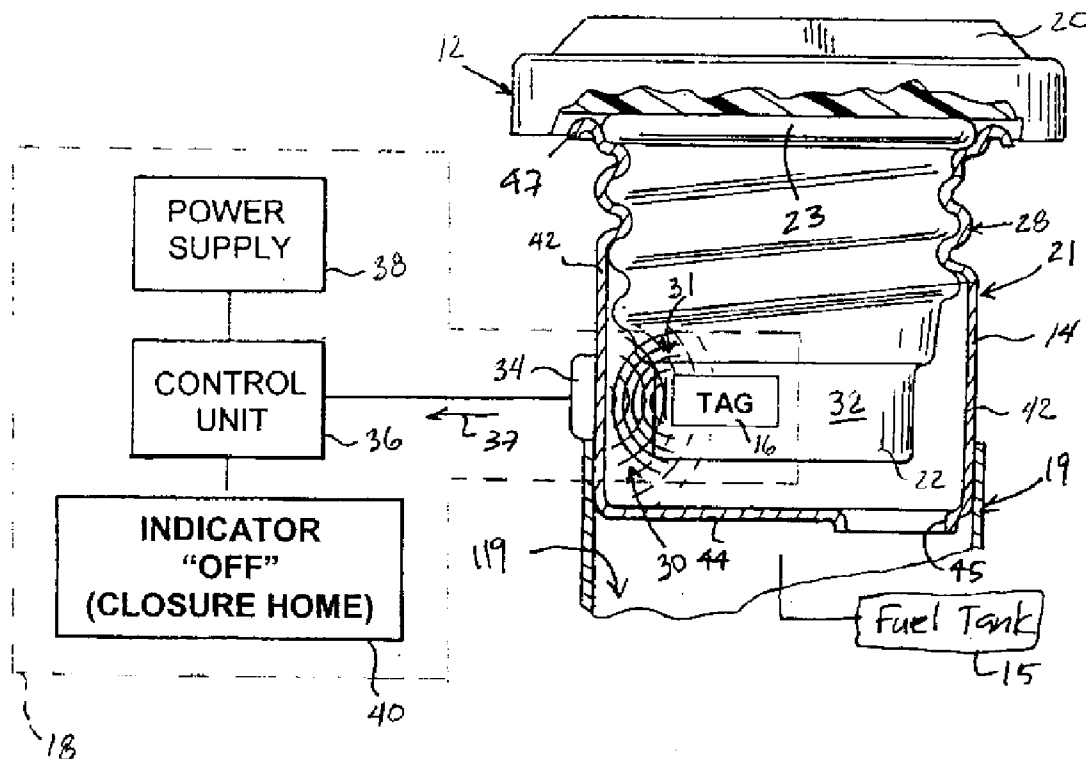
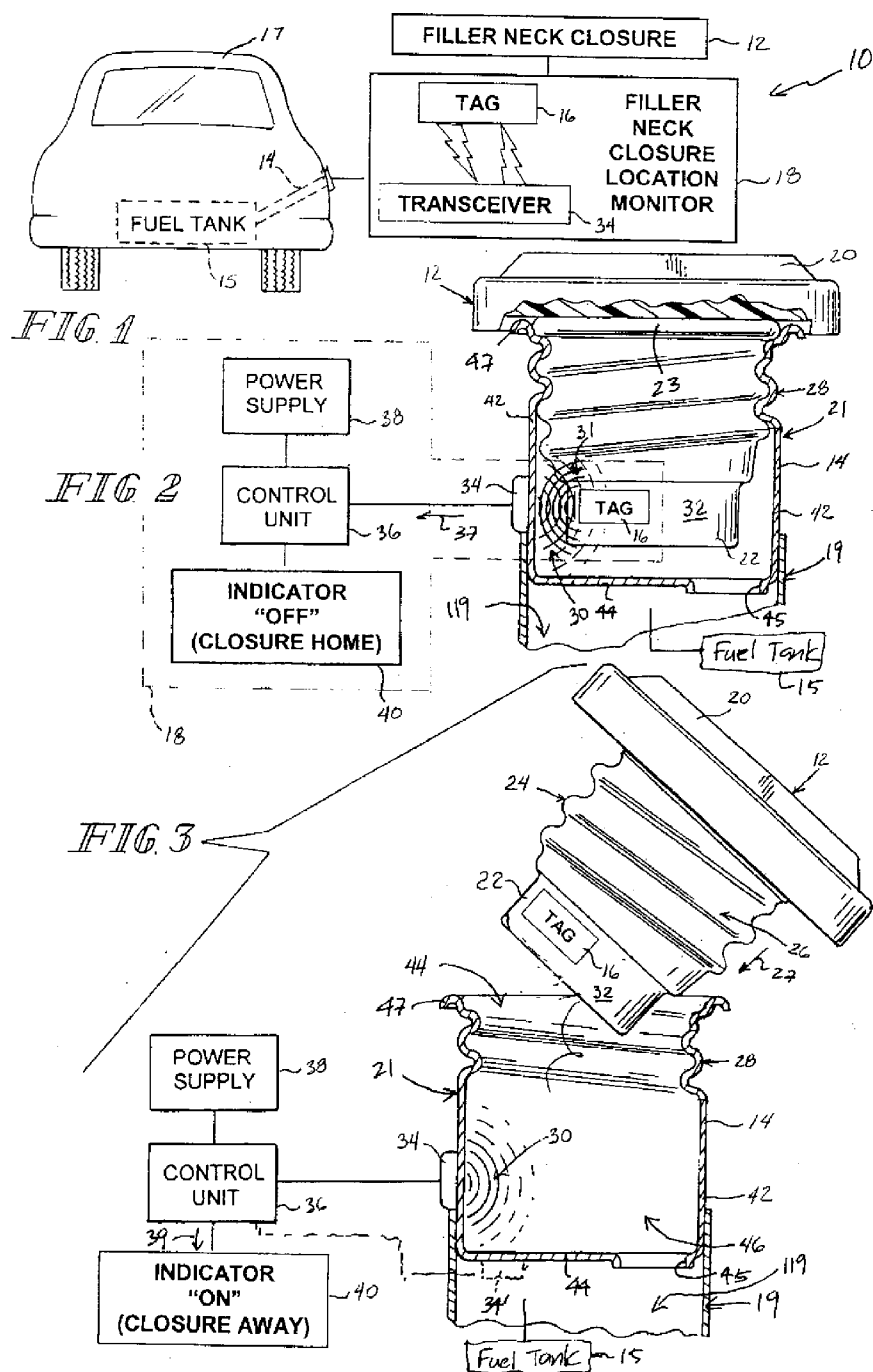




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DeCapua et al.(10) **Pub. No.: US 2007/0137730 A1**(43) **Pub. Date: Jun. 21, 2007**(54) **FILLER NECK CLOSURE DETECTOR****Related U.S. Application Data**(75) Inventors: **Dennis M. DeCapua**, Greenfield, IN
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220/212(73) Assignee: **STANT MANUFACTURING INC.,**
Connersville, IN (US)(57) **ABSTRACT**(21) Appl. No.: **11/610,095**A fuel system includes a fuel tank filler neck, a filler neck
closure, and a filler neck closure location monitor associated
with the fuel tank filler neck and the filler neck closure.(22) Filed: **Dec. 13, 2006**



FILLER NECK CLOSURE DETECTOR

[0001] This application claims priority under 35 U.S.C. § 119(e) to U.S. Provisional Application Ser. No. 60/743,043, filed Dec. 15, 2005, which is expressly incorporated by reference herein.

BACKGROUND

[0002] The present disclosure relates to closures, and particularly to fuel tank filler neck closures. More particularly, the present disclosure relates to filler neck closure detectors.

SUMMARY

[0003] According to the present disclosure, a vehicle fuel system comprises a fuel tank, a fuel tank filler neck coupled to the fuel tank, and a filler neck closure adapted to be coupled to the fuel tank filler neck to close an open mouth into a liquid fuel-conducting passageway formed in the fuel tank filler neck. A filler neck closure location monitor associated with the filler neck closure and with the fuel tank filler neck is also included in the vehicle fuel system.

[0004] In illustrative embodiments, the filler neck closure location monitor is configured to provide means for indicating removal of the filler neck closure from a home position closing an open mouth of the filler neck. The filler neck closure location monitor is used to alert a user that the filler neck closure has been removed from the filler neck, for example, when the fuel tank is being refueled.

[0005] In illustrative embodiments, the filler neck closure location monitor includes a tag coupled to the filler neck closure and a transceiver coupled to the filler neck. The tag and the transceiver cooperate to provide information to a control unit also included in the filler neck closure location monitor to cause the control unit to turn a dashboard warning indicator “on” in the vehicle when the closure is separated from the filler neck and to turn the dashboard warning indicator “off” when the closure is mounted on the filler neck.

[0006] The tag is a radio frequency identification (RFID) device in one embodiment of the present disclosure. The transceiver energizes the RFID tag to create a “closure-is-home” signal that is sent by the transceiver to the control unit when the filler neck closure is mounted on the filler neck in the home position. The control unit is programmed to turn the dashboard warning indicator “off” as long as the transceiver receives a closure-is-home signal sent by the RFID tag on the closure. The control unit is programmed to turn the dashboard warning indicator “on” whenever the transceiver does not receive a closure-is-home signal sent by the tag on the filler neck closure.

[0007] Additional features of the present disclosure will become apparent to those skilled in the art upon consideration of the following detailed description of illustrative embodiments exemplifying the best mode of carrying out the disclosure as presently perceived.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The detailed description particularly refers to the accompanying figures in which:

[0009] FIG. 1 is a diagrammatic view of a vehicle provided with a fuel system including a fuel tank, a fuel tank filler neck, a filler neck closure, and a filler neck closure location monitor in accordance with the present disclosure;

[0010] FIG. 2 is a side elevation view of a closure mounted in a home position in a filler neck (with portions broken away) to close a mouth opening into the filler neck and a diagrammatic view of the filler neck closure location monitor of FIG. 1 wherein the filler neck closure location monitor includes a radio frequency identification (RFID) “tag” coupled to the closure, a transceiver coupled to the fuel tank filler neck, a power supply, a control unit, and an indicator (OFF) providing a message that the closure is mounted in the home position in the filler neck; and

[0011] FIG. 3 is a view similar to FIG. 2 showing movement of the closure away from the filler neck and the transceiver to cause the RFID tag on the closure to be removed from the effective signal range of the transceiver on the filler neck, causing the control unit to activate the indicator (ON) providing a message that the closure has been removed from the filler neck.

DETAILED DESCRIPTION

[0012] A fuel tank filler neck closure detection apparatus 10 includes a filler neck closure 12 adapted to be coupled to a fuel tank filler neck 14 coupled to a fuel tank 15 associated with a vehicle 17 and a filler neck closure location monitor 18, as shown, for example, in FIG. 1. Filler neck closure 12 includes a hand grip 20, a tag carrier 22, an O-ring seal 23, and a retainer 24. Retainer 24 is interposed between and coupled to each of hand grip 20 and tag carrier 22 in an illustrative embodiment. Retainer 24 is formed to include external threads 26 and configured to carry O-ring seal 23 as suggested, for example, in FIG. 2.

[0013] Filler neck 14 includes a fuel pipe or conduit 19 coupled to fuel tank 15 and a closure receiver 21 coupled to an outer portion of fuel pipe 19 in an illustrative embodiment suggested in FIGS. 2 and 3. Fuel pipe 19 is formed to include liquid fuel-conducting passageway 119 as suggested in FIGS. 2 and 3. Closure receiver 21 is sized and shaped to receive tag carrier 22 and retainer 24 of filler neck closure 12 therein when filler neck closure 12 is mounted in a filler neck-closing “home” position on filler neck 14 as shown, for example, in FIG. 2.

[0014] In an illustrative embodiment, closure receiver 21 includes a threaded portion 28 configured to mate with external threads 26 on closure 12. It is within the scope of this disclosure to configure retainer 24 to include any suitable means for mating with filler neck 14 to retain closure 12 in the home position on filler neck 14.

[0015] Closure receiver 21 also includes a floor 43 formed to include an opening 45 and an annular side wall 42 positioned to lie adjacent to threaded portion 28 and arranged to interconnect annular side wall 42 and floor 43 as suggested in FIG. 3. Filler neck 14 is formed to include an open mouth 44 configured to receive a portion of filler neck closure 12 therein as also shown in FIGS. 2 and 3. Closure

receiver 21 is formed to include open mouth 44 in the illustrated embodiment and open mouth 44 is defined, for example, by an upper perimeter edge 47 of annular side wall 42. Threaded portion 28, floor 44, and annular side wall 42 cooperate to define an interior region 46 of closure receiver 21 as suggested in FIG. 3.

[0016] Hand grip 20 of closure receiver 21 is adapted to be grasped by a user to allow the user to move filler neck closure 12 from a “home” position mating with filler neck 14 and substantially covering open mouth 44 of filler neck 14 to an “away” position in which filler neck closure 12 is moved away from and uncovers open mouth 44 of filler neck 14. Tag carrier 22 is arranged to extend coaxially away from retainer portion 24 in direction 27 as suggested in FIG. 3. Tag carrier 22 is configured to be smaller in diameter than the larger diameter retainer 24 in an illustrative embodiment. External threads 26 of retainer 24 are configured to engage threaded portion 28 of filler neck 14 to couple filler neck closure 12 to filler neck 14 in the home position substantially covering mouth 44. It is within the scope of this disclosure to use any suitable means for coupling filler neck closure 12 to filler neck 14 in a filler neck-closing home position.

[0017] Filler neck closure location monitor 18 includes a tag 16 coupled to filler neck closure 12, a transceiver 34 coupled to annular side wall 42 of closure receiver 21, a control unit 36, a power supply 38, and a “warning” indicator 40. In an illustrative embodiment, tag 16 is coupled to tag carrier 22 of filler neck closure 12 as suggested in FIG. 3. It is within the scope of this disclosure to mount or locate tag 16 elsewhere on filler neck closure 12.

[0018] In an illustrative embodiment, tag 16 is arranged to be coupled to and lie generally flush along an outer surface 32 of tag carrier 22. Tag 16 may be configured, for example, as an inductively coupled or a capacitively coupled radio frequency identification (RFID) “tag” transceiver, a magnetic “smart card”, an infrared receptor, a transponder, or any other suitable electronic or non-electronic tracking device. Illustratively, tag 16 is an RFID tag coupled to tag carrier 22 of filler neck closure 12. When filler neck closure 12 is moved to the filler neck-closing home position in closure receiver 21 of filler neck 14, tag 16 is generally positioned to lie within an electromagnetic field 30 emitted by transceiver 34 as suggested diagrammatically in FIG. 2.

[0019] Transceiver 34 may be configured, for example, continuously to emit electromagnetic “tag locator” signal 30 generally within a certain region of filler neck 14 (e.g., interior region 46 of closure receiver 21) in which tag 16 on filler neck closure 12 will reside when filler neck closure 12 is mounted in the home position in filler neck 14. Transceiver 34 alternatively can emit an intermittent signal, emit a signal at predetermined times, project a magnetic field, or emit an electro-optical signal therein. Transceiver 34 is coupled electrically to control unit 36 to process signal data received by transceiver 34. Transceiver 34 is a radio transmitter-receiver that uses many of the same components for both transmission and reception in an illustrative embodiment.

[0020] In an illustrative embodiment, transceiver 34 is coupled to annular side wall 42 of closure receiver 21 as suggested in FIG. 2. Illustratively, transceiver 34 is positioned to lie outside liquid fuel-conducting passageway 119 formed in fuel pipe 19. In an alternative embodiment sug-

gested in FIG. 3, a transceiver 34' is coupled to floor 44 and positioned to lie inside liquid fuel-conducting passageway 119 formed in fuel pipe 19.

[0021] Power supply 38 is coupled electrically to control unit 36 and provides electrical power for operation of filler neck closure location monitor 18. Indicator 40 is electrically coupled to control unit 36 and is configured to provide a user with a visual and/or an aural and/or a sensory report when control unit 36 determines that filler neck closure 12 has been removed from within filler neck 14. In an illustrative embodiment, indicator 40 is mounted on a vehicle dashboard (not shown) or other suitable location in a vehicle.

[0022] Illustratively, transceiver 34 emits an electromagnetic tag locator signal 30 that has an effective range generally within a portion of filler neck 14 (e.g., interior region 46 of closure receiver 21) that can be received by tag 16 when filler neck closure 12 is received by filler neck 14 in the home position to close open mouth 44 as shown best in FIG. 2. In response, tag 16 is able to convert the electromagnetic energy received from tag locator signal 30 into a “tag-located” signal 31. Tag 16 then broadcasts tag-located signal 31 and tag-located signal 31 is received by transceiver 34 and further processed by control unit 36 to verify the presence of tag 16 (and thus filler neck closure 12) within filler neck 14 to establish that filler neck closure 12 has been placed in the home position in filler neck 14.

[0023] While filler neck closure 12 is in the home position in filler neck 14, control unit 36 will receive a “closure-is-home” signal from transceiver 34 indicating the presence of tag 16 in filler neck 14 and filler neck closure 12 in the home position in filler neck 14 as suggested diagrammatically in FIG. 2. In this situation, control unit 36 does not generate an indicator-actuated signal. Therefore, warning indicator 40 is inactive (i.e., off) and does not issue a “closure-is-away” report to a person in the vehicle. This absence of a report suggests to a user that filler neck closure 12 is located in the home position mounted on filler neck 14 to close open mouth 44 of filler neck 14.

[0024] As the user disengages filler neck closure 12 from filler neck 14 and moves filler neck closure 12 to the away position during fuel tank refueling, tag 16 moves “out of” and “away from” from the effective range of tag-locator signal 30 emitted by transceiver 34. Under these conditions, transmitter 34 is unable to generate and thus transmit tag-located signal 31 to control unit 36. Upon a failure to receive tag-located signal 31 from transceiver 34, control unit 36 generates a “closure-is-away” indicator-activation signal 39 and sends that signal to indicator 40 to energize indicator 40 (e.g., turn indicator 40 “on”) to alert the user that filler neck closure 12 has been moved from the home position to the away position as shown diagrammatically in FIG. 3.

1. A filler neck closure detector comprising
 - a filler neck,
 - a filler neck closure adapted to be coupled to the filler neck to establish a home position closing an open mouth into a fuel-conducting passageway formed in the filler neck, and
 - a filler neck closure location monitor including a warning indicator and detection means for activating the warn-

ing indicator upon movement of the filler neck closure to an away position uncoupled from the filler neck to provide a message to a user that the filler neck closure has been removed from the filler neck and for deactivating the warning indicator upon movement of the filler neck closure to the home position coupled to the filler neck to provide a message to a user that the filler neck closure has been mounted on the filler neck.

2. The detector of claim 1, wherein the detection means includes a tag coupled to the filler neck closure, a transceiver coupled to the filler neck, and a control unit coupled to the transceiver and to the warning indicator, and the transceiver is formed to include means for sensing the presence of the tag in the filler neck and instructing the control unit to activate the warning indicator only when the tag has been removed from the filler neck.

3. The detector of claim 1, wherein the detection means includes a tag coupled to the filler neck closure, a transceiver coupled to the filler neck, and a control unit coupled to the transceiver and to the warning indicator, the transceiver includes means for emitting a tag locator signal in the filler neck, the tag includes broadcast means energized by receipt of the tag locator signal emitted by the transceiver for broadcasting a tag-located signal to the transceiver upon movement of the filler neck closure to the home position in the filler neck, and the transceiver further includes signal receiver means for receiving the tag-located signal broadcast by the tag to verify the presence of the tag and the filler neck closure in the filler neck and instructor means for instructing the control unit to deactivate the warning indicator upon receipt of the tag-located signal broadcast by the tag and for instructing the control unit to activate the warning indicator upon failure to receive the tag-located signal broadcast by the tag.

4. The detector of claim 1, wherein the filler neck closure includes a hand grip, a tag carrier, and a retainer configured to mate with the filler neck to retain the filler neck closure in the home position and interposed between and coupled to each of the hand grip and tag carrier, and the tag is coupled to the tag carrier.

5. The detector of claim 4, wherein the filler neck includes a fuel pipe and a closure receiver coupled to an outer portion of the fuel pipe and the transceiver is coupled to the closure receiver.

6. The detector of claim 5, wherein the closure receiver includes an annular side wall having an upper perimeter edge formed to include an open mouth adapted to receive the filler neck closure therein upon movement of the filler neck closure to assume the home position in the filler neck, the

closure receiver further includes a floor formed to include an opening communicating with a liquid fuel-receiving passageway formed in the fuel pipe and coupled to the annular side wall to define an interior region receiving the tag carrier and the tag upon movement of the filler neck closure to assume the home position.

7. The detector of claim 6, wherein the transceiver is coupled to the annular side wall of the closure receiver.

8. The detector of claim 7, wherein the transceiver is positioned to lie outside the liquid fuel-receiving passageway formed in the fuel pipe.

9. The detector of claim 6, wherein the transceiver is coupled to the floor of the closure receiver.

10. The detector of claim 9, wherein the transceiver is positioned to lie inside the liquid fuel-receiving passageway formed in the fuel pipe.

11. A filler neck closure detector comprising

a filler neck,

a filler neck closure adapted to be coupled to the filler neck to establish a home position closing an open mouth into a fuel-conducting passageway formed in the filler neck, and

a filler neck closure location monitor including a tag coupled to the filler neck closure, a transceiver coupled to the filler neck, a control unit coupled to the transceiver, a power supply coupled to the control unit, and a warning indicator coupled to the control unit.

12. The detector of claim 11, wherein the transceiver includes means for emitting an electromagnetic tag locator signal that has an effective range generally inside the filler neck that can be received by the tag upon movement of the filler neck closure to assume the home position, the tag includes means for converting electromagnetic energy received from the tag locator signal into a tag-located signal upon movement of the filler neck closure to assume the home position and broadcasting the tag-located signal to the transceiver, the transceiver includes means for receiving the tag-located signal broadcast by the tag and sending a closure-is-home signal to the control unit whenever a tag-located signal is received by the transceiver, and the control unit includes means for turning the warning indicator off whenever a closure-is-home signal is received from the transceiver and means for turning the warning indicator on whenever a closure-is-home signal is not received from the transceiver.

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