J. J. TRACY AND L. H. MORSE.

CARBURETOR.

APPLICATION FILED JUNE 30, 1916. RENEWED APR. 8, 1918.

1,435,947. Patented Nov. 21, 1922.

2 SHEETS—SHEET 1.

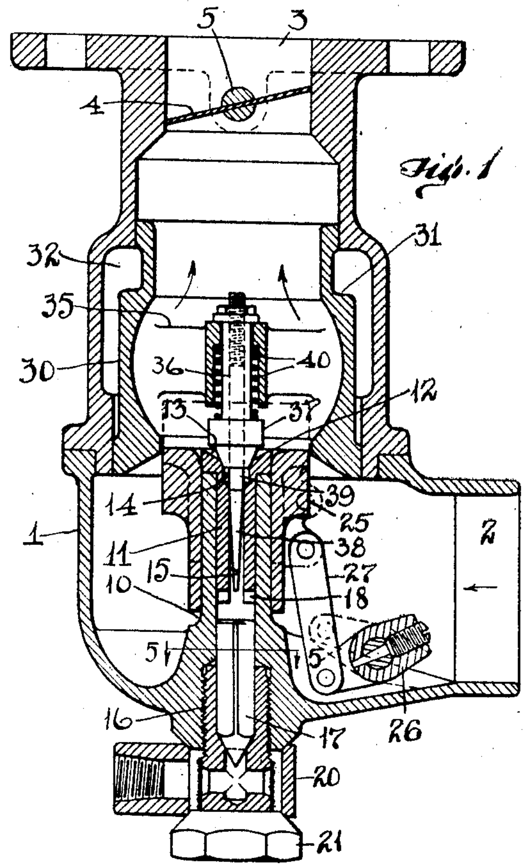


Fig. 1

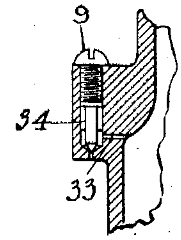
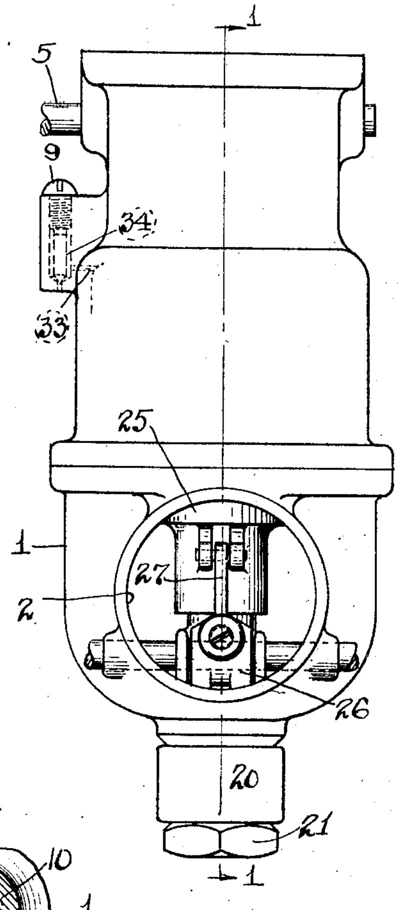


Fig. 4

Fig. 2



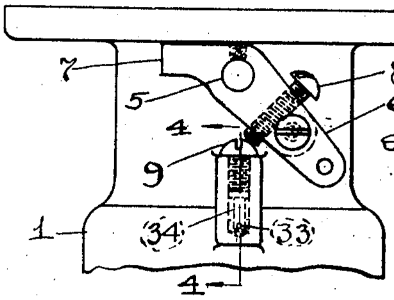


Fig. 3

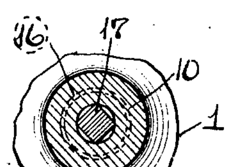


Fig. 5

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2 SHEETS--SHEET 2.

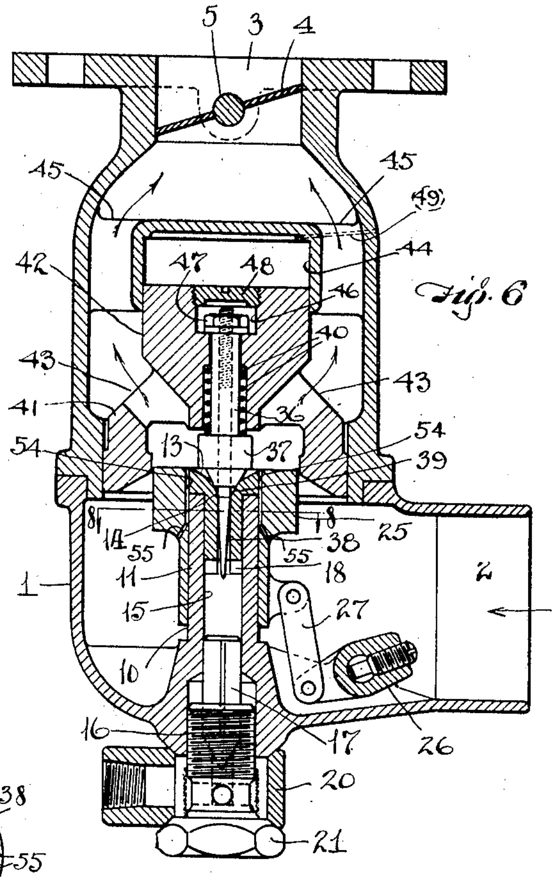

Fig. 6

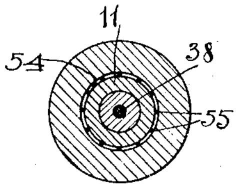

Fig. 8

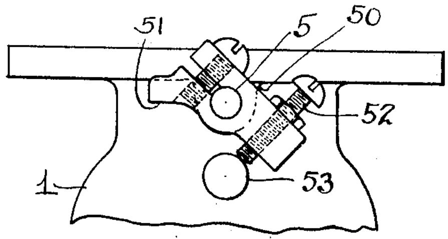

Fig. 7.

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UNITED STATES PATENT OFFICE.

JAMES J. TRACY AND LAWRENCE H. MORSE, OF CLEVELAND, OHIO; SAID MORSE ASSIGNOR TO SAID TRACY.

CARBURETOR.

Application filed June 30, 1916, Serial No. 106,777. Renewed April 8, 1918. Serial No. 227,400.

To all whom it may concern:

Be it known that we, JAMES J. TRACY and LAWRENCE H. MORSE, both citizens of the United States, and residents of Cleveland, county of Cuyahoga, and State of Ohio, have jointly invented a new and useful Improvement in Carburetors, of which the following is a specification, the principle of the invention being herein explained, and the best mode in which we have contemplated applying that principle so as to distinguish it from other inventions.

The present improved carburetor for internal combustion engines, relates more especially to that type of device of this class, wherein the air friction, or flow of air drawn through the device by the suction of the engine, is relied upon to open and regulate not only such flow of air but also the flow of the hydrocarbon fuel which is mixed therewith to form the charge proper. The object of the invention is to provide a device of this sort in which not only will the supply of both such ingredients of the charge be accurately graduated, but also an intimate mixture thereof insured under all conditions of operation of the engine from the no-load, or starting, point to that of maximum fuel consumption. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but several of the mechanical forms in which the principle of the invention may be used.

In said annexed drawings:—

Figure 1 is a vertical central sectional view of the device; Figure 2 is an elevation thereof as viewed from the right in Figure 1; Figure 3 is a broken elevation of the upper portion of the device as viewed from the left in Figure 2; Figure 4 is a sectional view of a detail at right angles to the section of Figure 1, the plans of the section being indicated by the line 4—4, Figure 3; Figure 5 is a sectional view of another detail, as indicated by line 5—5, Figure 1; and Figures 6, 7 and 8 illustrate a modified form of construction.

Referring first to the construction illustrated in Figures 1 to 5, inclusive, the body of the device will be seen to consist of a tubular casing 1, preferably in the form of an elbow, provided with an air inlet opening 2 at approximately right angles to the outlet opening 3 which is connected, of course, to the engine manifold, as need not be further explained. The throttle consists of a butterfly valve 4 of usual construction carried by an oscillatory shaft 5 transversely mounted in such outlet opening, and provided with suitable operating means.

Of such operating means the only part shown (see Figure 3) consists of a lever 6 secured on one end of the aforesaid shaft, such lever being provided with an extension 7 which engages the flanged upper end of the casing 1, or other suitable part, and so limits rotation of the shaft in a counter-clockwise direction, so as to leave the valve full open. The no-load, or starting, position of the valve is determined by means of a set-screw 8 threaded in the lever proper and adapted to contact with an abutment 9 on the side of the casing, such abutment happening to consist of the head of a screw which serves another purpose as well, as will be presently explained.

Rising centrally from the bottom of the casing 1 is a fuel-supply duct, or nozzle 10, in the upper end of which is fitted a nozzle, proper, 11 that has an enlarged head 12 of a diameter substantially equal to the external diameter of said duct. The upper portion 13 of the discharge opening through such nozzle is of conical shape, communicating with a cylindrical portion 14, which in turn communicates with another cylindrical portion 15 of smaller bore.

Into the lower end of the duct 10 is threaded a tubular member 16 provided with an upwardly facing seat on which normally rests a weighted valve in the form of a plunger 17 having its lower end coned to conform with such seat and its sides cut away to allow a relatively free passage of the fuel when the valve is raised, as shown in Figure 5. The lower end of the nozzle 11, which serves as a stop limiting the upward movement of this valve, is notched as at 18 so as to leave such communication open, even when the valve is raised thereagainst.

The fuel is supplied to the duct 10 through said tubular member 16 by means of a hollow sleeve 20 which is clamped between the bottom of the casing 1 and a polygonal head 21 on said member, the construction being such that upon rotating the member 16 so as to slightly loosen the same in the casing, said sleeve 20 may be rotated and left in any desired angular position with respect to said casing.

Surrounding the duct 10 and the upper end of the nozzle 11 so as to be freely slidable thereon is a tubular member or sleeve 25 constituting in effect an annular valve which serves to partially close the annular space between the duct and the surrounding casing wall. This valve is adapted to be raised from the normal position, in which it is shown in full lines in Figure 1, to the position indicated in dotted outline, or any intermediate position, by means of a rocker 26 mounted in the horizontal portion of the casing and connected to said valve by a link 27.

Fitted within the upper portion of the casing, so as to be freely slidable therein, is a second tubular member or sleeve 30, the lower end of which constitutes in effect a second annular valve that, in the normal position of said member, illustrated in said Figure 1, surrounds said first named annular valve 25 and substantially completely shuts off communication between the upper and lower portions of the casing. A predetermined vertical movement of this last named valve, however, will leave an annular opening as will be obvious, the size of such opening increasing as the valve continues such upward movement, while the point at which the opening first occurs depends upon the setting of the first named annular valve. A shoulder 31 on the outer wall of the valve acts to reduce the space within an annular chamber 32 left between such wall and the adjacent inner wall of the casing, upon upward movement of the valve. Such chamber has communication with the atmosphere through a lateral opening 33 (Figure 2) controlled by a weighted plunger 34, which permits inflow of air to the chamber, but restrains the outflow of such air, so that the effect is to dampen the movement of the valve 30, preventing any sudden or eccentric action on its part.

The screw 9 previously referred to as forming the abutment, with which the adjusting screw 8 in the lever 6 contacts, closes the opening that requires to be provided to permit the valve 34 to be put in place.

Centrally mounted in the annular air-valve 30 by means of spider-arms 35 is another valve 36 for controlling the opening in the fuel-supply nozzle 11. The body 37 of this valve is coned on its under side to fit the beveled discharge orifice in such nozzle, and is further provided with a relatively adjustable spindle or needle-valve extension 38 threaded in said body and adapted to project within the bore 15 of the nozzle. This extension is tapered gradually from one end to the other save for a short cylindrical section 39 immediately adjacent the coned valve-body, such cylindrical section being adapted to fit the aforesaid bore to entirely shut off the flow of fuel therethrough until the valve body has been raised a slight predetermined distance. Thereupon the tapering portion of the valve extension acts directly as a needle valve, permitting an increasing flow of fuel through the orifice, as the valve is raised higher and higher, it being understood that the degree of taper of such valve extension bears a predetermined relation to the angle of the suction actuated valve 30.

As shown in Figure 1 the fuel-valve 36 is not rigidly mounted in the spider 35, but is vertically reciprocable relatively thereto, being normally held in depressed position by means of a compression spring 40 interposed between the valve head and such spider. Furthermore, the valve is loosely fitted at its upper end in such spider so as to have a certain amount of lateral play, as well, and thus allow it to properly center itself in the nozzle.

In operation, assuming the position of the parts to be as illustrated in Figure 1, with the annular valve occupying either the position shown, or a slightly raised position, depending upon the setting of the rocker 26, it will be observed that at the same time the air valve 30 closes communication through the casing, the fuel-valve 36 is caused to seat in the nozzle so as to shut off the supply of fuel. The weighted valve 17 in the lower end of the fuel supply duct 10 will likewise be seated in this condition of the device, the weight of such valve being gauged to slightly exceed the pressure on the fuel line whether such fuel be supplied by a gravity feed system, or from a tank under pressure.

It should be explained that no float chamber is required with the device, fuel being led directly from said gravity or pressure chamber to the duct by means of the connections previously described.

Upon starting the engine, the suction, as regulated by the throttle valve 4, will immediately lift the air-valve 30 and thus the fuel-valve 36, so as respectively to open the annular air passage and lift such fuel valve sufficiently to open the discharge orifice in the nozzle. The effect of the suction, thus admitted to the interior of the duct 10, will be to overcome the weight of the valve plunger 17, nearly balanced as it is by the pressure of the fuel, and so permit the fuel to flow freely past the same, and, in regulated amount, past the fuel-valve proper. This amount will obviously increase, as said fuel valve is raised higher and higher with an increase in the suction effect of the engine. The air-valve of course is likewise lifted higher and higher, admitting a correspondingly larger and larger amount of air, so as at all times to provide air and fuel in proper proportions. The air or suction-actuated valve, it will be noted, has its lower face, viz, the one that co-operates with the annular valve, 25, beveled, whereby the proper proportions of air and fuel just referred to are maintained, since areas of the openings for passage of fuel and air are varied in predetermined fashion upon movement of said air-valve. The fuel as it escapes from the nozzle is spread by the action of the conical face of the fuel-valve into the path of the air current around the nozzle, and thus a very thorough and intimate mixture of the two ingredients of the charge is secured. More exactly, the fuel flows over the surface of the flat upper surface of the valve 25, which, whatever its adjusted position, constitutes in effect a continuation of the nozzle for the purpose under consideration. The thin film of liquid vaporizes directly, of course, but, more especially, as it reaches the edge of the flat circular surface in question, the air, here moving at its greatest velocity, whips off as it were the overflowing liquid into minute particles or spray, which quickly vaporizes in such air current as it passes beyond.

It will be observed that the clear area of the passage in which the air valve 30 operates, is relatively fixed with respect to the clear area of the discharge opening in which the throttle valve 4 is located, the area of such last named opening being just a trifle larger than that in connection with such valve 30.

The modifications in construction shown in Figures 6 and 7, relate primarily to the form of the annular air valve 41, the body of the valve proper being considerably shorter than in the case of the corresponding valve 30 of the first described construction. The central portion 42 of the spider 43, however, in which the supplemental valve 36 is mounted, is considerably larger in diameter than in said first described construction, and operates as a piston in a cylindrical chamber 44 centrally disposed in the upper portion of the casing 1, being there held by means of radial arms 45, as clearly shown in Figure 6.

This chamber acts as a dash pot to dampen the movement of the valve in just the same way as does the annular chamber 32, with the difference that a larger cross-sectional area is obtainable without restricting the passage for the gaseous mixture. A steadier action on the part of the valve results, and it is also easier and simpler to fit the parts together.

The fuel valve 36 is designed to be mounted in the spider in the same fashion as before, so as to be capable of a slight relative movement axially thereof, being held normally in depressed position by means of a compression spring 40, just as before. Inasmuch as the valve is preferably loosely fitted in the spider center for the reason previously described, the upper portion of the recess 46 in which the nut 47 that secures the valve in place is located, is sealed by means of a threaded plate 48 so that air can be admitted to and exhausted from the chamber 44 only through the restricted passage or vent 49 provided for this purpose.

Rotation of the shaft 5 which carries the butterfly valve 4 is limited in the same fashion as previously, by means of a lever 50 which engages at one end 51 directly with an abutment 53 on the side of the casing and carries at its other end a set-screw 52 adapted to contact with an abutment 53 on the side of the casing.

It will be noted that as shown in Figure 1, a slight space is left between the two annular valves 25 and 30, sufficient to allow a small volume of air to be drawn through, even before said valve 30 is perceptibly raised. This is necessary in order to draw the gasoline through the nozzle and provide the initial charge for the engine on starting. Instead of providing for this minimum draft of air in this fashion, or in supplement thereof, the further modification illustrated in Figure 6 may be utilized, consisting in the enlargement of the upper portion of the bore of said valve 25, which surrounds the fuel-supply duct and nozzle, so as to leave an annular space 54 which is connected by means of a series of apertures 55 with the lower portion of the casing.

The effect of the suction of the engine, as it is rotated in starting, will accordingly be to draw air through these apertures and such annular space immediately surrounding the nozzle, and thus even more effectively than before apply such suction to the drawing of the fuel through the nozzle. This arrangement will be more especially desirable in connection with large-size carburetors. It will be obvious that the general mode of operation of the modified construction of the device, including the action of the dash-pot, will be the same as that of the form shown in Figures 1 to 5 inclusive. Despite the central location of such dash-pot, the duct 49 leading from the cylinder 40 opens, it will be observed, into the atmosphere, and thus prevents the engine suction from producing a variable effect in the operation of the dash-pot by varying the pressure in the cylinder, this remaining always at atmospheric.

In both forms of our invention, it will be observed that the adjustment in position of valve 25 does not affect the normal position of the surrounding valve 30 or 41, as the case may be. In other words, said valve 25 may be raised without raising the surrounding valve which co-operates therewith to close the annular space between the nozzle and the casing wall, and without, as a consequence, raising the fuel-control valve 36. Depending, however, upon the setting of said valve 25, the surrounding valve will require to be raised a greater or less distance by the suction before air can pass to mix with the fuel from the nozzle. As a result, it will be seen that when a rich mixture is desired, as on starting the engine, this result automatically follows the raising of said valve 25 through operation of rocker 26.

This capacity for wholly independent movement of the valves in question, which may also be characterized as a capacity for movement through approximately the same range of travel, is believed to be unique in the present device, both in construction and in the operative effect thereby secured. The construction in question takes on particular significance where, as in the several carburetors illustrated in the drawings, no float-control for the fuel supply is provided. In such case, if the adjustment of valve 25 involved the raising of the needle-valve, the carburetor would be flooded with disastrous results.

We therefore particularly point out and distinctly claim as our invention:—

1. In a device of the character described, the combination of a tubular casing having an air inlet opening; a fuel nozzle discharging within said casing; two valves cooperating to substantially close the passage through said casing; external operating means for one of said valves, the other being adapted to be moved by the suction of the engine; and a third valve, operated by said suction-actuated valve, for controlling the supply of fuel through said nozzle, said first-named two valves being movable independently of each other, whereby adjustment of said externally operated valve does not affect the normal position of said suction-operated valve nor of said fuel-control valve.

2. In a device of the character described, the combination of a tubular casing having an opening constituting the sole air inlet for the device; a fuel nozzle rising centrally within said casing; two vertically reciprocable annular valves fitting one within the other and co-operating to substantially close the space between said nozzle and the casing wall; external operating means for one of said valves, the other being adapted to be raised by the suction of the engine; and a third valve, operated by said suction-actuated valve for controlling the supply of fuel through said nozzle, said two annular valves being reciprocable independently of each other, whereby adjustment of said externally operated valve does not affect the normal position of said suction-operated valve nor of said fuel-control valve.

3. In a device of the character described, the combination of a tubular casing having an air inlet opening; a fuel nozzle rising centrally within said casing; an annular valve reciprocable vertically of said nozzle; external operating means adapted to position said valve where desired; a second annular vertically reciprocable valve surrounding said first valve and adapted in co-operation therewith to substantially close the space between said nozzle and the casing wall; a third valve operated by said second annular valve for controlling the supply of fuel through said nozzle, said two annular valves being reciprocable independently of each other, whereby adjustment of said externally operated valve does not affect the normal position of said suction-operated valve nor of said fuel-control valve; a central piston carried by said second annular valve; and a cylinder having a duct communicating with the atmosphere, supported in said casing in position to receive said piston and form therewith a dash-pot adapted to dampen the movement of said second annular valve.

4. In a device of the character described, the combination of a suitable casing having an outlet for the charge and an air-inlet; a fuel-nozzle rising centrally and discharging within said casing; an externally adjustable annular valve surrounding said nozzle and formed and arranged to receive the fuel as it escapes from said nozzle and to discharge the same radially into the space between said valve and casing; and a second annular valve adapted to surround said first valve and in co-operation therewith to constrict or close the air-passage through said casing adjacent such point of discharge.

Signed by us, this 27th day of June, 1916.

JAMES J. TRACY.
LAWRENCE H. MORSE.

Attested by:—
JNO. F. OBERLIN,
D. T. DAVIES.