

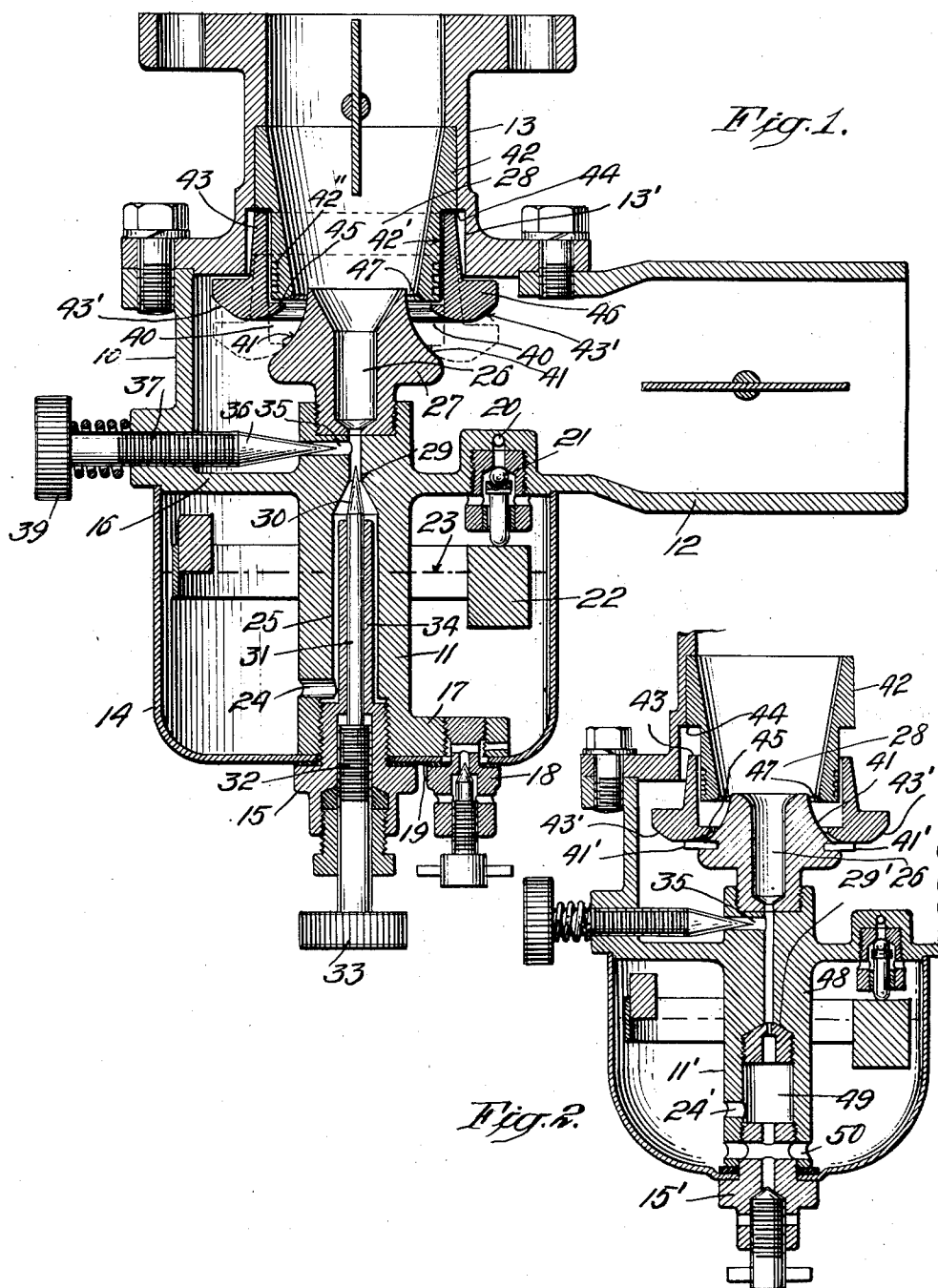
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CARBURETOR

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CARBURETOR

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This invention relates to carburetors for internal combustion engines. The invention aims to provide an improved carburetor of simple construction adapted to supply an explosive mixture of fuel and air in proper proportions throughout the range of engine speed from idling speed to the highest working speed.

In accordance with the invention the desired result is accomplished by providing a single mixture conduit having major and minor air inlets. Separate means are provided for regulating the flow of air through the two air inlets. The flow of air through the minor inlet is controlled by a manually adjustable valve which serves to adjust the mixture to the proper proportions for idling speed without materially affecting the richness of the mixture used at working speeds. This makes it possible to regulate the richness of the working mixture and the idling mixture independently without the provision of two separate fuel conduits. The richness of the mixture for working speeds is controlled by an orifice in the fuel conduit, which may or may not be regulatable during the operation of the carburetor, and by an automatic device regulating the major air inlet. This device includes a floating sleeve such as has heretofore been used for similar purposes, but an important feature of the invention consists in the arrangement for utilizing air friction to aid in holding the sleeve seated in its down position when the engine is idling and to prevent fluttering of the sleeve at low running speeds.

The features of the invention to which reference has been made, as well as other features thereof, may best be understood from a detailed description of the specific embodiments of the invention which are shown in the accompanying drawings in which:

Fig. 1 is a vertical central section of a carburetor embodying the various features of the invention in the form which I now consider most desirable, and

Fig. 2 is a similar view of the lower part of a modified carburetor.

To facilitate an understanding of the carburetors illustrated, I will describe first their

physical construction. Such construction embodies certain features of the invention which are, however, of less importance than the operative features hereinafter described. The framework of the carburetor shown in Fig. 1 includes a single casting providing a vertical cylindrical body 10, open at its top and closed at its bottom, an air intake conduit 12 extending from one side of the body 10, and a post 11 extending downwardly from the bottom of the body. An outlet conduit 13 is secured to the open top of the body 10. It is coaxial with the post 11. A cup shaped reservoir 14 for the liquid fuel is secured to the post 11. The reservoir 14 contains a central hole in its bottom through which is inserted a threaded shouldered plug 15 which is screwed into a tapped hole in the lower end of the post 11, to hold the reservoir on the post. When thus mounted on the post the reservoir has its upper edge in close contact with the circular bottom 16 of the body 10. In the form shown in Fig. 1 the post 11 has at its lower end a lateral arm 17 containing a drain opening for the reservoir and an additional plug 18 carrying a drain valve is screwed into this arm through another hole in the bottom of the reservoir. Packing 19 is provided between the plugs 15 and 18 and the bottom of the reservoir 14.

A fuel inlet passage 20 is provided in the body 10, and extends through its circular bottom 16. The flow of fuel through this opening is controlled by a valve 21 and a float 22 which serve to maintain the liquid level in the reservoir at the line 23. The float illustrated forms the subject matter of my Patent No. 1,613,599, dated January 11, 1927.

The fuel passes from the reservoir to the mixture outlet at the upper end of the conduit 13, through a passage which is formed by a lateral bore 24 in the post 11, a longitudinal bore 25 in the post extending from the lateral bore 24 to the top of the post which projects within the body 10, a primary mixing chamber 26 formed within a nozzle 27 which is screwed in the upper end of the post 11, and a secondary mixing chamber 28 provided in a mixture tube 42 in the

conduit 13. The bores 24 and 25 and the mixing chambers 26 and 28 form the fuel and mixture passage. The rate of flow of fuel through this passage is limited by an orifice 29 which has an area less than the cross-sectional area of any other part of the passage. In the form shown in Fig. 1, the effective size of this orifice 29 may be varied by means of a needle valve 30. The stem 31 of this needle valve extends through a central bore in plug 15 and has a threaded connection 32 with the plug, so that the vertical position of the valve may be regulated by turning a hand wheel 33 at the lower end of the stem below the bottom of the reservoir.

A feature of the invention consists in preventing leakage about the stem 31 of the needle valve. This is accomplished by providing the upper end of the plug 15 with an upwardly projecting integral sleeve 34 which extends materially above the liquid level 23. It follows that even though a liquid tight fit is not secured between the stem 31 and the plug 15, no fuel can escape around the valve stem when the carburetor is not in use. When the carburetor is in use, the liquid, of course, rises in the bore 25 above the upper end of the sleeve 34, but, as this results from sub-atmospheric pressure within the bore and as atmospheric pressure is of course applied to the outer end of the space between the valve stem and the plug 15, no outward leakage of the liquid can occur.

A minor air inlet into the fuel and mixture passage 24—25—26—28 is provided by a lateral bore 35 in the upper portion of the post 11 which projects within the body 10. The bore 35 enters the fuel passage between the orifice 29 and the primary mixing chamber 26. Flow of air through the minor inlet 35 is controlled by a needle valve 36 whose stem 37 projects through the side of the body 10 and has a threaded connection therewith, so that the position of the valve may be adjusted by means of a hand wheel 39 located outside the body.

The major air inlet 40 is an annular passage formed between the inwardly tapering outer wall 41 of the nozzle 27 and the lower end of the mixture tube 42 set in the conduit 13. This air inlet, it will be noted, enters the fuel passage at the point where the primary mixing chamber 26 opens into the secondary and larger mixing chamber 28.

The flow of air through the major air inlet 40 is automatically regulated by a floating sleeve 43. This sleeve has a loose sliding fit on the cylindrical outer surface 42' of the lower part of the tube 42. The sleeve has at its lower end an inwardly projecting flange 45. The bottom surface of the sleeve and flange is curved so as to cooperate with the curved and tapered outer surface 41 of the nozzle 27 to provide an annular upward-

ly-inclined air inlet passage of gradually decreasing cross-section, terminating at an annular orifice 47. The flange 45 projects into this air passage.

When the carburetor is not in use, the sleeve 43 falls by gravity and rests on the outer portion of the nozzle 27 as shown in dotted lines. When the engine suction is applied to the conduit 13, the sleeve is urged upwardly, because of the difference in pressure on the top and on the bottom of the flange 45. The width of this flange may be so proportioned to the weight of the sleeve that, when the engine suction is greatest, the difference in pressure on the two sides of the flange 45 is sufficient to hold the sleeve in its uppermost position shown in full lines, with its upper end against a stop 44; while when the engine is idling, the weight of the sleeve 43 exceeds the effect of the difference in the pressure on the two sides of the flange 45, so that the sleeve is in its lowest position shown in dotted lines. The balance between the weight of the sleeve and the width of the flange is such that, at intermediate speeds, the sleeve is held in intermediate positions, partially closing the major air inlet 40 to secure the proper proportioning of fuel and air.

While, with many engines, the flange 45 provides a sufficient means to regulate the position of the sleeve, I find it most desirable to supplement the effect of this flange by providing an upwardly and outwardly inclined deflecting surface 43' at the outer lower edge of the sleeve. The impulse against this surface of the air approaching the opening 40 serves to supplement the effect of the flange 45 in raising the sleeve, especially in the upper part of its movement.

The requisite weight of the sleeve 43 may be distributed uniformly along the sleeve. I find it more desirable, however, to concentrate the weight in the flange 46 projecting outwardly from the lower end of the sleeve. This tends to prevent tilting of the sleeve by keeping its center of gravity low, and also permits making the sleeve of smaller outside diameter than would otherwise be possible.

An important object of the present invention is to prevent chattering of the floating sleeve when the engine is idling, which has been a serious objection in previous floating-sleeve carburetors. In accordance with the invention, chattering is prevented by mounting the sleeve on the outer surface of the mixing tube 42, as has been described, instead of placing it within the mixing conduit in accordance with the usual practice, and utilizing the friction of the air leaking in between the sleeve and the tube to aid in holding down the sleeve when in its lowest position. To accomplish this a small clearance, preferably about one-hundredth of an inch, is allowed between the inner surface of the sleeve and

the outer surface 42' of the tube 42, and air is admitted freely to the upper end of this space when the sleeve is in its lowest position. In the form shown, in which the sleeve when in its upper position extends substantially above the top wall of the body 10, the lower end of the conduit 13 is made sufficiently large to permit free access of air to the top of the clearance space between the inner surface of the sleeve and the outer surface 42' of the tube 42. The wall of the groove 13' is spaced from the outer surface 42' of the tube 42, so as to provide an annular recess for the sleeve, in which the clearance outside the sleeve is materially greater than that inside of it. The result of this arrangement is that when the engine is idling and the sleeve is in its lowest position, air has free access over the top of the sleeve and leaks downwardly through the narrow clearance space between the sleeve and the tube, and the friction of this air against the sleeve prevents chattering of the sleeve.

A further feature of the invention consists in preventing rapid and irregular movements of the floating sleeve 43 by providing circumferential grooves 42'' in the outer surface 42' of the tube 42, which serve to damp movements of the sleeve.

The operation of the carburetor will be apparent to those skilled in the art from the above description. It should be particularly noted that the proportions of the mixture applied when the engine is working and the proportions of the mixture supplied when the engine is idling are susceptible to separate adjustment by means which are independent functionally as well as physically.

When the engine is operating at working speeds, so that the sleeve 43 is drawn away from the nozzle 27, the amount of air entering through the major air inlet 40 so far exceeds that which can enter through the minor inlet 35, that the richness of the mixture is determined by the relation between the major air inlet 40 and the orifice 29 in the fuel conduit, and is for practical purposes unaffected by slight change in the size of the minor air inlet. The air entering through the minor air inlet, although only a small proportion of that used at working speeds, has nevertheless an important function at these speeds, since, by mixing with the fuel in the primary mixing chamber 26, it results in supplying to the secondary mixing chamber 28 more or less vaporized fuel partially mixed with air, which readily mixes with the additional air drawn in through the major air inlet. Thus, the use of the minor air inlet and the two mixing chambers results in supplying to the engine a homogeneous mixture of fuel and air.

When the engine is idling, so that the floating sleeve 43 rests on the nozzle 27, the major air inlet 40 is closed, except for the leakage

through the clearance space between the sleeve 43 and the tube 42 through the clearance heretofore mentioned. Under these circumstances, a substantial proportion of the air used in the mixture enters through the minor air inlet 35 and the amount of the gasoline drawn up is so small that its flow is not appreciably retarded by the orifice 29. The richness of the mixture accordingly depends on the size of the minor air inlet.

In the use of the carburetor, adjustments to obtain the best working and idling mixtures are made in the following manner:

To obtain the right mixture for idling, the engine is allowed to run without load at idling speed and the needle valve 36 is adjusted until the engine runs evenly and quietly, indicating that the minor air inlet has been made just the right size to obtain the best mixture for idling. To obtain the correct working mixture, the engine is operated at high speed and under load, and various adjustments of the needle valve 30 are tried until the orifice 29 is given the size which produces just the right mixture.

After the idling and high speed working mixtures have thus been determined by setting the valves 36 and 30, the correct mixtures for lower working speeds are obtained automatically by changes in the position of the floating ring 43.

Since atmospheric conditions and temperature materially affect the idling of a gasoline engine, it may be necessary from time to time to adjust the valve 36 in accordance with such conditions in order to obtain just the best mixture for idling. The working mixture, on the other hand is affected very slightly by changes in atmospheric conditions. Consequently, little change need be made in the position of the needle valve 30 after an initial setting in connection with the engine with which the carburetor is to be used. The presence of this valve is, however, of advantage, since it makes possible the adjustment of the working mixture with reference to the idiosyncrasies of the particular engine with which the carburetor is used, as well as the use of the same carburetor for many different types of engines, without any change other than a slight turning of the hand wheel 33. But, when a large number of carburetors are to be made for use with a single type of engine satisfactory results may be obtained by initially adapting the orifice 29 to this type of engine, and the needle valve 30 may be dispensed with. This makes possible the use of the simplified carburetor construction illustrated in Fig. 2.

In the device shown in Fig. 2, the orifice 29' which determines the richness of the working mixture, is formed in a plug 48 threaded into an enlarged bore 49 extending into the bottom of the post 11'. The orifice 29' and the plug 48 in which it is formed are

located between the lateral bore 24' and the minor air inlet 35. The orifice might, of course, be formed by an integral restriction in the longitudinal bore of the post. This would, however, limit the use of the carburetor to one specific type and size of engine, while, with the arrangement shown in Fig. 2, the carburetor may be adapted for use with various different engines by merely substituting for the plug 48 a plug with an orifice of a different size.

The elimination of the needle valve 30 permits the provision of a drain passage 50 in the lower part of the post 11', and a drain valve in the plug 15' which is screwed into the bottom of the post 11', and thus eliminates the necessity of a drain plug at one side of the post and of the lateral arm on the post and the additional hole in the receptacle, which are required by the arrangement shown in Fig. 1.

A further modification illustrated in Fig. 2 consists in providing stop means such as the pins 41' extending from the outer surface of the nozzle 27, to limit the downward movement of the floating sleeve 43, so that its lower edge cannot come into close contact with the outer surface 41 of the nozzle. This modification is desirable when the carburetor is used with engines which require an especially large quantity of air when idling. The minor air inlet should not be opened to the point at which air entering through this inlet would lessen the lifting suction on the fuel at running speeds. Consequently, when the engine with which the carburetor is used requires more air in idling than can be obtained by opening the minor air inlet beyond this point, the air necessary in idling may be provided by the small leak under the lower edge of the floating sleeve which is permitted by use of the pins 41'. Notwithstanding this leak and the leak through the clearance space between the sleeve 43 and the tube 42, a substantial portion of the air is still admitted through the minor air inlet, so that the richness of the idling mixture can be controlled, as in the modification first described, by manipulation of the valve 36.

What is claimed is:

1. In a carburetor having a floating sleeve the bottom of which controls the admission of air in accordance with the speed of the engine to which the carburetor is connected, a tubular wall extending downward into the upper portion of the sleeve and providing between it and the sleeve a narrow clearance space to the top of which inflowing air has access.

2. In a carburetor having a floating sleeve for controlling the admission of air in accordance with the speed of the engine with which the carburetor is used, means for limiting the downward movement of the sleeve, and means providing an annular recess surrounding the upper portion of the sleeve and

formed to provide a small clearance space inside the sleeve and a larger clearance space outside the sleeve when the sleeve is in its lowest position.

3. In a carburetor, two co-axial conduits providing a mixing passage and having their adjacent ends spaced apart to provide an annular air inlet into said passage, a floating sleeve surrounding the upper conduit and fitting loosely thereon, an inwardly projecting flange near the lower end of the sleeve, and a frame connecting the upper and lower conduits and formed to permit free access of air to the upper end of the clearance space between the inner surface of the sleeve and the outer surface of the upper conduit.

4. In a carburetor, a vertical mixing conduit having a fuel inlet at its lower end and having an annular air inlet, and a floating sleeve surrounding the outer surface of the lower portion of the conduit with a narrow clearance space between it and the conduit wall open to the annular air inlet at the bottom and accessible to inflowing air at the top, said sleeve extending below the lower end of the conduit and slidable to control the air inlet.

5. In a carburetor, a mixing conduit having a central fuel inlet at its lower end and having an annular air inlet, a slidable sleeve surrounding the outer surface of the lower portion of the conduit with a narrow clearance space between it and the conduit wall open to the annular air inlet at the bottom and accessible to inflowing air at the top, and an internal flange at the lower end of the sleeve projecting into the air inlet.

6. In a carburetor, a mixing conduit having at its lower end a central fuel inlet and having an annular air inlet, a slidable sleeve loosely surrounding the lower portion of the conduit, an internal flange at the lower end of the sleeve projecting into the air inlet, and an external flange at the lower end of the sleeve to provide weight to counteract the upward pressure of the air on said flange when the engine with which the carburetor is connected is running slowly.

7. In a carburetor, a mixing conduit, a conical nozzle spaced from the lower end of the conduit and directed into the conduit, a floating sleeve loosely surrounding the outer surface of the conduit and slidable toward and away from contact with the nozzle, and an internal flange at the lower end of the sleeve projecting into space between the nozzle and the end of the conduit.

8. In a carburetor, a vertical mixing conduit, a nozzle directed into the lower end of the conduit and having an in-curved conoidal outer surface spaced from the lower end of the conduit, a floating sleeve slidably mounted on the outer surface of the conduit and having a curved annular surface at its lower end cooperating with the outer surface of

the nozzle to provide an air inlet of gradually decreasing cross-section, and an internal flange at the lower end of the sleeve projecting into said air inlet.

5 9. In a carburetor, a vertical mixing conduit having a fuel inlet at its lower end and having an annular air inlet, a floating sleeve surrounding the outer surface of the conduit with a narrow clearance space between it
10 and the conduit wall open to the annular air inlet at the bottom and accessible to inflowing air at the top, said sleeve being slidable to control the air inlet, and presenting an upwardly and outwardly inclined deflecting
15 surface to the air approaching the air inlet.

10. In a carburetor, a mixing conduit having a central fuel inlet at its lower end and having an upwardly inclined annular air inlet, a slidable sleeve loosely surrounding the
20 outer surface of the conduit and presenting an upwardly and outwardly inclined deflecting surface to the air approaching the air inlet, and an internal flange at the lower end of the sleeve projecting into the air inlet.

25 11. In a carburetor, a mixing conduit, a conical nozzle spaced from the lower end of the conduit and directed into the conduit, and a floating sleeve which loosely surrounds the outer surface of the conduit, is slidable
30 towards and away from the nozzle, has an internal flange at its lower end projecting into the space between the nozzle and the end of the conduit, and has an upwardly and outwardly inclined deflecting surface at its
35 lower outer edge.

12. In a carburetor, a fixed vertical sleeve having a fuel inlet at its lower end and having an annular air inlet, and a floating sleeve surrounding the outer surface of the fixed
40 sleeve with a narrow clearance space between it and the conduit wall open to the annular air inlet at the bottom and accessible to inflowing air at the top, said floating sleeve being slidable to control the air inlet, one of said
45 sleeves being provided in its surface opposed to the other with circumferential damping grooves.

In testimony whereof I have hereunto set my hand.

50 RALPH H. BEACH.

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