May 19, 1931. V. R. HEFTLER ET AL 1,806,348

CARBURETOR

Filed Aug. 12, 1925

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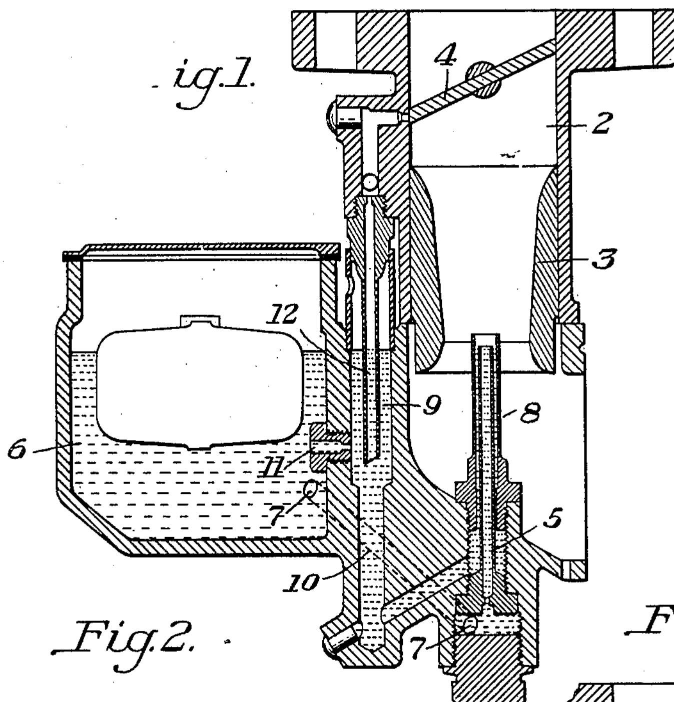


Fig.2.

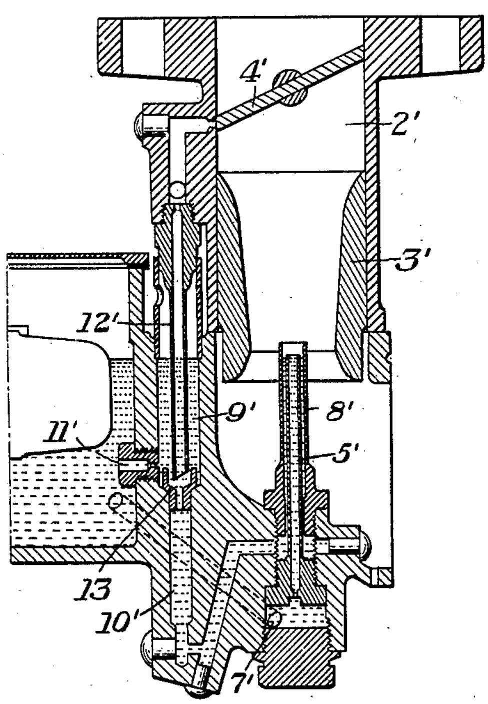
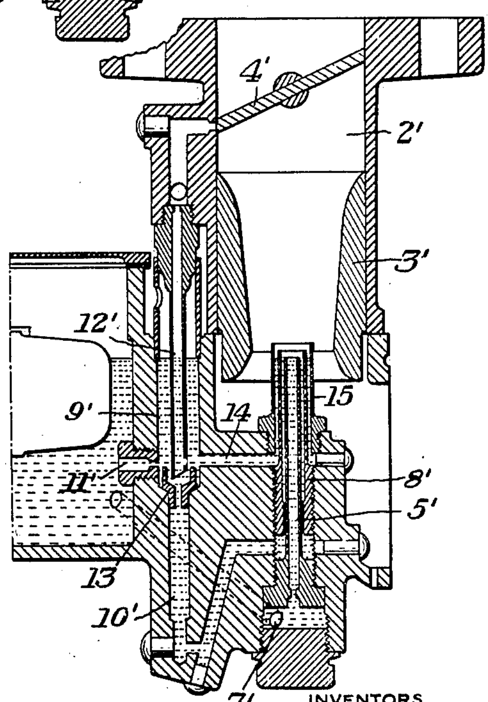


Fig.3.



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UNITED STATES PATENT OFFICE

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CARBURETOR

Application filed August 12, 1925. Serial No. 49,726.

The present invention relates broadly to the art of carburetion, and more particularly to apparatus for feeding fuel, the invention being especially adapted for use with internal combustion engines.

In carburetors as commonly constructed at the present time, there is usually some one point in the carburetor range that gives very unsatisfactory results. This point is usually referred to as a "bad spot," and many efforts have been made to overcome and eliminate it.

In the copending application of Victor R. Heftler, Serial No. 550,360, filed April 7, 1922, there is disclosed one method of improving carburetor operation either by forming a bad spot having a less effect at any one time or by such an arrangement that the stream undergoing a change in its flow characteristics constitutes a relatively smaller proportion of the total fuel supply, or by intermittently forming a change in the flow characteristics and distributing the results over a longer period range.

As pointed out in said application, the so-called bad spots are thought to be caused, at least to a very large extent, in an air vented nozzle carburetor by the irregular introduction of air within the nozzle. In the given condition of suction at which the bad spot occurs, the bubbles of air get into the fuel at intervals of time generally comparable to the time interval between successive explosions. This produces alternate spurts of fuel and air, the spurts of fuel constituting rich shots, while the air bubbles form lean shots. The successive shots where the time interval is comparable to that between explosions go to different cylinders. This necessarily means a poor combustion mixture to all of the cylinders, thereby causing so-called "bad spots." This condition is naturally much more noticeable at one speed than another, due partly to the time intervals referred to and also to the amount of air present in the emulsion.

In order to form a basis for a clearer understanding of the present invention, it may be pointed out that with a single suction nozzle in a fixed air passage the feed of fuel is a function of the suction, the flow increasing as the suction increases within predetermined limits of operation. The law of flow through a single air vented nozzle, that is, a nozzle having a single air bleeding orifice for admitting air thereto anterior to its point of delivery to the main air stream is discontinuous and a change in the character of flow occurs when the suction at the delivery 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 will hereinafter be referred to as the "critical" suction or point of emulsion.

This critical suction depends upon the vertical distance between the plane of the outlet of the fuel nozzle in the carburetting passage or chamber and the location of the opening through which air is permitted to enter, the fuel being delivered to such nozzle in order to form an air-fuel emulsion, on the relative size of the feed hole into the well and on the size of the restriction controlling the outlet from the well. If the feed hole size is unduly increased, the level of the fuel in the well will drop less for a given suction at the outlet than will be the case if the feed hole is decreased in size. Therefore, the value of this critical suction may be varied at will by the manufacture of the carburetor.

In carburetors having a compensating means, as shown, for example, in the patent to Francois Baverey No. 907,953, of December 29, 1908, the flow of fuel from the calibrated plug *i* and consequently from the cap nozzle *h* does not reach a condition of constancy until the calibrated plug is no longer covered with fuel in the well. While the calibrated plug is covered with fuel, the flow from the calibrated plug and the cap nozzle follows exactly the same law as the flow from an ordinary suction controlled nozzle connected to the constant level chamber by a passage sufficiently large to offer practically no restriction to the fuel flow. When the calibrated plug of such a carburetor is no longer covered by fuel in the well, the point of constancy or point of compensation is reached. When the fuel in the well is further lowered so as to permit air to flow into the compensating or cap nozzle along with the fuel, the critical suction or point of emulsion is reached.

The present invention has for certain of its objects improvements in the operating characteristics of carburetors of the general character set forth, whereby the disturbance created by the bad spots produced at the critical suction or point of emulsion is much less detrimental, thereby improving the mixture delivered by the carburetor to all of the cylinders throughout the entire operating range of the carburetor.

In the accompanying drawings there are shown, for purposes of illustration only, certain preferred embodiments of the present invention, it being understood that the drawings do not define the limits of our invention, as changes in the construction and operation disclosed therein may be made without departing either from the spirit of the invention or the scope of our broader claims.

In the drawings:

Figure 1 is a vertical sectional view through a carburetor of the general type illustrated in the Baverey patent referred to, but having our invention incorporated therein;

Figure 2 is a view similar to Figure 1, but illustrating a modification of the invention; and

Figure 3 is a view similar to Figures 1 and 2, illustrating the invention as applied to a carburetor of the general construction embodied in said Heftler application.

Referring more particularly to Figure 1 of the drawings, the invention is based broadly on increasing the value of the suction at which the critical suction or point of emulsion is reached. This is obtained by materially increasing the vertical distance between the plane of discharge of fuel from the nozzle into the carburetor passage or chamber and the point where air is admitted into the fuel stream, this increase being accomplished without disturbing the flow values or relations required for efficient operation. In accordance with the embodiment of our invention as illustrated in this figure, there is provided a carburetor having a carburetting passage 2 with a venturi 3 and a controlling throttle 4. There is a main suction controlled feed nozzle 5 receiving fuel from a constant level chamber 6 through a suitable conduit 7, and also a cap nozzle or compensating nozzle 8 receiving fuel from an atmospheric well 9. The connection between the atmospheric well and the compensating nozzle may comprise a U-shaped feed conduit 10, one leg of which may constitute a continuation, either actually or in effect, of the atmospheric well.

The atmospheric well is supplied with fuel from the constant level chamber by a calibrated plug 11 located intermediate the top of the well and the bottom of the conduit 10 and at a substantial point above the bottom of the conduit which may be considered as the effective bottom of the well. This insures the desired operating separation between the point of compensation of the carburetor and the critical suction or point of emulsion. The horizontal positioning and lateral delivery of the calibrated plug enables such an operation to be satisfactorily obtained.

To those skilled in the art it will be apparent that if the construction of the Baverey patent were changed merely by increasing the depth of the atmospheric well and at the same time lowering the calibrated plug feeding fuel to the well, as would ordinarily be done in such a case, the point of compensation and the point of emulsion would both be delayed. This would not be desirable, as a constant flow through the compensating nozzle is not obtained, as pointed out, until the point of compensation is reached and this point should not be unduly delayed. With the illustrated arrangement, however, the point of compensation is reached comparatively early in the carburetor operation, in accordance with the Baverey principle. From then on, true compensation is obtained and the critical suction or point of emulsion is delayed as much as desired, according to the depth of the U conduit.

In Figure 1 there is also shown an idling quill 12 delivering to the carburetor passage adjacent the throttle, as understood in the art. This quill preferably terminates a substantial distance above the top of the U conduit, as the extension of the quill to the effective bottom of the well would keep the idling feed in operation too long after the main fuel feeding nozzle has started delivery of fuel to the carbureting passage.

The termination of the quill as indicated and described presents another difficulty partially remedied by the construction of Figure 1. It may be assumed, for example, that the throttle is suddenly closed after the carburetor has been in operation for some time, which operation has been sufficient to empty the well to the bottom of the U conduit. Considerable time would then be required to fill the well to the lower end of the quill, and during that time the motor would not receive any fuel for the reason that the suction on the main and cap nozzles would be insufficient and the suction on the idling quill would draw in only air. This condition, however, is materially improved by making the portion of the well below the end of the quill, and here shown as comprising one leg of the conduit 10, of materially less cross-section than the remainder of the well. In this manner it is possible to greatly reduce the time required to build up the fuel level to the lower end of the idling quill.

In the embodiment of the invention illustrated in Figure 2, this last mentioned objection is entirely obviated. The general construction of this embodiment being similar to that of Figure 1, parts corresponding to parts already described are designated by the same reference characters, having a prime affixed thereto. In accordance with this form of the invention, a bushing 13 is located in the well 9′ at a point intermediate the effective length thereof and preferably adjacent the lower end of the quill 12′. By reason of this bushing, assuming an operation as already set forth, some air will be trapped in the lower portion of the well and U conduit, so that when the compensator 11′ delivers fuel to fill the well the fuel will pile up above the small opening in the bushing, whereby fuel will immediately be available for supplying the idling quill. In this manner the desired operative separation of the point of compensation and the point of emulsion is obtained without in any manner interfering with the operation of the idling nozzle.

Figure 3 illustrates a carburetor as disclosed in Figure 1, in which there have been incorporated certain additional features, as disclosed in the Heftler application set forth. In this form, in addition to the operating parts previously described, there is provided a supplemental conduit 14 communicating at one end with the well 9′ above the bushing 13, and at its other end delivering to a nozzle 15 which may be in the form of a cap nozzle surrounding the nozzles 5′ and 8′. By reason of this construction the point of emulsion is divided into two stages as represented by two different critical suctions. It will be obvious that comparatively early in the operation of the carburetor and before the idling quill has ceased the delivery of fuel, a critical suction will obtain such that the fuel will uncover the end of the conduit 14, whereby an emulsion will be delivered thereto. This emulsion, however, as produced by the variation from one critical speed to another will extend through only a comparatively small range of suction which cannot be maintained and almost immediately substantially pure air will be supplied to the nozzle 15. Furthermore, the quantity of fuel, emulsion or air delivered by the conduit 14 and nozzle 15 only constitutes a relatively small proportion of the total delivery to the carbureting passage as represented by the nozzles 5′, 8′ and 15, so that the resulting effect of the temporary emulsion is almost negligible.

After the first critical suction is passed, substantially pure air will be delivered by the nozzle 15, while nozzles 5′ and 8′ will both continue to deliver pure fuel until such time as a second critical suction value capable of uncovering the lower end of the conduit 10′ is reached. At this time there will be an emulsion delivered by the nozzle 8′ due to the simultaneous passage of air and fuel thereto from the atmospheric well or conduit 10′. This emulsion, as before pointed out, will however, only bear a small proportion to the combined delivery of all of the nozzles and will therefore, not seriously disturb the desired mixture conditions obtaining prior to the transition from substantially pure fuel to an air-fuel emulsion.

With all of the forms of the invention the construction is such that the point of constancy or point of compensation is obtained a very appreciable time before conditions are upset, even briefly, by the production of an emulsion which is obtained when the critical suction or point of emulsion is reached. This constitutes one advantage of the present invention.

A further advantage of the present invention arises from the provision of a carburetor and a method of feeding fuel by means of which the objectionable bad spots are so modified as not to impair the operating characteristics of the carburetor.

Further advantages arise from the provision of a carburetor which not only substantially eliminates noticeable bad spots, but which does not impair the other operating characteristics of the carburetor.

We claim:

1. In a carburetor having a constant level chamber and a carbureting passage, a venturi in said passage, an atmospheric well receiving a restricted amount of fuel from said chamber, a fuel feeding device adapted to deliver only fuel throughout the entire range of operation of the carburetor, a plurality of other fuel feeding devices adapted to separately receive fuel from said well at different levels and separately discharge the same within said venturi, a restriction in said well between the levels at which said last mentioned fuel feeding devices receive fuel therefrom, and an idling feed device positioned in said well and terminating adjacent said restriction, substantially as described.

2. In a carburetor, a carburetting passage, a suction fuel feeding means delivering fuel to said passage, a compensating fuel feeding means delivering fuel to said passage, an atmospheric well with which said compensating fuel feeding means connects by a passage intersecting the well at substantially the bottom thereof, a constant level chamber, and a calibrated fuel delivery means for delivering fuel from said constant level chamber to said atmospheric well, said calibrated means delivering fuel to said well at a point spaced from the bottom of the well a distance substantially as great as the difference between the plane of the fuel level in said constant level chamber

and the point of delivery of said calibrated means to said well.

3. In a carburetor, a carburetting passage, a suction fuel feeding means delivering fuel to said passage, a compensating fuel feeding means delivering fuel to said passage, an atmospheric well with substantially the bottom of which said compensating fuel feeding means connects, constant level chamber, and a calibrated fuel delivery means for delivering fuel from said constant level chamber to said atmospheric well, said calibrated means delivering fuel to said well at a point spaced from the bottom of the well a distance greater than the distance between the plane of the fuel level in said constant level chamber and the point of delivery of said calibrated means to said well.

4. In a carburetor, a carburetting passage, a suction nozzle therefor, a compensating nozzle therefor, an atmospheric well, said compensating nozzle receiving fuel from substantially the bottom of said well, and calibrated means delivering fuel to said well, said calibrated means being located a distance above the bottom of said well as great as its distance below the normal maximum level of fuel in said well.

In testimony whereof we have hereunto set our hands.

VICTOR R. HEFTLER.
HARRY B. NORRIS.