May 23, 1967 A. C. KORTE 3,321,195

CARBURETOR IDLE ADJUST NEEDLE VALVE LOCKING DEVICE

Filed Oct. 15, 1965

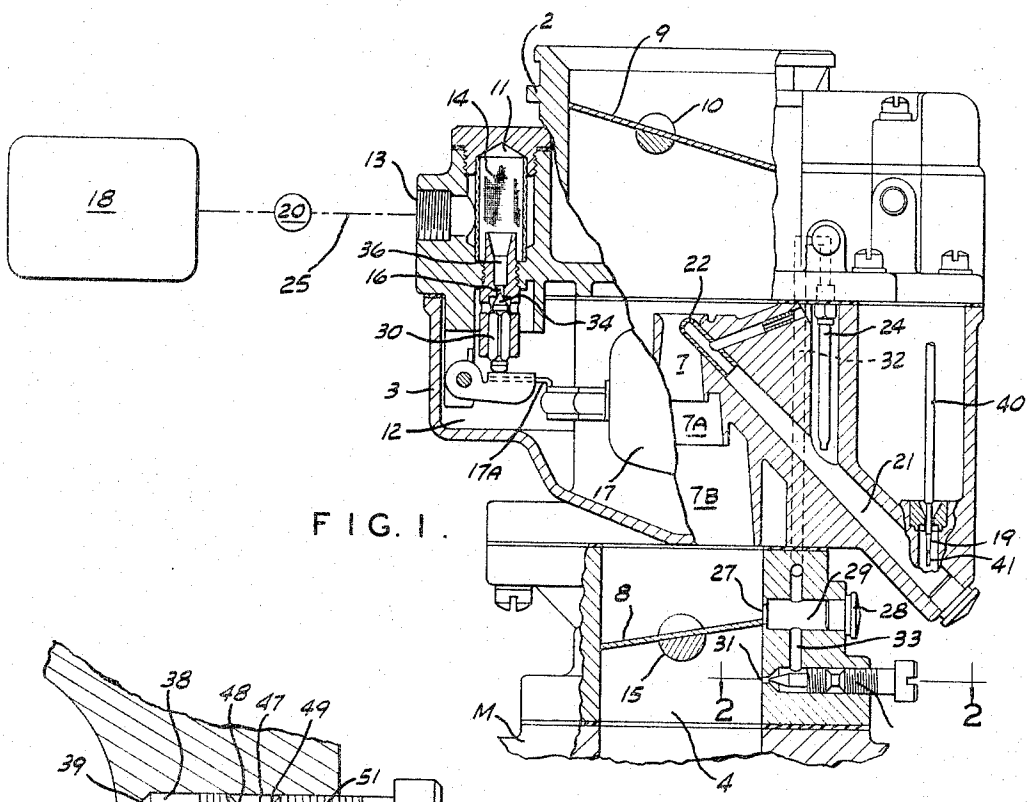


FIG. 1.

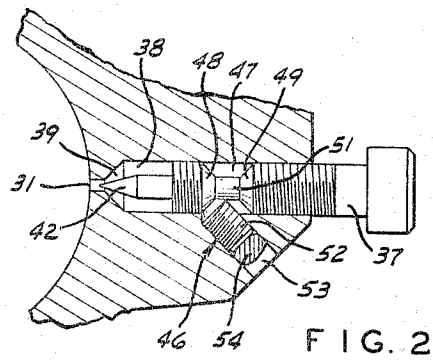


FIG. 2.

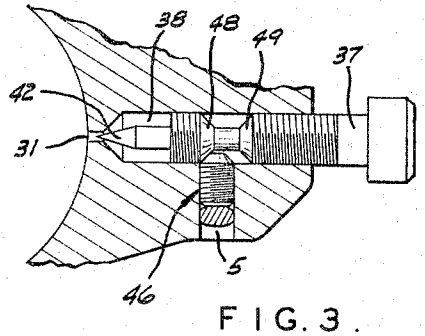


FIG. 3.

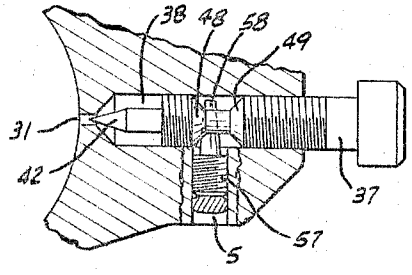


FIG. 4.

INVENTOR.
ALFRED C. KORTE
BY Robert B. Dunn
ATTORNEY

United States Patent Office 3,321,195
Patented May 23, 1967

3,321,195

CARBURETOR IDLE ADJUST NEEDLE VALVE LOCKING DEVICE

Alfred C. Korte, St. Louis, Mo., assignor to ACF Industries, Incorporated, New York, N.Y., a corporation of New Jersey

Filed Oct. 15, 1965, Ser. No. 496,335
9 Claims. (Cl. 261—41)

This invention relates to a carburetor for an internal combustion engine and particularly to an idle fuel system incorporated in the carburetor for limiting fuel mixture distributed to the engine at idle conditions.

Ordinarily, internal combustion engines operate on air fuel mixtures which vary under diverse operating conditions between about 12 to 1 and 16 to 1. It has been found that under some circumstances, whether the air fuel mixture be rich or lean, an undue amount of unburned hydrocarbon products are created and emitted to the atmosphere. This situation is most prevalent, and the offensive hydrocarbon emissions are found to be most distinct, under engine decelerating and idle conditions.

The rapid increase in automobiles in use today, together with increased commercial activity in many geographical areas of the country have created what is considered to be an unhealthy condition in the atmosphere. In effect, excessive pollution of the air under certain prevailing weather conditions has promoted what is generally referred to as smog.

Such air pollution if sufficiently concentrated can create a lethal mixture for human consumption. Although smog by no means is attributed entirely to automotive exhaust fumes, the latter have contributed to no small degree in amplifying the unhealthy situation. As a consequence, many municipalities and states have deemed it advisable to institute legislation directed toward minimizing or overcoming the amount of unburned hydrocarbon emission passed through the atmosphere as a result of motor vehicle operation.

Under ordinary running conditions, an efficient internal combustion engine introduces very little hydrocarbon emission to the atmosphere. This, however, changes radically when the engine is caused to decelerate or to idle for extended periods of time. It further changes over a period of time as engine and carburetor parts become warm.

Carburetor construction of most internal combustion engines presently manufactured, provides valve means for adjusting the carburetor to function as close as possible to theoretically ideal or optimum conditions. For example, the normal carburetor idle system includes a bypass channel formed in the carburetor wall, which channel introduces sufficient volume of air fuel mixture to the mixture conduit at a point downstream of the throttle plate when the latter is in closed or idle position to sustain the engine. This passage, or channel, is communicated with a port or opening disposed upstream of the throttle plate, and to a source of liquid fuel for achieving the desired idle air and fuel mixture.

It is found expedient, and in most instances essential, to include a flow adjusting valve in the carburetor idle system to regulate engine speed under varying idle load conditions.

Notably, engines will exhibit distinct load characteristics depending on such factors as the type of vehicle which it powers. The number of accessories which are connected to the engine, the age and condition of the engine are also pertinent factors. Thus, the idle adjust valve normally includes a needle valve or similar member disposed within the idle passage, and adapted to be regulated

external to the carburetor. The external portion includes a knob, a screwdriver slot or the like for manipulation while the engine is running.

Because the carburetor idle adjust needle is so accessible and readily manipulated, idle adjustments are often made by unskilled persons including the car owner, with the result that engine functioning is unimproved, and in some instances engine efficiency is drastically decreased. Further, since the amount of unburned hydrocarbons emitted to the atmosphere is so greatly enhanced under engine idle conditions, it is germane to the overall problem of smog control, that engine carburetors be provided with means for regulating the air fuel mixture under idle conditions so as to minimize or deter the creation of conditions which unduly promote atmospheric pollution.

It is therefore an object of the invention to provide an improved carburetor adapted to substantially decrease the production of excessive unburned hydrocarbon in an internal combustion engine.

A further object of the invention is to provide a carburetor embodying an adjustable idle fuel system adapted to regulate the limits of adjustability of said system.

A still further object of the invention is to provide an adjustable idle air fuel mixture valve including limiting means for regulating movement of said valve.

Another object of the invention is to provide a carburetor idle system adapted to be preset, and to avoid future adjustment thereof beyond predetermined critical limitations.

These objectives together with others not particularly enumerated will become clear to those skilled in the art from the accompanying description of the invention made in conjunction with the drawings.

In the drawings, FIGURE 1 is a side elevation in cross-section illustrating a carburetor with parts broken away, embodying the features of the present invention.

FIGURE 2 is an enlarged segmentary view of a portion of the carburetor shown in FIGURE 1, taken along line 2—2 in FIGURE 1.

FIGURE 3 is a segmentary view similar to FIGURE 2 showing an alternate form of the invention, and

FIGURE 4 is another view similar to FIGURE 2 illustrating an alternate embodiment of the invention.

Referring now to the drawings, for a better understanding of the invention, a downdraft carburetor is shown in FIGURE 1 as comprising an air horn section 2, a main body section 3, and an outlet section, said sections being secured together and forming a mixture conduit 6 having a stack of venturis 7, 7A, and 7B, in the main body section. The carburetor is mounted on the intake manifold M of a conventional internal combustion engine adapted for use in driving a vehicle.

A choke valve 9, operable to regulate intake air flow, is rotatably mounted in an unbalanced manner on a choke valve shaft 10 in the air horn section 2, which forms the air inlet end of the mixture conduit 6. A throttle valve 8 is rotatably mounted on a throttle shaft 15 in the outlet end of mixture conduit 6. Throttle shaft 15 is fixed to a throttle lever not shown, and connected by means of a suitable linkage to a manual control.

The main carburetor body section 3 is provided with a fuel bowl 12 having a fuel inlet 13 provided with a screen filter 14 fixed within an inlet recess 11. A fuel inlet valve 16 includes a needle valve 30 having a tapered point 34 in displaceable contact with a valve seat of a valve body structure 36 to control fuel flow from inlet 13 into fuel bowl 12. A float 17 carries an arm 17A pivotally mounted within the fuel bowl to actuate needle valve 30 for maintaining a substantially constant fuel level within the bowl 12. Fuel is supplied to the bowl from a fuel tank 18 by means of a conventional engine-operated fuel pump 20 interposed in a fuel conduit 25 leading to fuel inlet 13.

A fuel metering orifice **19** leads from fuel bowl **12** to an upwardly inclined main fuel passage **21** having a main fuel nozzle **22** discharging into the primary venturi **7**. Fuel flow from bowl **12** through orifice **19** into fuel passage **21** is controlled by a metering rod **40** having a stepped end **41** positioned in metering orifice **19**. Movement of rod **40** to position different stepped portions in orifice **19**, provides a change in fuel flow through the orifice **19**.

To achieve the above noted objects, the invention in brief includes the carburetor or charge forming device above described including the body **3** defining the air fuel mixture conduit **6** holding venturi **7**. Fuel bowl **12** is communicated to venturi **7** by the main fuel system for introducing fuel to mixture conduit **6** in response to movement of the throttle valve **8** carried at the outlet side of the mixture conduit.

The carburetor further embodies an idle fuel system including means forming an idle port **31** opening into mixture conduit **6** downstream of the throttle valve **8**. Passage means **32** communicates idle port opening **31** with a source of fuel such as the fuel bowl **12** or the main fuel supply system. The idle system also includes a second passage **33** communicated with said first passage **32** by way of chamber **29**, and opening into mixture conduit **6** upstream of throttle **8**.

The idle system includes a valve element **37** slidably received in constricted idle port **31** for regulating the amount of air fuel mixture introduced to mixture conduit **6** when the throttle valve **8** is in idle position. Means is further provided in the carburetor wall for engaging valve element **37** to minimize reciprocatory movement of the latter between predetermined positions thereby regulating within limitation, air fuel mixture which may be introduced to the carburetor under engine idle conditions.

The carburetor idle fuel system comprises basically a fuel well **23** communicated with and leading upwardly from the main fuel passage **21**. Well **23** surrounds a metering tube **24**, the latter being communicated at its upper end with a cross passage **26** connected to elongated idle passage means **32**. The lower end of the latter is communicated with mixing conduit **6** at opposed sides of throttle valve **8** when the latter is in either closed or open positions.

Idle port **27** disposed in mixing conduit **6** upstream of throttle valve **8**, includes a relatively narrow opening communicated with enlarged closed chamber **29** formed in the wall of the carburetor and provided with a removeable cap **28**.

Referring to FIGURE 2, downstream idle port **31** includes an elongated threaded well **38** formed in the carburetor wall and communicated with mixing conduit **6**. The inner end of well **38** is constricted at port **31** along tapered portion **39** which, together with the pointed end **42** of needle valve element **37**, defines an adjustable annular passage through which the idle air fuel mixture is metered prior to entering mixture conduit **6**.

Needle valve element **37** is threadably received in well **38** to be rotatably adjusted for regulating the axial position thereof. As above noted, the forward end of needle valve element **37** is provided with an elongated tapered, pointed end at tip **42** which cooperates with the adjacent tapered section **39**. Valve element **37** further includes an elongated shank **43** at least partially threaded along its length to engage the walls of well **38**, a knob **44** or slotted head is disposed at the other end of the shank. Knob **44** normally projects externally from the carburetor wall and may be adjusted to regulate the idle passage opening.

Shank **43** of valve element **37** is provided with means for engaging a locking element or idle valve positioner **46**. In one embodiment as shown in FIGURE 2, valve shank **43** is provided with a peripheral groove **47** formed approximately centrally thereof defining an inner and outer shank portion respectively. Peripheral groove **47** comprises oppositely spaced apart conical walls **48** and **49** connected by a central hub **51**. As shown, walls **48** and **49** are tapered inwardly from the shank periphery. It is understood however that the tapered configuration forming a preferred embodiment of the invention may be replaced by a similar wall exhibiting a suitable contour for engaging the idle valve position **46**.

Idle valve positioner or lock means **46** includes a member **52** such as a headless set screw carried in a threaded aperture **53** which intersects well **38** holding idle valve element **37**. Recess or aperture **53** as shown particularly in FIGURE 2, is positioned to intersect well **38** thereby permitting valve positioner **52** to engage the inner tapered wall **48** on the peripheral groove **47** and thus determine the maximum distance valve element **37** might be withdrawn from well **38**. As shown, when valve element **37** is rotated to withdraw the point end **42** from the tapered portion **39**, the point of the set screw **52** will come into an abutment with the tapered wall **48**, thereby prohibiting further withdrawal of the valve element thus prohibiting enlargement of the annular metering passage.

To avoid the possibility of the idle valve positioner **46** being tampered with or withdrawn thereby upsetting the preset or predetermined position of valve element **37**, means is provided for precluding access to positioner **46**. Such means as shown in FIGURE 2 includes a plug **54** imbedded in the outer part of recess **53**, thereby covering the upper end of set screw **52**. Plug **54** as shown, may comprise merely a metallic deformable member which is inserted into aperture **53** and thereafter upset so as to urge said member into the threads of the recess.

FIGURES 3 and 4 illustrate alternate embodiments of the invention particularly with respect to the disposition of positioner **46**. The axis of the positioner recess **56** may be normal to the axis of valve element **37** in contrast with the preferred embodiment shown in FIGURE 2, wherein the axis of said positioner **46** is disposed angularly with the axis of valve element **37** to provide a more positive contact between the tapered walls of groove **47** and the tip of the positioner.

Referring again to FIGURE 4, positioner **57** includes a modified set screw arrangement embodying an elongated forward end **58** which intersects the groove **47** in valve element **37**, in a manner similar to the embodiment shown in FIGURE 2. However, recess **56** for positioner **57** intersects the recess **38** either above or below the axis of the latter to permit a proper engagement of the mating tapered wall **48** and the positioner forward end **58**.

As can be appreciated from the foregoing description and the accompanying figures, the disclosed carburetor idle system minimizes the amount of adjusting or manipulation which may be accomplished to alter the air fuel flow rate to the mixture conduit under idle conditions. Thus, as is commonly practiced, the carburetor is adjusted preliminarily at the factory or point of assembly by subjecting the carburetor to simulated operating conditions by introducing varying air flows to the inlet of the mixture conduit.

The respective fuel control needle valves are then adjusted to achieve an optimum air fuel ratio at the carburetor discharge end. In the instance of the idle fuel system, the idle adjust needle valve element **37** is manipulated with throttle valve **8** in the closed position to simulate engine idle conditions. Valve element **37** is then gradually withdrawn. Thereafter, with a simulated air flow into mixture conduit **6**, element **37** is rotated inwardly to close the annular passage formed at the needle tip **42** and the adjacent tapered opening **39**.

Proper positioning of valve element **37** at maximum withdrawal is determined by the measured air fuel ratio of the fuel mixture, and the volume thereof entering the manifold conduit downstream of the throttle plate **8**. Under such conditions, positioner **52** is advanced to bring the tip thereof into engagement with the tapered wall **48** of peripheral groove **47**. This action prohibits further withdrawal of valve element **37** beyond the desired set-

ting. With the maximum withdrawn position of element **37** thus determined by positioner **56**, the valve element **37** may be advanced to gradually reduce idle mixture flow to the mixture conduit **6** for maintaining the desired engine speed.

It is readily seen that although the idle valve element **37** may be advanced a limited amount to constrict the annular passage at the needle tip **42**, it is impossible to withdraw the needle for permitting a greater fuel mixture feed under idle conditions. It is clear then that the present invention although basically simple in nature will preclude tampering with the carburetor idle which might otherwise foster an excessive amount of fuel mixture being fed under engine idle conditions.

With this limitation placed on the extent to which the carburetor might be adjusted, the amount of unburned hydrocarbons emitted to the atmosphere under engine idle conditions will be sharply curtailed and brought more within the control of the carburetor manufacturer at the time the carburetor is originally calibrated. However, it is understood that with the addition of accessories to the engine and due to engine and carburetor wear, the idle fuel feed will necessarily have to be adjusted. This is readily accomplished by manipulating valve element **37** with the engine operating until an optimum condition is achieved.

It is clear that the present invention constitutes an improvement of carburetors heretofore known particularly in minimizing the problem of unburned hydrocarbons and which contribute to the atmospheric smog problem.

It is further understood by those skilled in the art that the foregoing description prohibits a preferred embodiment of the invention and that certain modifications and changes may be made within the specification without departing from the spirit and scope of the invention.

I claim:

1. In a charge forming device for an internal combustion engine having a body, a mixture conduit in said body for forming an air/fuel mixture, a nozzle in said mixture conduit communicated with a source of fuel to form a main fuel system, a throttle operably positioned in said mixture conduit to regulate passage of said air/fuel mixture therethrough, the improvement therein of;

(A) an idle fuel system adapted to meter a predetermined amount of fuel to said mixture conduit under engine idle conditions, said idle fuel system being adjustable to alter said metered amount of fuel within predetermined limitations to prohibit introduction of an excessive amount of said air/fuel mixture to said engine thereby avoiding the creation of unburned hydrocarbon products from said internal combustion engine during idle conditions, said idle fuel system including;

(1) means forming a cavity in the body of said carburetor communicated with a source of fuel,

(2) an idle port opening into said mixture conduit, and communicated with said means forming a cavity,

(3) valve means operably carried in said means forming a cavity and being adjustable to regulate the flow of fuel passing through said idle port and into said mixture conduit, said valve means including;

(a) a needle valve element having a shank with a tip formed on the end thereof, the latter being cooperatively disposed in said idle port opening, thereby defining a variable flow passage, said needle valve element being rotatably moveable through said means forming a cavity to alter said fuel flow,

(b) a first peripheral shoulder on said valve element shank outward of said tip,

(c) locking means carried in said body and being so disposed that the longitudinal axis thereof intersects said cavity, said locking means being adjustable to engage said first peripheral shoulder on said valve element to define a contact area and thereby prevent further axial movement of said needle valve element in a direction away from said idle port opening after said needle has been withdrawn from said idle port opening a sufficient distance to provide the maximum desired amount of fuel to said mixture conduit under engine idle conditions.

2. In charge forming device as defined in claim **1**, wherein said locking means is threadably carried in said body and disposed in a direction substantially normal to said means forming a cavity, and at least one of the surfaces defining said contact area is comprised of a tapered portion.

3. In a charge forming device as defined in claim **1**, wherein said locking means carried in said body is disposed at an obtuse angle to the axis of said needle valve element.

4. In a charge forming device as defined in claim **1**, wherein said needle valve element includes, a tapered portion forming said peripheral shoulder to engage said locking means at said contact area.

5. In a charge forming device as defined in claim **1**, wherein the longitudinal axis of said locking means is so disposed to substantially interest the longitudinal axis of said means forming a cavity.

6. In a charge forming device as defined in claim **1**, wherein said first peripheral shoulder includes a tapered portion formed thereon, said locking means includes a tapered portion at the forward end thereof for engaging said first peripheral shoulder, said locking means being disposed at an angle to the axis of said means forming a cavity whereby the respective tapered portions formed on said said needle valve element and said locking means will define said contact area therebetween.

7. In a charge forming device as defined in claim **1**, wherein said needle valve element includes a second peripheral shoulder spaced longitudinally from said first peripheral shoulder, said locking means having the engaging end thereof disposed intermediate said respective first and second peripheral shoulders.

8. In a charge forming device as defined in claim **1**, wherein said locking means includes a tapered portion formed on the end thereof and adapted to engage said first peripheral shoulder on said needle valve element and form said contact area.

9. In a charge forming device as defined in claim **8**, wherein said needle valve element includes a tapered portion forming said first peripheral shoulder, and said locking means includes one end thereof being tapered and so disposed to engage said first peripheral shoulder to form said contact area.

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HARRY B. THORNTON, *Primary Examiner.*

T. R. MILES, *Assistant Examiner.*