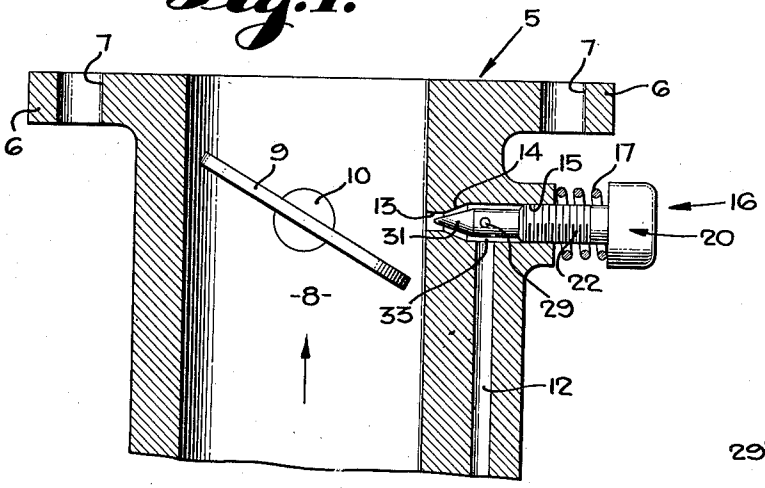
March 25, 1952 C. L. SNYDER ET AL 2,590,217

COMBINED AIR FILTER AND NEEDLE VALVE

Filed Aug. 31, 1948

Fig. 1.



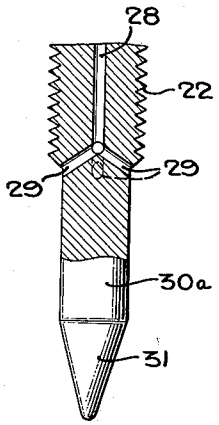


Fig. 4.

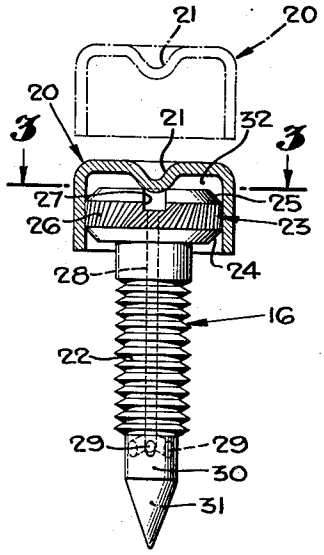


Fig. 2.

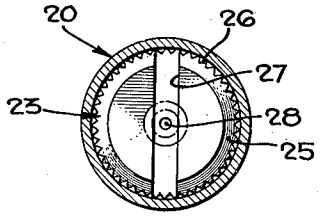


Fig. 3.

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COMBINED AIR FILTER AND NEEDLE VALVE

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5 Claims. (Cl. 183—44)

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Our invention relates generally to carburetors for internal combustion engines and more particularly to the idling fuel supply systems therefor.

In the conventional carburetor, it is the usual practice to provide a bypass conduit to conduct liquid fuel past the throttle valve so that when the latter is nearly closed, e. g., in idling condition, a small amount of fuel will still be supplied to the engine for idling purposes. When the throttle is nearly closed, as stated, a partial vacuum is created in the intake manifold and serves to draw the liquid fuel through the aforesaid bypass. It is further practice to provide such idling fuel conduit with a needle valve so that the amount of idling fuel delivered may be regulated.

One of the disadvantages of the system just described is that the fuel, usually gasoline, is delivered in an unatomized liquid condition into the intake manifold, thus making for very inefficient operation of the engine during idling conditions. This undesirable condition of the fuel during idling period is due to the fact that the air is supplied through the intake manifold past the nearly closed throttle valve and when it reaches the idling fuel inlet, is moving at a relatively low velocity. Thus, there is no atomizing effect of the air on the fuel with the result that the latter is delivered in relatively large droplets, rather than in atomized form, as is the case with fuel delivered by the high speed jets into a relatively high velocity air stream.

Some efforts have been made in the past to overcome the above difficulty by providing an auxiliary air inlet port immediately adjacent the needle valve controlling the idling fuel. In some cases, this has been done by drilling an axial hole clear through the needle valve to admit air at the tip of the needle valve where it is mixed with the liquid fuel. The disadvantage of this latter arrangement is that while the needle valve serves to regulate the flow of liquid fuel, the axial air-bleed hole through the center of the needle valve is unaffected by adjustment thereof and thus it is impossible to properly regulate the mixture of air and fuel.

Still other efforts have been made to provide air-bleed passages through the needle valve by drilling an axial hole partially through the needle valve and then connecting the same with a radial hole through the side of the valve.

A single radial hole of the type just described is not satisfactory, however, since rotation of the valve for the purpose of adjusting the needle relative to its seat rotates the air-bleed hole to

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various positions with respect to the adjacent fuel passage. Thus, the radial hole through which air is admitted to mix with the fuel may or may not be in an optimum position when the needle valve is adjusted to its optimum position relative to the seat.

A still further disadvantage encountered with previous air-bleed systems of the class described is that the air-bleed passage, being necessarily small, tends to become plugged with the ever-present grease and dirt which accumulates on automotive engines. Still further, particles of dirt or other foreign matter may enter through the air-bleed hole, but become lodged in the fuel passage, whereby to completely clog the idling fuel supply and prevent the engine from idling at all.

Bearing in mind the foregoing disadvantages of previous idling fuel supply systems, it is a major object of the present invention to provide means for admitting a supply of air into the idling fuel system whereby to effect efficient motor operation during idling periods.

It is another object of our invention to provide an air passage of the class described which is incorporated in the needle valve itself in order that such valve may be replaced in existing engines to increase the efficiency thereof.

It is still another object of my invention to provide a needle valve having an air passage therein which is adapted for efficient operation regardless of the adjusted position of the needle thereof.

A further object of the invention is to provide an air-bleed needle valve of the class described which incorporates a filter to prevent clogging of the air or fuel passages of the idling system in which the valve is incorporated.

The foregoing and other objects and advantages of the invention will be apparent from the following detailed description thereof, such consideration being given also to the attached drawings, in which:

Figure 1 is an elevational section through a portion of a conventional carburetor manifold, having the novel needle valve incorporated in the idling fuel supply system thereof;

Figure 2 is an enlarged elevational section of the valve shown in Figure 1;

Figure 3 is a section taken on the line 3—3 in Figure 2; and

Figure 4 is an enlarged elevational partial section of a slightly modified form of the valve shown in Figure 1.

In the drawings, we have illustrated the needle

valve of the present invention as incorporated in an up-draft carburetor of conventional design although it will be realized that the device is equally useful in other types of carburetors. Only the upper manifold portion 5 of the conventional carburetor is shown, the manifold portion 5 being provided with the usual attachment flanges 6 and bolt holes 7, whereby the carburetor is secured to the intake manifold of an internal combustion engine.

The main supply of air-fuel mixture for high speed operation flows through a main passageway 8, moving upwardly in the direction of the arrow shown in Figure 1, being regulated by a throttle valve 9 which is rotatable on a shaft 10 from a longitudinal or open throttle position to a transverse or closed throttle position in the usual manner.

When the throttle 9 is in nearly closed position, as illustrated in Figure 1, the rate of air flow through the main passageway 8 is relatively small with the result that practically no fuel is supplied through the main high speed jets of the carburetor in the venturi (not shown). Thus, for idling purposes, an auxiliary fuel supply must be provided. In the present instance, this auxiliary fuel supply is provided through a liquid fuel passage 12 formed integrally with the manifold 5, the passage 12 having its lower end located in a liquid fuel well (not shown) whereby the partial vacuum condition existing above the throttle during idling conditions will cause liquid fuel to rise in the passageway 12 and discharge through a transverse connecting passageway 13 into the main passageway 8. The rate at which liquid fuel is delivered through the passageways 12 and 13 into the main passageway 8 is regulated by means of a needle valve 16 having a conical needle portion 31 which may be moved toward or away from a conical seat 14 formed in the transverse passageway 13.

The needle valve 16 is provided with a threaded shank 22 received in a threaded opening 15 in the carburetor body 5. In order to hold the valve 16 in any adjusted position thereof, a relatively stiff compression spring 17 is secured under the head thereof whereby to exert a constant axial thrust outwardly on the valve 16 whereby to prevent the same from rotating due to the vibration of the engine.

For a detailed description of the construction of the valve 16, reference should now be had to Fig. 2, wherein it will be seen that the valve is formed with a relatively large diameter threaded shank 22, a reduced diameter needle portion 30 having a conical point 31. A generally flat head 23 is formed on the upper end of the shank 22, the head being provided with peripheral serrations 26, and a transverse slot 27. The upper and lower edges of the head 23 are heavily chamfered, as indicated by the reference characters 24 and 25.

In order to provide the filter hereinbefore mentioned, a cup-shaped cap 20 is pressed onto the head 23, having a light press fit with the points of the peripheral serrations 26.

An indentation 21 is formed in the upper wall of the cap 20 which indentation engages the top of the head 23 as illustrated in Figure 2, thus preventing the cap from coming into complete face-to-face engagement with the upper surface of the head 23.

An air-bleed passageway is provided in the valve 16, comprising an axial passage 28 connected by a plurality of transverse passages 29,

having their exits in the needle portion 30 at the lower end of the valve 16. It will be noted that, in the form shown in Figure 4, there are three transverse passages 29, although more may be provided if desired.

Thus, it will be noted that a passageway for air to be introduced with the fuel through the transverse idling passageway 13, is formed in the valve 16. The air enters this air-bleed passageway through the serrations 26 into a chamber 32 at the top of the valve. From the chamber 32, the air travels through the slot 27 into the axial passageway 28 from whence it discharges through the radial passages 29 adjacent the upper end of the liquid fuel passageway 12. Practically all particles of dirt or other material are filtered out by the passage of the air through the numerous small spaces or channels formed by the serrations 26 and since there are a large number of these serrations, the tendency for the air passageway to become completely clogged is virtually eliminated. It should be noted in passing that the relatively wide chamfers 24 and 25 reduce the width of the serrated periphery 26 whereby to reduce the air friction pressure drop as the air passes into the chamber 32.

It should also be noted that the velocity of the air passing through the valve 16 is greatly reduced in the chamber 32 and that any small particles of heavy material which might have been drawn through the serrations 26 will tend to remain trapped in the chamber 32 due to the fact that they are no longer suspended by the moving air stream. Since the cap 20 is a light press fit on the head 23, it may be removed and cleaned occasionally in order to get rid of any particles of dirt which may adhere to the serrations 26 or may have become entrapped in the chamber 32.

It has been found by experimentation that the optimum position of the transverse passageways 29 with respect to the vertical fuel passageway 12 is one in which the passageway 29 is neither directly opposed to the liquid fuel passageway 12 nor is on the opposite side of the valve 16 from the pasageway 12, i. e., pointing upwardly in Figure 1. Optimum mixture of the air entering through the valve 16 with the liquid fuel moving through the passageways 12 and 13 is achieved when one, at least, of the radial passageways 29 is somewhat transversely positioned with respect to the vertical passageway 12. It will be seen, therefore, that by providing a number of radial passages 29 angularly spaced around the needle portion 30, one at least will always be located substantially at the side of the valve 16 and thus in optimum position.

Due to the fact that the needle portion 30 is of considerably less diameter than the outside diameter of the threaded opening 15, an annular mixing chamber 33 is formed immediately above the upper end of the liquid fuel passageway 12. The air entering into the mixing chamber 33 through the orifices of the passageways 29 has ample opportunity therefore to mix with or "froth" the liquid fuel, thus greatly increasing the combustion efficiency thereof during the idling period.

In some carburetor designs, the seat against which the needle valve is moved to close the idling fuel passageway is located a considerable distance inwardly of the liquid fuel passageway 12. In such instances, it is desirable that the needle valve 16 be modified to elongate the needle portion as indicated by the reference

character 30*a* in Figure 4. In such modified valves, the mouths of the transverse passageways 29 are placed close to the juncture between the needle portion 30*a* and the threaded shank 22. It will be noted that, in the form illustrated in Figure 4, four transverse or radial passageways 29 have been employed, instead of three as shown in Figure 2.

While the valve shown and described herein is fully capable of achieving the objects and providing the advantages hereinbefore stated, it is capable of considerable modification without departing from the spirit of the invention. For this reason, we do not mean to be limited to the forms shown and described, but rather to the scope of the appended claims.

We claim:

1. For use with an air bleed needle valve of the type in which air is admitted through a passageway formed in the shank of said valve, a filter for said air comprising: a head formed on the rearward end of said valve, said head having a rearward opening of said passageway formed therein; an imperforate cap received on said head to enclose all but the undersurface thereof and to form an enclosed chamber adjacent said opening; and a plurality of relatively restricted channels formed in said head and opening in said undersurface to admit air into said chamber.

2. For use with an air bleed needle valve of the type in which air is admitted through a passageway formed in the shank of said valve, a filter for said air comprising: a head formed on the rearward end of said valve, said head having the rearward opening of said passageway formed therein and having a plurality of peripheral serrations formed therein; and a cap received on said head to enclose all but the undersurface thereof and to form an enclosed chamber adjacent said opening, said cap resting on the tips of said serrations whereby to admit air through the spaces between said serrations into said chamber.

3. For use with an air bleed needle valve of the type in which air is admitted through a passageway formed in the shank of said valve, a filter for said air comprising: a head formed on the rearward end of said valve, said head having the rearward opening of said passageway formed in the top surface thereof; a cap received on said head to enclose all but the undersurface thereof, said cap having a transverse wall with an indentation formed therein, said indentation being positioned and adapted to contact the top surface of said head and space said transverse wall therefrom whereby to form

an enclosed chamber adjacent said opening; and a plurality of relatively restricted channels formed in said head and opening in said undersurface to admit air into said chamber.

4. For use with an air bleed needle valve of the type in which air is admitted through a passageway formed in the shank of said valve, a filter for said air comprising: a head formed on the rearward end of said valve, said head having a rearward opening of said passageway formed in the top surface thereof and having a plurality of peripheral serrations formed therein; and a cap received on said head to enclose all but the undersurface thereof, said cap having a transverse wall with an indentation formed therein, said indentation being positioned and adapted to contact said top surface and space said transverse wall therefrom whereby to form an enclosed chamber adjacent said opening, the side wall of said cap resting on the tips of said serrations whereby to admit air between said serrations from said undersurface into said chamber.

5. An air filter for a needle valve member of the type having an axial bore therein, said filter comprising: a head formed on an end of said valve member with said bore opening in the top surface of said head and having longitudinally extending peripheral serrations formed in said head; and a cup-shaped, downturned cap having a press fit with said head, said cap being received on said head to surround all but the undersurface thereof, and having an indentation in the top wall thereof to space said wall from said top surface and to form a chamber adjacent said bore opening whereby air passing through said bore is filtered by also passing longitudinally through said serrations.

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