

[54] APPARATUS FOR PRODUCING A MIST OF A FLUID

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[58] Field of Search 123/25 R, 1 A;
261/18 A, 124, 122

[56] References Cited
UNITED STATES PATENTS

1,391,899	9/1921	Lynch	261/18 A
1,595,626	8/1926	Gunther et al.	261/18 A
1,755,056	4/1930	DeWeese	123/25 R
1,912,439	6/1933	Feller	261/122
2,073,887	3/1937	Strancke	261/18 A
2,207,689	7/1940	Baker	261/122
2,341,246	2/1944	Stowe	261/124
3,066,923	12/1962	Boteler	261/124

FOREIGN PATENTS OR APPLICATIONS

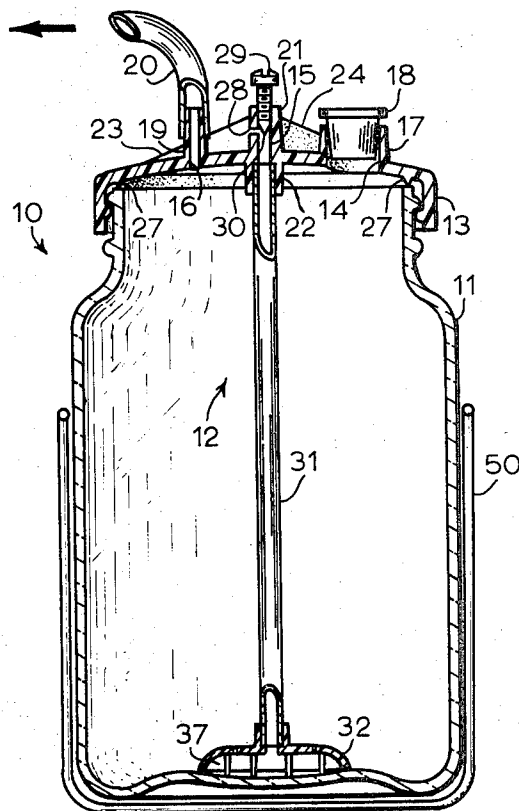
396,732	8/1933	Great Britain	261/122
1,009,829	3/1952	France	261/122

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[57] ABSTRACT

Apparatus for producing a mist of a fluid for connection into a fuel inlet stream of an internal combustion engine, in which the fluid is contained within a bottle having a gas inlet and outlet in its gas-tight cover. The inlet gas is controllable in amount and is released by an aerator beneath the surface of the contained fluid to produce a plurality of fine streams of small bubbles, which escape the surface of the fluid carrying with them a mist of the fluid entrained in the gas above the fluid. The gas and the entrained mist is exhausted through the output and injected into the fuel stream of the internal combustion engine.

3 Claims, 4 Drawing Figures



2 Sheets-Sheet 1

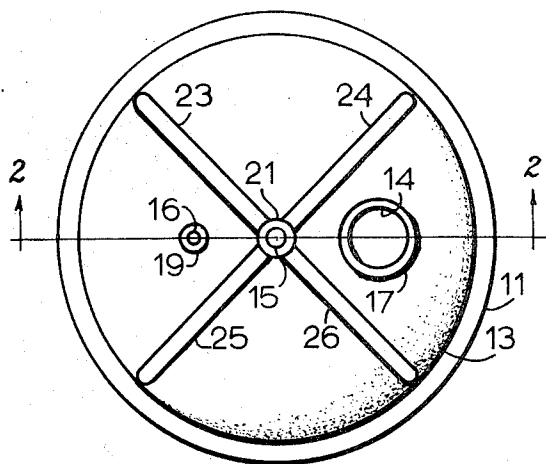


Fig. 1

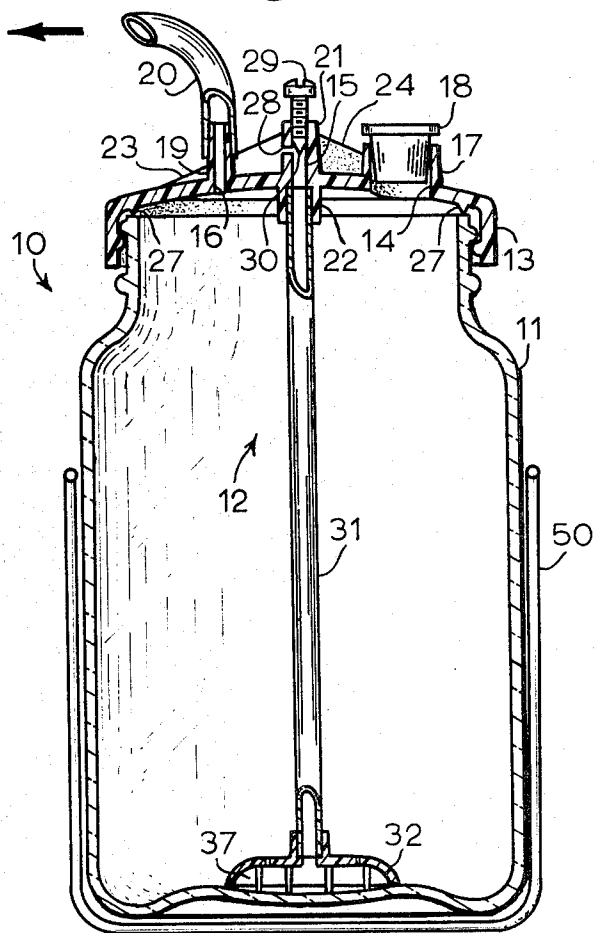


Fig. 2

Fig. 3

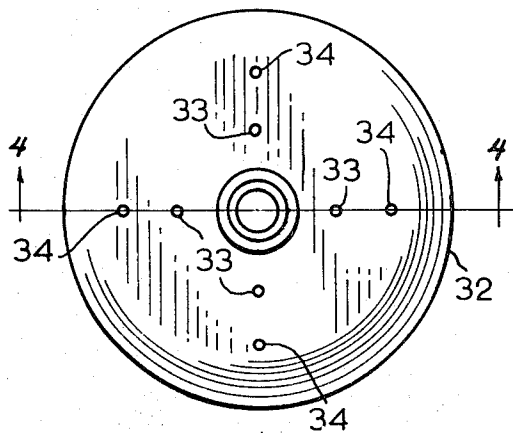
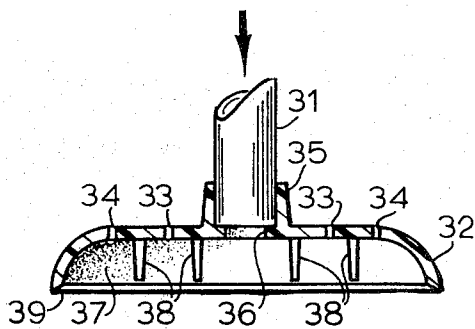


Fig. 4

APPARATUS FOR PRODUCING A MIST OF A FLUID

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an improved mist producing apparatus, and more particularly to an improved apparatus for producing a controllable and automatically adjusted amount of a mist of a desired fluid for insertion into the fuel stream of an internal combustion engine.

2. Description of the Prior Art

Only a few different types of vapor or mist producing devices or apparatuses have been proposed heretofore. Many such devices, although designed to accomplish purposes similar to that of the invention, include numerous moving parts. This is undesirable, especially in operation in conjunction with internal combustion engines since temperature extremes are frequently encountered, adversely affecting their operation. This may result in a different volume of mist produced at each different temperature, and may require continuous adjustment, which would be burdensome, at best, requiring one to adjust the apparatus, for instance, upon starting the engine, periodically as it warms up, when it is at normal operating temperature, and during periods of variation from the normal operating temperature encountered with varying loads upon the engine. Additionally, of course, moving parts are generally sources of trouble and require higher maintenance than, for example, devices not having moving parts.

In general, in the devices heretofore proposed, engine performance, economy performance and the amount of air pollution produced were not of primary concern; consequently, although such devices did have some beneficial effect in this regard, the results achieved are not optimized to any appreciable degree. These factors today are of major concern and it is to these ends that the present invention is directed.

One mist producing device advanced teaches an apparatus for leading a gas to a point below the surface of a body of a liquid and liberating it there to allow it to bubble through the liquid, and to form a mist removed at an outlet connected to the intake passage of an automobile. Neither in this nor any other apparatuses proposed is any provision made for controlling the quantity of input gas, a critical feature essential for beneficial operation in connection with internal combustion engines. Additionally, although many of the apparatuses advanced bubble a gas through a fluid to obtain a humidified gas, few recognize the importance of the relatively small sized bubbles required to produce a mist or vapor which may benefit the performance of the engine, and none recognized the importance of controlling the gas input in combination with obtaining the desired mist quantity with the fine gas bubbles. The devices heretofore proposed, for example, merely produce large gas bubbles within the fluid, which, because of their size, will not produce sufficient mist to be useful in the applications here under consideration.

Another factor of consideration is the quantity of mist entrained in the gas to be injected in the fuel stream. The apparatuses previously proposed had no single adjustment, which, when set, would allow the mist output to be that required regardless of the engine speed or operating condition, without some externally applied adjustment force, for example, a needle valve

moved in response to a carburetor setting. Not only would such moving valve suffer the problems inherent in moving parts, discussed above, it also would not react instantly to whatever condition to which it was designed to respond.

BRIEF DESCRIPTION OF THE INVENTION

In light of the above, it is therefore, an object of the invention to present a mist producing apparatus having a controllable gas input to present a desired amount of mist for injection into the combustion chambers, regardless of the speed of the engine.

It is a further object of the invention to present a mist producing apparatus, having a controllable gas input, which may be connected to inject the mist into the combustion chambers to increase the efficiency, enhance the performance, and reduce the pollution emissions of the engine.

It is a further object of the invention to provide a mist producing apparatus which, by adjustment of the quantity of an inlet gas to produce many fine bubbles, produces sufficient mist entrained in the input gas to be beneficial to the operation of internal combustion engines.

These and other objects, features and advantages will become apparent to those skilled in the art from the following description, appended claims, and accompanying drawing.

The invention, in its broad aspect, is intended for connection into a fuel inlet stream of an internal combustion engine, and includes a container for the fluid the mist of which is to be injected into the fuel stream at an appropriate engine input connection. An input means is provided for conducting a gas into the fluid within the container to bubble through it to form above its surface a mist of the fluid entrained in the gas. An output means is also provided for conducting the gas and the mist entrained in it into the fuel stream. Carrying both the input and output means is a means for providing a gas seal upon the container. The sealing means may fit upon the container, and allow gas to enter and exit only through the input and output means. Finally, a means for adjustably controlling the gas flow into the container, coacting with the input means to partially block the fuel flow through it is provided, thus enabling a precise variable desired mist to be produced, proportional to the speed of the engine.

BRIEF DESCRIPTION OF THE DRAWING

A preferred embodiment of the invention is illustrated in the accompanying drawing, wherein:

FIG. 1 is a plan view of a preferred embodiment of the invention.

FIG. 2 is a front view of the invention, in cross-section, taken along 2—2 in FIG. 1.

FIG. 3 is a plan view of the aerator assembly in accordance with the invention.

And FIG. 4 is a front view, cross-section of the aerator assembly, taken along 4'4' in FIG. 3.

It is understood that the drawings are not necessarily to scale, as dimensions of certain parts as shown in the drawings have been modified or exaggerated for the purpose of clarity of illustration and ease of description.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and in particular to FIG. 2, the humidifier apparatus of the invention, generally denoted by the reference numeral 10, includes a bottle or container 11, of any heat resistant material, and may conveniently be of glass, as such bottles are widely and commercially available. The bottle 11 may have screw threads or the like at its opening to allow a cover to be easily attached thereto. Since the bottle 11 will carry the fluid, which will be injected into the engine manifold, it should be of appropriate size to carry sufficient fluid to provide an adequate supply for desired distance before refilling. It has been found, for instance, that a four quart jar will contain enough fluid to last between approximately 3,000 to 4,000 miles, depending, of course, upon the number of cylinders, the length of the cylinder stroke, the speed and manner at which the engine is operated, and other such considerations.

Fitting into and within the bottle 11 is an aerator assembly 12, including a cap or cover portion 13, which may be formed from a wide variety of materials, preferably of molded plastic or other such yieldable material. Humidifier devices in the prior art frequently specify caps or covers for the container of metal, and generally specify that the metal be yieldable so as not to cause the jar to break when subjected to an interior vacuum. It has been found that plastic is of sufficient pliability to yield when subjected to high vacuums to prevent the container 11 from bursting, but also provides mechanical support for fixed adjustment means for the gas intake, a feature representing one of the major aspects of the present invention.

As shown in FIGS. 1 and 2, the cover 13 has three holes formed therethrough to provide a fill inlet 14, a gas inlet 15, and a mist outlet 16. The fill inlet hole 14 may include a cylindrical extension 17 extending upwardly from the cover 13 to receive a plug 18 to provide a gastight seal within the hole 14. Likewise, a cylindrical extension 19 may be provided on the mist outlet hole 16 to allow an output tube 20 to be connected thereto. Finally, cylindrical extensions 21 and 22 are provided above and below the gas inlet hole 15, respectively, to allow an inlet gas adjustment to be made and to accommodate a gas conduit to the aerator described below. Additionally provided on cover 13 are brace or support members 23, 24, 25, and 26. These brace members may be included as a part of the cover mold, and provide support and a certain degree of rigidity for the overall surface of the cap 13. The braces 23 through 26 should not, however, be of such dimensions as to render cap 13 incapable of any bending movement whatever, but may allow a limited degree of deformity to be exhibited when the interior of bottle 11 is evacuated and subjected to relatively high vacuums of, for example, 60 p.s.i. Under the top portion of cap 13 is provided a wedge shaped ring 27 which bears upon the upper edge or lip of the bottle 11 to effectuate a gas seal to the interior of bottle 11. Although the wedge ring 27 is illustrated as being wedge or V-shape, it may be of any easily moldable shape, so long as it is of uniform depth to bear equally upon all edges of the top of bottle 11 when the cap 13 is in its screwed down position illustrated.

The gas inlet hole 15 includes a lateral hole 28 drilled through a wall of the upwardly projecting cylinder 21 into its interior. Also extending downwardly into the cylinder 21 is an adjustment screw 29 (see FIG. 2) of length sufficient to have adjustment across the gas inlet hole 28. The adjustment screw 29 may have a needle point adjustment 30 to allow a greater range of adjustment. The diameter of the lateral hole 28 is not critical since the adjustment screw 29 is provided, but it has been found that for the best range of adjustment the diameter of the hole 28 be approximately eight times less than the diameter of the gas inlet hole 15. The diameter of the adjustment screw 29 should be slightly greater than the diameter of hole 15, and should be of sufficient tightness to provide a seal at the interface of hole 15 and the screw threads of the adjustment screw and additionally constrain the screw in the adjusted position throughout the vibration and jolts which are ordinarily encountered in the operation of the engine on which the humidifier is installed.

The screw 29 may be easily inserted into the extension 21 of the plastic cap 13, but on the other hand, the extension 21 of the plastic cap 13 exerts sufficient lateral pressure upon the screw 29 to maintain its adjusted position regardless of the temperature, jolts, vibrations and other operating conditions to which it may be exposed. Although a needle valve and seat assembly (not shown) may be used in place of the screw 29 and inlet hole 28 combination, such needle valve and seat assembly may be adversely affected by the temperature ranges encountered.

Interfitting with cylindrical extension 22 is a tube 31 which conducts the gas from gas inlet 28 to the aerator member 32. The conducting tube may be of any material such as plastic, glass, stainless steel, copper, or the like, but is preferably of stainless steel or other very rigid material which will not deform when subjected to pressure from the cap 13 or which will be bent by heat from the engine to which the unit is attached.

The aerator member 32, shown in FIGS. 3 and 4, may be made of plastic or the like, and conveniently may be of the same material that the cap 13 is made of and may be likewise injection molded, cast or otherwise such similarly formed. The member 32 is disposed upon an interior surface of the container 11, preferably upon the base or bottom, as illustrated. The member 32 is shaped to define a portion of a chamber 37 with the base of the container defining a closing portion of the chamber 37 (see FIG. 2). Formed through the member 32 are a number of holes 33 and 34. Holes 33, on an inside radius, may, for example, be of diameter of 0.25 inches, and holes 34 on an outside radius may be of a diameter of 0.050 inches to allow the gas within chamber 37 to escape therefrom in narrow streams of fine bubbles. Additionally provided upon member 32 is a cylindrical extension 35, to receive conducting tube 31. Extension 35 should be of such diameter as to affect a gas seal between conducting tube 31 and the interior face of the extension 35. Concentric with the extension 35 is a hole 36 formed through the member 11 to allow gas conducted through conducting tube 31 to flow into the interior chamber 37 of the foot 32.

A plurality of cylindrical feet 38 are strategically located within the interior 37 of foot 32 to provide support for the aerator member 32. The cylindrical feet are particularly important since, as described above the bottom of the bottle 11 in conjunction with the foot 32

of the aerator effectuates a closed chamber to force the gas conducted through conducting tube 31 into the chamber 37 to be allowed to exit therefrom only through holes 33 and 34. Thus, as the cap 13 is screwed onto the bottle 11 causing a downward force upon conducting tube 31, the aerator member 32 is not thereby crushed to allow deformities to exist around the periphery of member 32 which might allow large bubbles of the entrained gas to escape therefrom. To additionally effect the seal between aerator member 32 and the floor of bottle 11, the periphery of member 32 may be formed with a slight taper 39 which tightly interfits upon the floor of the bottle 11.

The entire assembly 10 may be received by a securing device 50 (see FIG. 2) formed of a rigid, forming fitting plastic or metal casing with appropriate attachments for securing the invention to a structure associated with the engine on which the device is installed. For example, the device may be affixed by securing device 50 to the firewall of an automobile, or, may be attached to a wall of the trunk of an automobile.

In operation, a fluid (not shown) is poured into the bottle 11 through fill hole 14. The output line 20 is connected to a point between the output of the carburetor and the input to the cylinders. Conveniently, such connection may be made in the PCV line on recent model cars, or, on older cars, directly into the intake manifold. Either connection will cause a vacuum to be pulled which will be transmitted by output line 20 to the interior of bottle 11 above the fluid contained therein. The unequal pressure sealed within the bottle by the cap 13 and the appropriate sealing devices incorporated thereon, described above in detail, will tend to be overcome by the device sucking air into the intake hold 28 through conducting tube 31 to be expelled through holes 33 and 34 in aerator member 32. The air thus drawn into the device and expelled through holes 33 and 34 will rise in narrow streams of the fine bubbles to the surface of the fluid, at which point they burst and escape the fluid, causing the surface tension of the fluid to be broken and additionally expelling a portion of the contained fluid into the vacuum maintained above the fluid. The mist or vapor thus produced will then be sucked into the engine through output tube 20 to the point at which the input connection is established.

It can be seen, therefore, that the adjustment on adjusting screw 29 is critical in obtaining the proper proportion of mist or vapor which is ordinarily maintained above the surface of the fluid and which is transmitted to the intake of the car. The appropriate adjustment should be such as to allow air bubbles to escape from the holes 33 and 34 upon idling of the car to be such that the bubbles do not escape from all eight holes shown all the time, but at which it does escape at some periodic time from all eight holes. If too many bubbles are permitted to escape for a particular engine operating condition, the overall effect will be to defeat the quantity of mist produced, an effect similar to allowing large bubbles to flow in the fluid. Likewise, if an insufficient number of bubbles is produced the mist will be insufficient to supply the demand by the engine.

Although the adjustment of the input gas is critical, it is easily made since the visual appearance of the fluid is dramatic. If too much air is being drawn into the container for the demand of the engine, large sized bubbles form, and the space above the fluid becomes clear, even if the output line 20 is disconnected. On the other

hand, if an insufficient amount of mist is formed, the quantity of bubbles escaping the holes 33 and 34 will be markedly reduced and the space above the fluid will be clear if the output line 20 is disconnected. The proper adjustment, therefore, is between the point at which the bubbles occur at most of the holes in member 32 and at which large bubbles begin to flow. At the proper adjustment, when the output line 20 is disconnected, a cloud will immediately appear above the fluid, indicating a large quantity of the fluid entrained in the gas.

It will be noted that no particular clamps or devices are necessary to keep the fill cap 18 and the vacuum tube 20 in their desired positions since the vacuum in the bottle 11 will be sufficient to pull thereupon to maintain their positions.

Although many fluids may be used in conjunction with the humidifier of the engine, it has been found that with automobile engines, and particularly those of the high compression engines becoming more widely available, that a mixture of about 2.5 parts of water and 1 part methyl alcohol is particularly beneficial in the operation of the car. Since the high compression engines tend to operate at higher temperatures, the alcohol has a cooling effect which will allow the ignition timing to be advanced without the ordinarily encountered pre-ignition problems associated with such an advance. The water, on the other hand, provides humidity to the interior of the cylinder during combustion and has particularly beneficial effects upon the engine's performance, especially in higher altitudes and locations at which the outside humidity is normally low.

Although the invention has been described and illustrated with a certain degree of particularity, it is understood that the present disclosure is made by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. An apparatus for producing a mist of a fluid for connection into a fuel inlet stream of an internal combustion engine comprising:
 - a container for receiving the fluid;
 - a cover for said container to provide a gas seal to the interior of said container, said cover having three holes therethrough to define a fill hole, an inlet hole, and an outlet hole,
 - a cylindrical extension coaxially disposed upon said inlet hole extending outwardly from said container and having a lateral hole of diameter approximately one-eighth the diameter of the inlet hole,
 - a screw disposed in said cylindrical extension adjustable to partially obstruct the passage defined by the lateral hole,
 - an aerator member defining with the floor of said container a gas chamber, said aerator member having an input part and a plurality of exhaust holes therethrough to produce a plurality of fine streams of small bubbles in the fluid in said container,
 - a plurality of support members affixed to said aerator member extending between the said aerator member and the floor of said container to maintain the shape of said aerator member and to preserve the integrity of the gas seal at the interface of said aerator member and the floor of said container,

a tube interconnecting the inlet hole on said cover and the input part in said aerator member, said tube being of length to exert pressure between said cover and said aerator member to maintain the position of said aerator member upon the floor of said container,

whereby when a vacuum is pulled on the output hole by the vacuum of the fuel stream of the engine to which the apparatus is connected, the gas surrounding the apparatus is sucked into the lateral hole, and adjustable in quantity by adjustment of said screw, and is conducted through the tube into the gas chamber, there to escape through the holes in the aerator member to bubble through the liquid and form a mist of the fluid above its surface within the container and be exhausted through the output hole into the fuel stream.

2. Apparatus for producing a mist of a fluid for connection into a fuel inlet stream of an internal combustion engine comprising: (a) a container for receiving the fluid; (b) a screw-type gas-tight cover for said container having therethrough at least a gas inlet hole and a mist outlet hole; (c) an inverted cup-shaped aerator disposed with its periphery contiguous with the bottom of the container; said aerator having an input hole passing centrally therethrough and having a plurality of exhaust holes of predetermined size passing therethrough spaced radially outward of said input hole; (d) a gas

conducting tube operatively interconnecting said gas inlet hole in said cover with said input hole in said aerator and adapted to be longitudinally compressed when said cover is screwed on to said container; (e) means for adjustably controlling the gas flow into said container through said gas inlet hole, whereby a controllable amount of gas may be conducted into the aerator when the mist outlet hole is connected to the fuel inlet stream of the engine, to produce a plurality of fine streams of small bubbles in the fluid which form a mist of the fluid above its surface; and (f) a plurality of cylindrical feet affixed to the undersurface of said aerator at spaced intervals and extending adjacent the bottom of the container, whereby said aerator is prevented from deforming at the interface between the periphery thereof and the bottom of the container when downward pressure is exerted by said gas conducting tube upon said aerator.

3. The apparatus of claim 2 wherein said aerator is made of plastic downwardly yieldable under pressure and additionally wherein the periphery of said aerator is tapered so that the outer edge lies slightly below the inner edge thereof, whereby, upon exertion of downward force by said gas conducting tube on said aerator, the periphery thereof will interfit tightly upon the bottom of the container.

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