W. GRINEWEZKI.

CARBURETER FOR INTERNAL COMBUSTION MOTORS.

APPLICATION FILED JULY 6, 1910.

1,028,713. Patented June 4, 1912

Fig. 1.

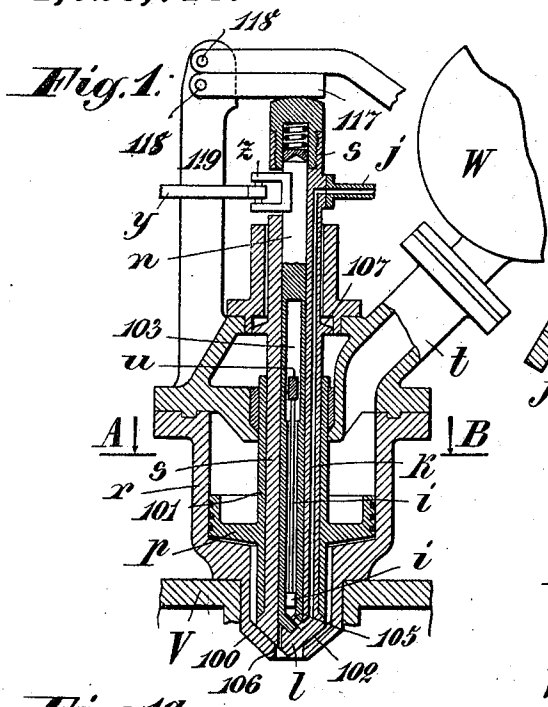


Fig. 2.

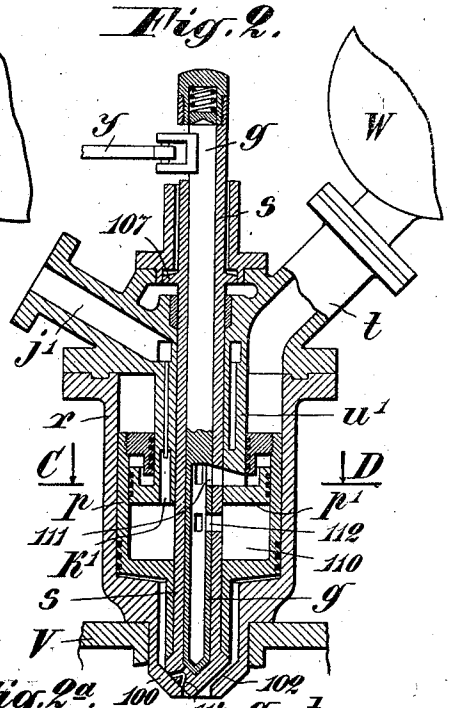


Fig. 1a.

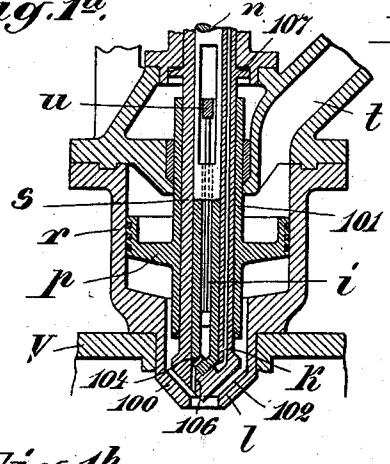


Fig. 2a.

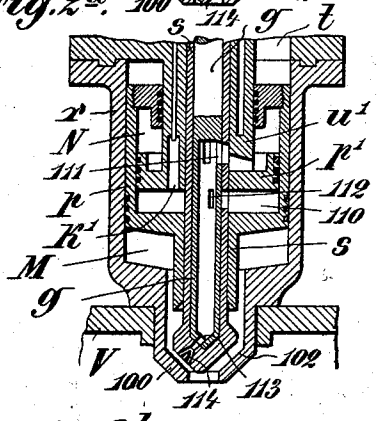


Fig. 1b.

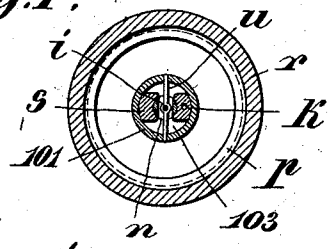
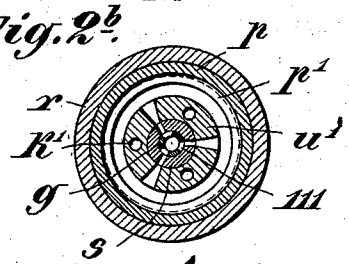


Fig. 2b.



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UNITED STATES PATENT OFFICE.

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CARBURETER FOR INTERNAL-COMBUSTION MOTORS.

1,028,713. Specification of Letters Patent. Patented June 4, 1912.

Original application filed January 28, 1907, Serial No. 354,575. Divided and this application filed July 6, 1910. Serial No. 570,539.

To all whom it may concern:

Be it known that I, WASSILY GRINEWEZKI, a subject of the Emperor of Russia, residing at Moscow, Russian Empire, have invented certain new and useful Improvements in Carbureters for Internal-Combustion Motors, of which the following is a specification.

My invention relates to governing carbureters for internal combustion motors using either liquid or gaseous fuel, and finds its best application in motors of the type illustrated in my pending application No. 354,575, filed January 28, 1907, of which this application is a division.

The best form of apparatus at present known to me embodying my invention is illustrated in the accompanying sheets of drawing in which,

Figure 1 is a longitudinal section of a carbureter for oil engines. Fig. 1[a] is a partial section of the same with the oil feed controlling spindle and air piston and air valve in different positions. Fig. 1[b] is a cross section on line A—B of Fig. 1, with the position of the cross piece *u* also shown, for greater clearness. Fig. 2 is a longitudinal section of a governing carbureter for gas engines. Fig. 2[a] is a partial longitudinal section showing another position of the gas feed controlling spindle, air valve and air piston, and Fig. 2[b] is a cross section on line C—D of Fig. 2.

Throughout the drawings like reference letters and numerals indicate like parts.

V represents a portion of the wall of the combustion cylinder of an engine (not shown).

r is the casing or outer shell of the governing carbureter which forms the air cylinder of said carbureter. It has a nozzle 100 which extends through an opening in the cylinder wall V, into the combustion cylinder. A pipe *t* connects to the upper portion of the carbureter casing *r*, and connects the air cylinder, formed in said casing, with a pressure chamber indicated at W (a portion being broken away in the drawing).

p is an air piston located in the air cylinder formed by the casing *r* and mounted on a hollow spindle or sleeve 101 which surrounds the spindle *s* of the air valve *l*. The seat for this air valve *l* is formed in the interior of the nozzle 100, and has a radial groove 102 to equalize the pressures existing under the air piston *p* and in the combustion cylinder. This groove 102 is shown in the drawings of somewhat exaggerated size, for clearness. The spindle *s* of the air valve is also hollow and contains a hollow revolving oil feed controlling spindle *n*, and in this hollow spindle *n* is a tightly fitting plunger *i* secured to a cross pin *u* which passes through slots 103 formed in the spindles *s*, and *n*, and is fixed in the sleeve 101 of the piston *p* (see Fig. 1[b]).

The upper end of spindle *n* has a laterally projecting lug or ear *z* which projects through an opening in the hollow spindle *s* and is connected to a rod *y* reciprocated by any suitable mechanism for turning the said spindle *n* about its axis through a certain angle. One or both of the parts *y* and *z* may be placed at an angle to the plane of the drawing, and so secure the angular relation necessary to cause an endwise movement of rod *y* and produce an oscillation of the ear *z*. The lower end of spindle *n* is provided with two openings 104 (see Fig. 1[a]) and 105 (see Fig. 1). When spindle *n* is in one position shown in Fig. 1[a], the opening 104 communicates with a number of fine passageways 106 through the face of air valve *l*. When the spindle *n* is in another position shown in Fig. 1, the opening 105 communicates with a channel *k* running lengthwise of the spindle *s* and extending to a nipple *j* in the upper end of the spindle to which any convenient source of oil (not shown) may be connected. These openings are spaced an angular distance apart of a little less than 180 degrees so that when the section plane passes through the opening 105, as in Fig. 1 the opening 104 does not show in that figure of drawing, and when the section plane passes through 104, as in Fig. 1[a], the opening 105 does not show. This slight angular motion of the spindle *n* is permitted by reason of the fact that slots 103 are wider than the cross pin *u*. While only one opening 104, and one opening 105 is shown in the drawing, there may be more of them similarly spaced. The openings not in the plane of the drawing cannot well be shown in dotted lines as the parts are on too small a scale and confusion would be produced by an attempt to show more than the one opening through which the section plane passes in each position.

117 is a lever arm pressing on the head of

spindle *s* and pivoted at 118 to the standard 119 formed on the casing of the carbureter.

107 is a flange on spindle *s* which limits its upward motion by striking against the carbureter casing.

The operation of the above described apparatus is as follows: The parts are in the position shown in Fig. 1, while compression is being produced in the combustion cylinder formed by walls V. A portion of the compressed air in the cylinder passes through slot 102 and, when the pressure is sufficient to overpower that produced on top of piston *p* by the air in pressure reservoir W, lifts piston *p* gradually. This raises spindle *s* through frictional engagement of hollow spindle 101 until shoulder 107 strikes the casing of the carbureter and checks further movement of spindle *s*. Further movement of piston *p* moves plunger *i* upward relatively to hollow plunger *n* in which it is mounted (the operative connection being formed by cross pin *u*), and plunger *i* acts as a piston to suck in a supply of oil through *j*, *k*, and 105 to the interior of hollow spindle *n*. Fig. 1[a] shows partly raised position of piston *p* and plunger *i*. When the piston in the combustion chamber reverses its motion and the compression diminishes the pressure above the piston *p* predominates and the piston *p* begins to descend tending to close the air valve *l*, but the closure of the valve is resisted by the pressure of the air being forced under it from the carbureter air cylinder *r* back to the combustion cylinder. At the moment of this reversal the spindle *n* is partially rotated by any convenient governing mechanism connected to rod *y*, so that the oil inlet to the interior of the spindle *n* is closed and the discharge opening 104 connects with the fine perforations 106 through the face of the air valve *l*. This shifting of spindle *n* is possible because of the width of slots 103 (see Fig. 1[b]) which permits a rotation of several degrees before the cross pin *u* checks further movement. The descent of the plunger *i* forces jets of oil through perforations 106 into the path of the current of air driven out by descending piston *p* and a combustible mixture of vaporized oil and air is thus formed and forced into the combustion cylinder. The rate of flow of the air can be positively controlled by positively controlling the area of the air valve opening, through pressure of lever 117 on spindle *s*.

The lever 117 may be operated by any simple mechanism driven from the engine shaft, such as an eccentric and intermediate connections to said lever. This will positively regulate the degree of opening of the air valve during the expulsion period and by simple adjustment of the eccentric and connections such opening may be regulated to deliver uniform quantities of the combustible mixture for each unit of travel of the motor piston.

The air valve *l* has but a limited opening due to the fact that upward motion of its spindle *s* is limited by flange 107 as above explained. It is opened to its full extent by the friction of the sleeve 101 of piston *p* at the beginning of the upward stroke of said piston, and by the pressure of air on the under face of the valve, and remains wide open during the remainder of the upstroke of piston *p*. This air pressure is too great to be overcome by friction of sleeve 101 on the downward stroke of the piston *p* and as a result the air valve would remain wide open during the entire descent also of piston *p* up to the moment that the lower end of sleeve 101 struck the shoulder at the lower end of spindle *s* and positively closed the valve at the end of the piston down stroke, if no means were provided for regulating that opening. As it is not desirable in all cases to thus leave the valve wide open until the downstroke of piston *p* is practically completed, the lever 117 is provided which presses on the upper end of valve spindle *s* and, being controlled in the manner above described, this lever may force a positively regulated partial closure of the valve during all or a part of the downstroke of piston *p*. The valve is, of course, held in such regulated position of opening by the constantly exerted upward pressure of the air on its under face and the downward thrust of lever 117.

Various changes could be made in the details illustrated without changing the principle of operation. Other distributing means could be substituted for the oil spindle *n*, and the relative positions of the oil plunger *i*, oil feed spindle *n*, and air valve spindle *s* may be varied. Other means for moving the oil plunger *i* might be substituted and other spraying mechanism employed. Equivalent means for equalizing pressures could take the place of the groove 102. Other resilient means for forcing down the piston *p* might be substituted for the compressed air in chamber W.

A modified form of governing carbureter designed for gas engines is shown in Figs. 2, 2[a] and 2[b]. The somewhat modified construction is due to the large dimensions of the gas cylinder as compared with the very small oil cylinder in the spindle *n* in Fig. 1. The upper end of the air cylinder *r* of the carbureter is connected with the pressure chamber W by the short pipe *t*, and the lower end is connected by the nozzle 100 to the combustion cylinder formed by walls V. The hollow air piston *p* forms a gas cylinder 110 the lower part of which constantly communicates with a high pressure gas container (not shown) by the chan-

nel k^1, the hollow sleeve w^1 and the pipe j^1. The piston p^1, connected with the sleeve w^1 separates the upper parts of the movable gas cylinder 110 from the lower part. A hollow gas spindle g adapted to turn and serve as gas distributer is inclosed in the spindle s. The spindle g is in constant communication with the upper part of the gas cylinder 110 by lateral openings 111. When the spindle g is by means of the reciprocating rod y turned into the closed position the inside of the spindle communicates by openings 112 with the lower part of the gas cylinder 110 (Fig. 2). In the open position the openings 112 are closed, and the opening 113 of the spindle g is in communication with the mixing perforation 114 of the air valve (Fig. 2^a). The ports 111 being wider than ports 112 (as best shown in Fig. 2^a) are never closed, the partial rotation of the spindle which is sufficient to close ports 112, not being sufficient to close ports 111. Consequently the interior of the spindle g is always in communication with the annular space N, and the flow of combustible in and out of said spindle is dominated by the movements of the compound piston p. The operation is as follows: At the upstroke of the piston p gas is forced from the chamber 110 into the chamber above the piston p^1, the channels 112 being open by reason of the spindle g being in the position of Fig. 2. On the downstroke of the piston p the channels 112 are closed by the spindle g being turned into the position shown in Fig. 2^a, and the gas will be forced from the chamber above the piston p through the hollow spindle g into the combustion cylinder formed by walls V, and at the same time gas will be drawn from the gas container through the channel k^1 into the chamber 110. The stroke volume or piston displacement of the gas cylinder of the governing carbureter is, with gas of the lowest heating value, about half of the stroke volume or piston displacement of the air cylinder, by reason of the gas being cooled in the intermediate cooler. That is to say, the effective cross sectional area of annular space N is about half that of annular space M, and the same stroke of piston p consequently forces two volumes of air into the combustion cylinder for one volume of gas. The stroke volume of the gas cylinder can be regulated to conform to the various kinds of gas by varying the outer diameter of sleeve w^1. For quick running engines the gas cylinder need not be made in one part with the air cylinder and can be provided with a controlling and accelerating mechanism (similar to that shown in Fig. 1, at 117).

In the oil carbureter shown in Fig. 1, the air piston p and the oil plunger i, being rigidly connected, form a compound piston. In the same way in the gas carbureter shown in Fig. 2, the piston p has an upper portion which operates on the gas in cylinder N and a lower portion which operates upon the air in M and forms a similar compound piston. In both cases this compound piston operates to force the air and combustible in measured quantities to the point of mixture and thence into the combustion cylinder.

Having, therefore, described my invention, I claim:

1. A carbureting device for internal combustion engines comprising in combination an air receptacle of variable volume, and a connection to the engine cylinder through which air compressed therein may be admitted to the air receptacle to expand the same, together with means serving to reduce the volume of the air chamber and at the same time spray a fluid combustible into the compressed air as it is expelled from the air receptacle by its contraction.

2. In a carbureter for internal combustion engines, the combination of a casing having an opening at one end, an air valve seated in said opening and having a hollow spindle extending into the casing, a hollow fuel-containing spindle in said air valve spindle, having an inlet connection, and a discharge connection through the air valve, a piston located in said casing, means for forcing said piston toward the open end of the casing, and means through which the motion of said piston controls the flow of fuel through the hollow fuel-containing spindle.

3. In a carbureter for internal combustion engines the combination of a casing having an opening at one end adapted to communicate with the engine cylinder, an air valve seated in said opening and having a hollow spindle extending through said casing, a hollow, fuel-containing spindle seated in said air valve spindle, having inlet and outlet connections, a compound piston located partly in said casing and partly in the fuel containing spindle, and means for forcing said piston toward the open end of the casing.

4. In a carbureter for internal combustion motors the combination of an air container terminating in a nozzle having a valve seat formed in its interior, and a hollow air valve having a conical perforated valve face adapted to seat itself in said valve seat, together with means for introducing a quantity of fluid combustible into the interior of said valve and simultaneously expelling the combustible in the valve and the air in the container through the nozzle of the container.

5. In a carbureter for internal combustion motors the combination of a casing having an opening at one end adapted to be connected to the combustion chamber of the

motor, a hollow spindle located and movable endwise in the casing and having a valve face adapted to seat itself in said opening, said valve face being perforated, means for admitting a quantity of fluid combustible into the interior of said spindle and expelling the same therefrom through its perforated face, said means comprising an annular piston in the casing mounted on the hollow spindle and having frictional contact with said spindle sufficient to reciprocate same, and means for forcing said piston toward the open end of the casing.

6. In a carbureting device for internal combustion motors, the combination of an air container terminating in a nozzle having an internal valve seat, a hollow air valve seated in said nozzle, and perforated for the discharge from its interior of a fluid combustible, a piston located in said hollow air valve for drawing fluid combustible into, and forcing it out of, the interior of said hollow air valve, and means for simultaneously forcing said air valve toward its seat and expelling the air through said nozzle.

7. In a carbureting device for internal combustion motors, the combination with an air container terminating in a nozzle, and a hollow air valve seated in said nozzle and perforated for the discharge from its interior of a fluid combustible, of a compound piston having two working faces of different displacement volumes, the larger one being located in the air container and the smaller one being located in the hollow air valve, together with means for forcing said compound piston toward the nozzle.

8. In a carbureting device for internal combustion motors, the combination with an air container terminating in a nozzle, and a hollow air valve seated in said nozzle and perforated for the discharge from its interior of a fluid combustible, of means for introducing a quantity of fluid combustible into the interior of said air valve and expelling the air and combustible fluid through said nozzle, said expelling means comprising a compound piston having two working faces of different displacement volumes, the larger one pressing on the air in the air cylinder and the smaller one on the combustible fluid, and a fluid pressure reservoir connected to the air container above the piston.

9. A carbureting device for internal combustion motors comprising in combination, an air container terminating in a nozzle having a valve seat formed in its interior, a hollow air valve seated in said nozzle and provided with spraying orifices in its face, means for simultaneously expelling air from the air container past the air valve and through the nozzle and fluid combustible through the spraying orifices into the nozzle, and means for positively controlling the position of said valve relative to its seat.

10. A carbureting device for internal combustion motors comprising in combination, an air container terminating in a nozzle, and a hollow air valve seated in said nozzle and perforated through its face, together with means for admitting air into the air container through the nozzle and lifting the valve from its seat, and means for forcing said air out again through the nozzle and simultaneously expelling a fluid combustible through the spraying orifices into the outgoing current of air.

11. A carbureter comprising in combination, an air container and nozzle, a perforated air valve seated in said nozzle, a hollow spindle connected thereto, a hollow oil spindle seated in said air valve spindle, both said spindles being provided with slots in their sides, a plunger in said oil spindle, an air piston in the air container mounted on the air valve spindle, and a cross pin extending from the plunger through the slots in oil and air spindles to the air piston.

12. In a carbureting device for internal combustion motors, the combination of an air container terminating in a nozzle having an internal valve seat, a hollow air valve seated in said nozzle and perforated for the admission to and emission from its interior of a fluid combustible, means for admitting a quantity of fluid combustible into the interior of said air valve and for emitting the same therefrom, and means for forcing said air valve toward its seat and expelling the air from the container through the nozzle contemporaneously with the emission of the fluid combustible from the air valve, said means for admitting and emitting the fluid combustible comprising a hollow, perforated spindle fitted in the hollow air valve.

13. In a carbureting device for internal combustion motors, the combination of an air container terminating in a nozzle having an internal valve seat, a hollow air valve seated in said nozzle and perforated for the admission to and emission from its interior of a fluid combustible, means for admitting a quantity of fluid combustible into the interior of said air valve and for emitting the same therefrom, and means for forcing said air valve toward its seat and expelling the air from the container through the nozzle contemporaneously with the emission of the fluid combustible from the air valve, said means for admitting and emitting the fluid combustible comprising a hollow, perforated spindle fitted in the hollow air valve, provided with radial port openings adapted to register with perfora-

tions in the air valve, and mechanism for giving said spindle a partial rotation about its longitudinal axis.

14. In a carbureting device for internal combustion motors, the combination of an air container terminating in a nozzle having an internal valve seat, a hollow air valve seated in said nozzle and perforated for the admission to and emission from its interior of a fluid combustible, means for admitting a quantity of fluid combustible into the interior of said air valve and for emitting the same therefrom, and means for forcing said air valve toward its seat and expelling the air from the container through the nozzle contemporaneously with the emission of the fluid combustible from the air valve, together with mechanism for positively regulating the degree of opening of the air valve during the air expulsion period.

15. A carbureting device for internal combustion engines comprising in combination an air cylinder terminating in a nozzle adapted to enter an opening in the wall of the engine cylinder, an air valve seated in said nozzle, the seat therefor being provided with a fine radial passageway affording communication between the air cylinder of the carbureter and the engine cylinder when the valve is seated, and a piston in the air cylinder mounted on the air valve spindle and forming a tight working fit therewith and normally tending to hold the air valve on its seat, together with mechanism for spraying oil into the nozzle.

16. A carbureting device for internal combustion engines comprising in combination an air container terminating in a nozzle adapted to enter an opening in the wall of the engine cylinder, an air valve seated in said nozzle and provided with a hollow spindle and inlet and discharge ports connecting with the interior of said spindle, the seat for said air valve being provided with a fine radial passageway affording connection between the air cylinder of the carbureter and the engine cylinder when the valve is seated, a piston in the air cylinder mounted on the valve spindle and forming a tight working fit therewith, means for forcing the piston toward the nozzle end of the air cylinder, a hollow combustible-controlling spindle seated in said air valve spindle and having ports adapted to register severally with the several air valve ports, and means for partially rotating said inner spindle and thereby severally opening or closing said ports.

17. A carbureting device for internal combustion engines comprising in combination an air container terminating in a nozzle adapted to enter an opening in the wall of the engine cylinder, an air valve seated in said nozzle and provided with a hollow spindle and inlet and discharge ports connecting with the interior of said spindle, the seat for said air valve being provided with a fine radial passageway affording connection between the air cylinder of the carbureter and the engine cylinder when the valve is seated, a piston in the air cylinder mounted on the valve spindle and forming a tight working fit therewith, means for forcing the piston toward the nozzle end of the air cylinder, a hollow combustible-controlling spindle seated in said air valve spindle and having ports adapted to register severally with the several air valve ports, and means for partially rotating said inner spindle and thereby severally opening or closing said ports, together with means for charging said inner spindle with combustible when the inlet ports register, and for expelling same when the discharge ports register.

18. A carbureting device for internal combustion engines comprising in combination an air container terminating in a nozzle adapted to enter an opening in the wall of the engine cylinder, an air valve seated in said nozzle and provided with a hollow spindle and inlet and discharge ports connecting with the interior of said spindle, the seat for said air valve being provided with a fine radial passageway affording connection between the air cylinder of the carbureter and the engine cylinder when the valve is seated, a piston in the air cylinder mounted on the valve spindle and forming a tight working fit therewith, means for forcing the piston toward the nozzle end of the air cylinder, a hollow combustible-controlling spindle seated in said air valve spindle and having ports adapted to register severally with the several air valve ports, and means for partially rotating said inner spindle and thereby severally opening or closing said ports, together with means for charging said inner spindle with combustible when the inlet ports register, and for expelling same when the discharge ports register, said charging and expelling means comprising a plunger located in the inner spindle and connected to the air piston.

19. A carbureting device for internal combustion engines comprising in combination an air receptacle of variable volume provided with a single opening adapted to serve for the passage of air to and from the interior of the engine cylinder, means for alternately increasing and diminishing said volume, and means for spraying a liquid combustible into the air expelled from said opening by the diminishing volume of the air receptacle.

20. A carbureter for internal combustion motors having a cylinder provided with an opening at one end adapted to be connected

to the combustion chamber of the motor, a piston in said chamber, a reservoir of compressed air connected to said chamber on the side of the piston opposite to the opening connecting with the combustion chamber, and means for spraying a fluid combustible at said opening operatively connected to the piston.

21. A carbureting device for internal combustion engines comprising in combination an air receptacle of variable volume, means for alternately increasing and decreasing said volume, a single connection to the engine cylinder through which air may be admitted to said receptacle and expelled therefrom, and means for spraying a liquid combustible into said connection while air is being expelled from the receptacle by a contraction of its volume.

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