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CARBURETOR INLET VALVE

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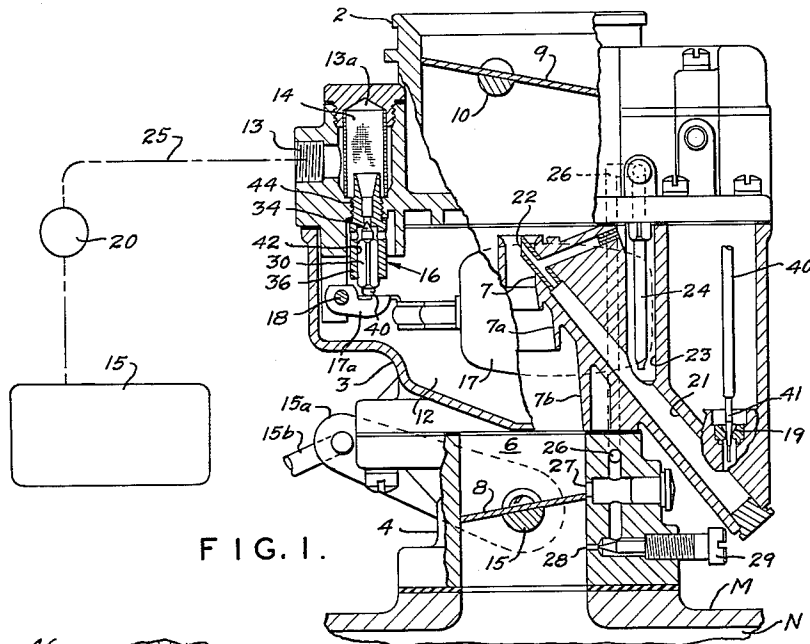


FIG. 1.

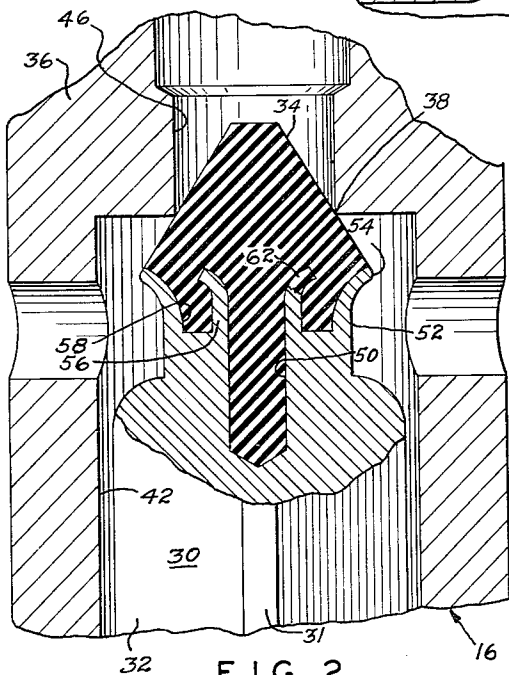


FIG. 2.

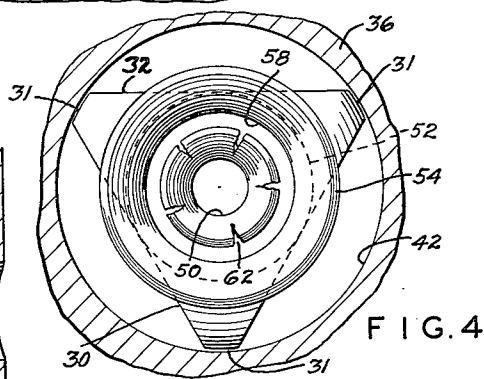


FIG. 4

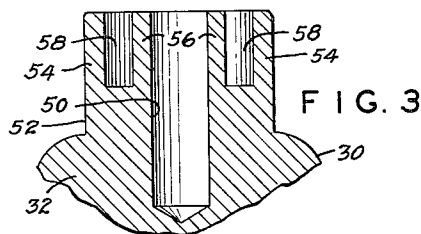


FIG. 3

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CARBURETOR INLET VALVE

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This invention relates to carburetors for internal combustion engines, and particularly to float actuated needle valves for maintaining a predetermined constant fuel level within a fuel bowl.

Conventional float actuated needle valves for carburetors comprise a valve body having a metallic seat for engagement by the tapered end of a metallic needle. To prevent leakage and flooding of the carburetor, the needle and seat must be manufactured to exact tolerances, and the fuel must be free from particles of foreign material which might interfere with proper seating of the needle. Also, when carburetors of this type are used on engines employed to drive boats, automobiles, and airplanes, engine vibration or rough travel of the vehicle may cause the float to oscillate and open the needle valve slightly when additional fuel is not required in the fuel bowl.

It is, therefore, an object of the invention to provide a novel carburetor needle valve structure adapted to insure proper seating of the needle against the valve seat to prevent flooding of the carburetor.

Another object of the invention resides in the provision of a novel carburetor needle valve, the operation of which is little affected by engine vibration or rough usage.

A further object of the invention resides in the provision of a novel carburetor needle valve structure during the operation of which the effect of particles of dirt in the fuel is minimized in interfering with proper seating of the needle.

The invention embodies other novel features, details of construction and arrangement of parts which are hereinafter set forth in the specification and claims, and illustrated in the accompanying drawing, forming part thereof wherein:

FIG. 1 is a side elevation in several partial sections, illustrating a carburetor provided with a float actuated needle valve embodying features of the invention.

FIG. 2 is an enlarged fragmentary longitudinal section showing the needle valve structure of FIG. 1.

FIG. 3 is an enlarged view of one end of the needle valve of FIG. 2 during a fabrication step thereof.

FIG. 4 is a transverse plan view of the needle structure of FIG. 2 with the tip removed.

Referring now to the drawing for a better understanding of the invention, a downdraft carburetor is shown in FIG. 1 as comprising an air horn section 2, a main body section 3, and a throttle outlet section 4, 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 N adapted for use in driving a vehicle.

A choke valve 9, operable responsive to intake air flow, is rotatably mounted in an unbalanced manner on a 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 shaft 15 in the outlet end of the mixture conduit 6. Throttle shaft 15 is fixed to a throttle lever 15a connected by means of a suitable linkage 15b 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 13a. A fuel inlet valve 16, includes a needle valve 30 having a tapered

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point 34 in 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 at 18 within the fuel bowl to actuate the needle valve 30 for maintaining a substantially constant fuel level within the bowl 12. Fuel is supplied to the bowl from a fuel tank 15 by means of a conventional engine-operated fuel pump 20 interposed in a fuel conduit 25 leading to the fuel inlet 13.

A fuel metering orifice 19 leads from the 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 the metering orifice 19. Movement of rod 40 to position a different stepped portion in orifice 19 provides a change in fuel flow through the orifice 19. An idle fuel system is shown as comprising a fuel well 23 leading upwardly from the main fuel passage 21. The well 23 has a metering tube 24 therein communicating with an idle passage 26 provided with idle ports 27 and 28. An idle adjustment screw 29 is provided for the idle port 28.

The fuel inlet valve 16 includes the needle 30 formed with a body 32 of non-circular cross section (FIG. 2 and FIG. 4). One end of the needle 30 is formed with a conical tip 34. The other end of the needle 30 is formed with a rounded head 40 for engagement by the float arm 17a. The needle is mounted for reciprocable movement within a cylindrical bore 42 formed in the valve body 36. The upper end of the valve body 36 is formed with external threads 44 (FIG. 1) for detachable engagement within a threaded aperture leading through a wall of the carburetor to the inlet recess 13a.

The valve body 36 is formed with a second cylindrical bore 46 coaxially aligned with the bore 42 and of smaller diameter. The bore 46 forms a shoulder 38, with bore 42 to provide a valve seat for tip 34 of needle 30.

The included angle of taper of the conical tip 34 of the needle 30 is from 60° to 90° for seating engagement against the sharp circular edge 38 of the valve seat.

In operation, fuel is forced by pump 20 from the fuel source or fuel tank 15 through fuel connections 25 into the inlet 13 of the carburetor. Fuel will flow through the screening 14 and the fuel passages 46 and 42 past the needle valve 30, when the float structure 17 of the carburetor is in a downward position to release needle 30 from its fuel passage closing position. When the fuel bowl 12 is filled to the desired predetermined level, the float lever 17a will force the needle valve 30 against the valve seat 38 and close off further flow of fuel to the carburetor. During engine operation, fuel fills the fuel passage 21 to the same level as within the bowl. Air flow through the mixture conduit 6 passes through the venturi stack 7—7a, causing a low pressure area at the mouth of fuel nozzle 22. Atmospheric pressure on the fuel level in the fuel bowl 12 forces fuel up the fuel passage 21 and out of the nozzle 22 to mix with the air in the mixture conduit 6. The flow of air and fuel mixture into the manifold M of the engine is controlled in a well known manner by the manually operated throttle valve 8.

As fuel flows from the fuel bowl 12 through the fuel passage 21 and the fuel nozzle 22, the level of fuel in bowl 12 is lowered, with a resulting lowering of the position of float 17. The downward movement of float arm 17a permits the fuel valve 30 to drop downwardly under the force of gravity and fuel pressure from above to permit fuel flow from inlet 13 into the fuel bowl 12 to replenish that used by the engine.

The tip 34 of the needle valve 30 is formed of a synthetic rubber material, such as a fluoroelastomer compo-

sition which is not affected by contact with fuel. The use of such a rubber-like material provides a more efficient operation of the valve structure 36. The fuel flowing through the valve structure 36 often contains particles of dirt which can become lodged between the needle tip 34 and the valve seat 38. The presence of dirt between the valve and its seat tends to keep the valve structure open, with the result that the fuel bowl 12 becomes flooded due to flow of fuel under pump pressure past the valve tip 34. Forming the valve tip of a rubber or resilient material will enable the tip to give and enclose the dirt particle and still provide a sufficiently good seal to prevent flow of fuel through the valve structure 36.

It also is advantageous to provide a needle having a rubber tip which would adapt itself to all sizes of valve seats to which it might be applied. For example, the inlet size of passage 46 varies somewhat from carburetor to carburetor, depending upon its size and the amount of fuel flow desired through the carburetor. However, the passage 42 may be retained at the same size irrespective of the designed size of passage 46. In a like manner, then, the needle 30 which slidably fits within passage 42 is retained at the same size and it is desirable that the rubber tip 34 be one which will operate successfully for all variations in the size of passage 46. This has been difficult with a rubber tipped needle due to the fact that if the passage 46 of the valve structure 36 is a maximum, the valve seat 38 will meet the needle tip 34 at a point adjacent to the region at which the rubber is fixed to the metal of needle 30 or near the lower edge of the rubber tip 34, as viewed in FIG. 2, for example. At this point, the rubber is not as resilient as it is at an intermediate region between the upper end of tip 34 and the lower region at which it contacts the metal of the needle 30. Also, it has been found that there is in this lower region of the tip 34 an unevenness or wrinkling where the rubber is fastened to the metal of the needle. Accordingly, it is desirable that a larger rubber tip be utilized so that, as shown in FIG. 2, an intermediate region of the tip 34 contacts the valve seat 38. In this region, then, the rubber of the tip is more resilient than at the lower surface of the tip. However, to provide a needle of having a larger rubber tip, it has been necessary to go to a metal needle 30 of larger diameter, in order to provide sufficient area to attach the tip 34. This has encountered a cost problem in the construction and design of the carburetor, since a larger passage 42 for the larger needle has been required with a resulting redesign of the valve structure 36. Thus, the difficulty has been that of providing different valve structures for different sized carburetors in order to provide room for a larger needle having a larger rubber tip.

In accordance with the invention, however, a rubber tip needle for a carburetor is provided having a sufficiently large rubber tip which is adaptable to carburetor valve structures of varying sizes. FIG. 2 discloses the rubber tip needle 34 of the invention fixed and anchored to a metal shank 32 of the needle valve by forming in the metal shank a central bore 50 and in the cylindrical end portion 52 a pair of annular rings or collars 54 and 56. The shank 32 as shown in FIG. 4 has a triangular cross-section forming longitudinal ribs 31 centering needle 30 within bore 42. FIG. 3 shows a sectional view of the upper end of the metal shank 32 of the needle prior to its final formation. This figure shows the two annular collars or rings 54 and 56 formed substantially coaxial with the common axis of the needle and the central bore 50. In order that the structure may receive a larger rubber tip, in accordance with the invention, the annular rings 54 and 56 are flared outwardly, as shown in the cross section of FIG. 2.

FIG. 4 shows a plan view of the upper end of the needle 32 after the flaring has taken place and before the rubber tip 34 has been added. It can be seen from this view of FIG. 4 that the lip of annular ring 54 now

extends outwardly a greater radial distance than its position in FIG. 3. However, it does not go as far as the greatest radial dimension of the needle 30 which is limited by the diameter of passage 42. As shown in FIG. 4, the flare of ring 54 is somewhere intermediate the original diameter of ring 54 and the outer extend of the rib portions 31 of the needle 30. Thus, with the greater radial extent of flare of the upper end of ring 54, a larger tip 34 may be applied to the end of needle 30 than is possible if the ring 54 were restrained to its original dimension, as shown in FIG. 3.

In like manner, and in accordance with the invention, the second or inner annular ring 56 is also flared outwardly and in a direction toward the outer ring 54. This is shown in a cross sectional view of FIG. 2, and provides between the rings 54 and 56 a space 58 which is partially enclosed by the flared upper end of the ring 56. This partially enclosed space or annular region 58 is filled with the rubber of the tip 34 by a molding operation or by any other appropriate manner. The upper flared end of the annular ring 56 locks the enclosed rubber in space 58 to prevent removal of the rubber tip from the needle 30.

As pointed out above, the metal needle 30 is made from metal rod stock having a triangular cross section, as shown in FIG. 4. The rib portions 31 of the stock in one size of needle of the type described and used successfully, extend substantially .125 mill from the axis of the valve needle 30. One end of the material is made or formed into the cylindrical end portion 52, having an outside diameter of 150 mills. End portion 52 is tangent to the sides of the needle. The annular collars 54 and 56, as well as the annular region 58, may be formed in the end of the cylindrical portion 52 in any appropriate manner. In the specific needles described, the annular collar 54 has an outside diameter of 180 mills while the inner annular collar 56 has an outside diameter of 92 mills. The radial dimension of space 58 between the annular collars 54 and 56 is of 47 mills. Bore 50 is one of 40 mills diameter and is drilled with a depth of substantially $1\frac{1}{64}$ of an inch, although this depth is not a limiting dimension.

The two annular collars 54 and 56 are flared outwardly, by a sleeve and die tool in which the sleeve is placed over the cylindrical end portion 52 of the needle and has an inside diameter of the amount desired for the outside diameter of the flared portion of collar 54. A tool then is inserted into the sleeve and has surfaces which contact the tops of collars 54 and 56 (FIG. 3) and which, upon applying sufficient amount of pressure to the tool, will cause the tops of the collars to be flared outwardly in the manner shown in FIGS. 2 and 4. This procedure is more of a metal drawing operation which presses out the tops of the collars and provides a conical surface to each.

The flaring procedure should be done so as to prevent undue stretching of the metal of the two collars 54 and 56 which would cause breakage or cracking. This can be done with known procedures. However, it is also a part of this invention to provide certain fractures or cracks in the inner collar 56. These fractures are shown in FIGS. 2 and 4 and represented by reference numeral 62. The fractures 62 are easily formed since the smaller diameter collar 56 will be stressed beyond its stress limits. Design of tool will also assist the cracking. These cracks or fractures 62 of the inner ring are of a distinct advantage since, when the rubber tip 34 is molded onto the flared rings 54 and 56, the rubber not only is pressed downwardly to fill the annular space 58 between the two rings, but is simultaneously forced into the fractures 62 to cause a further locking of the rubber tip to the metal of the needle 30.

The dimensions given above for a specific needle are only illustrative of a needle which has been used successfully in a manner described and in accordance with the

invention. None of these dimensions are particularly limiting and may be varied in any manner as seen fit without changing the invention. It has been found, however, that the depth of the annular space 58 is somewhat critical since, if the metal of the rings 54 and 56 becomes too thin, the metal will tend to buckle and wrinkle at the base of rings 54 and 56 when pressure is applied by the tool to the top portions of these rings to flare them outwardly. Thus, it is necessary that the metal thickness of the rings 54 and 56 be such as to stand the pressures applied to form the flare of the two rings. The steel may be annealed, however, to prevent any fracturing or cracking of the metal when the flares are formed. As the flare is formed in the outer ring 54, the metal of the ring is forced outwardly and against the sleeve to form a true roundness of the outer ring 54. This is necessary to provide a corresponding roundness of the conical surface of the rubber tip 34. As the die forces the metal of ring 54 against the sleeve, there is a coining of the edge of ring 54 at this point. This provides a smooth rim of the flare and permits the rubber of tip 54 to adhere closely to the metal of the needle 30.

The pair of flared annular rings 54 and 56 thus provide a means for firmly anchoring the rubber of tip 34 to the needle 30. The flare of the inner ring 56 not only locks the rubber within the annular channel 58, but also forces the rubber adhering to the ring 54 tightly against the inner surface of the flared portion of ring 54 and prevents it from separating from the surface during curing operations of the rubber. The depth of the bore 50, as pointed out above, is not critical, however, it does provide a further means for anchoring the rubber tip within the shank portion of the needle 30. The particular construction of the flared annular rings is one which firmly anchors the rubber to the metal of the needle and prevents the pulling away of the rubber when the needle is removed from the die after the rubber tip has been formed. At this time the rubber is only partially cured, and in the past there has been a tendency of the partially cured rubber to be separated from the metal of the needle when removed from the die. The novel locking means provided by the annular flared rings minimizes this disadvantage. Upon further curing of the rubber, the needle is ready for use in a carburetor. The novel locking features of the rubber to the metal needle provides a rubber tip fuel valve needle, which will not pull away from the metal during operation.

We claim:

1. A valve needle for a carburetor, having a valve seat in a fuel passage, said needle comprising, a tip on one end of said valve needle adapted to abut said valve seat to close said fuel passage, said valve needle having a pair of coaxial annular rings integral with and extending from said one needle end, the free end of one of said rings being flared outwardly from the common axis thereof, said needle tip comprising resilient fuel resistant material having a conical shape and anchored between said rings.

2. A valve needle for a carburetor, having a valve seat in a fuel passage, said needle comprising, a tip on one end of said valve needle adapted to abut said valve seat to close said fuel passage, said valve needle having a pair of coaxial annular rings integral with and extending from said one needle end, the free end of one of said rings being flared outwardly from the common axis thereof, the other one of said rings enclosing the flared end of said one ring, said needle tip comprising resilient fuel resistant material having a conical shape and anchored between said rings.

3. A valve needle for a carburetor, having a valve seat in a fuel passage, said needle comprising, a tip on one

end of said valve needle adapted to abut said valve seat to close said fuel passage, said valve needle having a pair of coaxial annular rings integral with and extending from said one needle end, the free ends of said rings being flared outwardly from the common axis thereof, one of said rings enclosing the flared end of the other one of said rings, said needle tip comprising resilient fuel resistant material having a conical shape and anchored between said flared rings.

4. A valve needle adapted to be mounted for movement within a fuel passage having a valve seat, a tip on one end of said valve needle adapted to abut said valve seat to close said fuel passage, said valve needle having a pair of flared annular rings integral with and extending from said one needle end, said needle tip comprising resilient material having a conical shape and anchored between said flared rings.

5. A valve needle adapted to be mounted for longitudinal movement within a fuel passage having a valve seat, a tip on one end of said valve needle adapted to abut said valve seat to close said fuel passage, said valve needle having an annular collar integral with and extending from said one needle end, the free end of said collar being flared outwardly from the axis of said needle, said needle tip comprising resilient material having a conical shape and enclosing said flared collar end and extending through said annular collar.

6. A valve needle adapted to be mounted for longitudinal movement within a fuel passage having a valve seat, a tip on one end of said valve needle adapted to abut said valve seat to close said fuel passage, said valve needle having a pair of spaced coaxially formed collars integral with and extending from said one needle end, the free end of the inner one of said collars being flared outwardly from the axis thereof, said needle tip comprising resilient material having a conical shape and filling the space between said collars.

7. A valve needle adapted to be mounted for longitudinal movement within a fuel passage having a valve seat, a tip on one end of said valve needle adapted to abut said valve seat to close said fuel passage, said valve needle having a pair of coaxial annular rings integral with and extending from said one needle end, the free end of one of said rings being flared outwardly from the common axis thereof, said needle tip comprising resilient fuel resistant material having a conical shape and anchored between said rings.

8. A valve needle adapted to be mounted within a fuel passage having a valve seat, said valve needle including a valve body and a conical tip on one end thereof adapted to close said fuel passage, said valve body terminating at one end in a pair of integral spaced outwardly flared axially aligned annular ring portions defining outwardly open inner and outer sockets, said tip comprising resilient material formed with a conical terminal at one end with its other end extending into the sockets defined by said annular rings and anchored therein.

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