No. 775,614. PATENTED NOV. 22, 1904.

G. F. SWAIN.

CARBURETER FOR EXPLOSIVE ENGINES.

APPLICATION FILED DEC. 26, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 3

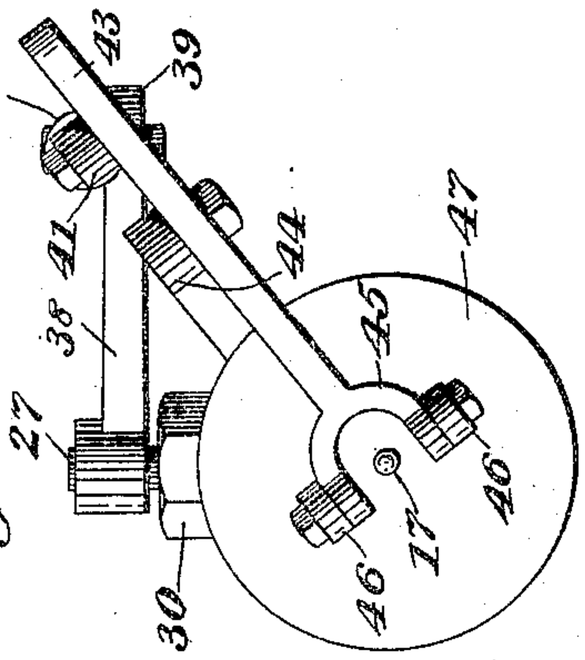


Fig. 5

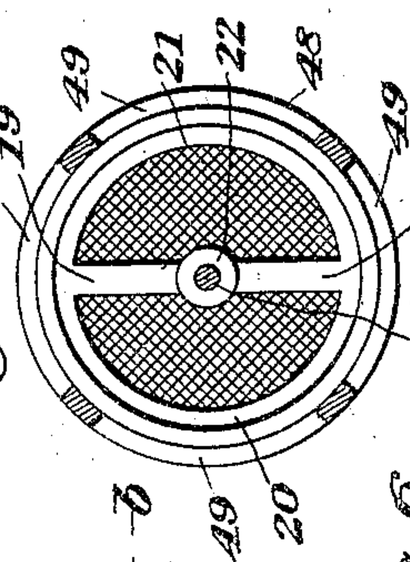


Fig. 6

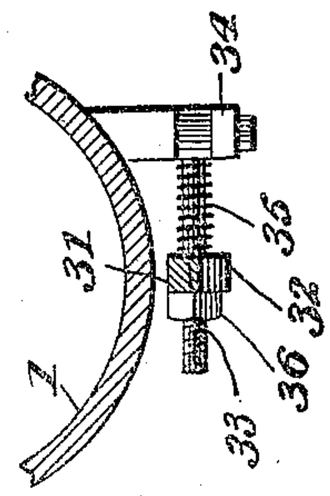


Fig. 2

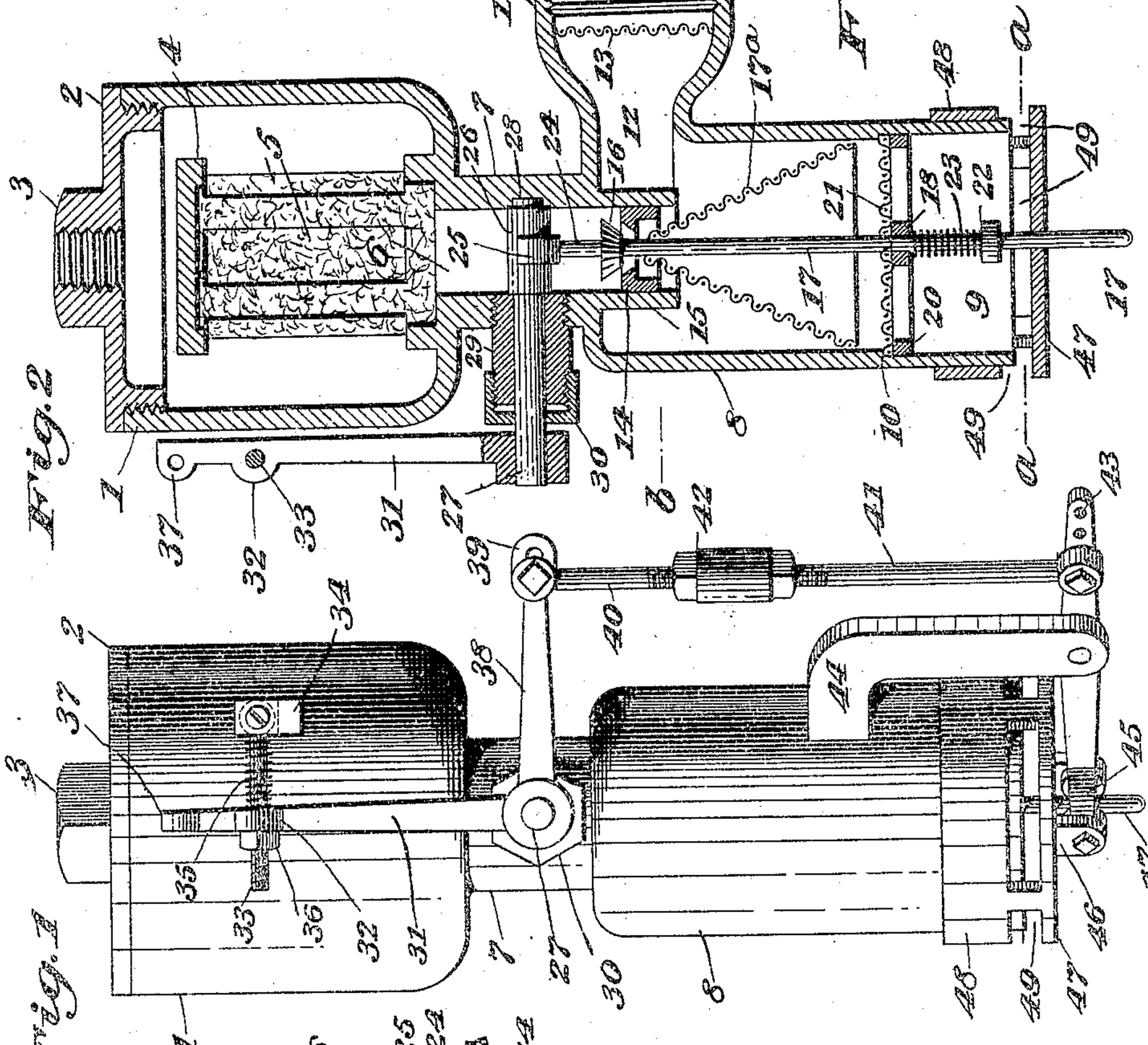
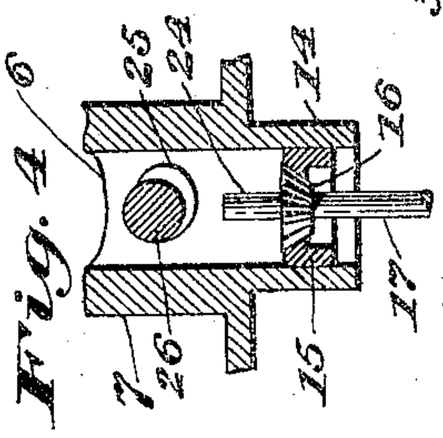


Fig. 4



Witnesses

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CARBURETER FOR EXPLOSIVE ENGINES.

APPLICATION FILED DEC. 26, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 10

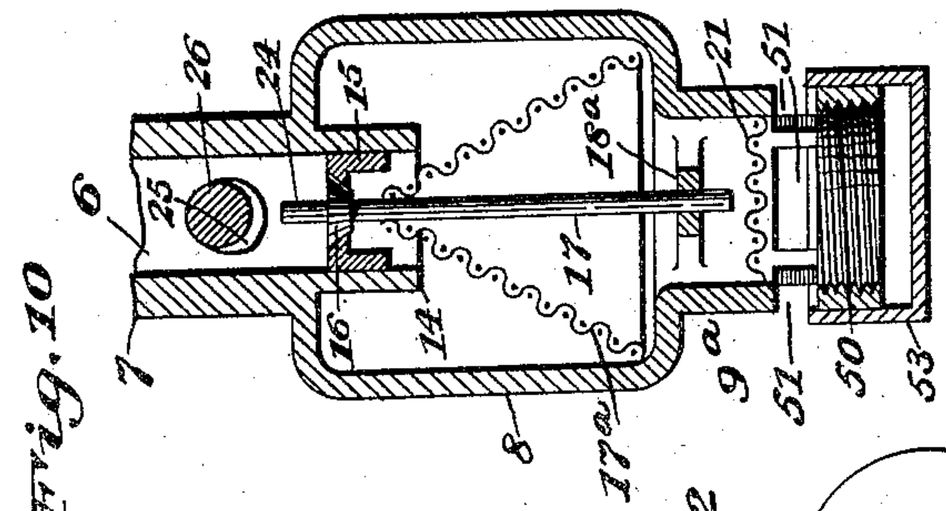

Fig. 9

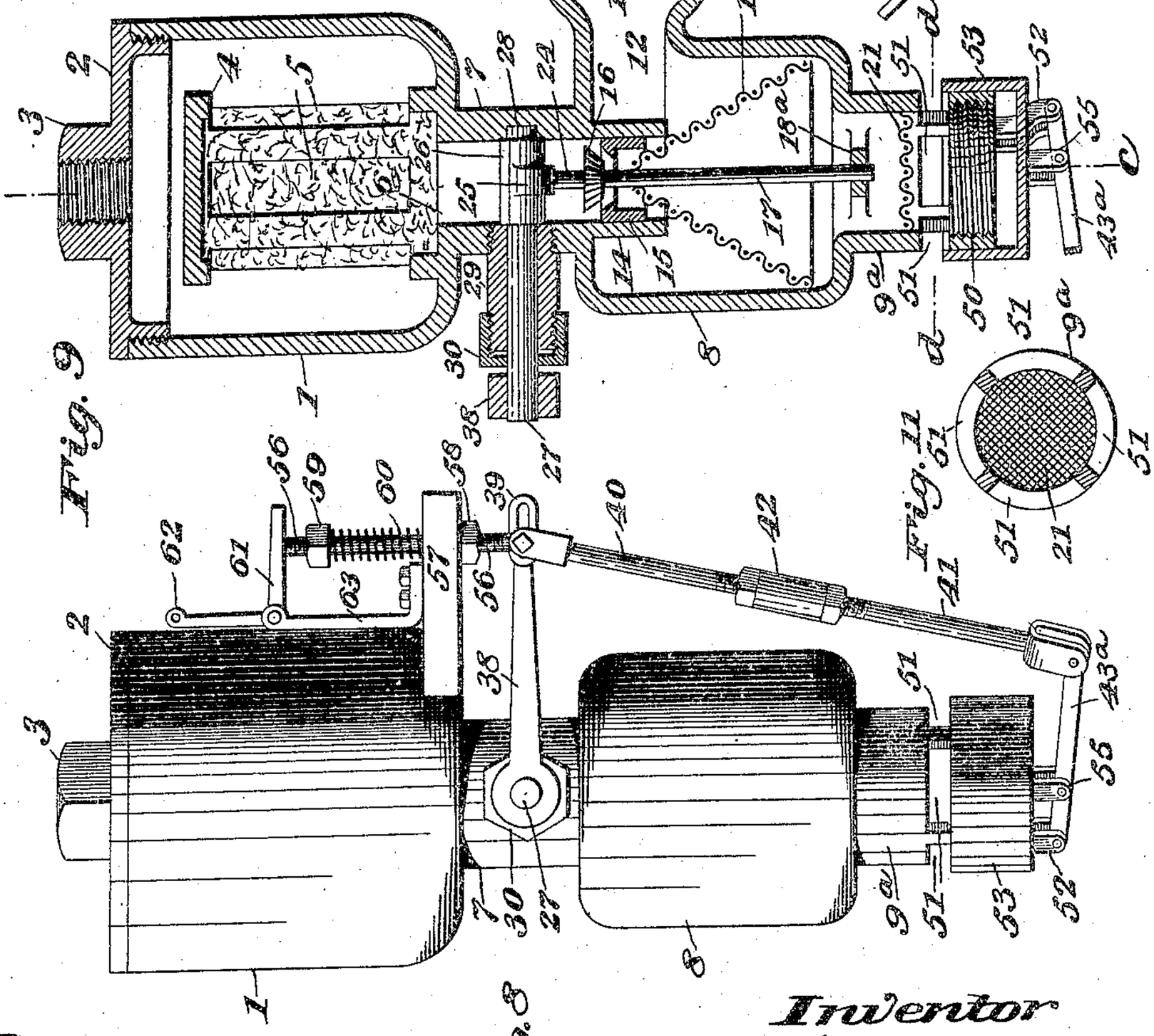

Fig. 12

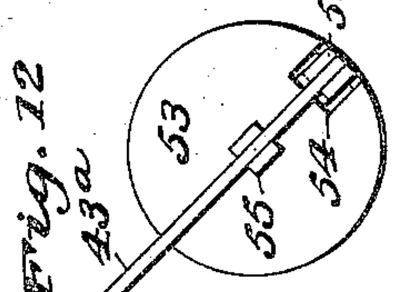

Fig. 11

Fig. 8

Witnesses

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No. 775,614. Patented November 22, 1904.

UNITED STATES PATENT OFFICE.

GEORGE F. SWAIN, OF HARVEY, ILLINOIS, ASSIGNOR OF ONE-HALF TO HENRY E. KELLOGG, OF HARVEY, ILLINOIS.

CARBURETER FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 775,614, dated November 22, 1904.

Application filed December 26, 1902. Serial No. 136,536. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. SWAIN, a citizen of the United States, residing at Harvey, Cook county, Illinois, have invented certain Improvements in Carbureters for Explosive-Engines, of which the following is a specification.

This invention relates to certain improvements in carbureters such as are especially designed for use in connection with gasolene and similar motors and other like devices; and the object of the invention is to provide a device of this character of a simple and inexpensive nature and of a strong, compact, and durable structure not liable to readily become deranged or broken in use and provided with improved means for effecting a complete and thorough vaporization of liquid hydrocarbon supplied to it and for insuring the proper mixing of the vaporized hydrocarbon and air to form the combustible mixture to be supplied to the motor or other device in connection with which the carbureter is used.

The invention consists in certain novel features of the construction, combination, and arrangement of the several parts of the improved carbureter, whereby certain important advantages are attained and the device is made simpler, cheaper, and otherwise better adapted and more convenient for use than various other similar devices heretofore in use, all as will be hereinafter fully set forth.

The novel features of the invention will be carefully defined in the claims.

In the accompanying drawings, which serve to illustrate my invention, Figure 1 is a front elevation showing a carbureter embodying my improvements, and Fig. 2 is an axial section taken vertically through the same and showing the construction and arrangement of the various interior parts thereof. Fig. 3 is an under side view showing certain features of construction of the air-regulating devices of the carbureter. Fig. 4 is a partial section taken through the hydrocarbon-supply passage of the improved carbureter in a plane at right angles to the plane of the section in Fig. 2 and showing certain details of the mechanism for regulating the supply of liquid hydrocarbon to the vaporizing-chamber of the device. Fig. 5 is a transverse section taken through the air-inlet of the vaporizer in the plane indicated by the line *a a* in Fig. 2. Fig. 6 is a partial sectional view showing certain features of the adjusting means for the regulating mechanism of the improved carbureter. Fig. 7 is a partial section taken transversely through the vaporizing-chamber of the improved carbureter in the plane indicated by the line *b b* in Fig. 2 and showing the arrangement of the outlet from said chamber for the mixed air and hydrocarbon vapor. Fig. 8 is a view similar to Fig. 1, but illustrating a modified arrangement of the improved carbureter. Fig. 9 is an axial section similar to Fig. 2, but showing the interior construction of the modified arrangement shown in Fig. 8. Fig. 10 is a partial section similar to Fig. 9, but taken in a plane at right angles to the plane of the section in that figure, as indicated by the line *c c* in said figure, and showing the valve and vaporizer in lowered position within the vaporizing-chamber of the carbureter. Fig. 11 is a section taken transversely through the air-inlet of the modified form of the device, the plane of the section being indicated by the line *d d* in Fig. 9. Fig. 12 is an under side view of the carbureter, showing the form of certain parts of the modified construction.

Referring first to Figs. 1 to 7, inclusive, the improved carbureter has a casing formed with an enlarged cylindrical upper part 1, hollowed out to produce an internal chamber the top of which is closed by a screw-cap 2, provided with a central nipple 3, having interior screw-threads by means of which a pipe (not shown) may be connected with the casing for the supply of liquid hydrocarbon thereto from a suitable source.

The walls of the support 4 are formed with openings 5, extended through them for the passage of the filtered or strained liquid hydrocarbon into the interior bore of the support, and said interior bore is alined with a bore or passage 6, extended down through a contracted central portion 7 of the casing below the enlarged upper part thereof.

8 indicates the vaporizing-chamber, which is also formed within an enlarged and hollow lower part of the casing below the reduced central part or neck 7, and the passage 6 is adapted for communication at its lower end with the upper part of said vaporizer-chamber at the central part thereof.

Below the vaporizing-chamber 8 the lower enlarged part of the casing in which said chamber is formed is extended down, as shown at 9, and is provided with an open lower end for receiving air for admixture with the hydrocarbon vapor in said chamber, said open lower end being provided with means to be hereinafter described for regulating the admission of air, so that a proper composition of the combustible vapor may be maintained when the supply of liquid hydrocarbon to said chamber 8 is increased or diminished.

At the upper part of the vaporizing-chamber the casing is also provided with an integral extension 11, directed away from the side of the casing and made in cylindrical or tubular form, so as to be adapted for connection with a pipe leading to a motor or other device in connection with which the improved carbureter is to be used, and said extension 11 forms an outlet-passage for conveying the combustible mixture away from the vaporizing-chamber to the motor or other device and has a portion 12 next to and communicating with the upper part of the chamber 8, which portion 12 is made flattened and is laterally widened so as to afford communication with the vaporizing-chamber around as great a portion of the circumference thereof as may be necessary or desirable.

Within the chamber 8 and at the top thereof the wall of the carbureter is formed with a downwardly-extended boss or flange 15, alined with the neck 7 of the casing, and the passage 6, through which the hydrocarbon is supplied, is extended down through said boss or flange 15, as seen in Figs. 2 and 4, the lower discharging end of the passage being in this way arranged at the lower part of or below the outlet 11, whereat the combustible mixture of air and vapor is discharged from the chamber 8, so that the hydrocarbon supplied through passage 6 will not be liable to run out at said outlet 11.

13 indicates a screen or diaphragm of wire-gauze or the like extended across the outlet 11 for preventing the escape of fine particles or spray of liquid hydrocarbon through said outlet under the draft exerted by the suction of the motor.

In the lower end of passage 6 is arranged a valve-seat 14, which may be formed from pressed metal and with which is adapted to be engaged a valve 16, movable in said passage and adapted to control the supply of liquid hydrocarbon to the vaporizing-chamber, said valve 16 being held on the upper end of a valve-stem 17, extended axially down through the vaporizing-chamber 8 and also through the open-bottomed lower part 9 of the casing, the length of said valve-stem being such that its lower extremity is extended below said lower part 9 of the casing, as shown in Figs. 1 and 2, in position to be conveniently engaged and pressed upward by the finger, so that the valve 16 may be raised at the starting of the motor to discharge an initial supply of hydrocarbon to the chamber 8 of the device.

On the valve-stem 17 within the vaporizing-chamber 8 is secured in any preferred way a vaporizer 17ª, herein shown as made in conical form from wire-gauze or similar foraminous material, its apex being secured to the upper part of the valve-stem and its sides being arranged to slope downward and outward toward the outer walls of the chamber 8, to which walls the lower edges of the vaporizer are closely adjacent.

Below the vaporizer 17ª the valve-stem 17 is guided in a bearing 18, held by transverse arms 19, extended across a ring 20, which is arranged within the lower open end portion 9 of the casing and held therein by frictional contact with the walls thereof, the said lower portion 9 of the casing being made with an enlarged bore in which the ring 20 fits and said bore producing at its upper end a shoulder 10, beneath which is clamped by said ring the edge portion of a wire-gauze or other screen 21, extended across the interior of the casing and centrally perforated for the passage through it of the valve-stem 17. By this arrangement it will be seen that the air entering at the lower open end of the casing is caused to pass upward and through the screen or diaphragm 21, so that the entry of foreign matter into the vaporizing-chamber is effectually prevented. The base of the vaporizer 17ª is arranged slightly above the diaphragm or screen 21, so that the air entering at the lower open end of the casing and passing up through said diaphragm 21 will be received within the interior hollow of the conical vaporizer and caused to pass through the meshes or interstices thereof.

Since the valve 16 is carried on the upper end of the stem 17, on which the vaporizer 17ª is secured, it will be obvious that when said valve is moved upward to lift it from its seat the liquid hydrocarbon flowing through passage 6 will be guided down along the stem and will flow down over the sloping sides of the vaporizer, so that the air, which, as above described, is caused to pass through the meshes or interstices of said vaporizer will quickly and completely vaporize the liquid hydrocarbon and produce a gaseous combustible mixture adapted for supply to a motor or other device and which will be discharged to the same through the extension or outlet 11.

Should more liquid hydrocarbon be supplied through the passage 6 to the vaporizer than can be held by the vaporizer, such ex-

cess supply will run down the sloping sides of the conical vaporizer and will drop upon the screen 21, by which it will be held, so that it may be completely vaporized by the air passing up through said screen, as above described.

Since the flattened portion 12 of the extension 11 is adapted for communication with a considerable portion of the circumference of the chamber 8 at the upper part thereof, it will be evident that the air will be caused to pass through the meshes or interstices of the vaporizer at substantially all points around the sides thereof, so that the hydrocarbon will be more completely vaporized than would be the case were said outlet arranged to communicate with the chamber 8 by way of a circular hole at one side of the casing only.

The improved carbureter constructed according to my invention is especially well adapted for use in connection with gasolene or other hydrocarbon motors, and when so used the extension or vapor-outlet 11 will be connected with the motor in such a way that the draft or suction of the motor will be exerted therethrough and through the vaporizing-chamber 8 and lower end portion 9 of the casing, so as to exert a lifting force upon the foraminous vaporizer 17ª, so that at each time said draft or suction is exerted by the motor to draw a charge of combustible mixture from the carbureter said vaporizer will be lifted within its chamber to the position shown in Fig. 2. The vaporizer will of course fall by gravity when the lifting force is no longer exerted by the motor; but should there be any tendency for the said vaporizer to stick and remain in its raised position the vaporizer will be drawn down by means of a spring 23 of suitable tension, coiled on the valve-stem 17 with its lower end engaged on a collar 22 on the stem and its upper end engaged beneath the bearing 18. This spring also serves to hold the valve 16 drawn down, so that it is normally seated to prevent the flow of hydrocarbon through passage 6, but does not interfere in any way with the lifting of the valve and vaporizer under the influence of the draft or suction of the motor.

Since the vaporizer is connected to the valve-stem 17, on which the valve 16 is held, it will be obvious that each time the vaporizer is lifted by the draft or suction of the motor the stem 17 will also be moved upward, and the valve 16, carried on the upper end thereof, will be lifted from its seat 14, so as to permit a suitable supply of liquid hydrocarbon to be discharged by way of the passage 6 to chamber 8, which hydrocarbon will flow down over the sloping sides of the vaporizer and will be vaporized by the entering air drawn through the open-ended lower part 9 of the casing and through the meshes of the vaporizer by the draft or suction of the engine. In this way it will be seen that the supply of liquid hydrocarbon to the vaporizing-chamber is regulated and controlled by the suction of the motor or other device in connection with which the improved carbureter is used, and since the liquid hydrocarbon so supplied is discharged directly upon the foraminous vaporizer through which the air is drawn it will be evident that a complete and thorough mixture and vaporization of the hydrocarbon is effected without liability of the hydrocarbon being drawn in liquid form into the motor or other device.

In connection with the improved carbureter constructed as above described I provide means for regulating the extent of opening of the valve, so that the liquid hydrocarbon supplied to the chamber 8 may be governed according to the requirements of the engine, and I also provide means for regulating the admission of air at the open lower end portion 9 of the casing, both of these regulating means being adapted for simultaneous actuation, so that the supply of air to the carbureter shall be increased or diminished in proportion with the increase or diminution of the supply of liquid hydrocarbon thereto. This regulating mechanism comprises a cam 25, held on an enlarged part 26 of a shaft 27, extended across the passage 6 above valve 16, the cam being adapted for engagement with the upper end of a part 24, projected above the valve and herein shown as formed of a continuation of the valve-stem 17. The shaft 27 is adapted for turning movement, so that the cam 25 may be adjusted to limit the opening movement of the valve 16 to a greater or lesser extent, and said shaft is held in a screw-plug 29 at one side of the neck 7 of the casing and has one end engaged in a bearing, as shown at 28, at the opposite side of said neck, the projecting end of the shaft outside of said plug being passed through a stuffing-box 30 and having secured upon it an elbow-lever one arm, 31, of which is extended upward in front of the enlarged upper part 1 of the casing and has a perforated bearing 32, through which is adapted to slide one end portion of a screw-threaded rod or pin 33, the opposite end portion of which is pivotally held to a lug 34, projecting from the casing, as shown in Figs. 1 and 6. On the pin or rod 33, between the lug 34 and the bearing 32 of arm 31, is coiled a spring 35, tending to press the arm 31 over toward the left, as the parts are shown in Fig. 1, and on the threaded end of said pin or rod 33 is held a nut 36, forming a stop to limit the movement of said arm 31 under the pressure of said spring 35. The upper end of the arm 31 is also formed with an opening 37, adapted to receive one end of a cord, chain, or other device (not shown) which should be extended within easy reach of the operator, who may by drawing on such device force the arm 31 over toward the right and against the tension of spring 35, whereby the shaft 27 will

be partially turned and the cam 25 be caused to extend farther down to lessen the extent of opening movement of the valve 16, whereby the supply of liquid hydrocarbon to the vaporizing-chamber 8 of the carbureter is diminished. The other arm, 38, of the elbow-lever on shaft 27 is extended laterally at about right angles to the arm 31 and has connection, as shown at 39, with the upper end of a connecting-rod formed of upper and lower parts 40 and 41, adjustably connected by means of a union-coupling 42, by means of which the length of said rod may be varied at will, and said rod is extended down at one side of the enlarged upper portion of the casing and has connection with the outer end of a lever 43, pivoted centrally upon the lower end of a stud 44, extended down from the casing, the opposite end of said lever being forked, as shown at 45 in Figs. 1 and 3, and having its bifurcations pivotally connected with lugs 46 46, extended down from the under side of an air valve or shield formed with a flat bottom 47 and having a raised marginal wall 48, adapted to fit round and slide upon the lower end portion 9 of the casing.

The marginal wall 48 of the air valve or shield is formed with openings 49 49, formed in it adjacent to the bottom 47 thereof, through which openings air is to be drawn in laterally beneath the lower edge of the open-bottomed lower part 9 of the casing, such air passing under the draft of the engine, up through said portion 9, and into the vaporizing-chamber 8, as above described. The bottom of the air valve or shield has a central opening, and the lower end of the valve-stem 17 is extended down through said opening below the valve, so as to be in convenient position for operation by the finger to lift the valve 16 and supply hydrocarbon to the chamber 8 for the starting of the engine. The valve-stem also fits in said opening in the valve, which is in this way caused to act as a second bearing to guide the stem in its movement and hold it from tilting within the casing. Since the lever 43 is forked and its forks are pivoted to the valve or shield at opposite sides of the center thereof, it will also be evident that clearance is provided between said forks for the play of the lower projecting end of the valve-stem, as above described. By this construction it will be seen that the nut 36 may be adjusted upon the rod or pin 33 in such a way as to limit the movement of the arm 31 toward the left as the parts are shown in Fig. 1, and consequently to limit the turning of the shaft 27 and of the cam 25 carried thereon, so that the valve 16 may be permitted to open to a greater or lesser degree. The movement of the shaft 27 will also be transmitted, through arm 38 and its connections, to the air-valve at the lower end of the casing, so as to slide said air-valve upward or downward upon the lower end portion 9 of the casing, so that the openings or ports 49 in the walls of said valve shall be more or less fully opened, permitting the entry of a greater or lesser supply of air into the casing and up into the vaporizing-chamber, the variation in the supply of air being in this way made proportional with the variation in the supply of liquid hydrocarbon. Since the connecting-rod between the arm 28 and lever 43 is formed of adjustably-connected parts, it is evident that it may be lengthened so as to permit of setting the air-valve in proper position relative to the cam 25, and by preference the said connecting-rod will have an adjustable connection with said lever 43, the lever being formed with a plurality of openings for engagement by the pivot-pin at the lower end of the rod, so that the stroke of the air-valve may be varied.

In the operation of an engine with which my improved carbureter is connected when it is desired to cut down the charge to correspond with lessened power to be developed it is only necessary to move the lever or arm 31 over toward the right by drawing upon the cord or other connection attached to said arm, whereupon the spring 35 will be placed under tension and the shaft 27 will be rocked to cause the cam 25 to extend farther down in the passage 6, so as to limit the opening movement of the valve 16 and reduce the volume of hydrocarbon supplied to the vaporizing-chamber at each upward movement of the vaporizer 17ª. At the same time the lever 43 will be rocked and by its connection with the air-valve will cause said valve to slide upward upon the lower open end 9 of the casing, so as to partially close the air-inlet openings or ports 49 in said valve and reduce the supply of air to the vaporizing-chamber in a proportion corresponding with the reduction in the supply of liquid hydrocarbon. When the draft on the cord or other device is relaxed, the spring 35 will act automatically to force the arm 31 over toward the left and against the nut 36, so that the cam 25 will again be turned to permit the valve 16 to rise higher, and at the same time the air-valve will be slid downward upon the casing to uncover the ports 49 and permit the entry of a correspondingly-increased volume of air.

From the above description it will be seen that the improved carbureter constructed according to my invention is of an extremely simple and inexpensive nature and is especially well adapted for use owing to the complete vaporization of the liquid hydrocarbon insured by its use and also owing to the automatic control of the supply of hydrocarbon and air exerted by the motor, whereby the supply of hydrocarbon and air to the vaporizing-chamber is governed from the draft or suction of the engine itself. Since the supply of hydrocarbon and air to the vaporizing-chamber of the carbureter is also adapted for

simultaneous regulation in corresponding proportions by the person in charge of the engine, it will also be seen that a very important advantage is attained, since the mixture produced by the carbureter is in this way caused to be of constant or uniform composition at all times, and the proportion of hydrocarbon contained in the gaseous mixture cannot rise too high nor fall too low to be adapted for the requirements of the engine.

It will also be obvious from the above description that the improved carbureter is capable of considerable modification without material departure from the principles and spirit of the invention, and for this reason I do not wish to be understood as limiting myself to the precise form and arrangement of the several parts of the device herein set forth in carrying out my invention in practice. For example, in some cases the construction shown in Figs. 8 to 12, inclusive, may be employed. This construction is very similar to that above described, except that the lower end of the valve-stem 17 is not extended through the lower end of the casing, but is guided in a spider 18^a in the lower part of the casing and above the screen 21. The said lower part 9^a of the casing is open at its bottom and is interiorly screw-threaded to receive a screw-plug 50, and above said screw-threaded portion the sides of said lower portion of the casing are formed with air-inlet ports or openings 51 51 for the entry of air for supply to the chamber 8. 53 indicates the air valve or shield, which is adapted to fit snugly on the lower end portion of the casing with its upper edge portion adapted when said valve is slid upward to more or less fully cover the openings or ports 51 to limit the entry of air thereat. The screw-plug 50 has downwardly-extended lugs 52 passed through an opening 54 in the bottom of the valve, and to said lugs is pivoted one end of a lever 43^a, coupled by an adjustable rod with the arm 38, as in the preceding form of the device. At the center of the valve 53 and on the under side thereof are provided lugs 55 for connection with the lever 43^a, so that said valve may be actuated from the swinging movement of the said lever, as will be readily understood. The arm 38 on shaft 27 has connection with the lower end of a screw-threaded rod or pin 56, which is passed up through and guided for endwise movement in an opening formed in an arm or lug 57 extended from the side of the carbureter-casing, as shown in Fig. 8.

To limit the upward movement of the rod or pin 56, a stop is provided thereon in the form of a nut 58 adjustably held on the screw-threads of said rod 56 and adapted for engagement on the under side of the lug 57, and to hold the rod or pin raised so that the cam 25 will ordinarily be held turned so as to permit a full opening of the valve 16 I provide a spiral spring 60, coiled on the pin or rod between a nut 59 adjustably held on the screw-threads of the rod and the upper surface of the lug 57.

63 indicates a bracket held on the lug 57 with an arm extended upward above the same, on which arm is pivoted an elbow-lever, one arm, 61, of which is adapted for engagement upon the upper end of the rod or pin 56, while the other arm, 62, of said lever is designed for connection with a chain, cord, or other flexible connection, by means of which the said lever may be moved in an easy manner by the person in charge of the engine. When the lever is thus moved, the rod or stem 56 will be pressed down, placing spring 30 under tension, and through its connection with the arm 38 on shaft 27 the movement of the rod will be communicated to rock said shaft and shift the position of the cam 25 so as to cause said cam to limit the opening movement of the valve to a greater or lesser degree, so that the supply of liquid hydrocarbon to the vaporizing-chamber will be correspondingly reduced. The movement of the arm 38 will also be communicated, through its connections, to the air-valve 53, so as to correspondingly vary the supply of air to the vaporizing-chamber of the device.

Having thus described my invention, I claim—

1. A carbureter comprising a casing having a vaporizing-chamber and having a downwardly-extended passage the lower end of which has a valve-seat and is connected with the upper part of the vaporizing-chamber for supplying liquid hydrocarbon thereto, a valve engaged with the valve-seat and adapted to be opened by upward movement for controlling the passage and having a valve-stem extended down into the vaporizing-chamber, a foraminous vaporizer secured to the valve-stem below the valve and adapted to receive liquid hydrocarbon from said stem, said vaporizer being extended across the vaporizing-chamber, means for admitting air to the vaporizing-chamber below the vaporizer and means for discharging vapor from said chamber above the vaporizer.

2. A carbureter having a casing provided with a vaporizing-chamber the upper part of which is formed with a vapor-outlet and the lower part of which has an air-inlet, said casing having a hydrocarbon-supply passage connected with the upper part of said chamber, a valve controlling said passage and having a valve-stem extended downward into said chamber and a vaporizer held on said stem in the chamber between the air-inlet and vapor-outlet thereof and having foraminous walls through which the air is adapted to be drawn.

3. A carbureter having a casing provided with a vaporizing-chamber the upper part of which is formed with a vapor-outlet and the lower part of which has an air-inlet, said casing having a hydrocarbon-supply passage con-

nected with the upper part of said chamber, a valve controlling said passage and having a stem extended down into said chamber, a vaporizer held on said stem in said chamber between the vapor-outlet and air-inlet thereof and having foraminous walls through which air is adapted to flow in passing from the inlet to the outlet and an air-valve movably held at the air-inlet of the casing and controlling the admission of air thereto.

4. A carbureter having a casing provided with a vaporizing-chamber the upper part of which is formed with a vapor-outlet and with a hydrocarbon-supply passage and the lower part of which is provided with an air-inlet, a valve controlling the hydrocarbon-supply passage and having a stem extended down within the chamber in line with the air-inlet at the bottom thereof, a vaporizer held on said stem in said chamber and having inclined walls formed from foraminous material and a sheet of foraminous material extended across the air-inlet and below said vaporizer.

5. A carbureter having a casing provided with a vaporizing-chamber and having a passage for supplying liquid hydrocarbon to the upper part of said chamber, a valve controlling the passage and having a stem extended downward in the chamber below said passage, a foraminous vaporizer secured to the valve-stem in the vaporizing-chamber and below the valve and adapted to receive liquid hydrocarbon from said stem, a part adjustably mounted and arranged to engage and limit the opening movement of the valve, means for supplying air to the vaporizing-chamber below the vaporizer and means for discharging vapor from said chamber above the vaporizer.

6. A carbureter having a casing provided with a vaporizing-chamber and having a passage for supplying liquid hydrocarbon to the upper part of said chamber, a valve controlling the passage and having a stem extended downward in the chamber below said passage, a foraminous vaporizer secured to the valve-stem in the vaporizing-chamber and below the valve and adapted to receive liquid hydrocarbon from said stem, a part held to turn and adapted, when turned, for adjustment to limit the opening movement of the valve, means for supplying air to the vaporizing-chamber below the vaporizer and means for discharging vapor from said chamber above the vaporizer.

7. In a carbureter the combination of a casing having a passage for the supply of liquid hydrocarbon, a vaporizer in the casing, a valve controlling the hydrocarbon-supply passage and connected with the vaporizer, a shaft one end of which is extended in the casing and provided with a cam to engage and limit the opening movement of the valve, said cam being adapted to be moved in one direction to lessen the opening movement of the valve, an arm on said shaft, an elastic device engaged on one side of said arm to press the same in one direction and means to limit the movement of the arm in an opposite direction.

8. A carbureter having a vaporizing-chamber provided with an air-inlet and with a hydrocarbon-supply passage, a valve controlling the hydrocarbon-supply passage and having a stem extended downward in the chamber below the passage, a vaporizer on the stem within the chamber, an air-valve for controlling the admission of air to said chamber, an adjustable device for limiting the opening movement of the hydrocarbon-supply valve, means for moving said device into adjusted position and an adjustable connection between said means and the air-valve whereby the air-valve and the limiting device are adapted for simultaneous movement.

9. A carbureter comprising a casing having means to supply hydrocarbon to its upper part and having a valve for controlling such supply and also having an air-inlet at its lower end, a valve-stem extended down in the casing and through the air-inlet, a vaporizer on the stem in the casing, an air-valve controlling the air-inlet and extended across the lower end of the casing and having a central opening through which the valve-stem is passed and means for moving the air-valve and comprising a lever one end of which has forks extended beneath and pivoted to the air-valve at opposite sides of the central opening thereof.

In testimony whereof I have hereunto signed my name, in the presence of two subscribing witnesses, at Chicago, Illinois, December 6, 1902.

GEORGE F. SWAIN.

Witnesses:
H. E. KELLOGG,
J. D. CAPLINGER.