E. C. NEWCOMB.

CARBURETER.

APPLICATION FILED OCT. 15, 1910.

1,010,066. Patented Nov. 28, 1911.

3 SHEETS—SHEET 1.

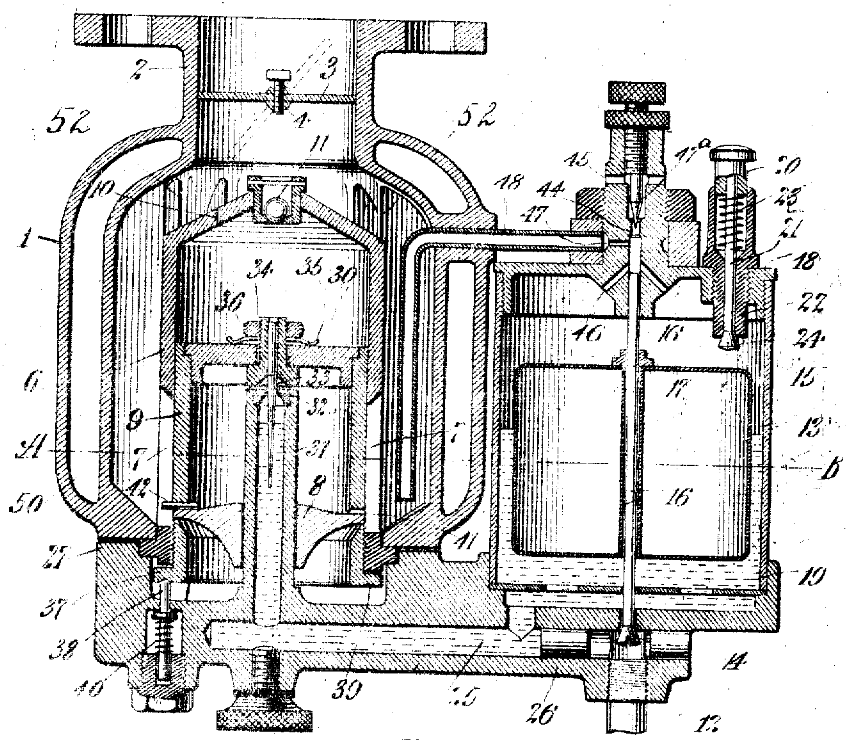

Fig. 1.

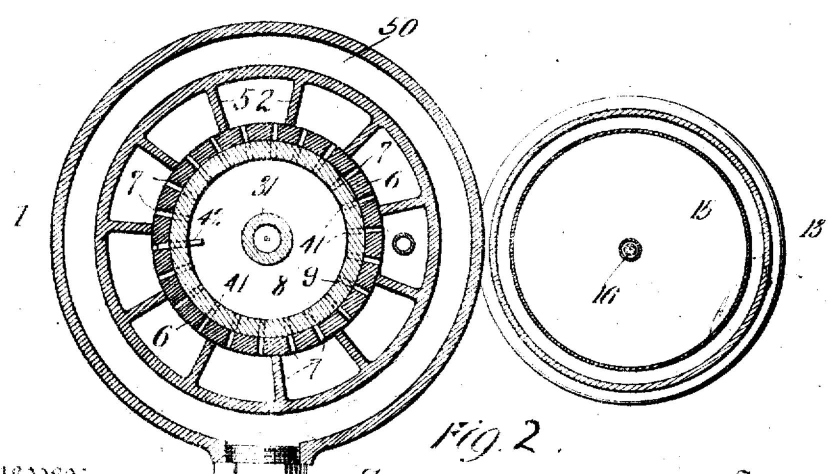

Fig. 2.

Witnesses:

Frank S. Ober

R. Raymond Murphy

Inventor

Edward C. Newcomb

By his Attorney J. H. Freeman

E. C. NEWCOMB.
CARBURETER.
APPLICATION FILED OCT. 15, 1910.

1,010,066.

Patented Nov. 28, 1911.

3 SHEETS—SHEET 2.

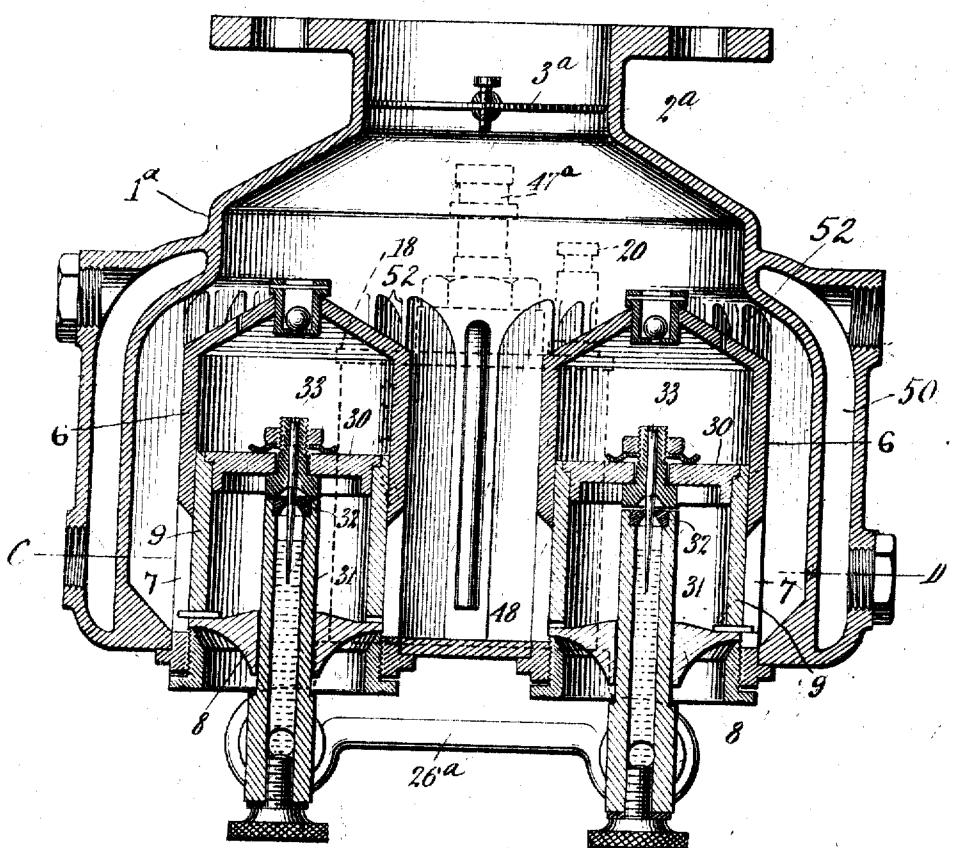

Fig. 3.

Witnesses:
Frank S. Ober
R. Raymond Murphy

Inventor
Edward C. Newcomb
By his Attorney J. H. Freeman

E. C. NEWCOMB.

CARBURETER.

APPLICATION FILED OCT. 15, 1910.

1,010,066.

Patented Nov. 28, 1911.

3 SHEETS—SHEET 3.

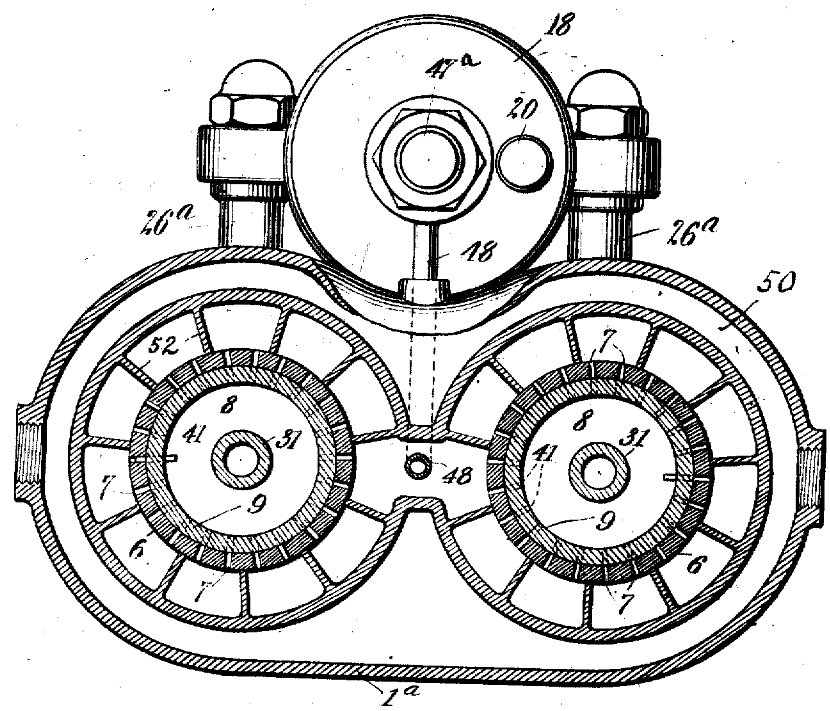

Fig. 4

Witnesses:

Frank S. Ober.

R. Raymond Murphy

Inventor

Edward C. Newcomb

By his Attorney J. H. Freeman

UNITED STATES PATENT OFFICE.

EDWARD C. NEWCOMB, OF NORTH SCITUATE, MASSACHUSETTS, ASSIGNOR TO NEWCOMB CARBURETER CO., A CORPORATION OF NEW YORK.

CARBURETER.

1,010,066. Specification of Letters Patent. Patented Nov. 28, 1911.

Application filed October 15, 1910. Serial No. 587,145.

To all whom it may concern:

Be it known that I, EDWARD C. NEWCOMB, a citizen of the United States, and a resident of North Scituate, Plymouth county, Commonwealth of Massachusetts, have invented certain new and useful Improvements in Carbureters, of which the following is a specification.

My invention relates to carbureters such as are used for supplying a mixture of fuel and air to internal combustion engines.

One object of the invention is to provide a carbureter which will operate automatically to maintain substantially predetermined proportions of fuel and air in the mixture throughout a wide range of variations in the quantity of the mixture supplied to the engine.

Other objects of the invention are to provide a carbureter which will operate as stated without producing a high vacuum in the mixture supply passages or strangling the supply of mixture to the engine, thereby enabling the maximum power of the engine to be developed; also to provide a carbureter which will automatically and reliably operate to supply a mixture richer in fuel, when the quantity of the mixture or the load on the engine is low than when the load is normal, the proportion of fuel by preference rapidly decreasing at first, then remaining practically uniform and finally decreasing somewhat as the maximum load on the engine is approached; also to provide a carbureter which is not substantially affected by variations of the temperature of the fluids; also to provide for the ready and accurate adjustment of the proportions of air and fuel and to provide for such adjustment without disturbing the predetermined relations of such proportions to variations of load; and also to provide for thorough vaporization of a liquid fuel, such as gasolene, in the air.

These and other objects of the invention will be in part obvious and in part more fully explained in the following description.

The invention consists in the novel parts, combinations of parts, and improvements herein disclosed.

In the drawings, which are referred to herein and form a part hereof, is illustrated one embodiment of the invention together with a modification thereof, the same serving in connection with the description to explain the principles of the invention.

Of the drawings: Figure 1 is a vertical central section of one embodiment of the invention; Fig. 2 is a horizontal section on the line A—B of Fig. 1; Fig. 3 is a vertical section of a modification; and Fig. 4 is a horizontal section on the line C—D of Fig. 3.

The maintenance of substantially predetermined proportions of air and fuel in the mixture throughout a wide range of variations in quantity requires extremely accurate control of the supplies of the fluids and especially of a liquid fuel such as gasolene because of its extremely small bulk as compared with that of the air, the relation being approximately as one to nine thousand.

Great accuracy of control of the fluid supplies is attained in accordance with the present invention by taking into consideration, not only the relative areas of the orifices or ports by which the fluids are controlled and the heads or differences of pressure at the opposite sides of the ports, but also the shapes and dimensions of the ports with respect to the effects of such shapes and dimensions upon the stream lines and viscosities, one or both, of the fluids.

In carrying out the invention the supplies of the fluids are controlled, throughout a part at least of the range of their variations, by varying the areas of the fluid-controlling ports, with or without varying the heads or differences of pressure at the opposite sides of the ports, and since for mechanical reasons it is not practicable to do this without varying the shape of the ports, the proportions or the actual areas of the ports are so determined as to compensate for the effect of the shapes of the ports upon the flows or stream lines of the fluids, thereby providing the required effective area or areas equivalent to those of ideal form controlling fluids having ideal qualities and of such proportions as to provide the required quality and quantity of mixture.

Referring now to the embodiment of the invention illustrated in the drawings, the ports by which the fluids are controlled are housed within a casing 1 having at its top an outlet for the mixture in the form of a flanged neck 2 adapted to be connected to the engine. Preferably, this outlet is controlled by a throttle valve 3, the valve illustrated comprising a disk diametrically secured to a stem 4 which projects through the neck 2 at one side and is provided with a suitable operating arm (not shown).

The casing 1 is open at its lower end and within this opening is secured a tubular member 6. This member 6 is also open at its lower end and is provided in its side walls with a multiplicity of narrow elongated air ports 7. These ports are normally closed by a relatively movable piston valve 8 fitted to the interior of the air port member 6. As shown, the air port member is fixed and the piston is arranged to slide vertically therein so as to open the air ports more or less in accordance with the quantity of air supplied to the engine. By making the air ports 7 narrow and elongated the stream lines of the air flowing through them will have substantially the same effect upon the flow of the air irrespective of the length of the ports which are brought into operation by the opening movement of the valve 8. That is to say, after the valve is elevated a distance equal to the width of the ports so that the maximum width of port is produced, the stream line effect upon the flow will be substantially the same as when the valve is moved to open the ports throughout their lengths. By reason of this, except for the very beginning of the opening movement of the air ports, the quantity of air which will flow through them will be directly proportional to the extent of movement of the valve, other conditions being equal and the total effective port opening produced by the relative movement between the valve and air port member will be substantially proportional to the extent of the movement. At the beginning of the opening movement the supply is strangled somewhat, but this is desirable in that it tends to produce a mixture richer in fuel when small in quantity.

In the present embodiment the valve 8 is automatically lifted by the pressure of the air entering through the lower open end of the air port member 6, when the pressure within the casing is reduced by the suction of the engine and the opening of the throttle valve 3. Where the closing of the air ports by the valve is effected by the gravity of the latter, as in the embodiment illustrated, the degree of vacuum required to lift the valve will depend upon the area and the weight thereof and will remain substantially constant throughout the entire range of movement of the valve which may or may not correspond to the entire range of variations in the supply of mixture to the engine, as hereinafter explained.

In order properly to control the movements of the valve and prevent undue vibration thereof, as by the more or less intermittent suction effect of the ordinary engine, and for other reasons hereinafter explained, the valve is provided with an upwardly extending closed tubular portion 9 which is fitted to the interior of the air port member 6, while the top of the latter member is closed except for a small passage 10 and a port normally closed by a check valve 11. This construction provides a dashpot which, while permitting a reduction of pressure to act with sufficient promptness through the check valve 11 and permitting the valve to close with sufficient promptness for practical purposes, prevents such rapid movement of the valve in either direction as would be apt to cause unpleasant noise or injury.

In the embodiment illustrated, the fuel is supplied through a pipe 12 and is admitted to a receptacle 13 through a valve 14 which is controlled by a float 15 so as to maintain the fluid in the receptacle 13 at a substantially predetermined level. As shown, the valve 14 is fixed on a stem 16 passing loosely through the float 15 and having a fixed collar 17 against which the float abuts to lift and close the valve. The stem 16 is guided at its upper end in a suitable aperture in the cover 18 of the receptacle 13 and near its lower end by an aperture in a diaphragm 19.

For the purpose of manually depressing the float to provide an extra supply of gasolene when desired, a push button 20 is provided, the same being fixed upon a stem 21 which is fitted in the bore of a plug 22 secured in the cover 18, the button and stem being maintained in an elevated position by a spring 23 housed in a large bore in the upper end of the plug 22. The stem 21 terminates in a conical head 24 forming a valve which is normally seated in the end of the plug by the action of the spring 23 so that the receptacle 13 will be normally sealed at this point.

From the receptacle 13 the gasolene flows through a passage 25 in a base member 26 to the casing 1. As shown, the base member 26 is provided with a circular flange 27, which is secured to the casing 1 by means of screws (not shown), the latter serving also to clamp the air port member 6 in position within the casing 1, as by means of a flange at the lower end of said member which is seated in an annular recess or rabbet in the flange 27.

For the purpose of distributing the fuel in the air and at the same time avoiding any direct aspirating effect of the currents of air upon the supply of the fuel, the latter is conveyed upward through the valve 8 and delivered into the enlarged chamber formed by the tubular portion 9 of the valve, this chamber being closed at the top as by a diaphragm or cover 30 which is fixed in the upper end of the tubular portion 9. To this end, the base member 26 is provided with an upwardly extending tubular member 31, which extends through and is freely fitted to an opening in the valve 8.

For the purpose of controlling the flow of fuel, the upper end of the member 31 is provided with a port 32, the effective opening of which is controlled and varied by a relatively movable tapering needle 33. As shown, the fuel port member 31 is stationary and the needle is carried by and moves in unison with the valve 8.

It will be seen that, since the effective area of the air inlet ports 7 varies directly with the degree of movement of the valve 8, the effective area of the opening through the port 32, as controlled by the needle 33, should vary in a predetermined relation to the movement of the needle in order that the supply of the fuel may be varied in the desired relation to the supply of air, assuming that the heads under which the two fluids flow through their respective ports bear a constant relation to each other. The effective area of the fuel port as controlled by the needle, however, will not correspond to the actual area thereof because of the viscosity of the fuel.

It is known that the retarding effect of viscosity upon the rate of flow of a fluid through a small opening is great. In the case of a capillary tube, for instance, the retarding effect of viscosity varies inversely as the fourth power of the radius and directly as the length of the bore of the tube. The width of the annular opening formed between the needle 33 and port 32 is small, its capillary character being most pronounced and most rapidly varied with relation to the movement of the needle, near the beginning of the opening movement of the needle. It follows, therefore, that the viscosity of the fluid tends to choke this narrow annular opening to a degree which varies with the degree of opening, so that the effective opening or port area will neither equal nor vary in the same degree with the actual area. Even if the effective and actual areas were equal or had a definite determinable relation, it would be difficult to give the needle such a form that the area of the fuel port opening would bear such relation to the area of the air port opening as would produce, with sufficient accuracy the quality of mixture required.

In accordance with one feature of this invention, it is proposed to take advantage of the effects of viscosity and provide a construction which may be produced and duplicated with the required accuracy and readily adjusted to give the desired quality of mixture. This is accomplished as follows: The needle is given a uniform taper from the base of the effective portion toward the point and preferably throughout its length, this being a form which can be practically produced and reproduced with great accuracy. The taper is such that, if continued to a point, the portion extending below the port when the parts are in their lowest position is longer, preferably about one-fifth, than the total length of the opening movement. The effective portion of the needle may, of course, be not substantially longer than the length of the needle movement. With this form of needle the actual area of the port opening will increase more rapidly with relation to the needle movement, than the total area of the air ports increases with relation to the valve movement during the first part of the movement of the needle and valve and more slowly during the latter part of such movement.

The viscosity of the fuel, will render the effective area of the fuel port opening less than the actual area and this choking effect will be greater during the first part of the needle movement so as to tend to compensate for the form of the needle. The effect of viscosity, however, will vary with the size of the needle and port. If, for illustration, the diameter of the needle base and port is too great, the choking effect of viscosity during the first part of the opening movement will be excessive and the mixture will be too weak. If, on the other hand, the diameter is too small or the length of the port too great, either the viscosity effect will be inadequate or it will be sustained throughout too great an extent of the opening movement to effectively compensate for the needle form or the port area will be so small as to require an excessive head on the fuel to force a sufficient quantity of it through the port to produce the required mixture. The diameter of the needle base and the diameter and axial length of the fuel port, therefore, are so determined that the taper form of the needle and the viscosity effect of the fuel mutually compensate for each other so as to provide an effective fuel port opening having the proper relation to the air port opening to produce the required quality of mixture for all loads on the engine. I have found that, with gasolene as a fuel and with a needle having a uniform taper, the diameter of the needle base and port should not exceed a maximum of about seven one hundredths or a minimum of about four one hundredths of an inch. Most satisfactory results have been attained with a needle about six one hundredths of an inch base diameter, the port being of the same diameter and as short in the axial direction as is practicable to make it. As shown, this port ring is flared at its under side to reduce the effective length of the port to the minimum.

Since the total opening movement of the air valve and needle is of considerable extent to afford air ports of great length relative to their width, the taper of the needle is of a small angle; but this is favorable as by reason thereof the lines of fluid flow through the port will not be materially changed throughout the opening movement, as would be the case if the needle taper was of a relatively great angle.

Provision is made, in accordance with one feature of the invention, for accurately centering the needle with relation to the port so that the width of the annular port opening will be uniform. This is important in order that the viscosity effect may be correct and to prevent contact between the needle and the port such as might cause wear and change of form or size of the needle and port, or interfere with the free movement of the needle and valve.

In order that the needle may be accurately centered with relation to the port, in the embodiment shown, it is fixed in a holder 34 provided at its lower end with a head, and having a stem which passes through an opening in the diaphragm or cover 30, which opening is slightly larger than the stem of the holder so that the latter is capable of a slight lateral movement in all directions with relation to the cover. The holder is frictionally held upon the cover between the head of the holder and a flexible washer 35 and nut 36 so that the holder will remain in whatever position it may be moved into with relation to the cover. The needle is so positioned with relation to the holder that when the latter rests upon the upper end of the tube 31 or the ring in which the port 32 is formed; the needle will just fill or close the port 32. If, then, the valve 8 be lowered until the head of the holder 34 comes into contact with the tube 31, the needle will position the holder with relation to the cover 30, so that the needle will be exactly concentric with the port 32.

In accordance with one feature of the invention means are provided for adjusting the needle with relation to the fuel port so that the latter may be given an initial opening when the air valve is closed. This initial opening or lead of the needle with relation to the air valve gives a mixture which is richer in fuel, but since the proportion of the extra opening due to this lead of the needle relative to the total opening is much greater at the beginning of the opening movement and rapidly diminishes until it is negligible, the degree of richness is substantial only near the early part of the opening movement. By varying the lead of the needle, the initial mixture may be made as rich as necessary to get the best results without substantially affecting the quality of the mixture for intermediate or heavy loads. The richening effect of the needle lead at or near the beginning of the opening movement is modified by the viscosity effect of the fuel, thereby affording a greater latitude in the range of the lead adjustment.

For the purpose of adjusting the needle in the embodiment shown with relation to the port 32 so as to provide the desired initial opening between the needle and the port, a ring 37 is screwed into the lower end of the tubular member 6, the upper edge of this ring being adapted to form a seat for the valve 8. By screwing this ring 37 more or less into the member 6, the valve 8 may be lifted, and with it the needle 33 may be lifted to give the desired initial opening of the fuel port. The ring 37 is retained in its adjusted position by a detent which, as shown, is in the form of a spring pressed pin 38, which is suitably guided in the base portion 26, being normally pressed by a spring 40 against the ring 37 so as to engage suitable recesses 39 formed therein.

According to one feature of this invention, the fuel is thoroughly distributed in the air without a direct aspirating effect of the air currents upon the fuel such as would affect the supply thereof. To this end the fuel is delivered, in the embodiment shown, through the port 32 into the chamber formed by the valve 8, with its tubular portion 9 and cover 30 and from this chamber the fuel is passed in minute streams through a series of ports 41 formed at the base of the tubular portion 9. These ports 41 correspond in number to and deliver the fuel streams into the air ports 7 so that each of the multiplicity of air currents formed by the ports 7 receives its proper proportion of fuel. The ports 41 are maintained in alinement with the ports 7 by a pin 42 which, for convenience, is inserted in one of the ports 41 and projects into one of the ports 7. To aid in the uniform distribution and continuous delivery of the fuel through the ports 41, a small supply of air to the chamber is preferably provided for, as by a slight clearance between the valve 8 and the fuel port member 31. The slight current of air thus admitted to the chamber will not exert a direct aspirating effect at the port 32 and yet will prevent any fuel from accumulating in the chamber. The air will entrain the fuel and cause it to pass with substantial uniformity through the ports 41.

It will be seen that whatever reduction of pressure or partial vacuum exists in the casing 1 at the delivery side of the ports 7 will be transmitted through the ports 41 to the chamber and to the delivery side of the fuel port 32. Atmospheric pressure will, of course, exist at the inlet side of the air ports and, if the fuel at the inlet side of the fuel port should be subjected to atmospheric pressure, the heads tending to force the two fluids through their respective ports would be the same. This, however, would require that the effective areas of the respective ports must be proportioned to give the desired proportions between the air and the fuel. It would be difficult to thus accurately proportion the respective ports and particularly to vary their relative proportions as would be required to vary the proportions of air and fuel in the mixture which is frequently necessary in practice. These difficulties are overcome in accordance with one feature of the invention, by the provision of means for varying the relative heads acting on the two fluids. In the embodiment illustrated, provision is made for this adjustment as follows: The space in the receptacle 13 above the fuel therein is closed to the pressure of the atmosphere except for a restricted port 44, which communicates with the atmosphere on the one hand through the ports 45 in an upwardly extending portion of the cover 18 and with the upper portion of the receptacle 13 on the other hand through the ports 46. The upper part of the receptacle 13 is also placed in communication by a restricted port 47 and the tube 48 with the interior of the casing 1 preferably adjacent to the discharge side of the air inlet ports 7, as shown in Fig. 3. Means are provided for varying the size of one of these restricted ports. Preferably and as shown, the opening in the port 44 is made adjustable, as by the needle valve 47ª. The result of this construction is that any partial vacuum existing in the casing 1 or at the delivery side of the air inlet ports 7 is transmitted in part to the upper part of the receptacle 18, the desired difference in pressure between the interior in the casing 1 and the upper part of the receptacle 18 being produced by adjustment of the needle valve 47ª. Thus, if the port 44 should be entirely closed by the needle valve 47ª, the pressure in the upper part of the receptacle 18 would equal the pressure in the casing 1 and at the delivery side of the fuel port 82, so that there would be no head tending to force the fuel through its port. On the other hand, if there were no restriction at the port 44, full atmospheric pressure would be transmitted to the upper part of the receptacle 13 and the head acting to force the fuel through its port 32 would be the same as the head acting to force the air through its ports 7.

By more or less restricting the entrance of air through the port 44 the pressure acting upon the fuel in the receptacle 18 can be made anything between the full atmospheric pressure and the degree of pressure existing in the casing 1, and consequently the head acting to force the fuel through its port can be varied from zero to an amount equaling the head acting at the air inlet ports. It will thus be seen that with a fixed relation between the respective ports for the fuel and air any desired ratio of the supplies of these fluids may be produced by adjusting the needle valve 47ª. Furthermore, the float in the fuel receptacle 13 may be adjusted to maintain the level of the gasolene at any desired point below the fuel port 32, so that when the carbureter is not in operation there is no danger of the gasolene leaking through this port, even though it is not entirely closed.

For the purpose of insuring the proper vaporization of the fuel and preventing the carbureter from freezing in cold weather the casing 1 may be, and preferably is, provided with a jacket space 50 which may be suitably connected with a source of heat, such as the water circulating system for the engine. The heating surface in contact with the air and fuel while they are being mixed is preferably increased by a series of radial ribs 52 formed integrally with the inner wall of the jacket space 50. The sub-division of the air and fuel currents by the multiplicity of air and fuel ports 7 and 41 and the immediate subjection of these currents to extensive heating surfaces insures a thorough vaporization of the fuel and its uniform absorption by the air before the mixture enters the engine.

With the construction as thus far described it will be seen that the carbureter may operate throughout its entire range with a practically constant reduction in pressure, and that this may be a slight reduction in pressure, being sufficient merely to overcome the weight of the valve 8 and the parts moving therewith, so that there will be little restriction or strangling of the supply of mixture to the engine, thereby enabling the maximum power of the engine to be developed. It is to be observed, however, that if the maximum capacity of the carbureter, when thus operated, is less than the maximum capacity of the engine, an increase in the demand upon the carbureter beyond the quantity of mixture which is supplied when the valve 8 reaches the upper limit of its movement, will only serve to increase the partial vacuum existing in the casing 1 and thus increase the quantity of the mixture supplied. Under these conditions the proportions between the fuel and air in the mixture will not be substantially varied from the proportions which exist when the valve reaches the upper limit of its stroke, because any increase in the partial vacuum, while increasing the head forcing the air through the air inlet ports, correspondingly increases the head acting to force the fuel through its port, the proportions between the heads being maintained by reason of the described connections between the interior of the casing 1 and the upper portion of the receptacle 13. When it is desired, however, to provide a carbureter having a capacity greater than one having a fuel inlet port of the dimensions above set forth and without having a greater reduction in pressure than that necessary to lift the inlet valve, this may be accomplished in accordance with one feature of the invention by providing a plurality of fuel inlet ports, each controlled by a separate needle, the air inlet ports being correspondingly increased. One embodiment of this feature of the invention is illustrated in Figs. 5 and 6. According to this construction, a casing 1ᵃ is provided, the same being so enlarged as to receive two or more of the air port members 6 with their air inlet ports 7, valves 8, and connected parts 9, 30, 33, etc., the casing preferably having a single flanged discharge passage 2ᵃ and throttle valve 3ᵃ, as shown. In this case a single float chamber with its cover 18, float operating button 20, needle valve 47ᵃ and other parts may be employed, the same being connected by a duplex base member 26ᵃ to the two supply tubes 31 having their fuel inlet ports 32 coöperating with the needles 33, as clearly indicated in these figures. In this case the tube 48 by which the partial vacuum in the casing 1 is transmitted to the upper portion of the fuel receptacle 13 may be located between the two members 6, as shown. In this construction the valves 8 may be slightly varied in weight so that one will come into operation after the other by a slight increase in the vacuum, thereby insuring a more certain control of the supplies of fuel and air, when the engine is running at a light load. While two sets of supply-controlling valves are shown, it is obvious that more may be added, if it is desired further to increase the capacity of the carbureter.

It is to be understood that my invention as to its broader aspects is not limited to the precise constructions herein set forth, as many changes may be made therein without departing from the main principles of the invention and without sacrificing its chief advantages.

I claim:

1. A carbureter comprising a member having a multiplicity of air supply ports, a valve for controlling said air ports, said parts having a relative movement, the total effective port opening produced by any such movement being substantially proportional to the movement, a member having a fuel supply port, a needle for controlling said fuel port, connections for producing a relative movement between the fuel port member and the needle proportional to the relative movement between the air port member and valve, and means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports.

2. A carbureter comprising a member having a multiplicity of narrow elongated air supply ports, a valve for controlling said air ports, said parts having a relative movement, a member having a fuel supply port, a needle for controlling said fuel port, connections for producing a relative movement between the fuel port member and the needle proportional to the relative movement between said air port member and valve, and means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports.

3. A carbureter comprising a member having a multiplicity of narrow elongated air supply ports, a valve for controlling said air ports, said parts having a relative movement, a member having a circular fuel supply port not greater than about seven one-hundredths of an inch in diameter, a needle for controlling said fuel port, connections for producing a relative movement between the fuel port member and the needle proportional to the relative movement between said air port member and valve, said needle having an approximately uniform taper, and means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports.

4. A carbureter comprising a member having a multiplicity of air supply ports, a valve for controlling said air ports, said parts having a relative movement, the total effective port opening produced by any such movement being substantially proportional to the movement, a member having a fuel supply port, a needle for controlling said fuel port, connections for producing a relative movement between the fuel port member and the needle proportional to the relative movement between the air port member and valve, means for adjusting the parts whereby the opening of the fuel port may be given a lead with respect to the opening of the air ports, and means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports.

5. A carbureter comprising a member having a multiplicity of air supply ports, a valve for controlling said air ports, said parts having a relative movement, the total effective port opening produced by any such movement being substantially proportional to the movement, a member having a fuel supply port, a needle for controlling said fuel port, connections for producing a rel-

ative movement between the fuel port member and the needle proportional to the relative movement between said air port member and valve, means for centering the needle with relation to its port, and means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports.

6. A carbureter comprising a member having a multiplicity of narrow elongated air supply ports, a valve for controlling said air ports, said parts having a relative movement, a member having a fuel supply port, a needle for controlling said fuel port, connections for producing a relative movement between the fuel port member and the needle proportional to the relative movement between said air port member and valve, means for centering the needle with relation to its port, means for adjusting the parts whereby the opening of the fuel port may be given a lead with respect to the opening of the air ports, and means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports.

7. A carbureter comprising a member having a multiplicity of narrow elongated air supply ports, a valve for controlling said air ports, said parts having a relative movement, a member having a circular fuel supply port not greater than about seven-one-hundredths of an inch in diameter, a needle for controlling said fuel port, connections for producing a relative movement between the fuel port member and the needle proportional to the relative movement between said air port member and valve, said needle having an approximately uniform taper, means for centering the needle with relation to its port, means for adjusting the parts whereby the opening of the fuel port may be given a lead with respect to the opening of the air ports, and means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports.

8. A carbureter comprising a tubular member having a multiplicity of narrow elongated air supply ports, a valve for controlling said ports, one of said parts being movable with respect to the other, a member having a fuel supply port, a needle for controlling said fuel port, said needle being connected to the movable part and opening the fuel port in advance of the opening of the air ports, and a dash pot for retarding the air-port closing movement of the movable part.

9. A carbureter comprising a tubular member having a multiplicity of narrow elongated air supply ports, a piston valve for controlling said ports, a member having a circular fuel supply port not greater than about seven one-hundredths nor less than about four one-hundredths of an inch in diameter, a needle for controlling said fuel port, said needle being connected to said valve and having a substantially uniform taper extending from its base portion toward its point, and means for adjusting the parts whereby the opening of the fuel port may be given a lead with respect to the opening of the air ports.

10. A carbureter comprising a member having a multiplicity of narrow elongated air supply ports, a valve for controlling said ports, one part being movable with respect to the other, a member having a fuel supply port, a needle for controlling said fuel port, said needle being connected to the movable part, and means for distributing the fuel and delivering it to the various air currents flowing through the air supply ports.

11. A carbureter comprising a tubular member having a multiplicity of narrow elongated air supply ports, a hollow piston valve fitted to said member and arranged to normally close said air ports by its gravity, a tubular member having a fuel supply port within said valve, a needle carried by said valve for controlling said fuel port, said valve having a multiplicity of fuel delivery ports leading from the interior thereof to said air ports, a dash pot for retarding the closing movement of said valve, and means for adjusting the parts whereby the opening of the fuel port may be given a lead with respect to the openings of the air ports.

12. A carbureter comprising a tubular member having a closed end with a check valve opening outward, and a multiplicity of narrow elongated air supply ports near the other end, a hollow piston valve fitted to said member and arranged to normally close said air ports by its gravity, a tubular member having within said valve a circular fuel supply port, and a needle carried by said valve for controlling said fuel port, said valve having a multiplicity of fuel delivery ports leading from the interior thereof to said air ports.

13. A carbureter comprising a tubular member having a closed end with a check valve opening outward and a multiplicity of narrow elongated air supply ports near the other end, a hollow piston valve fitted to said member and arranged to normally close said air ports by its gravity, a tubular member having within said valve a circular fuel supply port not more than seven-one-hundredths of an inch in diameter, a needle carried by said valve for controlling said fuel port, said needle having a substantially uniform taper extending from its base portion toward its point and opening the fuel port in advance of the opening of the air ports,

and said valve having a multiplicity of fuel delivery ports leading from the interior thereof to said air ports.

14. A carbureter comprising a member having a multiplicity of air supply ports, a valve for controlling said air ports, said parts having a relative movement, the total effective port opening produced by any such movement being substantially proportional to the movement, a member having a fuel supply port, a needle for controlling said fuel port, connections for producing a relative movement between the fuel port member and needle proportional to the relative movement between the air port member and valve, means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports, and means for varying said fixed relation.

15. A carbureter comprising a tubular member having a closed end and a multiplicity of narrow elongated air supply ports near the other end, a hollow piston valve fitted to said member and arranged to normally close said air ports by its gravity, a tubular member having a fuel supply port within said valve, a needle carried by said valve for controlling said fuel port, said valve having a multiplicity of fuel delivery ports leading from the interior thereof to said air ports, and means for maintaining during the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports, and means for varying said fixed relation.

16. A carbureter comprising a casing adapted to be connected to an internal combustion engine, a throttle valve between said casing and the engine, a member having a port or ports for supplying air to said casing, a valve for varying the area of said port or ports, one of said ports being controlled by the air flowing through said port or ports, means having a port for supplying fuel to said casing, a needle for varying the area of the fuel port, said needle being controlled by the air controlled member, a fuel supply receptacle connected with said fuel port, means for maintaining the supply of fuel in said receptacle at a substantially constant level, means having a restricted passage forming a communication between the atmosphere and the space above the fuel in said receptacle, and means having a restricted passage forming a communication between said casing and the space above the fuel in said receptacle.

17. A carbureter comprising a casing adapted to be connected to an internal combustion engine, a throttle valve between said casing and the engine, a member having a port or ports for supplying air to said casing, a valve for varying the area of said port or ports, one of said parts being controlled by the air flowing through said port or ports, means having a port for supplying fuel to said casing, a needle for varying the area of the fuel port, said needle being controlled by said air controlled part, a fuel supply receptacle connected with said fuel port, means for maintaining the supply of fuel in said receptacle at a substantially constant level, means having a restricted passage forming a communication between the atmosphere and the space above the fuel in said receptacle, means having a restricted passage forming a communication between said casing and the space above the fuel in said receptacle, and means for varying the size of one of said restricted passages.

18. A carbureter comprising a single casing adapted to be connected to an internal combustion engine, a single throttle valve between said casing and the engine, a plurality of members each having a multiplicity of air supply ports, a plurality of independent valves each controlling the air ports in one of said air port members, each valve and its air port member having a relative movement, the total effective port opening produced by any such movement being substantially proportional to the movement, means having for each of said air port members a circular fuel supply port not greater than about seven one-hundredths of an inch in diameter, a plurality of independent needles each controlling one of said fuel ports, connections for producing a relative movement between each needle and its fuel port proportional to the relative movement between the corresponding air port member and its valve, and means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports.

19. A carbureter comprising a single casing adapted to be connected to an internal combustion engine, a single throttle valve between said casing and the engine, a plurality of members each having a multiplicity of narrow elongated air supply ports, a plurality of independent valves each controlling the air ports in one of said air port members, each valve and its air port member having a relative movement, means having for each of said air port members a circular fuel supply port not greater than about seven one-hundredths of an inch in diameter, a plurality of independent needles each controlling one of said fuel ports, connections for producing a relative movement between each needle and its fuel port proportional to the relative movement between the corresponding air port member and its valve each needle having a substantially uniform taper extending from its base portion toward its point, independent adjusting means

whereby the opening of the fuel ports may be given variable leads with respect to the opening of the corresponding air ports, and means for maintaining under the normal conditions of operation a substantially uniform relation between the heads acting to force the fluids through their respective ports.

20. A carbureter comprising a single casing adapted to be connected to an internal combustion engine, a single throttle valve between said casing and the engine, a plurality of tubular members each having a multiplicity of narrow elongated air supply ports, a plurality of independent piston valves each controlling the ports in one of said air port members, a plurality of members each having a fuel supply port for one of said air port members, a plurality of independent tapering needles each controlling one of said fuel ports, each needle being connected to one of said valves and means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports.

21. A carbureter comprising a single casing adapted to be connected to an internal combustion engine, a single throttle valve between the casing and the engine, a plurality of tubular members each having a multiplicity of narrow elongated air supply ports, a plurality of independent piston valves each controlling the ports in one of said air port members, a plurality of members each having a fuel supply port for one of said air port members, a plurality of independent tapering needles each controlling one of said fuel ports, each needle being connected to one of said valves, independent means whereby the opening of the fuel ports may be given variable leads with respect to the openings of the respective air ports, and means for maintaining under the normal conditions of operation a substantially fixed relation between the heads acting to force the fluids through their respective ports.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

EDWARD C. NEWCOMB.

Witnesses:
FRANCES KINRBICH,
R. R. MURPHY.