United States Patent

[11] 3,537,434

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[45] Patented **Nov. 3, 1970**

[73] Assignee **assignor of a fractional part to David E. Sherrill, Dallas, Tex.**

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[54] **VACUUM FUEL ADDITIVE INDUCTOR FOR INTERNAL COMBUSTION ENGINES**
5 Claims, 15 Drawing Figs.

[52] **U.S. Cl.** **123/134,** 123/198
[51] **Int. Cl.** **F02m 17/22**
[50] **Field of Search** ..... 123/198(A) 198, 134

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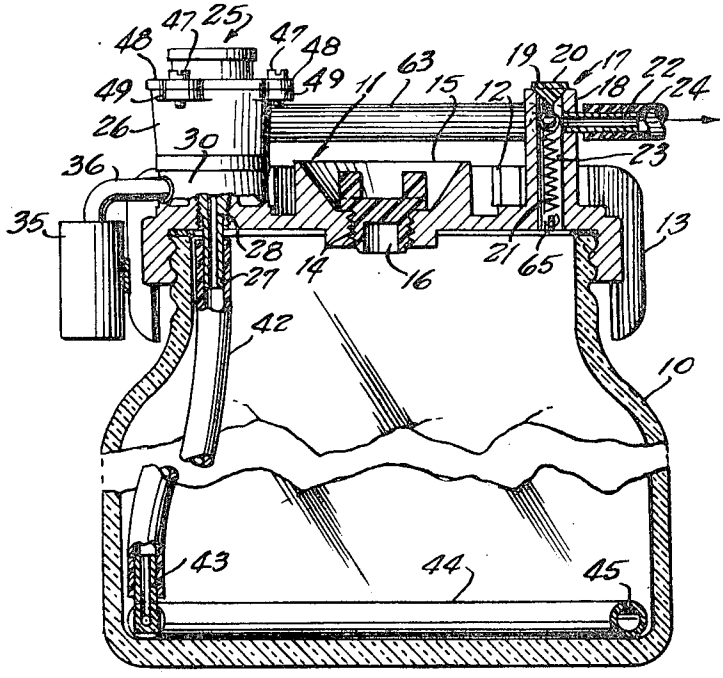
Primary Examiner—Wendell E. Burns
Attorney—Cecil L. Wood

ABSTRACT: A device for the induction by vacuum of a vaporized additive, such as a water-alcohol solution, into the fuel system of internal combustion engines, comprising a container for a liquid additive composition, having an adjustable vacuum controlled air intake valve therein whereby to produce vaporization of the additive composition, and a conduit for conducting the vapors into the fuel system, means being also provided for maintaining temperature control for the vapors entering the fuel system.



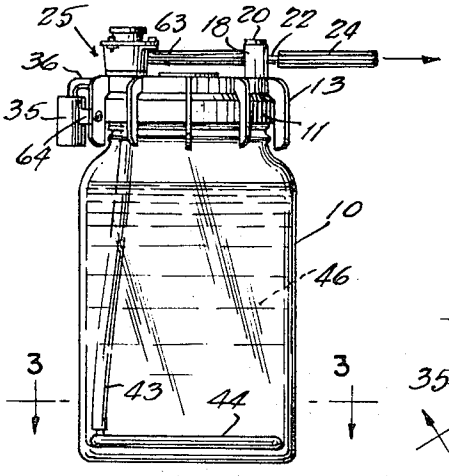
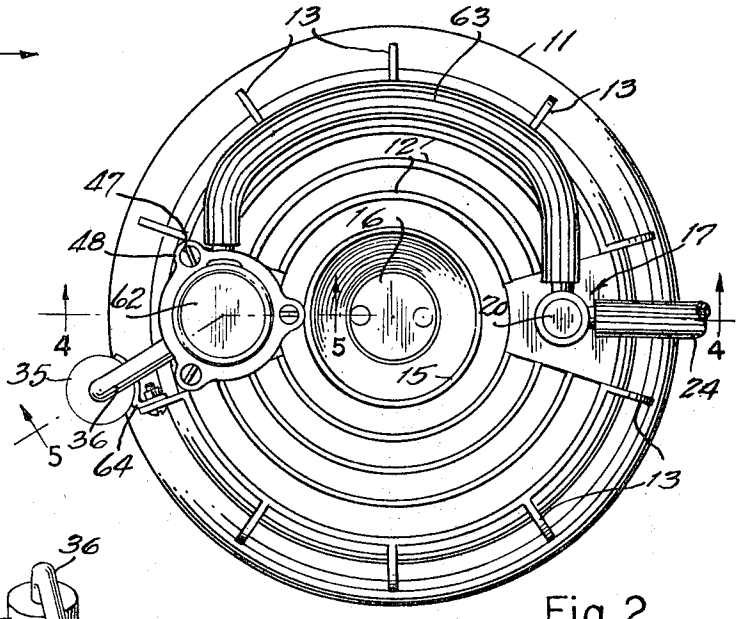


Fig. 1



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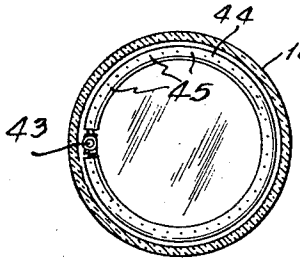


Fig. 3

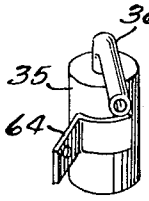
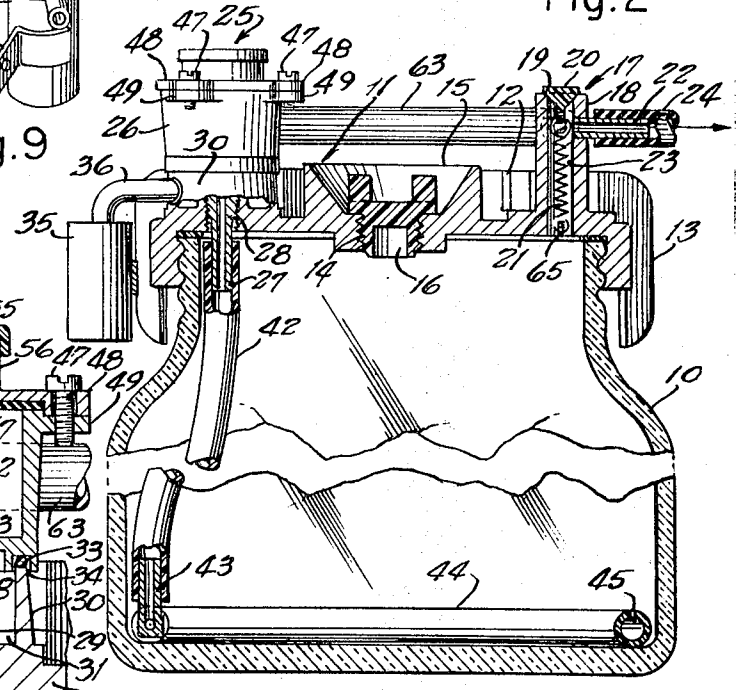


Fig. 9



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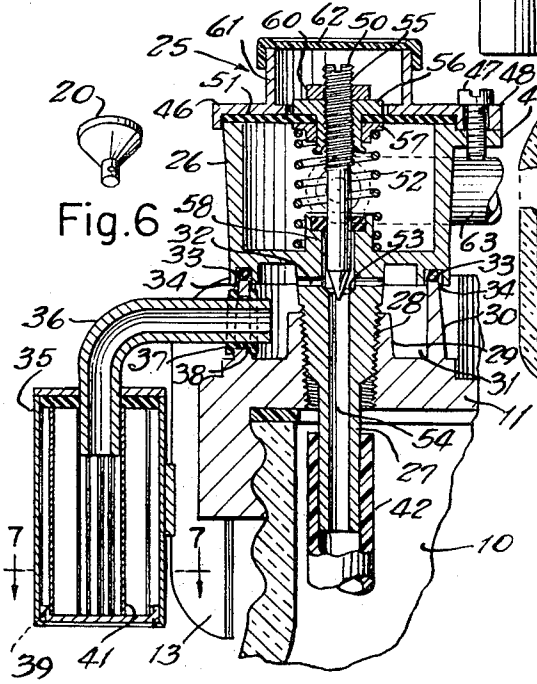

Fig. 5

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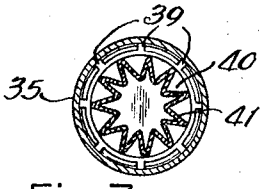

Fig. 7

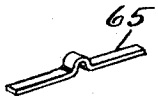

Fig. 8

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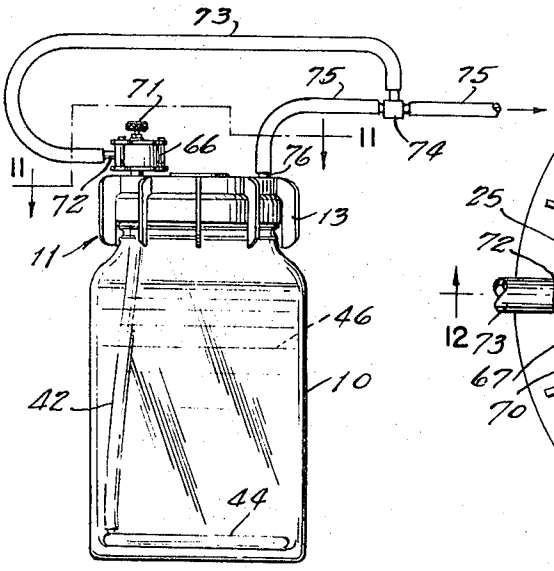
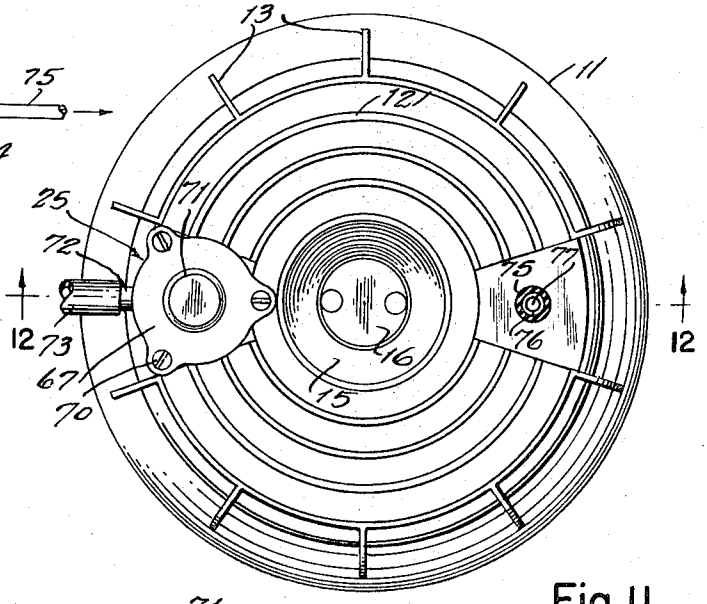


Fig. 10



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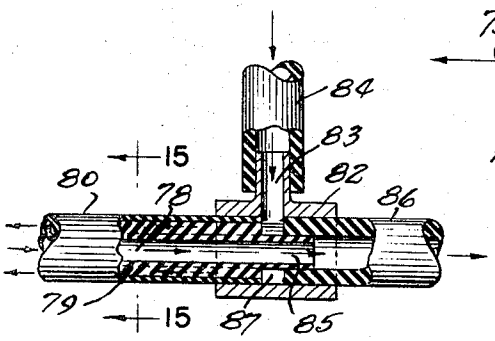
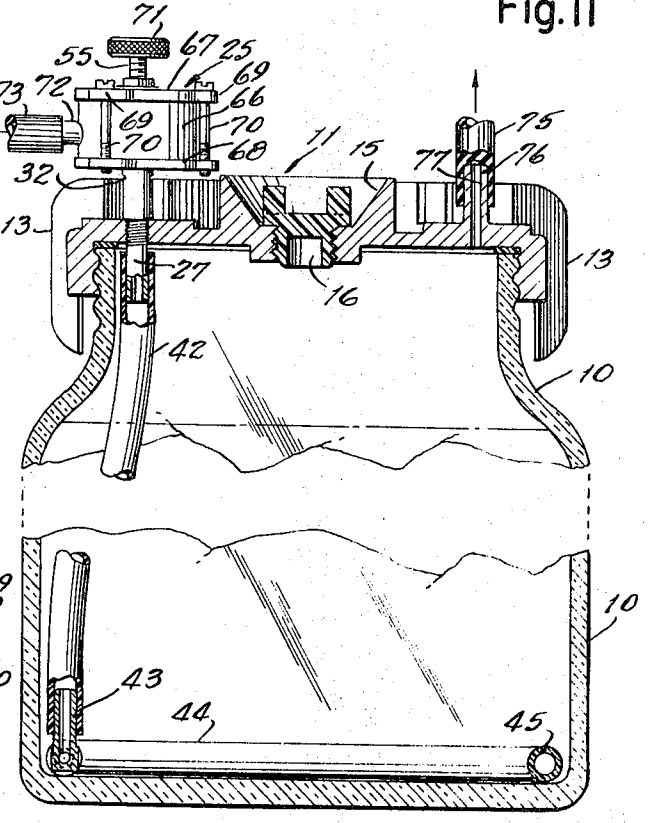


Fig. 14



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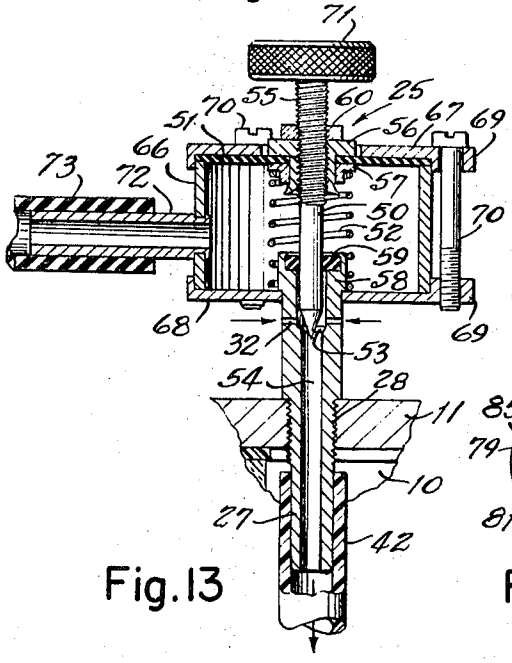

Fig. 13

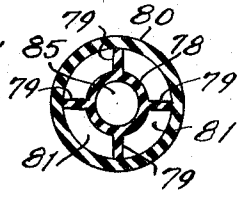

Fig. 15

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VACUUM FUEL ADDITIVE INDUCTOR FOR INTERNAL COMBUSTION ENGINES

SUMMARY

This invention relates to apparatus for inducting, by vacuum, a vaporized additive into the fuel systems of internal combustion engines, and it has particular reference to automotive installations.

A prime object of the invention resides in the provision of apparatus which consists of a container for a fuel additive, such as a water-alcohol solution, having a closure in which an adjustable vacuum controlled air intake valve is installed through which atmospheric air is admitted to an aerator in the container by which the contents are agitated to a vaporous state to be withdrawn by vacuum and inducted into the fuel system.

A further object of the invention is that of providing a simple and effective means of inducting an additive into the fuel system of a motor whereby to enhance the combustibility of the fuel, by lowering the flashpoint thereof, and to reduce waste due to incomplete combustion.

Still another object of the invention is that of providing a device by which water vapors, or any combination of water with soluble combustibles, can be inducted into the fuel system more effectively than conventional devices designed for such purpose which generally are lacking in effective vaporization of the additive elements and the most efficient control thereof whereby to insure a proper ratio between the carbureted fuel and additive vapors.

Broadly, the invention contemplates the provision of apparatus by which an additive can be vaporized and inducted into a fuel system by vacuum while controlling the volume thereof and while maintaining seasonal temperatures of the vaporized additive to prevent condensation and freezing.

While the foregoing objects are paramount other and lesser objects will become apparent as the description proceeds when considered in connection with the appended drawings wherein:

FIG. 1 is an elevational view of the preferred embodiment of the invention showing the container, its closure and the adjustable vacuum actuated air intake control valve and aerator.

FIG. 2 is a plan view of the container closure, the valve and air filter, the vacuum tube for actuating the valve, and the outlet conduit.

FIG. 3 is a transverse sectional view, on line 3–3 of FIG. 1, showing the aerator in the bottom of the container.

FIG. 4 is a fragmentary vertical sectional view, on line 4–4 of FIG. 2, showing the valve and air filter, and showing the outlet conduit and relief valve, and the aerator element.

FIG. 5 is an enlarged fragmentary sectional view, on line 5–5 of FIG. 2, showing the adjustable needle for controlling the air intake and the vacuum actuated diaphragm and air filter.

FIG. 6 is a perspective view of the relief valve shown in position in FIG. 4.

FIG. 7 is a transverse sectional view, on line 7–7 of FIG. 5, showing the air filter element.

FIG. 8 is a perspective view of the anchor element for the relief valve spring, shown in FIG. 2.

FIG. 9 is a perspective illustration of the air filter device shown in FIGS. 4 and 5.

FIG. 10 is an elevational view of a modified structure in which the vacuum tubes are connected directly to the valve and the container closure, and the filter and relief valve are omitted.

FIG. 11 is a plan view of the structure shown in FIG. 10 and in section on line 11–11 of FIG. 10.

FIG. 12 is a fragmentary vertical sectional view, on line 12–12 of FIG. 11, showing the valve, the atomizer element and the vapor outlet.

FIG. 13 is an enlarged vertical sectional view of the valve, similar to FIG. 5, showing the adjustable needle and diaphragm and exposed air inlet ports.

FIG. 14 is a fragmentary view, partially in section, showing a coaxial tube arrangement whereby heated or cooled air can be injected through the annulus about the vacuum conductor, as indicated by arrows, and

FIG. 15 is a transverse sectional view, on line 15–15 of FIG. 14, showing the vacuum tube and the annulus within the outer tube.

In its preferred form, shown in FIGS. 1 to 9, inclusive, the invention comprises a container 10, which may be of glass, plastic, or other suitable material, preferably transparent, having a closure 11 threadedly secured thereon, as shown in FIGS. 4 and 5, which may be formed with a series of concentric ribs 12 and a radial arrangement of vertical fins 13 about the periphery thereof. A filler opening 14, surrounded by a circular boss 15 is provided centrally of the closure 11 which is closed by a threaded plug 16.

A relief valve 17 is provided in the closure 10 comprising an integral cylindrical boss 18 projecting therefrom and having a seat 19 formed in its upper end against which a seating element 20 is normally biased by a spring 21. The boss 18 also functions as an outlet for the vapors from the container 10, and a fitting 22 is provided which communicates with the passage 23 in the boss 18 and has a flexible conduit 24 arranged thereon, as shown in FIGS. 1, 2 and 3.

A valve assembly 25 is mounted on the closure 11, opposite the relief valve 17, which controls the air intake into the container 10 and comprises a cylindrical housing 26 having a depending hollow stem 27, a portion 28 of which is threaded into an internally threaded boss 29 formed on the closure 11 concentrically of a circular rib 30 against which the housing 26 is seated defining an annular chamber 31 around the stem 27 which has one or more air ports 32 formed therein, all as shown in FIG. 5. The chamber 31 is sealed by O-rings 33 arranged in annular grooves 34 around the bottom of the housing 26.

Atmospheric air is drawn into the chamber 31 by vacuum through a filter 35 connected thereto by an L-shaped tubular fitting 36 extending through a grommet 37 in an opening 38 in the chamber 31. Air enters the filter 35 through a series of small ports 39 formed about the closure 40, as shown best in FIG. 7, and is drawn through a filter element 41 in the filter 35.

A flexible tube 42 is attached to the lower end of the stem 27 which is connected through a T-fitting 43 to a circular manifold 44 which reposes on the bottom of the container 10 and has a series of orifices 45 formed therein through which air entering through the valve assembly 25 is discharged upwardly through the liquid contents 46 emerging as a vapor which is drawn through the outlet passage 23 and the tube 24 to the carburetor of the vehicle engine (not shown).

The housing 26 of the valve assembly 25 is closed by a cap 46 secured in place by a plurality of screws 47 arranged through ears 48 and 49 formed on the cap 46 and the upper perimeter of the housing 26, respectively, in the manner shown in FIGS. 2, 4 and 5. An adjustable needle 50 is arranged concentrically of the housing 26 and through a diaphragm 51 by which it is moved vertically, against the tension of a compression spring 52 which surrounds the needle 50, with respect to a seat 53 formed in the passage 54 in the stem 27 immediately below the ports 32 therein.

The needle 50 has a threaded portion 55 at its upper end which is threaded through a flanged collar 56 arranged through the center of the diaphragm 51 and secured by a washer 57 therebeneath surrounding the collar 56, the lower perimeter of which is swaged, as shown in FIG. 5, to retain the washer 57. The spring 52 is seated at its upper end against the washer 57 and engages the bottom of the housing 26 around a boss 58 thereon. The needle 50 extends through a close fitting gasket 59 seated in an annular recess in the top of the boss 58. In the normal operation of th vehicle the vacuum pull is increased or decreased according to the acceleration of the engine. The suction drawn in the housing 26 will increase upon deceleration and act upon the diaphragm 51 to cause the nee-

dle 50 to approach its seat 53 to reduce the air intake through the ports 32 to avoid the induction of excess moisture into the carburetor.

The needle 50 can be adjusted vertically by a screw driver, or other suitable tool, and secured in adjusted positions by a lock nut 60. The needle 50 and the lock nut are enclosed within a circular chamber 61 formed atop the cap 46, a closure 62 being provided for the chamber 61.

Atmospheric air is drawn into the container 10 by the suction exerted upon the downstroke of the pistons of the vehicle engine, and the tube 24 being connected to the carburetor (not shown), a vacuum occurs in a tube 63, one end of which is connected to the passage 23 while having its opposite end connected to the housing 26, as shown in FIG. 2, and in broken lines in FIG. 5.

The vacuum drawn in the housing 26 will flex the diaphragm downwardly causing the needle 50 to move toward its seat 53 to reduce the intake air flow through the ports 32 into the container 10 while withdrawing the vaporized contents 46 from the container 10 and into the fuel system through the tube 24. The relief valve 20 is provided to prevent any excess pressure build-up in the container 10.

The filter 35 is attached to the closure 11 by a bracket 64, while the member 36 is slidably inserted through the relatively close fitting grommet 37 in the opening 38. The pull spring 21, which biases the relief valve 20 to its seat, is secured at its lowermost end to a key 65, shown in perspective in FIG. 8.

The modified form of the invention, shown in FIGS. 10 to 12, inclusive, is substantially similar to the structure described above but the air inlet valve assembly 25 differs in respect to the form of the housing 66 which, while cylindrical in shape, is open at top and bottom, and is closed by a cap 67 at the top and is seated on a plate 68, each of which is formed with ears 69 through which elongated screws 70 are arranged to secure the parts, as shown in FIGS. 11, 12 and 13.

The cap 67 is seated on the diaphragm 51 in the same manner as shown in FIG. 5, and the needle 50 is similarly arranged except that this element is provided with a knurled head 71 for adjustments. The air inlet ports 32 are exposed below the housing 66. A tubular fitting 72 is secured in the wall of the housing 66 to which is attached a flexible tube 73 which is connected by a T-coupling 74 to the vapor outlet tube 75, the latter being attached to a boss 76 on the closure 11 which has a passage 77 therethrough communicating with the interior of the container 10, as shown best in FIGS. 10, 11 and 12.

The obvious advantages afforded by the preferred structure, shown in FIGS. 1 to 9, inclusive, is in the provision of the filter 35, the enclosed ports 32 and the relief valve 20. The arrangement of the vacuum tube 63 for actuating the needle 50 in the structure of FIGS. 1, 2, 4 and 5 is more compact.

For more efficient operation, and to avoid condensation due to differentials in temperatures, such as may be encountered in extremely hot or cold climatic conditions, a tube 78 which may be extruded and formed with longitudinal ribs 79 and encased in an outer tube 80, in the manner shown in FIGS. 14 and 15, may be substituted for the tubes 24, 63, 73 and 75 so that, by reason of the several air passages 81 formed between the ribs 79, cooled or heated air can be inducted therethrough from a source, such as the heater or air conditioner on the vehicle, to create a desirable temperature for the air or vapors in the tube 78.

A typical arrangement in which the tube 78 is employed is shown in FIG. 14 in which a fitting 82 is provided having a ported boss 83 on one side to which is attached a tube 84. The tube 78, with its outer tube 80, is inserted into one end of the fitting 82. The ribs 79 are cut back to form a spigot 85 on the inner end of the tube 78 which is inserted into the inner end of an outlet tube 86 whereby the end of the latter is spaced from the cut back ribs 79 to define an air passage 87 around the spigot 85 communicating with the passages 81 in the tube 78 so that heated or cooled air inducted through the tube 84 is caused to flow through the passages 81 about the tube 78, as indicated by the arrows in FIG. 14. The tube 84 may be connected to the heater or air conditioner of the vehicle (not shown). This arrangement, however, is optional since it has been found that satisfactory performance can be accomplished without the preconditioned air flow through the system.

It is intended that the invention be limited only by the scope of the appended claims, and certain modifications may be resorted to, by persons skilled in the art, without departing therefrom.

I claim:

1. An inductor for vaporous fuel additives for internal combustion engines having a fuel reservoir and a carburetor, the combination comprising: a container having a liquid additive therein and a cover for sealing said container, a valve assembly, including a vacuum chamber, having a hollow stem arranged through said cover and extending into said container, a ported seat in said stem below said vacuum chamber open to the atmosphere, a manifold submerged in said liquid and connected to said stem and having a series of outlet orifices therein whereby to vaporize said liquid by the passage of air therethrough, a needle in said vacuum chamber extending into said hollow stem and operable with respect to said seat, a spring biased diaphragm on said needle in said vacuum chamber for actuating said needle with respect to said seat, a vapor outlet in said cover, and a suction tube connecting said vapor outlet to said carburetor and said vacuum chamber whereby to conduct vapors to said carburetor and actuate said diaphragm and said needle.

2. An inductor device for vaporous fuel additives for internal combustion engines having a fuel reservoir and a carburetor, the combination comprising: a container having a liquid additive therein and a cover for sealing the container, a valve assembly, including a vacuum chamber, having a hollow stem extending through said cover into said container, the said stem having a ported seat therein open to the atmosphere, a needle arranged in said vacuum chamber and extending into said stem and having a diaphragm thereon responsive to suction in said chamber to operate said needle with respect to said seat, a manifold submerged in said liquid having a series of orifices therein and communicating with said hollow stem to conduct air through and vaporize the liquid, a vapor outlet in said cover, and a suction tube connecting said outlet with said carburetor for conducting vapors thereto, the said suction tube also having connection with said vacuum chamber for actuating said diaphragm therein.

3. An additive inductor as described in claim 1, an annular air chamber formed on said cover about said stem and enclosing the ports in said seat and providing a seat for said valve assembly, and an air filter having communication with said air chamber for filtering atmospheric air admitted thereto.

4. An additive inductor as described in claim 2, a spring biased relief valve arranged in said vapor outlet in said cover.

5. An inductor device as described in claim 2, wherein the said needle is adjustable with respect to said seat and said diaphragm.