June 9, 1931. W. C. CARTER 1,809,507

CARBURETOR

Filed April 29, 1929

Fig. 1.

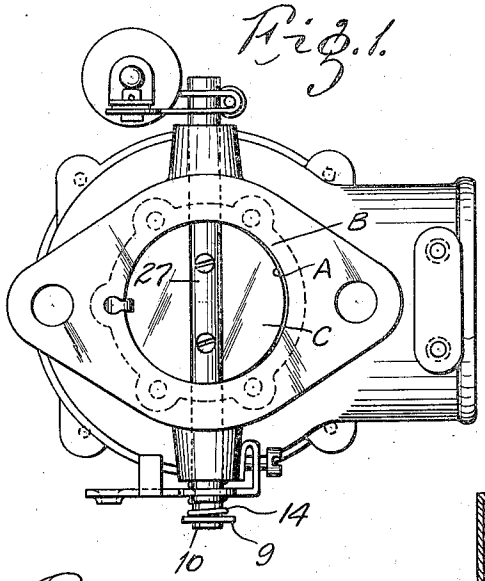


Fig. 3.

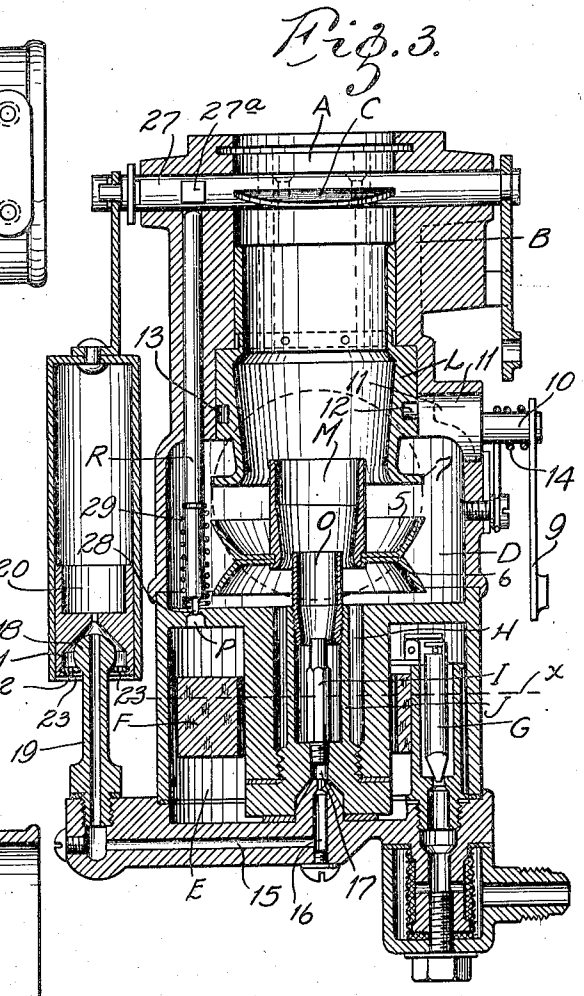
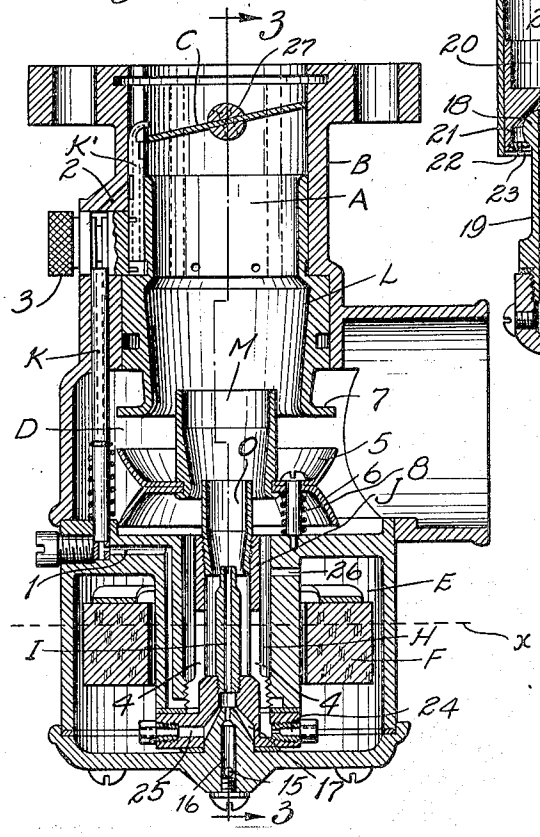


Fig. 2.



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CARBURETOR

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This invention relates to carburetors of the type that are equipped with a plurality of venturis or suction amplifiers.

One object of my invention is to provide a carburetor of the general type mentioned, that is equipped with a means by which the operator in charge of the engine on which the carburetor is used, can cut off the supply of air to all of the venturis or suction amplifiers in zero or extremely cold weather, and cause air to be drawn directly into the fuel passageway of the nozzle or main fuel supplying element of the carburetor so as to produce an aerated charge of fuel that facilitates starting the engine.

Another object is to provide a carburetor of the general type mentioned, i. e., a multi-venturi carburetor, in which the venturi that produces the first stage of suction amplification has an air inlet of substantially the same diameter or of greater diameter than the outlet of the carburetor which communicates with the intake of the engine, thereby making it practicable to equip the carburetor with at least three venturis which are of such relative diameter and arrangement that the volume of air flowing through all of the venturis will be great enough to float the fuel or insure the particles of fuel being carried freely into the main passageway of the carburetor.

Other objects and desirable features of my invention will be hereinafter set forth.

Figure 1 of the drawings is a top plan view of the carburetor embodying my present invention.

Figure 2 is a vertical sectional view of said carburetor; and

Figure 3 is a vertical sectional view, taken on the line 3—3 of Figure 2.

Referring to the drawings which illustrate the preferred form of my invention, A designates the main passageway of the carburetor, formed by a bore in the body B of the carburetor, C designates a throttle valve at the upper end of said main passageway, D designates an air chamber in the body of the carburetor, E designates the float chamber, F designates a float in said float chamber that governs a valve G which controls the supply of liquid fuel to the float chamber and H designates an accelerating well whose upper end communicates with the air chamber D. The main fuel supplying element of the carburetor is herein illustrated as consisting of a vertically-disposed nozzle I arranged inside of the accelerating well and projecting upwardly from the bottom of same, said nozzle being surrounded by a tubular member J of less diameter than the accelerating well which projects upwardly from the bottom of said well. The carburetor is also equipped with a means of the general type disclosed in my pending applications for patent Serial No. 206,030, filed July 15, 1927, and Serial No. 226,684, filed October 17, 1927, for supplying fuel to the main passageway A above the throttle valve when the throttle valve is closed or only partly open, said means being herein illustrated as consisting of a vertically-disposed fuel tube K (see Figure 2) mounted in the body of the carburetor in such a manner that its lower end communicates with a fuel-duct 1 that leads to the bottom of the accelerating well and its upper end communicates with a fuel duct 2 that leads to an adjustable terminal portion K′ for the fuel tube whose discharge end can be arranged in various positions with relation to the throttle valve by manipulating an adjusting device 3, which I will not describe in detail, as it forms no part of my present invention.

As previously stated, the carburetor is equipped with a plurality of venturis or suction amplifiers arranged between the throttle valve and the main fuel supplying element of the carburetor and consisting of a venturi L positioned in the lower end portion of the main passageway A of the carburetor for producing the first stage of suction amplification, a venturi M for producing the second stage of suction amplification arranged inside of the air chamber D, with its upper end disposed in concentric relationship with the air intake end of the first venturi L and projecting upwardly into same, and a venturi O for producing a third stage of suction amplification arranged at the upper end of the tubular member J in the accelerating well, with

its upper end projecting upwardly into the air intake end of the second venturi M. Due to the fact that the air intake ends of the first and second venturis are arranged inside of the air chamber D, air can pass from said chamber and flow upwardly through the annular space between the lower end of the venturi L and the upper end of the venturi M and also upwardly through the annular space between the lower end of the venturi M and the upper end of the third venturi O. The third venturi O receives its supply of air from the accelerating well H through vertically-disposed air slots 4 in the tubular member J in the well, whose upper ends terminate above the normal level of the fuel in the float chamber, represented by the broken lines *x* in Figures 2 and 3, the upper end of the accelerating well being in direct communication with the air chamber D, so that air can pass from said chamber and flow downwardly into the accelerating well, thence inwardly through the slots 4, and thence upwardly through the annular space between the upper end of the nozzle I and the third venturi O.

In a carburetor of the multi-venturi type it is essential that the annular passageways of all of the venturis be of great enough cross-sectional area to permit a sufficiently large volume of air to flow through said passageways to float the particles of fuel and carry the fuel upwardly into the main passageway A of the carburetor. Accordingly, I have constructed my carburetor in such a way that the first venturi L can be provided with an air inlet portion whose greatest diameter is equal to or greater than the main passageway A of the carburetor, and the other venturis can be made of such size as to produce a free vacuum carburetor through which sufficient air will travel when the carburetor is in use to insure the fuel being carried upwardly into the main passageway of the carburetor. One convenient way of accomplishing this highly desirable result is to provide the first venturi L with an enlarged portion having an air passageway whose side wall tapers or diverges from the air inlet at the lower end of the venturi whose diameter is such that the greatest diameter of the air passageway in the venturi L is equal to or in excess of the diameter of the main passageway A of the carburetor. Preferably, the venturi L is provided intermediate its ends with a throat or contracted portion that is arranged above the point of greatest diameter of the air passageway in the venturi L. As shown in Figures 2 and 3, the enlarged portion of the venturi L that contains the air passageway of gradually increasing diameter, is mounted in a counter bore at the lower end of the main passageway A of the carburetor. From the foregoing it will be seen that notwithstanding the fact that the first venturi L is positioned in the main passageway A of the carburetor, the intake portion of said venturi has a diameter equal to or in excess of the diameter of the main passageway A, thereby permitting the second and third venturis M and O to be made of greater diameter than would be possible if the first venturi L were constructed in the form of a tubular member of the same external diameter throughout its length, positioned in a bore of uniform diameter in the body of the carburetor, as has heretofore been the usual practice in carburetors of the multi-venturi type.

The first and second centuris L and M are mounted in such a manner that the operator in charge of the engine on which the carburetor is used can shift or change the positions of said venturis so as to cause them to act as choking devices that facilitate the starting of the engine when it is cold. Preferably, the first venturi L is mounted in such a manner that in moderate weather the operator can move said venturi downwardly, so as to cut off the supply of air to the annular space between the said venturi and the second venturi M, and the second venturi M is so constructed and arranged that a continued movement of the actuating device employed to shift the venturi L will cause said second venturi M to be moved into such a position as to cut off the supply of air to the annular air passageway of same and also to the annular air passageway of the third venturi O. In the form of my invention herein shown the first venturi L is reciprocatingly mounted in the body of the carburetor and the second venturi M is sustained or carried by a yielding supporting structure composed of two reversely arranged, cup-shaped members 5 and 6, as shown in the drawings, the member 5 being arranged with its side wall projecting upwardly and disposed oppositely to a flange 7 on the lower end of the venturi L, and the member 6 being arranged with its side wall projecting downwardly, thereby permitting air to pass from the air chamber D through the space between the top edge of the cup 5 and the flange 7 and through the space between the edge of the inverted cup 6 and the bottom wall of the air chamber D when the parts are in the positions shown in Figures 2 and 3. The yielding supporting structure that carries the second venturi M is sustained and normally maintained in the position shown in Figures 2 and 3 by springs 8. Means is provided for enabling the operator in charge of the engine to move the venturi L downwardly into engagement with the cup 5, or downwardly still farther so as to compress the springs 8, and thus cause the bottom edge of the cup 6 to engage the bottom wall of the air chamber D, said means being herein illustrated as consisting of a manually-operable lever 9 attached to a stud 10 on an oscillating device 11 in the body of

the carburetor that is provided at its inner end with an eccentrically-disposed pin 12 that enters a hole or annular groove 13 in the exterior of the venturi L. When the lever 9 is rocked in one direction, the venturi L will be moved downwardly, so as to cause the flange 7 thereon to engage the cup 6, thereby cutting off the supply of air to the venturi L and facilitating the starting of the engine. In extremely cold weather or zero weather a continued movement of the operating mechanism that is used to actuate the lever 9, causes the venturi L to continue to move downwardly, after it has engaged the cup 5, thereby compressing the springs 8, and causing the cup 6 to move downwardly into such a position that air cannot flow through the annular passageway of the second venturi M, or flow downwardly into the accelerating well H. As soon as the operator releases the operating mechanism that is used to actuate the lever 9, the device 11 rocks in the opposite direction under the influence of a torsion spring 14, thereby causing the venturi L to be moved upwardly back to its normal position, and permitting the springs 8 to expand and restore the second venturi M to its former normal position shown in the drawings. It will thus be seen that my improved carburetor is provided with two separate and distinct choking devices, one consisting of the first venturi L that is capable of being shifted into such a position as to cut off the supply of air to same in moderate weather, and the other consisting of the yielding supporting structure that carries the second venturi M and which is capable of being shifted into such a position in zero weather or extremely cold weather as to cut off the supply of air to the second and third venturis. At such times, i. e., after the venturi L has been moved downwardly far enough to cause the bottom edge of the inverted cup 6 to be pressed against the bottom of the air chamber D, and thus cut off the supply of air to the annular passageways of all of the venturis, air will be supplied to the fuel passageway of the nozzle I by an air duct 15 whose intake end is in communication with the atmosphere and whose discharge end is in communication with an air orifice 16 located beneath the fuel nozzle I at the center of an annular fuel passageway 17 from which the nozzle I receives its supply of fuel, the air that flows upwardly through the orifice 16 becoming mixed with the fuel that is drawn upwardly out of the fuel passageway 17 by the suction exerted on the nozzle, and thus producing an aerated charge that greatly facilitates the starting of the engine. The air duct 16 not only supplies air to the center passageway of the nozzle I when the carburetor is choked, but it also supplies air to said nozzle at all other times, when the suction exerted on the upper end of the nozzle is sufficient to cause fuel to be drawn upwardly into said nozzle from the annular fuel passageway 17, at the lower end of the nozzle. Accordingly, in my improved carburetor means is provided for introducing an aerated jet of fuel directly into the third venturi O of the carburetor located at the upper end of the nozzle I. The duct 15 that supplies air to the orifice 16 beneath the nozzle can be formed in various ways without departing from the spirit of my invention. In the carburetor herein shown the inlet end of the air duct 15 terminates in a ball-shaped portion 18 on a standard 19 that serves as a support for the piston 20 of a pump of the kind shown in my application Serial No. 359,096 filed of even date herein, but I wish it to be understood that said pump forms no part of my present invention. The ball-shaped portion 18 just referred to is arranged in a socket 21 on the underside of the pump piston 20, and the retaining plate 22 in the lower end of the piston that holds said ball in its socket is provided with air inlets 23 that establish communication between the atmosphere and the socket 21 in the piston, and thus permits air to enter the passageway 15 and flow to the air orifice 16 beneath the fuel nozzle.

Fuel is supplied from the float chamber E to the lower end of the accelerating well H by a fuel orifice or duct 24, as shown in Figure 2. A separate fuel supply duct or orifice 25, also shown in Figure 2, is provided for admitting fuel from the float chamber to the annular fuel passageway 17 located at the lower end of the fuel nozzle. The fuel duct 25 is preferably made large enough so that it is not liable to become clogged with foreign matter in the fuel, and in order to prevent said duct 25 from supplying too much fuel to the nozzle at high speeds, the carburetor is equipped with a fuel economizing device that consists of an air vent 26 that leads from the upper end of the float chamber E to the upper portion of the accelerating well H. When air is flowing from the air chamber D downwardly through the well H, said flowing stream of air creates a suction or partial vacuum in the upper portion of the float chamber that is exerted on the fuel in the float chamber in such a manner as to retard the escape of fuel from the float chamber through the duct 25 that leads to the fuel passageway 17, thereby effecting a considerable saving in the consumption of fuel at high speeds. The air that is supplied to the orifice 16 through the air duct 15 also has a tendency to reduce the quantity of fuel which the nozzle I introduces into the main passageway in certain positions of the throttle valve, due to the fact that the air which flows upwardly from the orifice 16 into the fuel passageway of the nozzle I cuts down the suction that is created inside of the nozzle. It is

highly desirable that a relatively great quantity of fuel be supplied to the nozzle when the throttle valve is moved into its wide open position, and in order that this result may be attained in carburetors of the type that are equipped with fuel economizing devices of the general character mentioned, I have provided my carburetor with a means that is inactive in all other positions of the throttle valve than the wide open position, but which comes into service automatically to modify, overcome or counteract the effect produced by the fuel economizing device when the throttle valve is moved into its wide open position, said means being of such a character that it increases the proportion of the fuel relatively to air, that is supplied to the nozzle when the throttle valve is wide open. In addition to modifying the action or effect produced by the fuel economizing device, said means also compensates for the diminution of the discharge of the fuel from the nozzle, produced by the admission of air to the interior of the nozzle through the air duct 15 and air orifice 16. In the form of my invention herein illustrated the means above referred to consists of an air vent P leading from the upper portion of the float chamber to the air chamber D of the carburetor, and a valve or closure R for said vent P that is governed by the throttle valve shaft 27. The valve R consists of a vertically-disposed rod mounted in the body of the carburetor and provided at its lower end with a projection 28 that is adapted to enter a reduced portion of the air vent P and serve as a closure for same. When the throttle valve A is in its closed or intermediate positions the valve rod R is engaged by the throttle valve shaft and maintained in such a position that the projection 28 thereon cuts off communication between the air chamber D and the upper portion of the float chamber, but when the throttle valve is moved into its wide open position, a flat portion 27^a on the throttle valve shaft comes into registration with the upper end of the valve rod R, thereby permitting said rod to move upwardly under the influence of a spring 29, with the result that the projection 28 on the valve rod will be withdrawn from the air vent P, thereby establishing direct communication between the upper portion of the float chamber and the air chamber D of the carburetor. Due to the fact that the air chamber D is under a lower pressure than the accelerating well to which the air vent 26 leads, the effect produced by opening the air vent P is to reduce the suction or partial vacuum that exists in the upper end of the float chamber, thereby modifying or reducing the retarding effect produced by the air vent 26 and permitting the fuel to flow freely from the float chamber through the duct 25 to the nozzle I, and consequently, increasing the proportion of fuel relatively to air, to such an extent that the nozzle will supply sufficient fuel to the main passageway A to effectively take care of the condition that exists when the engine is subjected to a heavy load with a wide open throttle, as, for example, when the automobile propelled by the engine is pulling through sand or pulling up a steep grade. It is, of course, immaterial what particular type or kind of valve or the like is used to open and close the air vent P leading from the upper portion of the float chamber, and while I have stated that said air vent P preferably leads to the air chamber D of the carburetor, this is not essential. The essential thing, so far as this feature of my invention is concerned, is that the air vent P lead to the atmosphere or to an air passageway or chamber that is under a materially lower pressure than the pressure which exists in the upper end of the accelerating well when air is flowing downwardly through the same. As previously stated, the auxiliary air vent P and the throttle-controlled governing device for same not only modifies the action of the fuel economizing device consisting of the air vent 26, but it also compensates for the diminution in the discharge of fuel from the nozzle I into the third venturi O, produced by admitting air to the interior of the nozzle through the orifice 16 and air duct 15.

By constructing the carburetor in the manner described I not only obtain a free vacuum carburetor that is exceptionally economical in the consumption of fuel, but I also obtain a carburetor in which the volume of fuel relatively to air for the fuel nozzle I, will be increased sufficiently when the throttle valve is moved into its wide open position to insure the main passageway A being supplied with a relatively great quantity of fuel at times when the engine is operating under a heavy load with a wide open throttle.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A carburetor provided with a main passageway, a throttle valve for said main passageway, a main fuel supply device, a plurality of venturis arranged in superimposed and concentric relation between the throttle valve and said fuel supply device, means for enabling the venturi that produces the first stage of suction amplification to be moved tion a position wherein it serves as a choking device which cuts off the supply of air to said first venturi, and means whereby the venturi that produces the second stage of suction amplification can be moved into such a position that the supply of air is cut off from the annular passageways of the second and third venturis.

2. A carburetor provided with a main passageway, a throttle valve for said main passageway, a main fuel supply device, a plural-

ity of venturis arranged in superimposed and concentric relation between the throttle valve and said fuel supply device, a shiftable structure that carries the second venturi, an operating device that is adapted to be actuated to move the first venturi into engagement with said shiftable supporting structure to cut off the supply of air to the first venturi, and means whereby continued movement of said actuating device causes said supporting structure to be moved into such a position that the supply of air is cut off from the annular passageways of the second and third venturis.

3. A carburetor provided with a main passageway, a throttle valve for said main passageway, a main fuel supply device, a plurality of venturis arranged in superimposed and concentric relation between the throttle valve and said fuel supply device, a shiftable supporting structure that carries the second venturi, springs for sustaining said supporting structure, and a means that is adapted to be actuated to shift the first venturi into a position to cut off the supply of air to the annular passageway of same and to thereafter move said spring sustained supporting structure into such a position as to cut off the supply of air to the annular passageways of the second and third venturis.

4. A carburetor provided with a main passageway, a throttle valve for said passageway, a main fuel supplying device, an air orifice communicating with the atmosphere, through which air passes into the interior of said fuel supplying device, a plurality of venturis arranged in superimposed and concentric relation between said fuel supplying device and said throttle valve, a supporting structure for the second venturi consisting of two reversely arranged, cup-shaped members, one of which is disposed oppositely to the lower end of the first venturi and the other being disposed oppositely to the bottom of the air chamber of the carburetor, springs for sustaining said supporting structure, and means whereby the first venturi can be moved downwardly into engagement with the cup-shaped member disposed oppositely to same and thereafter downwardly still farther so as to cause the reversely arranged, cup-shaped member to bear against the bottom wall of the air chamber, for the purpose described.

5. A carburetor provided with a main passageway, a throttle valve for said main passageway, a main fuel supplying device, a plurality of venturis arranged in superimposed and concentric relation between said throttle valve and fuel supplying device, an air chamber, an accelerating well communicating at its upper end with said air chamber and arranged so that the air supplied to the annular passageway of the third venturi must flow downwardly through said well, means for enabling the position of the first and second venturis to be changed so as to cut off the flow of air from said air chamber to said first and second venturis and to the accelerating well, and an air duct through which air is admitted to said fuel supplying device.

6. A carburetor provided with a main passageway, a throttle valve for said passageway, a main fuel supplying device, three venturis arranged in superimposed and in concentric relationship between said throttle valve and said fuel supplying device, a float chamber, a fuel outlet of relatively great cross-sectional area leading from said float chamber to said fuel supplying device, an air duct through which air is supplied to the interior of said fuel supplying device, and means governed by the throttle valve for varying the pressure that exists in the float chamber above the level of the fuel therein, for automatically increasing the proportion of fuel that is admitted to the fuel supplying device when the throttle valve is moved into its wide open position.

7. A carburetor provided with a main passageway, a throttle valve for said passageway, an air chamber, a fuel nozzle, an accelerating well surrounding said nozzle and arranged with its upper end communicating with said air chamber, three venturis arranged in superimposed and concentric relationship between the nozzle and the throttle valve, a float chamber, means for permitting liquid fuel to pass from the float chamber to said nozzle and to said accelerating well, an air orifice arranged so as to discharge a jet of air upwardly into said nozzle, means whereby the position of the first and second venturis may be changed to cut off the supply of air to the annular passageways of all of the venturis, and a means governed by the throttle valve for varying the pressure that exists in the upper portion of the float chamber above the fuel therein, according to the position of the throttle valve.

8. A carburetor provided with a main passageway, a throttle valve for said main passageway, a main fuel supply device, a plurality of venturis arranged in superimposed relation between the throttle valve and said fuel supplying device, means for enabling one of said venturis to be moved into a position wherein it serves as a choking device that cuts off the supply of air to said venturi, and means whereby a venturi that produces a different stage of suction amplification can be moved into a position to cut off the supply of air to all of the venturis.

WILLIAM C. CARTER.