

Feb. 7, 1961

F. ERNEST

2,970,822

CARBURETOR IDLE SYSTEM CONTROL APPARATUS

Filed June 13, 1957

2 Sheets-Sheet 1

Fig. 1.

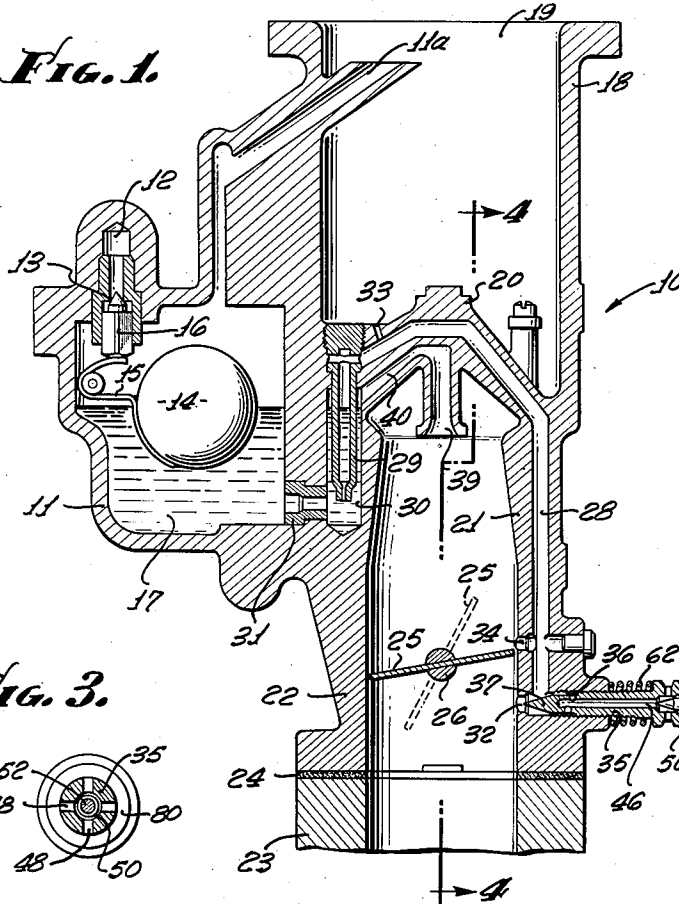


Fig. 3.

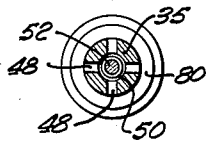
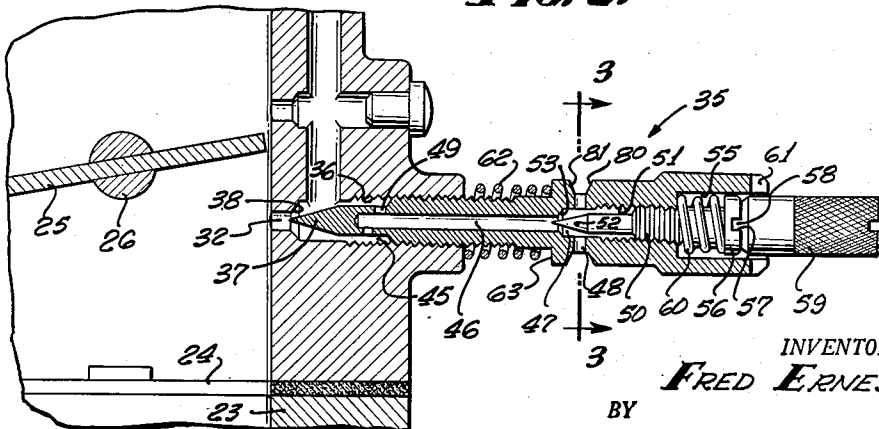


Fig. 2.



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2 Sheets-Sheet 2

Fig. 4.

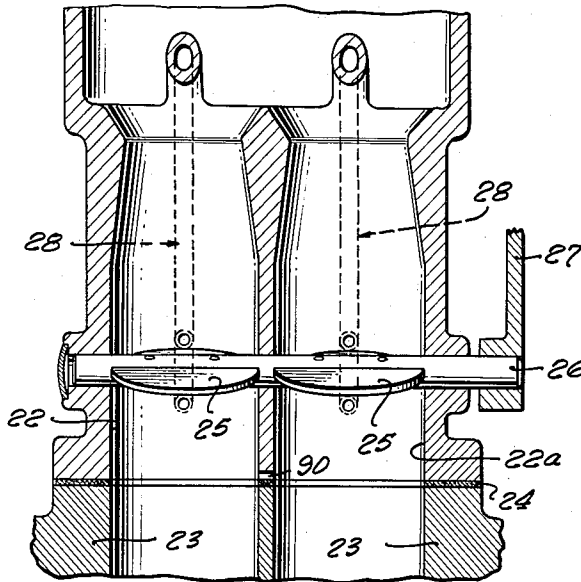


Fig. 6.

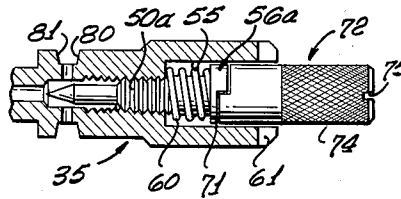


Fig. 7.

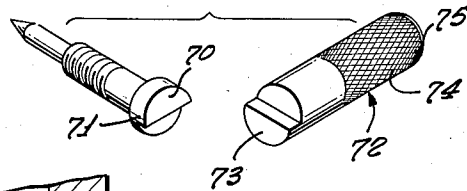
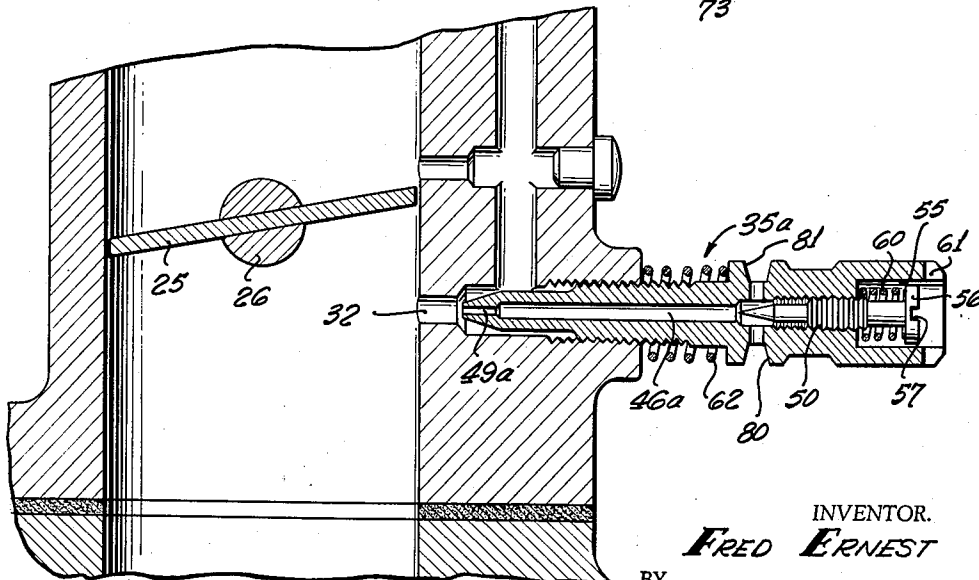


Fig. 5.



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CARBURETOR IDLE SYSTEM CONTROL APPARATUS

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15 Claims. (Cl. 261—41)

The present invention relates to carburetors for internal combustion engines, and more particularly to the provision of apparatus capable of adjusting carburetors for proper operation under conditions of engine idling or automotive vehicle coasting and deceleration.

When an internal combustion engine is idling, or when automotive equipment is decelerating or coasting, the throttle plate of the carburetor is in closed position. Fuel is then supplied to the engine substantially entirely through the carburetor idle system or passage, which bypasses the throttle plate. Although some air is bled into the idle passage, the idling fuel-air mixture supplied to the engine is found to be rich. It is also wet because of the failure of the air to atomize the fuel properly. The result is inefficient and uneconomical operation of the engine under idling, coasting and decelerating conditions.

Some carburetors have multiple barrels, one barrel only supplying a fuel-air mixture to certain engine cylinders. It is difficult to adjust the idling systems in each barrel to procure a smoothly functioning engine at idling or low speeds or under decelerating conditions. Not only is the idle mixture supplied to each barrel rich and wet, but a proper balance between the different idle systems is very difficult to achieve because of various factors, including intake manifold pulsations.

It is an object of the present invention to provide a carburetor for internal combustion engines capable of adjustment to provide the proper fuel-air ratio to the engine, which is maintained while the engine is idling or during the time that an automotive vehicle containing the engine is coasting or decelerating.

Another object of the invention is to provide a carburetor in which the fuel supplied to the engine through the carburetor idle passage is well atomized and, therefore, more easily fired in the engine cylinder or cylinders.

A further object of the invention is to provide a carburetor having an auxiliary air bleed in the idle system which is capable of adjustment to procure the desired fuel-air ratio in the idle system.

An additional object of the invention is to provide a carburetor having an auxiliary adjustable air bleed in the idle system which is prevented from becoming plugged or restricted by dirt particles and other substances.

Another object of the invention is to provide an air bleed valve in which the tendency for its inlet to become plugged with dirt particles is minimized considerably.

Still a further object of the invention is to provide a carburetor having a compound idle adjusting screw for controlling both the fuel and air in the carburetor idle system, which permits the effective discharge opening of the idle system into the carburetor throat to be made larger without increasing the amount of fuel passing through the idle system, the compound screw being capable of adjustment to the proper fuel-air ratio.

Another object of the invention is to provide a compound adjusting screw for controlling both the quantities of air and fuel supplied in a carburetor, in which one

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portion of the compound screw can be turned without effecting the turning of the other portion. More specifically, one portion, such as the fuel adjusting screw, has a greater resistance to turning than the other portion, such as the air adjusting screw, so that the latter can be adjusted without fear of rotating the former.

A further object of the invention is to provide a carburetor adjusting screw which is substantially tamper-proof to permit its adjustment only by qualified persons.

An additional object of the invention is to provide a multiple barrel carburetor in which a proper balance can be produced between the different idle systems of the several barrels.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several forms in which it may be embodied. Such forms are shown in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a vertical section through a carburetor with the throttle valve plate in closed position;

Fig. 2 is an enlarged fragmentary section of a portion of the apparatus disclosed in Fig. 1;

Fig. 3 is a cross-section taken along the line 3—3 on Fig. 2;

Fig. 4 is a fragmentary section taken along the line 4—4 on Fig. 1;

Fig. 5 is a view similar to Fig. 2 illustrating another embodiment of the invention;

Fig. 6 is a longitudinal section, and side elevational view of a portion of a modified form of adjusting screw;

Fig. 7 is an exploded isometric projection of part of the apparatus disclosed in Fig. 6.

The carburetor illustrated somewhat diagrammatically in the drawings may be of the single or multiple barrel type, the invention being applicable to both types and possessing certain additional advantages in connection with multiple barrel carburetors. The carburetor includes a carburetor body 10 having the usual float chamber 11, vented by the body passage 11a, into which fuel will pass from a fuel inlet 12 and through a valve seat 13. Such passage of fuel is controlled by the float 14 which rises or falls, depending upon changes in the fuel level in the float chamber. The float 14 is suitably connected to a float operating arm 15 that shifts the needle valve 16 with respect to the valve seat 13 for the purpose of determining the passage of fluid from the fuel inlet into the float chamber. In general, the mechanism contained in the float chamber tends to maintain a substantially constant level of fuel 17 in the chamber 11 to be supplied to the engine.

The carburetor body 10 has an upper portion 18 which constitutes the air horn, the air entering through the main air inlet 19 and passing downwardly on opposite sides of a cross or bridge member 20 extending across the carburetor body and through the venturi tube portion 21 of the body into the barrel 22 of the carburetor. This barrel is connected to the intake manifold 23 of the internal combustion engine, a suitable gasket 24 being clamped between these parts to prevent leakage therebetween. The flow of fluid through the barrel is determined by a throttle plate 25 secured to a suitable rod 26 pivotally mounted in the body 10 of the carburetor, and having an arm 27 connected thereto for operation by the usual throttle control mechanism, such as an accelera-

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tor pedal (not shown) of an automotive vehicle and the throttle linkage.

When the throttle plate 25 is in the closed position, such as illustrated in full lines in the drawings, fuel is supplied to the manifold 23 through an idle system which bypasses the throttle plate. As disclosed, the idle system includes an idle passage 28, which extends along the side portion of the carburetor body 10 to a point below the throttle plate 25, and runs upwardly through the cross member 20, communicating with an idle tube 29 extending downwardly into the main metering passage 30 of the carburetor, which has fluid communication with the float chamber 11 through a main metering jet 31. Thus, fuel can flow from the float chamber 11 through the main metering jet 31 into the main metering passage 30, passing upwardly through the idle tube 29 into the idle passage 28, and then through an idle discharge port 32 into the barrel 22 of the carburetor below the throttle plate 25.

A primary idle air bleed port 33 is also provided in the cross member 20 into the idle passage, so that some air is supplied with the fuel discharging through the idle discharge port 32 into the carburetor valve below the throttle plate. Disposed immediately above the throttle plate 25 when in closed position is an idle transfer port 34 extending between the idle passage 28 and the carburetor venturi 21. This transfer port functions as a secondary air bleed when the throttle plate 25 is in the closed position, the air passing from the venturi through the transfer port 34 into the idle passage 28, and comingling with the fuel in this passage.

The quantity of fuel passing through the idle discharge port 32 is determined by an idle fuel adjusting screw 35, which is threaded in a transverse threaded bore 36 in the carburetor body, and which has a forward tapered needle valve portion or head 37 adapted to coact with a companion valve seat 38 surrounding the discharge port 32 for the purpose of controlling the effective area between the valve seat 38 and needle valve 37 through which the fuel and air can pass into the barrel 22 on the downstream side of the throttle plate 25.

When the engine requires a greater quantity of fuel the throttle valve plate 25 is shifted towards the dotted line position illustrated in Fig. 1. As this throttle plate is opened wider, air will then flow around the cross member 20 and past the main discharge nozzle 39 of the carburetor. As the air moves through the restricted venturi tube portion 21, it creates a suction action at the outlet of the discharge nozzle 39, which will then draw fuel from the main metering passage 30, which surrounds the idle tube 29, and through a branch passage 40 into the nozzle 39. The mixture of air and fuel then passes downwardly through the carburetor venturi past the throttle valve 25 and into the intake manifold 23 of the engine.

When the throttle plate 25 just moves past the idle transfer port 34 (in moving to a throttle opening position), this latter port no longer functions to supply secondary air to the idle passage 28. Instead, the air flowing around the partly opened throttle plate 25 and past this port 34 draws fuel from the idling system 28 into the venturi of the carburetor, fuel and some air also being drawn through the idle discharge port 32. As the throttle plate 25 is opened wider and the engine speed increases, the main metering system begins to supply fuel to the engine by virtue of the increased flow of air through the venturi portion 21 and past the outlet of the main discharge nozzle 39. As the engine speed increases as a result of opening the throttle plate wider, the main metering system supplies substantially all of the fuel required by the engine, very little, if any, fuel being supplied through the idle passage 28.

It is found that the mere provision of an idle fuel adjusting screw results in a rich, wet mixture being supplied to the engine under idling conditions or conditions

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in which the throttle plate 25 is in closed position. The result is inefficient and uneconomical operation of the engine during periods of engine idling or during the time that the automotive vehicle in which the engine is contained is coasting or decelerating. By virtue of the present invention, the aforementioned difficulty is overcome by providing an auxiliary air passage in the idle system of the carburetor. The relative quantity of air entering the idle system can be adjusted, to secure the appropriate ratio of fuel to air entering the intake manifold 23 during the time that the throttle plate is closed or substantially closed.

To accomplish the aforementioned purposes, a compound idle adjustment screw is provided. This compound screw includes the idle fuel adjusting screw 35 threaded in the transverse threaded bore 36 of the carburetor body and having its forward portion 37 of reduced diameter to provide an annular space 45 therearound communicating with the idle passage 28. The idle fuel adjusting screw has a central passage 46 therethrough, the rear portion 47 of which is of an enlarged diameter, there being a plurality of circumferentially spaced transverse air inlet ports 48 extending from the exterior of the screw to the enlarged passage portion 47 to allow air to enter the screw 35. Such air will flow in a forward direction through the central passage 46 and will discharge through the transverse outlet passages or ports 49 into the annular space 45 around the reduced diameter portion 37 of the screw. The air will then flow toward the idle discharge port 32, comingling with the fuel and the air passing through the idle passage 28, the mixture discharging through the idle discharge port 32 into the barrel 22 on the downstream side of the throttle plate 25.

The quantity of air passing through the passage 46 of the idle fuel adjusting screw can be adjusted by an idle air adjusting screw 50. This screw is threaded into a companion threaded bore 51 in the fuel adjusting screw, disposed rearwardly of the air inlet ports 48. The forward portion 52 of the air inlet adjusting screw is constituted as a needle valve, the taper head of which extends in a forward direction and coacts with a valve seat 53 surrounding the reduced diameter passage 46 through the fuel adjusting screw, to determine the effective area of the passage through which air flowing through the inlet ports 48 can pass into the central passage 46 of the fuel adjusting screw. By appropriately turning the air adjusting screw 50 within the fuel adjusting screw 35 the quantity of air allowed to pass through the latter and into the idle system 28 can be regulated.

The rearward portion 54 of the fuel adjusting screw 35 is enlarged in diameter and is provided with a counterbore 55 in which the head 56 of the air adjusting screw 50 is disposed. This head is preferably disposed fully within the counterbore 55 throughout its range of adjustment in the screw 35. It may be provided with a suitable screwdriver slot 57 to enable the bit portion 58 of a suitable screwdriver 59 to be inserted into the counterbore 55 and into the slot for the purpose of turning and adjusting the air adjusting screw. This screw 50 is held in its position of adjustment by a helical compression spring 60 surrounding the shank of the screw and bearing against its head 56 and the base of the counterbore 55.

Similarly, the fuel adjusting screw 35 can be turned by inserting a suitable screwdriver or other suitable tool in the screwdriver slot 61 provided in the rear end of the fuel adjusting screw. By turning this screw 35, its conical or needle valve head 37 is appropriately spaced with respect to its companion seat 38. The adjustment is retained by a helical compression spring 62 surrounding the shank of the screw and bearing against the carburetor body 10 at one end and against a shoulder 63 provided on the fuel adjusting screw 35 at its other end.

The placement of a suitable tool in the screwdriver slot 61 of the fuel adjusting screw 35 and the turning of the latter will occur without affecting the adjustment

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of the idle air screw 50 relative to its seat 53. It is also desired to adjust the air adjusting screw 50 without correspondingly turning the fuel adjusting screw 35. To accomplish this purpose, the friction or resistance to turning of the air adjusting screw 50 is made much less than the friction or resistance to turning of the fuel adjusting screw 35 in its companion threaded bore 36. The substantially lesser resistance to turning of the idle air adjusting screw 50 can be secured by using a helical holding spring 60 of substantially lesser force than the other holding spring 62, or by using a much finer threaded interconnection between the air adjusting screw and its companion threaded bore 51 in the idle fuel adjusting screw 35 than is provided on the forward portion of the fuel adjusting screw and its companion threaded bore 36 in the carburetor body 10. The use of the finer or smaller pitch thread on the air adjusting needle valve 50 insures that it can be turned without turning the fuel adjusting screw 35. It also provides a vernier effect in that a finer adjustment of the air needle valve relative to its seat 53 can be secured than is possible with the idle adjusting screw 35 relative to its seat 38.

The idle and air screws are adjusted to their desired positions to determine the amount of fuel and air passing through the idle discharge port 32. With the engine idling, an appropriate relative adjustment can be made between the two screws 35, 50 so that fuel at the proper fuel-air ratio will pass through the idle discharge port 32 and into the carburetor barrel 22. The proportion of fuel passing into the discharge port 32 can be varied by appropriately turning the idle adjustment screw 35 within the carburetor body 10. The proportion of fuel can also be determined by turning the air adjusting screw 50 within the fuel adjusting screw 35. It is to be noted that the vacuum in the intake manifold 23 and in the carburetor is drawing fluid from both the idle passage 28 and the auxiliary air passage 46. By adjusting the air screw 50 to increase the effective opening through the auxiliary passage 46, a greater proportion of air will be drawn through the passage 46 into the idle discharge port 32 and there will be a lesser suction effect in the idle passage 28, so that less fuel is drawn there-through. Thus, if the idle mixture is to be made leaner, this can be accomplished either by feeding the idle adjusting screw 35 inwardly towards its seat 38, or by feeding the air adjusting screw 50 outwardly further away from its seat 53. In both instances, a lesser amount of fuel will be drawn through the idle passage.

To secure a leaner or a richer idle fuel-air mixture by turning both screws 35, 50 in the same direction, their threads are made of opposite hands. Thus, the fuel adjusting screw 35 and its companion threaded bore 36 may have right hand threads, whereas the air adjusting screw 50 and its companion threaded bore 51 are made with left hand threads. Accordingly, the turning of the fuel adjusting screw 35 to the right will feed it inwardly to restrict the idle discharge port 32; the turning of the air adjusting screw 50 to the right causing it to move in an outward direction from its seat 53 to increase the effective area of the air passage 46 through the fuel adjusting screw. Conversely, turning of the fuel adjusting screw 35 to the left will increase the effective area of discharge port 32, whereas turning of the air adjusting screw 50 to left will cause it to move closer to its companion valve seat 53 and decrease the effective area of the auxiliary air passage 46.

The compound adjusting screws 35, 50, including the auxiliary air passage 46, not only insure that the proper air-fuel ratio can be supplied to the engine during idling conditions or conditions in which the throttle plate 25 is closed, but it also insures that adequate air will be supplied with the fuel passing through the idle passage 28 under low speed or low load operating conditions. As described above, the idle transfer port 34 functions as a secondary air bleed when the throttle plate 25 is in its fully closed condition. Under this condition, air passes

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into the idle passage 28 through both the primary bleed port 33 and the secondary or transfer port 34. However, when the throttle plate 25 passes to the other side of the idle transfer port 34, the latter no longer functions as an air bleed. In the absence of the compound adjusting screw, the only air then available for the fuel in the idle passage 28 would be that entering through the primary port 33. Accordingly, the mixture supplied to the engine would be exceedingly rich. With the compound screw arrangement described, air is always being supplied through the auxiliary air bleed passage 46, despite the fact that the transfer port 34 may become ineffective. Assurance is had that fuel supplied through the idle passage 28 will be comingled with the required amount of air for proper combustion in the engine cylinders or cylinders.

In the form of invention illustrated in Fig. 5, the idle fuel adjusting screw 35a has a straight through passage 46a terminating in a forward central jet portion 49a coaxial with the idle discharge port 32 and adapted to discharge a stream of air directly into this port. This arrangement permits a greater volume of air to move down through the central bore 46a to be discharged into the idle fuel at the location of the discharge port 32, thoroughly comingling and atomizing the fuel-air mixture before it enters the intake manifold 23 and then passes into the engine cylinders.

To minimize the opportunity for unauthorized tampering with the idle adjustment of the carburetor, the head 56a of the air adjusting screw 50a may be formed in the manner illustrated in Figs. 6 and 7, in which it is of a step configuration, the rearward portion 70 of the head being semi-circular. The periphery 71 of the head itself is circular and has a diameter approaching that of the counterbore 55 in the fuel adjusting screw 35. The air screw 50a can be turned by the tool 72 disclosed, having its inner portion stepped and companion to the screw head 56a. Thus, the inner end of the tool will have a semi-circular bit portion 73 and also a diameter substantially the same as the diameter of the counterbore 55. When the semi-circular screw head 70 and bit head 73 are placed in overlapping relation (as shown in Fig. 6), with the periphery of the tool 72 within the counterbore 55, the tool can be turned either by grasping its knurled stem portion 74 or by inserting a screwdriver in its outer slot 75, to adjust the air screw 50a within its companion threaded bore 51 in one direction or the other. Lacking the special tool 72, unauthorized persons cannot change the effective area of the air passage 46 or 46a by changing the adjustment of the air screw within the fuel screw.

It is to be noted that the air inlet ports 48 open into a circumferential groove 80 in the fuel adjusting screw 35, the opposite sides 81 of the groove tapering inwardly toward one another. With this arrangement and by making the area of each port 48 equal to or greater than the area of the central air passage 46 through the fuel adjusting screw 35, the velocity of the air entering the ports 48 is relatively low, and for that matter, the velocity of the air in the circumferential groove 80 is lower still. As a result, there is comparatively little velocity in the air passing into the groove 80, and this velocity is insufficient to carry dirt particles and the like into the ports 48 and into the passage 46 through the apparatus. The groove 80 also functions as a baffle, protecting the ports 48 from becoming plugged during handling. In addition, air passing longitudinally of the idle adjusting screw 35 is not drawn with any great suction or velocity inwardly towards the ports 48. Accordingly, solid particles that might be carried in the air tend to move past the groove 80, rather than being drawn into the groove and the inlet ports.

The invention finds application in single barreled carburetors and also offers distinct advantages in connection with multiple barreled carburetors. By way of illustration, a two-barreled carburetor is shown in the draw-

ings, there being an equalizing passage 90 between the barrels 22, 22a on the downstream side of their respective throttle plates 25, which are both connected to a common operating rod 26, and which will move together between opened and closed positions. Each barrel has its own idling system 28, as well as its main metering passage 30 and discharge nozzle 39. A compound adjusting screw 35, 50 is employed in connection with each idle system and can be adjusted to appropriately balance each of the barrels 22, 22a of the carburetor. The fuel screws and air screws are appropriately adjusted to secure the proper fuel-air ratio in each barrel, and also to procure a proper balance between the volume of such fuel and air supplied to the respective carburetor barrels and intake manifold. Smooth operation of the engine at idling speeds and under conditions of coasting and deceleration is thereby assured.

The inventor claims:

1. In an internal combustion engine carburetor: a body having a main passage through which air and fuel are adapted to flow; a throttle valve controlling flow of air and fuel in said main passage; said body having an idling passage opening into said main passage; an idle adjusting valve threaded in said body and extending into said idling passage to control the flow of fuel in said idling passage, said idle valve having an air passage for supplying air to said idling passage; and an air adjusting valve threaded in said idle adjusting valve and extending into said air passage to control the flow of air therein; the threaded connection of said idle valve in said body being of the opposite hand from the threaded connection of said air valve in said idle valve.

2. In an internal combustion engine carburetor: a body having a main passage through which air and fuel are adapted to flow; a throttle valve controlling flow of air and fuel in said main passage; said body having an idling passage opening into said main passage on the downstream side of said throttle valve; an idle adjusting valve threaded in said body and extending into said idling passage to control flow of fuel therein, said idle valve having an air passage for supplying air to said idling passage; and an air adjusting valve threaded in said idle adjusting valve and extending into said air passage to control the flow of air therein; the threaded connection of said idle valve in said body being of the opposite hand from the threaded connection of said air valve in said idle valve.

3. In an internal combustion engine carburetor: a body having a main passage through which air and fuel are adapted to flow; a throttle valve controlling flow of air and fuel in said main passage; said body having an idling passage opening into said main passage on the downstream side of said throttle valve; an idle adjusting valve threaded in said body and extending into said idling passage to control flow of fuel therein, said idle valve having an air passage for supplying air to said idling passage; and an air adjusting valve threaded in said idle adjusting valve and extending into said air passage to control the flow of air therein; the threaded connection of said idle valve in said body being right hand and the threaded connection of said air valve in said idle passage being left hand.

4. In an internal combustion engine carburetor: a body having a main passage through which air and fuel are adapted to flow; a throttle valve controlling flow of air and fuel in said main passage; said body having an idling passage opening into said main passage on the downstream side of said throttle valve; an idle adjusting valve threaded in said body and extending into said idling passage to control flow of fuel therein, said idle valve having an air passage for supplying air to said idling passage; and an air adjusting valve threaded in said idle adjusting valve and extending into said air passage to control the flow of air therein; the pitch of the threaded connection of said air valve in said idle valve being

less than the pitch of the threaded connection of said idle valve in said body.

5. In an internal combustion engine carburetor: a body having a main passage through which air and fuel are adapted to flow; a throttle valve controlling flow of air and fuel in said main passage; said body having an idling passage opening into said main passage on the downstream side of said throttle valve; an idle adjusting valve threaded in said body and extending into said idling passage to control flow of fuel therein, said idle valve having an air passage for supplying air to said idling passage; and an air adjusting valve threaded in said idle adjusting valve and extending into said air passage to control the flow of air therein; the threaded connection of said idle valve in said body being right hand and the threaded connection of said air valve in said idle passage being left hand; the pitch of said left hand threaded connection being less than the pitch of said right hand threaded connection.

6. In an internal combustion engine carburetor: a body having a main passage through which air and fuel are adapted to flow; a throttle valve controlling flow of air and fuel in said main passage; said body having an idling passage opening into said main passage on the downstream side of said throttle valve; an idle adjusting valve threaded in said body and extending into said idling passage to control flow of fuel therein, said idle valve having an air passage for supplying air to said idling passage; and an air adjusting valve threaded in said idle adjusting valve and extending into said air passage to control the flow of air therein; the threaded connection of said idle valve in said body being of the opposite hand from the threaded connection of said air valve in said idle valve; said air adjusting valve being disposed completely within said idle adjusting valve.

7. In an internal combustion engine carburetor: a body having a main passage through which air and fuel are adapted to flow; a throttle valve controlling flow of air and fuel in said main passage; said body having an idling passage opening into said main passage on the downstream side of said throttle valve; an idle adjusting valve threaded in said body and extending into said idling passage to control flow of fuel therein, said idle valve having an air passage for supplying air to said idling passage; an air adjusting valve threaded in said idle adjusting valve and extending into said air passage to control the flow of air therein; first spring means releasably holding said idle valve in various adjusted positions; second spring means releasably holding said air valve in various adjusted positions; said second spring means and threaded connection between said air valve and idle valve providing substantially less resistance to turning of said air valve in said idle valve than is provided by said first spring means and threaded connection between said idle valve and body.

8. In an internal combustion engine carburetor: a body having a main passage through which air and fuel are adapted to flow; a throttle valve controlling flow of air and fuel in said main passage; said body having an idling passage opening into said main passage on the downstream side of said throttle valve; an idle adjusting valve threaded in said body and extending into said idling passage to control flow of fuel therein, said idle valve having an air passage for supplying air to said idling passage; and an air adjusting valve threaded in said idle adjusting valve and extending into said air passage to control the flow of air therein; said idle valve having an external circumferential groove; said air passage having an inlet opening into said groove.

9. In an internal combustion engine carburetor: a body having a main passage through which air and fuel are adapted to flow; a throttle valve controlling flow of air and fuel in said main passage; said body having an idling passage opening into said main passage on the downstream side of said throttle valve; an idle adjusting valve

threaded in said body and extending into said idling passage to control flow of fuel therein, said idle valve having an air passage for supplying air to said idling passage; an air adjusting valve threaded in said idle adjusting valve and extending into said air passage to control the flow of air therein; first spring means releasably holding said idle valve in various adjusted positions; second spring means releasably holding said air valve in various adjusted positions; said second spring means and threaded connection between said air valve and idle valve providing substantially less resistance to turning of said air valve in said idle valve than is provided by said first spring means and threaded connection between said idle valve and body; said idle valve having a counterbore; said air valve having a head in said counterbore comprising an offset segmental portion for coaction with a companion offset portion of a tool to be disposed in said counterbore to effect turning of said air valve.

10. In an internal combustion engine carburetor: a body having a main passage through which air and fuel are adapted to flow; a throttle valve controlling flow of air and fuel in said main passage; said body having an idling passage opening into said main passage; an idle adjusting valve threaded in said body and extending into said idling passage to control the flow of fuel in said idling passage, said idle valve having an air passage for supplying air to said idling passage; and an air adjusting valve threaded in said idle adjusting valve and extending into said air passage to control the flow of air therein; the threaded connection of said idle valve in said body being of the opposite hand from the threaded connection of said air valve in said idle valve; said air passage having an outlet coaxial of said idle passage and means for retaining said air valve in various positions of adjustment.

11. In a compound valve apparatus: an idle adjusting valve member having an externally threaded portion and an external circumferential groove, defined by opposed sides of said member axially spaced from one another, said member having an air passage therein opening at its inlet into said groove; and an air adjusting valve member adjustably threaded in said idle valve member and extending into said air passage to control the flow of air therein.

12. In a compound valve apparatus: an idle adjusting

valve member having an externally threaded portion and an air passage therein; an air adjusting member adjustably threaded in said idle valve member and extending into said air passage to control the flow of air therein; the threads of said externally threaded portion being of the opposite hand from the threaded connection of said air valve member in said idle valve member.

13. In a compound valve apparatus: an idle adjusting valve member having an external right hand threaded portion, said member having an air passage therein; and an air adjusting valve member having a left-hand threaded connection with said idle valve member and extending into said air passage to control the flow of air therein.

14. In a compound valve apparatus: an idle adjusting valve member having an external right hand threaded portion, said member having an air passage therein; and an air adjusting valve member having a left hand threaded connection with said idle valve member and extending into said air passage to control the flow of air therein; the pitch of the threaded connection of said air valve member in said idle valve member being less than the pitch of said externally threaded portion.

15. In a compound valve apparatus: an idle adjusting valve member having an externally threaded portion, said member having an air passage therein; said valve member having a counterbore; an air adjusting valve member adjustably threaded in said idle valve member and extending into said air passage to control the flow of air therein, said air valve member being disposed completely within said idle valve member; said air valve member having a head in said counterbore comprising an offset segmental portion for coaction with a companion offset portion of a tool to be disposed in said counterbore to effect turning of said air valve member.

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