D. CAHILL.

CARBURETER.

APPLICATION FILED SEPT. 15, 1913.

1,178,296.

Patented Apr. 4, 1916

3 SHEETS—SHEET 1.

fig. 1

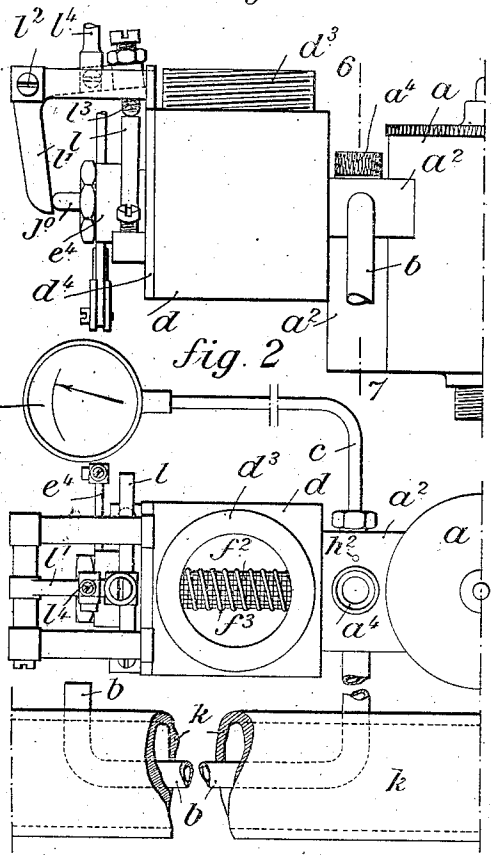


fig. 2

fig. 3

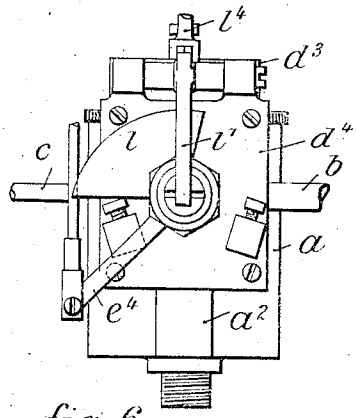
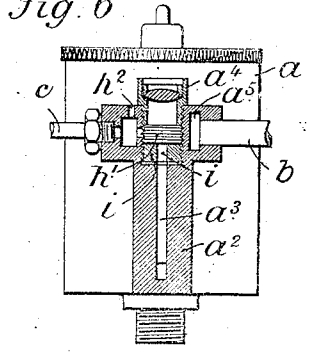


fig. 6



WITNESSES

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3 SHEETS—SHEET 2.

fig. 7.

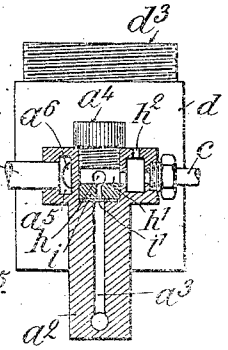


fig. 4.

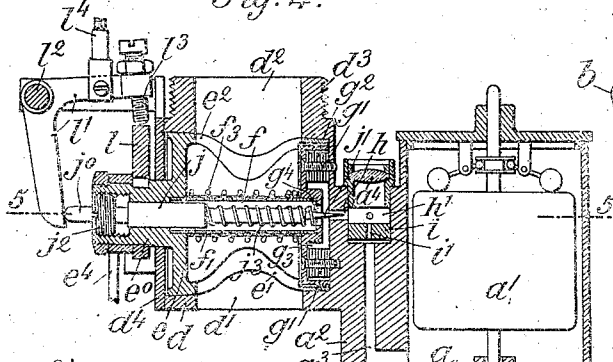


fig. 8.

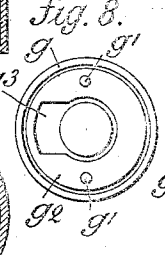


fig. 9.

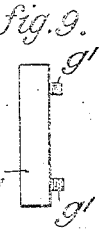
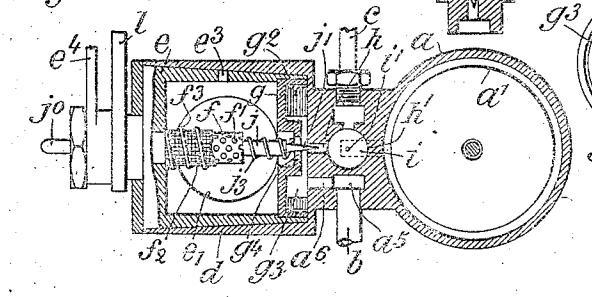


fig. 5.



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3 SHEETS—SHEET 3.

Fig. 13.

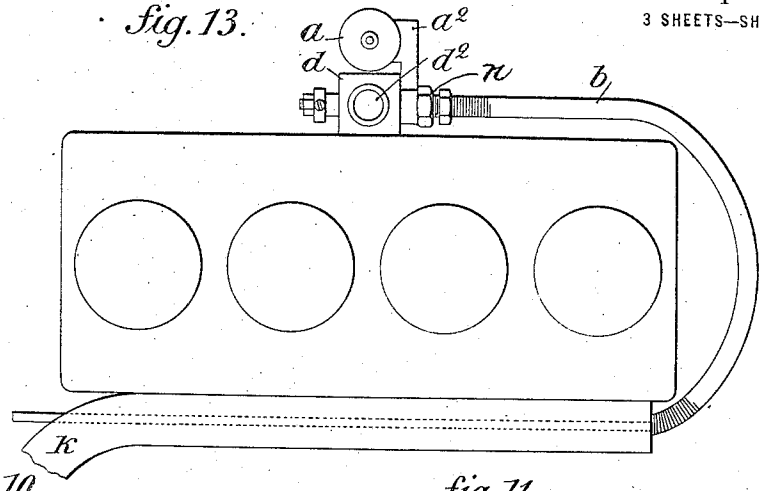


Fig. 10.

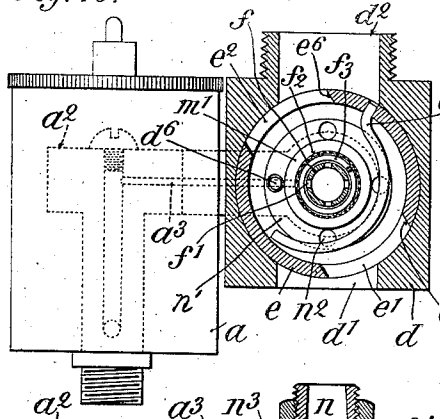


Fig. 11.

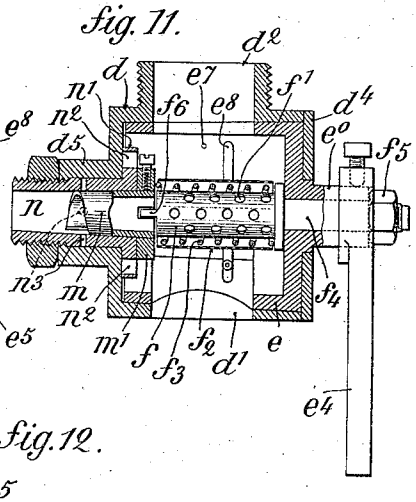
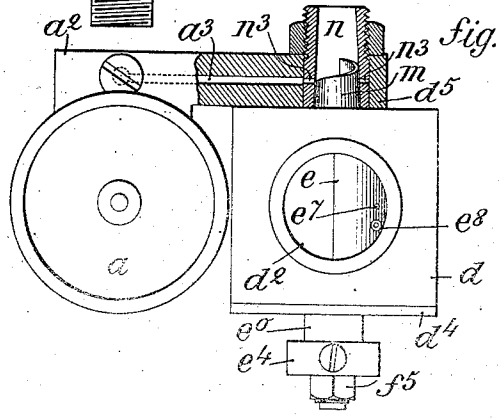


Fig. 12.



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DANIEL CAHILL, OF COURBEVOIE, FRANCE.

CARBURETER.

1,178,296. Specification of Letters Patent. Patented Apr. 4, 1916.

Application filed September 15, 1913. Serial No. 789,793.

To all whom it may concern:

Be it known that I, DANIEL CAHILL, subject of the King of Great Britain, residing at 108 Quai de Courbevoie, Courbevoie, Seine, in the Republic of France, have invented certain new and useful Improvements in Carbureters for Explosion-Engines, of which the following is a specification.

This invention relates to improvements in carbureters for explosion engines and more particularly to those of the type wherein a choking member, operated by hand and controlling the admission of the mixture of air and liquid fuel to the combustion chamber of the engine, is connected with a similar choking member designed to vary at the same time the sectional area of the passage for the air only, or both the sectional area of the air passage and that of the passage for the fuel.

The means employed, together with the carbureters of the kind referred to, to help the spraying of the liquid fuel before its admission to the combustion chamber, may be classed in three categories: firstly, the narrowing of the air passage, so as to give a great speed to the air; secondly, the adjunction or addition of artificial heat to the air drawn in, before or during its passage to the combustion chamber; thirdly, the adjunction of heat direct to the liquid, before its discharge through the spraying nozzle. However, the advantage obtained by the use of such means can only be secured to the detriment of the thermic output of the engine. Indeed, the resistance opposed to the flow of the air by reason of the very small sectional area of the passage of the same has the result of preventing the filling of the cylinder during the spells of great angular velocities; again, the elevation of the temperature gives rise to a variation in inverse directions of the respective weights of the air and liquid bodies which are actually drawn in, the weight of the air diminishing by unity of volume and the liquid increasing both in weight and in the volume discharged by unity of time.

The carbureter according to this invention does away with or greatly diminishes the aforesaid drawbacks, which are inherent in all the carbureters of the same kind, now in use.

In the accompanying drawings: Figure 1 is an elevation of the improved carbureter; Fig. 2 is a plan view of the same; Fig. 3 is a side view, as seen from the left of Fig. 1; Fig. 4 is a longitudinal vertical section on the central plane of the device. Fig. 5 is a horizontal section on the line 5—5 of Fig. 4; Fig. 6 is a section on the line 6—7 of Fig. 1, as seen from left to right; Fig. 7 is a similar section, as seen from right to left; Figs. 8 and 9 are details, as seen from the front and edgewise respectively, of a cup hereinafter described. Fig. 10 is an elevation of a second embodiment of this invention, partly in vertical section; Fig. 11 is a vertical section on the central plane of the regulator; Fig. 12 is a top plan view of the carbureter, partly in section; and Fig. 13 is a diagram showing the carbureter installed on an engine.

The apparatus shown in Figs. 1 to 9 inclusively is so built up as to communicate a large amount of heat to the liquid fuel, on its issue from the spraying nozzle and before its mixture with the amount of air which is required for its combustion. For this purpose, the spraying nozzle is located in a position away from the main passage for the air and it may be considered as being interposed on a small branch pipe one end of which is open to the atmosphere, while the other end is located on the axial line of the choking shell, which is placed in the suction pipe of the engine, between the atmosphere and the combustion chamber. The main supply of air is drawn in, before being heated, through such pipe and receives its supply of fuel when passing through the shell. The device comprises a reservoir or float chamber a always at the same level within which lies a float a^1 and which is provided on its outer wall with a projection a^2 in the shape of a hollow T, the vertical conduit a^3 of which communicates, at the bottom, with the interior of the reservoir a and is closed, at the top, by a detachable reading-sight a^4, one of the lateral arms of the hollow T being connected with a supply pipe b for the hot air and the other arm being connected by a pipe c with a vacuum manometer c^1. The part a^2 is integral with the casing d of the choker member, and in which a hollow conical shall e is enabled to revolve. The chamber a^5, with which the pipe b is connected, communicates, through a conduit a^6, with the interior of the casing.

However, the reservoir a having the float might be made separate from the casing d and might even be placed at some distance from the latter, in which case the part a^2 would be connected by piping with the casing d.

The casing d is provided with two ports diametrically opposed the one d^1 of which, located at the lower part, is open to the atmosphere while the other one d^2 is connected with the suction pipe of the engine by the threaded coupling d^3. The hollow shell e, which is open at one end, toward the part a^2, is likewise provided with two ports e^1, e^2 diametrically opposed, of the same diameter as the ports d^1, d^2 and coöperating therewith. Such casing is furthermore provided, at an angle of 90 degrees from the ports e^1, e^2, with a small hole e^3 (see Fig. 5) the function of which will be apparent farther on. The open end of the casing d is closed by a detachable lid d^4, having at its center a hole for the passage of the stem e^0 of the shell e, on which stem is secured the controlling arm e^4 which, in the case of a motor-car engine for instance, allows the driver of such car to operate at will, from his seat and through the medium of suitable gearing, the shell e as required.

Within the rotary shell e is arranged, concentrically therein, a diffusing tube constituted (see Figs. 4 and 5) by a metal tube f, the cylindrical wall of which, provided with holes f^1, is covered with fine wire-gauze f^2 also surrounded by a helical spring f^3 which keeps it in place. One of the ends of the tube f is embedded in the bottom of the shell e and its other end is maintained in a cup g which is secured by means of two screws g^1 to the bottom wall of the casing d and contains a piece of felt packing g^2 or other absorbent material, which is applied against such wall and has (see Figs. 4, 5, 8 and 9) an opening g^3 providing, within the cup, a chamber into which the aforesaid conduit a^6 opens. In the chamber g^3, which communicates with the interior of the diffusing tube f through a central port g^4, there also opens a conduit h which, bored in the part a^2 coaxially with the diffusing tube, communicates at its other end, with the chamber h^1 which is formed within the said part a^2 and in which is housed the spraying nozzle i which is above the channel a^3.

Within the diffuser tube f is placed a needle j the end j^0 of which extends outwardly through the stem e^0 of the shell e while its other end j^1, of conical shape, extends inwardly close to the conduit h and constitutes a point capable of obturating such conduit completely or partly. The part of the needle j which intersects the main part of the column of air drawn in by the engine, through the shell d and the ports d^1, d^2, is of reduced diameter for the purpose of forming, within the diffuser tube f, an annular space into which the liquid is discharged. The outer end j^0 of the needle j is likewise reduced and passes through a threaded plug j^2, screwed into the stem of the shell e. The shoulder formed on the needle j within the diffuser tube f, affords a bearing for a helical spring j^3 which serves to hold the point of the needle in its normal position and to restore the same when moved therefrom while imparting motion to the fuel which flows through the diffuser tube f. By this means, the liquid, issuing from the spraying nozzle i in the chamber h^1 and which is supplied through the port h, is spread on the whole of the periphery of the latter and can only get out by being very finely divided in the main column of the air sucked in through the casing d. These conditions so favorable to the quickness of the diffusion are obtained without providing any resistance to the main column of the air, as is the case when wire gauze is so secured as to obstruct the whole of the sectional area of the suction pipe. With the present invention, the main column of the air does not pass through the wire-gauze f^2 but is simply divided around the latter, into two symmetrical streams having a sectional area equal to that of the suction pipe itself.

The small pipe b, connected with the chamber a^5 of the portion a^2, is open at its outer end to the atmosphere and passes into the interior of the exhaust pipe k of the engine to some distance or preferably right through the length of the latter. By this means, the small amount of air sucked in through the pipe b during the suction strokes of the engine is superheated to such an extent as to be about equal to the temperature of the exhaust gases, temperature which is, to some extent, proportional to the amount of the air and the fuel consumed, and it meets with, under the form of a hot stream, the liquid jet issuing from the sprayer nozzle i and on which it strikes in a direction perpendicular to such jet. The liquid jet is thus immediately spread in spray or so disseminated as to display a very large area to the superheated air. The mechanical and physical actions, combined, to which the two bodies of air and fuel are subjected at this time and during their subsequent passage to the main column of the air have the result of raising considerably the temperature of the liquid mass and of causing the latter to pass in part to the state of saturated steam. The aforesaid diffuser tube secures, after this, the extremely fine subdivision of the particles and an increase of the contact surface of the main column of air.

The high temperature of the combustible mixture supplied to the diffuser tube through the port g^4 acts to efficiently prevent the obstruction of the meshes of the wire-gauze f^2

by the formation of batches of rime on the surface of the latter. The wire-gauze itself avoids any danger of a return of the flame to the reservoir *a* having the float, but, even in the case of a non-absorption of the flame by the wire-gauze, a combustion in the passage leading to the constantly level reservoir *a* cannot take place by reason of the small amount of air present and of its supersaturated state.

The movable point j^1 provides an easy means whereby to vary in a wide range the amount of fuel discharged and this without any modification either of the sectional area of the orifice of the sprayer nozzle itself, or of the respective sectional areas of the inlet and outlet ports d^1, d^2. The chamber h^1, into which opens the sprayer nozzle *i*, is in communication with the atmosphere through a small hole h^2 (see Fig. 2) through which a small amount of air is sucked and carried forward by the oil, through the said chamber and the discharge outlet *h*, to the diffuser tube. As the sectional area of the hole h^2 is always the same, any diminution of the sectional area of the discharge outlet *h*, tends to reduce the difference existing between the atmospheric pressure which acts on the constant level and that existing, in the chamber h^1, near the sprayer nozzle *i*.

The proper position of the obturating point j^1 with regard to the discharge outlet *h*, by which position the delivery is regulated, is obtained, for each open position of the shell, by means of a cam *l* suitably mounted and secured to the stem e^0 of the shell *e*. Such cam, which is carried forward by the rotation of such shell, transmits, by means of an intermediate bell crank lever l^1, pivoted at l^2, the required amount of motion to the needle *j* carrying the point j^1. The cam *l* can act on the bell crank lever l^1 through the medium of the adjustable abutment l^3, provided at the end of the latter and the said lever can be connected by means of any suitable gearing, such as the one l^4, with a handle located within reach of the driver, thus allowing the latter to act on the lever l^1 and, through the medium of the latter, on the needle *j*, for the purpose of completely closing, by means of the point j^1, the orifice *h*.

During the slow speed periods of the engine or motor, when the latter is running idle, one can stop completely the entry of the main air by so turning the shell *e* as to move the ports e^1, e^2 out of register with the ports d^1, d^2 and also as to cause the supply of air to be sucked in exclusively through the suction pipe *b*. In this position of the shell, the port e^3 allows of the passage of the small amount of combustible mixture required into the suction pipe.

The horizontal arrangement of the passage for the fuel to the interior of the shell *e*, and the faculty of being enabled to stop completely the entry of the main amount of air permit of closing instantaneously the choker, during the fast speed periods of the motor, without any loss of fuel which continues for the time being to flow from the sprayer nozzle *i*, by reason of the inertia of its motion. The liquid which lies in the diffuser tube is completely inclosed within the shell. The fact is that the slowness of the outflow, which is brought about by the idleness of the sprayer nozzle and which is commonly found in all carbureters, is avoided and the rapid acceleration of the motor on the opening of the shell again is greatly facilitated.

The horizontal direction given to the liquid on its passage from the sprayer nozzle *i* to the main column of the air and the very fine subdivision of its particles at the point of contact with such column secure the mixture of the liquid fuel and the air completely, even at the slowest speed of the air at which the outflow of the liquid can take place. Of course, under extreme conditions, the liquid will pass by gravity, to the diffuser tube *f* and will be held in suspension therein, by capillarity, on the surface of such tube until it is carried away by the air sucked in. The essential difference which exists, in this particular point of view, between the device according to this invention and all the other known carbureters, of the sprayer nozzle type, results from the fact that, in the latter, a relatively fast speed of the air must be maintained for the purpose of providing means whereby to break-up and raise the fuel discharged at all the velocities of the motor.

The sprayer nozzle *i* is made up of a small plug provided with a hole or port i^1, of suitable sectional area and secured in the bottom of the chamber h^1, at a point nearly corresponding to the upper level of the liquid in the constant level reservoir *a*. This arrangement of the fastening point of the nozzle is advantageous as to the facility of the access thereto which it provides, and it also presents this other advantage that the nozzle *i* can be removed or replaced without any loss of the liquid contained in the constant level reservoir. This latter advantage does not exist in any of the carbureter devices of the aforesaid type now known, in which the fastening point of the nozzle is found invariably below the level of the liquid so that, when the nozzle is removed, the splashing which results, besides the waste of the fuel carried away, constitutes a permanent source of danger of fire.

The sight-light a^4, which is located immediately above the nozzle *i*, permits of observing directly the level of the liquid at the nozzle itself, without having to remove or displace any part of the apparatus. The

sight-light a^4 can be removed instantaneously and when so removed, one has access immediately to the nozzle.

By the above described method of regulating the discharge of the fuel through the medium of the obturating point j^1, without any modification of the sectional area of the orifice i^1 of the nozzle i and without any variation of the respective sectional inlet and outlet areas of the ports e^1, e^2 of the shell, there can be obtained a constant indication of the consumption of the fuel in liters per hour, as the degree of consumption is a direct factor of the sectional area of the nozzle and of the vacuum existing immediately above such orifice. The manometer c^1, in the case of its application to a motor-car or an aeroplane, can be located in a position suitable for being constantly under the eyes of the driver who can thus obtain a complete control of the proportions of the mixture in a very simple manner and without any pothering.

In case the constant level reservoir a should be located at some distance from the body d, instead of being placed direct against such body as in the arrangement hereinbefore described, the fuel would be brought to the diffuser tube by means of a pipe leading from the chamber h^1. That being so, there would be available a supplementary means (or one that might be made use of instead of the heating of the tube b) whereby to heat the liquid in forming, around the pipe leading from the chamber h^1 to the diffuser tube f, a covering or wrapper through which a heating agent (preferably made up of the hot water from the circulation jackets of the cylinders) would be forced to circulate.

The invention permits of giving to the entry of the main air a sectional area greater than usual. This, concurrently with the absence of any obstacle to the orifice of the suction tube and with the complete continuity of the direction of the latter allows the outflow of the air taking place always in concordance with the requirements of the motor within limits of the speed range wider than those hitherto attained.

In the second embodiment of the invention shown in Figs. 10 to 13 inclusively, the regulating point located in the axial line of the tube mixing the oil with the hot air is replaced by a rotary and hollow obturator which is also located in the axial line of the mixing tube and which is located at the same time in the prolongation of the hot air supply conduit. Such air is thus supplied direct to the mixing tube, without any appreciable loss of head, so that the depression produced in the mixing tube acts fully on the orifice of the nozzle and that the delivery of the oil proportionate to the delivery of the air becomes as exact as possible.

a designates the constant level reservoir and d the casing in which the conical shell e is enabled to revolve, such shell serving to regulate the entry of the air through the lower aperture d^1 of the casing and the issue of the mixture through the upper aperture d^2 when the latter is connected with the motor. Such shell, held in the casing d by the lid d^4, can be turned or revolved at will by means of the arm e^4 secured to its stem e^0. Through the stem e^0 passes a rod f^4 associated with the perforated tube f and carrying at its outer end a nut f^5 which allows of its being rendered stationary with regard to the shell e on account of the clamping of the stem e^0 between each nut and the tube f.

Between the tube f and a cylindrical sieve of wire-gauze f^2 concentric with such tube is placed a helical spring f^3 which has several functions, one of which serves to hold the wire-gauze f^2 in place at a predetermined distance from the surface of the tube f in such a manner as to enable the mixture of air and oil issuing from the holes f^1 of the tube to be easily allotted between all the meshes of the sieve f^2; the spring f^3 serves also to push the shell e toward the lid d^4 in such a manner as to avoid its wedging in the casing d; again, the spring f^3 pushes in the opposite direction, against the bottom of the casing, a ring m^1 secured on the rotary obturator m of conical shape; the latter is placed in a socket n of the same shape which is engaged in a pipe d^5 at the bottom of the casing d and which has a flange n^1 bearing against such bottom; the rotation of the socket n is prevented by a stationary pin d^6 engaged in one of the holes n^2 made in the flange n^1; on the other hand, the obturator m is so coupled with the tube f by means of catches f^6 as to be caused to turn or revolve in association with the tube and consequently with the shell e. Such rotation has the effect of uncovering more or less one of the sprayer ports n^3 made in the socket n because the inner end of the obturator m is helically cut and may miss wholly or in part such port. The pitch of the screw and the fixation of the tube with regard to the shell e, by means of the nut f^5, are preferably so regulated that the segment of the circle of the port n^3 uncovered by the edge of the helical edge of the obturator m shall be exactly proportional to the circle segments of the orifices d^1, d^2 uncovered by the rectilinear edges e^5, e^6 of the apertures e^1, e^2 of the shell. To the outer end of the socket n is coupled the tube b which after having traversed the whole of the length of the exhaust collector k brings the hot air as directly as possible to the carbureter; the part of such tube comprised between the collector k and the carbureter is covered by a heat retaining sheath in order that the air supply shall be as hot as possible.

The oil or other fuel goes from the reservoir a to the sprayer port n^3 through a channel a^3 provided in a junction piece a^2 which connects the reservoir a with the casing d and which may be associated either with one or both of such members.

The operation is as follows: Under the influence of the suction produced by the motor in the casing d, the outer air enters through the ports d^1, e^1 and issues at a point diametrically opposite at e^2, d^2 after having passed symmetrically each side of the sieve f^2 and after having licked the whole surface of the same. Through such sieve, the depression is transmitted to the interior of the tube f, of the obturator m of the socket n and of the tube b so that there is produced a call for hot air through such tube and a call for oil through the port n^3 communicating with the conduit a^3. The oil jet led transversely to the stream of hot air is carried forward by the latter through n, m, f and f^2; in such course, the oil is highly heated and is volatilized in part; the passage of the oil through the sieve f^2 completes the pulverization and the volatilization of the oil, so that the current of air entering through d^1 carries forward a mixture of hot air and of oil vapors inclosing only a very little oil in the pulverized liquid state. Such result is obtained without overheating the greater part of the air and hence without reducing the specific gravity of the gaseous mixture, which would be detrimental to the power of the motor. For slow running, the shell e is turned in such a manner that the apertures e^1, e^2 are closed. However, the motor continues to suck in a small amount of the combustible mixture through a small port e^7 made in the wall of the shell and through a small tube e^8 of which the lower end opens into the lower part of the chamber of the shell; the mixture is then formed exclusively of oil and hot air. The function of the tube e^8 is to exhaust the oil which would tend to settle at the bottom of the shell on the slow working of the motor, such oil finding itself sucked through, such tube, and pulverized at its issue in the hot air sucked in at the same time. The arrangement of the socket n allows of locating any one of the holes n^3 in front of the channel a^3 so that in giving to such holes slightly different diameters, it is easy to change the delivery of the oil. One can furthermore easily modify the proportionate part between the deliveries of the air and oil by slightly changing the fixation of the tube f and consequently of the obturator m with regard to the shell.

Claims:

1. In a carbureter, the combination of a suction and mixing casing adapted to receive direct from the atmosphere the main supply of air without being previously heated, a mixing tube having its wall perforated and located in said casing, a sprayer nozzle, a conduit adapted to bring into the said mixing tube a small complementary air supply with the fuel issuing from the sprayer nozzle; and means whereby to heat such complementary air supply.

2. In a carbureter, the combination of a suction and mixing casing, adapted to receive direct from the atmosphere the main air supply without being previously heated, a mixing tube having its wall perforated and located in said casing, a conduit one end of which opens into the atmosphere and the other end into the said mixing tube and serving to bring therein a small complementary air supply, means whereby to heat such conduit and consequently such complementary air supply, and a sprayer nozzle opening into the said conduit in proximity to the said mixing tube.

3. In a carbureter, the combination of a casing having two opposite openings, a hollow shell revolving in such casing and having corresponding openings, a mixing tube having its wall perforated and located in axial line with such shell, a conduit communicating on the one hand with one end of such tube, and on the other hand with the atmosphere, heating means adapted to heat one portion of the said conduit, and a nozzle opening at a short distance from the said end of the mixing tube, so that, under the influence of a suction in the said casing, a mixture of hot air which is supplied through the said conduit and of fuel from the nozzle penetrates into such mixing tube and passes through its perforated wall to be mixed with the air which passes through the openings of the said casing and of the said shell.

4. In a carbureter, the combination of a casing having two opposite openings, a shell revolving in such casing and having also two opposite openings, a mixing tube located at the center of such shell and having its wall perforated, a socket located in the prolongation of such tube and having in its wall a sprayer orifice, a tube located in the prolongation of such socket and opening into the atmosphere, means whereby to heat such tube, and a hollow obturator revolving in the said socket and adapted to obturate in such a manner as to regulate the said sprayer orifice, such obturator being operatively connected with the said revolving shell.

5. In a carbureter, the combination of a casing having two opposite openings of circular shape, a shell revolving in such casing and having two opposite openings of which the active edges are rectilinear, a mixing tube located at the center of the shell and having its wall perforated, a conical socket located in the prolongation of such tube and

having in its wall a sprayer nozzle of circular shape, a tube located in the prolongation of such socket and opening into the atmosphere, a conical hollow obturator revolving in the said socket and adapted to obturate in such a manner as to regulate such sprayer orifice, the active edge of such obturator being substantially rectilinear, and the said obturator being operatively connected with the shell so that the uncovered portions of the sprayer nozzle and of the openings of the casing have the shape of circle segments and are always substantially similar to one another.

6. In a carbureter, the combination of a casing having openings at the bottom and at the top, a hollow shell revolving in such casing and having two opposite openings adapted to correspond to those of the casing, and having also two small openings adapted to open into the upper opening of the casing and a tube leading from one of such small openings and extending through such hollow shell in proximity to the point diametrically opposite to the said small opening, for the purpose specified.

7. In a carbureter, the combination of a suction and mixing casing, having a main air inlet, a hollow shell revolving in such casing and having openings diametrically opposite, a mixing tube located at the center of such shell and having its wall perforated, means for supplying liquid fuel and air to the mixing tube, a helical spring located around such tube, and a wire-gauze cylinder placed around such spring and spaced by said spring from the surface of the mixing tube.

8. In a carbureter, the combination of a suction and mixing casing a hollow shell revolving in such casing, a tube located at the center of such shell and having its wall perforated, such tube being adjustably secured to one end of the said shell, a socket located in the prolongation of such tube and secured to the said casing, such socket having a spray orifice in its wall, a hollow obturator revolving in such socket and operatively connected with the said tube, and means whereby to revolve the shell with such tube and with such obturator.

9. In a carbureter, the combination of a suction and mixing casing, a mixing tube located in said casing and having its wall perforated, a conduit connecting said tube with the atmosphere, a sprayer nozzle in such conduit, a manometer, and a tube the end of which is connected with such manometer and the opposite end of which opens in proximity to the sprayer nozzle.

10. In a carbureter, the combination of a suction casing having two opposite openings, a hollow shell mounted to turn in said casing and having corresponding openings, a mixing tube arranged axially in said shell and having its walls perforated, a spraying means for liquid fuel communicating with the mixing tube, means for conducting a supply of hot air with the fuel issuing from the spraying means to the said mixing tube, and means for regulating the amount of liquid fuel supplied.

In testimony, that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

DANIEL CAHILL.

Witnesses:
LUCIEN MEMMINGER,
MAURICE ROUX.