CAPLESS REFUELING SYSTEM

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ABSTRACT
A capless refueling assembly is provided that includes a retaining base and first and second doors. The retaining base has a fuel nozzle opening formed therethrough. The first door is pivotally secured to the retaining base, such that the first door covers a first portion of the fuel nozzle opening in a closed position. The second door is also pivotally secured to the retaining base, such that the second door covers a second portion of the fuel nozzle opening in the closed position. The first and second doors oppose one another and are configured to close the fuel nozzle opening in said closed position. The first and second doors are configured to pivot away from one another to open the fuel nozzle opening when a fuel nozzle is urged into the first and second doors.
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RELATED APPLICATIONS

[0001] This application relates to and claims priority benefits from U.S. Provisional Patent Application No. 60/852,045 entitled “Direct Fuel Fill System,” filed Oct. 16, 2006, which is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] Embodiments of the present invention generally relate to refueling systems for vehicles, and more particularly, to capless refueling systems.

BACKGROUND OF THE INVENTION

[0003] Vehicle fuel systems typically include a fuel tank and a filler tube through which fuel is dispensed into the tank. A removable cap is threadably secured at an end of the filler tube in order to close the tube. When the vehicle is to be refueled, the removable cap is typically twisted or otherwise rotated until it is removed from the filler tube. Heat, movement of the vehicle and the like may cause a build-up of vapor pressure in the fuel tank. Under some conditions, vapor and/or fuel droplets may discharge from the neck of the filler tube when the cap is removed from the filler tube. In addition to the unpleasant side effects of being sprayed with fuel and/or vapor, a person may be placed in danger from fire or explosion of the highly volatile substances.

[0004] Additionally, outer surfaces of the removable cap, which are engaged by a person, typically become dirty. Moreover, the caps may be covered with dried fuel and/or various impurities, which may be transferred to a person who touches the cap.

[0005] Also, once the cap is removed, it is not always replaced on the filler tube. Vehicle operators may forget to reconnect the cap after the refueling process. Thus, the filler tube may be open to the environment. Even if the cap is repsonitioned on the filler tube, the cap may not be properly threaded onto the filler cap, thereby providing a less than adequate seal.

[0006] In order to eliminate the various drawbacks of standard fuel cap assemblies, capless refueling assemblies have been manufactured. Such assemblies are disclosed, for example, in U.S. Pat. No. 6,539,990, entitled “Capless Refueling Assembly” (the “’990 patent”) and U.S. Pat. No. 6,789,586, entitled “Breakaway Capless Refueling Assembly” (the “’586 patent”). Both the ’990 patent and the ’586 patent describe capless refueling assemblies that may be used in place of conventional fuel caps.

[0007] The ’990 patent discloses a capless refueling assembly in which a single door swings open in order to provide access to the filler tube. The single door is relatively large, however, and may be too bulky for some vehicles. The clearance area for the door to swing may be too large for some refueling systems. For example, the door may swing into walls defining the refueling chamber that block the door from moving into a fully open position.

[0008] The ’586 patent discloses a cover structure that is attached to the filler tube by frangible connections, and is configured to separate from the filler tube assembly in the event of a crash. Similar to the ’990 patent, the ’586 patent discloses a capless refueling assembly that includes a relatively large door that is configured to swing into an open position. Both the ’586 and ’990 patents disclose a capless refueling system that may be too large to fit into certain vehicles, due to the relatively large size of the door. The clearance area for the door may be too large for the system to fit into some vehicles.

[0009] Thus, a need exists for a capless refueling assembly that may be used with most, if not all, vehicles. Further, a need exists for a capless refueling system that is capable of functioning in smaller, tighter spaces where operating space is limited.

SUMMARY OF THE INVENTION

[0010] Certain embodiments of the present invention provide a capless refueling assembly that includes a retaining base and two doors. The retaining base has a fuel nozzle opening formed therethrough. The retaining base may also include a plurality of nozzle guiding protuberances positioned around the fuel nozzle opening.

[0011] The first door is pivotally secured to the retaining base. The first door covers a first portion, such as a half, of the fuel nozzle opening in a closed position.

[0012] The second door is also pivotally secured to the retaining base, and covers a second portion, such as the other half, of the fuel nozzle opening in the closed position.

[0013] The first and second doors oppose each other and are configured to close the fuel nozzle opening when the doors are in the closed position. The first and second doors are configured to pivot away from one another to open the fuel nozzle opening when a fuel nozzle is urged into the first and second doors. The first and second doors may be configured to pivot through a plane that is parallel to a plane in which the fuel nozzle opening resides.

[0014] The assembly may also include a spring having first and second straight ends integrally connected to a coiled loop. The first end and second ends exert inwardly directed forces into the first and second doors, respectively.

[0015] The retaining base may further include a door pivoting post having a ridge. The coiled loop may also include a straightened coil, wherein the first and second doors and the coiled loop are pivotally secured around the door pivoting post. The straightened coil may abut against the ridge to prevent the spring from dislodging from the door pivoting post.

[0016] Each door may include a plurality of ribs separated by gaps. Each of the ribs may curve toward a bottom of the retaining base. The height of each rib may be greatest at an outer edge and shortest at an inner edge. Additionally, the outer edges of each of the ribs may be integrally connected to a strengthening beam.

[0017] The retaining base may include a first barb extending toward at least one of the doors, while at least one of the doors may include a second barb extending toward the retaining base. The first and second barbs abut one another in order to prevent the first and second doors from rocking with respect to the retaining base.

[0018] The assembly may also include a cover positioned over the retaining base. The cover may include a shroud that assists in securing the first and second doors to the retaining base. The shroud may also include an angled outer surface configured to guide a fuel nozzle toward the fuel nozzle opening. Additionally, the cover may include at least one bracing wall configured to prevent the retaining base from rotating with respect to the cover.
Certain embodiments of the present invention also provide a capless refueling system for a vehicle. The system is configured to allow fluid dispersed from a fuel nozzle to pass into the vehicle.

The system includes a filler tube connected to a fuel tank, and a capless assembly secured to the filler tube. The capless assembly includes a retaining base having a fuel nozzle opening that provides a fluid path to the filler tube, and two opposed doors pivotally secured to the retaining base. The doors cover the fuel nozzle opening in a closed position. The doors are configured to pivot away from one another to open the fuel nozzle opening when the fuel nozzle is urged into the doors.

DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 illustrates a front isometric view of a capless refueling system according to an embodiment of the present invention.

FIG. 2 illustrates a front plan view of a capless refueling system in a closed position according to an embodiment of the present invention.

FIG. 3 illustrates a front plan view of a capless refueling system in an open position according to an embodiment of the present invention.

FIG. 4 illustrates an isometric internal view of a fuel nozzle inserted into a capless refueling system according to an embodiment of the present invention.

FIG. 5 illustrates an isometric exploded view of a capless refueling system according to an embodiment of the present invention.

FIG. 6 illustrates a front isometric view of a retaining base according to an embodiment of the present invention.

FIG. 7 illustrates a rear isometric view of a retaining base according to an embodiment of the present invention.

FIG. 8 illustrates a front isometric view of a door according to an embodiment of the present invention.

FIG. 9 illustrates an isometric rear view of a door according to an embodiment of the present invention.

FIG. 10 illustrates a lateral view of a retaining base operatively supporting two doors according to an embodiment of the present invention.

FIG. 11 illustrates an isometric view of a spring according to an embodiment of the present invention.

FIG. 12 illustrates a rear isometric view of a cover according to an embodiment of the present invention.

FIG. 13 illustrates a front isometric view of a cover according to an embodiment of the present invention.

FIG. 14 illustrates a front plan view of a retaining base operatively supporting two doors according to an embodiment of the present invention.

FIG. 15 illustrates a front isometric view of a retaining base operatively supporting two doors according to an embodiment of the present invention.

Before the embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein are for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof is meant to encompass the items listed thereafter and equivalents thereof as well as additional items and equivalents thereof.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 illustrates a front isometric view of a capless refueling system according to an embodiment of the present invention. The system includes a capless assembly 12 secured to a filler tube 14. The capless assembly 12 may be formed of plastics, metals, or the like, such as those materials that form a conventional fuel cap.

The filler tube 14 may be a conventional filler tube of a vehicle fuel intake system, and the capless assembly 12 may secure to the filler tube 14 similar to a conventional fuel cap securing to the filler tube 14. That is, the capless assembly 12 may threadably engage a distal end of the filler tube 14. Thus, a conventional fuel intake system may be retrofitted by removing the fuel cap and replacing it with the capless assembly 12.

FIG. 2 illustrates a front plan view of the capless refueling system 10 in a closed position. The capless assembly 12 includes two opposed doors 15 and 16 that cover a filler tube inlet (hidden from view). The doors 15 and 16 are configured to swing open about a pivot point 18 when a fuel nozzle is inserted into an opening 20 of the capless assembly 12.

FIG. 3 illustrates a front plan view of the capless refueling system 10 in an open position. As shown in FIG. 3, the doors 15 and 16 are swung into an open position, thereby exposing the distal end of the filler tube 14, which is covered by a flapper door 22. The doors 15 and 16 move through a plane that is parallel to the plane that contains a fuel nozzle opening 24 of the capless assembly 12.

FIG. 4 illustrates an isometric internal view of a fuel nozzle 26 inserted into the capless refueling system 10 according to an embodiment of the present invention. The fuel nozzle 26 may be operatively connected to a delivery hose, which is in turn connected to a fuel dispensing housing, such as found at a typical gasoline station. The fuel nozzle 26 is inserted into the opening of the capless assembly 12 and is urged into the doors 15 and 16 (door 16 hidden from view). The force exerted by the fuel nozzle 26 spreads the doors 15 and 16 apart from one another into an open position, and the tip of the fuel nozzle 26 then passes into the fuel nozzle opening 24. As the fuel nozzle 26 moves further into the capless refueling system 10, the fuel nozzle 26 forces the flapper door 22 of the filler tube 14 open. The tip of the fuel nozzle 26 then passes further into the filler tube 14. Thus, the fuel nozzle 26 is in fluid communication with the fuel intake chamber, which may then be refueled.

FIG. 5 illustrates an isometric exploded view of the capless refueling system 10 according to an embodiment of the present invention. The capless assembly 12 includes a retaining base 27 that supports the doors 15 and 16. A single coiled spring 28 is operatively connected to each of the doors 15 and 16 and is configured to exert a resistive force into the doors 15 and 16. The spring 28 acts to keep the doors 15 and 16 closed, and forces the doors 15 and 16 back into a closed position when the fuel nozzle 26 (shown in FIG. 5)
is removed from the fuel nozzle opening 24. A cover 30 is positioned over the doors 15 and 16 and may snapably engage the retaining base 27.

[0043] A distal circumferential ledge 32 of the filler tube 14 is configured to receive and retain an annular retaining wall of the capless assembly 12 formed by regularly spaced bosses 34 of the base 14 and regularly spaced bosses 36 of the cover 30. The bosses 34 of the retaining base 27 secure into reciprocal notches 38 of the cover 30, while the bosses 36 of the cover 30 secure into reciprocal notches 40 of the retaining base 27 in order to secure the cover 30 to the retaining base 27 (and thereby form the annular retaining wall that is secured to the distal circumferential ledge 32).

[0044] A sealing member 42 may be disposed around a fuel intake passage 44 of the filler tube 14. The sealing member 42 provides a sealing interface around the fuel intake passage 44 and the fuel nozzle opening 24 of the retaining base 27.

[0045] A snap ring 46 may be positioned around the capless assembly 12 proximate the ledge 32 of the filler tube 14. The snap ring 46 is configured to maintain a secure connection between the cover 30 and the retaining base 27.

[0046] FIG. 6 illustrates a front isometric view of the retaining base 27. The retaining base 27 includes a generally circular planar body 48 integrally formed with the rearwardly extending bosses 34. As shown in FIG. 6, the bosses 34 are separated by the notches 40.

[0047] The fuel nozzle opening 24 is formed through the planar body 48. As shown in FIG. 6, the fuel nozzle opening 24 may be formed proximate a center of the planar body 48.

[0048] A door pivoting post 50 extends outwardly from a front surface of the planar body 48 over the fuel nozzle opening 24. The door pivoting post 50 is configured to pivotally retain the doors 15 and 16 (shown, for example, in FIGS. 2 and 5). The post 50 includes a spring ledge 52 configured to retain the spring 28 (shown in FIG. 5). The post 50 ensures that the spring 28 does not eject from the retaining base 27.

[0049] An anti-rocking barb 54 extends upwardly from the planar body 48 to a side of the post 50. The anti-rocking barb 54 is configured to engage a structure of the door 15 (such as another protuberance) in order to prevent the door 15 (and the door 16) from rocking on the base 27 and provide increased stability for the door 15, as discussed below.

[0050] Nibs or other such ramped protuberances 56 extend into the nozzle opening 24 from the planar body 48. The ramped protuberances 56 assist in guiding the fuel nozzle 26 (shown in FIG. 4) into a proper fueling orientation. That is, the ramped protuberances 56 ensure that the fuel nozzle 26 is centered with respect to the nozzle opening 24. The ramped protuberances 56 also provide a space between the fuel nozzle opening 24 and the fuel nozzle opening in the filler tube 14 (shown in FIG. 5) to accommodate fuel blow out to prevent seals (not shown) from being damaged.

[0051] A nozzle guide bracing member 58 extends outwardly from the front surface of the planar body 48 below the nozzle opening 24. The nozzle guide bracing member 58 includes a curved ramped beam 60 integrally connected to the lower ramped protuberance 56. The curved ramped beam 60 acts as an additional guide for the fuel nozzle 36. The nozzle guide bracing member 58 also includes bracing beams 62 on either side of the curved ramped beam 60. The bracing beams 62 are configured to be positioned within a reciprocal channel of the cover 30 (shown in FIG. 5) and may be wedged into an interior surface of the cover 30 in order to provide a bracing support between the cover 30 and the retaining base 27. Additionally, the curved ramped beams 60, and the nozzle guide bracing member 58 act as support ribs that provide increased structural support to the base 27.

[0052] FIG. 7 illustrates a rear isometric view of the retaining base 27. As shown in FIG. 7, ramps 63 extend inwardly from the bosses 34. The ramps 63 snapably engage the retaining ledge 32 (shown in FIG. 5) of the filler tube 14 (shown in FIG. 5).

[0053] FIG. 8 illustrates a front isometric view of the door 15 according to an embodiment of the present invention. The door 16 (shown, for example, in FIG. 5) is essentially a mirror image of the door 15, with some minor exceptions.

[0054] The door 15 includes a covering portion 64 integrally formed with a base pivoting member 66. The covering portion 64 includes a semi-circular covering panel 68 configured to cover half of the fuel nozzle opening 24 of the retaining base 27 (shown, for example, in FIGS. 6 and 7). The other half of the fuel nozzle opening 24 is covered by the semi-circular covering panel of the door 16. A plurality of curved ribs 70 extend upwardly from the covering base 68. Each rib 70 is separated from an adjacent rib 70 by a gap 72. Distal ends of the ribs 70 are integrally connected to another through a strengthening beam 74, which provides structural support to the ribs 70.

[0055] The ribs 70 curve downwardly from the covering base 68 as the ribs 70 radially extend from the covering base 68. Additionally, the height of the ribs 70 increases the further away from the closing edge 76 of the covering base 68. That is, the height of the ribs 70 is greatest proximate the strengthening beam 74, and shortest proximate the interface edge 76 (the interface edge 76 interfaces with respect to similar edge of door 16) of the covering base 68. The downward curve and increasing height of the ribs 70 away from the covering base 68, prevents collection of dust, dirt, debris, and the like on the door 15. Any excess material on the ribs 70 is forced down by gravity and slides down the ribs 70 through the gaps 72 away from the fuel nozzle opening 24 (shown in FIGS. 6 and 7). The downward curve of the ribs 70 allows substances on the ribs 70 to drain off the doors 15 and 16. Moreover, the shape of the ribs 70, with high outer edges, and a lower inner base, assist in guiding the tip of a fuel nozzle toward the fuel nozzle opening 24.

[0056] The base pivoting member 66 includes a panel 78 extending upwardly from the top rib 70. The panel 78 angles inwardly past the line defined by the interface edge 76. A post opening 80 is formed through the planar beam 78 proximate an end that is distally located from the covering portion 64. The panel 78 also includes a distal tip 82 having a barb (shown in FIG. 9) configured to abut against the barb 54 to prevent the door 15 from rocking or jiggling with respect to the base 27.

[0057] Referring to FIGS. 5-6 and 8, the post opening 80 of the door 15 is positioned around the door pivoting post 50. A similar post opening of the door 16 is then positioned around the door pivoting post 50. As such, the base pivoting member 66 of the door 16 may overlay a portion of the base pivoting member 66 of the door 15. In this position, the covering portions 64 of the doors 15 and 16 are aligned with, and oppose one another despite the fact that the base pivoting members 66 of the doors 15 and 16 do not. Thus, the doors 15 and 16 are not exact mirror images of another.
This arrangement does, however, ensure that the doors 15 and 16 cooperate to close the fuel nozzle opening 24.

[0058] FIG. 9 illustrates an isometric rear view of the door 15. A barb 84 extends from an underside of the distal tip 82 proximate the post opening 80. Referring to FIGS. 6 and 9, the barb 84 is configured to abut against the anti-rocking barb 54 of the retaining base 27 when the doors 15 and 16 are closed over the fuel nozzle opening 24. The abutting nature of the barbs 54 and 84 stabilizes the door 15 and prevents the door 15 from rocking or shifting in directions parallel to the longitudinal axis of the post 50.

[0059] FIG. 10 illustrates a lateral view of the retaining base 27 supporting the two doors 15 and 16. Referring to FIGS. 5-6, and 9, and 10, only one barb 54 is shown extending outwardly from the planar body 48 of the retaining base 27. As noted previously, the base pivoting member 66 of the door 15 is positioned below that of the door 16. Thus, only the base pivoting member 66 of the door 15 abuts against the planar body 48, while a rear surface of the base pivoting member 66 of the door 16 abuts against the front surface of the base pivoting member 66 of the door 15. Thus, the abutment of the barbs 54 and 84 stabilizes both doors 15 and 16 from rocking or shifting in the directions of arrow E when the doors 15 and 16 are in the closed position.

[0060] FIG. 11 illustrates an isometric view of the spring 28 according to an embodiment of the present invention. The spring 28 is a unitary piece, such as a single piece of metal. The spring 28 is formed with straight ends 86 and 88 integrally connected to a coiled loop 90 defining an opening 94. A coil 92 within the loop 90 is also straightened. The straightened coil 92 within the loop 90 is configured to abut against and/or snapably engage the spring ledge 52 of the door pivoting post 50 (shown in FIG. 6) in order to prevent the spring 28 from dislodging from the post 50. The force constant of the coil loop 90 exerts a resistive force into the ends 86 and 88 when the ends are squeezed together or spread apart.

[0061] Referring to FIGS. 5 and 11, once the doors 15 and 16 are positioned on the retaining base 27, the spring 28 is urged over the door pivoting post 50 such that the loop 90 surrounds the post 50. The loop 90 of the spring 28 may snapably secure around the post 50. The end 86 of the spring 28 operatively engages or abuts the door 15, while the end 88 operatively engages or abuts the door 16. For example, as discussed below with respect to FIG. 15, the ends 86 and 88 may be lodged into portions of the upper ribs of the doors 15 and 16. The force constant of the coiled loop 90 causes the end 86 to exert an inwardly directed force into the door 15, and the end 88 to exert an inwardly directed force into the door 16. Thus, a single spring 28 ensures that the doors 15 and 16 remain closed when no external force is exerted into the doors 15 and 16. Moreover, the spring 28 causes the doors 15 and 16 to close over the fuel nozzle opening 24 when a fuel nozzle is removed therefrom.

[0062] FIG. 12 illustrates a rear isometric view of the cover 30 according to an embodiment of the present invention. The cover 30 includes a main cylindrical body 96 having a lateral wall 98 integrally formed with a front wall 99. An open-ended inner chamber 100 is defined between the lateral wall 98 and the front wall 99. The opening 20 is formed through the front wall 99, thereby allowing access into the inner chamber 100. The notches 36 rearwardly extend from the lateral wall 98 and include lips or ridges 102 configured to snapably or latchably secure to the ledge 32 of the filler tube 14 shown in FIG. 5.

[0063] A plurality of strengthening ribs 104 extend from an interior surface of the front wall 99 to the interior surfaces of the lateral wall 98. The ribs 104 provide additional strength and protect the cover 30 from being damaged by oblique impacts.

[0064] Two bracing walls 106 extend inwardly from the lateral wall 98. A channel 108 is defined between the horizontal surfaces 109 of the two bracing walls 106. Referring to FIGS. 6 and 12, the nozzle guide member 58 is positioned within the channel 108. The horizontal surfaces 109 of the bracing walls 106 abut against either side of the nozzle guide member 58, thereby securing the nozzle guide member 58 in place. Thus, the retaining base 27 is secured from pivoting or rotating with respect to the cover 30.

[0065] Additionally, referring to FIGS. 8 and 12, the bracing walls 106 have curved upper surfaces 110 that conform to the outer perimeter of the strengthening beams 74 of the doors 15 and 16 when the doors 15 and 16 are rotated over the curved upper surface 110. The upper surfaces 110 provide a barrier for the doors 15 and 16. Thus, the doors 15 and 16 are prevented from downwardly shifting past the upper surfaces 110 of the bracing walls 106.

[0066] Referring to FIGS. 5, 8, and 12, the cover 30 also includes a post shroud 112 over the opening 20. The shroud 112 is positioned over the post 50, thereby securing the base pivoting members 66 of the doors 15 and 16 and the spring 28 in place.

[0067] FIG. 13 illustrates a front isometric view of the cover 30. An outer surface of the shroud 112 may be a smooth, inwardly angled surface 114 that provides an additional guide for the fuel nozzle 26 (shown in FIG. 4). That is, when the tip of the fuel nozzle 26 is urged into the shroud 112, the inwardly angled surface 114 directs the fuel nozzle 26 toward the central axis of the cover 30 and the fuel nozzle opening 24 of the retaining base 27 (shown, for example, in FIG. 6).

[0068] As shown in FIG. 13, distal edges of the bosses 36 include outwardly extending shoulders 116. Additionally, as shown in FIG. 6, upper ends of the bosses 34 of the retaining base 27 also include outwardly extending shoulders 118. Referring to FIGS. 6, 10, and 13, when the cover 30 is mated with the retaining base 27, a snap ring channel 117 is defined between the plane that contains the shoulders 116 of the cover 30 and the plane that contains the shoulders 118 of the retaining base 27. The snap ring 46 (shown in FIG. 5) is positioned within the snap ring channel 117 and secured from shifting out of place by the shoulders 116 and 118.

[0069] FIG. 14 illustrates a front plan view of the retaining base 27 operatively supporting the two doors 15 and 16. As noted above, the base pivoting members 66 of the doors 15 and 16 are pivotally secured to the post 50. The base pivoting member 66 of the door 15 is positioned underneath the base pivoting member 66 of the door 16. The door 15 is configured to pivot open about the pivot point 18 of the post 50 in the direction of arc A, while the door 16 is configured to pivot open in the direction of arc B.

[0070] Referring to FIGS. 12 and 14, the doors 15 and 16 are configured to ride on the upper surfaces 110 of the bracing walls 106 such that the strengthening beams 74 of each door 15 and 16 directly abut the upper surfaces 110. As noted above, the bracing walls 106 ensure that the door 15...
does not downwardly shift in the direction of arrows C, and that the door 16 does not downwardly shift in the direction of arrows D.

[0071] FIG. 15 illustrates a front isometric view of the retaining base 27 operatively supporting the two doors 15 and 16. An aperture 120 is formed through either side of the nozzle guide column 50. The apertures 120 capture lower tips 122 of the doors 15 and 16 when the doors 15 and 16 are closed. Thus, when the doors 15 and 16 are closed, each lower tip 122 passes into an aperture 120. The apertures 120 allow the doors 15 and 16 to completely close together.

[0072] As also shown in FIG. 15, a notch, or ledge 124 is formed in an uppermost rib 70 of each door 15 and 16 (only the notch 124 in door 15 is shown in FIG. 15). Referring to FIGS. 10 and 11, the end 86 of the spring 28 is positioned within the notch 124 of the door 15, while the end 88 of the spring 28 is positioned within a similar notch formed in the door 16. The end 86 of the spring 28 exerts a resistive force into a recessed wall 126 of the uppermost rib 70 of the door 15, while the end 88 of the spring 28 exerts a resistive force into a similar recessed wall of the uppermost rib 70 of the door 16. Thus, the spring 28 is operable to keep the doors 15 and 16 in a closed position when no external force is exerted into the doors (such as by a fuel nozzle). The force exerted by the spring 28 into the doors 15 and 16 also moves the doors 15 and 16 back to their closed positions when the fuel nozzle is removed from the capless assembly 12.

[0073] As shown in FIGS. 3 and 4, the capless refueling system 10 provides a capless assembly 12 in which two opposed doors 15 and 16 pivot away from one another to open a fuel nozzle opening 24. Because two doors 15 and 16 are used, instead of one large door, the clearance area for the moving doors is reduced. Thus, the capless assembly 12 may be used with various vehicle fuel intake systems. Indeed, the capless assembly 12 may replace virtually any standard fuel cap of a vehicle.

[0074] Thus, embodiments of the present invention provide a capless refueling assembly that may be used with most, if not all, vehicles. Further, embodiments of the present invention provide a capless refueling system that is capable of functioning in smaller, tighter spaces where operating space is limited. The embodiments of the present invention provide a cover or puck that is bifurcated or split in half in order to reduce the opening clearance area.

[0075] While various spatial terms, such as front, rear, upper, bottom, lower, mid, lateral, horizontal, vertical, and the like may be used to describe embodiments of the present invention, it is understood that such terms are merely used with respect to the orientations shown in the drawings. The orientations may be inverted, rotated, or otherwise changed, such that a front portion is a rear portion, and vice versa, horizontal becomes vertical, and the like.

[0076] Variations and modifications of the foregoing are within the scope of the present invention. It is understood that the invention disclosed and defined herein extends to all alternative combinations of two or more of the individual features mentioned or evident from the text and/or drawings. All of these different combinations constitute various alternative aspects of the present invention. The embodiments described herein explain the best modes known for practicing the invention and will enable others skilled in the art to utilize the invention. The claims are to be construed to include alternative embodiments to the extent permitted by the 5 prior art.

[0077] Various features of the invention are set forth in the following claims.

1. A capless refueling assembly comprising:
   a retaining base having a fuel nozzle opening;
   a first door pivotally secured to said retaining base, said first door covering a first portion of said fuel nozzle opening in a closed position; and
   a second door pivotally secured to said retaining base, said second door covering a second portion of said fuel nozzle opening in said closed position, wherein said first and second doors oppose one another and are configured to close said fuel nozzle opening in said closed position, and wherein said first and second doors are configured to pivot away from one another to open said fuel nozzle opening when a fuel nozzle is urged into said first and second doors.

2. The capless refueling assembly of claim 1, wherein said first and second doors are configured to pivot through a plane that is parallel to a plane that contains said fuel nozzle opening.

3. The capless refueling assembly of claim 1, further comprising a spring having first and second straightened integrally connected to a coiled loop, wherein said first end and second ends exert inwardly directed forces into said first and second doors, respectively.

4. The capless refueling assembly of claim 3, said retaining base further comprises a door pivoting post having a ridge, said coiled loop comprising a straightened coil, wherein said first and second doors and said coiled loop are pivotally secured around said door pivoting post, and wherein said straightened coil abuts against said ridge to prevent said spring from dislodging from said door pivoting post.

5. The capless refueling assembly of claim 1, each of said first and second doors comprising a plurality of ribs separated by gaps, wherein each of said plurality of ribs curves toward a bottom of said retaining base.

6. The capless refueling assembly of claim 5, wherein a height of each of said plurality of ribs is greatest at an outer edge and shortest at an inner edge.

7. The capless refueling assembly of claim 5, wherein outer edges of each of said plurality of ribs are integrally connected to a beam.

8. The capless refueling assembly of claim 1, said retaining base further comprising a plurality of nozzle guiding protuberances positioned around said fuel nozzle opening.

9. The capless refueling assembly of claim 1, said retaining base further comprising a first barb extending toward at least one of said first and second doors, at least one of said first and second doors comprising a second barb extending toward said retaining base, wherein said first and second barbs about one another preventing said first and second doors from rocking with respect to said retaining base.

10. The capless refueling assembly of claim 1, further comprising a cover positioned over said retaining base.

11. The capless refueling assembly of claim 10, said cover comprising a shroud that assists in securing said first and second doors to said retaining base.

12. The capless refueling assembly of claim 11, said shroud comprising an angled outer surface configured to guide a fuel nozzle toward said fuel nozzle opening.

13. The capless refueling assembly of claim 10, said cover further comprising a plurality of bracing walls that prevent said retaining base from rotating with respect to said cover.
14. A capless refueling system for a vehicle, the system being configured to allow fluid dispensed from a fuel nozzle to pass into the vehicle, the system comprising:
   a filler tube connected to a fuel tank; and
   a capless assembly secured to said filler tube, said capless assembly comprising:
   a retaining base having a fuel nozzle opening that provides a fluid path to said filler tube;
   two opposed doors pivotally secured to said retaining base, said doors covering said fuel nozzle opening in a closed position, said doors being configured to pivot away from one another to open said fuel nozzle opening when the fuel nozzle is urged into said doors.

15. The system of claim 14, wherein doors are configured to pivot through a plane that is parallel to a plane that contains said fuel nozzle opening.

16. The system of claim 14, further comprising a spring exerting resistive forces into said doors.

17. The system of claim 14, each of said doors comprising a plurality of ribs separated by gaps, wherein each of said plurality of ribs curves toward a bottom of said retaining base, wherein a height of each of said plurality of ribs is greatest at an outer edge and shortest at an inner edge.

18. The system of claim 14, said retaining base further comprising a plurality of nozzle guiding protuberances positioned around said fuel nozzle opening.

19. The system of claim 14, further comprising a cover positioned over said retaining base, said cover comprising:
   (i) a shroud that assists in securing said doors to said retaining base, said shroud comprising an angled outer surface configured to guide the fuel nozzle toward said fuel nozzle opening and (ii) at least one bracing wall that prevents said retaining base from rotating with respect to said cover.

20. A capless refueling assembly configured to allow fluid dispensed from a fuel nozzle to pass into a vehicle, the capless refueling assembly comprising:
   a retaining base having a door pivoting post with a ridge and a fuel nozzle opening within a nozzle plane, a plurality of nozzle guiding protuberances being positioned around said fuel nozzle opening;
   a first door pivotally secured to said retaining base, said first door covering a first portion of said fuel nozzle opening in a closed position;
   a second door pivotally secured to said retaining base, said second door covering a second portion of said fuel nozzle opening in said closed position, wherein said first and second doors oppose one another and are configured to close said fuel nozzle opening in said closed position, wherein said first and second doors are configured to pivot from one another to open said fuel nozzle opening when the fuel nozzle is urged into said first and second doors, wherein said first and second doors are configured to pivot through a plane that is parallel to said nozzle plane, each of said first and second doors comprising a plurality of ribs separated by gaps, wherein each of said plurality of ribs curves toward a bottom of said retaining base and a height of each of said plurality of ribs is greatest at an outer edge and shortest at an inner edge;
   a spring having first and second straight ends integrally connected to a coiled loop having a plurality of loop in which at least one of said loops is straightened, wherein said first end and second ends exert inwardly directed forces into said first and second doors, respectively, wherein said first and second doors and said coiled loop are pivotally secured around said door pivoting post, and wherein said straightened coil abuts against said ridge to prevent said spring from dislodging from said door pivoting post; and
   a cover positioned over said retaining base, said cover comprising:
   (i) a shroud that assists in securing said first and second doors to said retaining base, said shroud comprising an angled outer surface configured to guide the fuel nozzle toward said fuel nozzle opening and (ii) at least one bracing wall that prevents said retaining base from rotating with respect to said cover.

21. The capless refueling assembly of claim 20, said retaining base further comprising a first bar extending toward at least one of said first and second doors, at least one of said first and second doors comprising a second bar extending toward said retaining base, wherein said first and second bars abut one another preventing said first and second doors from rocking with respect to said retaining base.

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