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(54) **VENTED FUEL TANK CAP**

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(57) **ABSTRACT**

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A vented fuel tank cap for closing the filler neck portion of a fuel tank for a small gasoline powered implement. The fuel tank cap assembly includes a cap member having threads for removably attaching the cap assembly to the fuel tank filler neck. The cap member also includes a post depending from an interior of the cap member. The cap assembly further including a gasket having an annular rim surrounding a dome portion and an opening. The opening of the gasket is disposed on the post and retained by a rib protruding externally from the post. The gasket dome portion is deformed by the rib so that the annular rim is held in contact with the interior surface of the cap member. A vent path is provided through the post to vent fuel vapors from below a lower surface of the gasket, through a filter element captured between the gasket dome and the interior surface of the cap member, through a groove defined between the gasket annular rim and the interior surface of the cap member, and out through a space defined between the threads retaining the cap member to the filler neck.

(21) Appl. No.: **10/703,798**

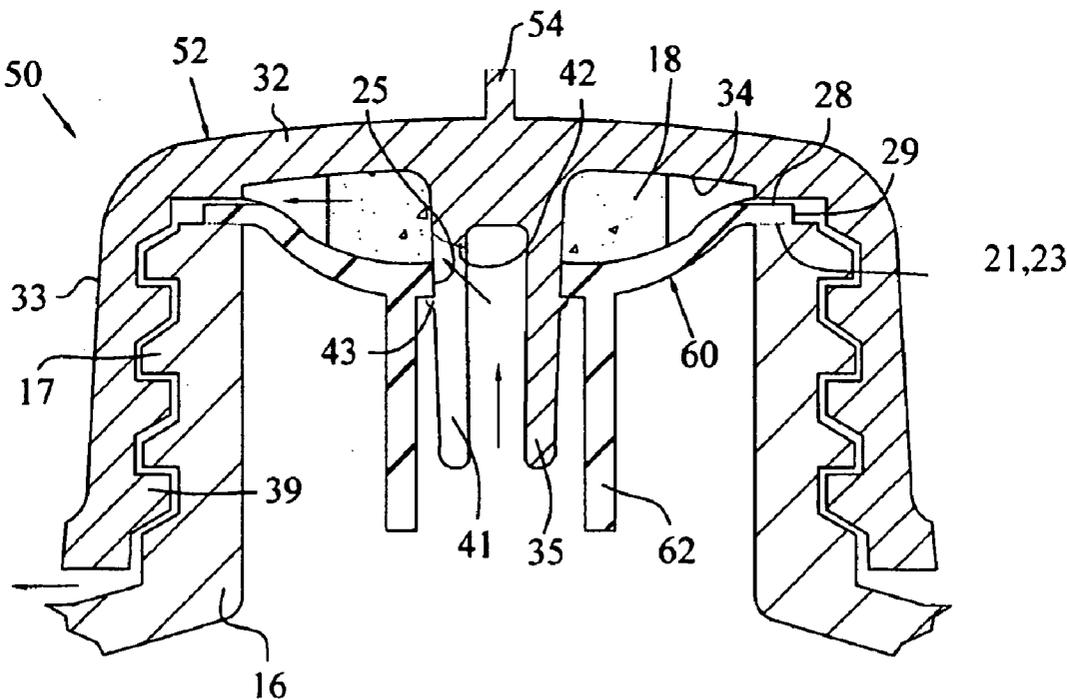
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(63) Continuation-in-part of application No. 10/178,678, filed on Jun. 24, 2002.

Publication Classification

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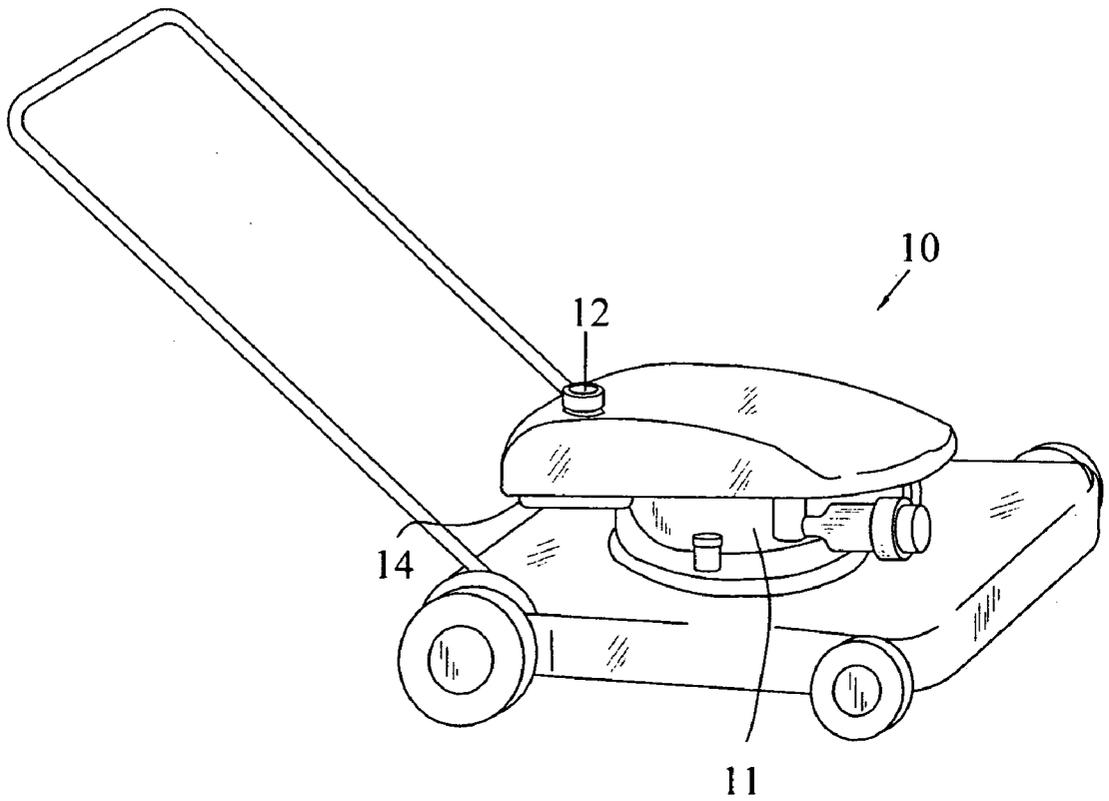


FIG. 1

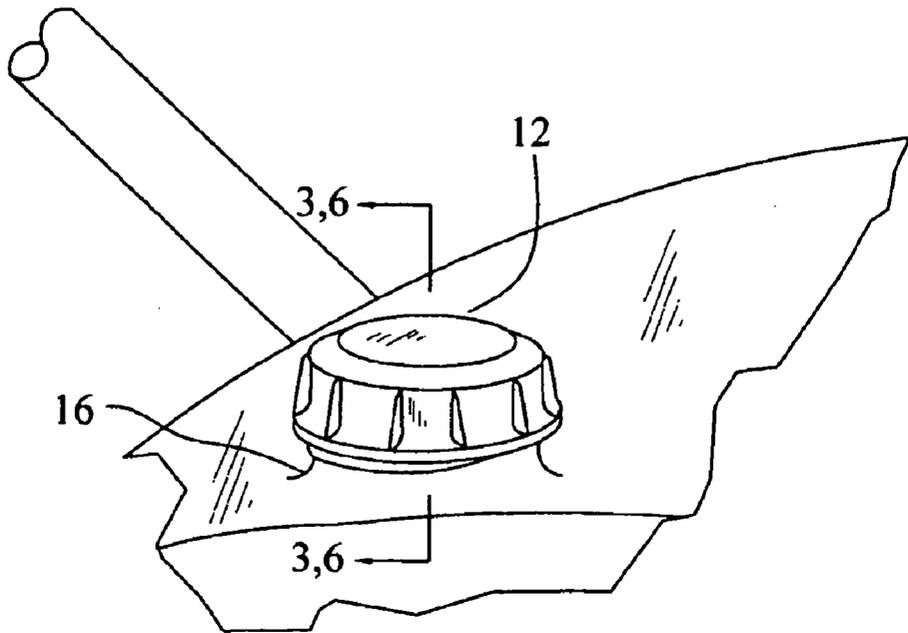


FIG. 2

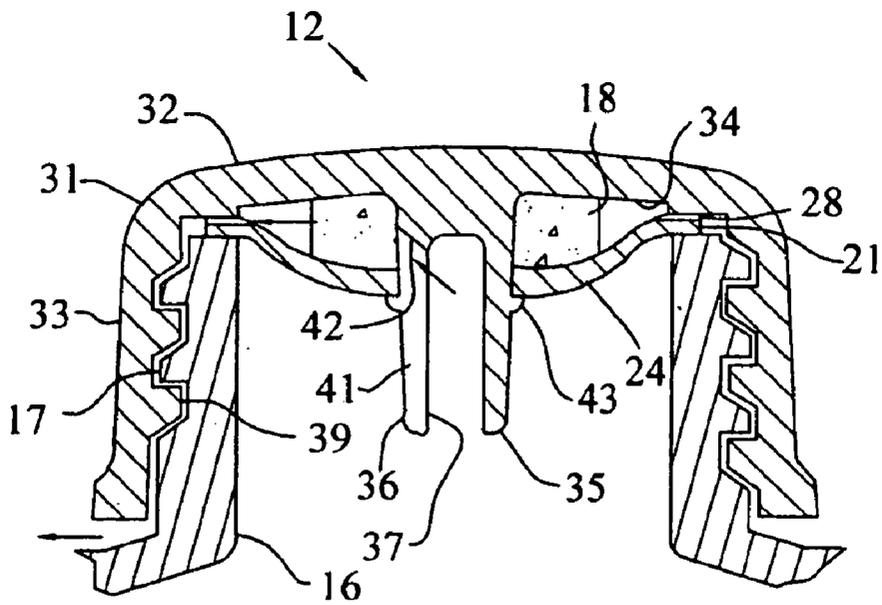


FIG. 3

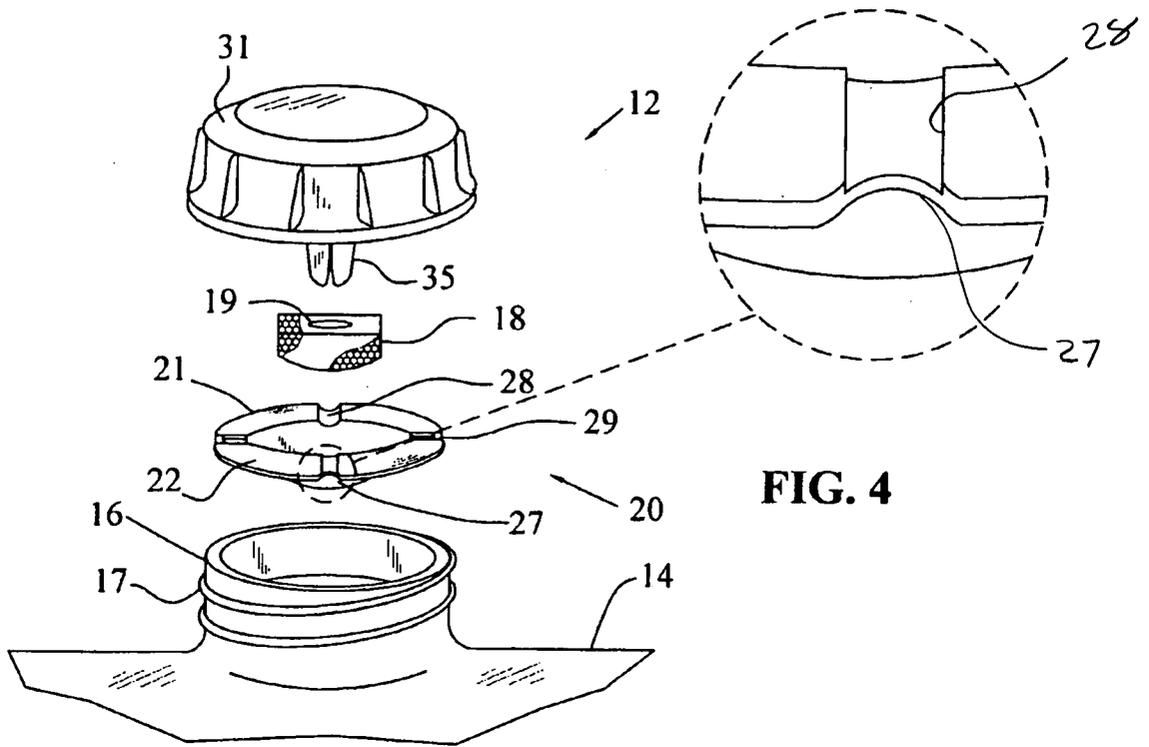


FIG. 4

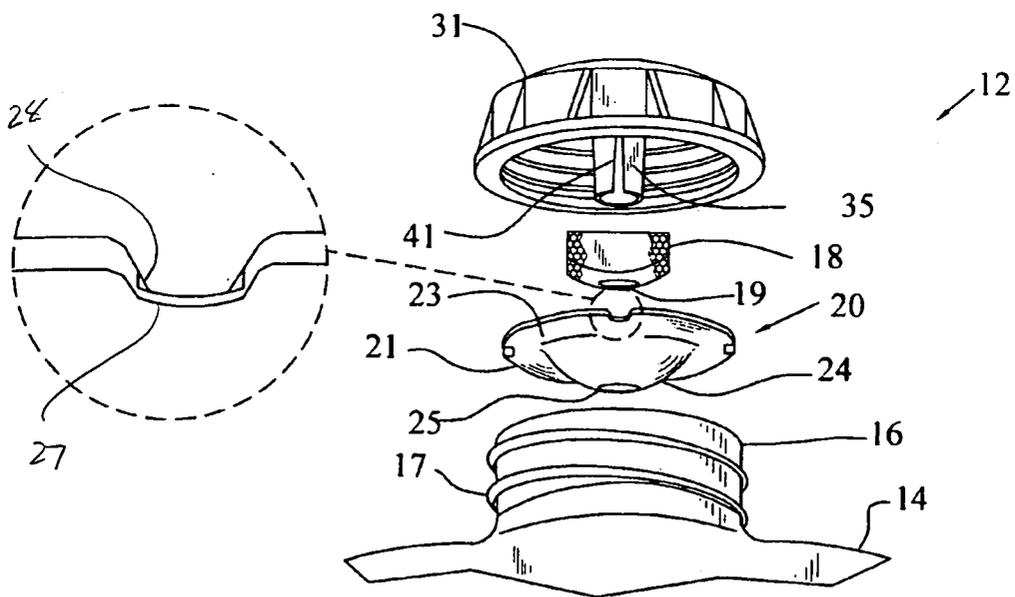


FIG. 5

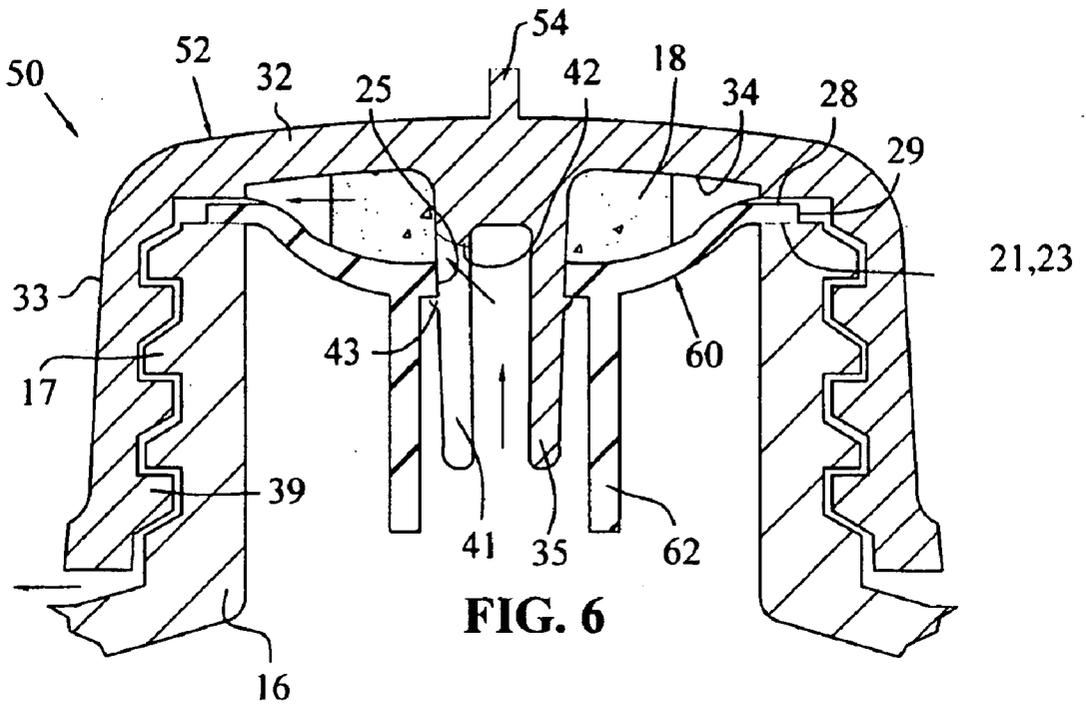


FIG. 6

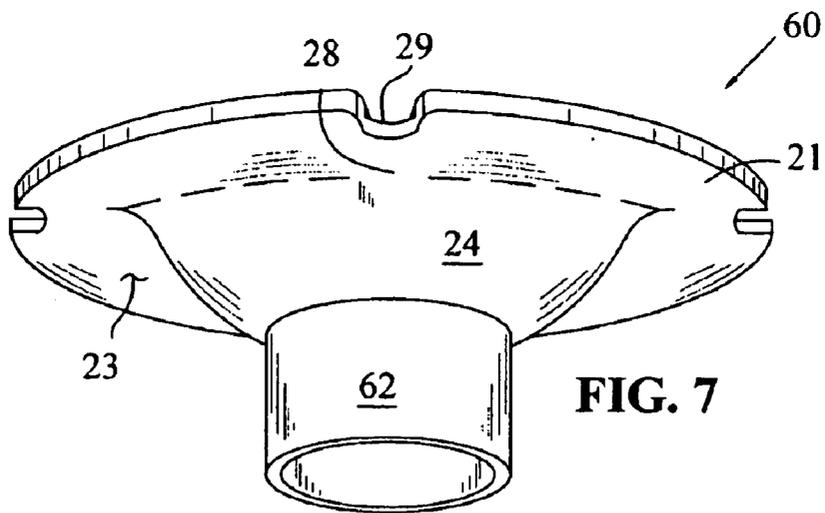


FIG. 7

VENTED FUEL TANK CAP

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Continuation-in-part of U.S. patent application Ser. No. 10/178,678, entitled VENTED FUEL TANK CAP, filed on Jun. 24, 2002.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to fuel tank caps for closing the filler neck of a fuel tank of a small internal combustion engine, particularly to a vented fuel tank cap.

[0004] 2. Description of the Related Art

[0005] Small implements having gasoline powered engines, such as lawnmowers, garden tillers, snow blowers, sport vehicles, electrical generators and the like, have fuel tanks attached. For closing the fuel tank, a fuel tank cap is applied to the open end of a filler neck connected to and extending from the fuel tank. The fuel tank cap is commonly constructed to prevent escape of liquid fuel from the fuel tank while, at the same time, permitting venting of gases between the tank and the atmosphere.

[0006] One known fuel tank cap includes a generally dome-shaped flexible gasket extending below the interior of the fuel tank cap. The lower dome portion of the fuel tank cap includes holes therethrough for venting of vapors. Additionally, sufficient clearance is provided between internal threads on the fuel tank cap and external threads on the filler neck to define a path for venting of vapors. A narrow central post depends from the interior of the fuel tank cap and through the gasket. Below the gasket and vent holes, the central post also supports a baffle for deflecting liquid fuel away from the gasket vent holes. However, an extra manufacturing step is required to heat deform the end of the central post so that it will retain the baffle and gasket, adding expense and complexity to manufacturing.

[0007] Another known fuel tank cap includes a dome-shaped flexible gasket having a central vent hole and an integral downward depending tubular-shaped baffle around the vent hole which deflects liquid fuel away from the vent hole. The gasket has an annular rim that is retained by a matching annular notch in the fuel tank cap. However, separation of the gasket and baffle from the fuel tank cap could potentially occur when the fuel tank cap is removed from the filler neck. Additionally, a separated or misaligned gasket may not adequately seal the fuel tank cap and the filler neck.

[0008] Therefore, what is needed is a fuel tank cap assembly that better retains the flexible gasket component thereof while minimizing the number of components and assembly steps.

BRIEF SUMMARY OF THE INVENTION

[0009] The present invention provides an improved vented fuel tank cap assembly. The vented fuel tank cap assembly includes a cap member having a disk-shaped cover portion and a cylindrical skirt portion extending therefrom. The cylindrical skirt portion includes internal threads for engagement to matching external threads located on the fuel tank

neck portion. The internal and external threads cooperate to define a vent path therebetween. The cap member includes a hollow central post depending downward from the interior of the cover portion. Advantageously, the hollow central post is integral with the cap member.

[0010] A filter element having a central hole for receiving the central post is located adjacent the interior of the cover portion. The filter element is held in position by a gasket having an annular rim surrounding a dome portion, the dome portion having a central hole disposed on the central post and compressing the filter against the interior cover portion. The annular rib around an outside diameter of the central post retains the gasket to the cap member slightly deforming the dome portion and sealing the annular rim against the interior surface of the cap member. Radial grooves are provided on the upper surface of the annular rim, i.e., the surface in contact with the interior surface of the cover portion.

[0011] The components of the vented fuel tank cap assembly are easily assembled. First, the filter element is slid onto the central post of the cap member, so that one side of the filter element is against the interior of the cover portion and the central post extends through the hole in the filter element. Second, the gasket is slid onto the central post, the dome portion extending away from the cap member. The dome portion is pressed toward the cap member cover portion, compressing and capturing the filter element, until the dome portion hole passes over the annular rib or other protuberance protruding from the central post. In this position, the annular rib retains the gasket and the filter element to the cover member and the annular rim is held in contact with the interior surface of the cover portion.

[0012] The assembled fuel tank cap provides a vent path for exchanging gases between the fuel tank and the surrounding atmosphere. The vent path is provided from the downward-depending end of the tubular central post, through the central post wall, through the porous filter element, through the grooves provided in the upper surface of the annular rim, and outwardly through the non-sealing threads of the cylindrical skirt member and neck filler portion to the surrounding atmosphere.

[0013] Advantageously, the vented fuel tank cap assembly firmly retains the gasket and filter element to the cap member. Also, the annular rim is held in position by the central post rib so that a seal is formed between the gasket and the filler neck end portion when the fuel tank cap is attached to the fuel tank. Additionally, the filter element and gasket are easily assembled with the cap member using a single step of positioning the filter element and gasket over the central post and rib. Thus, no additional manufacturing steps are required to complete the assembly or retain the components in position.

[0014] In one form thereof, the present invention provides a fuel tank cap assembly, including a cap member including a downwardly depending skirt portion and a hollow post depending from an interior surface of the cap member, the post having an external surface; and a gasket having a rim portion and an opening, the opening engaging the external surface of the post to retain the gasket to the cap member.

[0015] In another form thereof, the present invention provides a fuel tank cap assembly, including a cap member

including a downwardly depending skirt portion and a hollow post depending from an interior surface of the cap member, the post having an external surface; and a gasket having an opening engaging the external surface of the post to retain the gasket to the cap member, the gasket further including a wall portion depending therefrom which substantially surrounds the post.

[0016] In yet another form thereof, the present invention provides, in combination, a fuel tank having a filler neck; and a fuel tank cap removably attached to the filler neck, the fuel tank cap including a cap member including a downwardly depending skirt portion and a hollow post depending from an interior surface of the cap member, the post having an external surface; and a gasket including an opening engaging the external surface of the post to retain the gasket to the cap member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The above-mentioned and other features and advantages of the invention, and the manner of obtaining them, will become more apparent and the invention itself will be better understood by reference to the following description of embodiments of the invention taken in conjunction with the accompanying drawings, wherein:

[0018] FIG. 1 is a side perspective view of a lawnmower having a small internal combustion engine, a fuel tank, and a fuel tank cap assembly in accordance with the present invention;

[0019] FIG. 2 is a side perspective view of a portion of the engine of the lawnmower of FIG. 1, showing the fuel tank cap assembly;

[0020] FIG. 3 is a sectional view taken along line 3-3 of FIG. 2;

[0021] FIG. 4 is an exploded perspective view from above of the fuel tank cap assembly of FIG. 1;

[0022] FIG. 5 is an exploded perspective view from below of the fuel tank cap assembly of FIG. 1;

[0023] FIG. 6 is a sectional view taken along line 6-6 of FIG. 2, showing a fuel tank cap according to an alternate embodiment; and

[0024] FIG. 7 is a perspective view from below of the gasket of the fuel tank cap of FIG. 6.

[0025] Corresponding reference characters indicate corresponding parts throughout the several views. The exemplifications set out herein illustrate exemplary embodiments of the invention, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION

[0026] Referring to FIGS. 1 and 2, lawnmower 10 includes a small internal combustion engine 11 having fuel tank 14. Fuel tank 14 has an open filler neck end portion 16 (FIG. 2) providing an opening therein for filling fuel tank 14 with fuel. Vented fuel tank cap assembly 12 is attached to filler neck end portion 16 to prevent liquid fuel from escaping fuel tank 14. Lawnmower 10 is shown herein as an exemplary implement, and it should be understood that vented fuel tank cap assembly 12 may also be attached to

fuel tanks of other types of small implements having gasoline powered engines, such as garden tillers, snow blowers, sport vehicles, and electric generators, for example. Also, vented fuel tank cap assembly 12 may be attached to other types of tanks or reservoirs requiring venting of vapors other than fuel tanks.

[0027] Referring now to FIGS. 3-5, vented fuel tank cap assembly 12 generally includes cap member 31, filter element 18, and gasket 20. Gasket 20 is attached to cap member 31 and captures filter element 18 between cap member 31 and gasket 20.

[0028] Referring to FIG. 3, cap member 31 includes disk-shaped cover portion 32 and downwardly depending cylindrical skirt portion 33. The interior of skirt portion 33 defines threads 39 that engage filler neck threads 17 defined on the outside of filler neck end portion 16. Cap member threads 39 and filler neck threads 17 are dimensioned for screw-threading engagement with one another to retain cap member 31 to filler neck 16 while also defining a vent passage therebetween for the escape of fuel vapors from fuel tank 14.

[0029] Depending downwardly from interior surface 34 of cover portion 32 is central post 35. Central post 35 is shown as a generally hollow tubular structure, having a cylindrically-shaped exterior surface 36 and a cylindrically-shaped interior surface 37. Central post 35 is integrally formed with cap member 31, which may be molded of plastic or other similar material. Post 35 need not be cylindrical, but may be formed in other shapes, such as square or triangular in cross-section, for example. Additionally, post 35 may depend either from the center of cover portion 32 or from another part of cover portion 32 spaced from the center thereof.

[0030] Referring to FIGS. 4 and 5, gasket 20 includes an annular generally flattened sealing rim 21 surrounding a downwardly depending dome-shaped cavity 24. The central bottom portion of dome 24 defines hole 25 therethrough. Gasket 20 has an upper surface 22 and an opposite lower surface 23. The upper surface 22 of annular rim 21 defines four grooves 28 circumferentially spaced around annular rim 21; however, the number of grooves 28 in annular rim 21 may vary. Notches 29 are defined on the outside edge of annular rim 21 adjacent each groove 28. Gasket 24 is advantageously made of rubber or other flexible materials which are impervious to and non-reactive with liquid fuel.

[0031] Filter element 18 is generally rectangular shaped and defines a hole centrally therethrough. Filter element 18 allows passage of fuel vapor and atmospheric gases therethrough but is generally impervious to the passage of liquid fuel. Filter element 18 may be constructed of reticulated flexible polyurethane with open pores of approximately 50 per inch, for example, or other similar porous materials which trap liquid fuel yet allows fuel vapors and air to pass therethrough. Filter element 18 is positioned between cover portion 32 and gasket 20 in dome-shaped cavity 24.

[0032] Fuel tank cap 10 operates to allow fuel vapor to vent from fuel tank 14 and/or to allow atmospheric gases to enter fuel tank 14. As shown in FIGS. 3 and 5, vent path slot 41 is defined vertically along a portion of the length of central post 35. Specifically, slot 41 extends through the tubular wall of central post 35 from the downwardly depend-

ing end, toward cover portion 32, ending at slot end 42. Advantageously, slot end 42 is located above the level of dome 24 and adjacent to filter element 18. Additionally, grooves 28 between upper surface 22 of rim 21 and interior surface 34 of cap portion 31 and notches 29 define a vent path therethrough. Thus, fuel vapor escapes fuel tank 14 by passing from the interior of central post 35, through vent path 41 at slot end 42, through porous filter element 18, and into the space defined between gasket dome 24 and cover portion 32. The vent path for escaping fuel vapors continues through grooves 28 and notches 29 between annular rim 21 and cover portion interior surface 34, and between the non-sealing fuel cap threads 39 and filler neck threads 17. Air may vent into fuel tank 14 from the atmosphere via the opposite of the foregoing path, such as, for example, to displace liquid fuel in fuel tank 14 as same is consumed by the engine of lawnmower 10.

[0033] Referring to FIG. 3, the vented fuel cap assembly 12 is assembled as follows. Hole 19 of filter element 18 slides onto central post 35 until a surface of the filter is compressed against interior surface 34 of cover portion 32. Gasket 20 then slides onto central post 35 until hole 25 passes over and engages behind annular rib 43 defined around an external portion of central post 35, thereby retaining gasket 20 to cap member 31. Alternatively, central post 35 could be formed with an external groove in which the portion of gasket 20 about hole 25 is retained. In this engaged position, gasket 20 is firmly retained to cap member 31, and dome 24 is slightly deformed toward cap member 31 and annular rim 21 is sealingly compressed against interior surface 34 of cover portion 32. Rib 43 may be a single annular protuberance defined around part of or the entire diameter of central post 35, or may alternatively be a segmented series of protuberances, a single protuberance, or other arrangement of protuberances.

[0034] In this arrangement, vented cap assembly 12 may be threadably engaged to filter neck end portion 16 and operates to prevent liquid fuel from escaping fuel tank 14 while providing venting of fuel vapors to the atmosphere. As cap member 31 is screwed onto filler neck end portion 16, annular rim 21 of gasket 20 is captured between a top end of filler neck end portion 16 and interior surface 34 of cover portion 32, thus forming a seal between lower surface 23 of rim 21 and filler neck portion 16.

[0035] In this installed position, vented cap assembly 12 forms two deflection surfaces that resist passage of liquid fuel from fuel tank 14. The first is formed by exterior surface 36 of central post 35 and by gasket 24 which is sealably pressed against the upper end of filler neck end portion 16. The second deflection surface is defined by the interior surface 37 of central post 36. The deflection surfaces reduce splashing of liquid fuel toward the vent path, thus ensuring that only fuel vapors are vented though cap assembly 12 from fuel tank 14.

[0036] The escape of liquid fuel from fuel tank 14 is further prevented by the difficulty of liquid fuel reaching vent path 41 along slot end 42 and the resistance of filter element 18 to the flow of liquid fuel. Liquid fuel that reaches filter element 18 will be drained by gravity back through vent path 41 and back into fuel tank 14.

[0037] Referring to FIGS. 6 and 7, an alternate embodiment of the vented fuel cap assembly is shown. Except as

described below, vented fuel cap assembly 50 according to the embodiment of FIGS. 6 and 7 includes many features which are identical to those of vented fuel cap assembly 12 as described above, and the same reference numerals have been used to designate identical features therebetween. Also, except as described below, the assembly and venting operation of fuel cap assembly 50 are the same as that of fuel cap assembly 12 described above.

[0038] Referring to FIG. 6, cap member 52 of fuel cap assembly 50 includes an integral raised rib 54 extending across its upper surface, which may be grasped by a user for rotating fuel cap assembly 50 to screw-threadingly engage and disengage same from filler neck 16 of fuel tank 14.

[0039] Additionally, fuel cap assembly 50 includes gasket 60 having many features identical to those of gasket 20 described above. Referring to FIGS. 5 and 6, gasket 60 includes an integrally formed, downwardly depending wall portion 62 which surrounds central post 35 of cap member 52. Alternatively, wall portion 62 may comprise a separate component secured to gasket 60 in a suitable manner. Wall portion 62 is shown herein as having a tubular profile, although the particular shape of wall portion 62 may vary. For example, wall portion 62 may have a triangular, square, or other polygonal shape in cross section.

[0040] Wall portion 62 of gasket 60 serves as a barrier which deflects liquid fuel within fuel tank 14 away from central post 35, which liquid fuel might otherwise splash upwardly and enter central post 35 during use of lawnmower 10, for example. In this manner, wall portion 62 aids in preventing liquid fuel from entering the space between gasket 60 and cap member 52.

[0041] While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character. It should be understood that only the preferred embodiments have been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

What is claimed is:

1. A fuel tank cap assembly, comprising:

a cap member including a downwardly depending skirt portion and a hollow post depending from an interior surface of said cap member, said post having an external surface; and

a gasket having a rim portion and an opening, said opening engaging said external surface of said post to retain said gasket to said cap member.

2. The fuel tank cap assembly of claim 1, wherein said external surface of said post includes at least one rib, said opening of said gasket engaging said at least one rib to retain said gasket to said cap member.

3. The fuel tank cap assembly of claim 2, wherein said gasket is dimensioned such that said engagement of the opening thereof with said rib of said post presses said rim portion of said gasket into engagement with said interior surface of said cap member.

4. The fuel tank cap assembly of claim 1, wherein an interior portion of said hollow post is in fluid communication with a space defined between said gasket and said cap member to define a vent path therebetween.

5. The fuel tank cap assembly of claim 4, wherein said hollow post includes an opening therein fluidly communicating said interior of said hollow post with said space between said gasket and said cap member.

6. The fuel tank cap assembly of claim 4, wherein said rim portion of said gasket includes at least one recess defining a vent path between said rim portion and said interior surface of said cap member.

7. The fuel tank cap assembly of claim 1, further comprising a porous filter element disposed between said gasket and said interior surface of said cap member, said filter element allowing passage of air and fuel vapor therethrough but substantially preventing passage of liquid fuel therethrough.

8. The fuel tank cap assembly of claim 7, wherein said gasket is dimensioned such that engagement thereof with said post compresses said filter element between said gasket and said interior surface of said cap member.

9. The fuel tank cap assembly of claim 1, wherein said gasket further includes a depending wall portion substantially surrounding said hollow post of said cap member.

10. The fuel tank cap assembly of claim 1, wherein said skirt portion of said cap member is circular, and includes internal threads.

11. A fuel tank cap assembly, comprising:

a cap member including a downwardly depending skirt portion and a hollow post depending from an interior surface of said cap member, said post having an external surface; and

a gasket having an opening engaging said external surface of said post to retain said gasket to said cap member, said gasket further including a wall portion depending therefrom which substantially surrounds said post.

12. The fuel tank cap assembly of claim 11, wherein said external surface of said post includes at least one rib, said opening of said gasket engaging said at least one rib to retain said gasket to said cap member.

13. The fuel tank cap assembly of claim 11, wherein said gasket includes a rim portion, said gasket dimensioned such that said engagement of the opening thereof with said post presses said rim portion of said gasket into engagement with said interior surface of said cap member.

14. The fuel tank cap assembly of claim 11, further comprising a porous filter element disposed between said gasket and said interior surface of said cap member, said filter element allowing passage of air and fuel vapor therethrough but substantially preventing passage of liquid fuel therethrough.

15. The fuel tank cap assembly of claim 14, wherein said gasket is dimensioned such that engagement thereof with said post compresses said filter element between said gasket and said interior surface of said cap member.

16. The fuel tank cap assembly of claim 11, wherein said hollow post includes an opening therein, said opening fluidly communicating an interior portion of said hollow post with a space defined between said gasket and said cap member to define a vent path therebetween.

17. The fuel tank cap assembly of claim 11, wherein said skirt portion of said cap member is circular, and includes internal threads.

18. In combination:

a fuel tank having a filler neck; and

a fuel tank cap removably attached to said filler neck, said fuel tank cap comprising:

a cap member including a downwardly depending skirt portion and a hollow post depending from an interior surface of said cap member, said post having an external surface; and

a gasket including an opening engaging said external surface of said post to retain said gasket to said cap member.

19. The combination of claim 18, wherein said filler neck includes external threads and said skirt portion of said fuel tank cap includes internal threads, said threads engaging one another to secure said fuel tank cap to said filler neck.

20. The combination of claim 18, wherein said gasket further includes a rim portion disposed under compression between said filler neck and said interior surface of said cap member.

21. The combination of claim 18, wherein said external surface of said post includes at least one rib, said opening of said gasket engaging said at least one rib to retain said gasket to said cap member.

22. The combination of claim 18, wherein said hollow post includes an opening therein, said opening fluidly communicating an interior portion of said hollow post with a space defined between said gasket and said cap member to define a vent path therebetween.

23. A fuel tank cap assembly, comprising:

a cap member including a downwardly depending skirt portion and a hollow post depending from an interior surface of said cap member; and

a gasket attached to said cap member, said gasket having a wall portion depending therefrom which substantially surrounds said post.

24. The fuel tank cap assembly of claim 23, wherein said hollow post includes an opening therein, said opening fluidly communicating an interior portion of said hollow post with a space defined between said gasket and said cap member to define a vent path therebetween.

25. The fuel tank cap assembly of claim 24, further comprising a porous filter element disposed between said gasket and said interior surface of said cap member, said filter element allowing passage of air and fuel vapor therethrough but substantially preventing passage of liquid fuel therethrough.

26. The fuel tank cap assembly of claim 23, wherein said post includes an external surface with at least one rib, said gasket includes opening engaging said at least one rib to retain said gasket to said cap member.

27. The fuel tank cap assembly of claim 26, wherein said gasket includes a rim portion, said gasket dimensioned such that said engagement of the opening thereof with said post presses said rim portion of said gasket into engagement with said interior surface of said cap member.

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