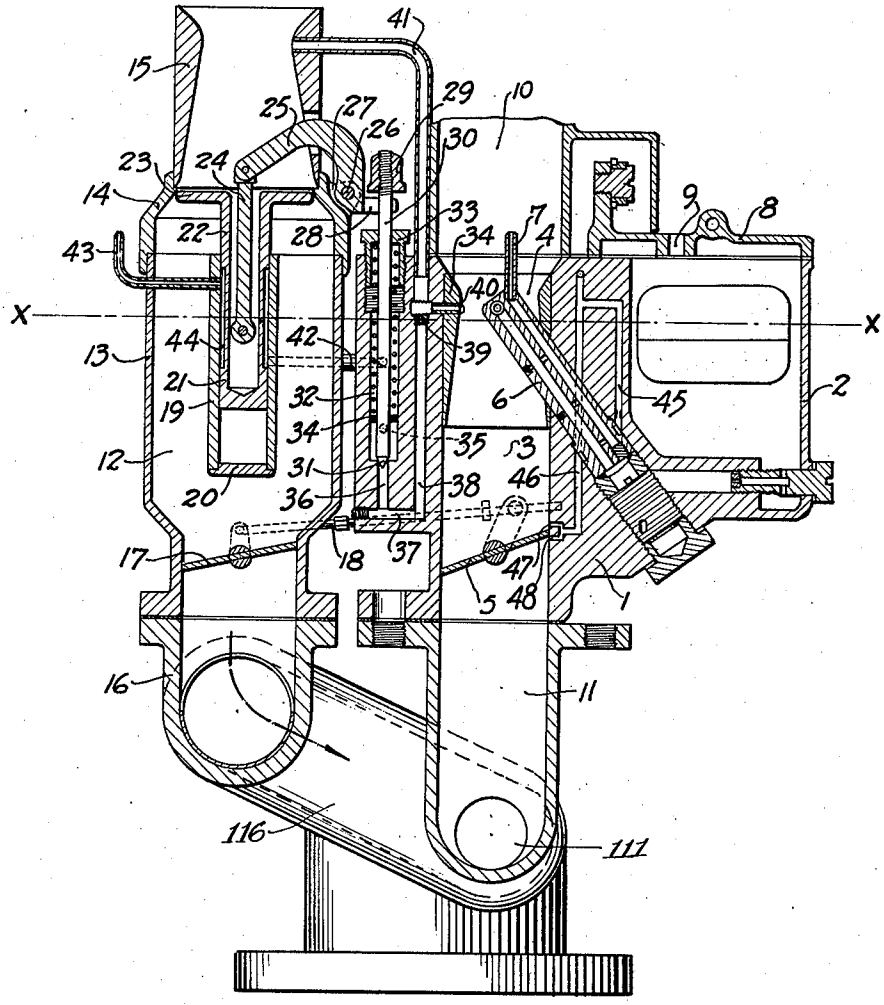
July 21, 1936. M. E. CHANDLER ET AL 2,048,428

CARBURETOR

Filed Dec. 4, 1930



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Patented July 21, 1936 2,048,428

UNITED STATES PATENT OFFICE

2,048,428

CARBURETOR

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Application December 4, 1930, Serial No. 499,862

17 Claims. (Cl. 261—41)

This invention pertains to carburetors for internal combustion engines and more particularly has reference to what is known as "cold" carburetors which are characterized by the feature that the liquid fuel is not delivered as a combustible fuel-air mixture through the main air intake passage but in the form of a very rich emulsion of fuel and air through an auxiliary passage which discharges it closely adjacent to the intake valves of the engine.

It is well known in the carburetor art that if liquid fuel is mixed with air in combustible proportions in the mixing chamber of the carburetor and then drawn in through the intake manifold of the engine a certain amount of liquid fuel condensation takes place on the walls of the manifold as long as the temperature of the manifold is below the dew point of the liquid fuel under the pressure conditions prevailing in the manifold. This condensation causes an impoverishment of the fuel-air mixture which results in irregular firing and lack of power in the engine.

This trouble is particularly pronounced when the engine is running at slow speed with the throttle nearly closed. To overcome this difficulty two general solutions have been proposed. First, to supply external heat to the intake manifold so as to raise and maintain its temperature above the dew point of the liquid fuel. This heat is usually supplied from the exhaust gases from the engine by causing them to circulate through a jacket surrounding the intake manifold. This is the "hot" carburetion method and is attended with two principal disadvantages: first, difficulty of properly controlling the amount of heat supplied to the intake manifold under varying conditions; and second, the lack of available heat for the manifold when starting the engine cold.

The second general solution to prevent fuel condensation in the manifold, and to insure the supply of a positive and uniform mixture at the engine cylinders is to deliver the fuel as an emulsion, or very rich mixture, of liquid fuel and air through a relatively small conduit separate from the main intake manifold and to then dilute it to a proper combustion ratio at the entrance to the cylinder by mixing it with air in controlled proportions. This is the method of "cold" carburetion and has the advantage of delivering proper mixtures to the engine without the aid of external heat. Such an arrangement in a somewhat different form is disclosed in Patent No. 1,796,902 of Wilford H. Teeter. The principal disadvantage of the cold carburetors previously proposed is the difficulty of synchronizing and balancing the plurality of fuel metering jets that have always been employed. Thus, prior to this time, it has been the practice to employ a separate fuel metering jet for each pair of cylinders of the engine and if these jets are not synchronized and balanced, the running of the engine is irregular and unsatisfactory.

An object of this invention is to devise a cold carburetor for multi-cylinder internal combustion engines in which all of the liquid fuel is metered from a single jet.

Another object of our invention is to provide a cold carburetor in which the metering of the liquid fuel is controlled by a drop in pressure in the main air passage which carries no fuel.

Still another object of our invention is to devise a cold carburetor comprising means for maintaining a flow (pressure differential) through the fuel duct when the main throttle is suddenly opened for acceleration.

A still further object of our invention is to provide a cold carburetor in which the main air passage and the fuel duct are each controlled by throttle, these throttles being so interconnected that varying degrees of lead or lag with respect to each other may be obtained by adjustment of the connecting means.

With these and other objects in view which may be incident to our improvements, our invention consists in the combination and arrangement of parts hereinafter described and illustrated in the accompanying drawing which shows in vertical section a carburetor embodying our invention.

Referring to the drawing the reference numeral 1 denotes the main body of the carburetor which contains a float chamber 2 and a primary barrel 3 in which latter is located a Venturi throat 4, throttle 5, and main jet nozzle 6 having an air bleed 7. Secured to the top of body 1 is a float chamber cover 8 having an air vent 9, and a primary air intake pipe 10, while bolted to the bottom of body 1 is the primary mixture passage 11 having a horizontal portion 111 which conducts the liquid fuel emulsion to its corresponding engine cylinder (not shown).

The reference numeral 12 denotes the secondary barrel of the carburetor which consists of a cylindrical body portion 13 surmounted by a reduced portion 14 which carries a secondary Venturi throat 15 opening to atmosphere at its top. Body 13 of the secondary barrel 12 is reduced near its lower end and is attached to an outlet 16 which has a transverse portion 116

which extends into alinement with portion 111 of the primary mixture passage 11, so that the primary mixture is discharged concentrically into passage 116 closely adjacent the cylinder of the engine (not shown). The control of the air flow to outlet passage 16 is effected by a secondary throttle valve 17 which is connected to primary throttle 5 by an adjustable link 18 so that the opening and closing of each throttle can be adjusted with reference to the other. The secondary barrel 12 is rigidly secured to primary barrel 3 by any suitable means (not shown) as will make the two function as a unitary structure.

Fixedly held in the center of secondary barrel 12 by suitable spider arms is a cylinder 19, closed at its lower end by a cap 20, which functions as a dash pot for a piston 21 which reciprocates therein. Piston 21 is integral with the stem 22 of air valve 23 which seats upon the reduced portion 14 of secondary barrel 12 and regulates the admission of air thereto. Stem 22 is hollow and accommodates a link 24 which is pivotally connected to stem 22 and to an arcuate arm 25 which is pivotally mounted at 26 upon a pair of ears 27 integral with member 14. Extending horizontally from arm 25 is a bifurcated lug 28 which is arranged to engage head 29 on stem 30 of a valve 31 so as to lift said valve whenever air valve 23 opens by a predetermined amount. The lag and throw of valve 31 is regulated by the position of head 29 which is screw threaded on stem 30 and movable for this purpose.

Valve stem 30 is mounted in a well 32 in body 1 by means of a guide sleeve cap 33 which is screw threaded into body 1 at the top of well 32. Stem 30 near its lower end carries a transverse pin 34 which not only serves to guide the stem but also serves as a base for a helical spring which surrounds the stem and is interposed between pin 34 and cap 33 so as to normally keep valve 31 closed unless retracted by the opening of air valve 23 as indicated above. Well 32 communicates near its lower end with an inlet passageway 35 which leads from float chamber 2 and keeps well 32 constantly supplied with liquid fuel. At the bottom of well 32 is an outlet passageway 36 which communicates throughout passages 37 and 38 and metering restriction 39 with secondary nozzle 40 which feeds into primary venturi 4 at a point of greatest suction opposite the outlet of primary jet nozzle 6. Nozzle 40 also communicates with the secondary venturi 15 through a suction passage 41 which leads from the metering restriction 39 to the zone of greatest suction in Venturi throat 15.

Well 32 also communicates with cylinder 19 through a passageway 42 and supplies cylinder 19 with liquid fuel from well 32. This liquid fuel collects in the bottom of cylinder 19 and retards the movement of piston 21 which fits somewhat loosely in cylinder 19 so that the liquid therein can be displaced sufficiently to permit limited and slow movement of the piston. In this manner the fluctuation or chattering of air valve 23 is prevented.

In order to establish atmospheric pressure on the top of the liquid fuel in well 32 and to provide a suitable vent for this well so that the movement of piston 21 will not disturb the liquid fuel therein, there is provided a venting passageway 43 which leads from near the top of cylinder 19 to the outside atmosphere. Also stem 22 of air valve 23 is reduced so as to form an annular channel 44 in cylinder 19 which serves to maintain communication between passages 42 and 43.

The idle fuel feed is by way of passages 45 and 46 to the ports 47 and 48 which lies astride of the primary throttle when it is in closed position. The operation of our improved carburetor is as follows:

When the carburetor is not operating (engine at rest) the static level of liquid fuel is as indicated by the line X—X. It is to be particularly noted that this static level is below the point of juncture of passages 45 and 46 of the idle feed and below the outlet ports of primary and secondary nozzles 6 and 40, hence there can be no dripping or waste of liquid fuel when the engine is not operating.

When the engine is started the primary and secondary throttles 5 and 17 are in the closed position shown in the drawing. Suction below throttle 5 through port 48 and passageway 46 lifts the fuel level in passage 45 until it reaches the juncture of passages 45 and 46 after which liquid fuel will continue to flow as long as this suction is exerted. After the suction has ceased the flow will continue by syphon action until the first air bleed hole in main nozzle 6 is uncovered. This will provide a small priming charge for subsequent starting but is too small to flood the carburetor or waste fuel. When it is desired to speed up the engine the primary throttle is first opened, and after it has reached a predetermined degree of opening, the secondary throttle commences to open. This is accomplished by the adjustable link 18 which connects these two throttles by which the main throttle 5 can be given any desired lead with respect to secondary throttle 17. Also it is to be noted that the operating lever of secondary throttle 17 is much shorter than that of primary throttle 5. Hence for any given movement of the accelerator pedal (not shown) the secondary throttle will open a greater proportionate amount than the primary throttle. Thus, even though primary throttle 5 starts to open first and has an initial lead over secondary throttle 17, the two will reach full open position together.

As soon as primary throttle 5 is moved a few degrees away from its closed position the suction on ports 47 and 48 decreases so that fuel feed therethrough ceases. At the same time the suction in the primary barrel 3 above throttle 5 has increased to such an extent that the primary jet from main nozzle 6 comes into action.

Since the main nozzle 6 is of relatively large size as compared to the primary barrel 3, as throttle 5 is opened a point is soon reached when a proportionately greater amount of fuel is flowing than air. This would result in an over-enrichment of the mixture were it not diluted by secondary air before it reached the cylinders of the engine. Such dilution is accomplished by commencing the opening of secondary throttle 17 at this point. This causes a suction in secondary barrel 12 which unseats valve 23 against the tension of spring 32 and also lifts valve 31 and permits fuel to flow from float chamber 2 into passage 38 up to the metering restriction 39. It is to be particularly noted that, while adjustable head 29 permits some opening of valve 23 before valve 31, if desired, once contact is established between lug 28 and head 29, valve 31 opens at once without any considerable further movement of valve 23.

Hence, no attempt is made to meter or control the amount of flow of liquid fuel through passages 37 and 38 and nozzle 40. This control is

effected by the suction through tube 41 which is created by and is proportional to the air flow through secondary venturi 15, acting in conjunction with metering restriction 39.

In other words, when once air flow through secondary barrel 12 has reached a point where valve 31 is unseated, the flow of supplementary fuel from nozzle 40 is proportional to the air flow through barrel 12. Before valve 31 is opened, the air flowing through barrel 12 simply dilutes the mixture flowing through barrel 3. As throttles 5 and 17 are further opened the increased flow of air through barrel 12 would overdilute the mixture flowing through barrel 3 if some means were not employed to supply additional fuel to that which is supplied by main nozzle 6. This additional fuel is supplied by secondary nozzle 40 in proportion to the additional air flow through barrel 12. As the outlet from barrel 3 is about half the size of the outlet from barrel 12, when the two throttles 5 and 17 are wide open, approximately four times the amount of air will flow through barrel 12 as through barrel 3. There is thus accomplished a dual feed to the cylinders of the engine consisting of a highly enriched mixture or emulsion from primary barrel 3 and a relatively greater volume of diluting air from secondary barrel 12. In this way condensation of fuel on the walls of the intake manifold is reduced to a minimum and the necessity for supplying external heat to the intake manifold is obviated.

As cylinder 19 is kept constantly supplied with liquid fuel from well 32 through passageway 42, it functions as a dash pot for piston 21 and exerts a retarding and steadying action on valve 23 and eliminating all chattering and irregular motions thereof. The vent 43 and channel 44 supply atmospheric pressure to the liquid fuel column in cylinder 19 and well 32 so that the suction through tube 41 acting on metering restriction 39 is balanced against atomspheric pressure and the slight movements of piston 21 do not disturb the flow through nozzle 40.

While we have shown and described the preferred embodiment of our invention, we wish it to be understood that we do not limit ourselves to the details of construction disclosed as these may readily be changed and modified by those skilled in the art without departing from the spirit of our invention or exceeding the scope of the appended claims.

We claim:

1. In a carburetor for multi-cylinder internal combustion engines, a primary barrel and a secondary barrel, means for supplying to said primary barrel under low suctions air and liquid fuel in proper proportions to form a correct explosive mixture, means for supplying additional fuel to said primary barrel under higher suctions to form a rich emulsion of air and liquid fuel, means for supplying to said secondary barrel under said higher suctions diluting air to form with said emulsion a correct explosive mixture, and a gravity fuel well having a valve controlled by said last named means.

2. A carburetor having a mixture-forming and feeding device and an air-feeding device arranged side by side, a fuel well between said devices communicating with the mixture-forming device and provided with a control valve, and an air valve for the air-feeding device connected and arranged to actuate said control valve.

3. A carburetor having a mixture-forming and feeding device and an air-feeding device, a fuel reservoir having a passage for delivering fuel to the mixture-forming device, a fuel well between said devices communicating with said passage and provided with a control valve, and an air valve for the air-feeding device connected and arranged to actuate said control valve.

4. A carburetor having a downwardly opening mixture chamber provided with a venturi having a fuel jet opening therein and provided with a throttle valve below the venturi, a downwardly-opening air passage beside said chamber having a throttle valve at its bottom and a yieldingly mounted air valve at its top, means for concurrently operating the two throttle valves, and a fuel reservoir having an outlet passage emptying into said jet and opening above the jet into the air passage above the air valve.

5. A carburetor having a downwardly-opening mixture chamber provided with a venturi having a fuel jet opening therein, a downwardly-opening air passage beside said chamber having a yieldingly mounted air valve at its top, and a fuel reservoir having an outlet passage emptying into said jet and opening above the jet into the air passage above the air valve.

6. In a down-draft carburetor for multi-cylinder internal combustion engines, a primary mixture passage adapted to be connected to an engine, means for supplying a rich emulsion of liquid fuel and primary air to the said primary mixture passage, a secondary passage also adapted to be connected to the said engine, means including a pressure responsive valve for separately supplying to said secondary passage diluting air in proper proportions to form an explosive mixture, and means for metering said liquid fuel in accordance with the rate of air flow through said primary passage and the position of said pressure responsive valve.

7. In a carburetor for multi-cylinder internal combustion engines, a primary mixture passage adapted to be connected to an engine, means for supplying a rich emulsion of liquid fuel and primary air to the said primary mixture passage, a secondary passage also adapted to be connected to the said engine, pressure responsive means for separately supplying to said secondary passage diluting air in proper proportions to form an explosive mixture, a fuel well positioned between said passages, including a valve controlling said fuel well and operably connected to said pressure responsive valve and means for metering said liquid fuel in accordance with the rate of air flow through said secondary passage.

8. In a carburetor for multi-cylinder internal combustion engines, a primary mixture passage adapted to be connected to an engine, means for supplying a rich emulsion of liquid fuel and primary air to the said primary mixture passage, a secondary passage also adapted to be connected to the said engine, means including an air valve for separately supplying to said secondary passage diluting air only, in proper proportions to form an explosive mixture, a fuel well positioned between said passages, and means for metering liquid fuel to the primary passage in accordance with the position of said air valve and the rate of air flow through said primary and secondary passages, respectively.

9. In a down-draft carburetor for multi-cylinder internal combustion engines, a primary mixture passage, means for supplying primary air to the primary mixture passage, a secondary passage, means including an air valve for separately supplying diluting air to said secondary passage,

and means including a valve controlled fuel well positioned between said passages for introducing liquid fuel into said primary air at a rate varying with the rate of air flow through said primary and secondary passages.

10. A carburetor having a primary mixture passage, a secondary air passage adjacent and parallel to the mixture passage, a venturi in each of said passages, interconnected throttle means in both of said passages, a fuel reservoir, a fuel well positioned between said passages and communicating with the reservoir, valve means for controlling the flow of fluid into said fuel well, a fuel jet positioned in the venturi of the mixture passage and communicating with the fuel well, a suction duct interconnecting the fuel duct and the secondary passage, a suction responsive air valve positioned in the secondary passage, and connecting means between the said valves.

11. A carburetor having a primary mixture passage, a secondary air passage adjacent and parallel to the mixture passage, a venturi in each of said passages, interconnected throttle means in both of said passages, a fuel reservoir, a fuel well positioned between said passages and communicating with the reservoir, valve means for controlling the flow of fluid into said fuel well, a fuel jet positioned in the mixture passage and communicating with the fuel well, and a suction duct positioned in the venturi of the secondary passage and communicating with the fuel jet.

12. A carburetor having a primary mixture passage, a secondary air passage adjacent and parallel to the mixture passage, a venturi in each of said passages, interconnected throttle means in both of said passages, a fuel reservoir, a fuel well positioned between said passages and communicating with the reservoir, valve means for controlling the flow of fluid into said fuel well, a fuel jet positioned in the venturi of the mixture passage and communicating with the fuel well, a suction duct interconnecting the fuel duct and the secondary passage, a suction responsive air valve positioned in the secondary passage, connecting means between the said valves, a dash pot operably connected with said air valve and communicating with the fuel reservoir, and means to vent the dash pot.

13. A carburetor having a primary mixture passage, a secondary air passage adjacent and parallel to the mixture passage, a venturi in each of said passages, interconnected throttle means in both of said passages, a fuel reservoir, a fuel well positioned between said passages and communicating with the reservoir, valve means for controlling the flow of fluid into said fuel well, a fuel jet positioned in the mixture passage and communicating with the fuel well, a suction duct positioned in the venturi of the secondary passage and communicating with the fuel jet, a suction responsive air valve positioned in the secondary passage, connecting means between the said valves, a dash pot operably connected with said air valve and communicating with the fuel reservoir, and means to vent the dash pot to maintain the same fuel level therein as is maintained in the fuel reservoir.

14. In a carburetor a primary passage adapted to supply a rich charge of fuel and air, a secondary passage adapted to supply diluting air, a manifold communicating with the primary and secondary passages, a fuel well positioned between said passages, a manually adjustable valve yieldingly urged in one direction to control the fuel level in the fuel well, primary means to supply fuel to the primary passage, auxiliary means operably connected to the fuel well to supply fuel to the primary passage, valve means controlling the entrance of air to the secondary passage, and connecting means between said valve means and the manually adjustable valve operable to actuate the adjustable valve when said valve means is actuated.

15. In a carburetor a primary passage adapted to supply a rich mixture of fuel and air, a secondary passage adapted to supply a quantity of diluting air to the primary passage, a fuel well positioned between said passages, a manually adjustable valve yieldingly urged in one direction to control the fuel level in the fuel well, primary means to supply fuel to the primary passage, auxiliary means operably connected to the fuel well to supply fuel to the primary passage, valve means controlling the entrance of air to the secondary passage, connecting means between said valve means and the manually adjustable valve operable to actuate the adjustable valve when said valve means is actuated, and means responsive to the rate of air flow through the secondary passage to increase the rate of fuel flow through the primary passage.

16. A down-draft carburetor having a primary passage, a secondary passage, means for supplying fuel and air to the primary passage communicating with the primary passage, interconnected throttle valves in the primary and secondary passages, means independent of the primary passage to admit air to the secondary passage, an air valve controlling the admission of air to the secondary passage, a dash pot for retarding opening movements of the air valve but constructed to exert no closing effect on said valve, and a spring operable to move the air valve toward the closed position independently of the dash pot.

17. A down-draft carburetor having a primary passage, a secondary passage, a manifold communicating with the primary and secondary passages, means for supplying fuel and air to the primary passage, interconnected throttle valves in the primary and secondary passages, air inlet means for the secondary passage independent of the primary passage, an air valve controlling the admission of air to the secondary passage, a dash pot for retarding opening movements of the air valve but constructed to exert no closing effect on said valve, a spring operable to move the air valve toward the closed position independently of the dash pot, and means operable upon movement of the air valve to supply an increased quantity of fuel to the primary passage.

MILTON E. CHANDLER.
DON COLE.

CERTIFICATE OF CORRECTION.

Patent No. 2,048,428. July 21, 1936.

MILTON E. CHANDLER, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, lines 37-38, claim 16, strike out the words "communicating with the primary passage" and insert the same after "passage" second occurrence, in line 36, same claim; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of July, A. D. 1937.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.