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CARBURETOR

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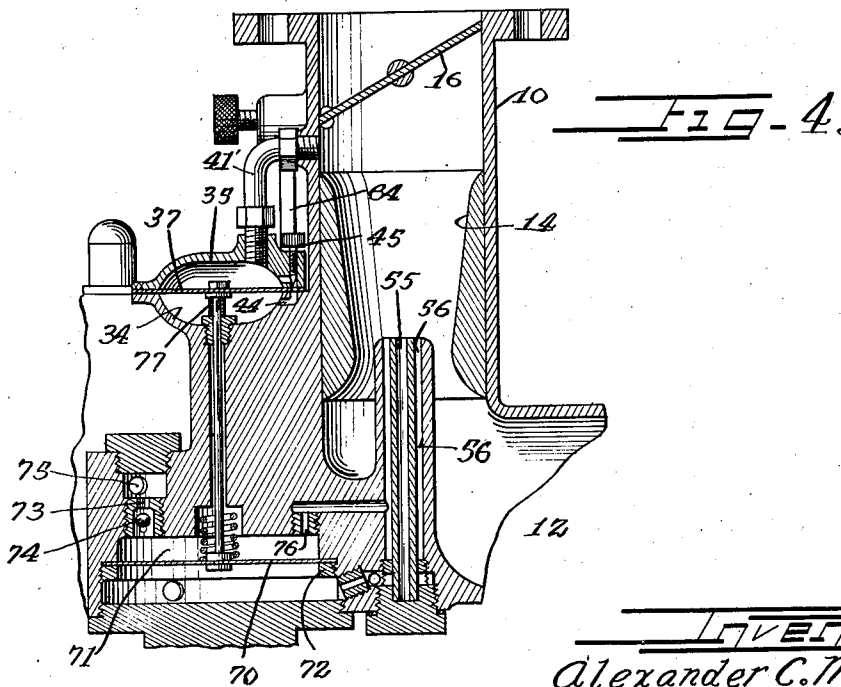
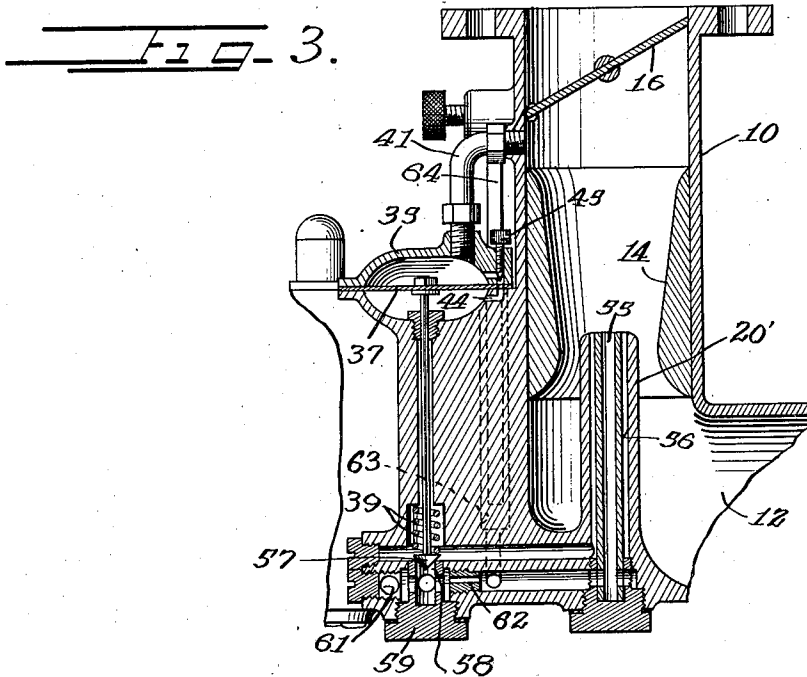
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CARBURETOR

Original application filed December 31, 1923, Serial No. 683,534. Divided and this application filed September 19, 1930. Serial No. 482,942.

This invention relates to carburetors for internal combustion engines and has special reference to accelerating fuel supply mechanism for producing a temporarily enriched fuel and air mixture following the opening of the throttle. The subject matter of the present application relates to a division of our copending application entitled "Carburetors", filed December 31st, 1923, Serial No. 683,534.

In carburetors it is usual to adjust the fuel metering system to provide an economical mixture for average driving conditions, providing a richer mixture for full power operating conditions and enrichening the mixture for accelerating purposes on more or less rapid opening of the throttle.

Where the economy setting is subject to throttle control, its arrangement or adjustment is, generally such that the throttle will give a fairly economical setting of the fuel regulating parts for the intermediate range of speeds, but will give a considerably richer mixture at approximately wide open throttle. The theory of this is that most driving is done at this intermediate throttle position (corresponding to approximately 20 or 25 miles per hour), and economy at this state is very saving in fuel consumption; while the requirement for an adequately rich mixture for loads is met by providing a richer mixture for the fuel open throttle position, so that when a temporary or sustained load is encountered, the desired increase in fuel ratio can be obtained by an opening of the throttle. Obviously, with such arrangement there is no economy obtained when driving under full open throttle, nor under restricted or slow speed throttle position, because the economy setting is confined to the intermediate throttle range. Moreover, an undesired diminution or increase in engine speed must always be corrected by appropriate movement of the throttle.

In the present invention we aim to obtain maximum economy at practically all throttle positions. This we obtain by providing means for proportioning the mixture in accordance with changes in throttle position and with changes in engine speeds. It is

well known by those acquainted with the problems of carburetion that throttle position and engine speeds do not bear a fixed or definite relationship to each other under all operating conditions. However, for utmost economy and proper engine performance, it is desirable that the mixture ratio be proportioned to correspond both to throttle position and to engine speeds. For example, in a carburetor in which the economy setting is governed by throttle position alone, if a greater load is suddenly thrown on the motor while operating under a lean economy setting, the speed of the motor drops off, whereupon the suction which is effective for atomization drops off, poorer atomization is obtained, and manifold condensation increases, with the result that the speed of the motor continues to diminish until corrected by change of throttle position. Mixture proportioning, by throttle control alone, is therefore not adequate. It is one of the principal objects of the present invention to correct the above condition by providing means which will automatically increase the ratio of fuel to air with a decrease in engine speed. Thus, in the above situation the carburetor will feed an increased volume of fuel to the air stream to a degree depending upon the rapidity at which the engine speed falls off. When the engine speed is restored to normal by this temporary enrichment of the mixture, the fuel regulating parts are restored to an economical setting, which setting can be for an extremely lean mixture because of the action of automatically enriching the mixture with any decrease in engine speed. According to a preferred method of practicing our invention, we first set the throttle at a certain position for predetermining a desired engine speed at which we wish to drive; then using this throttle position as a datum point the fuel flow is regulated to the end of obtaining a high degree of economy for that particular engine speed; and then this rate of fuel flow is automatically increased or decreased directly with any change of engine speed from the predetermined engine speed arrived at by the position of the throttle, so that with a decrease of engine speed the basic flow of

fuel is amplified, and for an increase in engine speed this basic flow is decreased. Thus, there is the tendency to automatically maintain the engine speed at a desired point predetermined by the setting of the throttle, with the attendant advantage of permitting a comparatively lean fuel setting for each engine speed.

The automatic function of increasing the fuel supply upon a decrease in engine speed at a given throttle position may be a sustained function, which is operative as long as the engine speed remains below its desired value; or this automatic enrichment may be a momentary function, operative for a short time period for the purpose of bringing the engine speed back to its desired value. That is to say, the automatic enrichment may be made to continue as long as the engine speed is below the predetermined rate, or the automatic enrichment may be merely momentary for a comparatively short period of time for the purpose of accelerating the engine speed to the desired rate. In the performance of this function the present mechanism operates as an accelerating device, and, in this aspect, our invention embodies improvements in accelerating devices.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a vertical sectional view of a carburetor embodying one form of the accelerating control mechanism of this invention.

Figure 2 is a similar view in which the accelerating control mechanism is applied to an air inlet or bleed to the fuel nozzle.

Figure 3 is a fragmentary sectional view illustrating a modified application of this method to the control of a supplementary fuel inlet.

Figure 4 is a view similar to Figure 3 wherein the mechanism is adapted to expel a supplementary supply of fuel for acceleration.

As shown on the drawings:

The structure common to the various figures comprises a carburetor body 10 embodying a float chamber 22, air inlet 12, and a mixture passage 13 containing a venturi 14, the passage 13 terminating in a mounting flange 15. The usual throttle valve 16 is provided in the passage 13.

The form of the invention illustrated in Figure 1 is designed to enrich the mixture temporarily upon opening of the throttle, or upon a falling off in engine speed. The fuel flow is from the float chamber 22 into the lower part 23 of a well 24. An accelerating

well sleeve 25 screws up into the well 24, this sleeve having a plurality of apertures 26 at graduated heights connecting the interior of the sleeve with the exterior chamber between the sleeve and the wall. The fuel is admitted into the interior of the sleeve 25 through a metering orifice 27, which is controlled by a metering pin valve 28. From the outer part of the accelerating well 24, the fuel and air is conducted through the transverse passage 29 opening into an annular passage 17 having outlets 18 into a secondary venturi 19. Air is admitted to the interior of the sleeve 25 through a passageway 31, opening into the upper part of the float chamber 22 through a metering plug 32. The orifice through this metering plug 32 bears a predetermined relation to the areas of the ports 26 so that a predetermined curve of compensation is secured.

The upper end of the metering valve 28 has adjustable threaded mounting in a flanged bushing 33, mounted in a diaphragm chamber 34. From the bushing 33, the stem of the valve 28, projects out through the top of the diaphragm housing cover 35, where it mounts a knurled head 36, by which the initial setting of the metering pin relative to the metering port 27 can be adjusted.

A diaphragm 37 divides the chamber 34 into upper and lower portions, being clamped between the lower surface of the housing cover 35 and the flat top of the carburetor casting. The bushing 33 extends down through a central aperture in the diaphragm, and is securely clamped to the diaphragm by a ring 38 which threads up against the under side of the diaphragm. A spring 39 is confined between the housing cover 35 and the top of the bushing 33, and this spring normally thrusts the lower end of the bushing 33 down against the bottom wall of the diaphragm chamber, this abutment defining a limiting stop for the travel of the bushing, relative to which all initial adjustments of the metering valve are made. A suction passageway 41 is extended down through the side wall of the carburetor chamber or mixture outlet through the diagonal passageway 42. This passageway 42 preferably opens into the interior of the carburetor at a point above the throttle 16. The lower end of the suction passageway opens into the diaphragm chamber 34 below the diaphragm 37, as indicated at 43. The lower area of the diaphragm chamber communicates with the upper area through a bleeding passageway 44, part of which is formed in the carburetor casting, and part of which is formed in the housing cover 35, the two portions of this passageway communicated through an opening in the diaphragm 37. A bleed adjustment screw 45 screws down through the housing cover 35 and registers with a portion of the duct 44 so that the effective area of this

duct can be readily adjusted to obtain any desired rate of bleed from one side of the diaphragm to the other.

The present design of carburetor shown is of the plain tube type, and hence this type of carburetor should preferably be provided with an idling jet discharging adjacent the lip of the throttle valve 16. To avoid complication, this idling jet is not shown, as it is an element which is well known to those skilled in the art.

In operation, the needle valve 28 would be given any desired adjustment for securing the proper rate of fuel feed to the main jets 18 during the intermediate and high running ranges of the engine. In the absence of any change in suction, resulting either from movement of the throttle, or a variation in engine speed, the needle valve 28 would retain this given setting under the action of the spring 39, forcing the bushing 33 down against the bottom of the diaphragm chamber 34. During this period of non-fluctuating suction, the suction effective in the intake manifold above the throttle 16 will be transmitted down through the passageway 41 into the diaphragm chamber 34 below the diaphragm. This suction, at first, tends to move the diaphragm 37 downwardly, but inasmuch as the bushing 33 is down hard against the bottom of the diaphragm chamber, no motion of the diaphragm 37 results. After the lower part of the diaphragm chamber has been subjected to the suction for a brief interval, the suction will have bled through the bleeding passageway 44 to the other side of the diaphragm 37. Assume now that the throttle is suddenly thrown open. The suction above the throttle immediately falls, and this diminished suction is instantly transmitted down through the passageway 41 to the under side of the diaphragm 37. Because of the restriction through the bleeding passageway 44, this reduced suction does not become effective upon the upper side of the diaphragm. Consequently, because of the higher degree of suction above the diaphragm, this diaphragm will be flexed upwardly for raising the metering valve 28, and permitting an increased flow of fuel to the jets 18 for producing the accelerating enrichment desirable upon the opening of the throttle. Gradually the reduced suction, which is effective below the diaphragm, will bleed through the passageway 44 and become effective upon the upper side of the diaphragm. This will result in the diaphragm and metering valve moving back to its original position. If, instead of a sudden opening of the throttle producing the diminution of suction in the manifold, this diminution should result from a dropping off of the engine speed without variation of the throttle position, it will be apparent that this same action will occur through

the transmission of this reduced suction below the diaphragm 37. This will momentarily raise the metering valve 28, as above described, to provide a richer fuel proportion for bringing the engine back to speed.

In Figure 2 we have illustrated one of these control units, which is temporarily unbalanced by change of suction, for controlling the air flow into the carbureting chamber. This air flow may be made to control the mixture proportion in various ways. For example, it may be employed to lean out the mixture without directly affecting the main fuel nozzle, or it may be vented into the fuel stream flowing up to the fuel nozzle, or it may be the air admitted to an air bleed accelerating well. An air passageway 47 opens into the top of an accelerating well 48, and also vents air into the fuel stream flowing up through the nozzle 20 through a plurality of ports 49 in the inner sleeve of the nozzle. Air is drawn from atmosphere or from a port adjacent the outer air horn of the carburetor through a passageway 51, from whence it passes through a metering plug 52, the outer end of which serves as a valve seat for the automatic controlling valve 53. This valve is actuated by a diaphragm 37, as described of the preceding embodiment, having a spring 39 normally tending to unseat the valve, and a thumb screw 54 by which the normal position of the valve may be shifted inwardly or outwardly relative to the seat plug 52. The suction conduit is through a tube 41'. For the purpose of illustrating another manner of effecting this automatic control, we have shown the tube 41' as entering the carbureting chamber below the throttle 16. Upon opening of the throttle, the higher suction, which will become instantly effective below the throttle, is transmitted down through the tube 41' to the inner side of the diaphragm 37, with the result that the diaphragm is drawn over to the left to seat the valve 53 or restrict the passageway to the plug 52, in order to diminish the air flow into the nozzle and thereby enrich the mixture momentarily. It will be apparent that the suction connection may be made at a point above the throttle, in this embodiment, by connecting the tube 41' to the outer part of the diaphragm chamber on the outer side of the diaphragm 37, and removing the stop screw 54.

In Figure 3 the above type of suction control unit is arranged for controlling an auxiliary supply of fuel which is supplementary to the main supply of fuel normally issuing from the main jet. The main fuel supply normally issues from a central tube 55 in a compound nozzle 20'. The supplementary fuel supply issues from an annular space 56 around the tube 55 in the nozzle 20'. The flow of fuel from the supplementary fuel passageway 56 is governed by a valve 57, 130

which, in turn, is controlled by the diaphragm 37. The valve 57 seats upon or controls the size of a port 58 passing up through a screw plug 59 screwing into the bottom of the carburetor. The fuel supply from the float chamber issues through a passageway 61 into a counterbore in which this plug 59 screws. From the counterbore, the fuel is conducted through a reducing or metering plug 62 to the main fuel supply duct 55. This main fuel supply duct may have communication with any suitable idling jet well 63, into which a tube 64 from the idling jet dips. This well 63 may be utilized to admit a compensating flow of air into the stream of fuel issuing from the main fuel duct 55.

Normally, the valve 57 is held seated, or in a restricting position, by the spring 39, but upon the flexure of the diaphragm 37, this valve is raised to permit the flow of the supplementary charge of fuel up through the outer passageway 56. This flexure of the diaphragm may be obtained from suction communication opening into the carburetor barrel at a point either above or below the throttle, in accordance with the embodiments hereinbefore described.

In Figure 4 we have illustrated the suction responsive element 37 as operating a piston or diaphragm for forcibly expelling the supplementary charge of fuel. This fuel expelling element is preferably in the form of a diaphragm 70 clamped across the bottom of a pumping chamber 71 by a ring nut 72. Fuel is supplied to this pumping chamber through a check valve plug 73 having a ball check 74 which moves upwardly and seats when the diaphragm 70 is flexed upwardly in a fuel expelling stroke. The float chamber 22 supplies fuel to the upper end of the check valve plug through the fuel passageway 75, the check valve 74 preventing the fuel being forced back into the float chamber when the pumping diaphragm 70 is actuated. Upon the pumping actuation of the diaphragm 70, the fuel is discharged through the metering plug 76 and up through the annular space 56 of the nozzle. The plug 76 meters any flow occurring through the nozzle space 56 during non-pumping intervals of the diaphragm. The diaphragm chamber 34 may be connected either with the suction channel 41 opening into the carbureting chamber above the throttle and into the chamber 34 below the diaphragm, as shown in Figure 1; or with the channel opening below the throttle and above the diaphragm, as shown in Figure 4. A spacing sleeve 77 may limit the downward motion of the two diaphragms.

It will thus be seen that we have invented improved carburetors embodying accelerating fuel supply systems responsive to engine demands and having a dwell period sufficient to maintain the accelerating fuel supply un-

til mixture conditions become stabilized at the increased volume of flow.

We are aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and we therefore do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

We claim as our invention:

1. In carbureting apparatus, the combination of a mixture passageway having air and fuel inlets, mixture proportioning means having a normal position and a mixture varying position, and actuating means comprising a suction responsive movable member for moving said mixture proportioning means to its mixture varying position, said mixture proportioning means automatically returning to normal position after a predetermined interval.

2. In carbureting apparatus, the combination of a mixture passageway having air and fuel inlets, mixture proportioning means having a normal position and a mixture enriching position, actuating means responsive to change of engine suction for moving said mixture proportioning means to its mixture enriching position, and means responsive to the change of suction for automatically restoring said mixture varying means to normal position.

3. In carbureting apparatus, the combination of a mixture passageway having air and fuel inlets, means for enriching the mixture upon change of suction from one degree to a different degree, and means for automatically restoring said enriching means independently of the continuation of the suction in said latter degree.

4. In carbureting apparatus, the combination of a mixture passageway having air and fuel inlets, means for varying the mixture proportion, a chamber, a diaphragm bisecting said chamber, means operatively connecting said diaphragm with said mixture varying means, a duct connecting one side of said chamber with said mixture passageway, and a restricted by-pass between the two sides of said chamber around said diaphragm.

5. In a carbureting apparatus, the combination of a mixture passageway having air and fuel inlets, pneumatically operated means for forcibly discharging fuel into said mixture passageway, and means for automatically restoring said pneumatically operated means after a predetermined time interval.

6. In a carbureting apparatus, the combination of a mixture passageway having air and fuel inlets, means for projecting fuel into said passageway upon change of suction from one degree to a different degree, and means for automatically restoring said

latter means to normal position independently of the continuation of the suction in said latter degree.

7. In a carbureting apparatus, the combination of a mixture passageway having air and fuel inlets, accelerating means for pumping fuel into said mixture passageway, operating means for actuating the latter upon change of engine speed, and means for automatically restoring said pumping means to normal position after a predetermined interval.

8. In combination, a carbureting chamber having a throttle therein, a fuel inlet discharging into said chamber, a constant level supply chamber, a fuel passageway between said supply chamber and said fuel inlet, said passageway comprising a well having a sleeve therein, said sleeve having a plurality of air ports therein, means for admitting air to the upper end of said sleeve, a fuel metering port controlling the inflow of fuel to said sleeve, a metering pin controlling said port, a diaphragm chamber having a diaphragm therein connected to said metering pin, a suction duct leading from said carbureting chamber to one side of said diaphragm chamber, and a restricted by-pass connecting both sides of said diaphragm chamber.

9. In combination, a carbureting chamber having a throttle therein, a fuel passageway discharging into said chamber, an air duct opening into said fuel passageway, a valve controlling said air duct, a diaphragm chamber having a diaphragm therein connected to said valve, and a suction conduit connecting said carbureting chamber with one side of said diaphragm chamber.

10. In combination, a carbureting chamber having a throttle therein, a fuel supply chamber, a fuel passageway supplied therefrom and discharging into said carbureting chamber, a metering restriction in said fuel passageway, a valve operable to admit a supplementary discharge of fuel to said carbureting chamber in shunt of said restriction, a diaphragm chamber having a diaphragm therein connected to said valve, a suction duct between said carbureting chamber and one side of said diaphragm chamber, and a restricted by-pass connecting both sides of said diaphragm chamber.

In testimony whereof, we have hereunto subscribed our names at Chicago, Cook County, Illinois.

ALEXANDER C. MABEE.
CAMERON A. WHITSETT.