March 16, 1965 D. J. BEECHER 3,173,572

DOOR CLOSURE

Filed May 28, 1962

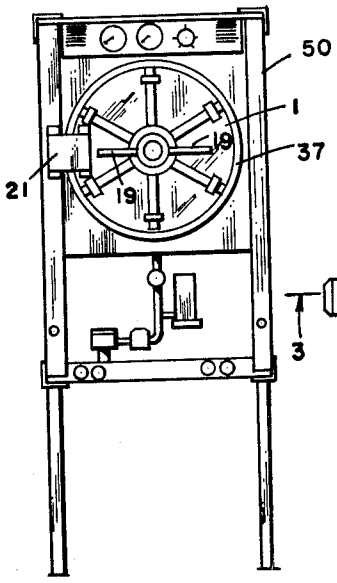


FIG. 1

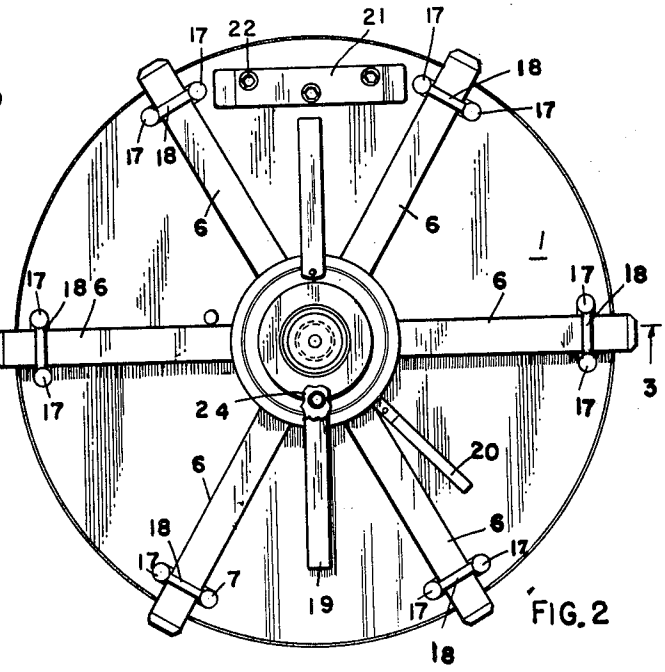


FIG. 2

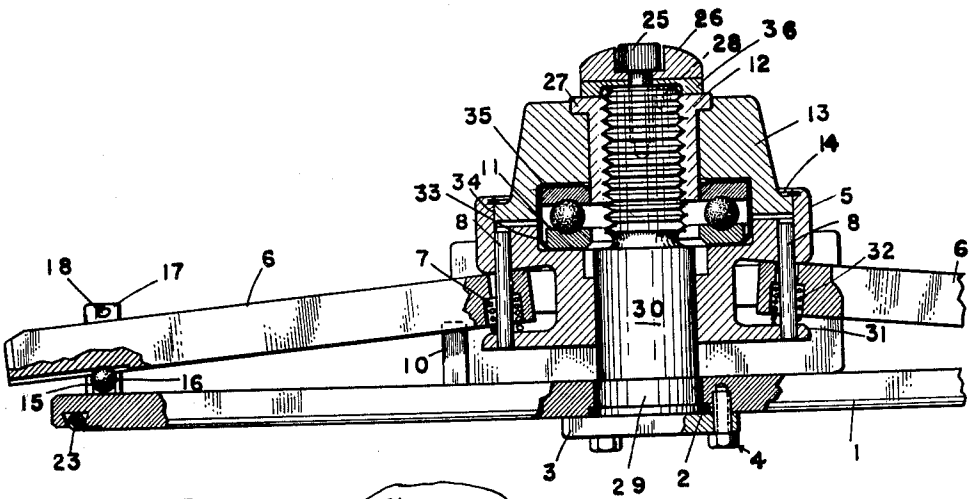


FIG. 3

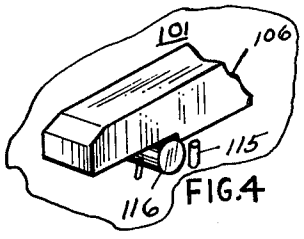


FIG. 4

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United States Patent Office 3,173,572 Patented Mar. 16, 1965

3,173,572

DOOR CLOSURE

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Filed May 28, 1962, Ser. No. 198,145
11 Claims. (Cl. 220—46)

This invention relates to door closures and, more particularly, to fasteners for door closures.

In closures for sterilizers, autoclaves, and the like which are designed to contain high pressure gases, it is necessary to seal and firmly clamp the door at several places around its periphery by a mechanical clamping means. When the ordinary type clamp having radially disposed arms is used, some of the generally radially disposed members will invariably exert a greater clamping force than others due to mechanical inaccuracies and manufacturing tolerances of the parts. This results in some of the clamping members exerting a considerable force while others exert hardly any force. This obviously results in an uneven clamping of the door.

It has been discovered that by providing fulcrums in the form of balls or cylinders for the arms to swing on and by making the part of the arm or the part of the door engaged by the arm of ductile material, an excessive force on any one of the clamping members will cause the particular fulcrum ball supporting that arm to brinell itself into the ductile material.

When the door is clamped thereafter, the inaccuracies of the arms will be compensated for by the balls and all of the clamping members will exert a uniform clamping force when the door is clamped thereby. The ductile material is thus self-compensating and gives the effect of a hydraulic clamping mechanism wherein all of the clamping members are clamped by a substantially equal force.

By controlling the hardness of the material, the ball can be made to brinell more or less deeply with a given force. Thus, the closure can be designed to adapt itself to a variety of applications.

It is contemplated within the scope of this invention to use a cylinder as a fulcrum member. A cylinder has advantages over a ball as a fulcrum in certain applications; however, in other applications, a cylinder may introduce a torsional force on the radiating arm and, in such applications, a ball may be used.

It is, accordingly, an object of the present invention to provide an improved door assembly.

Another object of the invention is to provide an improved clamping device and closure combination.

A further object of the invention is to provide an improved combination closure clamping means and autoclave.

Still a further object of the invention is to provide a door assembly which is simple in construction, economical in manufacture, and simple and efficient to use.

With the above and other objects in view, the present invention consists of the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawing and more particularly pointed out in the appended claims, it being understood that changes may be made in the form, size, proportions, and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawing:

FIG. 1 is an end view of an autoclave showing an improved door and clamping assembly according to the invention in position thereon;

FIG. 2 is an enlarged view of a door and clamping means;

FIG. 3 is a cross sectional view taken on line 3—3 of FIG. 2; and

FIG. 4 is a partial view of another embodiment of the invention.

Now with more specific reference to the drawing, an autoclave 50 is shown in the embodiment of FIGS. 1 to 3. The autoclave is of the usual type supported on downwardly extending legs and having a door 1. The door 1 is made of a round disk or plate like member having a groove on the inside thereof adjacent to the peripheral edge which receives an O-shaped door gasket 23. The door could be square, rectangular, or any other suitable shape within the scope of the invention. Any suitable gasket could be substituted for the member 23. The door will be made up of a sufficiently heavy material so that it can withstand the necessary pressures which are likely to be exerted on it.

The door clamping mechanism for clamping the door 1 in place is made up principally of the six arms 6 which radiate from a central hub 29. The six arms are disposed between spaced posts 17 and under a retainer roll 18 and rest on a fulcrum ball 16. The fulcrum balls 16 are made of a hardened material such as hardened steel and they are supported in retainers 15 which form a nest for each ball.

In practice, the material of the arms directly over the balls could be made of ductile metal such as aluminum or soft iron so that when an excessive force is exerted on any one of the arms, the ball supporting that arm will brinell itself into the material of the arm, thereby effectively lowering the fulcrum and thereby reducing the load on that arm and distributing the load equally to the other arms. The ball could also rest on the door itself if the door is made of a suitable ductile material so that the ball would brinell itself into the door.

The door 1 has a central hole therein which receives the central hub 29. The central hub extends through the central opening in the door 1 and is clamped thereto by means of a flange 3 which is integral with the central hub 29. The flange 3 has spaced holes which receive ring retainer studs 4. The central hole in the door is counterbored to receive a sealing ring 2 which forms a seal between the hub and the door.

The hub 29 has a cylindrical portion 30 which slidably receives a hub retraction member 5. The hub retraction member 5 is generally cylindrical and has an external peripheral groove 31 which receives the inner ends of the arms 6. Pins 8 extend through holes in the arms as well as through the upper flange of the retraction member 5. Each arm 6 has a counterbore 32 therein which receives a spring 7. The springs 7 urge the inner ends of the arms 6 to swing around the fulcrums to the position shown.

The outer part of the retraction member 5 has a first counterbore 33 and a second counterbore 34. The first counterbore 33 is of equal dimension with a counterbore 35 in a handwheel 13. A thrust bearing 11 is received in the counterbore 35.

The handwheel 13 has an inner flange which is received in the second counterbore 34. A retaining ring 14 is disposed in an internal groove in the flange of the hub retraction member 5. The ring 14 overlies the flange of the handwheel 13 and holds the handwheel in position. The handwheel 13 rotates between the retaining ring 14 on one side and the thrust bearing 11 on the other.

The outer end of the hub 29 is threaded as indicated and it threadably receives an insert sleeve 12. The insert sleeve 12 has a flange 27 which acts as a stop for the handwheel 13. When the handwheel 13 is rotated to move the sleeve 12 toward the door 1, the handwheel acts through the thrust bearing 11 and forces retraction member 5 toward the door. This causes the arms 6 to swing about the fulcrum balls 16.

A cap 26 is attached to the hub 29 by means of a cap screw 25. The cap screw 25 clamps a washer 36 be-

tween it and the hub **29**. The washer **36** is held against rotation by a pin **28**. Handles **19** are fixed to the handwheel **13**. The door **1** is swingably attached to the autoclave by means of a hinge **21** held to the door by cap screws **22**. When the door is closed and the ends of the arms **6** are extended under a rim **37** and the handwheel **13** is tightened by means of the handles **19**, the door **1** will be clamped in sealed relation.

When the door is clamped for the first time, some of the arms **6** may carry a greater load than others. This will result in non-uniform clamping. When an excessive force is exerted on the handle **19**, the balls **16** supporting those arms which are carrying more than their part of the total load will brinell themselves into the arms or the door itself, if designed as aforesaid. This will equalize the load. When the door is subsequently clamped, the arms will exert equal forces.

In the embodiment of the invention shown in FIG. 4, a cylinder **116** is shown substituted for the ball **16** of FIG. 3. The cylinder **116** is supported between retainers **115** on a door **101** and engages an arm **106**. A cylinder may have certain disadvantages over a ball as a fulcrum; yet, in some instances, it may have advantages.

The surface that the radial arm engages on the end of the autoclave is, in essence, a plane. The surface which the opposite end of the radial arm engages is also a plane. If the fulcrum between these two planes consists of another third plane, it can create in the arm a torsional stress between the fulcrum and the end ring as well as between the fulcrum and the plate at the door post. The presence of a sphere as a fulcrum eliminates the possibility of this condition between fulcrum and either surface. It is true that there still can be a torsional stress but it is between the ends of the radial arm and not between the fulcrum and the end.

It might be advantageous to use an ordinary cylinder as a fulcrum. The cylindrical fulcrum could also brinell in the ductile material of the arm and/or door.

The foregoing specification sets forth the invention in its preferred practical forms but the structure shown is capable of modification within a range of equivalents without departing from the invention which is to be understood is broadly novel as is commensurate with the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A door assembly comprising a door, a hub member supported on one side of said door, at least three spaced arms, one end of each said arm being engaged by said hub member, each said arm extending radially from said hub member, a fulcrum member disposed between each said arm and said door, means on each said arm to engage a member on a device to be closed, said hub member having means to force the ends of said arms engaged thereby to move said ends relative to said door, and means engaging each said fulcrum member holding each said fulcrum member in fixed relation to said door for supporting said arm in spaced relation to said door, said means engaging each said fulcrum member being made of ductile material whereby said means under any one of said arms having a greater force imposed thereon than the others is permanently distorted by said fulcrum member engaging it whereby the forces on said arms are equalized when said means to force the ends of said arms is subsequently actuated.

2. The assembly recited in claim 1 wherein said fulcrum members are balls.

3. The assembly recited in claim 1 wherein said fulcrum members are cylindrical in shape.

4. The assembly recited in claim 1 wherein said fulcrum members are round.

5. A door assembly comprising a door, a plurality of spaced arms attached to one side of said door and radiating outwardly from the center thereof, fulcrum means adjacent one end of each said arm, means on each said arm spaced from said fulcrum means and adapted to engage a clamping means on a device to be closed by said door, and means to exert a force on the end of each said arm remote from said means to engage said clamping means whereby said arms exert a non-uniform clamping force on said door, said fulcrum means comprising a member made of ductile material and a relatively hard member engaging said ductile material, said hard member being adapted to brinell said ductile material on the one of said arms carrying more clamping force than the others whereby the forces on said arms are equalized whereby said means to exert a force on the ends of said arms is subsequently actuated.

6. A door assembly comprising a door member, arm members on one side of said door member radiating from the center thereof, the outer end of each said arm member having means to engage a member on a device to be closed, a fulcrum at an intermediate position on each said arm member between the said arm member and said door member, and means to exert a force on each said arm member to swing it about said fulcrum, said fulcrum comprising a member made of ductile material and a relatively hard member adapted to permanently brinell said ductile material when a force thereon exceeds a predetermined value whereby the load carried by each said arm member is equalized whereby said means to exert a force on said arm members is subsequently actuated.

7. A door assembly comprising a door, a plurality of spaced arm members attached to one side of said door and radiating outwardly from the center thereof, fulcrum means adjacent an end of each said arm member, means on each said arm member spaced from said fulcrum means on each said arm member adapted to engage a clamping means on a device to be closed, said arm members, fulcrum means, and means on said arm members being adapted to exert uneven clamping forces on said device to be closed, and means to exert a force on the end of each said arm member remote from said means to engage said clamping means, said fulcrum means each comprising a ball made of relatively hard material and a seat for said balls between said arm members and said door made of relatively soft ductile material, said balls being permanently brinelled into said ductile material when the force thereon exceeds a predetermined value whereby the force carried by each said arm member is equalized whereby said means to exert a force on the ends of said arm members is subsequently actuated.

8. The assembly recited in claim 7 wherein said means to exert a force on said arm members comprises a hub member having means engaging said arm members and a threaded member for forcing said hub member toward said door.

9. An autoclave comprising a hollow body having an opening at one end and a rim spaced outwardly from said body and extending therearound, a door for said opening, said door comprising a plate like member having sealing means thereon to engage said door, radially extending arms on the outside of said door, the outer ends of said arms underlying said rim, a fulcrum ball between an intermediate part of each said arm and said door, each said ball being disposed on a member attached to said door, a hub having a cylindrical part and an outer threaded part, a hub retainer slidably received on said cylindrical part, means on said retainer receiving an end of each said arm, a handwheel threadably received on said threaded part of said hub, and a thrust bearing between said handwheel and said retainer, said handwheel being rotatable to exert a force on said retainer by way of said thrust bearing whereby said retainer is forced toward said door, rocking said arms about said fulcrum balls.

10. An autoclave comprising a hollow body, a door, said body having an opening at one end and a rim spaced outwardly from said door and extending therearound, said door comprising a plate like member having sealing

means thereon to engage said rim, radially extending arms on the outside of said door, the outer ends of said arms underlying said rim, a fulcrum ball between an intermediate part of each said arm and said door, each said ball being disposed on a member attached to said door, a hub attached to said door, said hub having a cylindrical part and an outer threaded part, a hub retainer slidably received on said cylindrical part, means on said retainer receiving an end of each said arm, a handwheel threadably received on said threaded part of said hub, and means between said handwheel and said retainer whereby a force is exerted on said retainer when said handwheel is rotated whereby said arms are rocked around said fulcrum balls.

11. An autoclave comprising a body having a door opening, opening means on said body spaced from said door opening for receiving the ends of arms, a door, spaced, radially extending arms on said door having their outer ends received under said opening means, a hub at the center of said door attached thereto and extending outwardly therefrom, a retainer slidably received on said hub, a peripheral groove in said retainer receiving the

inner ends of said arms, pins extending through said retainer and each said arm, a fulcrum between each said arm and said door, ductile means engaging said fulcrums, and means for urging the inner ends of said arms toward said door whereby said arms rock around said fulcrums and clamp said door to said autoclave, said fulcrums being adapted to permanently brinell said ductile means when the force thereon exceeds a predetermined value to equalize the forces on said arms whereby said means for urging the ends of said arms is subsequently actuated.

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