

[54] **AUTO POLLUTION GASOLINE TANK CAP ASSEMBLY**

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[51] Int. Cl.² **B65B 3/04; B67C 3/34**

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154, 198-229, 285, 288-295, 308-311,
382-389, 392, 326, 327, 350, 98; 137/588

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Primary Examiner—Houston S. Bell, Jr.

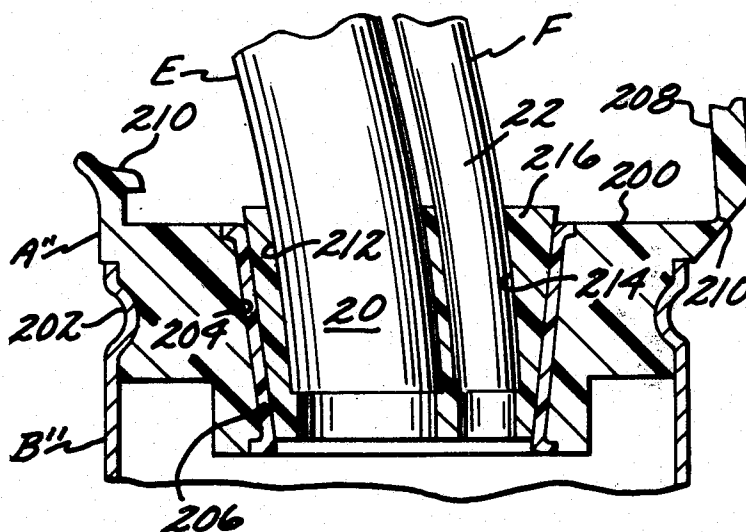
Attorney, Agent, or Firm—William C. Babcock

[57] **ABSTRACT**

A cap assembly that is mounted on or formed as a part

of the fill line of a tank to permit a volatile liquid fuel to be discharged into the tank without vapor from the tank escaping to the ambient atmosphere. The cap assembly during the filling operation is adapted to be removably and sealingly engaged by the free end portions of first and second tubes that are parallel and laterally spaced from one another. The first and second tubes are part of a valved nozzle, when the nozzle is in engagement with the cap, the first tube has liquid fuel discharged therefrom into the tank, and the second tube receives fuel vapor displaced from the interior of the tank during the filling operation. The nozzle is connected to a pliable hose through which fuel under pressure is supplied to the first tube of the nozzle. The second tube is connected to passage defusing means that may either be an integral part of the hose or tubing secured thereto through which the displaced vapor flows to an area where it may be recovered. The cap assembly is formed from a number of elements, the majority of which may be injection molded from a polymerized resin that is impervious to the action of gasoline.

8 Claims, 10 Drawing Figures



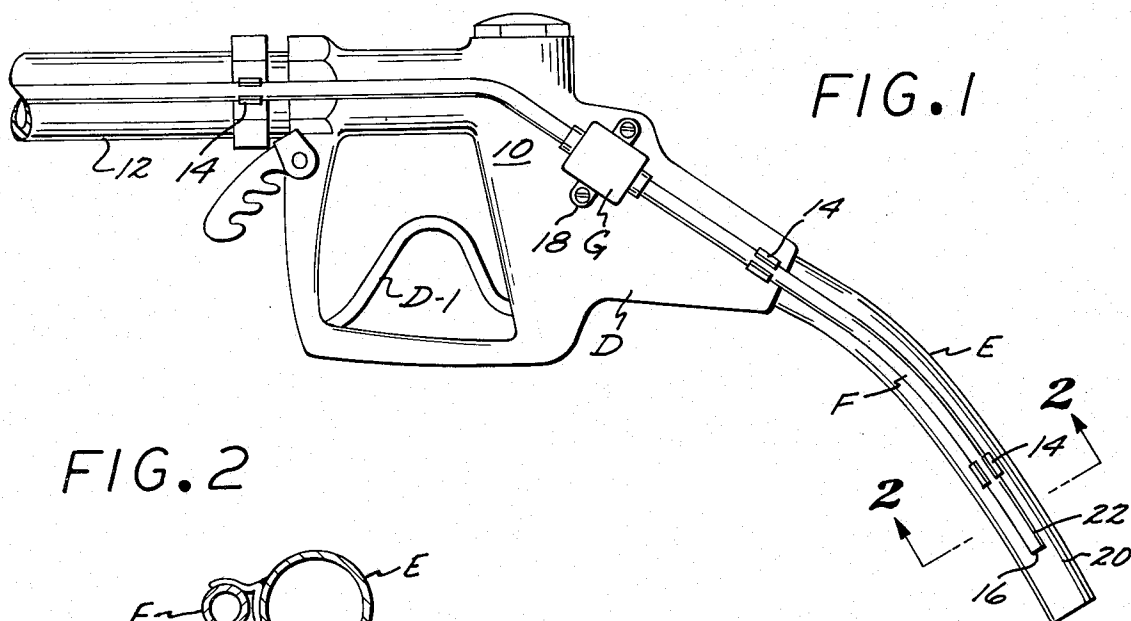


FIG. 2

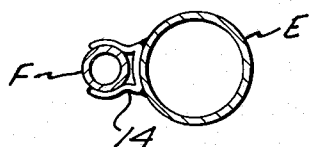


FIG. 3

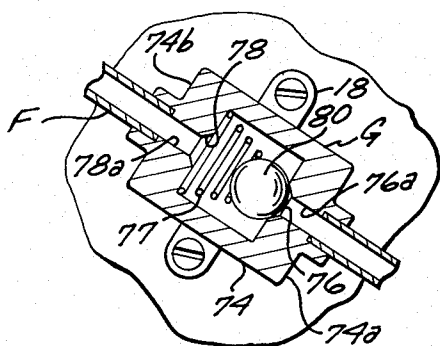


FIG. 4

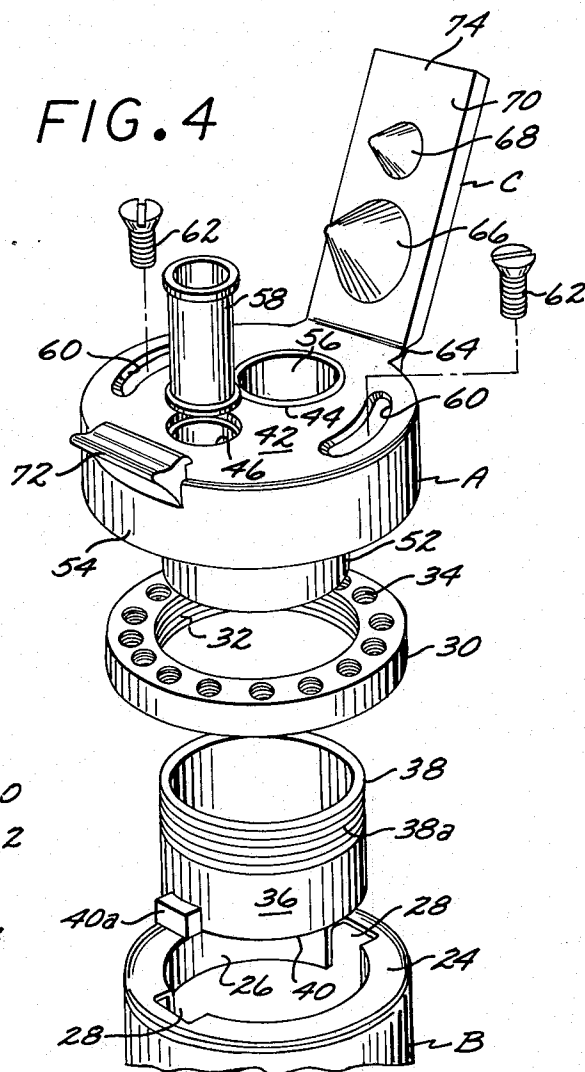
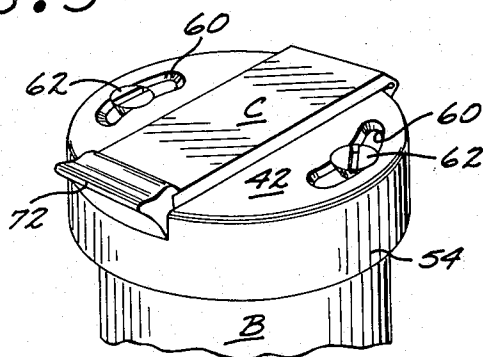
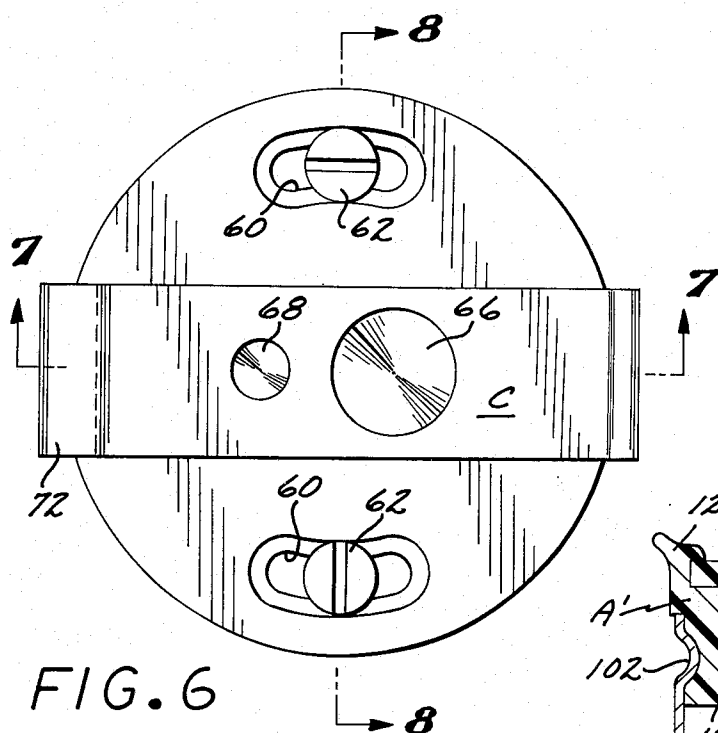
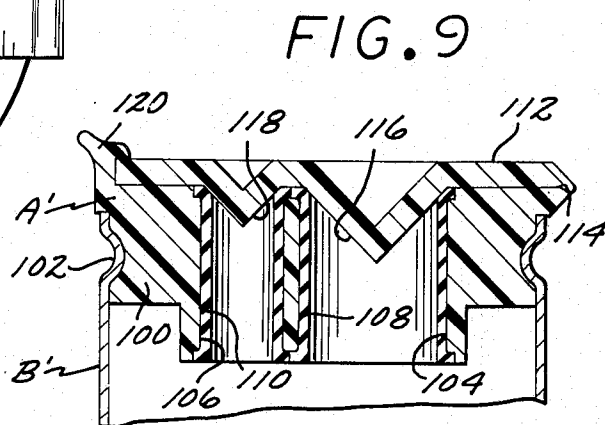
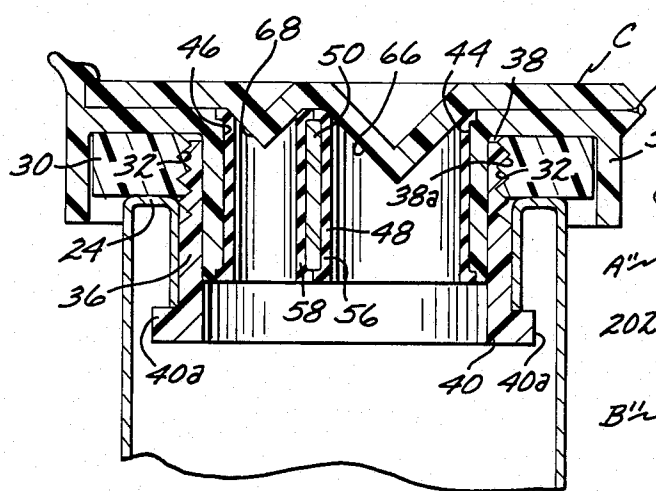
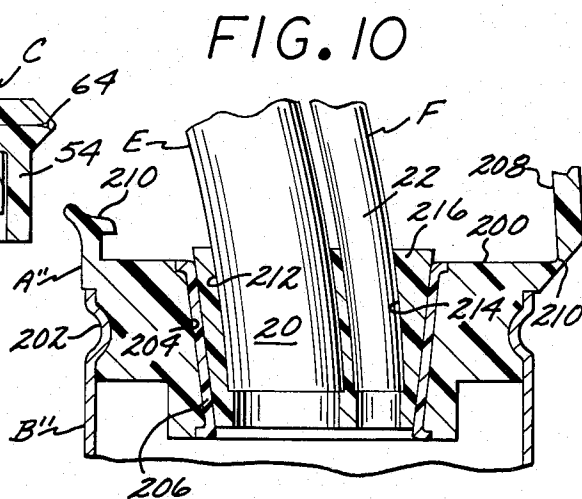
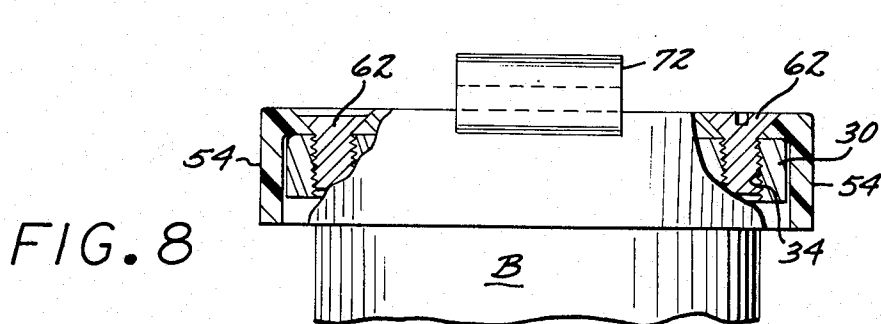


FIG. 5





AUTO POLLUTION GASOLINE TANK CAP ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

Anti-pollution gasoline tank cap assembly.

2. Description of the Prior Art

Within the past few years it has become recognized that a major pollutant in the ambient atmosphere is gasoline vapor that is displaced from fuel tanks during the filling thereof. In addition to such vapor polluting the atmosphere, a substantial quantity of the fuel being dispensed is needlessly lost and cannot be recovered.

A major object of the present invention is to provide a cap assembly that may be removably mounted on the fill line of a fuel tank or formed as an integral part thereof, which assembly will permit the tank to be easily and conveniently filled with fuel by a valved nozzle of unique design, and with gasoline vapor displaced from the tank during the filling thereof being recovered rather than discharging to the ambient atmosphere.

Another object of the invention is to furnish a gasoline tank cap assembly that is capable of being formed from injection molded components, has a simple mechanical structure, is inexpensive, and one that may be readily installed on a fill line of a tank by a person having a minimum of mechanical ability.

Yet another object of the invention is to provide a gasoline tank cap assembly that is simple and easy to use, is durable, requires a minimum of maintenance attention, and can be retailed at a sufficiently low price as to encourage the widespread use thereof.

A still further object of the invention is to furnish a valved nozzle that includes first and second laterally spaced tubes that have free end portions that act as bayonets to slidably and sealingly engage first and second resilient tubular liners in the cap assembly when the latter is in a fuel receiving position, with the first tube serving to discharge gasoline into the tank, and the second tube having displaced gasoline vapor discharged thereinto which is conducted to a location where the vapor is recovered as liquid fuel.

Another object of the invention is to provide a valved nozzle that permits fuel vapor discharge therethrough to a recovery area, but prevents liquid fuel flowing through the vapor recovery passage of the nozzle.

SUMMARY OF THE INVENTION

A valved nozzle that includes a first tube through which a liquid volatile fuel is discharged and a second tube laterally spaced from the first tube. The second tube has a check valve in communication therewith that permits fuel vapor to flow therethrough, but prevents liquid fuel flowing through the valve. A gasoline cap assembly is mounted on the fill line of each vehicle to be serviced by the nozzle. Each cap assembly includes a locking collar secured to the free end of the fill line, which collar has a plate in abutting contact therewith. The plate has first and second openings therein from which first and second tubular bosses extend towards the fill line, with the first and second bosses having first and second tubular liners therein of a resilient material impervious to the fuel. The plate by screws or other fastening means is secured to the locking ring. The first and second tubes may be slidably and sealingly inserted within the first and second liners to permit a volatile liquid fuel to be discharged into the

tank associated with the fill line, and displaced fuel vapor flowing through the second tube and check valve to a location where it is recovered. A closure member is pivotally supported from the plate. The closure member supports first and second protuberances. The closure member may be pivoted to a first position where it does not interfere with the nozzle being used to discharge liquid fuel into the tank. After the nozzle is removed from proximity with the fill line, the closure member may be pivoted to a second position where the first and second protuberances are in sealing engagement with the first and second liners to prevent escape of fuel vapor from the tank to the ambient atmosphere. Manually operable fastening means removably hold the closure member in the second position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the valved nozzle used in conjunction with the anti-pollution gasoline tank cap assembly;

FIG. 2 is a transverse cross-sectional view of the nozzle taken on the line 2—2 of FIG. 1;

FIG. 3 is a longitudinal cross-sectional view of a check valve used on the vapor recovery tube of the nozzle;

FIG. 4 is an exploded perspective view of the gasoline tank cap assembly;

FIG. 5 is a perspective view of the cap assembly in a closed position;

FIG. 6 is a top plan view of the cap assembly in a closed position;

FIG. 7 is a transverse cross-sectional view of the cap assembly taken on the line 7—7 of FIG. 6;

FIG. 8 is a transverse cross-sectional view of the cap assembly taken on the line 8—8 of FIG. 6;

FIG. 9 is a longitudinal cross-sectional view of a first alternate form of cap assembly that is permanently secured to the fill line of a fuel tank; and

FIG. 10 is a longitudinal cross-sectional view of a second alternate form of cap assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A first form A of the cap assembly that may be mounted on the fill line B of a fuel tank is shown in exploded perspective in FIG. 4, with the closure member C of the cap assembly occupying a first position. Cap assembly A when closure member C is in the first position may be removably and sealingly engaged by the nozzle D illustrated in FIG. 1.

The nozzle D includes a body 10 that has a first tube E projecting forwardly therefrom and a second tube F that is laterally spaced from the first tube and substantially parallel thereto. A pliable hose 12 is connected to body 10 and supplies liquid fuel to first tube E. Nozzle D includes a trigger D-1 which when pivoted upwardly as viewed in FIG. 1 opens a normally closed valve (not shown) in body 10 to establish communication between hose 12 and first tube E.

The second tube F is supported in laterally spaced relationship with first tube E, body 10 and hose 12 by a number of longitudinally spaced clips 14 as shown in FIGS. 1 and 2. The second tube F extends to an area (not shown) where fuel vapor that enters the first end 16 of the second tube as will later be explained is recovered. Second tube F has a check valve G therein, which check valve is preferably secured to body 10 by con-

ventional means 18 as shown in FIG. 1. Clips 14 so support second tube F from first tube E that the first and second tubes define first and second bayonet like end portions 20 and 22 that may removably and sealingly engage the cap assembly A when closure member C is in the first position as shown in FIG. 4. Check valve G permits full vapor to flow therethrough away from second end portion 22, but prevents liquid to flow there-through.

Cap assembly A is capable of being removably mounted on the fill line B which is of the conventional type that includes an inwardly extending ring shaped flange 24 that has a cylindrical lip 26 that projects downwardly from the inner edge thereof. The flange 24 and lip 26 have two or more circumferentially spaced slots 28 formed therein. A locking collar 30 abuts against the flange 24. Collar 30 has threads 32 on the interior surface thereof. A number of circumferentially spaced bores 34 are formed in collar 30, the purpose of which will later be explained.

A cylindrical shell 36 is provided that has first and second end portions 38 and 40. First end portion 38 has threads 38a formed on the exterior surface thereof, which threads engage threads 32. Second end portion 40 has circumferentially spaced lugs 40a projecting outwardly therefrom. After lugs 40a are moved downwardly through slots 28 and then rotated to be under the lower edge of lip 26, the locking collar 30 is rotated relative to shell 36, with the lugs 40a and locking collar 30 then cooperating to grip the flange 24 and lip 26 therebetween to hold the locking collar in a fixed position on fill line B as shown in FIGS. 5 and 7.

A circular plate 42 rests on locking collar 30, plate 42 has first and second spaced openings 44 and 46 therein that are in communication with the interiors of first and second tubular bosses 48 and 50 that depend from the plate. A first cylindrical wall 52 depends from plate 42 and encircles the first and second bosses 48 and 50. A second cylindrical wall 54 also depends from plate 42 and is adjacently disposed to the exterior surface of locking collar 30 as best seen in FIG. 7. First cylindrical wall 52 snugly engages the interior surface of shell 36.

The first and second bosses 48 and 50 have first and second tubular liners 56 and 58 respectively secured to the interior surfaces thereof. The liners 56 and 58 are formed from a resilient commercially available elastomeric material that is not adversely affected by gasoline. Liners 56 and 58 have externally ribbed ends that seat in recesses formed in the bosses 48 and 50 as shown in FIG. 7.

The plate 42 has a pair of diametrically opposed arcuate elongated slots 60 therein through which screws 62 extend to engage bores 34. Prior to the screws 62 being tightened, the slots 60 permit limited rotational adjustment of plate 42 relative to locking collar 30. Screws 62 when rotated form threads in the material of locking collar 30 in which bores 34 are defined. The components previously described are preferably injection molded from a polymerized resin that is not adversely affected by gasoline.

Closure member C is elongated in shape and is pivotally connected to a circumferential edge portion of plate 42 by a living hinge 64. First and second conical protuberances 66 and 68 are supported from surface 70 of closure member C. A resilient clip 72 is formed as a part of plate 42, with the clip capable of removably

engaging the free end 74 of closure member C when the latter is pivoted to the second position shown in FIG. 5. The first and second protuberances 66 and 68 are in pressure sealing contact with the upper extremities 56a and 58a of first and second liners 56 and 58 when the closure member C is in the second position and prevent volatile vapors in the fill line B escaping therefrom to the ambient atmosphere.

When the closure member C is in the first position shown in FIG. 4, the end portions 20 and 22 of first and second tubes E and F are slidably inserted in first and second liners 56 and 58 to effect seals therewith. Trigger D-1 upon being pivoted upwardly permits liquid fuel to flow from hose 12 and first tube E into the fill line B, with fuel vapor in the tank (not shown) associated with the fill line being displaced from the tank to flow through second tube F and check valve G to a recovery area (not shown).

Check valve G includes a hollow body 74 that has first and second valve seats 76 and 78 therein that are in communication with first and second passages 76a and 78a. First and second passages 76a and 78a are formed in first and second end walls 74a and 74b of valve body 74. A light tapered helical spring 77 abuts against the interior surface of second end wall 74b and at all times tends to maintain a ball 80 in sealing engagement with first seat 76. Fuel vapor displaced upwardly through fill line B as liquid fuel flows into the tank (not shown) will exert sufficient pressure on ball 80 to lift it from first seat 76, with the vapor then flowing through the interior of the check valve G to exit through the second seat 78. However, should liquid fuel tend to enter the interior of check valve G, the liquid fuel due to the greater density thereof will move the ball 80 into sealing engagement with second seat 78. Flow of liquid fuel through the check valve G will immediately terminate. When the flow of liquid fuel into check valve G has terminated, the spring 77 will expand and return ball 80 to the position shown in FIG. 3. Thus, it will be seen that volatile vapor from liquid fuel cannot escape to the ambient atmosphere when the closure member is in either the first or second position.

A first alternate form A' of the cap assembly is shown in FIG. 9 in which a cylindrical body 100 is inserted in the open end of a fill tube B', with the tube having a circumferential crimp 102 formed therein. The crimp 102 permanently secures body 100 to the fill tube B'.

Body 100 has first and second spaced bores 104 and 106 extending therethrough in which first and second liners 108 and 110 are disposed. A closure member 112 by a living hinge 114 is pivotally connected to body 100. Closure member 112 has first and second conical protuberances 116 and 118 supported therefrom that seal with the upper extremities of first and second liners 108 and 110 when the closure member is in the second position shown in FIG. 9. A resilient clip 120 is formed as a part of body 100 and serves to removably hold closure member 112 in the second position shown in FIG. 9. First and second end portions 20 and 22 of first and second tubes E and F slidable and sealingly engage first and second liners 108 and 110 in the same manner as they engage first and second liners 56 and 58 in the form A of the invention. The first alternate form A' of the cap assembly operates in substantially the same manner and has the same operational advantages as form A of the cap assembly.

A second alternate form A'' of the cap assembly is shown in FIG. 10 in which a cylindrical body 200 is held in the open end of a fill tube B'' by a circumferential crimp 202 formed in the fill tube. Body 200 has a tapered bore 204 therein in which a tapered resilient liner 206 is disposed. A closure member 208 is pivotally secured by a living hinge 210 to body 200, with the closure member supporting a single conical protuberance, identical to first protuberance 116, that seals with the upper extremity of liner 206 when the closure member 208 is in the second position. Closure member 208 is removably held in the second position by a clip 210 that is formed as a part of body 200.

End portions 20 and 22 of first and second tubes E and F engage first and second bores 212 and 214 formed in a resilient plug 216 that has a tapered external surface 218. Surface 218 tapers at the same angle as the interior surface of liner 206. When the closure member 208 is in the first position, plug 216 may be disposed inside liner 206 to seal therewith. Liquid fuel may now be discharged into fill line B'' through first tube 20, with fuel vapor being recovered from the fill line B'' by use of the second tube F in the same manner as previously described in conjunction with form A of the cap assembly.

The use and operation of the invention has been described previously in detail and need not be repeated.

I claim:

1. In combination with a valved nozzle that includes a first tube having a free bayonet like end portion through which a volatile liquid fuel may be discharged into a fill line of a fuel tank, said fill line having a free end, and said nozzle including a second tube having a free bayonet like end portion laterally spaced from said first tube through which fuel vapor may flow to a recovery area, a cap assembly mounted on said free end of said fill tube, said cap assembly including:

- a. a body mounted on said free end of said fill line, said body having at least one opening extending therethrough;
- b. movable closure means on said body that may be moved from a first to a second position to seal said opening to prevent escape of fuel vapor from said fill line to the ambient atmosphere during the time fuel is stored in said tank;
- c. first means for removably holding said closure means in said second position; and
- d. second means for removably effecting a seal between said opening and said bayonet like end portions of said first and second tubes when said closure means is in said first position to permit said liquid fuel to discharge into said fill line through said first tube and fuel vapor displaced from said tank during the filling thereof to discharge into said second tube to flow therethrough to said recovery area.

2. The combination as defined in claim 1 in which said opening in said body tapers inwardly and said second means is a plug having a tapered surface capable of sealingly engaging said opening, said plug having first and second bores that extend therethrough and said first and second bores being engaged by said first and second bayonet like end portions of said first and second tubes to support said plug therefrom.

3. The combination as defined in claim 2 which in addition includes:

e. a tapered tubular resilient liner mounted in said opening in said body, with said liner capable of being sealingly engaged by said plug when said closure means is in said first position.

4. The combination as defined in claim 1 in which said body has first and second laterally spaced openings that extend therethrough that are sealed by said closure means when the latter is in said second position, with said second means being first and second tubular resilient liners mounted in said first and second openings that are capable of being slidably and sealingly engaged by said bayonet like end portions of said first and second tubes when said closure means is in said first position.

5. The combination as defined in claim 1 which in addition includes:

e. third means for permanently securing said body to said fill line.

6. The combination as defined in claim 1 which in addition includes:

e. third means for removably securing said body to said fill line.

7. In combination with a valved nozzle that includes first and second laterally spaced tubes through which volatile liquid fuel may flow and through which vapor from said fuel may flow, a cap assembly mounted on a free end of a fill line of a tank to prevent escape of fuel vapor from said tank both when said tank is having liquid fuel discharged therein as well as while said fuel is stored in said tank, said assembly including:

a. a locking collar secured to said free end of said fill line;

b. a plate in abutting contact with said collar, said plate having first and second spaced openings therein, first and second tubular bosses secured to said plate that extend inwardly towards said fill line, and said first and second bosses in communication with said first and second openings;

c. first means for securing said plate to said locking collar;

d. first and second tubular liners formed from a resilient material impervious to said fuel, said first and second liners secured to the interior of said first and second bosses, and said first and second liners having such interior transverse cross sections that said first and second liners can be slidably and sealingly engaged by said first and second nozzles when said nozzles is discharging said liquid fuel into said tank;

e. a cover member pivotally supported from said plate, said cover member when in a first position permitting said first and second tubes of said nozzle to engage said first and second liners, and said cover member when pivoted to a second position extending across said first and second openings;

f. second means for removably holding said cover member in said second position; and

g. first and second protuberances on said cover member that sealingly engage said first and second liners when said cover member is in said second position to prevent fuel vapor in said tank escaping to the ambient atmosphere.

8. The combination as defined in claim 7 in which said free end of said fill tube is defined by a ring shaped flange that has a cylindrical lip extending inwardly from the inner circumference thereof, said flange and lip having a plurality of circumferentially spaced slots

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therein, said locking collar having first threads on the interior thereof, and said combination in addition including:

- h. a cylindrical shell having first and second ends, said shell having second threads adjacent said first end that can engage said first threads, and a plurality of lugs that extend outwardly from said second end of said shell, said lugs capable of being moved downwardly through said slots to dispose said shell

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at least partially in said fill tube with said shell capable of being rotated to dispose said lugs under said lip, and said locking ring and lugs capable of gripping said flange and lip therebetween when said locking ring is rotated in an appropriate direction with said first and second threads in engagement to rigidly secured said locking ring to said fill line.

* * * * *