June 17, 1958 C. C. DE PEW 2,839,215

FILLER CAP ASSEMBLY

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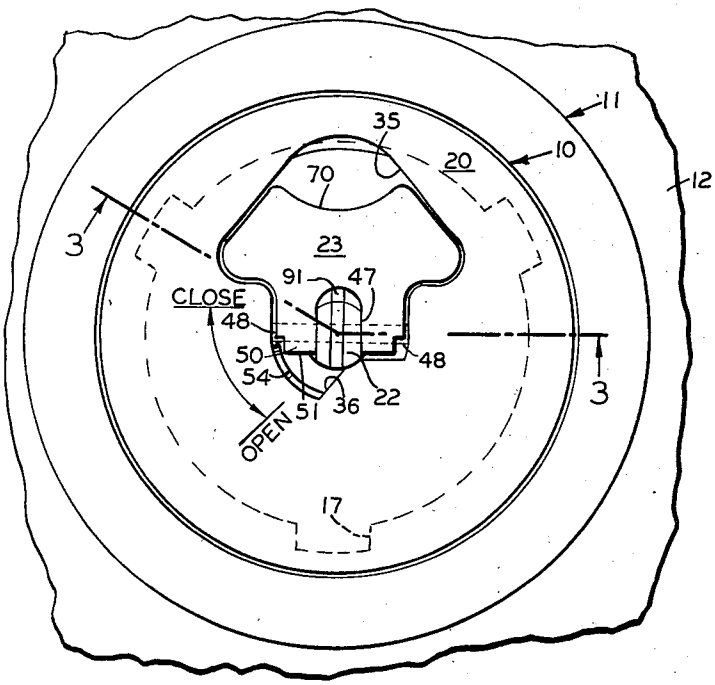


FIG. 1

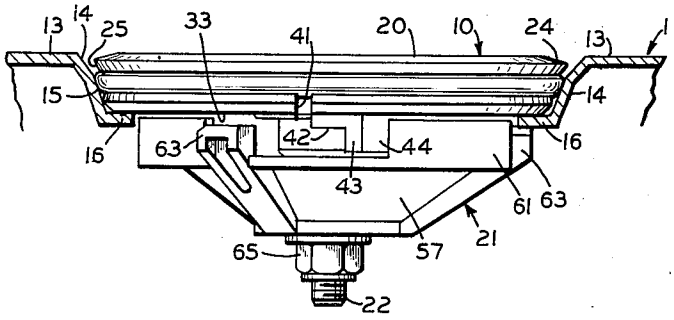


FIG. 2

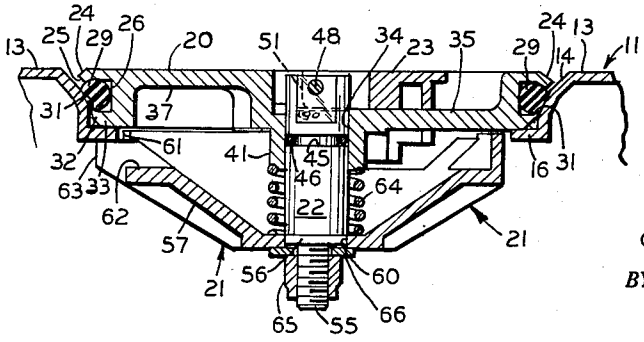


FIG. 3

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FIG. 4

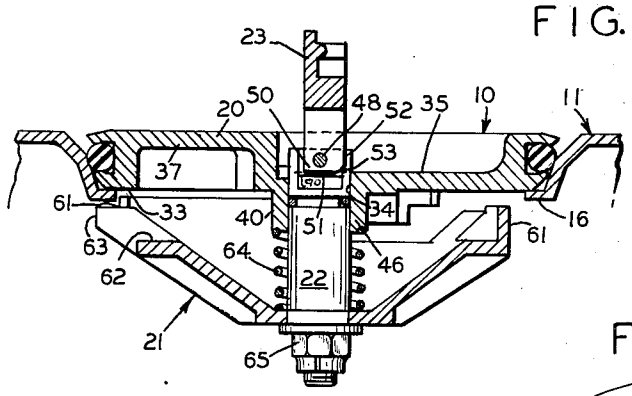


FIG. 5

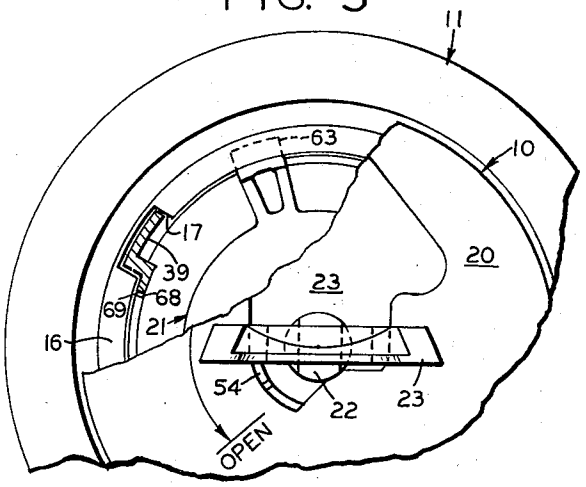


FIG. 6

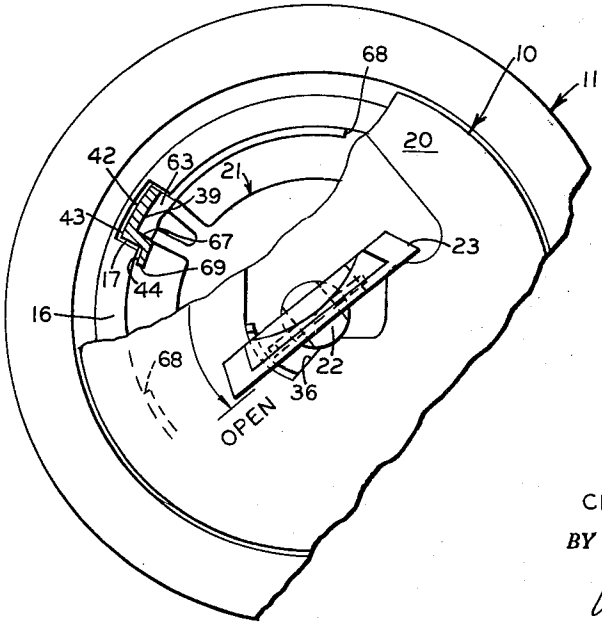
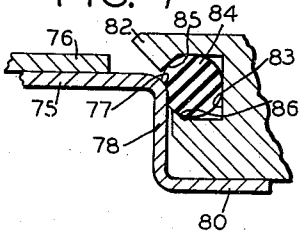


FIG. 7



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FILLER CAP ASSEMBLY

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Application July 8, 1955, Serial No. 520,736

2 Claims. (Cl. 220—25)

This invention relates to tank closures and relates more particularly to a novel closure assembly adapted for use in tanks such as those used in aircraft which are normally maintained under positive pressure.

An important object of the invention is to provide a closure for the filling opening of a tank which provides a positive, air-tight seal for the tank while the closure is locked but which permits the closure to become unlocked and removed by the simple act of raising a manipulating handle, pivoted on a rotatable stud, from its closed position in flush relation to the closure plate and then rotating the handle and stud something less than one quarter turn.

Another object of the invention is to provide a closure assembly wherein raising of the manipulating handle breaks the air-tight seal to release the air pressure but positively secures the closure plate against displacement until the handle has been rotated. This arrangement avoids injury due to the entrapped air under pressure from blowing the closure plate into the face of the operator.

A further object of the invention is to provide a closure assembly of the character described wherein a novel clamping plate carried below the closure plate is formed with a plurality of radially extending clamping fingers which initially pass through slots in an adapter plate secured to the tank at the filling opening. As the operating handle or flag is rotated from vertical to flush position novel cam means forming a part of the handle draws the clamping plate upwardly and the closure plate downwardly to provide an air-tight seal between the closure assembly and the adapted plate.

Yet another object of the invention is to provide an improved closure assembly wherein the upper surface of the closure plate is flush with the adapter ring and wherein the operating handle, if not flush with the plate, stands up as a flag to indicate an unlocked condition. The arrangement is such that if the flag is down and the closure is not locked, the closure assembly has not seated itself in the adapter ring, which fact is readily apparent.

Another object of the invention is to provide an improved locking arrangement for closure caps for fuel tanks wherein the lock is unaffected by severe vibration or shock.

In closures of this general character a rubber O ring is generally employed to effect the actual seal and this ring generally rotates relative to the adapter ring, during the acts of locking and unlocking, thus causing wear on the ring. In the closure of the present invention no rotation can occur between the closure plate and the adapter ring.

In the drawing:

Fig. 1 is a plan view of a filler cap assembly embodying my present invention.

Fig. 2 is a side elevation on the cap and showing the adapter plate in section.

Fig. 3 is a section on line 3—3 of Fig. 1.

Fig. 4 is a section similar to Fig. 3 but showing the lock in released position.

Fig. 5 is a broken plan view and showing parts in locked position.

Fig. 6 is similar to Fig. 5 but shows the parts in unlocked position.

Fig. 7 is a broken vertical section taken through the closure plate and a different type of adapter plate.

The embodiment of the invention chosen for illustration in the drawings includes a closure assembly **10** and an adapter plate or ring **11** which is suitably secured by bolts or rivets (not shown) to the margins of an opening in a tank **12**. The adapter plate is formed with an upper ring **13**, a downwardly and inwardly inclined annular flange **14**, an annular flange **15** more nearly vertical, and a base flange **16** parallel with the ring and having a plurality of equally spaced rectangular slots **17** extending outwardly from its inner periphery. The adapter ring, per se, forms no part of the present invention and the closure assembly is so proportioned as to fit a number of common rings currently in use.

The closure assembly includes a closure plate **20**, a clamping plate **21** carried on a stud **22**, below the closure plate, and a manipulating handle **23**. The upper surface of the closure is substantially plane with the upper surface of ring **13** and its periphery is beveled as shown at **24**. Below the beveled upper periphery the plate is inwardly beveled as shown at **25** and an undercut annular slot **26** of special cross sectional contour is formed below the annular bevel **25**.

A circular resilient gasket **29** which is generally round in cross section is positioned within the annular slot and upper and lower shoulders **30** and **31**, extending downwardly and upwardly, respectively, serve to retain the gasket within this dovetailed slot. In other words, except for the inner corners of this undercut annular slot its cross-sectional contour is generally C shaped and the resilient gasket has a greater diameter than the distance between the points of the C so it must be force-fitted into the slot and when it expands on contact with the liquid fuel, nevertheless is held firmly captive at all times. Below slot **26** the outer face of the plate is again inwardly beveled as shown at **32** and adjacent said latter beveled section is an annular seat **33**. It will be noted that this annular face just below this O ring groove has a diameter only slightly smaller than the diameter of the adjacent area of the adapter ring so it acts as a pilot to accurately center the closure upon application to the ring.

The plate is provided with a central opening **34** forming a bearing for stud **22**. A well **35** extends downwardly from the upper face of the closure plate, such well being shaped to receive the manipulating handle **23** in flush relation and having an extension **36** to permit rotation of the stud and the handle carried thereby when the latter is raised to the position of Fig. 4. On its lower surface the plate is cut away at **37** to reduce weight and is further provided with a central boss **40** to increase the length of the bearing for the stud.

Annular seat **33**, which merges into the lower wall in the area of the well, is formed with equally spaced slots **41** and on one side of each slot is a shallow flange **42** terminating in a downwardly extending lug **43** having a relieved portion **44** at one end. The inner face of the lug is thus formed with a recess **39** (Fig. 5). This entire closure plate may be die-cast and formed in a single piece.

The stud **22** is formed with an annular slot **45** which receives an O-ring **46** to effect a seal between the stud and closure plate while nevertheless permitting free rotation of the stud. At its upper end the stud is relieved on each side thereof to form two flat faces **47** and a pin **48** passes through this upper section for mounting the

manipulating handle. The latter is of bifurcated construction and the two spaced legs **50** are formed at their outer ends with flat faces **51** lying relatively close to the pivot pin and with flat faces **52** at right angles thereto and lying at a greater distance from the pin. These two faces are connected by a curved edge **53**, all for a purpose to be described.

The pivot pin extends beyond the outer faces of the legs and its terminals engage camming surfaces **54** in the well on opposite sides of the central opening. At its lower end the stud has a reduced threaded section **55** and above the latter is a non-circular portion **56**.

The clamping plate **21** has a dished central portion **57** and a non-circular central opening **60** to receive the non-circular portion **56** of the stud so as to rotate therewith. At the upper end of the dished section the plate has an upstanding annular flange **61** which is formed with a plurality of cut-away sections **62** and at one end of each cut-away section there is formed an outwardly projecting clamping finger **63** which underlies the base flange **16** when the parts are in locked position and which is received in recess **39** (Fig. 6) in nested relation when the parts are in unlocked position. Thus the radial wall **67** at the inner end of the recess **39** forms a stop limiting rotation of the clamping plate from the locked position of Fig. 5 to the unlocked position of Fig. 6. At the other end of each cut-away section **62** there is formed a shoulder **68** providing a stop which limits rotation of the clamping plate when it is rotated from the unlocked position of Fig. 6 to the locked position of Fig. 5. This shoulder **68** thus contacts edge **69** of lug **43**. It will be seen that by this arrangement clamping plate **21** rotates to locked position while the closure plate is maintained in non-rotative relation with the adapter. It will be noted that the upper face of each finger is positioned below the upper edge of flange **61**.

A compression spring **64** is carried on the stud below boss **40** and a lock nut **65** retains the clamping plate on the stud. A washer **66** may be positioned above the nut.

The manipulating handle generally fits the well except that it is cut away at **70** and this edge is of reduced thickness to provide a finger grip to enable the handle to be raised.

When the closure assembly is displaced from the adapter ring the handle **23**, in an upright position, has been moved to its maximum counterclockwise position with reference to well extension **36** in the closure plate (Fig. 6). In this position the clamping plate **21** is also in its maximum counterclockwise position and lug **43** has acted as a stop to limit further counterclockwise rotation of clamping finger **63** on the clamping plate. Slot **17** in the adapter ring is only of sufficient length to permit portions **63**, **42** and **43** to pass therethrough. In the illustrated embodiment there are three slots **17** but it will be appreciated that in a large cover more slots and lugs may be used.

The closure assembly is thus applied to the adapter ring and the lugs **63** of the clamping plate pass below the slots **17** of the ring. The upright manipulating handle and the stud **22** on which it is pivotally mounted are rotated to the position of Fig. 5. This rotation causes the clamping plate and fingers **63** carried thereby to turn so that the latter underlie flange **16**. The relationship between rubber O ring **29** and its annular seat in the adapter ring is such that the closure plate does not become initially fully seated on flange **16** and will not become seated until the ring has become deformed on its outer face by contact with the annular surface **15** of the adapter ring.

As the manipulating handle is rotated on its own pivot from the position of Fig. 4 to the position of Fig. 3 curved camming surfaces **53** draw the stud **22** and the clamping plate **21** carried thereby upwardly and simultaneously moves the closure plate downwardly, causing additional deformation of that portion of the rubber O ring which contacts the adapter ring from a round contour to a flat contour.

Fig. 7 shows a modified form of adapter ring wherein the upper ring **75** is secured to the lower surface of the tank **76**. The ring has a curved inner annular section **77** which merges into a vertical annular section **78**, said curved section having a radius less than the radius of the O ring in cross-section. The lower ring portion **80** is parallel with the upper ring.

The closure plate **82** has the same undercut or dovetailed annular recess **83** for the O ring **84** and shoulders **85** and **86** confine the ring within the recess and that the distance between the shoulders is such that the ring is always confined within the recess even when maximum swelling or shrinkage, both in circumference and in cross-sectional area, has occurred. This is also true of the arrangement of Fig. 3. When the adapter peripheral surface of the closure ring is fully seated on lower ring the cross-sectional contour of the O ring has been deformed as shown and a firm seal is effected.

If the closure plate is made from relatively soft metal it may be desirable to position a wear plate **90** of stainless steel or other hard metal under handle **23**. Also, in the event that pin 48 should shear off due to excessive wear it may be convenient to provide a screw driver slot **91** at the upper end of the stud in order to remove the same.

While there have been described herein what are at present considered preferred embodiments of the invention, it will be obvious to those skilled in the art that many modifications and changes may be made therein without departing from the essence of the invention. It is therefor to be understood that the exemplary embodiments are illustrative and not restrictive of the invention, the scope of which is defined in the appended claims, and that all modifications that come within the meaning and range of equivalency of the claims are intended to be included therein.

What I claim is:

1. A filler cap assembly for a tank, and an apertured adapter therefor provided with a downwardly curved annular flange and a slotted ring at the lower end of the flange, said assembly including a closure plate provided with a downwardly and inwardly inclined outer peripheral surface having an annular groove therein and formed along its upper and lower outer edges, respectively, with downwardly and upwardly inclined shoulders giving the groove a generally dovetailed contour, and a resilient O ring in the groove, said O ring having a cross-sectional diameter greater than the distance between the upper and lower shoulders, said shoulders preventing movement of the O ring out of the slot when its circumference or cross-sectional diameter increases or decreases due to expansion or shrinkage, means for compressing the O ring against the downwardly curved portion of the annular flange, said curved portion having a radius less than the cross-sectional radius of the O ring, said means including a stud rotatably mounted centrally of the closure plate, a clamping plate formed with outwardly extending clamping fingers and secured at the lower end of the stud, spaced lugs carried around the lower periphery of the closure plate which are contacted on one side thereof by the clamping fingers when the clamping plate is rotated to unlocked position to permit the lugs and fingers to pass through the adapter slots, the opposed vertical edges of said lugs contacting the opposed edges of said adapter slots and preventing rotation of the closure plate in either direction during rotation of the stud and clamping plate to locked and unlocked position, the clamping plate being provided with shoulders forming stops which contact the opposite sides of said lugs when the clamping plate is rotated to locked position, a handle pivoted at the upper end of the stud and provided with a camming surface to draw the fingers upwardly into engagement with

the adapter ring and move the O ring downwardly into firm engagement with the curved adapter flange.

2. A filler cap assembly for a tank having an apertured adapter provided with a funnel shaped annular flange and a seat at the lower end of the flange having spaced slots therein, said assembly including a closure plate provided with a downwardly and inwardly inclined outer peripheral surface having an annular groove therein which is formed along its upper and lower outer edges, respectively, with downwardly and upwardly inclined shoulders giving the groove a generally dovetailed contour, and a resilient annular gasket in the groove, said gasket having a cross-sectional diameter greater than the distance between the upper and lower shoulders, said shoulders preventing movement of the gasket out of the slot when said diameter increases or decreases due to expansion or shrinkage, the diameter of the closure plate at said lower outer edge of the groove being only slightly less than the adjacent diameter of the adapter but being large enough to act as a pilot to center the closure plate upon insertion, means for compressing the gasket against the annular flange of the adapter including a stud rotatably mounted centrally of the closure plate, a clamping plate formed with outwardly extending clamping fingers and secured at the lower end of the stud, spaced lugs carried around the lower periphery of the closure plate and having recesses to receive the clamping fingers in nested relation when the clamping plate is rotated to unlocked position to permit the lugs and fingers to pass through the adapter slots, the opposed vertical edges of said lugs contacting the opposed edges of said adapter slots and preventing rotation of the closure plate in either direction during rotation of the stud and clamping to locked and unlocked position, the clamping plate being provided with shoulders forming stops which contact the opposite sides of said lugs when the clamping plate is rotated to locked position, a handle pivoted at the upper end of the stud and provided with a camming surface which, when the handle is rotated downwardly to closed position effects a clamping action between the clamping plate and the closure plate to draw the fingers upwardly into engagement with the adapter ring and move the O ring downwardly into firm engagement with the curved adapter flange.

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