June 17, 1969 C. L. ASHBROOK 3,450,039

PRESSURE VESSEL

Filed May 18, 1967

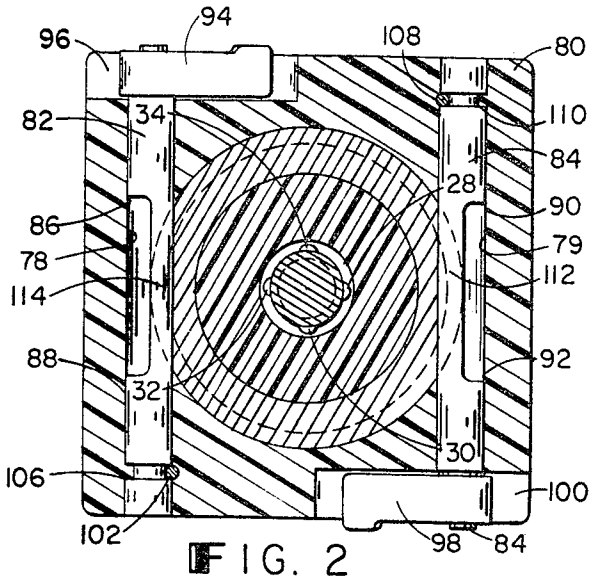


FIG. 2

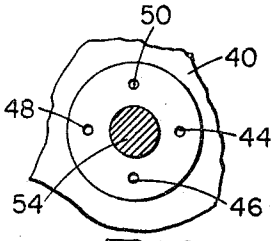


FIG. 3

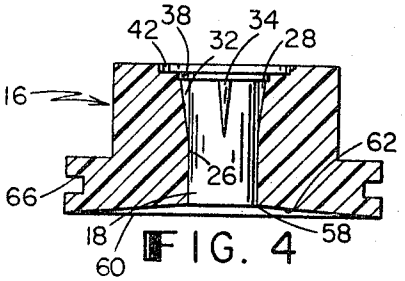


FIG. 4

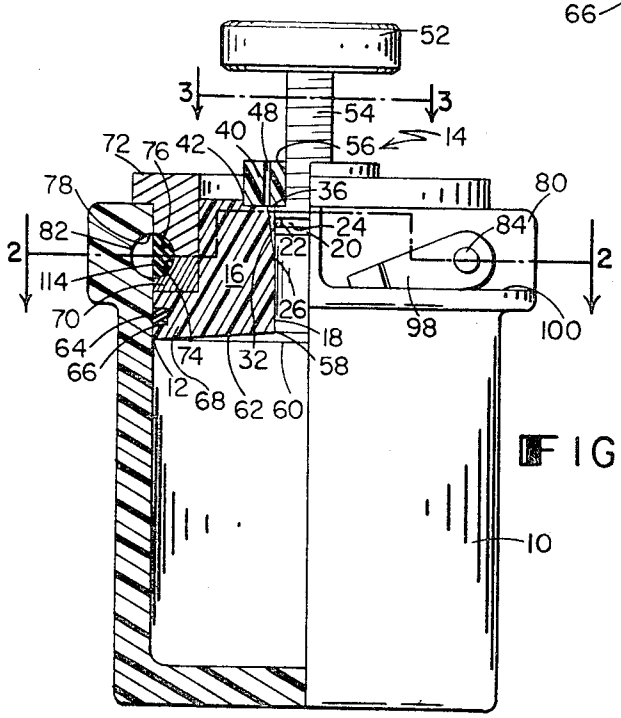


FIG. 1

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PRESSURE VESSEL

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ABSTRACT OF THE DISCLOSURE

A resilient pressure vessel for applying hydraulic pressure to objects therein including a container having an opening therein, a cover for sealing the opening, a piston movable in a cylinder in the cover to pressurize fluid in the container, and bleeder passages communicating with the cylinder for receiving air and excess fluid driven out by the piston in the initial portion of its pressurizing stroke.

SUMMARY OF INVENTION

This invention relates to manually-operable hydraulic pressure vessels.

Molded objects which have been allowed to set or dry at normal room conditions, i.e. bench cured, are often very porous. Porosity, resulting in low density and hardness of the object, is often due to air bubbles and voids which are trapped in the molding material, and also to the high volatility of constituents of the molding material such as the methylene chlorate associated with acrylic plastic molding materials.

Such shortcomings are of major importance when the molded object is a denture which will be subject to hard wear and corrosive and staining agents, but may be overcome by curing under pressure.

However, conventional pressurizing devices are often complex and expensive and may require considerable manual effort of the operator to apply sufficient pressure to the mold. Such devices may be complicated and difficult to assemble and disassemble, and they often apply uneven pressure to the dentures and other objects.

Accordingly, it is a primary object of this invention to provide a simple, inexpensive, easy to manually pressurize and easy to assemble and disassemble pressure vessel, which reduces the porosity and increases the density of molded objects used therein.

It is a further object of this invention to provide such a vessel which drives voids and air bubbles out of the molding material and prevents volatile constituents from vaporizing in the mold material during curing.

It is a further object of the invention to provide a pressure vessel which applies hydraulic pressure uniformly on the object and which bleeds off air trapped with the hydraulic fluid as the pressure is applied, to increase the effectiveness of the hydraulic system and prevent explosion dangers of air pressure systems.

The invention is accomplished by a resilient pressure vessel for applying hydraulic pressure to objects therein including a container having an opening therein, closure means for the container adapted to sealingly engage the opening, pressurizing means for applying pressure to the hydraulic fluid in the container, and bleeder means associated with the pressurizing means for removing air and excess fluid from the container as the pressurizing means is actuated.

DISCLOSURE OF A SPECIFIC EMBODIMENT

Other objects, features and advantages will appear from the following desecription of a preferred embodiment, taken together with the attached drawings, in which:

FIG. 1 is a partially sectioned elevational view of a pressure vessel according to this invetntion.

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a sectional view of a base member of the closure portion.

There is shown in FIG. 1 a pressure vessel having a resilient plastic container **10** with opening **12** at its upper portion which receives closure **14**. Plastic base **16** of closure **14** contains a centrally located cylindrical bore **18** which receives pressurizing piston **20** having an O-ring **22** in groove **24**. Complete sealing by O-ring **22** between piston **20** and bore **18** is not effected until piston **20** has moved downward past the level **26** of the ends of the four bleeder channels **28**, **30**, **32** and **34** recessed in the bore **18**. These bleeder channels are set at 90° intervals about bore **18**, FIG. 2, and are tapered at a 5° angle downwardly and inwardly so that their cross section area decreases from a semi-circular area of 3/64 inch radius at the top of bore **18** to zero area at level **26** where channels **28**, **30**, **32** and **34** disappear. Annular chamber **36** formed by recess **38** in base **16** and threaded plastic block **40** mounted in recess **42** of base **16**, connects bleeder channels **28**, **30**, **32** and **34** to bleeder vents **44**, **46**, **48** and **50** in block **40**, FIG. 3.

Manually rotatable hand wheel **52** rotates screw **54** engaged with internal threads **56** in block **40** for driving piston **20**, connected to the lower end of screw **54**, up and down in bore **18**. Bore **18** communicates with the interior of the vessel at orifice **58** in the central and deepest area of recess or cavity **60** formed in the lower surface of base **16**. Bleeding off of the excess air in the vessel is facilitated by 5° inclined frusto-conical surface **62** which allows entrapped air to rise along surface **62** toward the highest level of the fluid, i.e. deepest area of the recess, and accumulate in bore **18**, where it may be driven out through the bleeder channels and vents by piston **20** as said piston moves along the channels toward their lower ends at level **26**. Recess **60** need not be frusto-conical, but may as well be concave, parabolic, etc. Preferably, there is at least one channel or surface extending between shallow and deep areas of the recess to permit the air to rise to bore **18**.

An annular ledge **68** extending outwardly from base **16** includes an O-ring **64** in groove **66** for insuring a good seal between base **16** and opening **12**, and supports an aluminum ring **70** and shouldered plastic ring **72**. Rings **70** and **72** each contain a 90° arcuate surface **74**, **76**, respectively, which form an annular recess of 1/4 inch radius semi-circular cross section that cooperates with similarly-shaped recesses **78** and **79** in flange **80** of container **10**.

Closure **14** is secured to container **10** by two shafts **82**, **84** passing through bores **86**, and **88** and bores **90**, **92**, respectively, in flange **80**. Shaft **82** extends from flange **80** into thumb lever **94** at ledge **96** and shaft **84** extends into thumb lever **98** at ledge **100**. The other end of shaft **82** is retained against axial movement in bores **86** and **88** by pin **102** passing through bore **88** and engaging annular groove **106** of shaft **82**. Similarly, the other end of shaft **84** is retained against axial movement in bores **90** and **92** by pin **108** passing through bore **90** and engaging annular groove **110** of shaft **84**. Shaft **84** has a reduced section **112** at its central portion which engages arcuate surfaces **74** and **76**, preventing removal of closure **14**, when thumb lever **98** is in the position shown in FIG. 2, and rests in recess **79** clear of rings **70** and **72** and ledge **68** permitting removal of closure **14**, when thumb lever **98** is rotated approximately 180° in the clockwise direction from the position it occupies in FIG. 1. Thumb lever **94** and shaft **82** operate similarly to engage reduced section **114** with recess **78** or arcuate

surfaces 74 and 76 as a securing means for closure 14. A pressure gage may be mounted in container 10 for indicating the pressure developed within the vessel.

In operation, thumb levers 94 and 98 are rotated outwardly to place reduced sections 112 and 114 in recesses 78 and 79, respectively. Hand wheel 52 is grasped and rocked gently to remove closure 14 from opening 12 in container 10. A dental plate or partial dental plate to be pressure cured is inserted in the container 10 and the container is filled with enough hydraulic fluid to maintain the fluid level slightly higher than level 26 when closure 14 is in place.

Hand wheel 52 is rotated counterclockwise to place piston 20 in the fully retracted position. Piston 20 should be fully retracted before inserting closure 14 to insure that the fluid will be able to rise to at least level 26 in cylinder 16 to make maximum use of the stroke of piston 20 and to provide some space above level 26 to receive entrapped air as it rises through the fluid. Closure 14 is fully seated, so that shouldered portion of ring 72 abuts flange 80, before thumb levers 94 and 98 are rotated inwardly to place reduced sections 112 and 114 in engagement with surfaces 74 and 76, locking closure 14 to container 10.

Hand wheel 52 is rotated in the clockwise direction driving piston 20 downwardly in bore 18 towards the interior of the vessel. As piston 20 moves toward level 26 air and excess fluid is bled or driven off through channels 28, 30, 32 and 34, chamber 36 and vents 44, 46, 48 and 50 in block 40. Once piston 20 reaches level 26, the air has been expelled, the bleeder path beginning at channels 28, 30, 32 and 34 at level 26 is no longer accessible to the fluid and piston 20 is directly pressurizing the fluid. Since the fluid is nearly incompressible at the pressure levels applied by the vessel, the pressurizing of the fluid is accomplished by the force generated in the resilient plastic portions of the vessel as they oppose deformation by the fluid displaced by piston 20.

The area of piston 20 in contact with the fluid in bore 18 is sufficiently small to require a force that can be easily supplied to hand wheel 52 by an average operator such as a female dental assistant. Thus, a pressure in the order of 6 or 7 atmospheres, i.e. 100 p.s.i., may be easily generated throughout the fluid in the vessel and applied to the denture or other object. The pressure is applied uniformly to all surfaces of the curing denture preventing volatile constituents of the molding material from vaporizing and leaving voids in the denture, while simultaneously causing air bubbles trapped in the denture to be driven out of it. The porosity is thus decreased while the density is increased.

Other embodiments will occur to those skilled in the art and are within the following claims.

What is claimed is:

1. A resilient pressure vessel for manually applying hydraulic pressure to objects therein comprising:
- a container having an opening therein,
- closure means for said container adapted to sealingly engage said opening,
- pressurizing means for applying pressure to the hydraulic fluid in said container, and
- bleeder means located in said closure means associated with said pressurizing means for removing air and excess fluid from said container as said pressurizing means is actuated.

2. The vessel of claim 1 in which said pressurizing means is located in said closure means.

3. The vessel of claim 1 in which said pressurizing means includes a conduit communicating with the interior of said vessel, a piston slidable in said conduit to apply pressure to the fluid within said vessel, and
- a manually operable drive means for moving said piston in said conduit.

4. The vessel of claim 3 in which said conduit and said piston have circular cross-sectional areas and said drive means includes a screw drive having one end connected to said piston and the other end connected to a hand wheel externally accessible for manual manipulation.

5. The vessel of claim 3 in which said bleeder means includes vent means extending from the exterior of said vessel to said conduit for bleeding off air and excess fluid as said piston is driven towards the interior of said vessel.

6. The vessel of claim 3 in which said pressurizing means is in said closure means, and said opening in said container which is sealed by said closure means is at the top of said container.

7. The vessel of claim 1 in which said bleeder means includes vent means extending from the exterior of said vessel to a position proximate said pressurizing means for bleeding off air and excess fluid as said pressurizing means is driven to increase the pressure in said vessel.

8. The vessel of claim 1 in which said bleeder means communicates with the interior of said vessel at a location which is at the upper portion of the vessel where air normally collects.

9. A resilient pressure vessel for manually applying hydraulic pressure to objects therein comprising:
- a container having an opening at its top,
- a closure adapted to sealingly engage said opening,
- a bore disposed in said closure communicating with the interior of said vessel,
- a piston movable in said bore for applying pressure to hydraulic fluid in said vessel,
- a manually operable externally accessible screw drive for moving said piston,
- at least one bleeder vent communicating with the upper portion of said bore, for bleeding off air and excess hydraulic fluid as said piston is driven towards the interior of said vessel, and
- a recess formed in the interior portion of said closure, said recess having at least one sloped surface extending between a shallow area of said recess and a deep area of said recess, said bore communicating with the interior of said vessel at said deep area.

10. The vessel of claim 9 further comprising two securing mechanisms for holding said closure in engagement with said container, each of said mechanisms including:
- a bore in said vessel,
- a portion of said bore being formed in part by said container and in part by said closure,
- a shaft rotatable in said bore and having a reduced section disposed in said portion, said shaft having at least two positions, a first position in which said reduced section engages only the part of said portion formed by said container and a second in which said reduced section engages only the part of said portion formed by said closure.

11. A resilient pressure vessel for manually applying hydraulic pressure to objects therein comprising:
- a container having an opening therein,
- a closure for said container adapted to sealingly engage said opening,
- two securing mechanisms for holding said closure in engagement with said container, each of said mechanisms including:
- a bore in said vessel,
- a portion of said bore being formed in part by said container and in part by said closure,
- a shaft rotatable in said bore and having a reduced section disposed in said portion, said shaft having at least two positions, a first position in which said reduced section engages only the part of said portion formed by said container and a second in which said reduced section engages only the part of said portion formed by said closure,
- pressurizing means for applying pressure to the hydraulic fluid in said container, and
- bleeder means associated with said pressurizing means

for removing air and excess fluid from said container as said pressurizing means is actuated.

12. A resilient pressure vessel for manually applying hydraulic pressure to objects therein comprising:

a container having an opening therein,

closure means for said container adapted to sealingly engage said opening,

pressurizing means for applying pressure to the hydraulic fluid in said container, and

bleeder means associated with said pressuring means for removing air and excess fluid from said container as said pressurizing means is actuated, said bleeder means including a recess formed in the interior portion of said closure means, said recess having at least one sloped surface extending between a shallow area of said recess and a deep area of said recess, said conduit communicating with the interior of said vessel at said deep area.

References Cited

UNITED STATES PATENTS

669,279	3/1901	Harrington	72—63
1,230,013	6/1917	Morwitz	100—211 XR
1,372,190	3/1921	Randall et al.	100—211 XR
1,782,103	11/1930	Solberg et al.	100—269
2,648,125	8/1953	McKenna et al.	264—84
2,887,717	5/1959	Smith	18—5.7
2,955,530	10/1960	Nilo	100—289
3,225,418	12/1965	Fara	29—113

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U.S. Cl. X.R.

18—5.7, 33; 72—63; 100—289; 264—17