Feb. 8, 1927. G. N. WILCOX

CARBURETOR

Filed Feb. 27, 1925

2 Sheets-Sheet 1

Fig. 1.

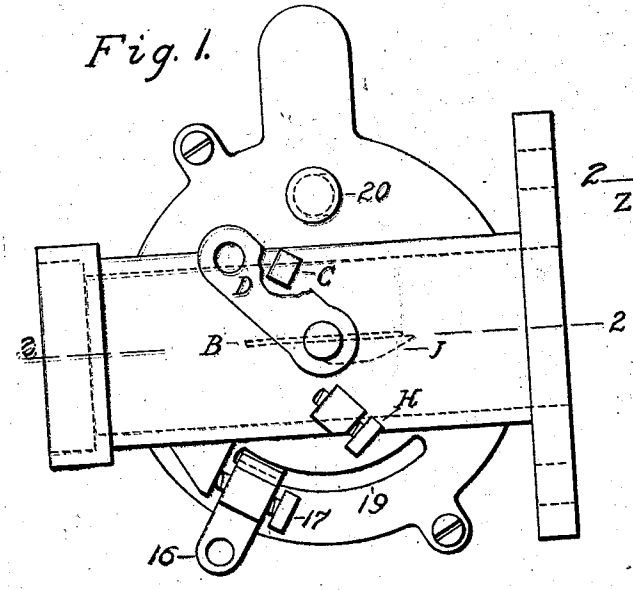


Fig. 3.

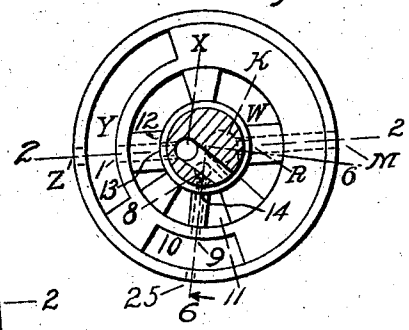


Fig. 4.

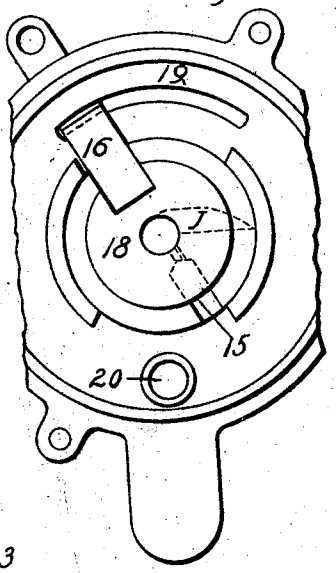


Fig. 2.

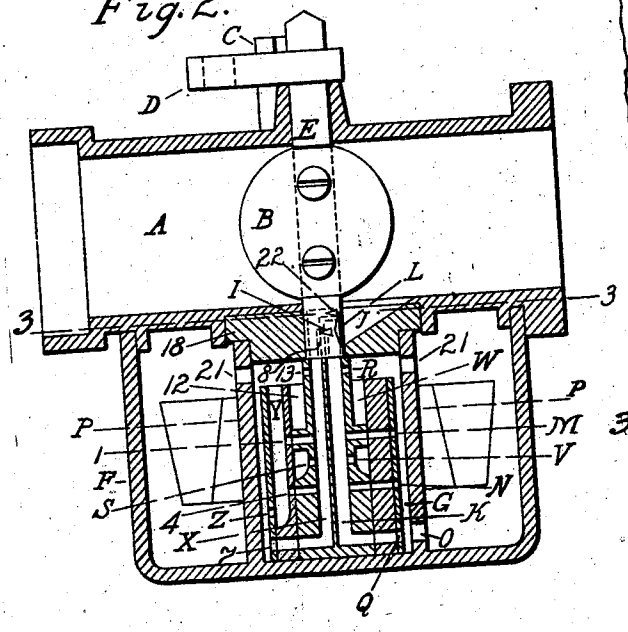
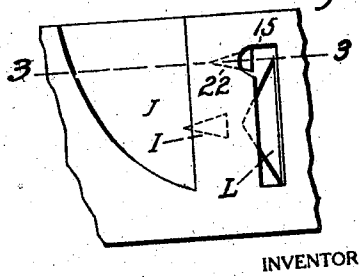


Fig. 5.



INVENTOR

George N. Wilcox

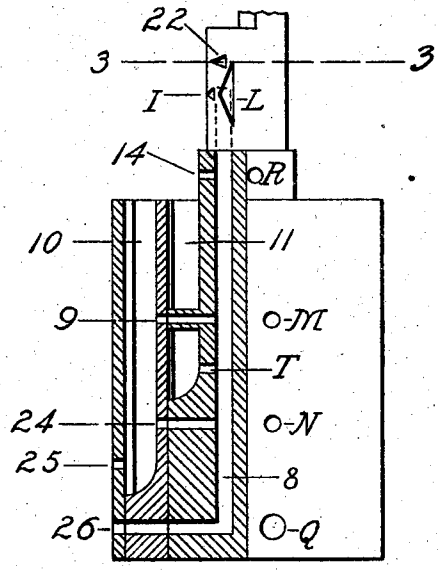
Feb. 8, 1927. 1,616,726

G. N. WILCOX

CARBURETOR

Filed Feb. 27. 1925 2 Sheets-Sheet 2

Fig. 6.



INVENTOR

George N. Wilcox

Patented Feb. 8, 1927. 1,616,726

UNITED STATES PATENT OFFICE.

GEORGE N. WILCOX, OF PRESTON, CONNECTICUT.

CARBURETOR.

Application filed February 27, 1925. Serial No. 12,089.

My invention relates to carburetors of the type which use no suction operated valve to let in air; and the objects are to so adapt and reorganize those known means of injecting the fuel on the engine side of the throttle that their inherent advantage of distinguishing between conditions of high speed and light load and low speed and heavy load without separate means for this purpose may be made available through a full and sufficient range, and no nozzle anterior to the throttle need be used, nor separate means moved by and with the throttle to reduce the mixture at low throttle.

In the accompanying drawings—

Figure 1 is a top view of a whole carburetor, showing how the throttle is opened in Fig. 2 beyond the preferred working limit to get a section that more clearly illustrates, and showing the lever 16 controlling the adjustable cut-off bushing 18. Figure 2 is a section taken on the lines 2—2, Figs. 1 and 3, and illustrates the relation of the wells, passages, throttle shaft and cut-off bushing. Figure 3 is a top view, to a scale twice that of Fig. 2, of the throttle shaft extension illustrating the wells and pockets as formed in and on the throttle shaft, with the shaft proper shown in section taken at the point on the shaft where it is cut by line 3, Figs. 2, 5 and 6, this section showing the layout of passages through the shaft. Figure 4 is part of a bottom view of the main body as with the float chamber and throttle shaft removed, and shows the cut-off bushing and the relief vent 15 to prevent leakage. Figure 5 is a view of a portion of the periphery of the throttle shaft and the covering surface of the cut-off bushing, shown as though these surfaces were unwound and laid out flat, showing a layout, shaping and proportioning of the terminal openings of the passages and the relief vent 15, about such as would be used in practice, and is four times the scale of Fig. 2. Figure 6 is a view of the throttle shaft extension, showing, mostly in a section taken at line 6—6, Fig. 3, the passage 8 and its attached pocket and well, and is to the scale of Fig. 3.

The main ideas may perhaps be best understood from a consideration chiefly of Fig. 2, in which A is the throttle throat, through which air passes from left to right. B is the disc of the common butter-fly throttle which is here shown opened to a position parallel with the center line of the throat. This is done because a view of the throttle shaft and attached parts which best shows how they are formed may thus be had; but in practice I prefer to stop down the greatest opening about thirty degrees, as indicated by the solid stop C and broken out lever D in Fig. 1. This does not mean that the range is that much less than in other carburetors, because the throat is enough larger so that the opening is still a little larger than the smallest point in the venturi of some standard carburetors for the same size engine. While I have not fully proven it, I think it is preferable to use the large throat and somewhat closed throttle, rather than a smaller throat and wide open throttle, at least with the form as shown.

The lower end of the throttle shaft E is extended down to the bottom of the float chamber F and well G, and in and on this shaft are formed the secondary or intermediate wells and acceleration pockets and passages.

In this application a well is defined as a compartment through which fuel passes, coming in at one opening and going out at another; and a pocket will be a compartment into which fuel backs through an opening and empties through the same one.

There is, in the case of an automobile carburetor, a range of throttle openings and accompanying speeds under constant resistance to traction; and each degree of opening of throttle has a speed range from the lowest to the highest that is possible at that throttle opening, and with a traction resistance, due to friction plus grade, if any, plus inertia, as great as the engine at that throttle opening can overcome, and the inertia part of which resistance decreases as the speed increases. At the lowest speed and wide open throttle the engine has its greatest force load, and should then have a mixture that will give the greatest pull. This is the richest mixture that is required, as measured by the rich and poor limits between which the engine is able to run, and not by actual proportions, whatever these may be. At this lowest speed and wide open throttle a certain quantity rate of air is going through, but there will be a certain condition of partly closed throttle and lighter load between which and wide open throttle

each degree of throttle opening will have an accompanying speed and load which will draw the same quantity rate of air as the lowest speed and wide open throttle. In general, such carburetors as have a nozzle anterior to the throttle do not distinguish between these conditions, without separate means for this purpose, such as a fuel valve which opens with the throttle, but each quantity rate of air is given a certain richness, whereas, a comparatively rich mixture should be had at low speed and wide open throttle, and a poorer one at the same air quantity rate with lighter load, higher speed and partly closed throttle.

When the throttle is in the idling position a small corner of the terminal opening I, of the passage 8, is open into the notch J, Figs. 2 and 5, and as the throttle is further opened opening 22, of passage X, and L of passage K, come into notch J, openings I and 22 remaining open and their passages 8 and X working with passage K in the wide open position. However, as all the openings of passages 8 and X are made comparatively small the effect which they add is not very material, but there is advantage in keeping them in action, as they can neither lag nor be found filled up on a sudden closing of the throttle.

In explaining the parts and their action I prefer to first assume that an automobile to which the carburetor is attached is running at high speed and wide open throttle. The largest passage K, whose terminal opening is shown at L, Figs. 2 and 5, will be in action by reason of the opening L being in registry with notch J, Fig. 1, 2, 4 and 5. Passages 8 and X will also be in action, but as they are the same in principle, what is said of K may be taken as applying to their combined effect, except where otherwise stated. In this condition the fuel in the well G will be lowered to a point below any of the openings M and N by reason of having to come through the restricted opening O from the float chamber by virtue of this drop in level below that of the float chamber, which is at the line P—P, and the fuel for passage K will all be coming into it through opening Q at the bottom; openings R, M, N and V will all be drawing air. Now with the throttle still held wide open, assume that a grade is encountered, slowing the engine by load slowly down to the lowest speed when gears have to be shifted. As this change takes place the fuel will be sucked out of well G at a slower rate, and the level in the well will gradually rise, covering first opening N and then M, making the mixture richer for the hard pull; and this covering of opening M which is higher than opening V, can take place without covering opening V, because the suction is sufficient to draw pocket W empty while the level in well G is kept up by what comes in at O, thus allowing opening V to be made large and openings M and N to be made small. The advantage in this is that in opening suddenly from a low speed with nearly closed throttle an extra pick-up dose is needed, which is taken in through opening V from pocket W, this being then full to the then high level of well G as opening L is then in cut-off position; this applies to pocket 12, but pocket 11 will be full only when the engine is stopped. This is momentary and not maintained. If the same opening were depended on for V and for M and the pick-up dose taken from the outer well, an opening M which is large enough to give sufficient pick-up might make the mixture too rich on a pull down to the same speed that it picked up from.

The air which is drawn in through any of the above openings will come into the well through openings 21. The principle of the effect of restricting these openings 21 is well known, but I prefer them large and unrestricted.

These elements in some form have been before used, if not in quite the same combination. The distinctively different action when using this combination opening at a properly varying rate on the engine side of the throttle, from using the so-called main nozzle anterior to the throttle, is, that if the throttle is held open so that the opening L is only say one third open, there will be a lesser suction at opening Q than if wide open under the same condition of load, but if opening L is wide open and by heavier load the engine is slowed till the suction at Q is the same, the combination of opening L and the throttle has the inherent capability of being proportioned by the shaping of opening L so that a different quantity rate of air may be coming in through the throttle than in the other case, thus distinguishing between a condition of somewhat closed throttle and higher speed, and a condition of open throttle and slow speed due to heavier load. Likewise, as between running on a smooth level road with the throttle in such a position as to allow only passages 8 and X to be in action, and running up such a grade wide open as will hold the speed down so that the air quantity rate is the same as in the other case, openings I and 22 may be so proportioned with relation to the throttle opening and the suction as to draw less fuel for the lighter load, and openings I, 22 and L with relation to the greater throttle opening and the lesser suction to draw more for the heavier load, whereas, any inspirating means working wholly by the suction anterior to the throttle cannot make this distinction, except possibly by the steady flow of air in the one case and the somewhat intermittent flow in the other, timing with the

piston stroke. This is not true of that part of the range taken care of by the nozzle anterior to the throttle in these other carburetors, as is evidenced by some of them using separate means worked by the throttle to effect a similar result. However, as this principle is inherent in the above-throttle idling passages in some of these carburetors, if the openings uncovered by the throttle are proportioned with this in view and no nozzle anterior to the throttle is used, I am not claiming this feature of itself.

When the throttle is closed enough so that opening L is completely closed, while these openings overlap and in the wide open position all work together, we may consider the second passage X separately, as has been done with K. As shown, the only difference between K and X is in the use of the intermediate well Y, Figs. 2 and 3, which takes in fuel from the outer well G through the opening Z, and the advantage of such a well is what might be called a vernier action, for with the smaller amount being used the level would not have drop enough to pass openings 1 and 4, or would be less controlling than the change of level from the unavoidable tilt of the automobile, or other inaccuracies of action; but as the fuel flows by gravity through opening Z the level must always be lower in the well Y than in the outer well G when the engine is running subject to the restriction of Z; or, on the other hand, if opening O were small enough to effect a sufficient drop for this case the maximum drop in level under wide open conditions would be too great and uncover openings Q and O. It will be seen that all the fuel for passage X does not come in through the intermediate well Y, but this passage has an opening 7, corresponding to opening Q on passage K, the intermediate well controlling only as to whether openings 1 and 4 get fuel or air. However, it will be seen that opening 4 will get some fuel till the level in the outer well G falls below opening Z.

Passage 8, well 10 and pocket 11 are shown in Fig. 6, mostly in the sectional part, which section is taken on the line 6, Fig. 3. Well 10 and pocket 11 correspond to Y and 12, on passage X, opening 14 corresponds to 13, 9 to 1, 24 to 4, 25 to Z, T to S and 26 to 7, and opening I corresponds to 22.

In the idling position the throttle will be but slightly opened from a position square across the throat, by the adjustment screw H, Fig. 1. In this position a very small corner of the first terminal opening I, Figs. 2 and 5, will be open to the notch J, Figs. 1, 2, 4 and 5, as the suction in this condition will be very high. The change in speed due to change in load will not be great with the throttle steady in this position, but the speed will of course be maximum for this position with no load. If the clutch is let in to start the vehicle from rest and the speed is slowed by the load thus applied, opening 9, Fig. 6, may be covered by the rise of the fuel in well 10, just as 1 in the second passage X, or M in passage K.

The object of openings R, 13 and 14, besides helping to atomize the fuel, is more particularly to reduce the equivalent height that the liquid must be raised by suction from the float chamber level to the throttle throat, as when the liquid is mixed with a small proportion of air it is as if the specific gravity were reduced, and the point the pure liquid must be lifted to is to the opening R, until V is uncovered. The proportion of this head to the total suction may be great at low suction compared to its proportion at the highest suction, making a very material increase in the richness at the high suctions.

The major proportioning of the mixture throughout the speed range of any set throttle opening is effected by the size and height of openings R, 13 and 14, and V, S and T, the lower the air opening the more does the gradation tend to be rich at the lower and poor at the higher speeds. This applies to V, S and T after the pockets are emptied. Openings M, N, 1, 4, 9 and 24 and wells Y and 10 should have only a minor and modifying effect, and it is only for the covering and uncovering of openings M and N that the partition forming the well G, and its restricted openings O are used, as no change of level in the space G is required for the other parts.

In testing the major parts and their action, wells Y and 10, and openings M, N, 1, 4, 9 and 24 being omitted, the sizes of the openings used were, in decimals of an inch: Q, .053; 7, .038; 26, .018; V, .070; S, .038; and .050; T, .038; R, .038; 13, .038; 14, .038. The diameter of opening O was $\frac{3}{32}''$ but was restricted by a needle-valve for adjustment, being opened $\frac{1}{16}''$ from seat. However, I do not favor the use of a valve adjustment in this opening, as a change of adjustment has more effect under open throttle conditions than under lower throttle conditions, when the other openings are proportioned in the preferred manner as indicated above. A restricted opening O was retained, though it is not necessary in this case; with a constant level in G, or with the addition of wells Y and 10, and openings M, N, 1, 4, 9 and 24, slight corrections might be necessary, but it is thought that it will be helpful to start from the above figures.

By reference to Figs. 4 and 5 it will be seen that I have provided a vent or relief opening 15 to more surely prevent the high suction of nearly closed throttle from drawing

any fuel from the openings L and 22 by leaking between the throttle shaft and its bearing if they are to loosely fitted or worn.

It will be seen from Figs. 2 and 4 that the lower throttle bearing containing the notch J is made as a separate bushing 18, which is adjustable in a rotary direction. Thus by moving the attached lever 16 by turning the stop screw 17, a greater opening of the first terminal opening I will be had in the idling position, and at each position of the throttle the total terminal openings will be somewhat greater. By suitable connections running from this lever to the dash, the bushing 18 may be swung through a large angle to give a wide opening for starting.

It will be seen that the lever 16, Figs. 1 and 4, comes, by an off-set, through a slot 19, in the main casting, and this slot would constitute a sufficient vent to the float chamber, even if a baffle were used to prevent slopping, but in case the bushing 18 were not used and the notch J were cut in the main casting, I have shown a separate vent 20, Figs. 1 and 4, as it is of importance to have a large vent for the benefit of the openings 21 into the well G. When no adjustable bushing 18 is used adjustment would generally be got by an adjustable vent into the throat on the engine side of the throttle, but as this is sometimes used with almost any type of carburetor, I have not thought best to illustrate its application here.

I claim:

1. In a carburetor, a constant level fuel chamber, a throttle throat, a throttle working therein, a throttle shaft exending into the fuel of the fuel chamber, a plurality of fuel passages leading from said chamber through said shaft and all gradually and successively opening at a varying rate into the throat with the opening of the throttle and on the engine side thereof, air openings into said fuel passages above the fuel level of the fuel chamber, and acceleration pockets connected with said passages.

2. In a carburetor, a constant level fuel chamber, a throttle throat, a throttle working therein, a well with an opening into it from the fuel chamber, a throttle shaft extending into the fuel in said well, a plurality of fuel passages leading from said well through said shaft and all gradually and successively opening at a varying rate into the throat with the opening of the throttle and on the engine side thereof, air openings into said fuel passages above the fuel level of the fuel chamber, and acceleration pockets connected with said passages.

3. In a carburetor, a constant level fuel chamber, a throttle throat, a throttle working therein, a well with an opening into it from the fuel chamber, a throttle shaft extending into the fuel in said well, intermediate wells formed on said shaft with openings into them from the first well, a plurality of fuel passages leading from said first well through said shaft, a notch in the bottom of the throat and the engine side of the lower throttle bearing at their intersection, terminal openings of said passages of varying width turning gradually and successively into registry with said notch with the opening of the throttle, air openings into said fuel passages above the fuel level of the fuel chamber, openings between said passages and said wells each below the highest working level of the well with which it connects, acceleration pockets formed on said shaft, and openings between said passages and said pockets to be closed against air by the fuel till the emptying of the pockets.

4. In a carburetor, a constant level fuel chamber, a throttle throat, a throttle working therein, a well with an opening into it from the fuel chamber, a throttle shaft extending into the fuel in said well, intermediate wells formed on said shaft with openings into them from the first well, a plurality of fuel passages leading from said first well through said shaft, an angularly adjustable lower throttle bearing, a notch in the bottom of the throat and the engine side of the lower throttle bearing at their intersection, terminal openings of said passages of varying width turning gradually and successively into registry with said notch with the opening of the throttle, a vent opening through the throttle bearing adapted to register with said terminal openings when they are in cut off position, air openings into said fuel passages above the fuel level of the fuel chamber, openings between said passages and said wells each below the highest working level of the well with which it connects, acceleration pockets formed on said shaft, and openings between said passages and said pockets to be closed against air by the fuel till the emptying of the pockets.

Feb. 23, 1925.

GEORGE N. WILCOX.