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E. L. ANDERSON ET AL.

3,352,446

CLOSURE APPARATUS FOR PRESSURE CHAMBER

Filed June 9, 1965

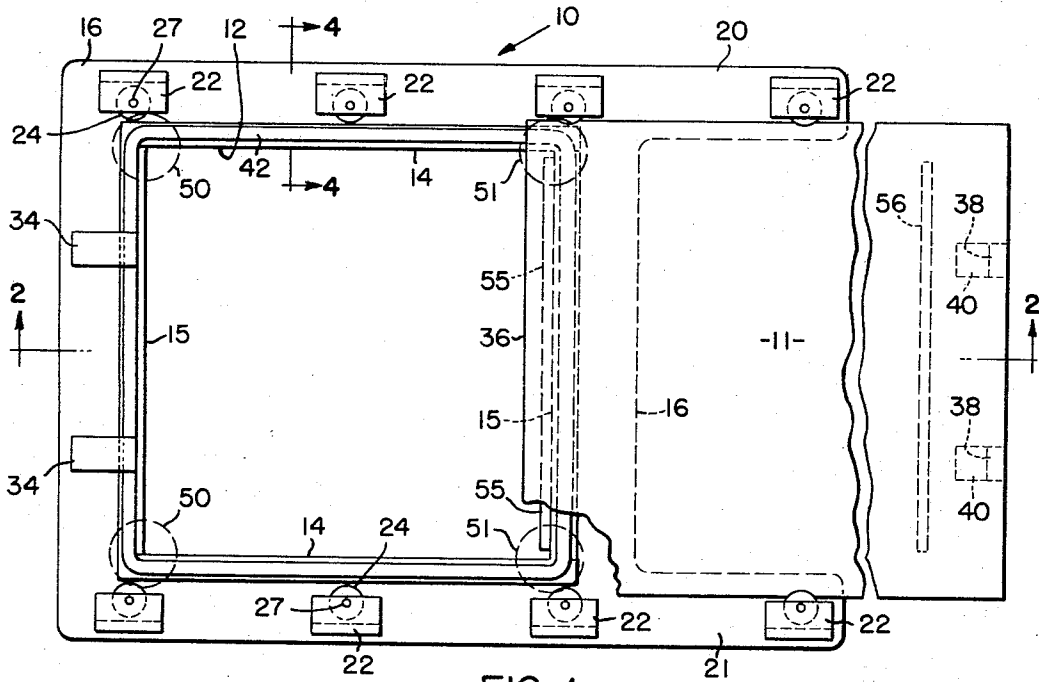


FIG. 1

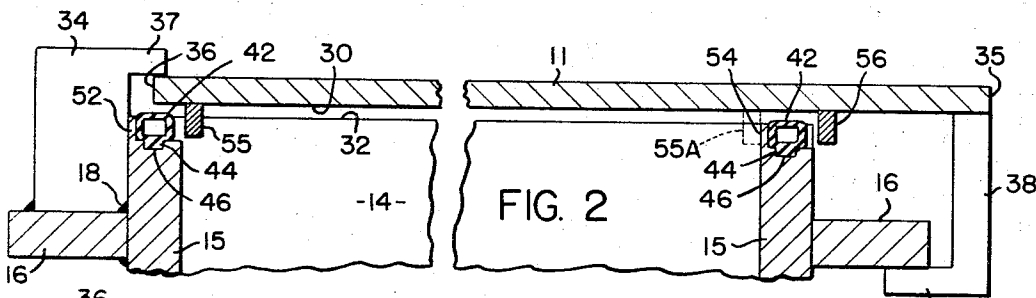


FIG. 2

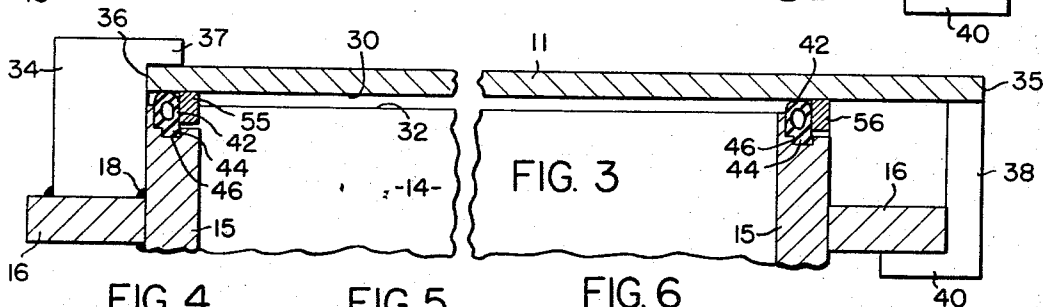


FIG. 3

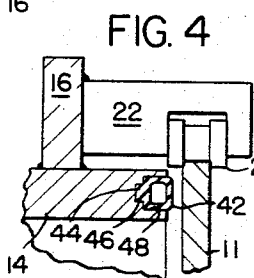


FIG. 4

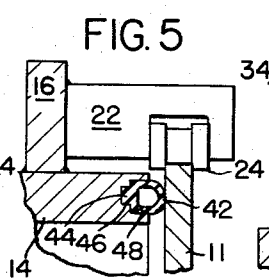


FIG. 5

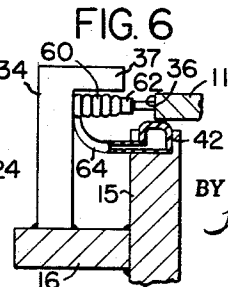


FIG. 6

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1

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CLOSURE APPARATUS FOR PRESSURE CHAMBER
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 13 Claims. (Cl. 220-41)

This invention relates to apparatus for closure and sealing of pressure chambers and more specifically to apparatus for closure and sealing of pressurizable sterilizing chambers.

One object of this invention is to provide improved apparatus for closing and sealing a pressure chamber.

A further object of this invention is to provide an improved door or closure construction for a pressure chamber eliminating the need for conventional locking means for securing the door in closed and sealed relationship with the opening of the pressure vessel.

It is a further object of this invention to provide a greatly simplified, less expensive pressure chamber closure construction.

It is a significant object of this invention to provide a slidable door with means for limiting the outward movement of the door away from the pressure vessel opening when at least in the closed position with the opening.

It is a significant object of this invention to provide an inflatable compressible seal between the door and the pressure vessel around the opening thereof and structure on the door and vessel which is responsive to movement of the door member to a closed position with the vessel opening for inflating at least a portion of the seal thereby to seal the door in pressure tight relationship around the opening of the vessel.

It is an important object of this invention to provide a deformable seal which when compressed along a portion of the length thereof into sealing relationship between the door and vessel, the remainder is responsively deformed into sealing relationship between the door and the vessel.

Other objects and advantages of this invention will be particularly set forth in the claims and will be apparent from the following description, when taken in connection with the accompanying drawings, in which:

FIG. 1 is a front elevational view of one embodiment of this invention with parts broken away;

FIGS. 2-3 are enlarged cross-sectional views of the FIG. 1 embodiment taken along the line 2-2 looking in the direction indicated by the arrows and with parts broken away; these views illustrate the door in different positions, described more in detail hereinafter.

FIGS. 4-5 are enlarged cross-sectional views taken along the line 4-4 of FIG. 1 looking in the direction indicated by the arrows illustrating relative positions of the seal corresponding to the door positions of FIGS. 2 and 3 respectively.

FIG. 6 illustrates a second embodiment of this invention.

With reference to the figures, there is a horizontally disposed sterilizer or pressure vessel generally indicated by the numeral 10, referred to hereinafter in the claims as a "vessel member." This vessel 10 is constructed according to conventional pressurizable vessels, preferably of all steel and or Monel construction. There is a door or closure member 11 adapted for closure of a vessel opening 12 defined by continuous integral steel or other rigid horizontal top and bottom walls 14 and vertical sidewalls 15 of the pressure vessel 10. Although not illustrated, it will be understood that there is an integral back wall generally completing the vessel.

Although not illustrated, it will be understood that any

2

of the conventional control systems for supplying steam or other fluid under pressure and/or for reducing pressure are adaptable for use with the pressurizable vessel herein illustrated and described.

There is a vertical peripheral flange 16 of steel or other rigid material mounted rigidly as for example by welding 18 (FIG. 3) around the entire outside periphery of the vessel and spaced from an open end 32 of the vessel 10. Flange 16 is provided with a pair of integral vertically spaced horizontal extensions 20 and 21 at the top and bottom of the vessel. The top and bottom portions of the flange including extensions 20 and 21 carry a plurality of steel or other rigid brackets 22 mounted rigidly thereon in spaced relationship horizontally across those portions of flange 16 and extensions thereof.

Brackets 22 project horizontally from the flange 16 and extensions thereof. Each bracket 22 retains a double-flanged roller 24 rotatably mounted thereto, as for example journaled on the outer race of a roller bearing assembly (not shown here but shown more in detail in co-pending application entitled, "Closure Apparatus for Pressure Chamber," inventor John I. Nugent filed simultaneously herewith). The roller bearing assembly has a pair of shanks 27 on opposite sides of the inner race thereof. Shanks 27 are journaled into a horizontal bore 28 extending through the bracket 22.

The plurality of brackets 22 mounted above and below the vessel opening 12 are adapted to slidably support and guide the door 11 between open and closed positions, respectively shown in those positions in FIGS. 1 and 3.

The plurality of flanged rollers 22 also coactively function to limit the outward movement of the door 11 away from the open end 32 of the pressure vessel 10, thereby confining the door to a selected minimal spaced relationship between an inner surface 30 of the door and the open end 32 of the pressure vessel 10 (see FIGS. 2 and 3).

There are a pair or plurality of rigid flanged stop or clamp elements 34 rigidly mounted along the left-hand vertical portion of the peripheral flange 16 as viewed in FIG. 1. The stop elements 34 are adapted to orient or align the left-hand (as viewed in FIG. 1) or leading edge 36 of the door 11 against sliding movement beyond the closed position such as illustrated in FIG. 3. A vertical flange portion 37 of each of the stops 34 forms an internal shoulder with the main body portion of the stops 34. This shoulder is adapted to be engaged by and to embrace the leading edge 36 of the door 11.

There are a pair or plurality of rigid flanged stop elements 38 rigidly mounted to the inside surface 30 of the door 11 at substantially the right-hand (as viewed in FIG. 1) or trailing edge 35 thereof. Stop elements 38 are similar in construction to the stop elements 34 and are provided with vertical flanges 40, thereby forming an internal shoulder with the main body portion thereof adapted to embrace or engage the right-hand vertical edge of the peripheral flange 16 as illustrated in FIG. 3 thereby coacting with the left-hand vessel flanges 34 to align the door 11 in the closed position relative to the vessel opening 12.

The flanges 37 and 40 of both the left-hand flanged stops 34 and the right-hand flanged stops 38 are coactive with the flanges of rollers 24 to limit around the entire periphery of the door 11, the outward movement of the door away from the vessel 10 when in the closed position.

The inside surface 30 of the door 11 is sealed to the open end 32 of the vessel 10 by a hollow, resilient, inflatable, deformable and compressible seal 42 seated in the open end 32 of the vessel, thereby to maintain the vessel 10 in pressurized condition, as for example when steam is introduced into the chamber, or to maintain a vacuum in the vessel if the air pressure is reduced.

The hollow resilient inflatable seal 42 may be composed of the silicon rubber or ethylene propylene types or any other suitable resilient inflatable material which will withstand the high and low external pressures and high temperatures of sterilization without rupturing. Seal 42 is provided with a ridge or projection 44 (illustrated in cross-section in FIG. 2) extending around the entire length thereof. The ridge 44 is seated in a lower smaller slot or groove 46 extending around the entire open end 32 of the top and bottom walls 14 and sidewalls 15 of the vessel. Along the open end 32 of only the top and bottom walls 14, the lower smaller slot 46 communicates with an upper larger slot 48 (see FIGS. 4 and 5) which retains the hollow inflatable portion of the inflatable seal 42 extending along those walls of the vessel. However, the upper larger slots 48 in the top and bottom walls 14 terminate at the four corners of the open end of the vessel as illustrated at the four circled portions 50 and 51 of FIG. 1. At the open end 32 of the vessel along only the vertical sidewalls 15 the right-hand sidewall of the larger upper slot 48 is milled or cut away (FIGS. 2 and 3) thereby leaving only left-hand slot sidewalls or flanges 52 and 54 defining shoulders in lieu of the larger upper slot 48. The hollow inflatable portion of the seal 42 is retained in and designed to conform in shape to these shoulders formed by the left-hand sidewalls.

Rigidly mounted on the inside surface 30 of the door 11, we provide a pair of rigid horizontally spaced vertical flanges 55 and 56 which extend substantially transversely of the sliding movement of the door 11 between open and closed positions.

As illustrated in FIG. 1, both of the flanges 55 and 56 terminate short of the upper and lower edges of the door 11 so as to be received between the inside surfaces of the top and bottom walls 14 of the vessel 10. Flanges 55 and 56 are in width (horizontally as viewed in FIG. 1) a sufficient distance to compressibly engage the compressible seal 42 as it moves from the FIG. 2 to the FIG. 3 position, but only wide enough to be received by the shoulder formed along the open end of the vertical sidewalls 14 of the vessel by the slot sidewalls 52 and 54. In this manner, the door flanges 55 and 56 form a pair of shoulders with the inside surface of the door 11 extending substantially transversely of the sliding movement of the door and coactive with the shoulders formed by the vessel slot sidewalls 52 and 54 for compressing that portion of the length of the seal extending along the open end of the two vertical sidewalls 15 of the vessel 10.

As the door 11 is moved from the partially closed position of FIG. 2 to the completely closed position of FIG. 3 at which latter position the leading edge 36 of the door 11 abuts the stop elements 34, the door flanges 55 and 56 cooperate with the flanges 52 and 54 to compress and at least partially deflate substantially one-half of the entire length of the seal 42, thereby expelling at least a portion of the air or other fluid therefrom and into the remaining one-half of the length of the inflatable seal 42 extending along the outer surface 32 of the top and bottom walls of the vessel 10. Thus, such remainder of the seal is inflated responsive to the partial deflation of the seal just described.

When the door is in the partially closed position of FIG. 2, the entire length of the seal is in the normal inflated state indicated in FIGS. 2 and 4. However, when the door is moved to the closed position compressing one-half of the seal in the manner illustrated in FIG. 3, then the remaining one-half is inflated to the condition illustrated at 42A of FIG. 5 thereby to provide a seal around the entire periphery of the opening 12 responsive to movement of the door member to the closed position for sealing the door 11 to the entire periphery of the open end 32 of the walls 14 and 15 of the vessel 10. It will be understood that the fluid in the hollow portion of the seal 42 must be sealed internally of the seal 42 so that upon

compression and deflation of part of the seal the remainder thereof is inflated responsive thereto.

Because of the flange 55 being of greater width horizontally than the spacing between the inner surface 30 of the door 11 and the open end 32 of the walls 14 and 15 of the vessel, it will be understood as illustrated in broken line at 55A in FIG. 2 that the flange 55 functions as a stop for limiting the open-most position when it engages the inner surface of the right-hand vertical sidewalls 14.

Although not illustrated, it will be understood that there are a number of alternative ways of providing means between the door 11 and the sidewalls 14 for compressing a portion of the length of the seal 42, thereby for inflating the remaining portion responsive thereto, as for example, by forming a slidable bevel wedge compressing the seal 42 responsive to a cooperative beveled portion on the inside surface of the door 11.

Also there are a number of alternative ways for inflating the seal responsive to movement of the door 11 to closure, without compressing the seal. For example, in FIG. 6, there is illustrated a second embodiment of this invention which does not have the vertical flanges 55 and 56 for compressing a portion of the length of the seal 42; in lieu thereof there is provided a sealed compressible diaphragm or bellows 60 or other source of fluid such as a cylinder and piston which is compressed or depressed by a contact 62, or merely by the leading edge 36 of the door 11 in the absence of such contact 62, upon closure of the door 11. Compressing the diaphragm injects fluid internally of the diaphragm 60 through a conduit 64 into the seal 42 responsive to closure of the door 11, thereby to inflate the seal 42 for sealing the door 11 to the vessel 10 around the opening 12 thereof.

Although it is preferable to provide the seal on the vessel itself, it will be understood that as an alternative construction the seal could be mounted on the inside surface of the door and retained in the above described shouldered portion formed by the door flanges 55 and 56.

While we have shown and described the preferred form of mechanism of our invention, it will be apparent that various modifications and changes may be made therein particularly in the form and relation of parts, without departing from the spirit of our invention as set forth in the appended claims.

We claim:

1. Improved apparatus for combination with a pressure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

- (a) means between said members adapted for supporting door member for movement between open and closed positions with said opening,
- (b) inflatable seal means between said members around said opening when in said closed portions, and
- (c) means between said members including a shoulder on at least said door member responsive to movement of said door member to said closed position inflating at least a portion of said seal into sealing relationship with said members thereby to seal said members in pressure tight relationship around said opening.

2. Improved apparatus for combination with a pressure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

- (a) means between said members adapted for supporting said door member for movement between open and closed positions with said opening,
- (b) inflatable seal means between said members around said opening when in said closed position, and
- (c) means between said members including a shoulder extending transversely from one of said members responsive to movement of said door member to said closed position comprising two opposing portions

5

of the length of said seal into sealing relationship with said members thereby to seal said members in pressure tight relationship around said opening.

3. Improved apparatus for combination with a pressure vessel member having an opening and door member for closure of said opening, said improvement comprising in combination therewith:

(a) means between said members adapted for supporting said door member for movement between open and closed positions with said opening,

(b) deformable seal means between said members extending only peripherally around said opening and interposed only between an inner surface of the door member and an open end of said pressure vessel member when in said closed position, and

(c) means between said members responsive to movement of said door member to said closed position compressing two opposing portions of the length of said seal for deforming substantially the remainder of said seal into sealing relationship with said members thereby to seal said members in pressure tight relationship around said opening.

4. Improved apparatus for combination with a pressure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

(a) means between said members adapted for supporting said door member for movement between open and closed positions with said opening,

(b) inflatable seal means between said members around said opening when in said closed position, and

(c) means between said members responsive to movement of said door member to said closed position compressing two opposing portions of the length of said seal for inflating a substantial portion of the remainder of said seal into sealing relationship with said members thereby to seal said members in pressure tight relationship around said opening.

5. Improved apparatus for combination with a pressure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

(a) means between said members adapted for supporting said door member for movement between open and closed positions with said opening,

(b) inflatable seal means between said members extending only peripherally around said opening and interposed only between an inner surface of the door member and an open end of said pressure vessel member when in said closed position, and

(c) means between said members responsive to movement of said door member to said closed position deflating a portion of the length of said seal for inflating substantially the remainder of said seal into sealing relationship with said members thereby to seal said members in pressure tight relationship around said opening.

6. Improved apparatus for combination with a pressure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

(a) support means between said members adapted for slidably supporting said door member for movement between open and closed positions with said opening,

(b) deformable seal means between said members extending only peripherally around said opening and interposed only between an inner surface of the door member and an open end of said pressure vessel member when in said closed position, and

(c) means between said members responsive to sliding movement of said door member to said closed position for deforming said seal into sealing relationship with said members thereby to seal said members in pressure tight relationship around said opening.

7. Improved apparatus for combination with a pres-

6

sure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

(a) support means between said members adapted for slidably supporting said door member for movement between open and closed positions with said opening,

(b) inflatable seal means between said members extending only peripherally around said opening and interposed only between an inner surface of the door member and an open end of said pressure vessel member when in said closed position, and

(c) means between said members responsive to sliding movement of said door member to said closed position for inflating at least a portion of said seal into sealing relationship with said members thereby to seal said members in pressure tight relationship around said opening.

8. Apparatus in accordance with claim 7 in which said inflating means includes means for limiting outward movement of said door member as it moves between open and closed positions.

9. Improved apparatus for combination with a pressure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

(a) support means between said members adapted for slidably supporting said door member for movement between open and closed positions with said opening,

(b) inflatable seal means between said members around said opening when in said closed position, and

(c) first shoulder means formed on an inside face of said door member extending substantially transversely of the sliding movement of said door, and second shoulder means formed on an outside face of said vessel member coactive with said first shoulder means for compressing a portion of the length of said seal for inflating substantially the remainder of said seal into sealing relationship with said members when said members are moved to said closed position, thereby to seal said members in pressure tight relationship around said opening.

10. Improved apparatus for combination with a pressure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

(a) support means between said members adapted for slidably supporting said door member for movement between open and closed positions with said opening,

(b) inflatable seal means between said members around said opening when in said closed position, and

(c) first shoulder means formed on an inside face of said door member extending substantially transversely of the sliding movement of said door having a flange means adapted to engage a trailing edge of a portion of the length of said seal, and second shoulder means formed on an outside face of said vessel member having a flange means adapted to engage a leading edge of said portion of the length of said seal and being coactive with said first shoulder means for compressing said portion of the length of said seal for inflating substantially the remainder of said seal into sealing relationship with said members when said members are moved to said closed position thereby to seal said members in pressure tight relationship around said opening.

11. Improved apparatus for combination with a pressure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

(a) flanged support means between said members adapted for slidably supporting said door member for movement between open and closed positions with said opening and for limiting outward movement of

said door member at least when in said closed position,

(b) inflatable seal means between said members around said opening when in said closed position, and

(c) first shoulder means formed on an inside face of said door member extending substantially transversely of the sliding movement of said door having a flange means adapted to engage a trailing edge of a portion of the length of said seal, and second shoulder means formed on an outside face of said vessel member having a flange means adapted to engage a leading edge of said portion of the length of said seal and being coactive with said first shoulder means for compressing said portion of the length of said seal for inflating substantially the remainder of said seal into sealing relationship with said members when said members are moved to said closed position, thereby to seal said members in pressure tight relationship around said opening.

12. Improved apparatus for combination with a pressure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

(a) flanged support means between said members adapted for slidably supporting said door member for movement between open and closed positions with said opening and for limiting outward movement of said door member at least when in said closed position,

(b) inflatable seal means between said members around said opening when in said closed position, and

(c) first shoulder means formed on an inside face of said door member extending substantially transversely of the sliding movement of said door having a flange means adapted to engage a trailing edge of a portion of the length of said seal, and second shoulder means formed on an outside face of said vessel member having a flange means adapted to engage a leading edge of said portion of the length of said seal and being coactive with said first shoulder means for compressing said portion of the length of said seal for inflating substantially the remainder of said seal into sealing relationship with said members when said members are moved to said closed position, thereby to seal said members in pressure tight relationship around said opening, stop means on said door member extending along a trailing edge of said

door member and adapted to embrace a portion of said vessel member when in said closed position, stop means on said vessel member adapted to embrace a leading edge of said door member when in said closed position, both of said stop means being coactive with said flanged roller means for limiting outward movement of said door member at least when in said closed position.

13. Improved apparatus for combination with a pressure vessel member having an opening and a door member for closure of said opening, said improvement comprising in combination therewith:

(a) flanged roller means between said members adapted for slidably supporting said door member for movement between open and closed positions with said opening for limiting outward movement of said door member at least when in said closed position, said roller means extending along two opposite edges of said door as it moves between said positions,

(b) inflatable seal means between said members around said opening when in said closed position, and

(c) first shoulder means formed on an inside face of said door member extending substantially transversely of the sliding movement of said door and second shoulder means formed on an outside face of said vessel member coactive with said first shoulder means for compressing a portion of the length of said seal for inflating substantially the remainder of said seal into sealing relationship with said members when said members are moved to said closed position, thereby to seal said members in pressure tight relationship around said opening.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,352,446

November 14, 1967

Edgar L. Anderson et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 52, for "door" read -- said door --;
line 55, for "portions" read -- positions --.

Signed and sealed this 4th day of February 1969.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents