July 1, 1952 T. B. HARRIS 2,601,936

CLOSURE FOR PRESSURE VESSELS

Filed Aug. 23, 1946 4 Sheets-Sheet 1

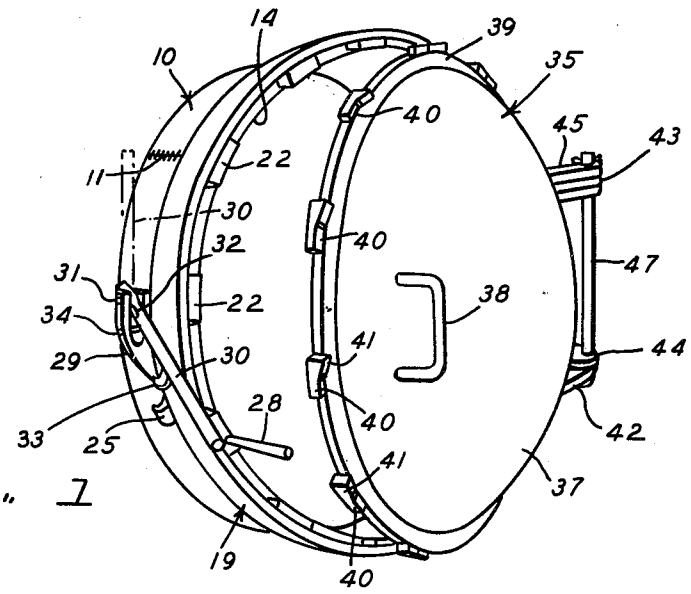


Fig. 1

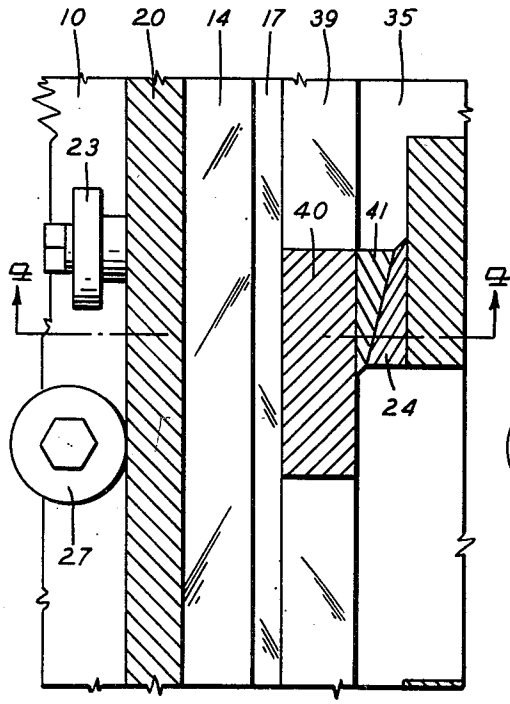


Fig. 2

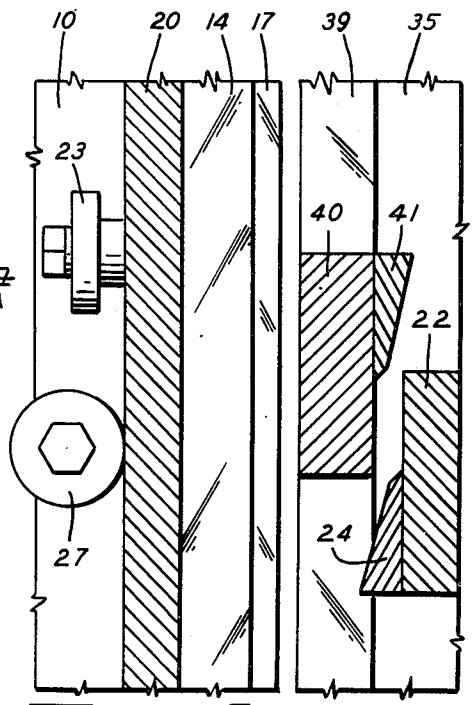


Fig. 3

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CLOSURE FOR PRESSURE VESSELS

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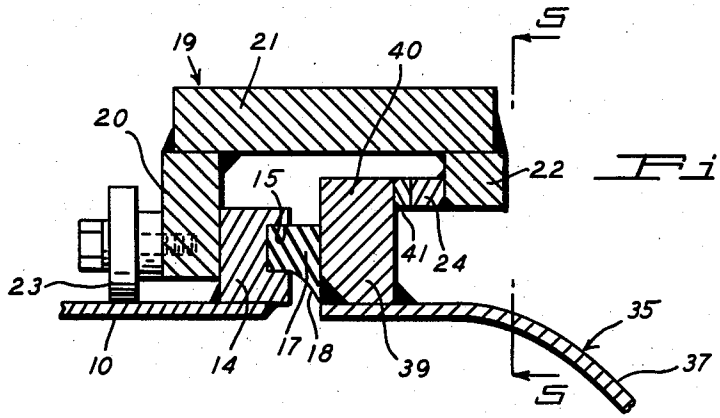


Fig. 4

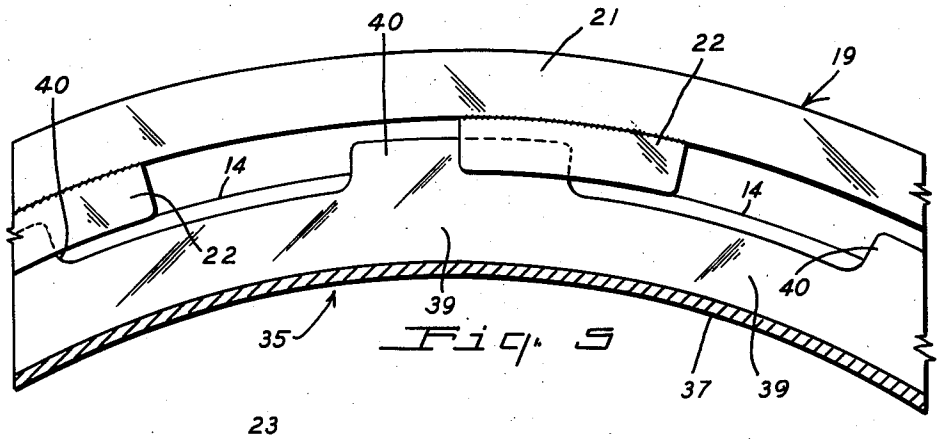


Fig. 5

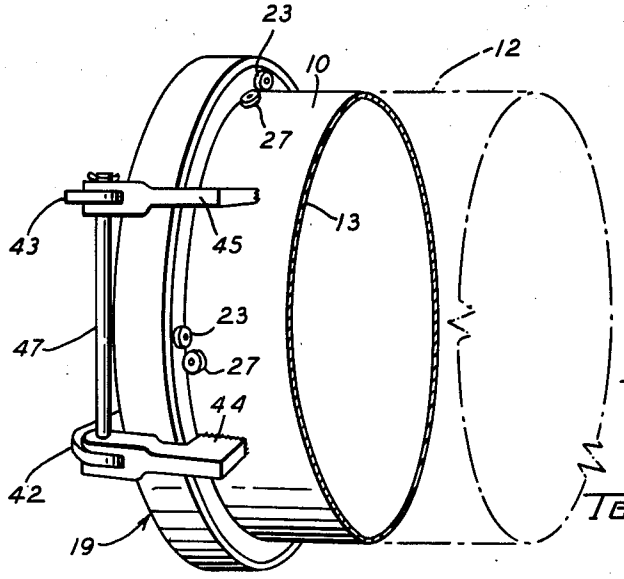


Fig. 6

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CLOSURE FOR PRESSURE VESSELS

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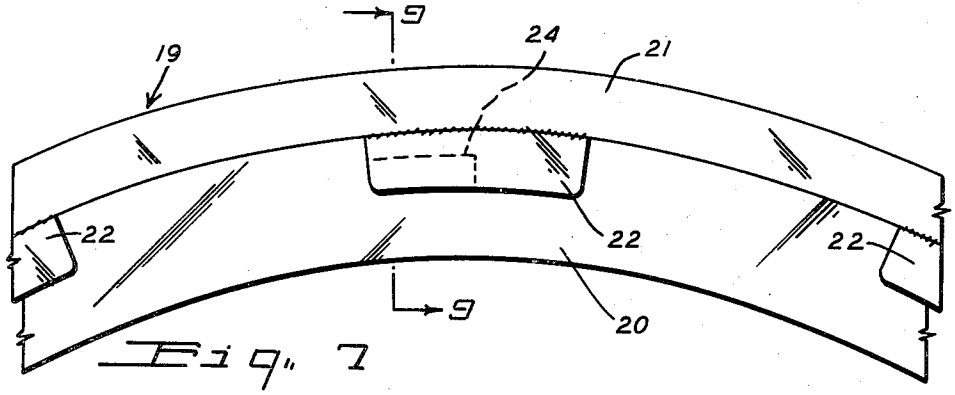


Fig. 7

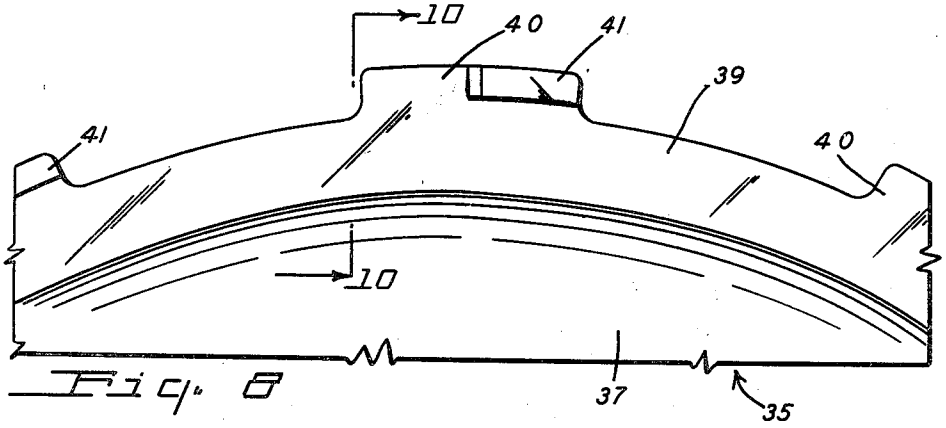


Fig. 8

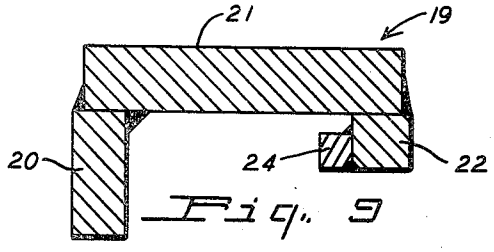


Fig. 9

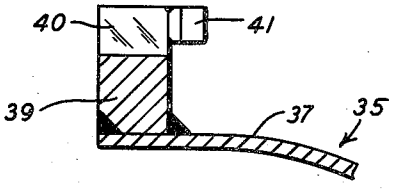


Fig. 10

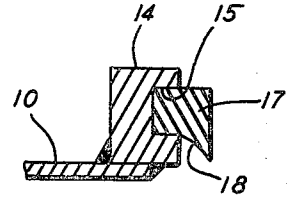


Fig. 11

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CLOSURE FOR PRESSURE VESSELS

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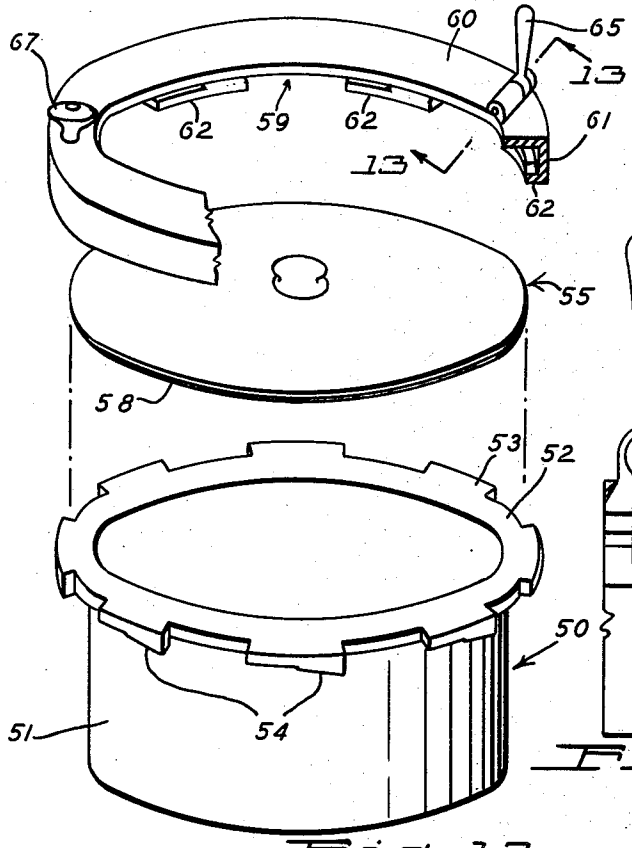


Fig. 12

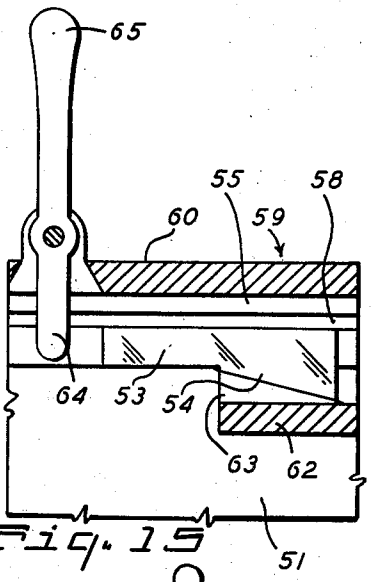


Fig. 15

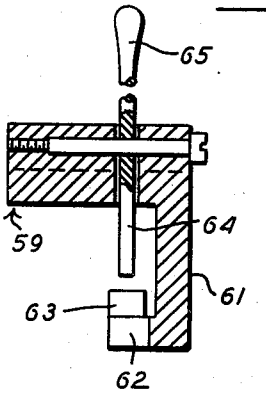


Fig. 13

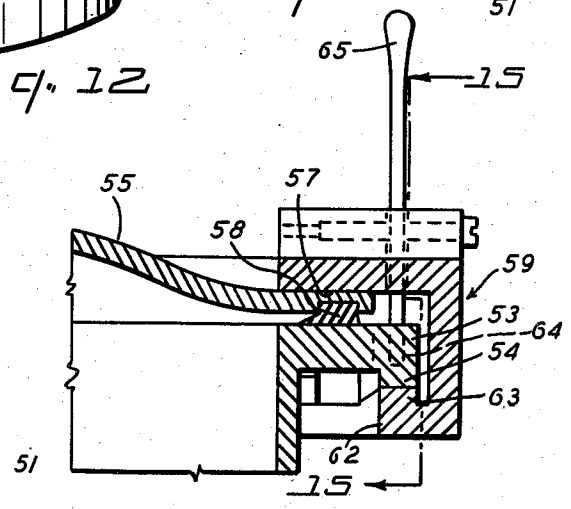


Fig. 14

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UNITED STATES PATENT OFFICE

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CLOSURE FOR PRESSURE VESSELS

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Application August 23, 1946, Serial No. 692,618

2 Claims. (Cl. 220—40)

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The present invention relates to a closure for pressure vessels, and more particularly to a closure which can readily be brought into and out of sealing relation with the vessel on which it is mounted.

In various types of vessels which may vary in size all the way from small domestic cooking vessels to large retorts such as those used for the pressure treating of telephone poles with preservative, it is desirable to have a closure which may readily be brought into sealing relation with the vessel on which it is mounted, which will remain in sealing relation under substantial pressure, and which may be released from pressure sealing engagement with the vessel without danger to an operator performing the unsealing or opening operation.

Various types of closures for pressure vessels have been developed, some of which are extremely simple in operation and others which are rather cumbersome and complicated. However, in larger pressure vessels at least, it still is common practice to use a plurality of wing nuts mounted on pivoted bolts around the mouth of the vessel which engage lugs on the cover so that by screwing down the wing nuts the cover is forced into pressure sealing engagement with the vessel.

An object of the present invention is to make an improved closure for pressure vessels.

Another object is to make a closure for pressure vessels which will seal a vessel effectively against leakage from internal pressure and which may readily be released from sealing engagement with the vessel.

Another object is to make a closure for a pressure vessel, the closure having a plurality of radially projecting axially acting cams which, through inter-action with cams carried by the vessel, draw the cover into sealing relation with the vessel.

Another object is to provide a closure for pressure vessels with a locking cam ring whereby the closure can be drawn into pressure sealing relation with the vessel and thereafter can be released first to an initial pressure releasing stage, and secondly to a fully open condition.

Another object is to provide a closure for pressure vessels with a cam acting device for holding the closure in pressure sealing relation with the vessel and to provide simple and safe releasing means for releasing the closure from pressure sealing relation with the vessel.

These and other objects and advantages of the invention will be more fully apparent from a

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perusal of the following description of a specific embodiment of the invention, and the accompanying drawings which illustrate such embodiment.

In the drawings, of which there are four sheets:

Fig. 1 is a view in perspective of a retort door embodying the present invention, the door being mounted on a short cylinder of boiler plate which is adapted to be welded so as to be co-extensive with the cylindrical side wall of a tank for which the door is intended, the door in Fig. 1 being illustrated as slightly ajar;

Fig. 2 is an enlarged fragmentary sectional view taken on a plane parallel to the axis of a cylindrical wall portion and perpendicular to a radius of the cylindrical tank section on which the device is mounted, said plane passing through a pair of interlocking cams with the door closed and locked;

Fig. 3 is a sectional view similar to Fig. 2 but with the cams unlocked;

Fig. 4 is a fragmentary sectional view taken on line 4—4 of Fig. 2;

Fig. 5 is a fragmentary sectional view on the line 5—5 of Fig. 4;

Fig. 6 is an elevational oblique rear view showing the hinge side of the assembly shown in Fig. 1;

Fig. 7 is a view on the same scale as Figs. 2–5, inclusive, showing a fragment of a cam locking ring as viewed from the forward or door side;

Fig. 8 is a similarly enlarged view of a marginal edge portion of the cover, showing a cam locking lug;

Fig. 9 is a sectional view on the line 9—9 of Fig. 7;

Fig. 10 is a sectional view on the line 10—10 of Fig. 8;

Fig. 11 is a sectional view through the marginal rim about the open end of the tank or vessel on which the device is mounted, showing a resilient sealing ring mounted in a groove in the rim;

Fig. 12 is an exploded view of a modified form of closure showing a vessel, a lid and a locking ring in relatively upwardly separated position, a fragment of the locking ring being broken away;

Fig. 13 is an enlarged sectional view on the line 13—13 of Fig. 12;

Fig. 14 is an enlarged fragmentary sectional view through the upper marginal rim portion of the assembly shown in Fig. 12 with the parts assembled and the cover locked in sealing position thereon; and

Fig. 15 is a sectional view on the line 15—15 of Fig. 14.

Referring to the drawings in detail, and considering first the embodiment illustrated in Figs. 1–11, inclusive, a tank top portion 10 is of boiler plate rolled into cylindrical form to correspond with the size of boiler on which it is to be mounted. The ends of this cylindrical portion are secured together as by welding at 11, Fig. 1. This cylindrical tank top portion 10 is adapted to be welded onto a cylindrical tank 12, as shown in dot-dash lines in Fig. 6, along the line 13, the cylindrical top portion 10 and the wall of the tank 12 being co-extensive. In the case of large tanks this practice is preferred to building a door or closure assembly directly onto the tank, since the short cylindrical top portion 10 is easier to handle during the production of the device than is an entire tank, although either method may be employed. Furthermore, this arrangement greatly facilitates replacing of other types of doors or closures where tanks already are in operation in the field. It merely requires cutting off the portion of the old tank having the door or closure mechanism embodied thereon and welding on the new cylindrical top portion 10 with the new cover assembly mounted thereon. The cylindrical portion 10 may be considered as the wall of the tank and will be referred to as such herein.

The outer end of the tank wall 10 has a radially projecting rim 14 of steel, which may be either rolled up into a ring from suitable rectangular bar stock, or may be cast, or cut from a suitable plate, as desired.

In order to facilitate explanation of the various parts of the present mechanism, the rear of all parts will be assumed to be toward the bottom of the tank, while the term "front" will be used to refer to the opposite direction.

The rear face of the rim 14 is machined to a smooth surface in a plane perpendicular to the axis of the tank, and a groove 15 is machined in the forward face of this rim. A sealing ring 17 of resilient material, such as synthetic rubber, is mounted in the groove 15. The front portion of this sealing ring has a beveled edge portion 18 directed radially inward toward the center of the tank. A locking ring 19 is illustrated as a welded assembly comprising an annular rear section 20, an annular intermediate section 21, and a plurality of locking lugs 22 which are welded to the forward end of the intermediate section to project radially inwardly therefrom.

The forward face of the rear locking ring member 20 is machined smoothly on a plane perpendicular to the axis of the annular assembly thus formed, and a plurality of rollers 23 are mounted on the rear face of the rear locking ring member 20 to roll on the tank wall 10 and thus permit free rotation of the locking ring 19, within limits of the structure to be described later herein.

The internal diameter of the annular rear portion 20 of the locking ring 19 is somewhat larger than the diameter of the tank wall 10 so as to permit free rotation of the locking ring without binding on the tank wall.

The lugs 22 preferably are shorter than the spaces between adjacent lugs 22. A locking cam 24 is mounted on the rear face of each of the lugs 22, these locking cams extending approximately one-half the length on each of the lugs 22. The rearward faces of the cams 24 are disposed at a slope of approximately 5 degrees to the plane of the locking ring 19.

A cam releasing lug 25 is welded to the rear peripheral portion of the locking ring 19 to project radially outwardly therefrom.

A plurality of rollers 27 are mounted on the tank wall 10 just rearwardly of the position occupied by the rear annular member 20 of the locking ring 19. These rollers are mounted to have rolling engagement with the rear face of the locking ring 19 as best shown in Figs. 2 and 6, so as to prevent rearward displacement of the locking ring. These rollers 27 are mounted to engage the rollers 23 mounted on the rear of the locking ring assembly, after the locking ring has been rotated to a predetermined position relatively to the cover, as will be brought out later herein. The rollers 23 and 27 thus act as a stop to limit the rotation of the locking ring 19 during an unlocking operation.

A handle rod 28 is securely mounted on the locking ring assembly, as by welding, to provide means for manually rotating the locking ring relatively to the tank in opening and closing the tank door or closure. A device for releasing the cam lock when it is desired to open the door includes a yoke 29 welded to the tank wall 10 rearwardly of the locking ring 19. A lever 30 is pivoted on a pin 31 mounted in the yoke 29. The lever 30 has a slot 32 lengthwise therein adapted to receive the pin 31 so that the lever 30 is free for limited movement axially thereof. A hook 33 is secured to a side of the lever 30 to project downwardly therefrom when the lever is swung to unlocking position.

In normal position the lever 30 is upright, as indicated in dotted lines in Fig. 1, with the lower end thereof retained by a pin 34 mounted transversely of the yoke 29. To release the lever from this upright position it may be raised axially upwardly, the pivot pin 31 riding in the slotted opening 32 in the lever 30 to release the lower end of the lever from engagement with the retaining pin 34. When the locking ring assembly is in locking position the lug 25, which projects radially outwardly from the locking ring, is in position to be struck by the lever 30 when the lever is swung from the dotted line position in Fig. 1 to the solid line position in the same figure. Striking this lug 25 with the lever 30 provides a powerful lever inertia action which rotates the locking ring 19 and moves the cams from sealing position, after which the locking ring rotates freely on the rollers 23 and may be manipulated by the handle 28.

A door or closure 35 comprises a domed portion 37 which may be of suitable boiler plate with a U-shaped handle 38 mounted thereon. A door rim 39 which may be cut, as by means of a cutting torch from a plate of steel of suitable thickness, is of a size to receive the lower marginal edge portion of the domed portion 37 therein. The rim 39 is welded to the portion 37 as shown in Fig. 4.

A plurality of door lugs 40, which may be of approximately the same length as the lugs 23 on the locking ring, projects radially outwardly from the rim 39. On the forward face of each of these lugs a cam 41 is welded similar to the locking ring cams 24.

A pair of hinge support lugs 42 and 43 are welded to the door and these lugs are mounted in hinge supports 44 and 45 which are welded on the tank wall 10 rearwardly of the locking ring. A hinge rod or pin 47 pivotally secures the hinge support lugs to the hinge supports. The fit between the hinge pin 47 and the parts pivotally associated therewith is relatively free so as to

permit some wobble movement of the door when seating under the action of the cams on a locking operation of the locking ring 19.

The operation of the device is as follows: The locking ring 19 is rotated by downward pressure on the handle 28 to the position illustrated in Fig. 1, where it is prevented from further rotation in a counterclockwise direction relatively to the tank by the engagement of the rollers 23 and 27 (see Fig. 6). This moves the lugs 22 on the locking ring out of registering position relatively to the lugs 40 on the door 35. The door 35 is then swung to closed position on its hinges, the door lugs 40 passing through the spaces between adjacent lugs 23 on the locking ring 19.

The operator then grasps the locking ring handle 28 and raises up on it forcibly, thereby rotating the locking ring on the rollers 23 in a clockwise direction as shown in Fig. 1. This action drives the ring locking cams 24 forcibly onto the locking cams 41 on the door, thereby forcing the door rim 39 rearwardly into compressive engagement with the resilient sealing ring 17 and effectively sealing the door to the tank. When thus in cam locked position, the lugs 22 and 40 and cams 24 and 41 are in the relative positions illustrated in Fig. 2. It is to be noted that the locking cams 24 and 41 are so positioned that as the locking ring is rotated into locking position the lugs 22 and 40 initially overlap before the cams overlap and engage, as shown in Fig. 3.

After the processing which is conducted in the tank has been completed, the door is released by raising the releasing lever 30 axially upward to free its lower end from engagement with the retaining pin 34 and then forcibly swinging the lever 30 downward in a clockwise direction from the dotted line position of Fig. 1, causing the lever 30 to strike lug 25 on the locking ring. This action rotates the locking ring in a counterclockwise direction which moves the cams out of engagement with each other and moves the lugs 22 and 40 into the relative positions illustrated in Fig. 3. The hook 33 mounted beneath the lever 30 engages the lug 25 during this downward swinging movement and arrests the rotative movement of the locking ring 19. This prevents the locking ring from rotating beyond the position illustrated in Fig. 3 during this unlocking action by means of the lever 30. This leaves the lugs 22 and 40 in overlapping relation and prevents the door from opening fully, although it is opened sufficiently to release the sealing pressure on the resilient member 17 and permits the release of steam or pressurized gases from the tank. The retaining of the lugs 22 and 40 in such overlapping relation prevents the door from being blown forcibly outward in case pressure should still exist within the tank or retort when the cam lock is released.

After all pressure has been released from the interior of the tank with the parts in the position illustrated in Fig. 3, the lever 30 is returned to the dotted line position illustrated in Fig. 1, thereby releasing the hook 33 from engagement with the lug 25. After the hook 33 has been released from engagement with the lug 25, the locking ring 19 can be rotated by means of the handle 28 to the full limit of its counterclockwise rotation, as determined by the rollers 23 and 27. In this position the door lugs 40 are free to pass between adjacent lugs 22 on the locking ring, and the door may be swung open on its hinges by grasping the door handle 38.

In the embodiment of the invention shown in Figs. 12–15, inclusive, which may be assumed to be for use on a domestic or restaurant cooking vessel 50, a wall 51 of the vessel corresponds to the tank wall 10 in the form previously described. A rim 52 projects radially outward from the upper edge of the vessel wall 51 and a plurality of lugs 53 project radially outward from the periphery of the rim 52. A portion of the lower surface of each of these lugs is sloped, as at 54, to form a cam.

A cover member 55 comprises a domed disc which may be of a diameter substantially equal to that of the rim 52 between the lugs 53. The cover 55 has a groove 57 in the lower edge thereof, as shown in Fig. 14, and a sealing ring 58 of suitable resilient material is mounted in the groove.

A locking ring 59 has an annular top portion 60, the internal diameter of which is substantially equal to the internal diameter of the mouth of the cooking vessel. The locking ring 59 also has an annular side wall portion 61, the internal diameter of which is slightly greater than the overall diameter of the top rim 52 and the lugs 53.

A plurality of radially inwardly directed lugs 62 are provided on the lower edge of the side wall 61, these lugs being of a size to fit within the spaces between adjacent lugs 53 on the rim 52. A portion of the upper surface of each of the inwardly directed locking ring lugs 62 of the locking ring is sloped to form a cam 63 adapted to engage the cams 54 on the rim lugs 53.

A lever 64 is pivoted on the locking ring, the lower end of the lever extending downwardly within the ring so as to be positioned adjacent an end of a lug 53 on the rim 52 when the locking ring is in locking position. The lever 64 has an upwardly extending handle portion 65 in position to be grasped for swinging the lower end of the lever against the end of the rim lug 53, thereby rotating the locking ring to free the cams from locking engagement with each other.

A knob 67 is provided on the locking ring, preferably diametrically opposite to the release lever 64, so that by grasping the knob 67 and the lever 64, the cover may be rotated to force the cams into locking relation with each other, thereby forcing the cover downwardly to compress the resilient sealing ring 58 against the rim 52 as illustrated in Fig. 14.

While I have illustrated and described a preferred embodiment of my invention, both for heavy industrial use and for lighter domestic purposes, it will be apparent to those familiar with the art that numerous modifications are possible without departing from the spirit of my invention. It is, therefore, desired not to limit the invention except as specifically defined in the following claims.

I claim:

1. A closure for pressure vessels comprising in combination with an open mouthed vessel, a rim projecting radially around the open mouth of said vessel, said rim having a sealing surface thereon, a closure adapted to close the open mouth of said vessel, said closure having a sealing surface adapted to be positioned opposite the sealing surface on said rim, a plurality of radially disposed lugs on one of said members having a sealing surface thereon, a cam on each of said lugs, said cams extending less than the full length of said lugs, a locking ring having a portion thereof adapted to overlie a marginal portion of one of said members having a sealing surface thereon, said locking ring having a

plurality of radially disposed lugs adapted to pass between adjacent lugs on said member, a cam on each of said locking ring lugs, said latter cams extending less than the full length of the locking ring lugs, said locking ring being rotatable initially to carry the lugs into overlapping non-sealing relation and thereafter into cam engaging position to force said cover and said rim into mutual sealing engagement, and releasable stop means apart from said lugs for limiting release movement of said locking ring to a position such that said first-mentioned lugs and said locking ring lugs are in overlapping non-sealing relation.

2. A closure for pressure vessels comprising in combination with an open mouthed vessel, a rim projecting radially outward around the open mouth of said vessel, a closure removably positioned on said rim, resilient sealing means interposed between the closure and the rim, a plurality of cam lugs adjacent said sealing member, a rotatable locking ring surrounding said rim and having portions thereof projecting inwardly to overlie said rim and said closure, cam means carried by said locking ring and having cam engagement with said closure, thereby forcing said closure toward said rim in compressive sealing engagement with said resilient sealing member, force multiplying means including

a lever on said vessel mounted to rotate said locking ring toward a cam releasing position, interengaging releasable stop means on said lever and said locking ring to limit the degree of rotation of said locking ring by said force multiplying means, and secondary stop means mounted to limit further rotation of said locking ring after release thereof from said releasable stop means.

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