

DRUM CAP VENTING DEVICE

Related Application

The present application claims the benefit of U.S. Provisional Application No. 60/669,946 filed April 8, 2005, which is incorporated herein in its entirety by reference.

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Field of the Invention

This invention relates generally to fluid dispensing systems. More particularly, the invention relates to a bung cap device having a venting mechanism for evacuating pressurized fluid from a dispensing container.

Background of the Invention

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In industries such as semiconductor processing, pharmaceutical and chemical manufacturing, high purity, highly corrosive or highly caustic liquids are utilized. Due to safety and quality considerations, these liquids must be contained in containers and dispensing systems of high reliability and integrity. The connections, tubing, and fittings for handling these fluids must be formed from highly inert materials. Fluoropolymers have been found to be suitable for use in these environments. The tubing can be formed of PFA, the fittings, valve components and dispense heads may be formed of components such as PFA and PTFE, and other fluoropolymers. Containers for handling these liquids are typically plastic drums formed of high purity polyethylene such as those disclosed in U.S. Patent No. 6,045,000, which is hereby incorporated by reference. The drums will conventionally have a bung opening with a drum insert that includes a down tubing portion connecting to an upward and concentric nipple of the bung. A dispense head couples with the drum insert and has a main fluid passageway that connects to and sealingly engages the nipple for dispensing fluid from the drum.

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When transporting or storing the drums, conventional caps or plugs are placed over or in the bung opening of the drum. Various factors can cause pressure to build up within the drum during transportation and storage. These factors can include the type of fluids/materials stored within the drum, the time of storage, altitude and temperature changes, transporting activities, and the like. For instance, ammonia hydroxide and peroxide are commonly stored and transported fluids that often cause pressure to build up

in drums. When the cap is eventually removed from a pressurized drum to connect the dispense head to the drum prior to use, gasses or even the stored liquid itself can be discharged out of the bung opening, posing a very serious safety threat to those in proximity of the drum.

5 Venting systems have been developed in an attempt to address these pressure-related concerns. Namely, various vent connection ports and valves have been added to the drum fittings or drum closures to vent the internal drum pressure. Examples of such systems are disclosed in previously incorporated U.S. Patent No. 6,045,000. However, such conventional venting techniques do not incorporate the designs and mechanisms
10 required to ensure evacuation or venting of the pressurized gas to a safe area. Accordingly, a storage and transporting drum cap is needed that will address the dangers and concerns inherent with pressure buildup within conventional fluid storage and dispensing drums.

Summary of the Invention

15 A fluid dispensing system generally includes a drum with a bung, a drum insert that includes a downtube that inserts into the bung, and a dispense head that couples with the drum insert to provide dispensing access to the fluids in the drum. To facilitate shipment and/or storage of the drum and its contents, the dispense head can be removed. In these circumstances, a cap is threadably engaged with the bung opening or the drum
20 insert to close off the bung opening.

 The drum cap venting device in accordance with the present invention generally includes a venting cap assembly. The venting cap assembly can include a venting cap and a venting key. The venting cap generally includes a main body portion, a valve portion and a ring portion. The venting key generally includes a key body portion and a venting
25 tube. The venting key is rotatably engageable with the valve portion of the venting cap such that rotation of the key provides a passageway of continuous fluid communication from the drum, through conduits in the venting cap, and out the venting tube of the venting key. As a result, any release or evacuation of pressurized gasses from the drum can be directed away from the user to a safe area or device.

A feature and advantage of embodiments of the invention is that the drum cap venting device ensures safe evacuation of pressurized fluid to a safe location. Undesirable spraying of gasses and liquid from an opening in the drum is avoided upon opening.

5 A feature and advantage of embodiments of the invention is that a combination of the venting cap and venting key components ensure proper evacuation of fluids from the drum. As such, unsafe evacuation of fluid from the drum is avoided.

A feature and advantage of embodiments of the invention is that the venting cap device can be constructed of various thermopolymers, such as PE, PFA, PTFE and the like.

10 A feature and advantage of embodiments of the invention is that the venting key can be separately retained by the end user such that when the drum and venting cap arrive, selective venting can take place. As a result, venting can take place at facilities having appropriate safe venting environments or devices.

15 A feature and advantage of embodiments of the invention is that the venting valve assembly can be self-contained within the shipping and storage cap.

A feature and advantage of embodiments of the invention is that the user can use the venting cap on various drums rather than relying upon unique integrated venting mechanisms for each drum. As such, only those drums containing chemicals or material requiring venting need use the venting cap device.

20 Brief Description of the Drawings

Fig. 1 is a perspective view of a fluid dispensing drum and venting device, with a venting tube routed to a scrubber in accordance with an embodiment of the present invention.

25 Fig. 2 is a cut away perspective view of a fluid dispensing drum, drum insert and dispense head for use in accordance with an embodiment of the present invention.

Fig. 3 is a cross-sectional view of a drum insert engaged with a drum bung opening for use in accordance with an embodiment of the present invention.

Fig. 4 is an exploded perspective view of a drum cap venting device in accordance with an embodiment of the present invention.

Fig. 5 is an exploded perspective view of a drum cap venting device in accordance with an embodiment of the present invention.

5 Fig. 6 is an exploded cross-sectional view of a drum cap venting device in a closed position in accordance with an embodiment of the present invention.

Fig. 7 is a cross-sectional view of a drum cap venting device in an open position in accordance with an embodiment of the present invention.

Detailed Description of the Drawings

10 Referring generally to Figs. 1-8, a fluid container venting system 10 is depicted. The venting system 10 generally includes a drum 12 and a venting cap assembly 14. As shown in Figs. 1-3, the drum 12 can include a container housing 16, at least one bung or access opening 18 and a drum insert 20. The drum insert 20 includes a downtube portion 22 and at least one upper threaded portion 24. The drum 12 can be constructed of multiple
15 layers, such as from polymers formed in a blow molding process, and can include various internal bags/membranes or lining portions. While in one embodiment the drum 12 is constructed of polyethylene, a myriad of other materials are also envisioned. The at least one bung opening 18 is defined generally in a top portion of the drum 12 and the drum insert 20 is adapted to couple with the bung 18, as depicted in Figs. 1-3. Further, various
20 dispense heads 21 and other fittings can be coupled to the drum insert 20 and/or the bung 18 to facilitate the dispensing of fluids from, and the recirculation of fluids into the drum 12. Examples of drums, inserts, dispense heads and other fittings and components that can be employed with the present invention are disclosed in U.S. Patent Publication No. 20030010387A1, and U.S. Patent Nos. 4,699,298, 5,108,015, 5,526,956, and 5,957,328,
25 each of which is incorporated herein by reference.

Referring primarily to Figs. 4-7, the venting cap assembly 14 is shown. The venting cap assembly 14 can include a venting cap 26 and a venting key 28. The venting cap 26 generally includes a main body portion 30, a valve portion 32 and a ring portion 34. In one embodiment, the venting cap 26 components are distinct and assemblable to

construct the venting cap 26, as particularly shown in Fig. 4. However, in other embodiments one or more of the components may be integrally formed or otherwise coupled. The venting cap 26 can be constructed of various materials, such as PFA, PTFE, PE or a myriad of other polymers and known materials.

5 The main body portion 30 of the venting cap 26 includes an insertion portion 35, at least one engagement tab 36, a main body conduit 37 and a valve recess portion 38. The insertion portion 35 is adapted to couple the cap 26 to the drum insert 20, or other structure of the drum 12, to seal off the at least one bung opening 18. For instance, the insertion portion 35 of the cap 26 can be threaded, adapted for pressure insertion, and the like. Other coupling techniques are also envisioned. The valve recess portion 38 can include a lip or groove portion 39a and a slot or groove portion 39b. As shown in Figs. 6-7, the main body conduit 37 can be angled and configured to terminate out through the main body portion 30 for fluid communication with the drum insert 20 or the interior of the drum 12.

15 The valve portion 32 includes a main vent member 40, a valve body ring 46, at least one engagement ear 48 and rotating slot portions 49. The main vent member 40 further includes a main valve conduit 42 generally along the longitudinal axis of the member 40, and a transverse valve conduit 44. The conduits 42, 44 are in fluid communication with each other through the vent member 40. In one embodiment, the transverse valve conduit 44 passes completely through side walls of the vent member 40, and is measurably smaller than, and generally perpendicular to the main valve conduit 42. The valve body ring 46 can be disposed around the vent member 40 with the engagement ears 48 extending out from the valve body ring 46. The rotating slot portions 49 can be slotted portions defined within the valve body ring 46 to engage a respective portion of the key 28 as described herein.

25 The ring portion 34 can include a ring aperture 50 defined therethrough, a gripping portion 52, and a threaded portion 53. The ring aperture 50 is generally sized to receive at least a portion of the key 28 and/or the main body portion 30. The gripping portion 52 can be defined along the periphery of the ring portion 34 to facilitate manual manipulation of the cap 26. In one embodiment, the gripping portion 52 is a series of spaced flats and indents. Other configurations and designs are also envisioned. The threaded portion 53 is generally provided within an interior section of the cap 26 and adapted for threadable

coupling with corresponding threading on the opening 18 or threading 24 of the drum insert 20 (Fig. 3). Other threading or coupling configurations can be employed as well.

In one embodiment, the cap portions 30, 32, 34 are snappingly or fittingly engageable, or otherwise coupleable to create or assemble the venting cap 26, as shown in Fig. 4. For instance, in one embodiment, the valve portion 32 is secured within the valve recess 38 of the main body portion 30. As such, the valve body ring 46 is slidable along corresponding slot portions 39b of the main body 30 such that the two opposing engagement ears 48 ride along or within the lip portion 39a of the main body 30. Rotatable displacement of the valve portion 32 within the main body portion 30 may be limited by abutable engagement of the ears 48 against wall or stop positions within the valve recess portion 38 or other portions of the main body portion 30. Accordingly, rotation of the ears 48 can be limited to a rotational travel distance of 180 degrees or less. Other rotational displacement and travel configurations for the valve portion 32 and ears 48 can be employed without deviating from the spirit and scope of the present invention.

Referring generally to Figs. 5-7, the engagement tabs 36 engage respective portions of the ring 34 proximate the ring aperture 50 to couple the ring 34 and main body portion 30 together. As a result, the assembled main body portion 30 and valve portion 32 are securely positioned within the ring aperture 50 such that the insertion portion 35 of the main body 30 extends down from the ring 34 for engagement with the drum insert 20. With such a configuration, the valve portion 32 can be independently rotated within the cap 26 and main body 30. It should be noted that various other attachment techniques and methods can be employed for coupling the various venting cap components 30, 32, 34. For instance, snap or pressure fittings, bonding techniques, molding techniques and a myriad of other known attachment techniques can be implemented as well.

In one embodiment, the venting key 28 is separate from the venting cap 26 and can include a key body portion 54, at least one engagement tab 56 and a venting tube 58. The key body portion 54 includes a bore 55 therethrough to receive the venting tube 58. The at least one engagement tab 56 can include a flange 60. The venting tube 58 can further include a first end portion 62, a tube body portion 64 and a tube conduit 68 therethrough. The first end portion 62 can be flared to slide over an end of the main vent member 40, as shown in Figs. 6-7. As such, the conduits 42, 44 of the vent member 40 and the tube conduit 68 can be brought into fluid communication upon insertion of the key 28 into the

cap 26. A second end of the venting tube 58 can extend out a distance from the venting cap assembly 14 for connection to various devices, or placement in various environments, as discussed further herein. In alternate embodiments, the venting tube 58 can be coupled to a portion of the key 28, such as the interior of the bore 55 or an exit portion of the bore 55, by way of bonding, fittings, adhesive, or various other known techniques and methods.

As shown in Figs. 6-7, the venting key 28 can be inserted into the main body portion 30 of the venting cap to engage the valve portion 32. Specifically, in one embodiment, the venting key 28 includes two opposing engagement tabs 56 mateably alignable within the rotating slots 49 of the valve portion 32. With such a configuration, the flanges 60 generally rest on a surface of the valve body ring 46 to further provide secure engagement of the engagement tabs 56 with the valve portion 32. As a result, rotation of the inserted and engaged key 28 causes the flanges 60 to force the valve portion 32 into corresponding rotational displacement. This rotational displacement, again, can be limited by start and stop positions of the ears 48 and ring 46 along portions of the valve recess 38 and/or the main body portion 30.

The rotation of the valve portion 32 and the corresponding main vent member 40 through rotation of the engaged venting key 28, likewise provides selective alignment of the transverse valve conduit 44 with the conduit 37 of the main body portion 30. In the generally closed position of Fig. 6, the transverse valve conduit 44 is not in fluid communication with the conduit 37 of the main body portion 30 such that fluids, such as pressurized gasses, within the drum 12 and drum insert 20 are fully contained therein. Removal of the venting cap 26 from the bung opening 18 at that point would release pressurized fluid contents of the drum 12 and potentially injure those in close proximity. To minimize such dangers, operation of the venting cap assembly 14 can serve to vent the pressurized fluids or gasses away from the drum 12 prior to removal of the cap 26.

To vent pressurized gasses within the drum 12 to a safe area (*e.g.*, a scrubber device 80), the inserted key 28 is rotated within the valve portion 32. This rotation of the valve portion 32 and vent member 40 along a path of travel, correspondingly rotates the transverse valve conduit 44 into communication with the conduit 37 of the main body portion 30, as shown in Fig. 7. Consequently, an open valve position is achieved and continuous fluid communication is provided from the drum 12, through the body conduit 37, through the transverse valve conduit 44 and main valve conduit 42, and into and out of

the tube conduit 68. This in turn provides a fluid communication path for the pressurized contents of the drum 12, and drum insert 20, out through a terminating end of the venting tube 58 to the safe venting area. By requiring engagement and rotation of the venting key 28 with the valve portion 32 before venting can occur, the present invention ensures that

5 the pressurized fluids or gasses will be vented to the safe area, rather than at the cap itself as is the case with conventional venting mechanisms. Safe environments or areas can include isolated rooms, enclosures, and known devices such as scrubbers 80 (Fig. 1). A myriad of other areas and/or devices are envisioned for communication with an end of the venting tube 58 to provide a safe place for fluid evacuation.

10 The present invention may be embodied in other specific forms without departing from the spirit of any of the essential attributes thereof. Therefore, the illustrated embodiments should be considered in all respects as illustrative and not restrictive, reference being made to the appended claims rather than to the foregoing description to indicate the scope of the invention.

What is claimed is:

1. A venting cap device for evacuating pressurized fluid from a fluid containment drum, wherein the drum includes at least one bung opening providing access into an interior of the drum, the venting cap device comprising:

a cap portion including:

a main body to operably engage with the at least one bung opening of the drum, the main body including a body conduit in operable communication with the interior of the drum;

a rotatable valve body including a valve member, the valve member including a valve conduit extending therethrough;

a venting key portion including:

a key body including at least one engagement member to operably engage the rotatable valve body; and

a venting tube including a first end portion capable of operable alignment and communication with the valve conduit upon operable engagement of the engagement member with the rotatable valve body, such that rotation of the venting key rotates the engaged rotatable valve body to align the valve conduit with the body conduit to provide a continuous fluid passageway to evacuate pressurized fluid from the interior of the drum, through the body conduit and valve conduit, and out through the venting tube.

2. The venting cap device of claim 1, wherein at least the cap portion and the venting key portion are constructed of a fluoropolymer.

3. The venting cap device of claim 1, wherein the valve conduit includes a first valve conduit portion defined along a longitudinal axis of the valve member, and a transverse valve conduit portion generally transverse to the longitudinal axis and in fluid communication with the first valve conduit portion, wherein the transverse valve conduit is alignable with the body conduit upon rotation of the engaged engagement member of the venting key.

4. The venting cap device of claim 1, wherein the venting tube terminates at a second end portion distal the first end portion a distance from the drum.

5. The venting cap device of claim 4, wherein the second end portion is operably coupled to a scrubber device.

6. The venting cap device of claim 4, wherein the second end portion is routed to a safe fluid evacuation area.

7. The venting cap device of claim 1, wherein the rotatable valve body includes at least one extending ear portion operably engageable with at least one stop portion of the main body to limit rotational displacement of the rotatable valve body.

8. The venting cap device of claim 1, wherein the main body of the cap portion operably engages with a drum insert coupled to the at least one bung opening.

9. The venting cap device of claim 1, wherein the drum includes a drum insert having a top threaded portion disposed above the bung opening and a downtube portion extending down into the interior of the drum, the venting cap further including a threaded portion to threadably engage the top threaded portion of the drum insert.

10. The venting cap device of claim 1, wherein the venting key portion and the cap portion are separate.

11. A venting device for evacuating pressurized gasses from a fluid containment drum, wherein the drum includes at least one access opening into an interior of the drum, the venting device comprising:

a cap portion including:

a main body to operably threadably engage with the at least one access opening of the drum;

a rotatable valve body disposed within the main body, the rotatable valve body including a valve member, the valve member including a first valve conduit extending longitudinally therethrough and a second valve conduit extending transversely therethrough and in fluid communication with first valve conduit;

a venting key portion including:

a key body including a bore extending therethrough and at least one engagement member, the at least one engagement member adapted to operably engage the rotatable valve body;

a venting tube adapted to extend through the bore and including a first end portion capable of alignment and communication with the first valve conduit upon operable engagement of the engagement member with the rotatable valve body; and

wherein operable engagement of the engagement member of the key body with the valve body rotation of the venting key to an open position correspondingly rotates the valve body to align the second valve conduit for operable fluid communication with the interior of the drum to evacuate pressurized fluid from the drum out through the venting tube.

12. The venting device of claim 11, wherein at least a portion of the cap portion and the venting key portion are constructed of a fluoropolymer.

13. The venting device of claim 11, wherein the venting tube terminates at a second end portion distal the first end portion a distance from the drum.

14. The venting device of claim 13, wherein the second end portion is coupled to a scrubber device.

15. The venting device of claim 13, wherein the second end portion is routed to a safe evacuation area.

16. The venting device of claim 11, wherein the rotatable valve body includes at least one extending ear portion engageable with at least one stop portion of the main body to limit rotational displacement of the rotatable valve body.

17. The venting device of claim 11, wherein the main body of the cap portion threadably engages with a drum insert coupled to the at least one access opening of the drum.

18. The venting device of claim 11, wherein the venting key portion and the cap portion are separate.

19. A cap assembly for evacuating pressurized fluids from a fluid containment drum, wherein the drum includes at least one access opening into an interior of the drum, the cap assembly comprising:

means for capping off the at least one access opening of the drum, the means for capping including:

valve means for operably rotatably aligning a valve conduit with the at least one access opening of the drum; and

means for operably rotatably engaging the valve means to selectively align the valve conduit with the at least one access opening of the drum to evacuate pressurized fluid from the drum.

20. A method of evacuating pressurized fluids from a drum, comprising:

providing a fluid containment drum having an access opening into an interior of the drum;

providing a drum cap to operably engage the at least one access opening of the drum, the drum cap including a rotatable valve member, the valve member further including a valve conduit extending therethrough;

providing a venting member, the venting member adapted to operably engage the drum cap and having a venting tube extending therefrom;

operably engaging the venting member with the drum cap; and

rotating the venting member such that the valve member of the drum cap is correspondingly rotated until a fluid passageway is opened from the interior of the drum, through the valve conduit of the valve member and out through the venting tube to evacuate pressurized fluid from the interior of the drum.

21. The method of claim 20, wherein providing a venting member includes providing a venting key.

22. The method of claim 20, wherein operably engaging the venting member with the drum cap includes engaging at least one engagement tab of the venting member with a corresponding engagement portion of the rotatable valve member.

23. The method of claim 20, wherein the valve conduit of the rotatable valve member includes a first valve conduit extending longitudinally therethrough, and a second valve conduit extending transversely therethrough and in fluid communication with first valve conduit such that rotation of the valve member by the corresponding rotation of the engaged venting member brings the second valve conduit into operable fluid communication with the interior of the drum to provide the fluid passageway to evacuate pressurized fluid from the interior of the drum.

24. The method of claim 20, wherein providing the venting member includes providing a fluoropolymer venting member.

25. The method of claim 20, wherein providing the drum cap includes providing a fluoropolymer drum cap.

26. The method of claim 20, wherein providing the venting member includes providing the venting member with the venting tube having a second end portion terminating at a safe fluid evacuation area.