Jan. 30, 1934. F. C. MOCK ET AL 1,945,199

CARBURETOR

Filed May 22, 1930 4 Sheets-Sheet 1

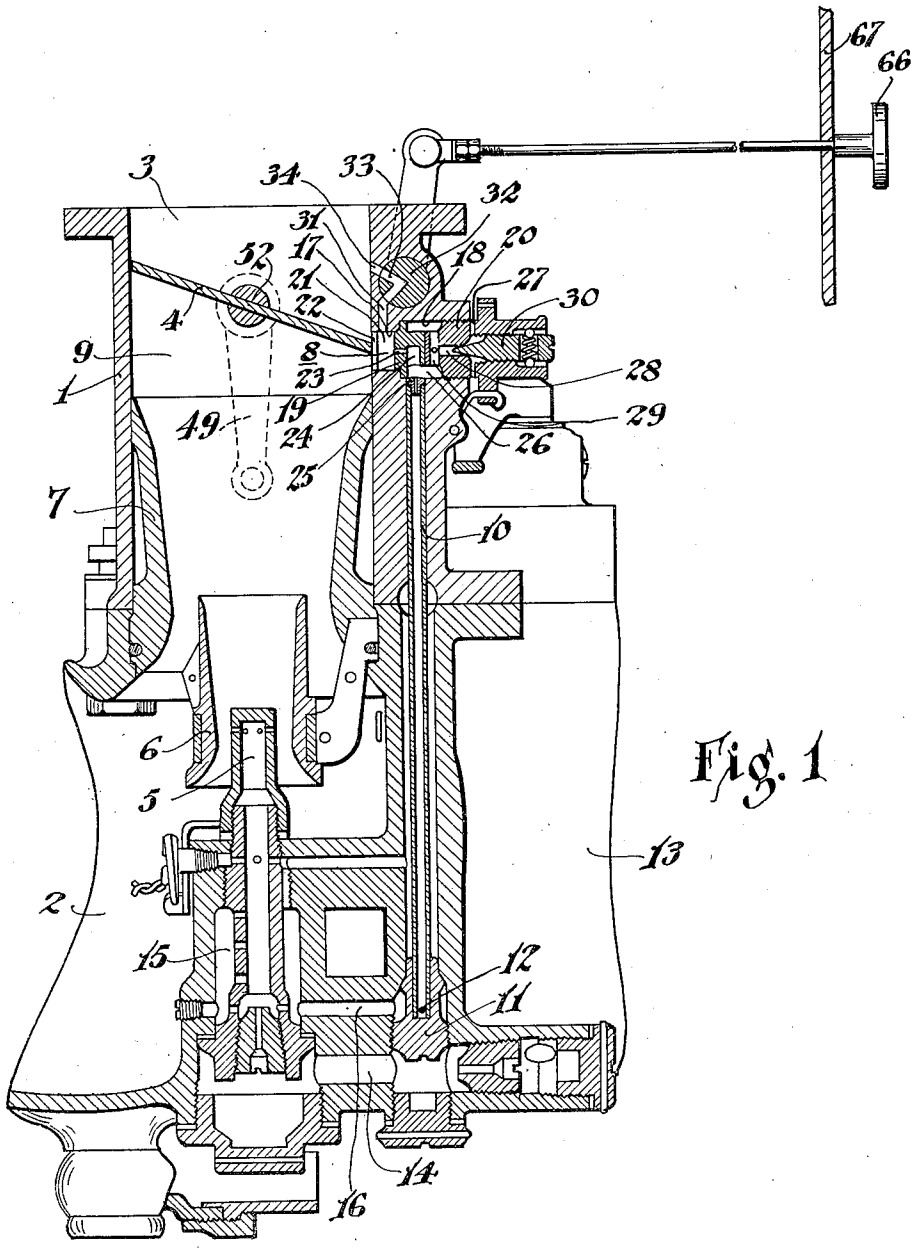


Fig. 1

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CARBURETOR

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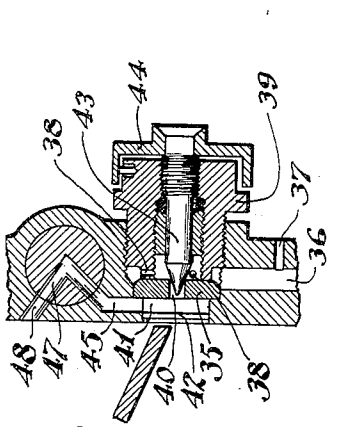


Fig. 4.



Fig. 5

Fig. 2

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CARBURETOR

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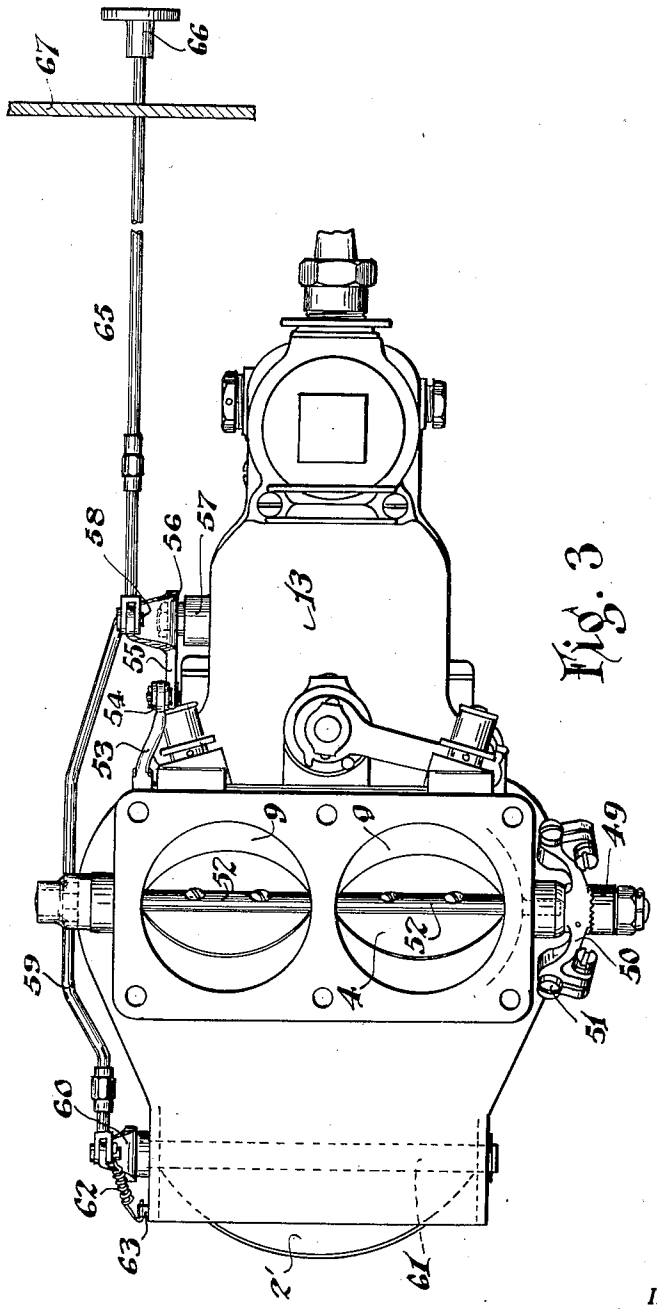


Fig. 3

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CARBURETOR

Filed May 22, 1930 4 Sheets-Sheet 4

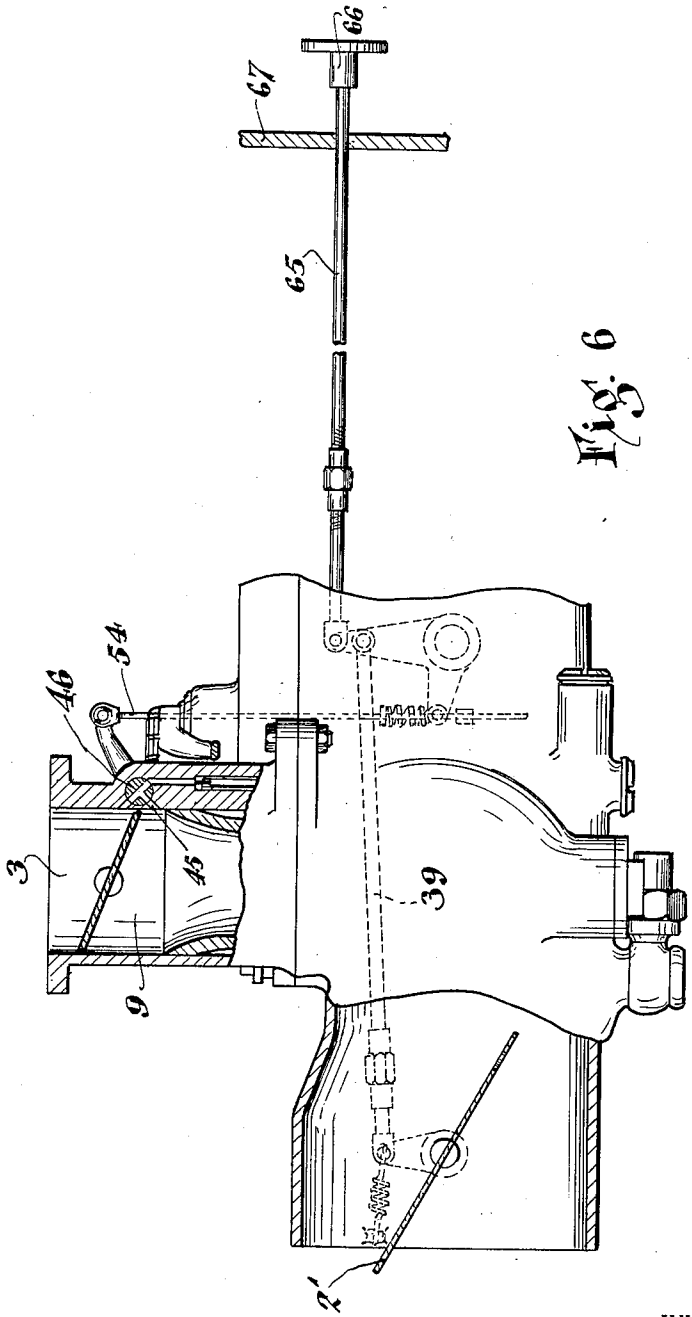


Fig. 6

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UNITED STATES PATENT OFFICE

1,945,199

CARBURETOR

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Application May 22, 1930. Serial No. 454,577

9 Claims. (Cl. 261—41)

The present invention relates to improvements in carburetors, particularly priming and idling devices, and is a continuance in part of our copending applications, Serial No. 556,160, filed April 24, 1922, which matured to Patent No. 1,872,786 granted August 23, 1932, and Serial No. 244,231, filed July 10, 1918, now Patent No. 1,620,827, granted March 15, 1927.

It is well known that in starting an internal combustion automobile engine to get the first explosion requires an enrichment of the mixture over that necessary for ordinary running conditioins. In order to secure such an enrichment for starting, it has heretofore been customary to provide a valve in the air intake of the carburetor, known as a choke valve. This valve is operated manually by a pull button on the dashboard of the automobile, and by nearly closing the air intake of the carburetor, it not only reduces the volume of air passing therethrough, but also greatly increases the suction on the main jet and thus causes a small volume of greatly enriched mixture to be delivered to the engine. The principal disadvantage of this method of starting is the difficulty of accurately judging the amount of choke, or closing of the choke valve, necessary to give a proper mixture. If the choke valve is closed too much, the mixture is too rich and the engine will not start. This condition of over-enrichment is technically known as "flooding" the carburetor because of the large amount of raw liquid fuel drawn out of the main jet which overflows the mixing chamber. An engine cannot be started with a flooded carburetor until the excess liquid fuel is drawn off to a point where an explosive mixture can be obtained. This necessitates prolonged cranking and much trouble and loss of time in starting. On the other hand, if the choke valve is not closed far enough, the mixture is too lean for explosion to occur and again much cranking, juggling with the choke, and trouble is experienced in starting.

For airplane engines, the air horn of the carburetor is so large and the carburetor is fitted into such a restricted space that there is no room available for a choke valve in the air horn. Consequently, such engines must be started by priming with liquid fuel either directly into the engine cylinders or the intake manifold from a source separate from the carburetor. This has added greatly to the difficulties of starting airplane engines.

To overcome these difficulties, various schemes for enriching the starting mixture have been proposed. These are known generically as "priming" devices and have consisted, in addition to the conventional choke valve mentioned, of various means of securing an additional fuel flow for starting. The common disadvantage of all the devices heretofore used for this purpose is that they do not give a predetermined quality and quantity of starting mixture but vary erratically in performance. Also they are usually difficult to keep in proper adjustment and add materially to the cost and complication of the carburetor.

Another difficulty in starting is the necessity for first opening the throttle valve to the correct amount before cranking the engine. If the throttle is not first opened to some extent before cranking, it is obvious that practically no mixture will be delivered to the engine and starting is impossible. Also, if the throttle is opened too much a proper starting mixture is not obtained and starting is difficult. To get a proper starting mixture the throttle must be only slightly opened. This is known as "cracking" the throttle and, aside from the judgment required as to what is the proper amount of opening for cracking, it constitutes an additional operation, often overlooked, for starting and adds to the difficulties of the occasion. As a remedy for this trouble, it has been proposed to mechanically hook up the throttle valve with the choke valve (in carburetors having choke valves) so that the throttle will automatically be cracked as the choke valve is closed. This arrangement, while an improvement over prior art, is not entirely satisfactory as the mechanical adjustment to secure the right amount of throttle opening is difficult and tends to easily get out of adjustment because of the more or less indeterminate fit of the average butterfly valve and the difficulty of properly synchronizing the movements of two such valves with an ordinary mechanical linkage.

In addition to the starting problem outlined above, our invention has to do also with the problem of idling. With normal idling of a warm engine, the mixture admitted past the throttle is just strong enough to overcome the friction of the engine. With a cold engine, however, the friction is usually higher, due to the greater viscosity of the oil, and the amount of mixture required for idling is thus greater than for a warm engine. Also, a richer mixture is required for cold idling due to the condensation of the liquid fuel component upon the walls of the intake manifold. Hence, when the ordinary idling feed is adjusted for warm idling, it is insufficient for cold idling and it is necessary to provide some means of increasing the volume and richness of the idling

mixture. Also, after the engine is started its idling will be more stable, and it will be less apt to stall when the throttle is suddenly closed, if the predetermined idling opening for air is larger than the opening required for warm idling. In accordance with our invention, the proportions of the idling air and fuel inlets are so selected that the percentage of fuel increase is greater than the percentage of air increase so that the net effect is both that of more mixture and a richer mixture for cold idling.

For any given air opening to the engine, the suction tends to vary, roughly, as the square of the engine speed. Therefore, if the engine be cranked over slowly, say at the rate of 40 R. P. M., the suctions existing around and above the throttle will be approximately 1/64th of what they would be with the engine idling at 320 R. P. M. Accordingly, it is desirable for starting to have a throttle opening slightly greater than that necessary for idling, but if it is very much greater, say more than a few thousandths of an inch, the opening will be so great that the suction on the idling jet is not sufficient to lift and deliver fuel. In this connection we wish to emphasize that the throttle controls of the ordinary motor car or airplane are not sufficiently delicate to give the required accurate setting of throttle opening to best facilitate starting. We have, therefore, provided an auxiliary opening past the throttle of predetermined size in addition to the normal idling opening, for starting. This is highly advantageous as it permits the correct openings to be obtained for both starting and idling. Also, it is desirable to be able to obtain the correct air and fuel openings for a cold engine and then be able to come back to a predetermined adjustment of air and fuel for a warm engine. This change in adjustment can be readily effected in our device.

An object of our invention is to assist in getting the first explosion in starting by supplying an enriched mixture of predetermined proportions.

Another object of our invention is to assist in getting strong following explosions in starting by having a predetermined air opening to the intake manifold in addition to that past the throttle when same is closed to the ordinary idling position.

Another object of our invention is to provide a temporary minimum idling condition suitable for a cold engine by having a greater air and fuel feed than is needed for a warm engine, without disturbing the throttle setting as made and kept for idling the engine when warm.

A further object of our invention is to provide a priming device which will automatically give a predetermined quantity and quality of starting mixture with certainty and which does not depend upon the judgment of the operator.

A still further object of our invention is to provide a starting device which automatically opens a channel of communication to the engine past the throttle without disturbing the position of the throttle, as the choke valve is closed.

A still further object of our invention is to provide a primary device which cannot flood the carburetor by an error of judgment on the part of the operator.

Still another object of our invention is to provide a combined starting and idling device which is easy to construct, simple to adjust, and which adds little to the complication and cost of the carburetor.

Numerous other improvements will be apparent from the following specification and claims:

In the accompanying drawings which form a part of this specification, we have illustrated one embodiment in which our invention may appear.

Figure 1 is a vertical longitudinal section of one form of carburetor embodying our invention with a portion of the float chamber structure omitted.

Figure 2 is a similar view of a slightly different type of carburetor embodying a modified form of our invention.

Figure 3 is a top plan view of the carburetor shown in Figure 2.

Figure 4 is a fragmentary sectional view on an enlarged scale of our priming and idling device shown in Figure 2.

Figure 5 is a plan view of one form of idling nozzle plug.

Figure 6 is a modified form of priming device where no idling features are present.

The particular form of carburetor illustrated in Figure 1 is selected for illustrating a typical embodiment of our invention simply because it forms the subject matter of our copending application 556,160 of which this application is a continuance in part; it being obvious that the present invention is capable of embodiment in practically any type of carburetor. A specific description of this carburetor being available in said co-pending application, suffice it to say here that it comprises a body portion or casting 1, having an air intake 2, and a mixture outlet 3. A throttle 4 controls the mixture outlet 3, and a main nozzle 5 discharges into the innermost of two concentric venturis 6 and 7. The idling nozzle, which is designated 8 in its entirety, discharges into the mixture passageway 9 in close proximity to the edge of the throttle 4. This idling nozzle draws fuel through a tube 10, which is secured at its lower end in a plug 11, the tube having a lateral hole 12 which also extends through the plug for admitting fuel to the tube. Fuel is supplied to both the main jet and the idling jet from a float chamber 13 which discharges through a passageway 14 into the center of the main nozzle 5 and into an accelerating well 15 surrounding said nozzle. The idling nozzle 23 draws fuel from this accelerating well through a passage 16.

Referring to the particular construction of the idling nozzle 8, it will be noted that the nozzle is arranged in a relatively large hole which is formed to extend through the side wall of the casing 1 adjacent the point where the lower lip of the throttle 4 comes into approximate contact with the side wall of the passageway 9 when the throttle is in its restricted position. This bore 17 has an enlarged counterbore 18 which is threaded at its outer end. Fitting in this bore is a nozzle plug 19 having a reduced portion extending into the bore 17 and an enlarged portion extending into the counterbore 18. This plug is backed up and held in any position in which it may be adjusted by a threaded closure plug 20 which screws into the threads in the end of the counterbore 18 and abuts the rear end of the nozzle plug 19. The nozzle plug 19 has a transverse bore 21 which communicates by way of a slot 22 with the mixture passageway 9, this slot 22 lying in proximity to the lip of the throttle valve 4 when the same is in closed or restricted position. The plug 19 has a central axial bore 23 through which the fuel mixture for idling passes on its way into the engine manifold. The plug 19 also has a lateral recess 24 lying immediately above the tube 10, which tube may have

a plug restriction 25 in its upper end if desired. A channel or annular space 26 is formed about the inner end of the plug 19 and constitutes a space for air which is admitted by way of the port 27, valve port 28, and radial port 29 in the plug 20.

A needle valve 30 is threaded into the hub of the plug 20 for controlling the amount of air which enters by way of the port 27, which air in connection with the liquid fuel entering from the tube 10 forms a mixture of controlled and predetermined proportions for applying the engine during idling when warm. This needle valve comprises a cylindrical stem which is threaded to fit within the boss extension on the end of the plug 20, and has a slot or other suitable means for applying an adjusting tool, such as a screw driver.

When the throttle 4 is in its restricted position with the lower lip thereof substantially intersecting the slot 22, as shown in Figure 1, it will be apparent that a certain rate of fuel feed will occur through the slot 22 depending upon the suction above the throttle, the suction below the throttle, and the velocity of air around the throttle lip through the slot 22. It will be observed that by turning the plug 19 through an acute angle, a greater or lesser area of the slot 22 is brought into alignment with the lower lip of the throttle 4. This brings a greater or lesser proportion of the slot area under the influence of the suction existing around the edge of the throttle. Thus, by changing the angle of the plug 19 and its slot 22, different rates of fuel feed can be obtained and the quality of the idling mixture fixed at any proportions desired. The channel or annular space 26 maintains communication with the upper end of tube 10, or rather the restricted plug 25, so that fuel flow will be maintained even though the plug 19 is adjusted through a wide angle. The separate mounting of the plug 19 in the casting 1 obviously permits of this adjustment with little difficulty, and after the plug has been properly adjusted for warm idling, it is secured firmly in position by screwing the closure plug 20 hard against it.

The transverse bore 21 communicates with a passageway 31 extending up to a priming valve 32 which comprises a rotary plug having an angular passageway 33 therethrough communicating with the passageway 31 and a second passageway 34 opening into the mixing chamber above the throttle valve. Under normal running conditions priming valve 32 is closed, but on starting the engine, it is opened by a dash control similar to a choke control with carburetors having a choke valve. The opening of valve 32 permits an increased flow of fuel with some entrained air to pass up through the valve and out through passageway 34 under the influence of the relative high suction prevailing above the closed throttle. When the engine starts under its own power priming valve 32 is closed, the engine then depending upon the idling nozzle 8 to supply the necessary mixture for turning over at the desired idling speed, until the throttle is opened to give increased speed.

It will be noted from Figure 1 that the throttle valve 4 shuts across slot 22 in idling nozzle 8 so that when the throttle is closed, the normal position for idling a warm engine, only a small part of the slot opens above the throttle. This area of opening is materially less than the area of the passage 23 through the nozzle 8. In the normal idling of a warm engine, there is about eight pounds of suction above the throttle valve in the intake manifold and under this strong suction air flows through the relatively large area of slot 22 below the throttle valve, into the passage 21, and then out into the intake manifold through the part of the slot 22 above the throttle valve. The position of the needle valve 30 is then adjusted to give the right amount of air for the best idling mixture when mixed with the air taken through the slot 22. The control of the idling mixture delivered through the nozzle 8, during the first opening movement of the throttle and until the main nozzle 5 begins to come into action, is effected by the rotational position of the slot 22 with respect to the edge of the throttle 4, as explained in our co-pending application 556,160.

The control of the mixture for normal warm idling with throttle closed is effected by the relative size of the slot 22 and axial bore 23 in the idling nozzle 8 in conjunction with needle valve 30 which regulates the amount of air entering port 27. As stated above, to idle a cold engine requires an increase in both quantity and richness of the idling mixture. This is secured by leaving open the priming valve 32 during the warming up period. Thus, when valve 32 is open passageway 21, in addition to being subject to the suction exerted on it from the part of slot 22 above the throttle, is also subject to suction exerted through the passageways 31, 33 and 34. This delivers materially more air to the engine, and at the same time causes a greater suction to exist in the passage 21 and draws more fuel through the opening 23. In actual practice, we select the proportions so that the percentage of fuel increase is greater than the percentage of air increase and the net effect is both that of more mixture and a richer mixture than when the valve 32 is closed. It is thus seen that this system also has an advantage in keeping the engine running after the first explosions are obtained on the initial start.

In Figures 2 and 4 we have illustrated a modified construction of the idling nozzle and valve. Here the adjustable and removable nozzle plug 35 is of relatively shallow depth and the fuel passageway 36 enters the plug bore behind the plug 35. The passageway 36 has an air bleed 37 which communicates with the outside of the carburetor and permits air to be drawn in with the ascending column of liquid fuel entering the nozzle 35 and thus replaces the air port 27 of the form shown in Fig. 1. The fuel and entrained air pass through a number of holes 38 in the interior of the outer closure plug 39, from whence they pass to the mixing chamber 9 through an axial bore 40, transverse bore 41 and slot 42 which are in all respects similar to corresponding elements 23, 21 and 22 in the form shown in Fig. 1. Similarly a needle valve 43 controls the passageway 40, this needle valve having threaded engagement in the outer end of plug 39 and having a cap or handle 44 secured to its outer end by which the needle valve can be adjusted to control the idling feed. Also, transverse bore 41 in nozzle plug 35 communicates with a passageway 45 extending up to a priming valve 46 which comprises a rotary plug having an annular passageway 47 therethrough communicating with the passageway 45 and a second passageway 48 opening into the mixing chamber above the throttle valve. This priming valve construction is identical with that shown in Fig. 1.

The throttle is held in correct idling position by the controlling lever 49 and a pair of stop

bracket arms 50. These arms contain suitable set screws 51 for adjusting the limits of rotation of the throttle valve 4 and are fastened to a common hub which in turn is attached to the throttle shaft 52. The set screws 51 are so adjusted that the throttle when closed just clears the wall of the mixing chamber 9 in the vicinity of idling nozzle 8 by a few thousandths of an inch so that the desired amount of suction is exerted upon slot 22.

In Fig. 2 we have illustrated a type of carburetor having a choke valve. Here the priming valve 32 is connected to the choke valve 2' by a lever 53 which is fixed to one end of the rotary plug 32 and at its other end is connected to an adjustable link 54 which is in turn attached to an arm 55 of the bell crank 56. This bell crank is journalled in a boss 57 on one side of the float chamber 13 (see Fig. 3) and carries a pin 58 which is connected by an adjustable link 59 to a lever 60 fixed on the shaft 61 of the choke valve 2'. A spring 62 is connected to the free end of lever 60 and to a stud 63 on the outside wall of the air horn 2 and normally holds the choke valve 2' in a horizontal (open) position. Also through links 54 and 59 and bell crank 56, the spring 62 holds priming valve 32 normally closed.

Bell crank 56 also carries a third pin 64 to which is attached an adjustable link 65 connected to a choke rod 66 on a dash 67 of an automobile. It is obvious from this arrangement that when choke rod 66 is pulled out it opens priming valve 32 and simultaneously closes choke valve 2'.

The frictional fit of choke rod 66 in dash 67 is such that it will remain in any desired position against the tension of spring 62. This is necessary as it is desirable that priming valve 32 remain open during the warming up of the engine in order to supply the necessary additional mixture required for cold idling over that required for warm idling. After the engine is warmed up by a few explosions choke rod 66 is pushed back closing priming valve 32 and opening air horn 2 to its full capacity.

For air valve and other types of carburetors not employing idling systems of the type herein disclosed, the starting features of our invention can still be utilized. In this case, the idling nozzle plug and associated valve mechanism is omitted and the passageway 45 extended in the wall of the mixing chamber down to a point below the lower edge of the throttle when in closed position, as shown in Fig. 6. As in Fig. 2 the priming valve 46 is connected with the choke valve 2' and with dash control 66, so that the priming valve is automatically opened as the choke valve is closed. The adjustable links 54, 59 and 65 make it possible to so co-ordinate and adjust the opening and closing of the priming and choke valves that any desired relative movement can be secured. As priming valve 46, when open, furnishes a by-pass around the throttle, it is not necessary to crack or move the throttle for starting. Also movement of the throttle for starting is unnecessary in the form of our device shown in Fig. 1.

In our system of priming, when a choke valve is not employed, it is apparent that the carburetor cannot be flooded through an error of judgment of the operator in pulling the primer control out too far or hold it out too long, for the following reasons: As the throttle valve remains closed and the air intake wide open, the small area of the slot in the idling nozzle cannot transmit enough suction to the mixing chamber in the region of the main nozzle to draw any fuel out of the main nozzle. Hence the maximum fuel that can find its way into the mixing chamber is that passing through the axial bore of the idling nozzle and the size of this bore is so related to the air passage bleeding into the idling feed that a proper mixture is always formed regardless of the position of the priming control valve 32.

As the operation of our invention is clear from what has been said above, no further description thereof appears to be necessary.

While we have shown and described a specific embodiment of our invention, we do not limit ourselves to any specific construction and arrangement of parts, and we may alter the construction and arrangement of parts as occasion requires without departing from the spirit of our invention or exceeding the scope of the appended claims.

We claim:

1. In a carburetor, a mixture outlet, a throttle valve controlling said outlet, an idling nozzle adjacent said throttle, a priming passageway of a predetermined size above the throttle communicating with said idling nozzle, and a valve for opening and closing said passageway.

2. In a carburetor, a mixing chamber having a throttle valve therein, a slot adjacent the edge of said throttle valve in the wall of the mixing chamber, a longitudinal passageway opening into said slot and communicating with a priming outlet above the throttle valve, a valve controlling said priming outlet, a fuel supply passage to said longitudinal passage, and a valve governing the supply of fuel and air to said longitudinal passage.

3. In a carburetor, a mixing chamber having a throttle valve therein, an idling nozzle adjacent the throttle, a priming passageway above the throttle communicating with the idling nozzle, and a cut-off valve operable from a distance for controlling the priming passageway.

4. In a carburetor, a mixing chamber having a throttle valve therein, an idling passage for supplying fuel to the mixing chamber at the minimum rate required when the engine is warm, separate means supplied with fuel from said idling passage for supplying additional fuel to the mixing chamber, and means independent of the throttle for controlling said separate means.

5. In a carburetor having a mixing chamber, a main nozzle, and a throttle valve, means independent of the main nozzle for delivering fuel to the mixing chamber at the minimum rate required when the engine is warm, and means operable from the driver's seat independently of throttle position for delivering to the mixing chamber an increased quantity of fuel for starting and idling when the engine is cold.

6. In a carburetor having a mixing chamber, a main nozzle, an idling passage operable independently of the main nozzle and discharging into the mixing chamber, a bypass leading from the idling passage to the mixing chamber, and manually operable means controlling the bypass.

7. In a carburetor having a mixing chamber and a throttle, an idling passage discharging into the mixing chamber adjacent the throttle, a bypass leading from the idling passage to the mixing chamber, and remote control means for the bypass.

8. In a carburetor having a mixing chamber, a throttle, and a choke valve; an idling passage discharging into the mixing chamber, separate means discharging fuel into the mixing chamber

above the throttle, and means for simultaneously controlling said separate means and said choke valve.

9. In a carburetor having a mixing chamber, a throttle, and a choke valve, an idling passage discharging into the mixing chamber, separate means fed from the idling passage and discharging into the mixing chamber above the throttle, and remote control means simultaneously effective on the choke valve and said separate means.

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