United States Patent [19]

Casteline, Jr.

[11] **3,911,973**

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[54] **FUEL VAPOR SEAL DEVICE**

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[73] Assignee: **Cities Service Oil Company**, Tulsa, Okla.

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[52] **U.S. Cl.** **141/59;** 141/207; 141/208; 141/346

[51] **Int. Cl.**[2] **B65B 31/00;** B67C 3/34

[58] **Field of Search** ..... 141/1, 4, 5, 44, 52, 59, 141/93, 206–209, 217, 290, 346, 347, 383–386, 392; 220/85 VR, 85 VS, 86 R

[56] **References Cited**

UNITED STATES PATENTS

2,936,799	5/1960	Mannon	141/208
3,719,215	3/1973	Murray	141/207

FOREIGN PATENTS OR APPLICATIONS

255,749	9/1962	Australia	141/208

Primary Examiner—Richard E. Aegerter
Assistant Examiner—Frederick R. Schmidt
Attorney, Agent, or Firm—Howard M. Ellis

[57] **ABSTRACT**

A fuel dispensing apparatus of the type having an automatic vacuum shut-off valve in combination with a fuel vapor seal and collection device carried on the delivery spout of said apparatus which will eliminate virtually all loss of fuel during tank filling operations. The vapor seal and collection device, which must be locked into place before fuel is dispensed, comprises a locking-ring assembly with means for interconnecting with the fill pipe of a fuel tank to prevent loss of fuel to the atmosphere. The assembly is provided with a projection having a closure element operable to open and close a vacuum shut-off aperture of the dispensing apparatus when the device is moved relative to the spout. The locking-ring assembly includes conduit means for channeling fuel vapor displaced from the tank to a storage facility, and spring means for moving and turning the fuel vapor seal and collection device to close the shut-off aperture automatically when the delivery spout is disengaged from the tank fill pipe.

13 Claims, 5 Drawing Figures

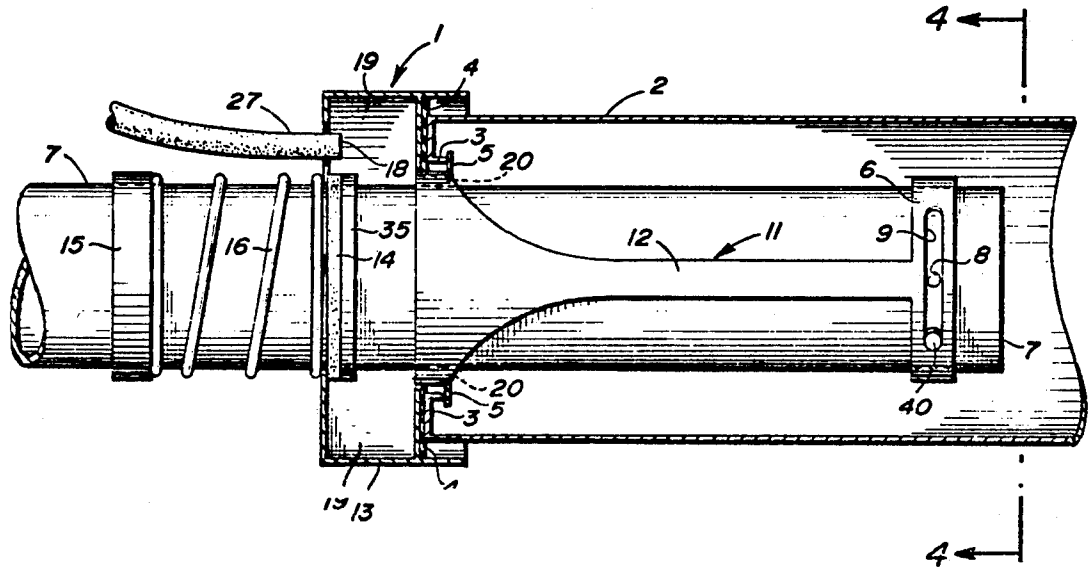


Fig. 1

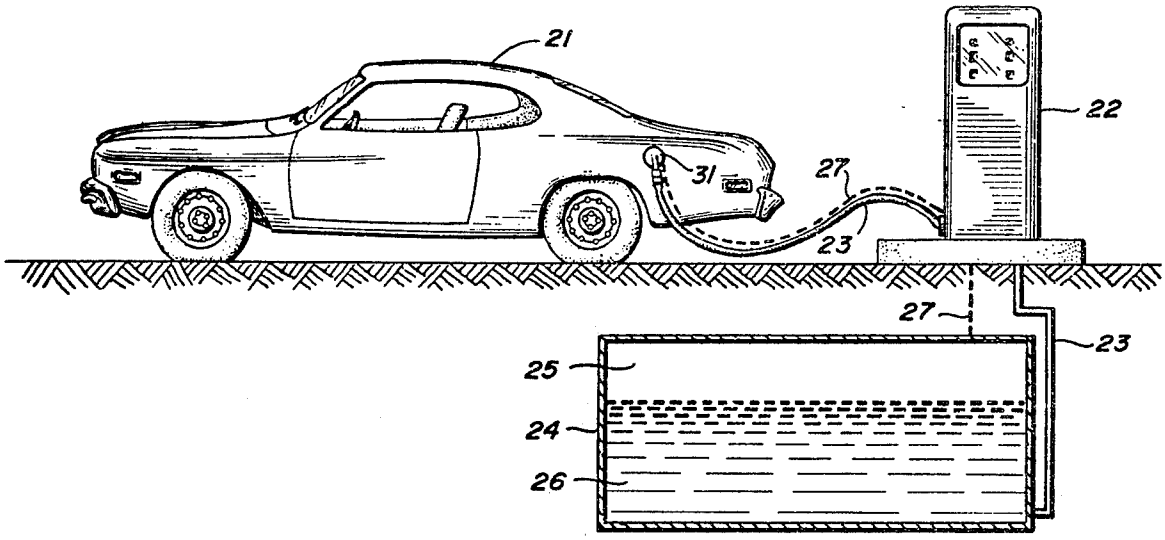
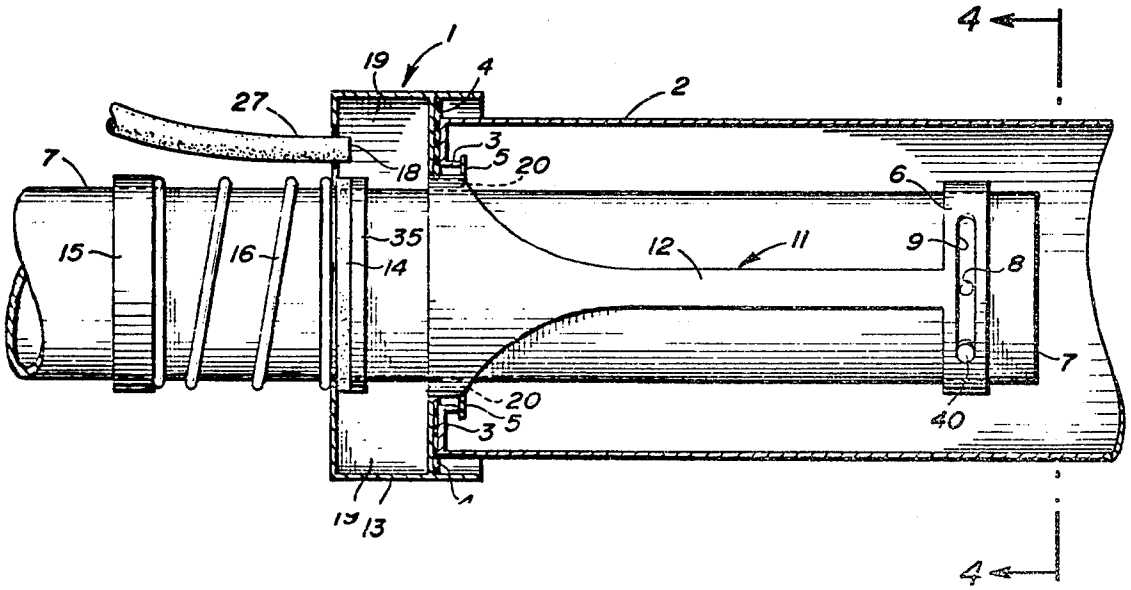

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Fig. 3


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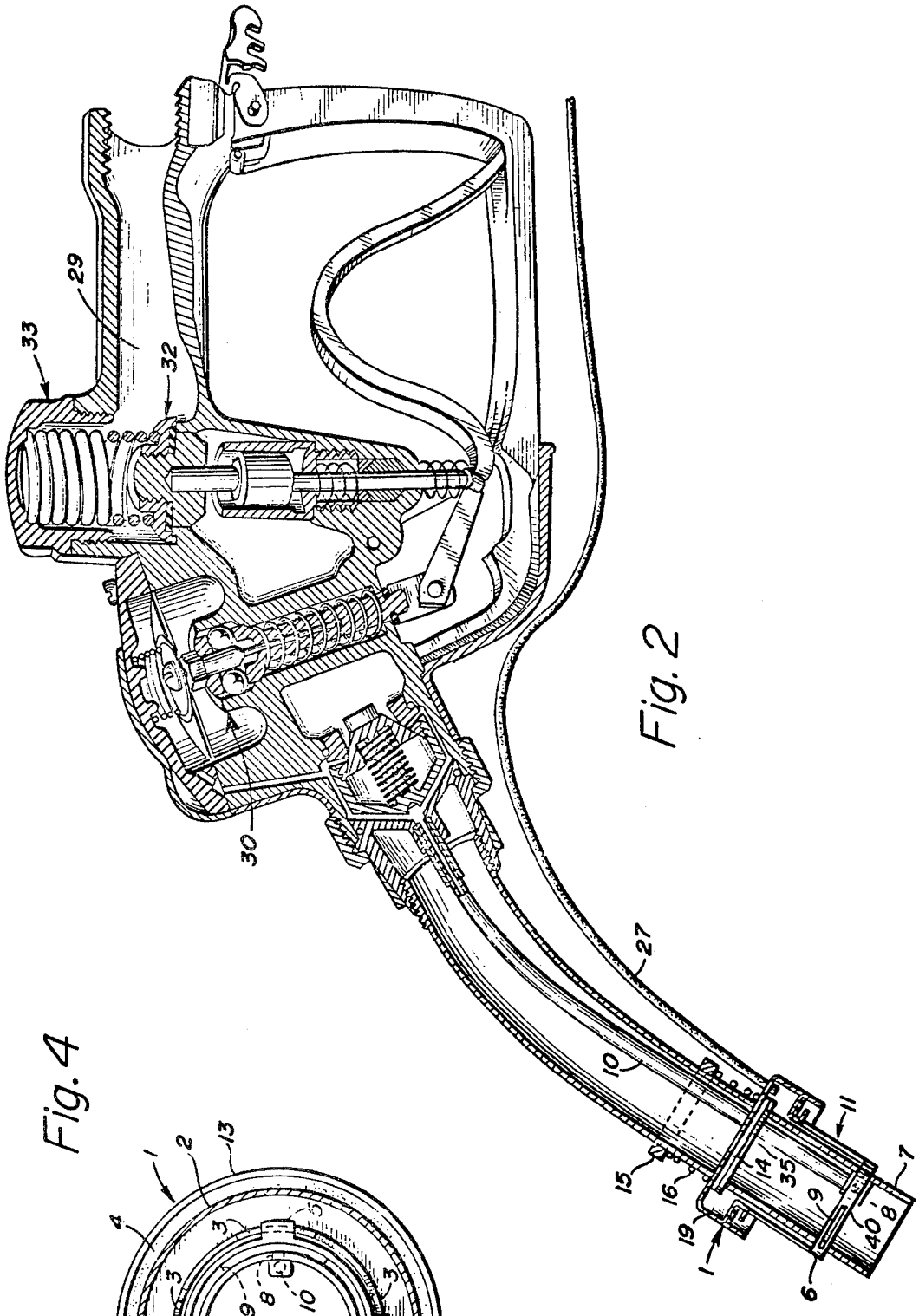


Fig. 2

Fig. 4

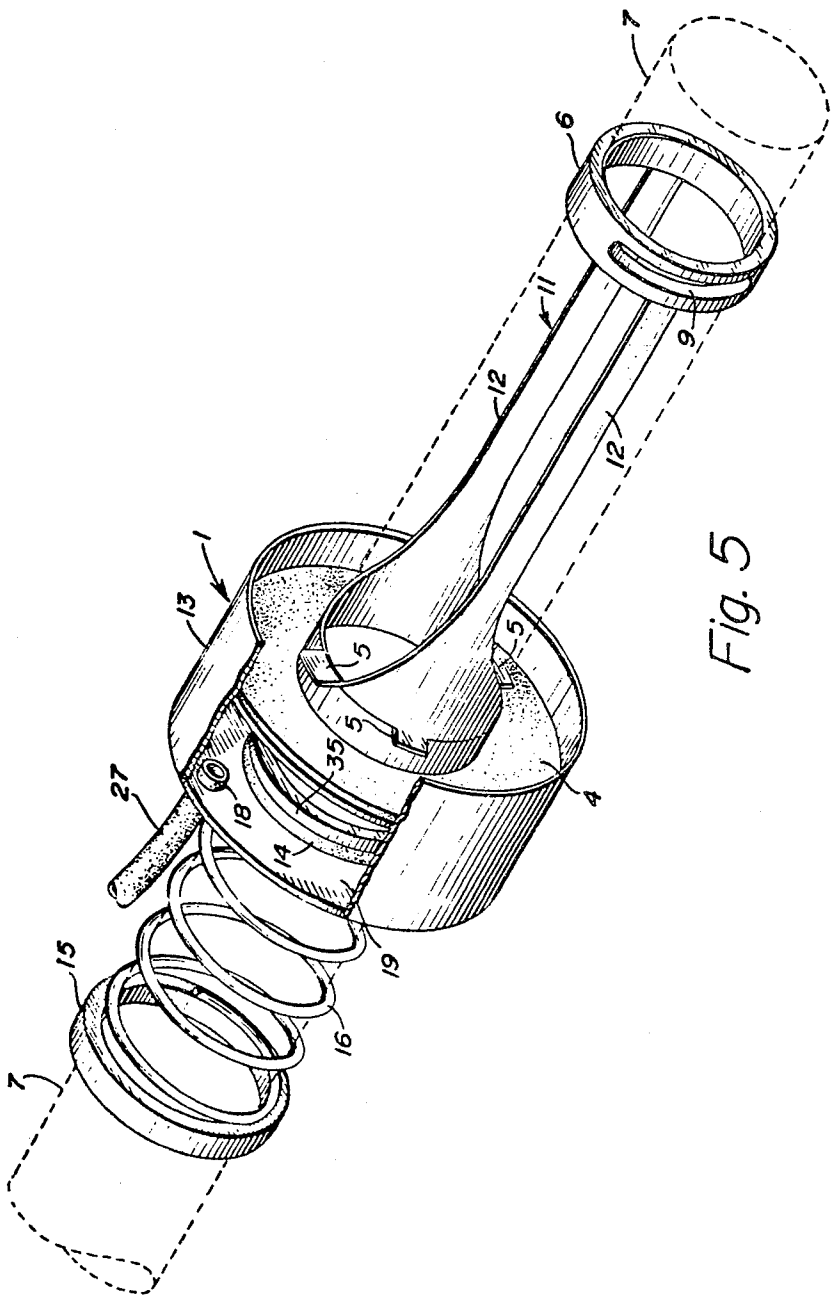


Fig. 5

FUEL VAPOR SEAL DEVICE

BACKGROUND OF THE INVENTION

This invention relates to the filling of fuel tanks with volatile liquids, and more particularly, to a device aiding the introduction of fuel, such as gasoline into storage tanks of motor vehicles.

During the process of refueling motor vehicles, including unloading of fuel tank trucks at gasoline service stations, fuel vapor in the headspace of the tank being filled is steadily displaced by the liquid fuel and discharged through its fill pipe and into the atmosphere. Heretofore, this loss of fuel, mostly in the form of vapor, was not regarded as an extremely serious problem, just so long as normal precautionary measures were exercised to avoid ignition and possible explosion. However, as the number of motor vehicles increased several fold problems of environmental air pollution and fuel shortages became matters of increasing concern. To date, the greatest concentration of effort devoted to correcting and maintaining acceptable air standards has been directed to more efficient operating engines and cleaner burning lead-free fuels. Nevertheless, it has now become recognized that during refueling operations disturbing quantities of noxious hydrocarbons are, in fact, discharged and lost into the atmosphere thus further compounding the ever great problems of air pollution and fuel scarcity.

It has been discovered that the most desirable approach to solving the problem of escaping hydrocarbon vapor would be to employ a device that is entirely compatible with popular present day fuel dispensing equipment, so their desirable automatic features can still be utilized. In the process of dispensing gasoline and other fuels into the tanks of motor vehicles the industry has widely accepted the automatic vacuum shut-off type dispensing nozzle, where the attainment of a predetermined filling level in the tank operates automatically to close a valve in the nozzle, thereby spontaneously shutting-off the flow of fuel to the tank. This type of automated fuel dispensing equipment permits an operator to refuel several vehicles simultaneously without the danger of fuel overflow.

Generally, this type of dispensing apparatus comprises a handle member housing a main valve seat and tappet, the valve being operated by a hand lever which can be latched in the valve-open position. The flow of the fluid through the valve body creates a suction by Venturi action, the suction being effective upon one side of a diaphragm in a supplementary chamber. The diaphragm is connected with a locking means for a spring pressed plunger to which the lever is fulcrumed. The suction is normally relieved by an in-flow of air or fuel vapor through a small tube having an outlet or aperture in or near the end of the fuel delivery spout. When fluid in the tank reaches the aperture in the fuel delivery spout, a resistance to in-flow through the aperture to the tube is created, the diaphragm operates to unlock the plunger, and the main valve is permitted to close by movement of the plunger, thus stopping the flow of fuel.

Typical fuel dispensing nozzles of the type discussed hereinabove are disclosed in U.S. Pat. Nos. 3,085,600 and 2,582,195, both of which are hereby incorporated-by-reference into the instant application.

Previous attempts made to collect displaced hydrocarbon vapor discharged during tank refueling entailed

use of various types of resilient sealing closures or "boots" on the delivery spout of the dispensing apparatus. This approach proved to be less than satisfactory, mainly because it failed to provide the necessary positive vapor seal required for recovery of all displaced vapor. Furthermore, because such devices were cumbersome to handle and had to be firmly held against the mouth of the fuel tank fill pipe, the operator was unable to attend to more than one vehicle at a time. Obviously, commercial use of these earlier fuel vapor collection devices would ultimately lead to greater manpower requirements and cost, since the automatic shut-off features of the dispensing apparatus which normally permit simultaneous, multi-vehicle refueling could not be effectively utilized. In addition to the lower efficiency, greater manpower factors associated with earlier fuel vapor seal devices, it was also found that actual employment could be easily avoided by the operator, because the automatic shut-off type fuel dispensing nozzles employed in combination with such devices could be activated at the will of the operator. Under such circumstances, there were no compelling incentives for an operator to actually employ this type of earlier sealing device.

Accordingly, it is the principal object of this invention to provide a device useful for positive sealing and collection of hydrocarbons displaced from a fuel tank during filling operations.

It is a further object of the present invention to provide an economical device which is entirely compatible for use with most conventional fuel dispensing apparatus having automatic vacuum shut-off type valves.

A still further object of the instant invention is to provide a dispensing apparatus having a fuel vapor seal device useful for eliminating loss of fuel during tank filling operations wherein the seal device must be first interconnected with or locked to the fuel tank to render the dispensing apparatus operable.

These and other objects, features and advantages of this invention will become apparent to those skilled in the art after a reading of the following more detailed description.

PREFERRED EMBODIMENTS OF THE INVENTION

Broadly, the invention is directed to a seal and collection device which operates to prevent fuel, either in the form of liquid or vapor from being discharged into the atmosphere during the process of filling a storage tank. Fuel for purposes of the present invention includes gasoline, diesel and other motor spirits containing mixtures of volatile hydrocarbons suitable for operating motor vehicles.

The fuel vapor seal and collection device is used in combination with most conventional fuel dispensing apparatus having a delivery spout with an automatic vacuum shut-off aperture, said seal device comprising a locking-ring assembly or vapor seal member operable to make a vapor-tight seal to the exterior of the spout while being movable relative to the spout. The locking-ring assembly also includes means for channeling the displaced fuel vapor to a vessel and a projection which cooperates with the vacuum aperture operable to open and close the aperture when the assembly is moved relative to the spout. The projection from the locking-ring assembly may comprise a closure member mounted to

the assembly by means of one or more connecting elements or straps.

Actuation of the fuel dispensing apparatus to fill the tank of a motor vehicle may be accomplished by inserting the terminal end of the delivery spout and the closure member of the locking-ring assembly into the fill pipe of the tank, so that ultimately engagement of the assembly with the mouth of the fill pipe moves the closure member of the projection to open position, thus exposing the vacuum shut-off aperture in the spout. Fuel can then be dispensed as disclosed and described in said U.S. Pat. Nos. 3,085,600 and 2,582,195. Correspondingly, when the delivery spout of the dispensing apparatus is at rest and not connected to the tank fill pipe, or upon disengagement of the locking-ring assembly from the fill pipe after completion of the refueling operation, the closure member of the locking-ring assembly operates to close the vacuum shut-off aperture. This action will stop the in-flow of air to the vacuum shut-off valve of the dispensing apparatus and prevent further flow of fuel through the apparatus.

The fuel vapor seal and collection device of the instant invention may also include resilient means for moving and torquing the locking-ring assembly and its projection relative to the spout to close the vacuum shut-off aperture automatically when the spout is at rest. Fuel may not be dispensed when said aperture is blocked.

The locking-ring may further include a tank capping element for engaging and locking the delivery spout of the fuel dispensing apparatus to the fuel tank fill pipe.

Having thus indicated the general nature of the invention, reference is made to the accompanying drawings forming a part of the specification and showing an illustrative embodiment of the invention, wherein

FIG. **1** is a schematic view of a fuel dispensing station during the refilling of a motor vehicle. Conduit means are disclosed for channeling displaced fuel vapor back to the head space of a fuel reservoir.

FIG. **2** is a lengthwise section of a fuel dispensing apparatus with automatic vacuum shut-off means in combination with a fuel vapor seal and collection device.

FIG. **3** is a detailed view of the fuel vapor seal device illustrated in FIG. **2.**

FIG. **4** is a sectional view of the fuel vapor seal device taken along a line **4—4** of FIG. **3.**

FIG. **5** is a perspective view of the fuel vapor seal and collection device.

As illustrated in FIG. **1** the process of refueling a motor vehicle with gasoline requires a pump **22** to meter out the liquid fuel **26** from storage reservoir or vessel **24.** The fuel traverses through tubular member **23** entering the fuel tank of motor vehicle **21.** Heretofore, hydrocarbon vapors in the head space of such a tank would be displaced by the in-flow of liquid fuel and discharged into the atmosphere. However, the present invention creates a positive vapor seal at junction **31** of the fuel tank fill pipe and fuel dispensing apparatus, collecting virtually all displaced vapor which is channeled via vapor return conduit **27** to headspace **25** of the storage reservoir. The vapor is retained without adversely affecting the surrounding atmosphere.

FIGS. **2–5** illustrate fuel vapor seal and collecting device defining a vapor seal member or locking-ring assembly **1** carried on fuel delivery spout **7,** the locking-ring assembly being movable relative to the spout and effective to seal said spout to fuel tank fill pipe **2,** FIG. **3,** thereby preventing escape of fuel to the atmosphere. To insure formation of a positive, vapor-tight seal at the junction of the locking-ring assembly and fill pipe, it is preferred that gasket means **4** of suitable material, be included with said assembly. Further, it is preferred that locking-ring assembly **1** include a tank capping element **13** having vapor collection chamber **19,** which together with the side wall of delivery spout **7** forms vapor duct **20.** As fuel is dispensed into the storage tank of a motor vehicle, displaced vapor is propelled outwardly through fill pipe **2** to vapor duct **20** and into collection chamber **19,** exiting said chamber through fuel vapor outlet **18** of conduit **27,** where the vapor is channeled to head space **25** of vessel **24.** To guard against loss of fuel vapor from chamber **19** to the atmosphere, a circular seal or washer member **14,** preferably a slip-ring seal of suitable material, encircles spout **7.** Washer **14** is sandwiched between a collar **35** fixed to spout **7** and tank capping element **13** and is held under compression by coil spring **16.**

To secure the fuel delivery spout to fuel tank fill pipe **2** during dispensing operations capping element **13** of locking-ring assembly **1** includes means for engaging the assembly to the mouth of the fill pipe, said means comprising a multiplicity of locking lugs **5** operable to interlock with mating lugs **3** at the mouth of said fill pipe in well known fashion.

FIG. **2** in illustrating a conventional automatic vacuum shut-off type dispensing apparatus **33** with fuel delivery spout **7,** also shows handle housing **29,** automatic vacuum shut-off valve **30** and main valve **32** with both valves disposed in said housing. Adjoining valve member **30** is vacuum shut-off conduit **10** and aperture **8,** also shown in FIG. **4.** As previously mentioned, the flow of fuel through vacuum shut-off valve **30** creates a suction by Venturi action. The suction is relieved by the in-flow of air through shut-off aperture **8** and conduit **10.** But, any resistance to the in-flow of air to the conduit breaks the suction and valve **30** is permitted to close, automatically terminating the flow of fuel to a storage tank. Accordingly, locking-ring assembly **1** includes projection **11,** which cooperates with vacuum shut-off aperture **8** and operates to open and close the aperture when the locking-ring assembly is moved relative to the delivery spout. Projection **11** comprises closure member **6** rigidly mounted to the locking-ring assembly by means of one or more connecting elements or straps **12.** Closure member **6** is most preferably a collar encircling delivery spout **7,** said collar being formed with opening **9.**

More specifically, by rotational movement of tank capping element **13,** collar **6** operates to open and close aperture **8** on delivery spout **7.** (Compare FIGS. **2** and **3**) One embodiment of the present invention provides locking lugs **5** of the capping element **13** to interlock with fill pipe mating lugs **3,** so that when said capping means is interconnected with the fill pipe the automatic shut-off aperture **8** is then exposed through opening **9** of collar **6.** Only then may fuel be dispensed.

The device of the instant invention may optionally, but preferably have resilient driving or torquing means for automatically closing shut-off aperture **8** when the locking-ring assembly **1** and spout **7** are disengaged from a fuel tank fill pipe. In most instances the torquing force on the assembly can best be achieved by appropriately tensioning coil spring **16** encircling delivery

spout 7. The spring is held under tension by stop ring 15 and by stop pin or lug 40 fixed to spout 7.

When the locking ring assembly is connected to the fill pipe it is rotated manually against the tension of spring 16 to move the collar 6 to the open or operative position shown in FIG. 3 and when the assembly is disconnected from the fill pipe it automatically returns to the "rest" or closed position as shown in FIG. 2 and the dispensing apparatus is rendered inoperative.

It is thus evident from the foregoing discussion that when the vapor seal device of this invention is employed in combination with a conventional automatic vacuum shut-off dispensing apparatus, the device must be mounted, rotated and tightly sealed to the fill pipe before the dispensing apparatus can be actuated.

While the apparatus and its operation has been described in conjunction with the above explanation, this is illustrative only. Accordingly, many alternatives, modifications and variations of the apparatus and its operation will be apparent to those skilled in the art in light of the foregoing descriptions, and it is therefore intended to embrace all such alternatives, modifications and variations as to fall within the spirit and broad scope of the appended claims.

I claim:

1. A fuel vapor seal and collection device for collecting fuel vapor from a fuel storage tank and channelling it to a reservoir, said device for use in combination with a fuel dispensing apparatus of the type having a delivery spout with an automatic vacuum shut-off aperture, said fuel vapor seal and collection device comprising a locking-ring assembly operable to make a vapor-tight seal to the exterior of a delivery spout of a dispensing apparatus while being movable relative to the spout, said locking-ring assembly having (a) conduit means for channeling the fuel vapor displaced from a full storage tank to a reservoir during filling operations, and (b) a projection mounted to the assembly and positioned adjacent to an vacuum shut-off aperture automatic in said spout cooperating to open and close said aperture when the device is moved relative to the spout.

2. The device of claim **1** including resilient means for moving and torquing the locking-ring assembly and the projection relative to the spout to close the vacuum shut-off aperture automatically when the assembly is not connected to the fill pipe of the fuel storage tank.

3. The device of claim **2** wherein the locking-ring assembly includes a tank capping element for engaging and securing the spout to the fill pipe.

4. The device of claim **1** wherein the projection comprises a closure member mounted to said locking-ring assembly by means of one or more connecting elements.

5. The device of claim **4** wherein the closure member comprises a collar encircling the spout and the collar is formed with an opening operable to register with said aperture.

6. A dispensing apparatus useful for eliminating loss of fuel during filling of a fuel storage tank comprising in combination a fuel delivery spout having a handle, housing an automatic vacuum shut-off valve disposed in the handle, a vacuum shut-off aperture formed in the spout and a fuel vapor seal and collection device disposed about said spout, said fuel vapor seal and collection device comprising a tank capping element movable relative to the delivery spout and effective to seal said spout to a fuel storage tank to prevent escape of fuel to the atmosphere, said capping element having (a) conduit means for channeling fuel vapor displaced from the fuel storage tank to a fuel reservoir, and (b) a projection mounted to the capping element and positioned adjacent to the vacuum shut-off aperture cooperating to open and close said aperture when the device is moved relative to the delivery spout.

7. The apparatus of claim **6** wherein the fuel vapor seal and collection device includes resilient means for moving and torquing the tank capping element and the projection relative to the spout to close the vacuum shut-off aperture of the delivery spout automatically when the spout is disengaged from a fuel tank fill pipe.

8. The device of claim **7** wherein the tank capping element cooperates with a stop lug fixed to the spout to limit motion of the capping element relative to the spout.

9. The apparatus of claim **6** wherein the projection of the capping element comprises a closure member connected to said capping element by means of at least one strap.

10. The apparatus of claim **9** wherein the closure member defines a collar with an aperture.

11. In an automatic shut-off dispensing apparatus having a fuel delivery spout with a vacuum shut-off aperture, the dispensing apparatus being useful for introducing fuel into the fuel storage tank of a motor vehicle, said tank having a fill pipe and a removable cap having locking lugs operable to interlock with mating lugs on the fill pipe, the improvement comprising a vapor seal member having tank capping means carried by the delivery spout while being movable relative to the spout and operable to interlock with the tank fill pipe and effective to seal the spout to the tank during filling operations, said tank capping means including (a) a conduit for channeling displaced fuel vapor from the storage tank to a vapor reservoir, (b) an aperture closure member secured to said capping means by one or more connecting elements and positioned adjacent to the vacuum shut-off aperture cooperating to open and close said aperture, and (c) spring means for moving and torquing the vapor seal member automatically to a closed position closing said aperture when the delivery spout is disengaged from the tank fill pipe.

12. The apparatus of claim **11** wherein the aperture closure member of the vapor seal member is a collar formed with an opening.

13. The apparatus of claim **12** wherein the tank capping means is formed with locking lugs operable to interlock with said mating lugs on the fill pipe so that when said tank capping means is interlocked the vacuum aperture is open.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,911,973 Dated October 21, 1975

Inventor(s) Peter Casteline, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 38 reads:

-- to an vacuum shut-off aperature automatic in --

should read:

-- to an automatic vacuum shut-off aperature in --

Signed and Sealed this

tenth Day of February 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks