said cylinder and provided with an air-inlet opening, said vaporizer comprising a hollow casing having a central mixing-chamber, a compartment at one side of said mixing-chamber to which fuel is delivered, and a compartment at the opposite side of said mixing-chamber which is connected with the said in-

let-port of the power-cylinder, a rotative plug-valve constituting an air-valve for controlling the inflow of air through said air-inlet passage to said mixing-chamber, a fuel-valve comprising a valve-seat in the wall separating the mixing-chamber from the fuel-chamber, and a valve-closure acting on said seat, said valve-closure having a stem which has screw-threaded engagement with the valve-casing and is arranged parallel with the stem of the air-valve, and intermeshing gears on the stems of the said air and fuel valves, whereby the same are simultaneously moved.

2. The combination with the power-cylinder of an explosive-engine, of a vaporizer connected with said cylinder and provided with an air-inlet opening, said vaporizer comprising a hollow casing having a central mixing-chamber, a compartment at one side of said mixing-chamber to which fuel is delivered, and a compartment at the opposite side of said mixing-chamber which is connected with the said inlet-port of the power-cylinder, a rotative plug-valve constituting an air-valve controlling the inflow of air through said air-inlet passage to the mixing-chamber, said plug-valve having a rotative stem, a fuel-valve comprising an aperture in the wall separating the mixing-chamber from the fuel-chamber, and a valve-seat surrounding said aperture at the side of the partition adjacent to the fuel-chamber, a valve-closure acting on said seat, and having a stem which has screw-threaded engagement with said valve-casing, intermeshing gears on the stems of said air and fuel valves, and rigidly-connecting check-valves acting to close the passage from the mixing-chamber to the power-cylinder, and also the aperture in said partition between the fuel-chamber and the mixing-chamber.

3. The combination with the power-cylinder of an explosive-engine, of a vaporizer comprising a mixing-chamber, a fuel-receiving chamber, and a discharge-chamber connected with the inlet-port of the engine, said vaporizer being provided with an air-inlet passage communicating with said mixing-chamber, an air-valve controlling said air-inlet passage, consisting of a rotative valve-plug provided with a stem, a fuel-valve embracing a valve-seat in the wall between the mixing and discharge chambers and a valve-closure acting on said seat, said valve-closure being provided with a rotative stem having screw-threaded engagement with the casing, a check-valve between the mixing-chamber and the cylinder inlet-port, embracing a port in the wall between the mixing and discharge chambers, and a valve-closure fitting said seat, and a check-valve between the fuel-supply passage in the mixing-chamber, consisting of a valve-seat at the outlet of said fuel-supply passage, and a valve-closure which is connected and moves with the closure of the first-mentioned check-valve, and intermeshing gears on the valve-stems of said fuel and air valves.

In testimony that we claim the foregoing as our invention we affix our signatures, in presence of two witnesses, this 21st day of January, A. D. 1901.

ELWOOD HAYNES.
ELMER APPERSON.

Witnesses:
A. J. THARP,
M. C. WYGANT.