

June 24, 1952

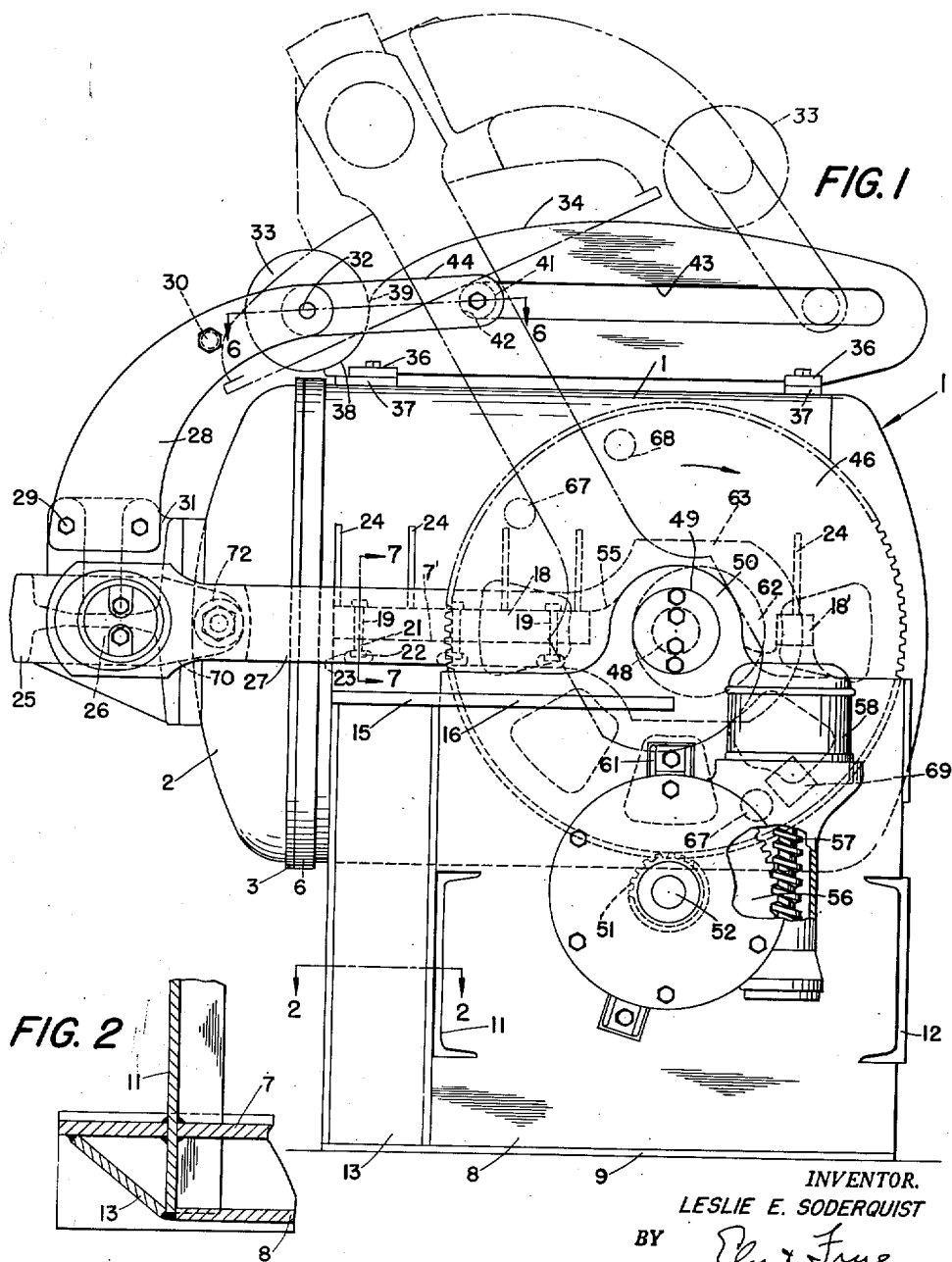
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2,601,566

CLOSURE OPERATING MECHANISM

Filed March 24, 1949

4 Sheets-Sheet 1



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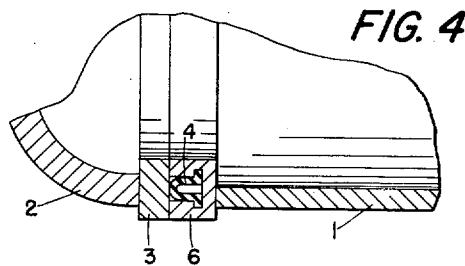
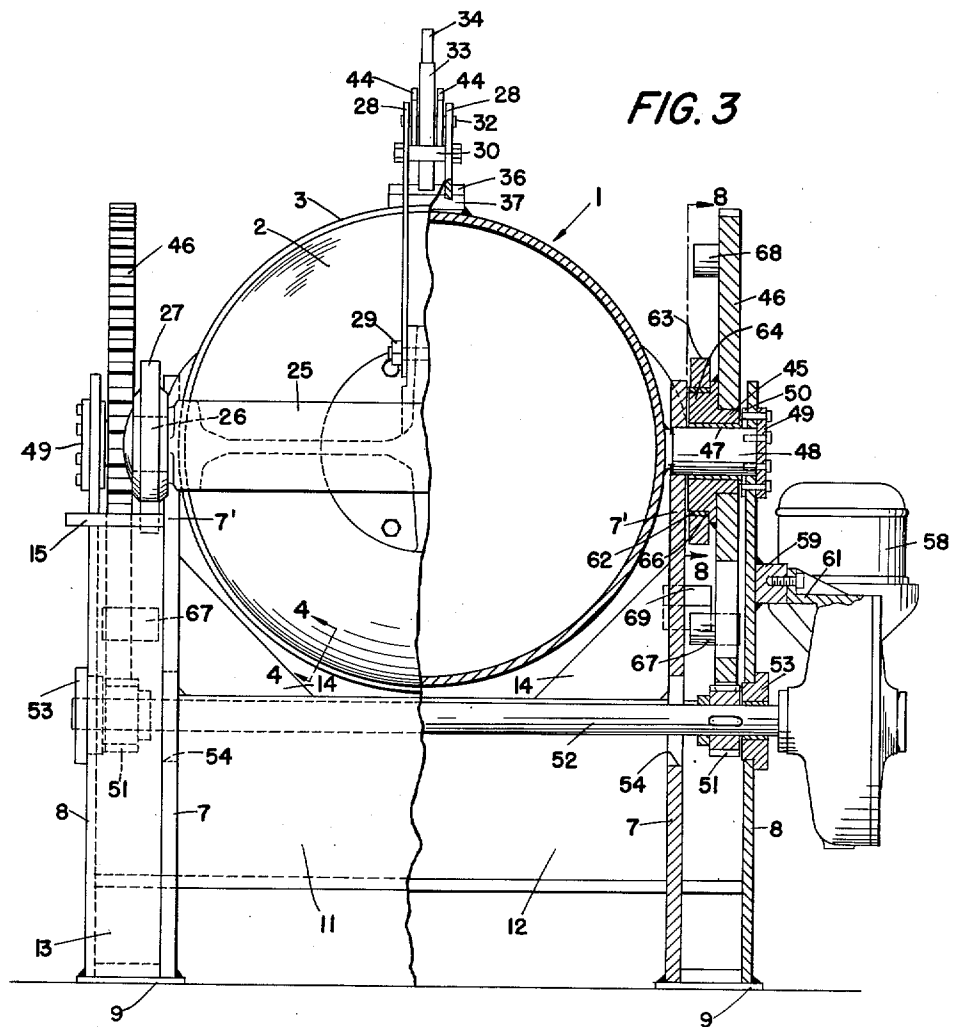
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CLOSURE OPERATING MECHANISM

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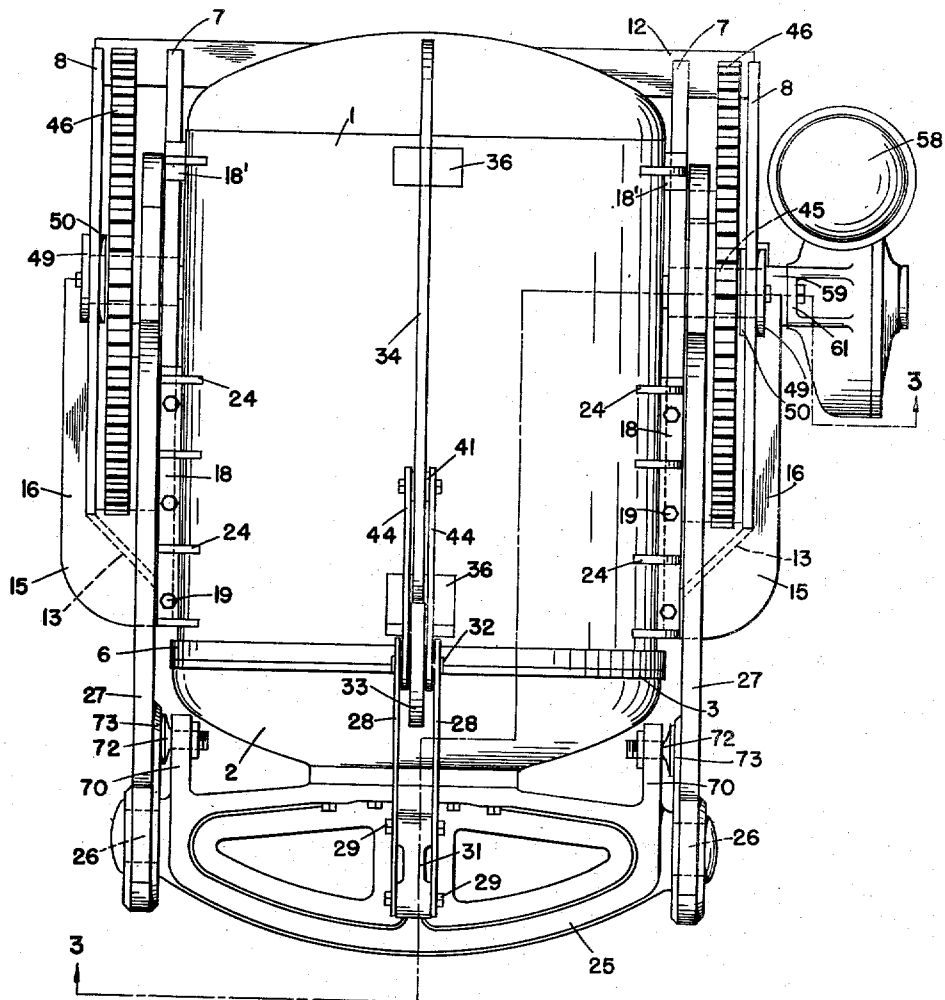
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CLOSURE OPERATING MECHANISM

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FIG. 5



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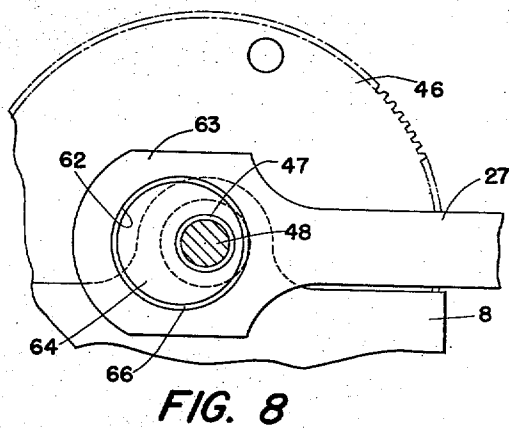
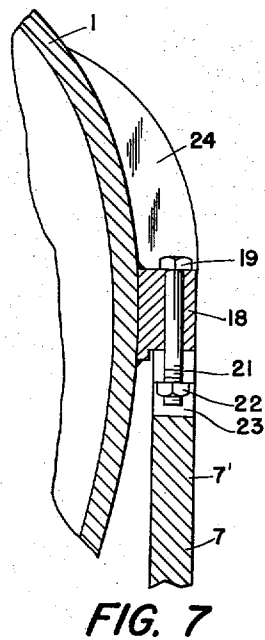
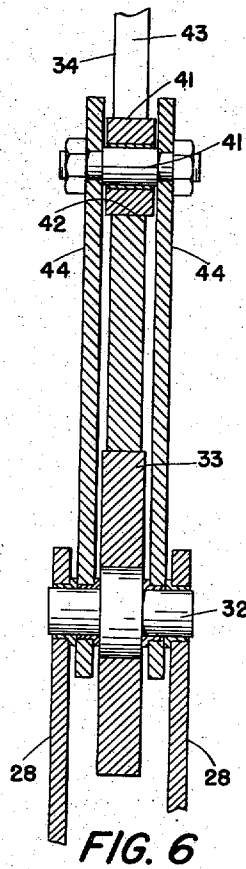
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CLOSURE OPERATING MECHANISM

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CLOSURE OPERATING MECHANISM

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20 Claims. (Cl. 268-74)

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This invention relates to a mechanism for opening and closing heavy and bulky closure elements such as the covers for the openings of large autoclaves employed in the rubber industry. These comprise long, horizontally arranged tanks of sturdy construction and large girth, and the charge opening, and therefore its closure, are of correspondingly great size.

Heretofore such massive closures have entailed a considerable amount of manual handling in the use of such conventional locking means as multiple bayonet joints or hinged doors with cross-bars having threaded thrust bolts for locking in closed position. The closures have been variously articulated in one way or another to the structure or separately handled as by hoists. The problem has, in general, been aggravated by the fact that in spite of the size and weight of the closure structure certain minimum requirements of precision of fit are involved in a structure which must be pressure sealed.

Furthermore, in the prior practice, the closures have been handled in the area in front of the autoclave and thus required space for their movement which could be otherwise employed to advantage.

It is, therefore, an object of this invention to provide automatic means for opening and closing heavy closure members. A further object is to provide a means for opening and closing closures for pressure-sealed devices which obviates the use of interlocking parts at the closure area. Another and particular object is to provide a manipulating means for a closure member for a container which utilizes the space above the container for receiving the removed closure. In still greater particular, it is an object to provide an automatic closure-operating means which will, in opening, move the closure away from the mouth of the chamber and then upwardly around one end of the chamber to a position above the chamber and, in closing, first lower the closure to a position over the mouth of the chamber and then bring it against the chamber in tight sealing relation to the chamber.

These and other ends will be apparent to those skilled in the art in the light of the following specification and as illustrated in the accompanying drawings, in which:

Fig. 1 is an elevation of the right hand side of an autoclave,

Fig. 2 is a detail section taken on the line 2-2 of Fig. 1,

Fig. 3 is a front elevational view of the structure of Fig. 1, sectioned as along the staggered line 3-3 of Fig. 5,

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Fig. 4 is a detail section taken on the line 4-4 of Fig. 3,

Fig. 5 is a top plan view of the structure of Fig. 3,

Fig. 6 is a detail section taken along the line 6-6 of Fig. 1,

Fig. 7 is a detail section taken along the line 7-7 of Fig. 1, and

Fig. 8 is a section taken along the line 8-8 of Fig. 3.

Referring to the drawings by characters of reference, there is shown in Fig. 1 a horizontal autoclave of conventional aspect as to its cylindrical tank or chamber, indicated as a whole by the numeral 1. Since the structure of the tank proper is not modified in the present invention, it is shown only in general outline, without the various appendages it normally carries.

The door 2 of the tank is dome-shaped and has a flanged rim 3, engageable with an annular U-shaped resilient sealing member 4 contained in a groove in a mating flange 6 on the opening of the tank body 1.

The tank is supported on each side by an upright wall member comprising an inner plate 7 and a spaced, parallel, outer plate 8, each pair of plates being attached to a foot member 9 as by welding. The wall members are connected and given lateral rigidity by means of two channel members 11 and 12 which pass through complementary openings in the plates and are welded in place. The outer plates 8 are somewhat shorter than the inner plates 7 and the front edges of each pair are connected by a diagonally positioned vertical plate 13.

The inner walls are further braced by means of corner pieces 14 welded to the said walls and to the channels 11, 12. A shelf 15 for the accommodation of valves and other controls (not shown) is supported on and welded to the top edge of the vertical plate 13, is welded to plate 7, and has an extension 16 welded to the side of outer plate 8.

The tank 1 is supported on the top 7' of inner plates 7 by means of ribs 18, welded to the sides of the tank forwardly thereof, and short ribs 18' in the rear portion, and is secured in place (Fig. 7) by means of bolts 19 passing through bores in the ribs 18 and 18' and through slots 21 in the top of the plate 7 and engaged by nuts 22 in enlargements 23 of the slots 21. Arcuate ribs 24 on the tank 1, above ribs 18, 18', assist in carrying the load, thus relieving strain on the welds of the ribs.

The door 2 is carried by an arched cross-head or beam 25 to which it is bolted and supported

over a substantial central area. This cross-head is of generally I-section and is trunnioned, as at 26, in the front ends of a pair of links 27 which, when the door is closed, are in a horizontal plane on either side of the tank. The rear end of each link is articulated to the driving gearing presently to be described. The door and the front ends of links 27 are supported by a pair of curved arms 28, each of which is bolted at 29 to a lateral extension or boss 31 on the beam 25. The arms 28 lie in the central plane of the door and near their upper ends are spaced apart by a spacer sleeve 30. At the upper ends of the arms is located a pin 32 carrying a supporting roller 33. The latter is adapted to ride on top of a curved track or cam 34 having lugs or feet 36 by which it is bolted to plates 37 welded to the top of tank 1. The purpose of this cam track will be later explained in connection with the door opening mechanism.

In the position of the parts when the door is closed, as shown in Fig. 1, the roller 33 is dwelling upon an arcuate section 38 of the cam track adjoining a steep portion 39 thereof. The arcuate portion 38 thus carries the load due to the weight of the door, roller 33, links 28, and part of links 27. The cam is terminated abruptly at this point in order to afford clearance for the door in its upward swing.

By means presently to be described, the movement of the door when near its closed position has a considerable component axially of the tank 1. Since the door and attached links 28 revolve about trunnions 26 and since the links 27, at or near the closed position of the door, are free to revolve about their rearward articulation, the roller 33 would tend to roll off the end of the cam track but such action is prevented by a roller 41 journaled on a pin 41a carried in links 44 which are mounted at their forward ends on the pin 32. This roller moves in a slot 43 in the cam track, the outer end 42 of the slot serving to arrest the forward movement of the arm 28 when the roller 33 reaches the portion 38 of the cam track.

The power mechanism for opening and closing the door will now be described.

On each side of the tank 1 is a bull gear 46 which has a welded central bushing 45 journaled through an anti-friction sleeve 47 on a stationary shaft 48 supported in a bore in a vertical arcuate extension 50 of the plate 8, and a bore in a generally similar extension 55 of the plate 7, the shaft 48 being bolted to a circular plate 49 which is in turn bolted to the outside of the extension 50.

The bull gears are driven by spur gears 51 keyed to a common shaft 52 journaled in bushings 53 in the outer plates 8 and passing through enlarged openings 54 in the inner plate 7. The shaft 52 is driven by a worm wheel 56 which in turn is driven by a worm 57 on the shaft of a motor 58. The integral housing for the worm wheel, worm, and motor is attached to a welded extension 59, on the outer support plate 8, by a bracket 61.

Each link 27 has a circular bore 62 in its enlarged rearward end 63 which is journaled on an eccentric boss 64 on the inner end of the bushing 45 through a bearing sleeve 66 (see Fig. 8). From this construction it will be apparent that as the gear 46 rotates in direction of arrow shown on gear 46, Fig. 1, carrying with it the bushing 45, the center of opening 62 in the end 63 of link 27 will describe a circle about the center of shaft 48 with the result that link 27 will move longitudinally of the tank 1. This is in the nature of

a toggle action of high mechanical advantage which is effective to seal the door tightly in place or to break such a seal and represents one phase of the door operating cycle, the second phase being the swinging of the door to position above the tank 1.

During the initial opening action of the door, the forward thrust of the links 27, caused by rotation of the eccentrics 64, causes the links 28 to turn about pin 32 and the axis of trunnions 26 moves away from the opening of the chamber about the center 32. When this movement has proceeded to a point where the door has cleared the mouth of the chamber, the links 27 are picked up by cylindrical pins 67 attached to the gears 46, and thereafter the links 27 partake of a swinging motion about the center of gears 46, the eccentric action being nullified by the conjoint movement of the links and the gears. The axis of trunnions 26 thereafter moves in a circle and the angular position of door 2, at any phase of the swing, is dependent upon the configuration of the track 34, which, through roller 33, prevents the door from swinging about trunnions 26 under the influence of its own weight.

The fully open position is indicated in broken lines in Fig. 1, the rim of the door 2 being clear of track 50 but the front part of the track being received within the hollow interior thereof.

In order to prevent overtravel of the gear 46 in opening direction, a second pin 68 is provided on the inside of one of the gears 46, which pin is adapted to engage with an abutment 69, carried on the inner support plate 7. Rotation in the closing direction is arrested by contact of pin 67 with abutment 69.

In the closing movement of the door, the action takes place in reverse order. The door is first moved in an arc downwardly about the center of gears 46 with the weight of the door partly carried on pins 67 through links 27 and partly carried by cam 34 through roller 33. When the roller 33 drops into arcuate section 38 of the cam track, the door can no longer move bodily downward. At the point where the roller 33 comes to rest at section 38 the pin 67 leaves the links 28 and continued movement of the gears 46 through the eccentrics 64 draws the door into tight clamping relation, with a considerable component of its motion axially of the tank and with a force of increasing magnitude as the door closes over the tank opening due to the eccentric mounting of the links. To guide the door to its closed position, the transverse beam 25 is provided with inwardly extending arms 70, in the ends of which are mounted adjustable wearing shoes 72 which, as the door closes, ride on wearing surfaces 73 formed on the inner surfaces of links 27.

It will be seen that there is herein provided a mechanism which not only serves to automatically swing open a heavy door and move it into a non-essential space, but also serves as a powerful and efficient locking means. The operation of the motor 58 is regulated by push button control means not shown, with which are associated limit switches which stop the motor at either end of its movement. In actual commercial adaptations, timing mechanism may be provided to actuate the motor and open the door at the end of a heating cycle.

While a preferred embodiment has been shown, the invention is not to be considered as limited thereto, various changes, modifications or improvements being possible without departure from the spirit and scope of the appended claims. The

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mechanism is primarily intended for the operation of doors for so-called horizontal vulcanizers used in the curing of rubber goods, thermo-setting plastics and the like, but may be likewise adapted to any type of heating chamber where the closure is heavy and hard to handle manually and where it is essential that the door be held and closed tightly against high internal pressures.

What is claimed is:

1. A closure means for containers comprising a door, a link pivoted at one end to said door, a gear to which the other end of said link is eccentrically pivoted, and means on the gear arranged to raise said link after a predetermined degree of rotation of the gear, whereby the link is moved by the eccentric pivoting in one phase of rotation of the gear, and is swung in unison with the gear by the said means in another phase of rotation of the gear.

2. A closure means for containers comprising a door, a door supporting link fixed to said door, a second link articulated at one end to said door, a gear to which the other end of the second link is eccentrically pivoted, and means on the gear arranged to contact the said second link after a predetermined degree of rotation of the said gear whereby the said second link is moved by the eccentric pivoting in one phase of rotation of the gear and is swung in unison with the gear by the said means in another phase of rotation of the gear.

3. A closure means for containers comprising a door, a door supporting link fixed to said door, a roller carried on the outer portion of said link, a track over which the roller moves during the opening and closing of the door, a second link articulated at one end to said door, a gear to which the other end of the second link is eccentrically pivoted, and means on the gear arranged to raise the said second link after a predetermined degree of rotation of the said gear whereby the said second link is moved by the eccentric pivoting in one phase of rotation of the gear and is swung in unison with the gear by the said means in another phase of rotation of the gear.

4. In combination, a container having an opening, a closure for said opening, a gear, a link articulated to said closure, means on the gear adapted to impart an outward thrust to the link to move the closure away from the container, a device actuated by further movement of the gear to raise the link at a predetermined degree of rotation of said gear, a rail above the container, and a door supporting arm fixed to said closure with its outer end adapted to ride on the rail during movement of the door.

5. In combination, a container having an opening, a closure for said opening, a gear, a link on said gear articulated at its other end to said closure, means on the gear adapted to contact the underside of said link to lift the same after a predetermined degree of rotation of the gear, an arm fixed to the closure, a rail above the container, and means on said arm adapted to bear on the rail during movement of the closure.

6. In combination, a container having an opening, a closure for said opening, a gear, a link on said gear articulated at its other end to said closure, means on the gear adapted to contact the underside of said link to lift the same after a predetermined degree of rotation of said gear, a cam track above the container, and an arm fixed to said closure and adapted to ride on said cam track during movement of the closure.

7. In combination, a container having an open-

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ing, a closure for said opening, a gear, a link articulated at its outer end to said closure, means to impart an outward thrust to the link, means on the gear adapted to contact the underside of said link after a predetermined degree of rotation of said gear, a cam track above the container having a high portion joined to a low portion at the end of the container adjacent the said opening, and a door supporting arm fixed to the closure and adapted to ride on the cam track during movement of the door.

8. In combination, a container having an opening, a closure for said opening, a gear, a link on said gear articulated at its outer end to said closure, means on the gear adapted to lift said link after a predetermined phase of rotation of said gear, a cam track above the container having a high portion joined to a low portion at the end of the container adjacent the said opening, an arm fixed to the closure and adapted to ride on the cam track during movement of the closure, and stop means to interrupt movement of said arm when said arm reaches said low portion.

9. In combination, a container having an opening, a closure for said opening, a gear, a link on said gear articulated at its outer end to said closure, means on the gear adapted to contact the underside of said link after a predetermined phase of rotation of said gear, a cam track above the container having a high portion joined to a low portion at the end of the container adjacent the said opening, an arm fixed to the closure and adapted to ride on the cam track during movement of the closure, and stop means adapted to arrest said arm when it is dwelling on said low portion.

10. The combination with a horizontal autoclave having an opening at one end, a door for said opening, a pair of links pivotally connected to the door, rotatable elements at the sides of the autoclave, eccentrics in said elements over which the links are received, a door supporting arm connected at its lower end to the door, a track above the autoclave over which the upper end of the arm may ride, and means operative to raise the links after the eccentrics have swung the door to partially open position and to cause the arm to move over the track.

11. The combination with a horizontal autoclave having an opening at one end, a door for said opening, a pair of links pivotally connected to the door, gears at the sides of the autoclave, eccentrics on said gears over which the links are received, a door supporting arm connected at its lower end to the door, a roller on the upper end of the arm, a track above the autoclave over which the roller moves, and abutments on the gears located and arranged to lift the arms after the eccentrics have moved the door to partially open position and to cause the roller to move over the track as the door is raised.

12. In combination, a container having a lateral opening, a closure for said opening, an eccentric, a link connected to the closure and actuated by the eccentric to partially open the closure and to draw the closure against the opening, means engageable with the link and operative when the closure is spaced from the opening to lift the closure and swing it around an end of the container to a position above the container, and guiding means to control the angular position of the closure during its swinging movement.

13. The combination with a horizontal autoclave having an opening at one end thereof, a swinging arm supported on the top of the auto-

clave and depending in front of the opening, a closure for the opening carried by the lower end of the arm, links pivoted at the sides of the autoclave and connected to the closure, means operating in sequence first to shift the links to move the closure laterally away from the opening and then to swing the links and lift the closure and the arm, a roller on the upper end of the arm, and a cam track above the autoclave on which the roller moves during the lifting of the closure, said cam track being shaped to guide the closure around the end of the autoclave to a position above the autoclave during the swinging movement of the links.

14. An autoclave closure operating mechanism such as set forth in claim 13 in which on reverse movement the closure is guided around the end of the autoclave to a position opposite the opening, whereupon the links are shifted to draw the closure against the opening.

15. In combination with a horizontal autoclave having an opening at one end thereof, a closure for the opening, an arm attached to the closure, a roller at the upper end of said arm, a cam track above the autoclave and extending axially thereof, said roller riding upon the cam track, means operative first to shift the closure laterally of the opening and then to raise the closure and swing it in an arc about the end of the autoclave to a position above the autoclave, said cam track being shaped to guide the closure in its swinging movement and prevent contact thereof with the end of the autoclave.

16. In combination with a horizontal autoclave having an opening at one end thereof, a closure for the opening, an arm attached to the closure, a roller at the upper end of said arm, a cam track above the autoclave and extending axially thereof, said roller riding upon the cam track, means operative first to shift the closure laterally of the opening and then to raise the closure and swing it in an arc about the end of the autoclave to a position above the autoclave, said cam track being arched to keep the closure in position so that it clears the end of the autoclave in its movement to and from its position above the autoclave.

17. In combination with a horizontal autoclave having an opening at one end thereof, a closure for the opening, an arm attached to the closure, a roller at the upper end of said arm, a cam track above the autoclave and extending axially thereof, said roller riding upon the cam track, means operative first to shift the closure laterally of the opening and then to raise the closure and swing it in an arc about the end of the autoclave to a position above the autoclave, said cam track having a rest for the roller at its forward end and being arched rearwardly thereof to keep the closure in position so that it clears the end of the autoclave in its movement to and from its position above the autoclave, and means to prevent the roller from passing forwardly beyond the rest.

18. In combination with a horizontal autoclave

having an opening at one end thereof, a closure for the opening, an arm attached to the closure, a roller at the upper end of said arm, a cam track above the autoclave and extending axially thereof, said roller riding upon the cam track, means operative first to shift the closure laterally of the opening and then to raise the closure and swing it in an arc about the end of the autoclave to a position above the autoclave, said cam track having a rest for the roller at its forward end and being arched rearwardly thereof to keep the closure in position so that it clears the end of the autoclave in its movement to and from its position above the autoclave, and means to prevent the roller from passing forwardly beyond the rest, said last named means comprising a slot in the body of the cam track and a pin connected to the arm and movable in the slot.

19. In combination with a horizontally positioned chamber having an opening in the side thereof, a closure for said opening, an arm connected to the closure, an arched trackway above the chamber and extending rearwardly from the opening, the upper end of the arm riding along the trackway, means connected to the closure to move it toward and away from the opening while the arm is at rest on the trackway, and means operative thereafter to move the arm along the trackway after the closure is spaced from the opening to shift the closure through an arcuate path to and from its fully opened position above the chamber.

20. In combination with a horizontally positioned chamber having an opening in the side thereof, a closure for said opening, an arm connected to the closure, a trackway above the chamber and extending rearwardly from the opening, the upper end of the arm being pivotally supported and movable along the trackway, means connected to the closure to move it toward and away from the opening about the pivot of the arm, and means operative to move the arm along the trackway after the closure is spaced from the opening to shift the closure through an arcuate path to and from its fully opened position above the chamber.

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