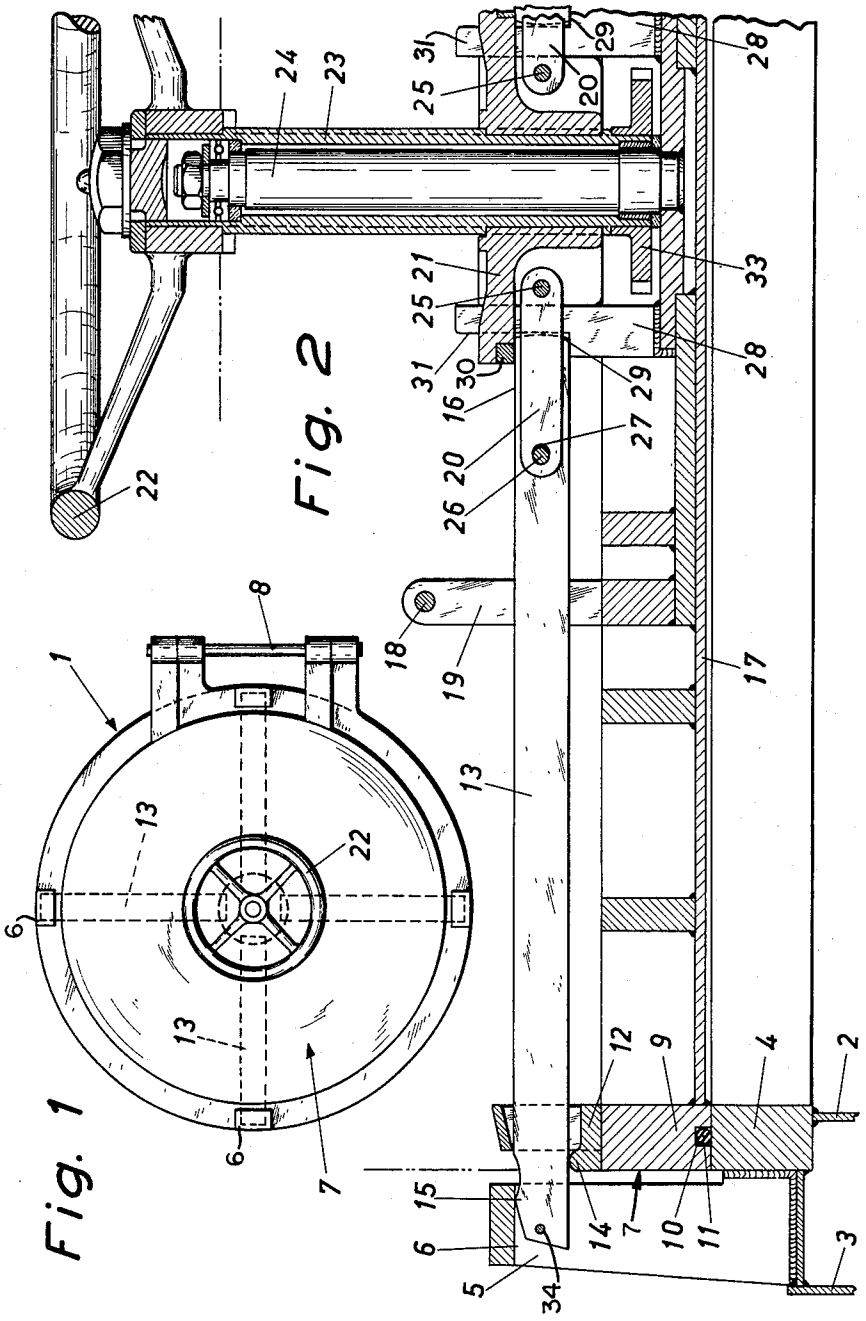
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LOCK FOR DOORS TO AUTOCLAVES AND THE LIKE

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LOCK FOR DOORS TO AUTOCLAVES AND THE LIKE

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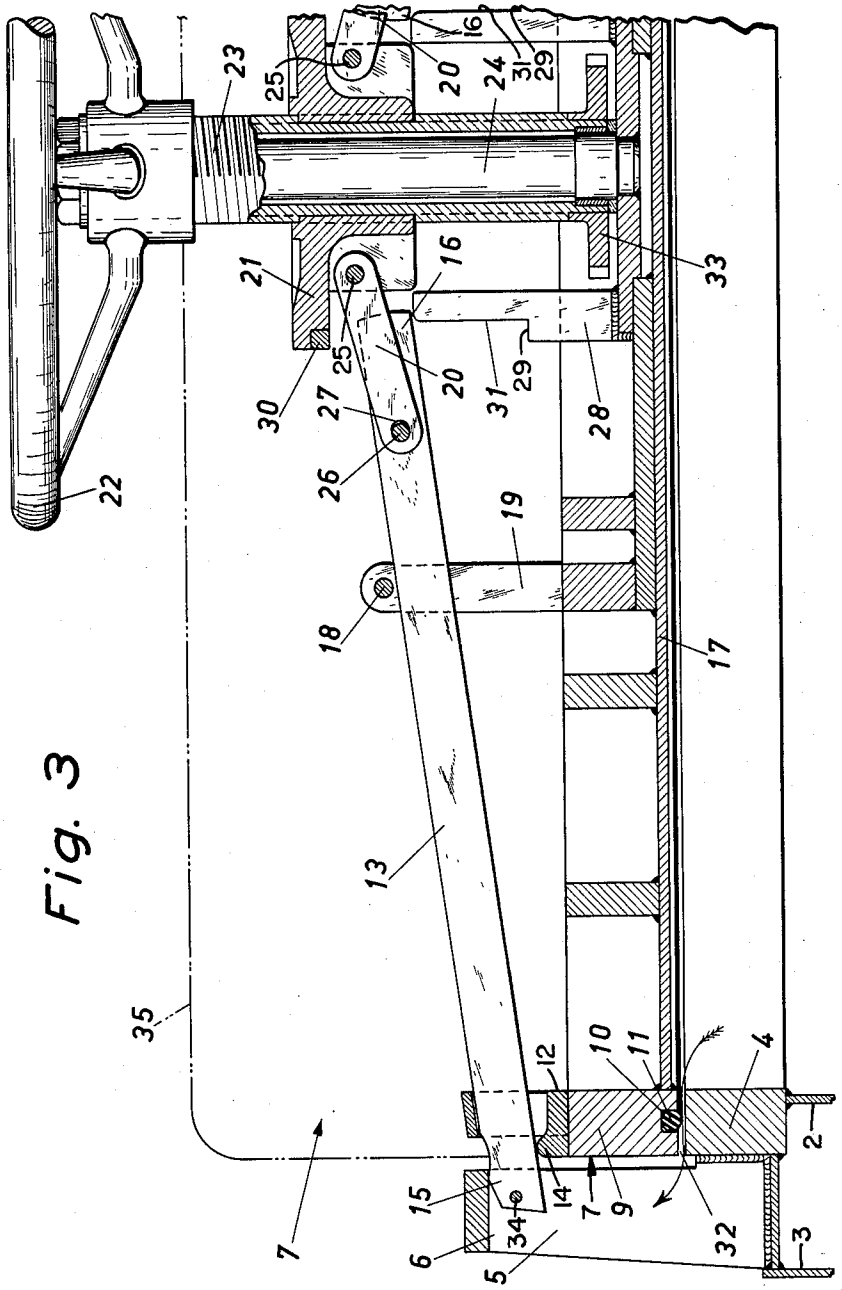


Fig. 3

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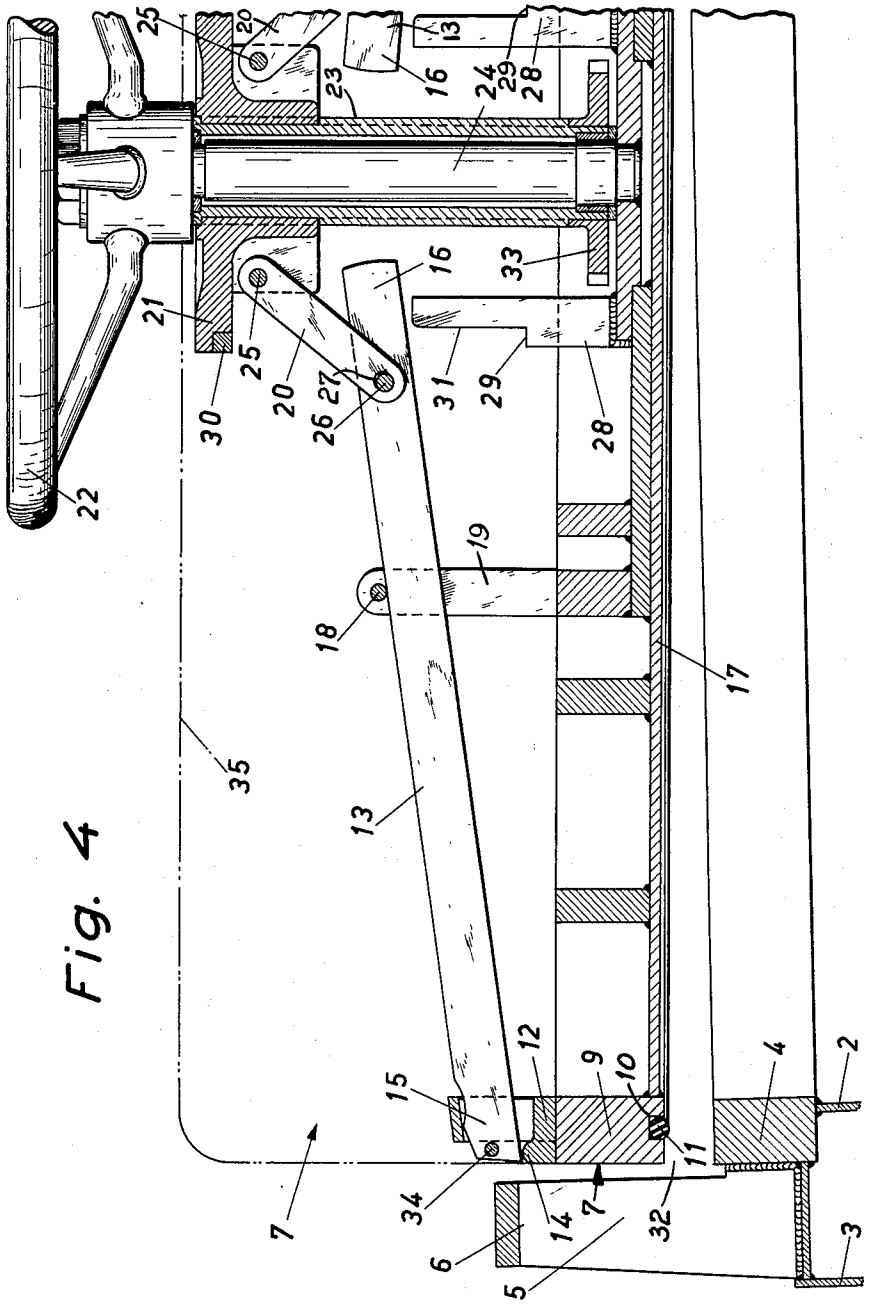


Fig. 4

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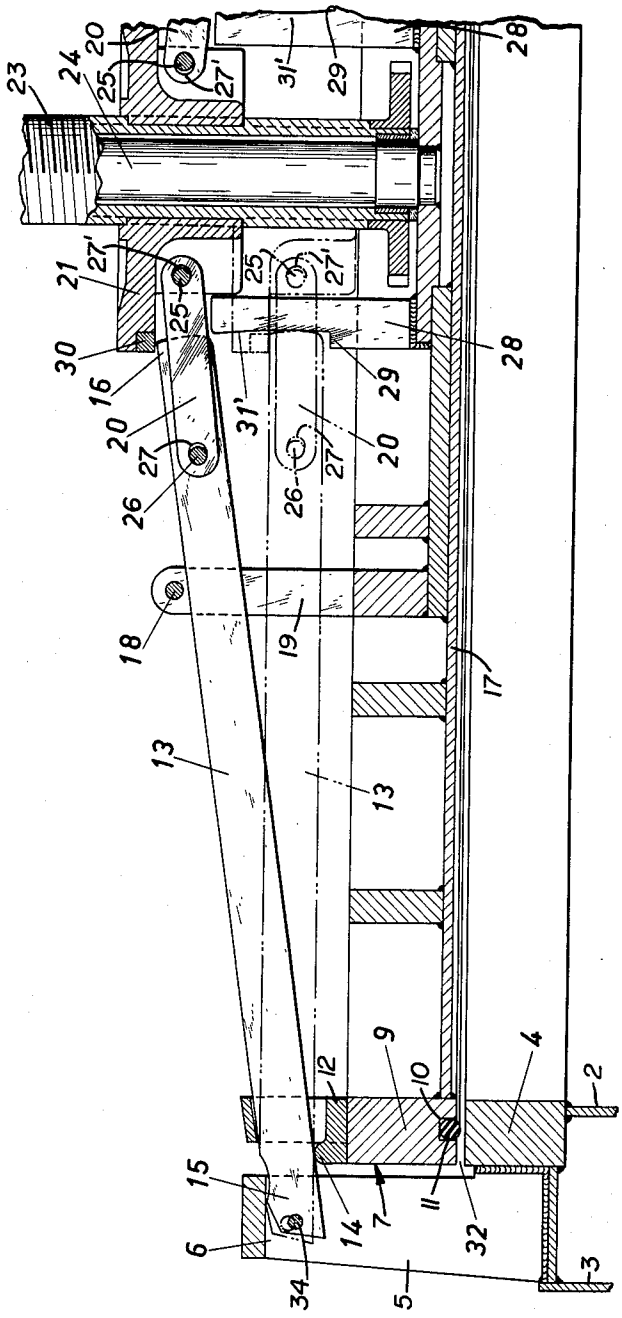


Fig. 5

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LOCK FOR DOORS TO AUTOCLAVES AND THE LIKE

Knut Anders Osborne Wallden, deceased, late of Kaptensgatan 1, Kungsbacka, Sweden, by Carl Lennart Jonsson, legal representative, Kungsbacka, Sweden

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15 Claims. (Cl. 292—6)

This invention relates to vessels in which fluid pressures are developed, such as steam heating cabinets and other big containers employed for sterilization. Vessels of this type, which hereinafter will be referred to as autoclaves, are usually provided with locking devices for the doors which are of such construction that when safety devices, which normally are provided for autoclaves to vent steam or vapor from the interior of the autoclaves to the atmosphere before the doors are opened, are out of order, the locking devices will permit the doors to be opened to such an extent that the vapor or steam will vent at a high velocity through gaps between the door rims and the door frames before the locks or locking devices are completely opened.

This invention relates more particularly to locks or locking devices for doors of autoclaves and the like of the kind which comprise a number of lock bolts actuated by screw spindles and nuts, the lock bolts being axially movable in their lengthwise directions from the screw spindles for their outer ends to engage behind inward facing surfaces of the door frames for retaining the doors in their closed positions against the pressures developed in the autoclaves, the bolts including linkage pivotally connected to the nuts and functioning as two-armed levers which are swingable about guide surfaces formed at the peripheries of the door rims.

Further, the doors are provided with stops or abutments for limiting the swinging of the levers to definite outer positions. The main feature of the invention is that the doors are also provided with abutments arranged closely adjacent to the screw spindles and formed with slide surfaces which are turned towards and face the inner ends of the lock bolts, the abutments being adapted when the doors are opened to prevent axial movement of the lock bolts toward the screw spindles until, responsive to the swinging outward movements of the two-armed levers of the lock bolts, their inner ends engage the stops or abutments.

The stops or abutments function as guides for the inner ends of the lock bolts and make certain that the lock bolts, when the doors are opened, will first swing about the guide surfaces or border heels at the peripheries of the door rims until they reach or almost reach the stops or abutments before they are retracted clear of the shackles. Due to the swinging movement of the locking bolts just described, the doors move from the door frames to provide sufficient play between the door rims and door frames to allow vapor or steam in the autoclaves to vent therefrom to reduce the pressure therein. With continued outward movement imparted to the nuts, the lock bolts are actuated and axially moved inward so that their outer ends move out of engagement with the shackles. Under these conditions the pressures in the autoclaves will be reduced to such an extent that the doors cannot be thrown outward by the pressures and strike the operators of the autoclaves.

The invention will now be described with reference to the accompanying drawings, in which:

FIG. 1 is a front elevation of an autoclave embodying the invention with the door closed;

FIG. 2 is an enlarged fragmentary sectional view taken through the central portion of the autoclave shown in FIG. 1 with the door closed;

FIG. 3 is a sectional view similar to FIG. 2 with the door in an initial open position;

FIG. 4 is a sectional view similar to FIG. 3 with the lock bolts completely retracted to permit the door to be fully opened; and

FIG. 5 is a fragmentary sectional view of another embodiment of the invention illustrated in FIGS. 1 to 4.

The autoclave 1 shown in FIGS. 1 to 4 is provided with a casing having an inner wall 2 and an outer wall 3. A frame 4 with forwardly extending shackles 5 extends around the open end of the autoclave, and each of the shackles 5 is provided with an engagement portion 6. The autoclave door 7 is provided with a hinge 8 about which the door can be moved. An annular groove 10 is provided about the door rim 9 which opens toward the frame 4 and receives a ring-shaped gasket member 11. The front of the door rim 9 is provided with a number of shackle-shaped supports 12 through each of which a lock bolt 13 passes. The supports 12 are provided with border heels or guide surfaces 14 about which the lock bolts 13 can be swung like two-armed levers, as seen in FIGS. 3 and 4. The outer ends 15 of the lock bolts 13 are axially moved against the rear faces of the engagement portions 6.

The swinging movement imparted to the lock bolts 13 causes their inner or rear ends 16 to move from the door bottom 17 and is limited or restricted by stops or abutments 18 provided on stands or members 19 extending forward from the bottom 17 of the door 7. By means of links 20 the lock bolts 13 are journaled on a nut 21 which is axially movable on a screw spindle 23 provided with a hand wheel 22. The screw spindle 23 is axially immovable on a bolt 24 upon which it is mounted and extends forward from the door bottom 17. The links 20 at one end are pivotally connected by bolts 25 on the nut 21, and the opposite ends thereof are pivotally connected by bolts 26 to the inner ends 16 of the lock bolts 13.

Ports or openings 27 at the outer ends of the links 20 are oblong and larger than the bolts 26 extending therethrough. The ports or openings 27 extend lengthwise of the links 20. It is therefore possible to impart swinging movements to the links 20 to a certain extent without transmitting a corresponding movement to the lock bolts 13. Abutments or stops 28 are provided for the rear or inner ends 16 of the lock bolts 13 at the vicinity of the central portion of the door 7. The abutments 28 are formed with shoulders 29 against which the rear or inner ends 16 of the lock bolts 13 are angularly moved when the door 7 is locked, the inner ends 16 of the lock bolts 13 being moved against the shoulders 29 of the members 28 by a ring 30 of a wear resistant material at the underside of the nut 21. Outside the shoulders 29 the guiding borders or guide surfaces 31 of the abutments 28 incline toward the outer end of the bolt 24 and face the inner or rear ends 16 of the lock bolts 13 which are slightly bevelled or rounded.

The door 7 of the autoclave is closed in the following manner. The door 7 is first moved about the hinge 8 until the door rim 9 is at the door frame 4. The spindle 23 is then rotated by the hand wheel 22 to move the nut 21 toward the door bottom 17. When the inner ends 16 of the lock bolts 13 engage the outer or forward ends of the abutments 28, as shown in FIG. 3, the links 20 function to move the lock bolts 13 axially outward into the shackles 5 on the door frame 4. Such outward axial movement of the lock bolts 13 continues until their inner ends 16 engage the guiding borders or guide surfaces 31. The outward axial movement of the lock bolts 13 then ceases and they swing or pivot about the border heels or guide surfaces 14 on the supports 12 to lock the door 7 in its closed position and compress the tightening gasket 11 against the door frame 4. The

pivotal movement of the lock bolts **13** continues until their inner ends **16** engage the shoulders **29** providing the door **7** has not already reached the limit of its closing movement. The pressure at which the door **7** is held closed by the mechanism illustrated and described above should, of course, exceed the internal pressures developed within the autoclave during its operation.

When the door **7** is opened, the spindle **23** is turned in the appropriate direction by the hand wheel **22**. This causes the nut **21** to move outward from the front face of the door **7** and pivotally move the links **20**. By providing oblong ports or openings **27** the links **20** will be moved to a definite angular position with respect to the lock bolts **13** before the rear or inner ends **16** of the lock bolts pivotally swing and move from the inner face of the door **7** or door bottom **17** by movement imparted thereto by the links **20** while the lock bolts move along the guide borders or surfaces **31**. Such pivotal movement imparted to the lock bolts **13** is promoted and aided by the pressures developed within the autoclave which cause the lock bolts **13** to swing outward and engage the stops or abutments **18**. The outward movement imparted to the rear or inner ends **16** of the lock bolts **13** forms a gap **32** between the door rim **9** and the door frame **4**, as shown in FIG. 3, to enable vapor or steam to vent from the interior of the autoclave and to reduce the pressure therein. With this arrangement there is no danger that the door **7** will be thrown outward by the pressures developed within the autoclave because the outer ends **15** of the lock bolts **13** are still held within the closed ends **6** of the shackles or U-shaped brackets **5**. When the nut **21** is moved further outward, the lock bolts **13** will be retracted and disengaged from the shackles or holding brackets **5** to permit the door **7** to be moved to its fully open position.

In the modification shown in FIG. 5, it will be seen that the outward facing surfaces **31'** are of concave form. When the door **7** is opened in the modification of FIG. 5 the concave-shaped guide surfaces **31'** function to make certain that the outer ends **15** of the lock bolts **13** will not become disengaged from the closed ends **6** of the holding brackets **5** before the inner or rear ends **16** thereof engage the stops or abutments **18**, as shown in FIG. 5. The guide surfaces or borders **31'** of the abutments **28** may form arcs of circles with the heel borders or guide surfaces **14** as the radii of curvatures.

In FIG. 5, when the autoclave door **7** is closed, the lock bolts **13** and links **20** assume the positions shown in dotted lines. When the lock bolts **13** are moved outward or forward by the links **20** toward the solid line positions shown in FIG. 5 with the rear or inner ends **16** of the lock bolts **13** moving over the upper ends of the guide surfaces or borders **31'**, the links **20** will then be essentially in alignment with the lock bolts **13** and serve as extensions of the lock bolts **13**. Hence, when the door **7** is being closed by moving the nut **21** toward the door bottom **17** no noticeable outward axial movement and no noticeable pivotal movement is imparted to the lock bolts **13**. When the ring **30** of the nut **21** reaches and acts against the inner ends **16** of the lock bolts **13**, pivotal movement is then imparted to the lock bolts and their inner bevelled ends will move and slide over the guide surfaces or borders **31'** toward and against the shoulders **29**, as shown in the dotted and solid line positions of the parts in FIG. 5.

When the door **7** is opened, the lock bolts **13** swing or pivot about the outer guide surfaces **14** due to the towing or pulling effect of the links **20**, the rear or inner ends **16** of the lock bolts sliding and moving along the guide surfaces or borders **31'** with no inward axial movement being imparted to the lock bolts **13** until the latter strike and engage the stops or abutments **18**. The swinging movement imparted to the lock bolts **13** causes the gap **32** to be formed between the door rim **9** and the door frame **4** to enable vapor or steam to vent from the autoclave, whereby the pressure will be reduced so that the door **7** can be opened safely by moving the nut **21** outward from the door and retracting the lock bolts **13** axially from their locked positions.

A safety device, as pointed out above, usually has been provided in autoclaves according to regulations in effect to relieve the pressures developed in autoclaves before the doors are opened. The safety device may include a gear like the gear **35** illustrated in FIGS. 2 to 5. By employing the improvement illustrated and described above, such a safety device is, of course, not necessary.

Stop pins **34** may be provided at the outer ends **15** of the lock bolts **13**. The pins **34** are arranged to engage the support members **12** when the lock bolts **13** are in their retracted positions and out of engagement with the holding brackets **5**. The door **7** may be provided with a body of insulation diagrammatically indicated by the dotted line **35**.

In view of the foregoing, it will now be understood that the autoclave **1** essentially is a pressure vessel having a door frame **4** and door **7** having a rim **9** formed with guide means **12, 14**. The nut **21** may be referred to as a part which is mounted on the screw spindle or mounting means **23** for forward and rearward movement thereon from and toward, respectively, the inner face or bottom **17** of the door **7**. A plurality of lock members **13, 20** are movable radially outward and inward, respectively, from and toward the part **21**. The outer ends **15** of the lock members **13, 20**, upon outward radial movement thereof from the part **21**, engage the inward facing surface portions **6** of the door frame **4** to hold the door **7** in its closed position. Each of the lock members **13, 20** comprises a pair of inner and outer link elements **20** and **13**, respectively, defining toggles having knuckles, first connecting means **26** at the knuckles for pivotally connecting the outer and inner link elements to one another and second connecting means **25** pivotally connecting the inner ends of the inner link elements **20** to the part **21**. The pivotal connecting means **25** and **26** form components of motion transmitting means for imparting radial movement to the lock members **13, 20** in which the latter are swingable like two-armed levers with the outer link elements **13** pivotally movable about the guide means **12, 14** at the rim **9** of the door **7**.

The door **7** includes structure **19** providing stops **18** to limit the pivotal movement of the outer link elements **13** about the guide means **12, 14**, and abutments **28** at the vicinity of the part **21**. The abutment means **28** are formed with slide surface regions **31** which are adjacent to the part **21** and face the inner ends **16** of the outer link elements **13**. The slide surface regions **31**, when the door **7** is moved from its closed position at the door frame **4**, function to impede radial inward movement of the outer link elements **13** toward the part **21** until the stops **18** act against the inner ends **16** of the outer link elements **13** responsive to pivotal movement of the outer link elements **13**.

The shoulders **29**, which face the inner ends **16** of the outer link elements **13**, may be referred to as stop means which are in the path of movement of the nut or part **21**. The part **21** is of annular form and movable toward the shoulders **29** over the narrower ends of the abutment means **28**. The shoulders define the end of the rearward movement of the part **21** toward the inner face or bottom **17** of the door **7**, the part **21** when bearing against the shoulders or stop means **29** functioning to hold the lock members **13, 20** in their radial outward positions, as shown in FIG. 2.

The embodiments illustrated and described above are to be regarded as examples only and the different details of the locking device may be modified within the scope of the invention, as set forth in the following claims. For example, the oblong ports or openings **27** at the outer ends of the links **20** may be formed at **27'** at the inner ends of

the links through which the bolts **25** extend, as shown in FIG. 5. The locking device, of course, can be employed equally effectively with circular, square and rectangular doors. The door frame **4** may be provided with a member of annular form which extends about the open end of the autoclave and serves as a holding bracket for all of the lock bolts **13**.

What is claimed is:

1. In a pressure vessel of the class described having a door frame and door having a rim formed with guide means, the combination of a plurality of lock members, a part, means for mounting the part for forward and rearward movement, respectively, from and toward the inner face of the door, motion transmitting means comprising the movable part for moving the lock members radially outward and inward, respectively, from and toward the part, the outer ends of the lock members upon outward radial movement thereof from the part engaging inward facing surface portions of the door frame to hold the door in a closed position, each of the lock members comprising a pair of inner and outer link elements defining toggles having knuckles, first connecting means at the knuckles for pivotally connecting the outer and inner link elements to one another, the motion transmitting means further including second connecting means pivotally connecting the inner ends of the inner link elements to the part, the lock members being swingable like two-armed levers with the outer link elements pivotally movable about the guide means at the rim of the door, the door including structure providing stops to limit the pivotal movement of the outer link elements about the guide means and abutment means at the vicinity of the part, the abutment means having slide surface regions adjacent to the part which face the inner ends of the outer link elements, and the last-mentioned slide surface regions, when the door is moved from its closed position at the door frame, functioning to impede radial inward movement of the outer link elements toward the part until the stops act against the inner ends of the outer link elements responsive to pivotal movement of the outer link elements.

2. Apparatus as set forth in claim **1** in which at least one of the first and second pivotal connecting means comprises structure providing a loose pivotal connection to enable initial movement to be imparted to the part, when it is desired to move the door from its closed position, before the part functions to impart inward radial movement to the outer link elements.

3. Apparatus as set forth in claim **2** in which the first connecting means comprises said structure providing the loose pivotal connection between the outer and inner link elements.

4. Apparatus as set forth in claim **2** in which the second connecting means comprises said structure providing the loose pivotal connection between the inner link elements and the part.

5. Apparatus as set forth in claim **1** in which the slide surface regions extend forward from the inner face of the door and slope inward toward the path of movement of the part.

6. Apparatus as set forth in claim **1** in which the slide surface regions extend forward from the inner face of the door and define convex-shaped surface regions extending lengthwise of the path of movement of the part.

7. Apparatus as set forth in claim **1** in which the abutment means having the slide surface regions facing the inner ends of the outer link elements include stop means in the path of movement of the part, the last-mentioned stop means defining the end of the rearward movement of the part toward the inner face of the door, the part when acting against the last-mentioned stop means functioning to hold the lock members in their radial outward positions.

8. Apparatus as set forth in claim **7** in which the abutment means is formed with shoulder means at the slide surface regions thereof facing the outer ends of the inner

link elements, and the part being of annular form and movable over the abutment means toward the shoulder means which function as the stop means.

9. In a lock for an autoclave and similar article, the autoclave including a door frame defining an opening and a door for closing the opening, the door frame having an engagement border and the door having a rim formed with border heel means, a screw spindle which is transverse to the plane of the door and mounted thereon, an internally threaded nut axially movable on said spindle, a plurality of lock bolts, each of said lock bolts being movable in the direction of its length from and toward said screw spindle, the outer ends of said lock bolts, upon movement thereof from said screw spindle, engaging behind the engagement border when the door is in its closed position to hold the door closed against the action of the positive pressure in the autoclave, means for transmitting movement to said lock bolts, said movement transmitting means including said nut and a plurality of links and means journaling the inner ends of said links to said nut and the outer ends thereof to the inner ends of said lock bolts, said lock bolts and links being swingable like two-armed levers about said border heel means on the door by said movement transmitting means responsive to movement of the nut on the screw spindle, the door having first abutments to stop and limit swinging of the inner ends of said lock bolts to definite outer positions, and the door further including second abutments having slide surfaces which are adjacent to the screw spindle and are turned toward the inner ends of said lock bolts, said slide surfaces functioning, when said nut is moved on said screw spindle to effect opening of the door, to prevent movement of said lock bolts toward the screw spindle until sufficient swinging movement has been imparted to said lock bolts by said movement transmitting means for the latter to reach or almost reach said first stop abutments.

10. Apparatus as set forth in claim **9** in which said means journaling the inner ends of said links to said nut and the outer ends thereof to the inner ends of said lock bolts provides movement transmitting means having a loose connection to enable said nut to be moved axially on said screw spindle for a definite distance before said lock bolts move in the direction of their lengths toward said screw spindle.

11. Apparatus as set forth in claim **10** in which said movement transmitting means, when said nut is moved axially on said screw spindle within the definite distance, effects swinging movement of said lock bolts to move the inner ends thereof toward said first abutments, and said door rim having means coacting with the border heel means to enable the door to move from its closed position to a partially open position to vent vaporous fluid from the autoclave while the outer ends of said lock bolts remain engaged behind the engagement border and before sufficient movement is imparted to said latch bolts to retract the latter from said engagement border and permit the door to be moved to its fully open position.

12. Apparatus as set forth in claim **10** in which said links and latch bolts form connecting members having oblong ports and said journaling means includes said ports and pins extending therethrough.

13. Apparatus as set forth in claim **12** in which the oblong ports are formed at the outer ends of said links and said pins are provided at the inner ends of said latch bolts and pass through said ports.

14. Apparatus as set forth in claim **9** in which said slide surfaces of said second abutments are disposed alongside said screw spindle and extend outward from the inner face of the door and slope toward the axis of said screw spindle.

15. Apparatus as set forth in claim **9** in which said second abutments are formed with outwardly facing shoulders against which the inner ends of said latch bolts bear when the outer ends thereof engage behind the en-

gagement border with the door in its closed position, and a ring of wear resistant material which is fixed to said nut and arranged to act against the inner ends of said latch bolts and maintain the latter against the shoulders.

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PATRICK A. CLIFFORD, *Primary Examiner.*

M. HENSON WOOD, JR., *Examiner.*

J. R. MOSES, *Assistant Examiner.*