Aug. 6, 1940. E. G. ATKINS 2,210,055

CARBURETOR

Filed Feb. 4, 1938

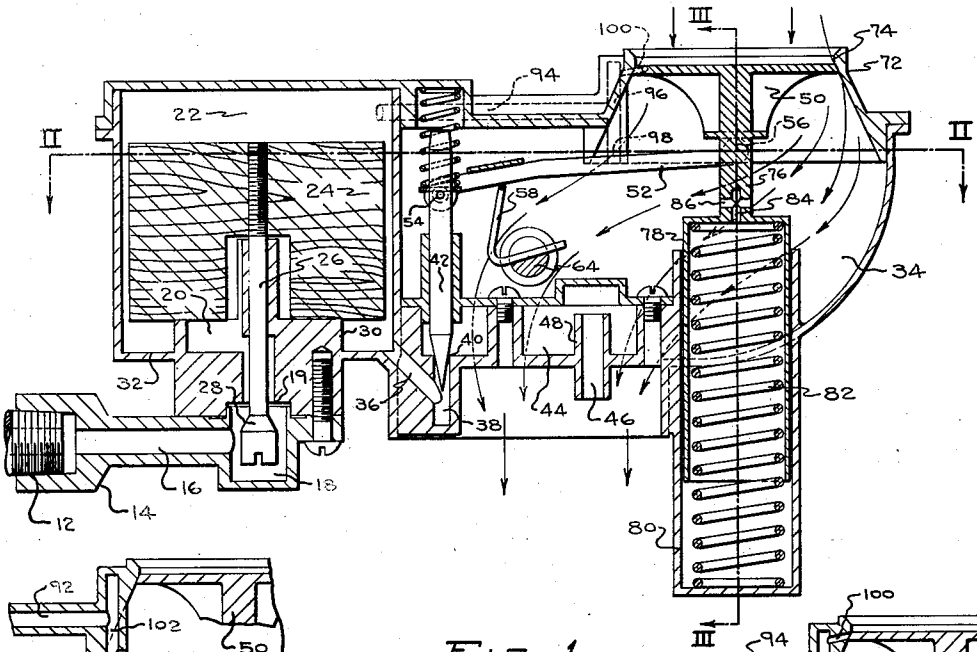


Fig. 1

Fig. 4

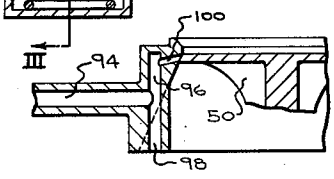


Fig. 5

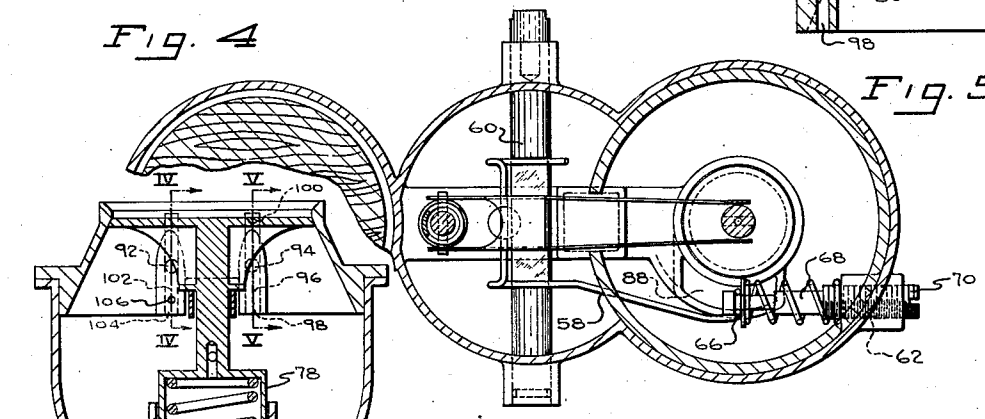


Fig. 2

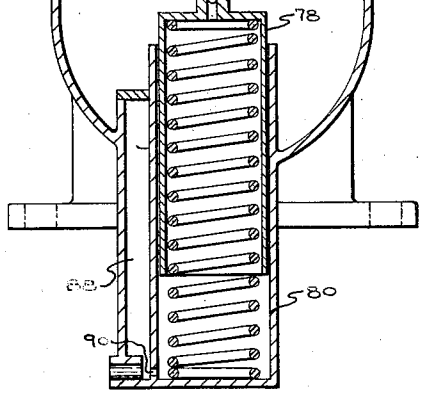


Fig. 3

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CARBURETOR

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Application February 4, 1938, Serial No. 188,628

4 Claims. (Cl. 261—72)

The present invention relates to improvements in carburetors for internal combustion engines of the so-called "self-lifting" type and constitutes an improvement upon my copending application, Serial No. 79,701, filed May 14, 1936.

As in the case of my copending application, one of the objects of the present development is to provide a carburetor of a self-lifting type which is characterized by the absence of any intermediate or auxiliary structure or machanism for assisting the delivery of the fuel from the fuel tank to the carburetor, yet is capable of giving the efficiency and performance experienced in carburetors now in general use. Carburetors of the aforesaid type have long been desired by the automobile industry for the reason that the expense and difficulties connected with the fuel pumps now being extensively used for lifting the fuel and delivering the same to the carburetor may be eliminated. However, up to the present time self-lifting carburetors have not enjoyed any wide commercial use because of the fact that their efficiency and performance throughout the full range of operation have not been as satisfactory as carburetors of conventional design. Flooding is one difficulty that has been experienced. Unsatisfactory performance at low speed, as well as reduction in high speed when compared with conventional carburetors, can also be mentioned. While in most self-lifting carburetors satisfactory performance has been secured during the intermediate operative range, difficulties have been experienced in the ranges of operation on both sides thereof.

For the most part, the above difficulties are contributable to the inability to maintain the correct differential in the vacuum existing between the float chamber and the mixing chamber. In the present invention flooding has been eliminated through an arrangement whereby upon engine stoppage the gas level in the float chamber is lowered through gravity return into the fuel tank. For securing satisfactory performance and economy throughout the entire range of operation in the carburetor, I have provided novel means for establishing and maintaining the correct differential in vacuum between the float chamber and the mixing chamber.

One object of the invention is to provide a carburetor of the type disclosed in which the liquid level of the float chamber during the operation of the carburetor is above the inlet nozzle feeding into the mixing chamber with an arrangement whereby upon engine stoppage the fuel level in the float chamber is lowered, preferably by gravity return into the fuel tank.

Another object is to provide a novel arrangement for maintaining the correct differential in vacuum existing between the float and mixing chambers under the control of an air valve having proportional operation with the usual throttle valve.

Another object resides in provision of a carburetor of the type described having one or more vents leading between the float chamber and the mixing chamber which have their effectiveness regulated through the movement of the air valve.

Further objects of the invention reside in the specific construction and arrangement and combination of parts resulting in the simplicity and reduction in cost of manufacture of the carburetor disclosed in the present invention over that disclosed in my copending application.

Referring to the drawing,

Fig. 1 is a vertical cross-sectional view taken on the longitudinal center line of my improved carburetor,

Fig. 2 is a cross-sectional view taken on the line II—II of Fig. 1,

Fig. 3 is a cross-sectional view taken on the line III—III of Fig. 1,

Fig. 4 is a fragmentary cross-sectional view of a vent structure taken on line IV—IV of Fig. 3, and

Fig. 5 is a view similar to Fig. 4 of another vent structure taken on line V—V of Fig. 3.

The principles of my invention have been illustrated in a carburetor of the down-draught type, the air cleaner connection at the top and the connection to the throttle valve at the bottom being omitted from the showing.

Reference character **10** generally designates the carburetor structure, which may be fabricated from several suitable die castings assembled in any conventional manner. The fuel line **12**, extending rearwardly to the fuel tank conventionally located at the rear of the vehicle and at a lower level than the carburetor, is shown coupled to the fuel inlet connection **14**. Incoming fuel passes through the conduit **16** into the valve chamber **18** having an outlet **19** communicating through one or more conduits **20** with the interior of the float chamber **22**. A float **24** having a stem **26** and a valve head **28** functions to regulate the outlet **19** to control the flow of fuel into the float chamber **22**. The opening of the passage **20** into the float chamber **22** is through a circular wall structure **30** having the upper

edge thereof a considerable distance above the bottom 32 of the float chamber 22. In its lower position the float 22 is supported upon the walls 30, as illustrated in Fig. 1. It therefore follows that when the level in the float chamber 22 is sufficient to float the float 24 closing the outlet 19, the level will be above the wall 30. As the valve 28 moves as a unit with the float 24, the sub-atmospheric pressure in the float chamber acting upon the valve 28 causes the float to ride higher in the fuel than would otherwise be the case. As the fuel tank is located below the carburetor, especially in the case of a down-draught carburetor, when the vacuum is broken in the carburetor upon engine stoppage the float will be insufficient to hold the valve 19 fully closed and the difference in elevation between the fuel tank and the carburetor will cause the fuel in the line 12 to return to the tank by gravity returning from the float chamber 22 all fuel above the upper level of the walls 30. It will be appreciated that the head of fuel in the line 12 will reduce the pressure upon the valve 28 below atmospheric in assisting the removal of the valve from its seat. Through this arrangement any tendency to flood the carburetor due to the level of gas in the float chamber is avoided by arranging the inlet nozzle to the mixing chamber, as will be hereinafter more fully described, at or slightly above the level of the walls 30.

Fuel is metered into the mixing chamber 34 by passing downwardly through the conduit 36 opening into a valve chamber 38 having an outlet 40 which is adjustably closed by a needle valve 42. Depending upon the position of the valve 42 with reference to its seat in the outlet 40, the fuel passes into the chamber 44 where it overflows into the inlet nozzle 46 after the level has reached that of the wall 48, the wall 48 and the wall 30 preferably being at substantially the same level. As shown, the inlet nozzle 46 is tubular in shape and of substantially greater cross-sectional area for the passage of fuel than the area of the outlet 40 with the needle valve 42 in the position shown. This fact, in addition to slight air leaks around the valve 42 and the cover plate for the chamber 44, prevents any tendency for the fuel below the wall 30 in the fuel chamber to be syphoned out upon engine stoppage.

As is the usual practice in self-lifting carburetors, the needle valve 42 is actuated through movement of the air valve 50, which is connected to the needle valve 42 through a lever 52 pinned to the valve 42 at 54 and contacting the valve 50 at its opposite ends 56. The lever 52 has an adjustable fulcrum 58, which is supported upon the choke shaft 60 and has adjustment relative to the end of the lever 52 through the adjustment mechanism broadly designated at 62. A portion of the fulcrum 58 rests upon an eccentric portion 64 of the shaft 60, and upon rotation of the shaft 60 by suitable choke mechanism (not shown) the fulcrum 58 is lifted vertically, carrying with it the needle valve 42 to draw in a rich mixture of fuel into the chamber 34. At its outer end 66 the fulcrum 58 is connected to an adjustment screw 68 having a head 70 to receive a screw driver for adjusting the fulcrum 58 along the lever 52 so as to vary the lift of the needle 42 upon movement of the air valve 50.

The air valve 50, which seats within the conical connector 72 to completely close the opening 74 therein, has a stem 76 which is connected to a cylinder 78 operating in the dash pot 80. Preferably, the cylinder 78 is hollow to receive an elongated spring 82 designed to offer the desired resistance to opening the air valve 50 and very little built up in resistance upon opening movement of the valve 50. The dash pot 80 is ported into the chamber 44 so that the same level of fuel will exist in the dash pot 80 as in the chamber 44. Upon sudden opening of the valve 50 resulting from the throttle valve (not shown) being suddenly thrown full open, a certain amount of fuel will be pumped out through the ports 84 and 86 into the mixing chamber 34 to provide the desired acceleration. To avoid an abnormal withdrawal of fuel from the chamber 44 upon sudden opening and closing of the throttle valve which will impart similar action to the air valve 50, a reservoir 88 is provided at one side of the dash pot 80 and communicates therewith through a port 90. Upon sudden closing of the air valve 50 the fuel is drawn into the dash pot 80 from the reservoir 88, rather than directly from the chamber 44, which might have the effect of lowering the level of the chamber 44 below the wall 48 and momentarily interrupt the flow of fuel through the nozzle 46 into the mixing chamber.

The broad principle of operation of the present carburetor construction is similar to that of my copending application, as well as being similar to the general scheme of operation of carburetors of this type. The fuel is lifted into the float chamber 22 through one degree of vacuum established therein, while through the creation of a higher degree of vacuum in the mixing chamber the fuel from the float chamber is caused to flow into the mixing chamber by being metered past the needle valve 42. One of the novel features of the present invention resides in the manner in which the desired vacuum is maintained in the float and mixing chambers. As should be readily understood, at the time the throttle valve is slightly opened the air exhausting action of the engine will have the immediate effect of creating a vacuum in the mixing chamber 34. If there is communication between the mixing chamber 34 and the float chamber 22, a vacuum will likewise be created in the float chamber. This reduction of pressure in the float chamber will have the effect of lifting fuel from the fuel tank into the float chamber, from which it will be delivered into the mixing chamber either by gravity or by maintaining a higher vacuum in the mixing chamber than in the float chamber.

From the standpoint of operation, it is only necessary that the degree of vacuum in the float chamber 22 be sufficient to lift from the fuel tank into the float chamber 22 under all operating conditions an adequate supply of fuel to be fed from the float chamber 22 into the chamber 44 by gravity and differential vacuum. With reference to the degree of vacuum in the mixing chamber 34, it is desirable that the vacuum be sufficient to deliver through the outlet nozzle 46 amounts of fuel directly proportional to the operation of the air valve 50. While in theory it might appear to be most desirable to maintain a substantially uniform differential in vacuum between the chambers 22 and 34 throughout the full range of operation of the carburetor, in practice it has been found desirable to have a slightly increasing degree of vacuum in the chamber 34 as the throttle goes from fully closed to fully opened positions. If efficiency is to be obtained, however, it is necessary that the increase in vacuum of the chamber 34 be controlled within definite limits, or otherwise a too rich mixture of

fuel and air will result. According to the present invention, I have provided one or more by-passes between the float chamber 22 and the mixing chamber 34, which are under the control of the air valve 50. In the drawing I have shown two by-passes 92 and 94 extending between the float chamber 22 and the conical connector 72. The by-pass 94 opens into a transverse passage 96, which has an opening at 98 into the chamber 34, as well as a ported bleeder passage 100 opening through the seat defining portion of the connector 72 closed by the valve 50. When the valve 50 is in a closed position, the ported passage 100 is closed. As more clearly shown in Fig. 4, the passage 92 opens into a passage 102, which opens at 104 into the chamber 34, a bleeder port being provided at 106 into the passage 102.

The desired differential in vacuum existing between the chambers 22 and 34 is considered to be obtained in the following manner as a result of the above described construction: The spring 82 tends to hold the air valve 50 closed. As the engine is cranked to start the same, the idling position of the throttle valve (not shown) will cause a mixture of air and fuel to be exhausted from the chamber 34, reducing the pressure therein to below atmospheric. Air and fuel vapors will also be exhausted from the chamber 22 through the by-passes 92 and 94 and openings 98 and 104. This will bring about a raising of the fuel level in the chamber, whereby the fuel can flow by gravity into the chamber 44 in addition to being drawn by the differential vacuum, as the valve 42 is never completely closed and is always sufficiently cracked from its seat for starting and idling purposes. As the by-passes 92 and 94 are relatively small in cross-sectional area, there is a tendency for a slightly higher vacuum to exist in the mixing chamber 34 than in the fuel chamber 22 with the air valve 50 closed or substantially so. As the throttle valve is opened, reduction in pressure within the chamber 34 becomes sufficient to lower the air valve against the action of the spring 82. Movement of the valve 50 opens the bleeder passage 100 to reduce the exhausting effect that the opening 98 would normally have upon the chamber 22 through the by-pass 94. Preferably, the passage 100 is so located that the air is actually deflected into the same by the air valve 50 upon its initial opening movement. Obviously the location and size of the passage 100 may be varied to accomplish the results desired. Shown substantially below the passage 100 is a second bleeder passage or port 106 opening into the passage 102. As the air valve 50 travels downwardly as the throttle valve is opened wider, air entering the mixing chamber will be deflected by the air valve 50 into the bleeder port 106 to reduce the exhausting effect of the passages 92 and 102 upon the chamber 22. As in the case of the passage 100, the size and location of the bleeder port 106 may be varied to meet desired conditions. Moreover, in some cases a single bleeder arrangement will be found adequate, while in others more than the pair herein illustrated may be desired. In effect, through the bleeders 100 and 106 I have obtained the equivalent action of a variable exhaust port between the fuel chamber 22 and the mixing chamber 34. I fully anticipate that the present disclosure will readily suggest other arrangements to those skilled in the art. Accordingly, I do not desire to be limited to the specific construction shown but wish to claim broadly one or more fixed exhaust ports having their effectiveness varied in relation to the throttle valve operation.

It is to be understood that although the fuel is syphoned out of the chamber 22 and returned to the fuel tank when the engine stops, adequate provision has been made to assure prompt starting of the engine. The fuel reserve in the chamber 22 below the level of the wall 30 is immediately available upon the existence of the differential in the vacuum between the chambers 22 and 34. At the same time the tension of the spring 82 is such in practice as to support in the order of a fifty inch column of fuel, and as the valve 28 is fully open upon starting, this substantial reduction in pressure below atmospheric causes a prompt and vigorous lifting of the fuel into the chamber 22.

The exhaust ports 98 and 104 may be extended, shifted or otherwise varied with reference to the air stream to alter the operation of the carburetor. In this manner the richness of the mixture may be varied in accordance with the degree of throttle opening; as, for example, a richer mixture may be desired during a certain range of operation where power at the expense of economy is required, or a change in mixture is required over a certain speed range or ranges, in order to give the desired performance.

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

1. In a carburetor of the type described, a fuel chamber, a mixing chamber, a conduit opening into said fuel chamber above the fuel level and extending to and opening into said mixing chamber, an air valve actuated by sub-atmospheric pressure in said mixing chamber and having a seat, a bleeder passage communicating with said conduit at a point spaced from the opening of said conduit into said mixing chamber, said bleeder passage having an orifice defined in said seat so as to be restricted by said air valve in a closed position, said bleeder passage with said air valve open reducing the exhausting capacity of said conduit, whereby the pressure differential between said chambers is altered in accordance with the operation of said air valve.

2. In a carburetor, a fuel chamber, a mixing chamber, a downwardly opening nozzle through which fuel flows by gravity communicating with said mixing chamber, a fuel inlet communicating with said fuel chamber, means for conducting fuel from said fuel chamber to said nozzle, said fuel inlet opening into said fuel chamber at a level not to exceed the level at which fuel is delivered to said nozzle for discharge by gravity, a reservoir for fuel defined below the level of said fuel inlet, a fuel line communicating with said inlet and adapted to extend to a fuel tank below said chamber, means defining a passage between said mixing chamber and said fuel chamber, a passage between said chambers opening into said fuel chamber above the fuel level therein for reducing the pressure in said fuel chamber to lift fuel thereinto through a fuel line, a fuel line connected to said fuel inlet, a valve so constructed as to open by downward movement regulating the flow of fuel through said fuel inlet into said fuel chamber, said inlet being open during the inactive period of the carburetor so as to permit the withdrawal of fuel from said fuel chamber back through said fuel inlet and fuel line, whereby flooding of the carburetor is avoided upon engine stoppage.

3. A down draft carburetor of the self-lifting type comprising a fuel chamber, means subject-

ing said fuel chamber to sub-atmospheric pressure during the active period of the carburetor, a mixing chamber, a fuel inlet opening into said fuel chamber above its bottom so as to provide a reservoir within said chamber below said inlet, a fuel nozzle located in said mixing chamber, a conduit for the passage and storage of fuel between said fuel chamber and said nozzle, said nozzle including a rim portion in said conduit defining an orifice opening downwardly for the downward discharge of fuel, said rim being at substantially the same level as said fuel inlet opening, a fuel line communicating with said inlet and adapted to extend to a fuel tank below said fuel chamber, a float valve for regulating the flow of fuel through said fuel inlet into said fuel chamber, said valve being so constructed as to open by downward movement and having a maximum restricting action during the active period of the carburetor with a reduced pressure in said fuel chamber, during an inactive period of the carburetor said valve having a minimum restricting action to enable fuel above said reservoir to be returned by gravity from said fuel chamber through said fuel line.

4. In a carburetor, a body having defined therein a fuel chamber, a mixing chamber, a fuel passage communicating below the liquid level in said fuel chamber and discharging into said mixing chamber, a valved air inlet passage to said mixing chamber through which substantially the entire air flow to said mixing chamber passes, means to maintain a substantially constant vacuum in said fuel chamber above the liquid level, a vacuum responsive air valve in said inlet passage, said vacuum being sufficient at all times to lift liquid fuel from a source of supply, but less than the vacuum in the mixing chamber at the outlet port of said fuel passage, said means comprising passages having calibrated ports connecting the top of said fuel chamber, said mixing chamber and the atmosphere, the port to mixing chamber being located on the mixing chamber side of said air valve so located as to be exposed to the normal vacuum in said mixing chamber, whereby the differential in pressure between said chamber is relatively uniform throughout the operating range of the carburetor, each of said ports comprising an orifice in fixed relation to said body.

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