Jan. 30, 1934. A. J. E. ROUALET 1,945,462

CARBURETOR

Filed Feb. 27, 1931

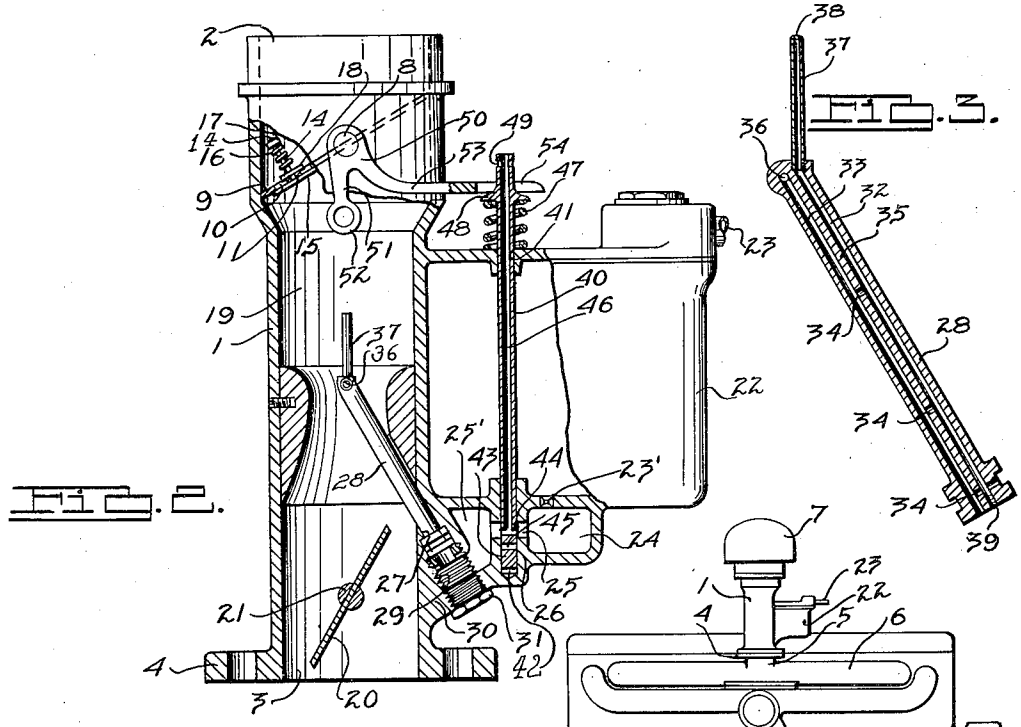


Fig. 2.

Fig. 3.

Fig. 1.

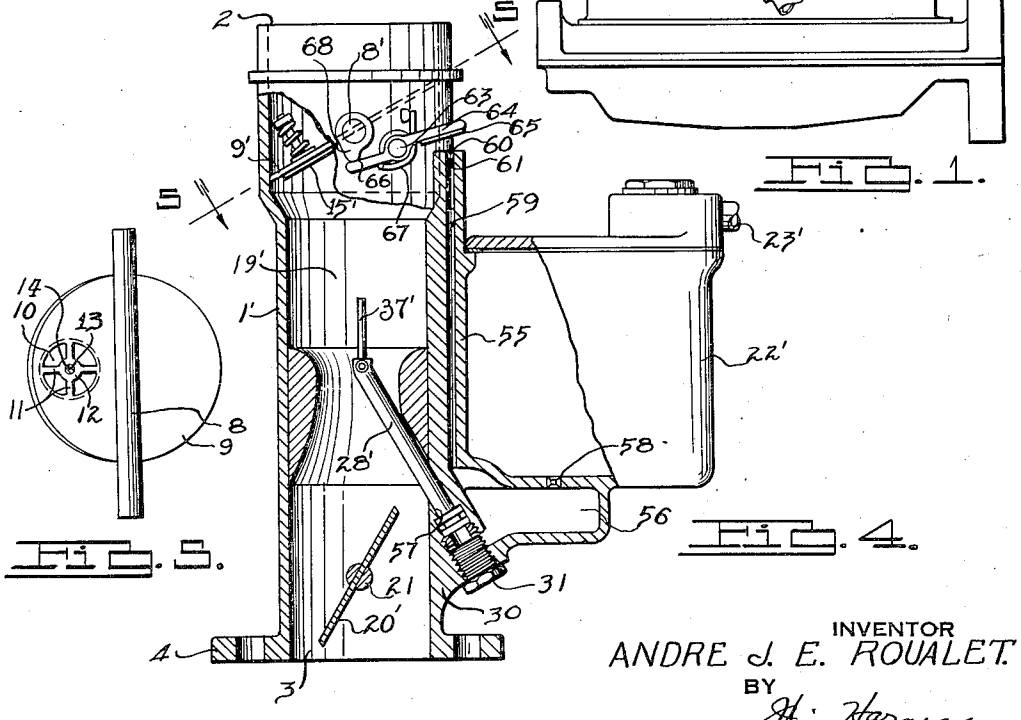


Fig. 4.

Fig. 5.

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Patented Jan. 30, 1934 1,945,462

UNITED STATES PATENT OFFICE

1,945,462

CARBURETOR

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Application February 27, 1931. Serial No. 518,608

10 Claims. (Cl. 261—50)

This invention relates to an improved carburetor and particularly to improved means in a carburetor for conditioning it for starting.

In starting an internal combustion engine, it is common practice to substantially close the inlet through which air is supplied to the carburetor so as to augment the suction at the outlet or nozzle of the fuel system and to reduce the quantity of air supplied to the carburetor. This results in the formation of a fuel mixture of greater fuel content than that required for normal operation. In carburetors having air bled nozzles, particularly of the type known as "differential nozzles", such closing of the choke valve, cuts off the supply of air to the air bleed of the nozzle and as a result, the starting fuel mixture is poorly atomized and in some cases, it is fed to the manifold and combustion chamber of an engine substantially in a liquid stream. This is also true of nozzles which are not air bled, for with a closed choke, there is insufficient air flow in the mixing chamber to properly atomize the fuel during starting.

Equally as serious difficulties are encountered in metering the fuel system of a carburetor to produce a predetermined starting mixture at one time and a predetermined running mixture during normal operation, for these two mixtures differ greatly in fuel content. The difference in the degree of vacuum created by cranking and that existing during normal running of an engine prevents accurate predetermining of the fuel content of the starting and normal running mixtures in a carburetor of conventional construction which employ the same fuel metering orifice for producing the starting and normal running fuel mixtures.

The main objects of this invention are to provide means in a carburetor for air bleeding the fuel system when the choke is closed for starting so as to atomize the starting mixture; to provide means of this kind which will not disturb the normal predetermined running fuel mixture during normal operation of an engine; and to provide means for changing the liquid fuel metering characteristics of the fuel system so as to condition the carburetor for accurately producing one fuel mixture for starting and another materially different fuel mixture for normal operation of an engine.

Other objects of the invention are to provide an auxiliary air inlet to the mixing chamber for predetermining the air factor of the starting fuel mixture while the fuel is metered when the choke of the carburetor is closed during starting; to provide an auxiliary air inlet of this kind which is controlled by the suction in the mixing chamber of the carburetor so as to proportion the air supply during starting with the fuel supplied by the carburetor suction; and to provide air controlling means of this kind which is adapted to regulate the air supply to the mixing chamber of a carburetor when the choke is only partly open during the warming up stage which follows starting of the engine.

An illustrative embodiment of the invention is shown in the accompanying drawing, in which:

Fig. 1 is a side elevation of an internal combustion engine which is equipped with my improved carburetor.

Fig. 2 is a vertical section of a carburetor which embodies my invention.

Fig. 3 is an enlarged central section of the fuel nozzle included in Fig. 2.

Fig. 4 is a view similar to Fig. 2, but showing a carburetor which embodies a modified form of the invention.

Fig. 5 is a plan view of a choke valve which is employed in my improved carburetor.

In both forms shown in the drawing, a down draft carburetor is illustrated, but substantially the same starting mixture producing apparatus may be applied to a conventional up draft carburetor without changing the main features of the invention. The carburetor illustrated in Fig. 2, includes a tubular structure 1 having a direct passage which is provided at its upper end with an end air inlet 2 and at its lower end with a fuel mixture outlet 3. The outlet end 3 of the tubular structure 1 has a radial flange 4 by which it is mounted on a neck 5 of an intake manifold 6, as shown in Fig. 1, with the outlet 3 communicating with the intake manifold. Mounted on the inlet end of the tubular structure 1 is an air cleaner 7.

A shaft 8 which carries a butterfly type choke valve 9 extends transversely of the tubular structure 1 and is located in close proximity to its inlet end. This valve is of conventional construction and it is provided with an aperture 10 across which radial ribs 11 extend. The ribs 11 are integrally joined at the center of the aperture 10 by a small disc 12 having an opening 13 through which a valve stem 14 passes. Formed on the lower end of the valve stem 14 is a valve plate 15 which is normally held against the lower side of the choke valve by a spring 16 that bears between a collar 17 on the upper extremity of the valve stem and a washer 18 that is seated upon

the upper side of the disc 12. The spring 16 yieldably holds the valve 15 in a closed position.

Located at the opposite end of the mixing chamber 19 is a butterfly type of throttle valve 20 which is carried by a shaft 21 that extends transversely of the tubular member 1 and is rotatably mounted in the walls thereof.

The carburetor has a fuel system which includes a fuel reservoir 22 having an inlet 23 which is controlled by conventional float actuating valve mechanism (not shown). The reservoir 22 is formed integral with the structure 1 and its interior communicates with a fuel chamber 24 through a metering orifice 23' n the bottom wall of the reservoir. The fuel chamber 24 connects with a transverse fuel passage 25 that is formed in a partition 26 between the fuel chamber 24 and an adjacent fuel chamber 25'. Formed in the wall of the tubular structure 1 is a passage 27 that communicates with the fuel chamber 25' and in which is mounted an air bled fuel nozzle 28. The nozzle 28 has an enlarged head on its lower end which is received in an opening 29 of a web structure 30 that is integral with the side wall of the tubular structure. The lower end of the opening 29 is closed by a cap screw 31 which may be conveniently removed to permit removal and replacement of the nozzle.

The air bled nozzle 28 is of conventional construction and it extends diagonally into the mixing chamber 19. This nozzle is provided with a pair of adjacent longitudinal passages 32 and 33 which are connected by apertures 34 extending through the wall 35 that separates the passages. Formed at the upper end of the passage 33 is a fuel outlet 36 which extends transversely through the end portion of the nozzle forming an opening at each side thereof. An upright stem 37 threaded in the upper open end of the passage 32 is provided at its outer extremity with a metering orifice 38 that is located in the path of the air which flows into the mixing chamber. The lower end of the passage 32 is plugged at 39. The passage 32 and stem 37 form an air bleed which allows a metered flow of air to enter the nozzle and flow into the passage 33 through which fuel is supplied to the mixing chamber 19 from the fuel chamber 25' with which the lower end of the passage 33 communicates.

When the choke valve 9 of a carburetor having only the above air bleeding facilities for the fuel system is closed during starting, for example, a limited quantity of air passes through the mixing chamber which is insufficient to properly air bleed the nozzle. As a result, the fuel that is sucked into the mixing chamber enters in the form of liquid. Under cold starting conditions, this fuel reaches the manifold and combustion chambers of the engine in a liquid state and hinders starting.

In order to properly air bleed the fuel reservoir during starting, an air bleed is provided which has an inlet located externally of the mixing chamber so that regardless of the position of the choke valve, an ample supply of air is available to properly atomize the fuel as it issues from the outlets 36 of the nozzle. Apparatus is also provided for closing the air bleed when the choke valve is open and allowing the same to be open only when the choke valve is closed so as to prevent the starting air bleed from disturbing the normal carburetor operation which exists during normal running of the engine.

In the form shown in Fig. 2, the auxiliary air bleed of the fuel system includes a tubular stem 40 which is slidably mounted intermediate its ends in an aperture 41 in the top wall of the casing, and at its lower end in a passage 42 formed in the partition 26 between the fuel chambers 24 and 25'. The stem 40 has a solid lower end portion 43 through which transverse metering orifices 44 and 45 extend. The orifice 44, which meters the fuel for the starting mixture, communicates with the air passage 46 of the stem 40 and it is smaller in size than the orifice 45 which meters the fuel for the normal running mixture. The stem 40 is normally held in an upper position by a spring 47 which bears between the top wall of the reservoir and a flange 48 on the stem so as to normally retain the metering orifice 45 in registration with the fuel passage 25.

When the stem 40 is in its uppermost position, the metering orifice 44 is closed by the side walls of the passage 42 in the partition 26 and thus the lower end of the air passage 46 is sealed and the auxiliary air bleed is prevented from supplying air to the fuel system. The metering orifices 44 and 45 are so located with respect to each other that one orifice comes into full registration with the fuel passage 25 as the other is moved out of registration therewith. The inlet end of the air passage 46 in the stem 40 is metered at 49 so as to predetermine the flow of air into the fuel system from this auxiliary source.

The choke valve 9 and shaft stem 40 are provided with actuating mechanism by which they are operated in a predetermined timed relation. In the form shown, this mechanism includes a bell crank lever 50 which is rigidly mounted on one end of the shaft 8 of the choke. The lever 50 has a downwardly extending arm 51 on which is formed an eye 52 for pivotally connecting the mechanism with a conventional choke operating rod (not shown). The other arm 53 of the bell crank lever 50 extends outwardly over the reservoir 22 and is provided at its free extremity with a slot 54 in which the upper end portion of the stem 40 is received. The free end portion of the lever 53 is seated upon the flange 48 of the stem 40 and as the choke valve 9 is moved to a closed position, the lever 53 urges the stem 40 downwardly against the action of the spring 47 to bring the metering orifice 44 into registration with the fuel passage 25. When the choke valve 9 is returned to its open position, the free end 54 of the lever 53 is rotated in a counter-clockwise direction allowing the stem to be returned to its upper position under the action of the spring 47, thus bringing the metering orifice 45 into registration with the fuel passage 25 and shutting off the air bleed.

In operation, when the choke valve 9 is closed to condition the carburetor for starting, the stem 40 is shifted downwardly so as to bring the lower end of the passage 46 and the starting metering orifice 44 into communication with the fuel system. The suction in the mixing chamber draws fuel through the passage 33 of the nozzle 28 together with air from the air passage 46 of the stem 40, the air serving to atomize the fuel and assist in controlling the fuel ratio of the starting mixture. The effect of the air bleed upon the fuel ratio of the starting mixture may be conveniently controlled by varying the size of the metering orifice 49 at the inlet end of the stem 40 without influencing the normal operating characteristics of the carburetor. This is particularly advantageous since engines of different sizes, capacities and constructions require various starting fuel mixtures which differ materially from their nor-

mal running fuel mixtures. The fuel content of the starting mixture may also be conveniently controlled without interfering with the normal running characteristics of the carburetor by varying the size of the metering orifice 44.

The air entering the fuel system through the auxiliary air bleed during starting forms only a part of the quantity of air required to produce a suitable starting mixture, and therefore provision is made to admit a controlled supply of air directly into the mixing chamber through the yieldable valve 15 which is operable by the suction in the mixing chamber. The yieldable valve 15 may be calibrated by predetermining the size of the opening 10, in conjunction with which it functions, and the tension of the spring 16 so as to accurately proportion the quantity of air drawn into the mixing chamber by the suction created during cranking of the engine, with respect to the fuel that is drawn into the mixing chamber by this suction.

After an internal combustion engine is started, it is the practice, particularly in extremely cold weather, to operate during the warming up stage which follows starting with a partially opened choke. Under this condition some of the air supplied to the mixing chamber may continue to enter through the yieldable valve and the fuel supplied to the nozzle may continue to be metered by the orifice 44. This is accomplished by properly locating and proportioning the dimensions of the orifice 44 with respect to the fuel passage 25 so that the orifice 44 will remain in registration with the fuel passage 25 during the first open range of the choke 9.

In a carburetor having the above starting fuel mixture regulating apparatus, it is possible to produce the desired gradation of the starting fuel mixtures during varying speeds in the cranking and warming up ranges of the engine which produce correspondingly varying rates of air flow through the mixing chamber.

In carburetors of internal combustion engines of some types, it may be found unnecessary to change the rate at which the fuel supply to the nozzle is metered in order to obtain satisfactory starting. Under such conditions, a carburetor of the form shown in Fig. 4, which has an auxiliary starting air bleed may be employed to advantage. In this form of the invention the carburetor includes a tubular structure 1' having a choke valve 9' which is provided with a yieldable valve 15' and a throttle valve 20', all having substantially the same construction as shown in Fig. 2. This carburetor also includes a fuel reservoir 22' which is formed integrally with a thickened wall 55 of the tubular structure. The reservoir 22' has a fuel inlet 23' which is also controlled by conventional float actuated valve mechanism (not shown). Formed below the reservoir 22' is a fuel chamber 56 having an inclined passage 57 in which is mounted an air bled nozzle 28' that is substantially identical to the nozzle shown in Figs. 2 and 3. The fuel passage of the nozzle 28' communicates with the fuel chamber 56 which in turn communicates with the interior of the reservoir 22' through a metering orifice 58 in the bottom wall of the reservoir.

Formed in the thickened wall 55 of the tubular structure 1' is an air passage or bleed 59 having an inlet 60 at its upper end which is metered at 61 and which communicates with the atmosphere. The lower end of the air passage 59 communicates with the fuel chamber 56.

Journaled on a screw 63 that is threaded in the wall of the tubular structure 1' is a valve 64 having a pad 65 at one end registering with the inlet 60 of the air passage 59 and an arm 66 on its opposite end. The valve 64 is normally held in a closed position when the choke valve 9' is open by a spring 67. Rigidly mounted on the shaft 8' on which the choke valve 9' is mounted is a cam member 68 which registers with the arm 66 of the valve 64. This cam member bears upon the arm 66 when the valve 9' is rotated to a closed position so as to open the valve and permit air to flow through the passage 59 to the fuel system of the carburetor when the latter is conditioned for starting.

In this manner, air is bled into the fuel system through the auxiliary air bleed only during starting under choked conditions. This air supply aids in atomizing the starting fuel discharge and at the same time influences the fuel ratio, but as in the above described form of my invention, the yieldable valve 15' which is operable by the suction in the mixing chamber is the primary factor governing the air content of the starting fuel mixture.

Although but several specific embodiments of this invention have herein been shown and described, it will be understood that various changes in the size, shape and arrangement of parts may be made without departing from the spirit of my invention and it is not my intention to limit its scope other than by the terms of the appended claims.

What I claim is:

1. A carburetor including a mixing chamber, a fuel nozzle in said mixing chamber, a fuel system communicating with said nozzle including a source of fuel and having an air bleed, variable means in said fuel system between said nozzle and said source of fuel for predetermining the supply of fuel to said nozzle during starting and during normal operation of said carburetor respectively and adapted to control said air bleed, a choke valve for conditioning said carburetor for starting, and mechanism for operating said choke valve and variable means in timed relation so as to close said air bleed and meter the supply of fuel to said nozzle at one rate when said choke valve is open and to open said air bleed and meter the supply of fuel to said nozzle at a different rate when said choke valve is closed.

2. A carburetor including a mixing chamber, a fuel nozzle in said mixing chamber, a fuel system communicating with said nozzle including a source of fuel, a choke valve in said mixing chamber for conditioning said carburetor for starting, apparatus for controlling said choke valve, and means operable by said apparatus having a pair of metering orifices for predetermining the supply of fuel to said nozzle when said carburetor is conditioned for starting and normal operation respectively, and having an air bleed communicating with the starting metering orifice for admitting air to said fuel system only during starting.

3. A carburetor including a mixing chamber, a fuel nozzle in said mixing chamber, a fuel system communicating with said nozzle including a source of fuel, a choke valve in said mixing chamber for conditioning said carburetor for starting, apparatus for controlling said choke valve, means operable by said apparatus having a pair of metering orifices for predetermining the supply of fuel to said nozzle when said carburetor is conditioned for starting and normal operation respectively, and having an air bleed communi-

cating with the starting metering orifice for admitting air to said fuel system only during starting, and yieldable means operable by the suction in said mixing chamber for controlling the direct admission of air thereto when said choke is closed during starting.

4. A carburetor including a mixing chamber and a fuel system having a fuel nozzle in said mixing chamber and a communicating fuel reservoir, a metering member shiftably mounted in said carburetor having a metering orifice for controlling the flow of fuel to said nozzle during starting and a second metering orifice for controlling the flow of fuel to said nozzle during normal operation and having an air bleed communication with said first metering orifice, and means for alternatively placing said orifices in operative positions so as to condition said carburetor for starting and normal operations respectively.

5. A carburetor including a mixing chamber and a fuel system having a fuel nozzle in said mixing chamber and a communicating fuel reservoir, a metering member shiftably mounted in said carburetor having a metering orifice for controlling the flow of fuel to said nozzle during starting and a second metering orifice for controlling the flow of fuel to said nozzle during normal operation and having an air bleed communication with said first metering orifice, a choke valve in said mixing chamber, and means for operating said choke valve and metering member in timed relation for conditioning said carburetor for starting and normal operation respectively.

6. A carburetor including a mixing chamber, a fuel system including a fuel nozzle and a communicating source of fuel, a variable member extending into said fuel system between said nozzle and said source of fuel having a pair of metering orifices, one for metering the flow of fuel to said nozzle during normal engine operation and the other for metering the flow of fuel thereto during starting; and means for selectively placing said orifices in operative positions so as to condition said carburetor for starting and normal operation.

7. A carburetor including a mixing chamber, a fuel system including a fuel nozzle and a communicating source of fuel, a variable member extending into said fuel system between said nozzle and said source of fuel having a pair of metering orifices, one for metering the flow of fuel to said nozzle during normal engine operation and the other for metering the flow of fuel thereto during starting; a choke valve in said mixing chamber, and actuating mechanism for operating said choke valve and said variable member in a predetermined time relation so as to place one metering orifice in an operative position when said choke valve is open and the other orifice in an operative position when the choke valve is closed.

8. A carburetor including a mixing chamber, a fuel system including a fuel nozzle and a communicating source of fuel, a variable member extending into said fuel system between said nozzle and said source of fuel having a pair of metering orifices, one for metering the flow of fuel to said nozzle during normal engine operation and the other for metering the flow of fuel thereto during starting; a choke valve in said mixing chamber, actuating mechanism for operating said choke valve and said variable member in a predetermined time relation so as to place one metering orifice in an operative position when said choke valve is open and the other orifice in an operative position when the choke valve is closed, and a yieldable member operable by the suction in said mixing chamber when said choke valve is closed for controlling the direct admission of air thereto during starting.

9. In a carburetor having an air inlet and a fuel system including a nozzle having an air bleed calibrated for normal engine operation and communicating with said air inlet, a member between said air bleed and said air inlet for restricting the latter to condition said carburetor for starting and adapted to substantially cut off the supply of air to said air bleed, means having an auxiliary air passage calibrated for starting and communicating with said fuel system and nozzle for supplying air to the latter when said member is closed, and means for closing said passage when said carburetor is conditioned for normal operation.

10. In a carburetor, a fuel mixture passage having an air inlet, a fuel system including a nozzle in said fuel mixture passage having an air bleed communicating with the latter and calibrated for normal engine operation, a throttle valve in said mixture passage, a choke valve in said air inlet for conditioning said carburetor for starting and adapted to substantially cut off the supply of air to said air bleed, means having an auxiliary air passage calibrated for starting and communicating with said fuel system for supplying air to said nozzle when the supply of air to said air bleed is obstructed, and means operable in timed relation with said choke valve for closing the auxiliary air passage when said carburetor is conditioned for normal operation.

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