Aug. 17, 1948. O. O. VELIE 2,447,042

CLOSURE MECHANISM

Filed Feb. 27, 1945 3 Sheets-Sheet 1

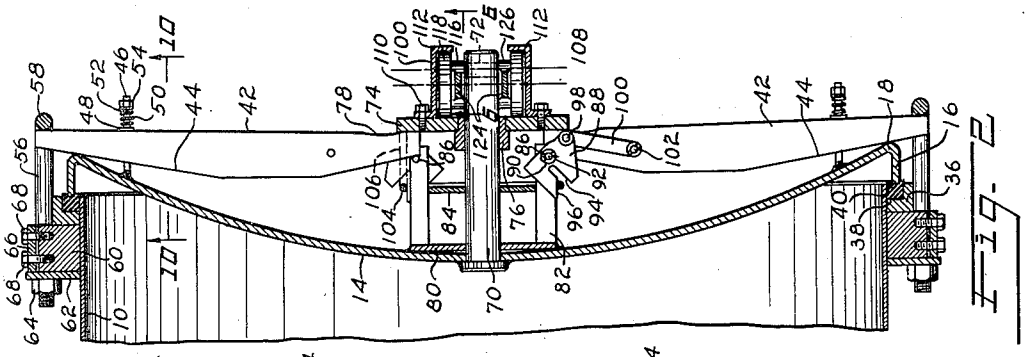

Fig. 2

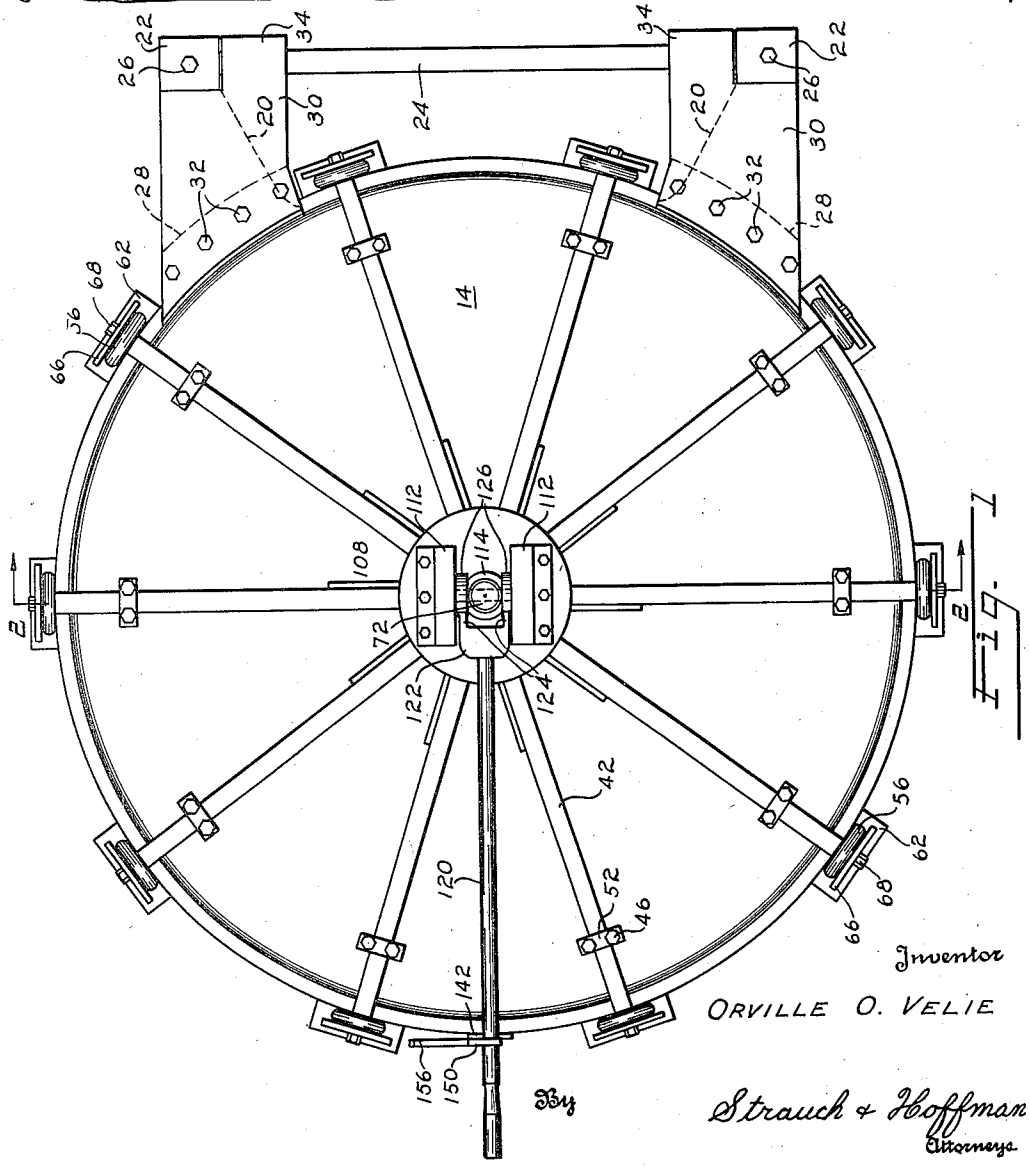

Fig. 1

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Fig. 3

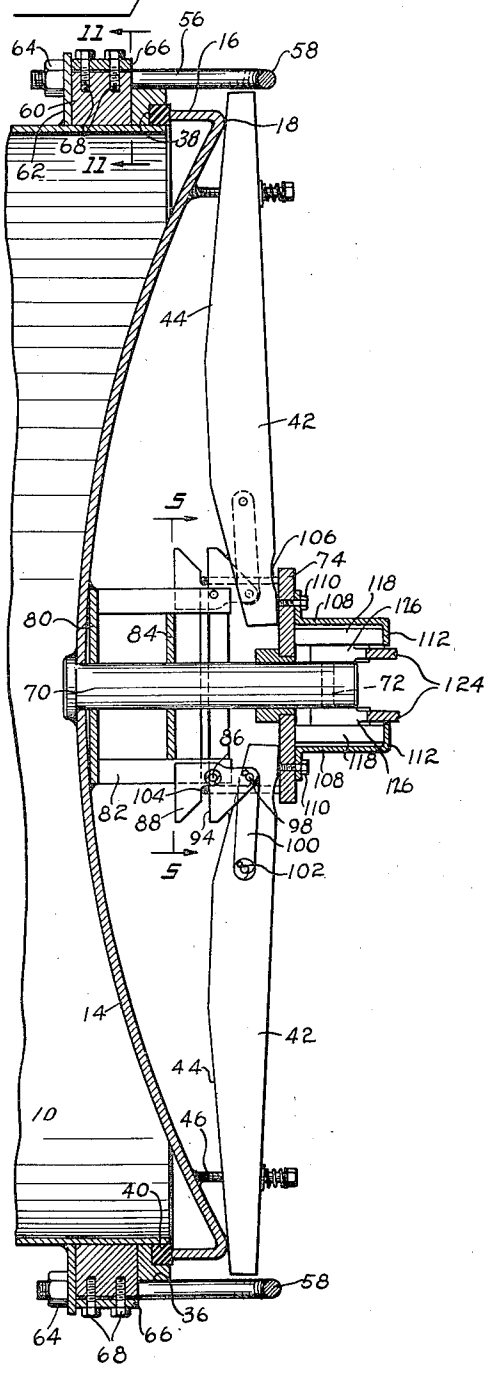

Fig. 4

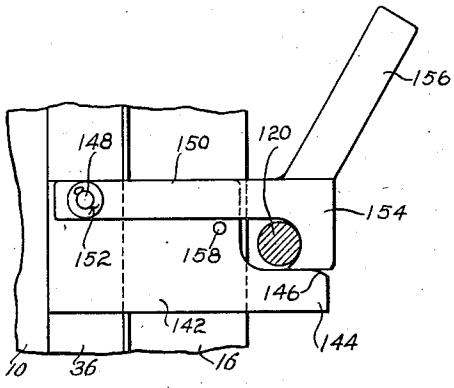

Fig. 5

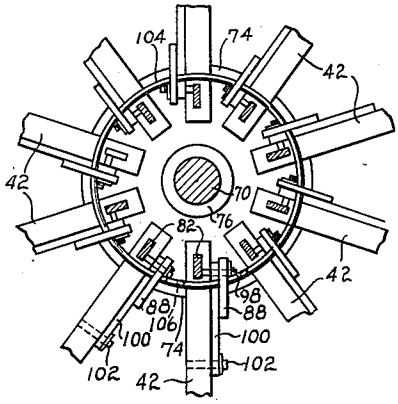

Fig. 6

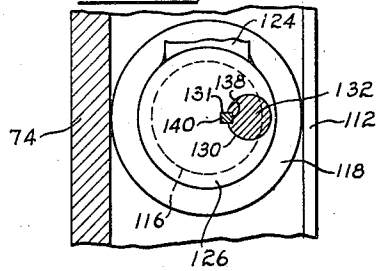

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Fig. 7

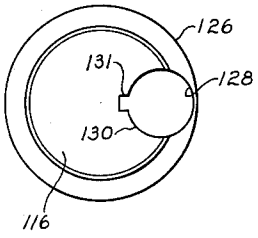


Fig. 8

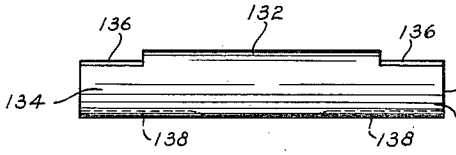


Fig. 9

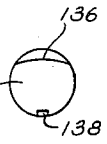


Fig. 10

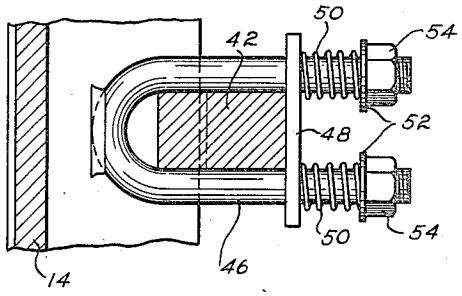


Fig. 11

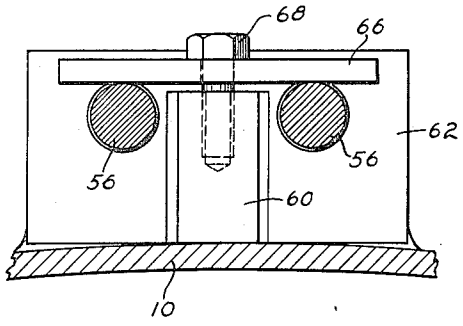
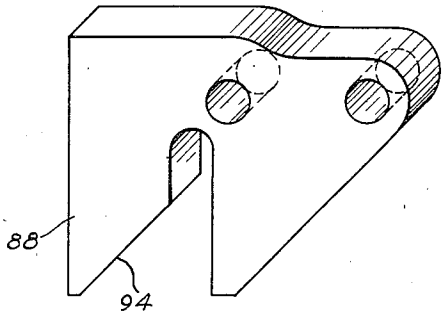


Fig. 12



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Patented Aug. 17, 1948 2,447,042

UNITED STATES PATENT OFFICE

2,447,042

CLOSURE MECHANISM

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Application February 27, 1945, Serial No. 579,932

8 Claims. (Cl. 220—55)

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This invention relates to closure mechanism for pressure vessels such, for instance, as are used in the processing of foods, and for sterilizers, kilns, bulkheads, escape hatches, manholes, or other apparatus requiring a closure mechanism which may be easily and quickly operated to open or closed position.

It is an important object of the present invention to provide a novel mechanism of this kind particularly designed for the purpose of obtaining a substantially fluid-tight seal between the door or closure member and the body of the vessel when the door is in its closed position, but which, nevertheless, may be readily operated with a minimum of manual exertion so that the door may be moved to its open position.

It is another object of the invention to provide mechanism for securely locking or retaining the door or closure member in its closed position, in which the internal pressure in the vessel will not be transmitted through the locking elements to the operating mechanism, therefor mounted on the door, so that said mechanism will be capable of easy operation at all times without resistance by such pressure forces.

It is a more particular object of the invention to provide closure mechanism embodying a plurality of radially disposed locking levers mounted on the door and fulcrumed adjacent their outer ends upon the door for locking engagement with keeper members fixed upon the body of the vessel together with manually operable means centrally mounted on the door and including a novel construction and arrangement of cam elements operatively connected with the respective levers to radially project the same to locking position or to retract said levers and release the door for opening movement.

It is also a further object of the invention to provide a common operating member for the lever actuating cams axially movable relative to the door, together with a pivoted operating lever and means eccentrically connected with the lever pivot controlling the axial movement of said cam operating member.

The invention has for its further aim and purpose to provide a closure mechanism as above characterized which comprises a comparatively small number of cooperating elements of rugged and durable structural form, enabling such a mechanism to be produced at minimum cost, and which will efficiently function in a positive and reliable manner under the most severe conditions of use.

With the above and other subordinate objects in

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view, the invention comprises the improved closure mechanism and the construction and relative arrangement of its several parts, as will hereinafter be more fully described, illustrated in the accompanying drawings and subsequently incorporated in the subjoined claims.

In the drawings wherein I have disclosed one simple and satisfactory embodiment of my invention, and in which similar reference characters designate corresponding parts throughout the several views:

Figure 1 is a front elevation showing one preferred embodiment of my invention;

Figure 2 is a sectional view taken substantially on the line 2—2 of Figure 1;

Figure 3 is a fragmentary section similar to Figure 2 showing the locking levers in retracted position;

Figure 4 is a fragmentary side elevation showing the door cover in closed position;

Figure 5 is a sectional view taken substantially on the line 5—5 of Figure 3;

Figure 6 is a detail section taken substantially on the line 6—6 of Figure 2;

Figure 7 is an end elevation of one of the operating lever roller trunnions;

Figure 8 is a detail elevation of the trunnion pivot pin;

Figure 9 is an end elevation thereof;

Figure 10 is a detail section taken substantially on the line 10—10 of Figure 2;

Figure 11 is a detail section taken substantially on the line 11—11 of Figure 3, and

Figure 12 is a detail perspective view of one of the lever actuating cam plates.

With further detailed reference to the drawings, in Figure 2 thereof I have shown the open end portion of the body 10 of a pressure vessel such as is generally used in the processing of food products. As herein shown, the door or cover 12 for the open end of the vessel 10 is in the form of a concavo-convex plate 14 of aluminum alloy or other sheet metal of the requisite thickness. The convex side of the door plate faces inwardly and at its perimeter is formed with an inwardly projecting annular rim or flange 16 joined to the body of the door plate by the curved wall section 18 which provides an outer convex bearing surface for the ends of the locking levers to be presently described.

While the door structure above described may be inexpensively fabricated and is light in weight, it will become apparent from the following description that the present invention is also applicable for use in connection with door struc-

tures of various other forms and sizes. Also any suitable means may be employed for hingedly mounting the door at one side thereof upon the body 10 of the vessel. For this purpose, I have herein shown a pair of hinge arms 20 riveted or otherwise securely fixed at one of their ends upon the outer side of the body wall 10, above and below a horizontal plane intersecting the axis of the vessel, and projecting laterally therefrom. These arms terminate at their free ends in the sleeves or knuckles 22 in which the upper and lower ends of the vertical hinge rod 24 are suitably fixed, as by means of set screws indicated at 26. Similar hinge arms 30 are rigidly secured at their inner ends to flanged metal plates 28 which are welded or otherwise securely fixed to the outer face of the door flange 16. Preferably the hinge arms 30 are detachably secured to the plate 28 by means of the bolts indicated at 32. At their outer ends the arms 30 are formed with hinge knuckles or sleeves 34 which are arranged in alignment respectively with the upper and lower knuckles or sleeves 22 and loosely receive the hinge rod 24. If desired, a suitable type of anti-friction thrust bearing may be interposed between the lower hinge knuckles 22 and 34 to facilitate the free swinging movement of the door structure to open and closed position.

The body wall of the vessel 10 at its open end is circumscribed by a metal ring 36 of rectangular form in cross section which is welded or otherwise permanently fixed to said wall. This ring is formed with an internal annular recess 38 having an open side substantially flush with the end edge of the body wall 10. Within this recess, a ring of packing material 40 is contained against which the edge of the cover flange 16 is forcibly urged when the cover is in closed position to thus form a substantially fluid-tight seal between the cover and the body of the vessel.

The mechanism which I provide for releasably locking the cover 14 in its closed position may be best described with reference to Figures 1 to 6 of the drawings, from which it will be noted that said mechanism includes a plurality of locking levers 42 disposed radially of the door or cover plate, said levers being of rectangular form in cross section and having longitudinally inclined inner edge portions 44 converging toward the outer ends of the levers with respect to their outer edges and having fulcrum contact adjacent their outer extremities upon the convex annular surface 18 of the door or cover 14 and upon which said levers have rocking as well as radial movement. Inwardly of the door surface 18 an inverted U-shaped guide rod 46 straddles each of the levers 42. The intermediate portions of these guide rods are welded or otherwise securely fixed to the outer surface of the door or cover 14. Upon the parallel portions of each guide rod 46 the apertured ends of a metal plate 48 are loosely engaged, said plate being yieldingly urged into bearing contact upon the outer edge of the lever by means of the coil springs 50. The outer ends of said springs bear against the pressure plates 52 and nuts 54 are threaded upon the ends of the rod 46 whereby the tension of the springs 50 may be properly regulated.

The outer end of each lever 42 is adapted for engagement within a U-shaped keeper rod 56, suitable means being provided for properly adjusting this rod so as to position its medial portion 58, with the inner side of which the end of the locking lever has bearing contact, in proper relation to the part 18 of the door or cover when the latter is closed. This adjustable mounting for the keeper rod 56, as herein shown, includes a metal lug or block 60 at the inner side of the ring 36 to the rear edge of which a plate 62 is centrally welded and projects beyond the outer end of said lug. This plate and the lug may be welded or otherwise suitably fixed to the wall of the vessel 10. The threaded ends of the legs of the keeper rod 56 are received through openings in the plate 62 and provided with nuts 64 for adjusting the position of the keeper relative to said plate. The keeper rod is securely clamped and held in adjusted position by the plate 66 disposed transversely across the outer end of the lug 60 and the legs of the keeper rod and rigidly secured in contact therewith by cap screws 68 engaged in threaded bores in the lug.

One end of a guide rod 70 is welded or otherwise secured to the door or cover plate 14 and projects axially therefrom. This rod adjacent to its other end is provided with a transverse opening 72 for a purpose to be presently explained.

A metal disk or plate 74 is provided with a central bushing 76 having free sliding movement on the rod 70. The levers 42 have tapering inner end portions extending beneath the disk 74, the outer edges of the levers being cut away or arcuately recessed as at 78 to permit relative angular movement between the contacting inner ends of the levers and the plate or disk 74 in the outward radial projection of the levers to locking position.

Surrounding the rod 70 a base plate 80 is welded at its outer edge to the door plate 14. To this plate a plurality of circumferentially spaced guide arms 82 are rigidly fixed at their inner ends, said arms being disposed in parallel relation with the rod 70. These guide arms may also be rigidly connected and supported relative to the rod 70, intermediate of their ends by means of the annular web or plate 84 suitably joined at its outer edge to each of said arms. In the outer end of each arm 82 a pivot pin or stud 86 is rigidly fixed and projects transversely from one side thereof. On this pin, a cam plate 88 is oscillatably supported, and held against axial movement on the pin by the washer 90 and cotter pin 92 or other equivalent means. The cam plate 88 at one side of the pivot 86 is provided with a slot 94. The inner closed end of this slot is located adjacent the pivot pin 86 and the outer end thereof opens upon one edge of the plate 88 and has one side edge thereof obliquely inclined at an angle of approximately 45°, as indicated at 96, which provides a flaring or gradually widening entrance to said slot.

Each of the cam plates at its outer end carries a fixed pivot pin 98 with which one end of a link 100 is connected, said link at its other end being connected with a similar pivot pin 102 fixed in one of the levers 42. It will of course be understood that the number of the guide arms 82 and of the cam plates 88 and links 100 corresponds with the number of locking levers 42.

The cam plates 88 are actuated by a common operating member in the form of a ring 104 which surrounds the arms 82 and is guided thereby in its axial movement relative to the fixed post or rod 70. This ring is rigidly connected to the plate or disk 74 between the spaced locking levers 42 by means of the spaced rods 106 which may be welded or otherwise rigidly fixed at their ends to said ring and plate.

Upon the front face of the plate or disk 74, above and below the rod 70, the Z-shaped plates 108 are mounted, the flanges at one end of said

plates being rigidly fixed to the disk 74 by the bolts 110. At the opposite ends of said plates, the flanges 112 thereof project inwardly towards each other. In the opening 72 of the rod 70 the intermediate portion of a pin or shaft 114 is rotatably mounted. To the opposite ends of this pin, trunnions 116 are eccentrically fixed and upon these trunnions the rollers 118 are journalled for free rotation between the disk 74 and the flanges 112 of the plates 108.

An operating lever 120 has a forked head 122 suitably secured to one end thereof, the spaced arms 124 of said head being welded or otherwise permanently secured to the peripheral faces of the cylindrically enlarged inner ends 126 of the trunnions 116.

Referring more particularly to Figure 7 of the drawings, it will be noted that the pin or shaft receiving opening of each trunnion 116 includes an eccentrically located cylindrical portion 128 extending through the enlarged end 126 of the trunnion and a semi-cylindrical portion 130 extending through the roller bearing portion of the trunnion and opening upon the peripheral face thereof. At the inner side of said pin receiving opening, a keyway 131 is formed in the trunnion.

Referring now to Figures 8 and 9 of the drawings, the pin or shaft 114 includes an intermediate cylindrical section 132, the opposite end portions of which are received in the cylindrical ends 128 of the openings in the roller bearing trunnions. At its opposite ends the pin 114 is formed with the semi-cylindrical sections 134, said end sections at one side of the axial center of the pin being provided with the convex arcuate surfaces 136, the radius of which is substantially the same as the radius of the roller bearing sections of the trunnions 116, as will be clearly seen in Figure 6 of the drawings. The pin 114 is also provided with longitudinal keyways 138 extending inwardly from the ends thereof and having a length substantially corresponding to the axial length of the trunnion 116. These keyways are disposed in mating relation with the keyways 131 in the trunnions to receive the keys 140, whereby the trunnions 116 are rigidly fixed on the ends of the pin 114 in eccentric relation to the axis of rotation of said pin.

From the above description, the operation of my improved closure mechanism will be readily understood. When the door or cover 14 is in open position, the operating lever 120 is disposed in angularly projecting relation to the plane of the door structure and the locking levers 42 are in approximately the positions shown in Figure 3 of the drawings. After first swinging the door structure upon the hinge rod 24 to closed position with its flange 16 in contact with the packing ring 40 on the body wall of the vessel, the operating lever 120 is then forced inwardly toward the door. The eccentrically mounted rollers 118 are thus caused to exert an inward bearing pressure against the disk 74, also moving the ring 104 inwardly along the guide arms 82. This ring, coacting with the slots 94 in the cam plates 88, rocks said cam plates upon the pivot pins 86, forcing the link connections outwardly and thereby radially moving the locking levers 42 outwardly on the door structure. The outer ends of said levers are received between the parallel legs of the respective U-shaped keeper rods 56. In this outward movement of the locking levers, as the links 100 also exert an inward thrust upon the inner ends of said levers axially of the door, the inclined edges 44 of the levers will fulcrum on the part 18 of the door structure so that the outer ends of the levers engaged in the keeper rods 56 are angularly moved in the plane of the levers to exert an outward thrust against the intermediate portions 58 of the keeper rods and an inward thrust on the adjacent door flange 16. Thus the edge of this door flange is forced into fluid-tight sealing contact with the packing ring 40. In the outward radial movement of the levers 42 to locked position, rocking or fulcruming contact of the edges 44 of said levers upon the part 18 of the door structure is yieldingly maintained by means of the bearing plates 48 and springs 54.

By reference to Figure 2 of the drawings, it will be noted that when the door structure is thus locked in closed position any inward radial movement of the locking levers 42 relative to the keeper rods 56, independently of the operating lever 120, is effectively prevented by reason of the bearing contact of the edges 96 of the cam plates 88 against the inner side of the operating ring 104. Also it will be observed that the inner ends of the locking levers 42 are in bearing contact with the inner face of disk or plate 74. Further, the cam plates and link connections with the levers 42, by reason of the contact of the edges 96 on said plates with the operating ring 104 prevent any outward pressure by the inner ends of the locking levers against the disk 74. In other words, the pressure within the vessel 10 against the door structure will react substantially entirely against the outer ends of the levers and the keeper rods 56. This is a very important factor in the ease of operation of the mechanism in opening the door, since there is a minimum resistance to relative movement between the cam plates and link connection 100 in retracting the levers 42 from the locking positions of Figure 2 to the door releasing positions shown in Figure 3. Thus relatively little manual exertion will be required to operate the lever 120 and cause the eccentrically mounted rollers 118 to exert an outward bearing pressure against the flanges 112 of plates 108, whereby the ring 104 is engaged in the cam slots 94 and the actuating elements for the locking levers 42 are moved to the positions seen in Figure 3.

For the purpose of centering the outer ends of the locking levers 42 with respect to the keeper rods 56 and to releasably latch the operating lever 120 against accidental movement from its locking position, I preferably secure, by welding or otherwise, one end of a lug 142 to the peripheral face of the ring 36 on the body wall of the vessel, said lug projecting forwardly from said ring and having an end portion 144 of reduced width provided with an upper curved cam edge 146. As seen in Figure 1, this lug is so located on one side of the vessel that as the operating lever 120 is forced inwardly toward the door structure, the lower face thereof will engage and ride upwardly over the cam edge 146 of the lug 142, in the event that there is any looseness in the hinge connections between the door and rod 24 due to wear. Thus, the outer ends of the levers 42 in their locking positions are substantially centrally located in the U-shaped keeper rods 56 and out of frictional contact with the side legs thereof, which further conduces to the easy and quick retracting movement of the locking levers.

In the fixed end of the lug 142 adjacent the upper edge thereof the pivot stud 148 is rigidly secured and upon this pin or stud one end of the latching lever 150 is pivotally retained by the

cotter pin 152. The free end of the lever 150 is formed with a downwardly extending hook 154 and an upwardly and forwardly projecting handle 156. Downward swinging movement of the lever 150 to its latching position is limited by the stop pin 158 fixed in the lug 142. Thus, it will be evident from reference to Figure 4 of the drawing that, at the end of the locking movement of the operating lever 120, when said lever is positioned upon the end portion 144 of the lug 142, the latch lever 150 may be swung downwardly so as to engage the hooked end 154 thereof over the outer side of the lever 120, and thus effectively latch said lever against accidental horizontal outward movement with respect to the door structure, which might result in an inward retraction of the latching levers 42 and a release of the sealing pressure of the door flange against the packing strip 40.

From the foregoing description and the accompanying drawings, it will be seen that I have devised a very novel closure mechanism of general application and use and which may be very easily and quickly operated with a minimum of manual effort. The invention is more particularly applicable to sterilizers or vessels in which food or other materials are processed under high temperatures, in which case more or less frequent periodic opening and closing of the door or cover structure is required for purposes of inspection. By means of the present invention, after each inspection, the door structure may be quickly moved to closed position and locked by the rapid outward movement of the levers 42 to their locking positions in connection with the keepers 56 while at the same time a substantially air and fluid-tight seal between the door structure and the body of the vessel is obtained. Thus, reduction in tempertaure in the interior of the vessel will be held to a minimum. Also the locking levers can as easily be retracted, notwithstanding high internal pressures, it being noted that in this retracting movement of the levers, recesses 78 in the outer edges thereof permit rocking and radial outward movement of the inner ends of the levers without frictional resistance from the disk or plate 74. Also, in order to further reduce frictional resistance to the operation of the mechanism, if desired, a suitable type of anti-friction bearing may be used between the rollers 118 and the eccentrically mounted lever trunnions 116.

My improved closure mechanism, as herein disclosed, comprises a comparatively small number of elements of simple and rugged structural form which may be easily and quickly assembled in proper cooperative relation so that the production cost of such a mechanism will be relatively low. While the embodiment of the invention herein described has given excellent results in practical use, it is apparent that the latching levers 42 may be of other structural forms and also that a greater or less number of these levers may be provided than illustrated herein, as may be found most advisable in any particular application of the invention.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In combination with a hollow body and a cover structure hingedly mounted on one end thereof, a plurality of keeper members circumferentially spaced about the body wall and fixed thereto, a rod fixed at one of its ends to the cover structure in coaxial relation thereto, a plurality of radially disposed locking levers slidably engaged at their outer ends with the cover structure, a plurality of guide arms fixed to said structure in parallel relation to said rod, actuating means individual to the respective levers to radially project said levers into locking engagement with the keepers and to retract the same therefrom, said means including a cam plate pivotally mounted on each of said guide arms and a link pivotally connected to one of said plates and to one of the levers, and manually operable means mounted on said rod including a common operating member for said cam plates surrounding said guide arms and movable axially thereof to simultaneously coact with said cam plates.

2. The combination defined in claim 1, in which said manually operable means also includes a disk axially movable on said rod and rigidly connected with said operating member, and said locking levers when in locking position have bearing contact at their inner ends with a side face of said disk.

3. The combination defined in claim 1, in which said manually operable means also includes a disk axially movable on said rod and rigidly connected with said operating member, an operating lever pivotally mounted at one end on said rod, and rollers eccentrically mounted on the ends of the lever pivot in eccentric relation to the pivot thereof coacting with means on said disk to transmit axial movement thereto in each direction.

4. The combination defined in claim 1 in which the keeper members are of U-shaped form and the levers are projected between the legs thereof, and the manually operable means includes a pivotally mounted operating lever, and wherein a cam lug is fixed to the body and coacts with said operating lever to center the locking levers between the legs of the keeper members.

5. The combination defined in claim 1 in which the keeper members are of U-shaped form and the levers are projected between the legs thereof, and the manually operable means includes a pivotally mounted operating lever, and wherein a cam lug is fixed to the body and coacts with said operating lever to center the locking levers between the legs of the keeper members, together with a latch member pivotally mounted on said cam lug to engage and hold the operating lever against accidental movement in a direction to retract said locking levers.

6. In locking mechanism for vessel closures, a rod centrally fixed to the closure, a plurality of radially movable locking levers, and means for actuating said levers to and from locking position comprising a cam plate associated with each lever and pivotally mounted on the closure in parallel relation to the lever, a link pivotally connected to the cam plate and to the associated lever to impart longitudinal thrust forces to the latter, a plate axially movable on said rod and having direct bearing contact upon the inner ends of said levers when in locking position, manually operable means mounted on said rod for axially moving said plate in each direction, and means rigidly connected to said plate and coacting with

the cam surfaces of said cam plates to pivotally rock the latter and cause said links to bodily move said locking levers radially of said axially movable plate to or from locking position.

7. The locking mechanism defined in claim 6, wherein said last named means includes an annular member concentric to said rod and each cam plate having a slot receiving said member when the levers are moved to unlocking position.

8. In locking mechanism for vessel closures, a rod centrally fixed to the closure, a plurality of radially movable locking levers, and means for bodily moving said levers radially to and from locking position, comprising individual actuating means mounted on the closure and operatively connected to the respective levers, a plate axially movable on said rod, an operating lever having a pin fixed to one end thereof rotatably mounted in a transverse opening in said rod, spaced members fixed to one side of said plate, means eccentrically carried by each end of said pin coacting with said members and the plate to move the latter axially of the rod in opposite directions,

and means connected to the opposite side of said plate in axially spaced relation therefrom for simultaneously operating said individual actuating means for the locking levers.

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