Dec. 13, 1927. 1,652,859

V. R. HEFTLER

CARBURETOR

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Fig. 1.

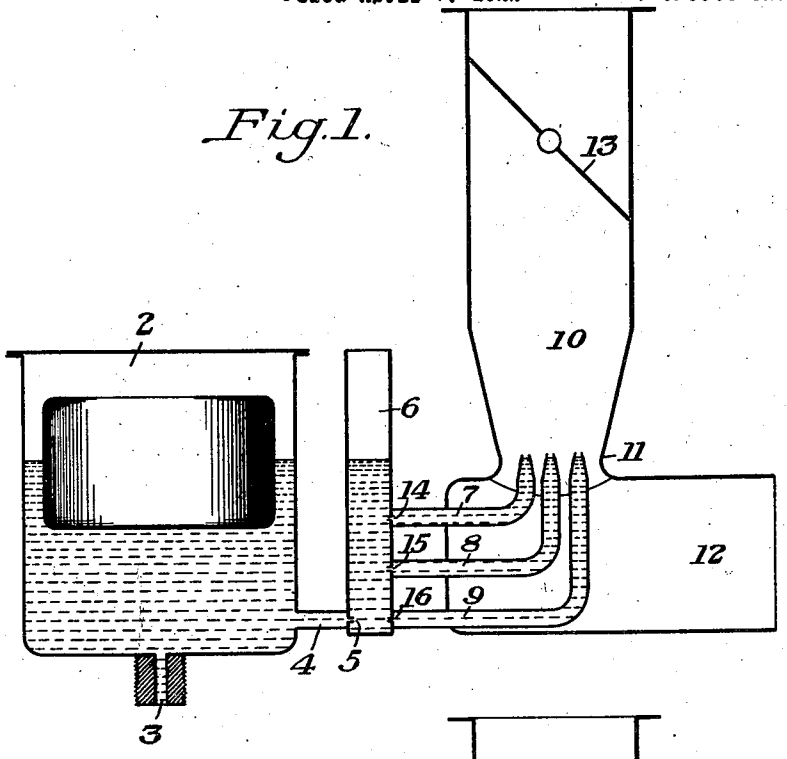
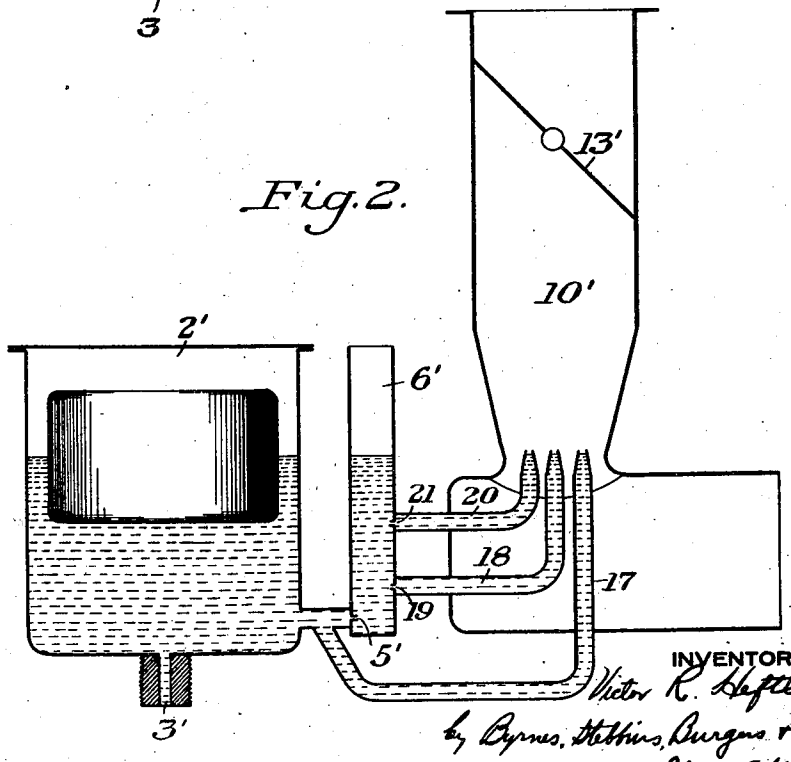


Fig. 2.



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CARBURETOR

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Fig.3.

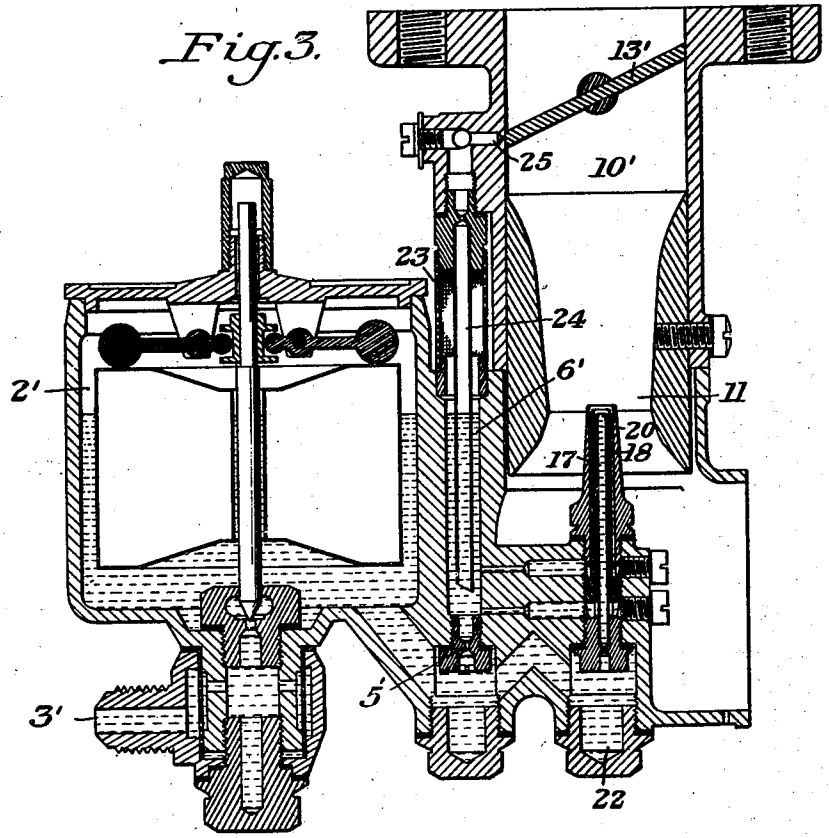


Fig.4.

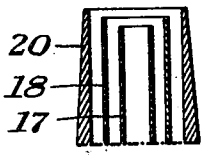


Fig.5.

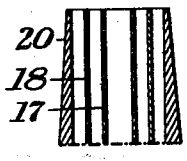
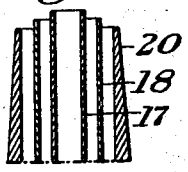


Fig.6.



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CARBURETOR

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Fig. 7.

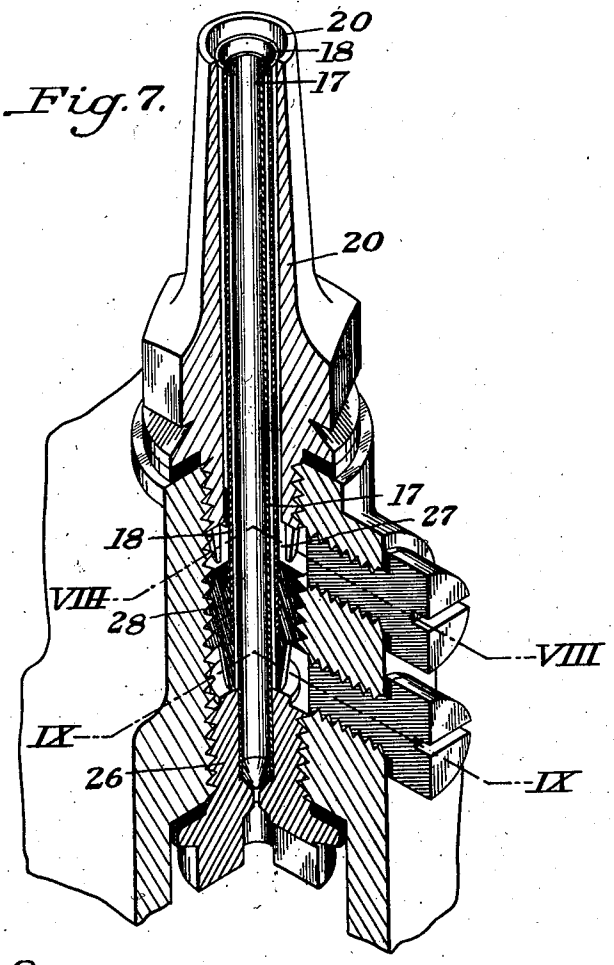


Fig. 9.

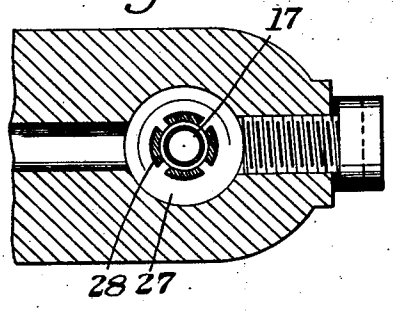
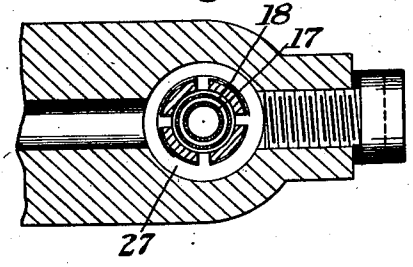


Fig. 8.



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Patented Dec. 13, 1927. 1,652,859

UNITED STATES PATENT OFFICE.

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CARBURETOR.

Application filed April 7, 1922. Serial No. 550,360.

The present invention relates broadly to carburetors, and more particularly to a fuel feed for carburetors of the type adapted to be utilized with internal combustion engines.

It has heretofore been proposed to provide fuel feeding jets having a vent opening to the atmosphere. It has also been proposed to provide single jets each having a series of openings effective as vents and adapted to be successively uncovered in accordance with the increasing demands upon the carburetor. Such constructions, while partially satisfactory for certain purposes and at certain speeds, have usually produced a so-called "bad spot" requiring some form of corrective device.

This invention relates particularly to a fuel feeding system comprising a plurality of jets some or all of which are vented to provide means for admitting air thereto anterior to the point of discharge, and in which such jets as are vented have but a single air opening leading thereto. In this manner, the objections inherent in a construction embodying the successive uncovering of a plurality of vent openings to a single jet are obviated.

The foregoing and other objects together with the advantages arising therefrom, will be apparent as the invention becomes more clearly understood by reference to the accompanying drawings and specification. It will be understood that the drawings are illustrative only of certain preferred embodiments of my invention, and that changes may be made in the construction and operation disclosed herein without departing from the spirit of the invention or the scope of my claim.

In the drawings,—

Figure 1 is a diagrammatic view illustrating one embodiment of the present invention;

Figure 2 is a view similar to Figure 1 illustrating another embodiment of my invention;

Figure 3 is a vertical sectional view through a carburetor of commercial form constructed in accordance with the disclosure of Figure 2;

Figures 4, 5, and 6 are illustrative of different types of jets which may be utilized in accordance with my invention;

Figure 7 is a perspective view, partly in section, illustrating one form of fuel feeding device, the jets being in assembled relation;

Figure 8 is a detail sectional view on the line VIII—VIII of Figure 7; and

Figure 9 is a detail sectional view on line IX—IX of Figure 7.

By a series of experiments I have found that the "bad spots" hereinbefore referred to are caused in an air vented jet carburetor by the irregular introduction of air within the jet. In the given condition of suction at which this bad spot occurs, the bubbles of air get into the fuel at intervals of time generally comparable to the time interval between successive explosions. These spurts of fuel form rich shots, while the bubbles of air form lean shots. These successive shots where the time interval is comparable to that between explosions, go to different cylinders. This necessarily means a poor combustion mixture in all of the cylinders, thereby causing the so-called "bad spots". This condition is more noticeable at one speed than another, due partly to the time intervals referred to and also to the amounts of air present in the emulsion.

With the present invention, I effectively overcome the objectionable effects of such "bad spots". The results accomplished may be attributed either to the formation, with the present invention, of a bad spot having a less effect at any one time, by making the emulsion constitute a less proportion of the total fuel being fed, or by the intermittent formation of such an emulsion and the distributing or attenuating of the resulting bad spots over a longer total range, the emulsion formed at any one time by transition from one critical speed to another extending through a small range of suction, which range cannot be maintained. Either or both of these operations have the desired effect, producing a fuel feed in which the bad spot is not felt.

Before going into a detail description of the present invention, it may be stated that with a simple suction jet in a fixed air passage, the feed of fuel is a function of the suction, the flow increasing as the suction increases. The law of flow through a single air vented jet, that is, a jet having a single orifice for admitting air thereto anterior to its point of delivery into the main air stream is discontinuous, and a change in the character of the flow occurs when the suction at the outlet has reached a value high enough

to cause the level of the fuel in the atmospheric well to uncover the air bleeding orifice. This value of the suction I have called a "critical suction". The critical suction depends on the vertical distance between the point where the fuel is delivered into the carbureting passage or chamber and the point where air is admitted into the fuel stream and on the relative size of the feed hole into the well and of the restriction controlling the outlet from the well. It will be plain that if the feed hole to the well is very large, the level of the fuel in the well will drop less for a given suction at the delivery outlet than if the feed hole is smaller. Therefore, the value of this critical suction may be varied at the will of the designer. While the suction at the delivery orifice is lower than the critical suction, the flow follows the law of an ordinary simple suction jet, and is equivalent to the flow through a virtual jet, the opening of which is a function of the size of the fuel hole leading into the atmospheric well and of the size of the discharge hole from the well. When the suction is higher than this critical suction, the law of flow changes and is intermediate a pure gravity flow and a pure suction flow. If the well is widely opened to the air, this flow is practically due to the gravity alone, but if the well opening to the air is restricted, there will be some degree of suction in the well and the flow of fuel therein will depart from a true gravity flow. This deviation from the constant flow will depend on the respective sizes of the discharge holes from the well and the opening to the atmosphere.

Referring more particularly to Figure 1, there is illustrated diagrammatically a carburetor comprising a constant level chamber 2 having a fuel inlet 3 and a fuel outlet 4 adapted to supply fuel through a calibrated orifice 5 to an atmospheric well or wells 6. From the atmospheric well or wells, I may provide at different levels a series of fuel feeding jets 7, 8, and 9 adapted to supply fuel to the carbureting passage 10 of a carburetor. These jets may terminate in the venturi at any desired point with respect to the point of maximum constriction of the venturi 11, but preferably at a point where they are subjected to the pressure prevailing in the region of maximum depression. The carbureting passage 10 may be provided with the usual air inlet 12 and with a controlling throttle 13 of any desired construction. These jets usually extend a short distance above the level of the fuel in the constant level chamber.

With a carburetor construction of this character, it will be apparent that when the carburetor is under no suction, which condition prevails when the motor is at rest, the level of the fuel in the constant level chamber, the atmospheric well or wells, and all of the jets, will be substantially the same. Under low suctions, the fuel level in the atmospheric well or wells will be gradually lowered until such a suction is reached that the fuel level therein will uncover the discharge orifice 14 to the jet 7. Up until this time, all of the jets will supply pure fuel streams to the carbureting passage. During a short period, or a short range of speed, the jet 7 will supply an emulsion of the character referred to. This emulsion will, however, constitute but a small proportion of the total amount of fuel being fed, as it represents but one of three of the fuel streams, and the feeding of such an emulsion will only continue for a very brief period or until such time as the level of the fuel in the atmospheric well supplying the jet 7 passes below the orifice 14. After this time, the jet 7 will feed air only to the carbureting passage. The suction at which the level of the fuel in the atmospheric well reaches the orifice 14 may be termed the "first critical suction". I have found that until this suction is reached the flow from the fuel system follows exactly the same law as the flow from an ordinary suction controlled jet connected to the constant level chamber by a passage sufficiently large to offer practically no restriction to the flow. The area of this virtual jet depends upon the ratio of the calibrated orifice 5 to the sum of the discharge orifices 14, 15 and 16. The size of the atmospheric well feeding the jet has practically no influence upon this flow when a stable condition is reached, i. e., a condition at which the level of the fuel within the well remains substantially constant. The size of the well until such stable condition or critical suction is reached is, however, of importance as it determines the amount of additional fuel which will be fed to the carburetor when passing from a lower to a higher suction. This is true for the reason that the flow from the atmospheric well or wells, represented by the difference between the higher and the lower levels therein, is in addition to the normal flow. If the transition from lower to higher suction is slow and gradual, this reserve or additional flow will be spread out over a longer time than if the transition is a sudden one.

It will be apparent that in passing through this critical suction, there is a sudden change from one law governing the flow to a different law, as orifice 14 does not supply fuel any longer, and only air will pass therethrough. The flow of fuel will then be equivalent to the flow through a virtual single suction jet, the size of which is determined only by the sizes of orifices 5, on one hand, and the sum of 15 and 16 on the other. This second virtual jet is smaller than

the first virtual jet and the tendency to increase the richness of the mixture is therefore counteracted. By the present invention I not only provide a usable mixture, but automatically maintain the proportions substantially constant, whereby the efficiency of the carburetor is increased.

Continued operation of the motor being supplied by fuel from the carbureting passage 10, if kept at a substantially constant speed, will not materially affect the level of the fuel in the atmospheric well beyond that referred to. If, however, the throttle is opened wider and the speed of the motor is increased, the suction will increase to such an extent that the level of the fuel will be gradually lowered beyond the level produced when operating at the first critical suction. If this condition is continued, a second critical suction will be reached, at which the discharge orifice 15 supplying the jet 8 will be uncovered. Orifice 15 does not supply fuel any longer, and the flow of fuel will be equivalent to the flow through a virtual single suction jet which is of smaller size than the second virtual jet which orifice 15 has eliminated. At this time, the operations which occurred at the first critical suction will be repeated. Still further increase in engine speed may result in the production of a third critical suction at which the discharge orifice 16 supplying the jet 9 will be uncovered. It is also obvious that the size of the orifices may be so chosen that the third critical suction may be very high and near the highest suction which the motor may create.

It will be obvious that the number of jets and wells may be varied, and that both the area of the discharge orifices leading thereto and the location of these orifices may be changed. Preferably, the construction will be such that with a carburetor of this type the third critical suction would be very high and in the upper limits of the suction range.

A carburetor of this construction is effective for supplying a constant mixture of fuel and air, as it is equivalent broadly to a carburetor having a single suction jet with a metering orifice decreasing as the suction increases. In this respect it differs materially from the ordinary single suction jet carburetor having a flow which is a function of the suction and which increases as the suction increases.

In Figure 2 I have illustrated diagrammatically a carburetor embodying the principles of construction shown in the Baverey patent hereinafter referred to. In this construction the float chamber 2′ delivers fuel both to an atmospheric well 6′ and to a main suction jet 17. The flow from the constant level chamber into the atmospheric well is preferably through a calibrated orifice 5′, as before described, and the well is adapted to supply a compensating jet 18 through a discharge orifice 19. In order to eliminate the formation of a "bad spot", there is also provided one or more jets 20 each adapted to be supplied through a discharge orifice 21 from the atmospheric well. With this construction, at the first critical suction the discharge orifice 21 will be uncovered. At the second critical suction, if only one supplemental jet is provided, the discharge orifice 19′ will be uncovered, and thereafter the carburetor will operate on the principle of Baverey Patent No. 907,953 of Dec. 29, 1908. It will be apparent that the orifice 19 may be so proportioned as to delay this operation, which is in accordance with the ordinary zenith principle, as desired. At the first critical suction, however, there will be a brief period during which pure fuel will be supplied in two streams while an emulsion supply is being supplied in a third stream from the jet 20. This condition is, as pointed out, of extremely short duration, and immediately thereafter the jet 20 supplies only air.

With both forms of the invention, it will be apparent that there are provided jets each of which has but a single air inlet, whereby the flow through one of the jets may be varied without modifying the flow through the other jets. Until the first critical suction is reached, the three jets all give out pure fuel in proportion to their discharge areas. After the first critical suction is reached, the first jet will no longer receive any fuel, but will discharge air only, as the other jets under higher suction are of sufficient capacity to take care of the fuel flow into the atmospheric well. The invention permits of a wide range of operation by a variation in the respective areas and locations of the different orifices whereby successive operations can be made to vary both in importance and in position. For example, by increasing the area of the orifice supplying fuel into the atmospheric well or wells, the richness of the mixture throughout the whole suction range will be increased, while increase in the area of the upper discharge orifice which is uncovered at the first critical suction will increase the richness at low suction and will result in a lower critical suction for this orifice.

In Figures 3, 7, 8 and 9, there is illustrated the commercial embodiment of a carburetor constructed in accordance with the disclosure of Figure 2. In this construction, the jets 17, 18 and 20 are illustrated as being of successively larger diameters arranged one within the other. The main suction jet 17 receives its supply of fuel through the channel 22 having an area sufficiently large to afford practically no restriction to the flow therethrough; while the jets 18 and 20, respectively, communicate with the atmospheric

well 6′, having an opening 23 to the atmosphere, at successively higher levels. The well 6′ is illustrated as having a priming device cooperating therewith comprising a quill 24 adapted to discharge into the carbureting passage 10′ through an orifice 25 located adjacent the throttle 13′.

By reference more particularly to Figure 7, it will be apparent that the main suction jet 17 is provided with a threaded enlargement 26 adapted to be screwed into position in the vertically disposed interiorly threaded opening 27 in the body of the carburetor. After the jet 17 is in position, the compensating jet 18 having a threaded enlargement 28 is then threaded into position. After this, the jet 20, illustrated as being in the form of a cap jet, is also screwed into position. This construction provides a composite jet having a series of concentric annular passages each adapted to supply fuel as set forth.

In Figures 4 and 7, the inner jet is illustrated as terminating below the outlet orifice of the other jets. This construction is, however, not essential, and in Figure 5 the jets are illustrated as terminating in substantially the same plane, while in Figure 6 they are illustrated as terminating in the reversed stepped relation. The jets may be modified to change the point of discharge in the venturi as desired.

By the present invention, I am able to overcome the objectionable features of the "bad spot" as usually produced, and this constitutes an important advantage of the present invention.

I claim:

In a carburetor having a constant level chamber and a carbureting passage, a venturi in said passage, an atmospheric well having a restricted connection directly to said chamber, a fuel-feeding device adapted to deliver fuel throughout the entire range of operation of the carburetor, and a plurality of other fuel-feeding devices adapted to separately receive fuel from said well only and at different levels and to separately discharge the same within said venturi, substantially as described.

In testimony whereof I have hereunto set my hand.

VICTOR R. HEFTLER.